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Opioid Use and Dosing in the Workers' Compensation Setting. A Comparative Review and New Data From Ohio

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Background *Many authorities are concerned about the rising use and the potential overuse of opioid pain medications. A study of opioid prevalence and dosage in Ohio's workers' compensation (WC) system was conducted, with comparisons made to opioid use in other WC and non-WC settings.*

Methods *Systematic literature reviews of WC and non-WC opioid use and dosage nationally were conducted. Two years of Ohio WC data (2008–2009) were analyzed to determine average daily morphine equivalent dose (MED), opioid costs, pharmacies used per claimant, and extent of long-duration cases.*

Results *Nearly one-fifth (19.2%) of Ohio WC claims involved opioid use, compared to 31.8% in other WC systems and 17.9% in non-WC settings. Mean MED was 57.5 mg, compared to 47.8 mg in other WC systems, and 41.8 mg among non-WC populations. Nearly 10% of WC claims involved relatively high MED exceeding 120 mg/day.*

Conclusion *Policy makers need to develop strategies for addressing high opioid use in WC systems.* Am. J. Ind. Med. 55:313–324, 2012. *© 2011 Wiley Periodicals, Inc.*

KEY WORDS: workers' compensation; Ohio; opioids; opiates; narcotics; morphine equivalent dose

INTRODUCTION

The use of opioid pain medications has grown substantially in the United States during the past decade [Sullivan et al., 2008; Boudreau et al., 2009]. It is estimated that as of 2008, opioids are used regularly by approximately 2.0% of adults in the U.S. and that an additional 2.9% use opioids occasionally [Kelly et al., 2008]. Opioids are widely used for managing pain from acute injuries, surgeries, and advanced cancer. Additionally, use of opioids for treatment of non-cancer pain, such as chronic back pain and pain related to musculoskeletal conditions, is increasingly common. Data from the National Ambulatory Medical Care Survey suggest that opioids are prescribed in about 15–16% of all chronic back pain cases [Caudill-Slosberg et al., 2004; Hall et al., 2008].

There is little doubt that long-term opioid therapy for chronic non-cancer pain helps improve pain relief for some patients. But it also appears to increase the risk of drug dependency, overdose, and other adverse events. Studies have shown that long-term use of opioids for chronic non-cancer pain increases the risk of overdose, including fatal overdose [Franklin et al., 2005; Ballantyne and LaForge, 2007; Bohnert et al., 2011]. Increasing

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average daily dosage is associated with an elevated risk of fatal overdose [Dunn et al., 2010]. Also, the frequent use of prescription drugs in some circumstances may contribute to drug diversion, involving the transfer of legally prescribed medications for illicit or inappropriate purposes [U.S. General Accounting Office, 2003]. For example, according to one recent study, fewer than half (44%) of persons who died of unintentional prescription drug overdose received opioids that had been prescribed to them by a physician [Hall et al., 2008]. While there is evidence that use of opioids can bring about short-term pain relief, it is less certain whether or not opioid use improves functional outcomes (e.g., vocational function), which is a primary concern in workers' compensation (WC) [Ballantyne and Shin, 2008].

Occupational musculoskeletal injuries are among the most frequently reported type of claim in state WC systems. It is thus not surprising that the use of opioids in WC is growing, along with concerns about potential misuse, dependency, diversion, and overdose. A 2009 study estimated that 52% of WC low back pain claimants received at least one opioid prescription [Volinn et al., 2009]. The California Workers' Compensation Institute reported in 2008 that opioid analgesics such as morphine, oxycodone, methadone, and hydromorphone grew from less than 1% of California WC prescriptions filled in 2005 to nearly 6% of the prescriptions filled during the first 9 months of 2008 [Swedlow et al., 2008]. As of 2009, opioid pain medications account for about one-quarter of all WC pharmacy costs, or about $1.05 billion annually [Lipton et al., 2009; Paduda, 2009].

Various WC authorities have expressed concerns about how chronic opioid use affects medical care costs, prolonged duration of work disability, and increased attorney involvement [CWCI, 2009; Lipton et al., 2009; Brown and Roper, 2010]. For example, a 2008 study by the California Workers' Compensation Institute found that injured workers with multiple opioid prescriptions and higher dosage levels (above 280 mg daily morphine equivalent dose [MED]) were more likely to have claims with higher costs and a higher likelihood of other adverse outcomes, such as lost time from work and a longer duration of paid temporary disability [Swedlow et al., 2008].

The growing concern about the widespread use of prescription opioids, with its attendant health risks and potentially adverse outcomes, prompted the Ohio Bureau of Workers' Compensation (BWC) to sponsor this analysis of opioid use among injured workers in Ohio. The principal aims of this research study were:

1. To determine current patterns of opioid use in the Ohio WC system.
2. To determine the prevalence of opioid use in Ohio's WC system compared to the prevalence of opioid use for non-cancer pain in other similar WC and non-WC settings.
3. To determine MED levels among Ohio WC claimants compared, to the extent possible, to average dosage levels for non-cancer pain from other similar WC and non-WC settings.

The Ohio BWC considered this to be a preliminary exploratory study that will establish a foundation for future studies to analyze the effects of dosing patterns over time for injured workers with various conditions, and to measure the effects of opioid dosing patterns on clinical and non-clinical outcomes (e.g., return to work, length of disability, and costs). The ultimate goal of this research is to provide a better understanding of opioid use in Ohio to benefit health care providers, patients, policy makers, and other stakeholders that will help make opioid use safer for WC claimants in Ohio and other states, and identify opioid use patterns that could be potentially inappropriate or harmful. Additionally, this study provides researchers and policy makers with new information (e.g., concerning the extent of dual use of antidepressants with opioids in WC populations) that has not previously been reported in the research literature.

MATERIALS AND METHODS

Data Source and Variables

In this study, we employed a population-based approach to conduct a retrospective descriptive analysis of opioid use among WC claimants in the Ohio BWC system for Ohio fiscal years (FY) 2008 and 2009, the two most recent FY for which full-year data on opioid use were available. We used the entire census of WC claims from FY 2008 and FY 2009 including those with and without opioid use. FY 2008 contained all active claims between July 1, 2007 and June 30, 2008 and FY 2009 contained all active claims between July 1, 2008 and June 30, 2009. The Ohio BWC system covers all public and private employers in the state of Ohio, with the exception of self-insured employers. In FY 2008, the BWC covered 270,110 employers and in FY 2009 it covered 262,251 employers. In FY 2008, there were 143,199 new claims accepted by the BWC (of 159,611 filed) and 118,855 accepted new claims in FY 2009 (of 132,549 filed). Total WC benefit payments by the Ohio BWC were $2.06 billion in FY 2008, of which $839.5 million (40.7%) were medical benefits, and $1.96 billion in FY 2009, of which was $833.5 (42.4%) were medical benefits [Ohio BWC, 2010].

Data for this study were retrieved by BWC staff from the Ohio BWC data warehouse, using the ORACLE EPM query tool [Hickman, 2010]. These data were encrypted

by information systems personnel from the Ohio BWC and then were transmitted to the researchers as de-identified records to maintain the confidentiality of all claimants, medical providers, and pharmacies. The data covered all employers in the state of Ohio, excluding employers that were self-insured. The data acquisition and analytical protocol for the study were reviewed and approved by the Ohio State University Institutional Review Board.

Specific data items retrieved from the claim records included encrypted claimant demographic information, injury date and type, claim disposition and status, number of lost work days, medical and indemnity (wage compensation) costs, encrypted medical provider information, and encrypted information concerning the dispensing pharmacy. Detailed pharmacy information was obtained for claims involving the filling of at least one prescription for opioid usage during the study period, including the name of the drug, number of pills per prescription, strength of the drug, and number of days covered by the prescription.

In this study, an *opioid* is considered to be one of the class of drugs covered under U.S. Drug Enforcement Administration Schedule II that are used for treatment of pain and are similar to the opium alkaloids that occur in nature. In our analyses, we included all Schedule II drugs along with a few non-opioid pain medications (e.g., tramadol) that are used frequently in WC systems and have similar opioid-like characteristics.

Opioids include natural opioids (e.g., morphine), and synthetics with morphine-like action (e.g., codeine, hydromorphone, methadone, oxycodone, meperidine, and fentanyl). Opioids are further categorized as either short- or long-acting. Short-acting opioid formulations generally have an effect that begins quickly and lasts less than 8 hr while long-acting opioid formulations generally are meant to last 8–72 hr, making them appropriate for patients with persistent non-cancer pain that requires stable, around-the-clock dosing [Argoff and Silvershein, 2009]. All Schedule II opioid usage is considered to have the potential for abuse, and a potential for significant psychological or physical dependence.

Opioids vary considerable in potency; for example, fentanyl is about 80 times as potent as a comparable amount of morphine. This study thus required construction of a variable that would allow the comparison of claimants' daily opioid dose across various opioid prescriptions having different strengths, number of pills, and duration (days) of use. The daily MED in milligrams (mg) is the standard measure used to evaluate opioid use in patient populations. Calculations to measure the MED for each type of opioid prescription were conducted using standard formulas for converting a particular opioid formulation into a standardized daily MED [Sullivan et al., 2008; Dunn et al., 2010]. An aggregated MED for each claimant's prescriptions for each month was compiled and then divided by the total number of days supplied each month to derive an approximate daily MED per claimant (in mgs). In cases in which a person was taking two or more opioid medications concurrently, we combined the daily doses and divided by the total number of days (per month) in which at least one of the drugs was being used, to calculate an effective average daily dose.

Literature Review

A systematic literature review was conducted to compare the prevalence and dosage findings from Ohio to average prevalence and dosage levels from other population-based estimates in both WC and general medicine (non-WC) populations. For the literature review, searches were performed in the Pub Med and Google Scholar bibliographic databases using the following search terms: *workers' compensation, occupational, opioid, opiate, narcotic, morphine equivalent, prevalence, and dose*. Only peer-reviewed articles involving population-based studies were included. Randomized controlled trials, other (opioid) drug-specific studies or intervention studies were excluded. We only selected studies published since 2000 to capture opioid use during the past decade when escalating opioid use emerged as a significant public health issue in WC and other contexts.

Statistical Analysis

Using the Ohio BWC data, summary statistical analyses were performed to calculate the prevalence of opioid use in the Ohio BWC system, the mean and median daily MED by FY, the mean cumulative MED, and the average duration of opioid use during the study period. Comparisons were made between the mean prevalence and dosage findings in the Ohio BWC system and those from the WC and non-WC studies identified in the literature review. Additional descriptive statistical analyses were performed to summarize opioid prescriptions by type for each FY, claims with and without opioid use, the distribution of the duration of opioid use, the distribution of mean daily MED among opioid users, and a summary of opioid costs during the study period. These analyses were further stratified by FY to identify changes in dosing levels, costs, and other indicators from one year to the next. Since this study was essentially descriptive in nature, we did not compute the statistical variance of differences in the value of those indicators between FY.

Additionally, we compared claims involving opioid use to claims not involving opioid use during the 2-year assessment period along a variety of dimensions including claimants' age, gender and region of residence, injury type, lost workdays per claim, duration of claim (from claim initiation), and claim status (new claim filed during

the study period or open claim filed prior to the study period). Other analyses were conducted to determine the proportion of the 2-year study period in which claimants used opioids (among claimants who filled an opioid prescription at least once).

We also examined pharmacy dispensing records to determine the distribution of the number of pharmacies used by claimants filling opioid prescriptions over the 2-year study period. These analyses were performed to determine the extent to which claimants were filling their opioid prescriptions at multiple pharmacies, and if so, whether the number of pharmacies was related to the claimants' total MED dosage. All analyses were performed using SAS v9.2 software.

RESULTS

Systematic Literature Review

As summarized in Table I, we identified ten studies that have been published in peer-reviewed scholarly journals since 2000 examining opioid use in WC settings. Of those ten studies, nine estimated prevalence of opioid use among injured workers and four estimated average daily opioid dosage. Among the nine studies determining prevalence, estimates of opioid use among injured workers ranged from 8.8% to 52.2%, with a mean estimate of 31.8%. Average opioid dosage estimates ranged from 7.8 mg daily MED to 110 mg daily MED, with a mean estimate from the four studies of 47.8 mg daily MED. The estimates varied according to the length of time following injury in which opioid use was assessed and by whether or not the claims were limited to a particular type (e.g., low back injuries).

Table II summarizes prevalence and dosage estimates derived from seven general population studies of opioid used in non-WC settings, among people with non-cancer chronic pain. Among those seven studies, three estimated opioid prevalence and five estimated average daily opioid dosage. Prevalence estimates ranged from 8% to 29.9% with a mean estimate of 17.9% among those with non-cancer chronic pain. Average opioid dosage estimates ranged from 13.3 mg daily MED to 127.5 mg daily MED, with a mean estimate from the five studies of 41.8 mg daily MED. The estimates varied according to duration of usage evaluated, by whether or not the claims were limited to a particular type (e.g., low back injuries), and by type of setting (e.g., Medicaid vs. commercial health plan population).

Statistical Analysis of Ohio BWC Data

Table III summarizes prevalence and dosage estimates derived from the Ohio BWC population for FY 2008 and FY 2009. Overall, 19.2% of claims involved use of opioids during the 2-year study period. The mean daily MED per claimant was 57.5 mg. The median daily MED per claimant was 37.6 mg, indicating that a small percentage of claimants took very high doses of opioids. The three most commonly prescribed opioid formulations were hydrocodone-acetaminophen (36.3% of all opioid prescriptions), oxycodone-acetaminophen (11.2%), and tramadol-HCL (8.4%), collectively accounting for more than half of all opioid prescriptions during the 2-year period (as noted earlier, tramadol is similar to opioid-like pain medications, though not technically a Schedule II drug). A significant portion of claimants who filled opioid prescriptions also filled prescriptions for other drugs, including antidepressants (22.2% of the opioid claimants), skeletal muscle relaxants (31.0%), benzodiaepines (14.3%), and hypnotic-sedatives (13.1%).

The average cost per opioid prescription rose from $81.47 in FY 2008 to $92.49 in FY 2009, an increase of 13.5%. From FY 2008 to FY 2009, the average opioid cost per claimant (among those using opioids) grew by 21.8%, from $734.94 to $895.22 per claimant. Overall, the costs of opioids grew by 12.4% in the Ohio BWC system during that period, increasing from $42.6 million in FY 2008 to $47.9 million in FY 2009.

There was a wide range in daily MED dosage among claimants taking opioids. The standard deviation was approximately 1.5 times the mean daily MED (104 mg in FY 2008 and 115 mg in FY 2009). A small proportion of claimants (120 active claims representing 0.2% of all opioid claimants) had an exceptionally large average daily MED dose levels exceeding 1,000 mg/day. To identify the claimants with highest daily MED, we divided the distribution of claimants' mean daily MED into quintiles. Table IV indicates the mean for each quintile and the cut point demarcating the lowest value of each quintile.

Opioid use was more common in claims that involved extended periods of lost work time. While the prevalence of opioid use among all WC claims was 19.2%, the prevalence among claims involving one or more lost work days was 22.7%. In claims involving 14 or more lost work days the prevalence of opioid use was 32.6% and was 57.4% in claims involving 180 or more lost work days.

Most (72.2%) claimants filled all of their opioid prescriptions at a single pharmacy. However, some claimants filled their opioid prescriptions at multiple pharmacies. As indicated in Table V, on average, claimants' mean daily MED increases in correspondence to the number of pharmacies used to fill opioid prescriptions. For example, claimants who obtained opioids at three or fewer pharmacies had a mean daily dose of 64.9 mg. In contrast, those claimants who obtained opioids at four or more different pharmacies had a mean daily dose of 118.4 mg.

TABLE I. Summary of Studies Concerning Use of Opioids among Workers' Compensation Claimants

	Population	Use of opioids	Average opioid dose (MED)	Average duration of use	Study findings
Cifuentes et al. [2010]	A sample of 8,443 WC claimants with acute back pain from a single multi-state WC insurance company, with claims filed between January 1, 2002 and December 31, 2003	Thirty-four percent of claimants received an opioid prescription in the 2-year period following their injury. 9.4% were prescribed long-acting opioids (5.7% of non-surgical cases and 24.1% of surgical cases)	Not assessed	The median duration of opioid usage was 27 days for non-surgical cases and 364 days for surgical cases	After adjusting for covariates, there was a small but significant positive correlation between the initial prescription doses and later dose escalation
Franklin et al. [2005]	Claim records for all Schedule II–IV opioid prescriptions for 1996–2002 were obtained and analyzed	In the Washington State WC systems, prescriptions for Schedule II opioids increased from 23,000 annually in 1996 to approximately 57,000 annually in 2002, despite a decrease in WC claims filed during that period	The average daily MED for Schedule II long-acting opioids increased from 88 mg/day in 1996 to 132 mg/day in 2002	Not assessed	Thirty-two deaths were identified that were definitely or probably related to accidental overdose of opioids
Franklin et al. [2008]	A sample of 1,843 WC claimants from with acute back injuries who filed claims with the Washington State WC Fund between July 2002 and April 2004	34.1% of claimants received an opioid prescription in the first 6 weeks following their injury	Among those taking opioids in the first 6 weeks after injury, the mean MED/day was 47.9 mg and the mean total accumulated MED was 547.6 mg	Not assessed	After adjusting for baseline covariates, the receipt of opioids for more than 7 days during the first 6 weeks was significantly associated with work disability at 1 year
Franklin et al. [2009]	A sample of 1,843 WC claimants from with acute back injuries who filed claims with the Washington State WC Fund between July 2002 and April 2004. Follow-up assessment of opioid dose was made for 1 year after injury for each claimant	42% of claimants received an opioid prescription in the year following their injury	The mean cumulative MED per quarter (3-month-period) ranged from 465 mg during the first quarter after injury to 3,824 mg for those still using opioids in the fourth quarter	Among claimants with opioid prescriptions, 59% took opioids only during the 1st quarter after injury, 44% continued into the second quarter, 26% continued into the third quarter, and 16% were still taking opioids in the fourth quarter	After adjusting for covariates, three factors were associated with an increased likelihood of long-term opioid usage (all 4 quarters): higher baseline pain, functional status at baseline, and injury severity at baseline
Gross et al. [2009]	Records from the Alberta Canada WC board on 137,175 WC claims for sprains, strains, fractures, dislocations, amputations, or burns between January 1, 2000 and December 31, 2005	The percentage of WC claimants receiving any opioid during the first year after injury ranged from a high of 11.4% in 2000 to a low of 8.3% in 2005	Not assessed	Specific duration of opioid use was not presented	Claimants with amputations, dislocations, or fractures were more likely than those with back strains to have received opioids. Claimants with early opioid use had, on average, a longer duration of work disability than those without early opioid use
Mahmud et al. [2000]	A random sample of 415 cases among 3,214 WC low back pain claimants from a single insurance company, with claims filed between June1, 1995 and August 31, 1995	Thirty-eight percent of claimants were prescribed opioid narcotics	Not assessed	Not assessed	Use of opioids for more than 7 days was associated ($P = 0.036$) with an increased length of disability compared to those not using opioids or using them for less than 7 days (45 days vs. 17 days, $P = 0.036$)

(*Continued*)

TABLE I. (*Continued*)

	Population	Use of opioids	Average opioid dose (MED)	Average duration of use	Study findings
Stover et al. [2006]	A sample of 1,067 WC back pain claimants from Washington State who filed claims with the State Fund between July 1, 2002 and June 30, 2003	Thirty-five percent of claimants received an opioid prescription at the first medical visit or within the first 6 weeks after injury	Not assessed	Not assessed	After adjusting for covariates, three factors were associated with an increased likelihood of receiving an opioid prescription: daily tobacco use, suffering from a major sprain, and being diagnosed with radiculopathy
Volinn et al. [2009]	A set of 122,530 compensable lost-time WC claims for non-specific low back pain filed with the Utah WC Fund with dates of injury between January 1, 2002 and June 30, 2005	52.2% of WC claimants with lost-time claims for low back pain filled at least one opioid prescription, and 18.0% filled opioid prescriptions for at least 90 days continuously	Not assessed	Not assessed	Claimants who took opioids were more likely to have chronic work loss exceeding 90 days. The strength of the opioids taken (Schedule II vs. Schedule 3 and 4) and the length of opioid use (at least 90 days) was associated with a greater likelihood of chronic work loss (>90 lost work days or a settled claim). Compared with low back pain claimants who did not take opioids, total claims costs for claimants taking Schedule II opioids were on average $19,453 higher, and $25,678 higher if the opioids were taken for 90 days or more
Webster et al. [2007]	A sample of 8,443 WC cases of claimants from 46 states who filed claims for acute low back pain with a single WC insurance company between January 1, 2002 and December 31, 2003	21.2% of claimants received at least one opioid prescription within the first 15 days ("early" users) following the injury. 10.4% of claimants received 5 or more opioid prescriptions between 30 and 730 days following injury ("late" users)	Among claimants receiving opioids, the average cumulative MED during the first 15 days was 385.8 mg (25.7 mg daily dose), with a range of 5.7 mg average daily MED in the lowest quartile and 64.0 mg average MED in the highest dose quartile	Not assessed	After controlling for covariates, the average MED dose among "early" users was associated with increasing mean disability duration, mean medical costs, likelihood of subsequent low back surgery, and late opioid use. The mean medical cost per claim among low back pain claimants taking opioids was $18,646 compared to $12,188 for low back pain claimants not taking opioids
Webster et al. [2009]	A sample of 8,262 WC cases of claimants from 39 states, who filed claims for acute low back pain with a single WC insurance company between January 1, 2002 and December 31, 2003	21.3% of claimants received at least one opioid prescription within the first 15 days following the injury	Not assessed	Not assessed	There was considerable variation in opioid prescribing among states, with a weighted coefficient of variation of 53%. Between-state variation was associated with household income inequality, number of physicians per capita, and WC cost containment efforts

TABLE II. Summary of MED Dose and Prevalence Estimates From Population-Based Studies for Non-Cancer Pain in General (Non-Workers Compensation) Settings

	Population	Use of opioids (prevalence)	Average opioid daily dose (MED)
Boudreau et al. [2009]	Records for 338,645 episodes of opioid use from 1997 through 2005 among members of two commercial health plans were used	The prevalence of opioid use grew from 15.5% in 1997 to 18.7% in 2005 at one of the health plans and from 14.9% in 1997 to 16.0% at the other health plan	From 1997 to 2005, the average MED per day for users of opioids ranged from 19.6 to 22.1 mg at one of the health plans and from 20.2 to 22.6 mg/day at the other health plan
Caudill-Slosberg et al. [2004]	Data on patient visits from the National Ambulatory Medical Care Survey from 1980–1981 (n = 89,000) and 1999–2000 (n = 45,000) were used to identify visits at which opioids were prescribed for musculoskeletal pain	In 1980–1981, approximately 8% of primary care visits involved prescribing of opioids for acute and chronic musculoskeletal pain. In 1999–2000, the level had risen to 11% for acute pain and 16% for chronic pain	Not assessed
Cepeda et al. [2010]	Data from a pharmacy management database for 48,986 subjects who were dispensed opioids on at least two occasions at least 6 months apart. Ninety-nine percent of subjects (48,367) used the opioids intermittently and 1% (619) used them continuously during the study period. Follow-up assessment ranged from a half-year to more than 8 years	Not assessed	During the 8-year study period, the mean daily MED ranged from 55.7 to 72.5 mg for intermittent opioid users, and from 62.1 to 127.5 mg (attained at 7.5–8.0 years of continuous use) for continuous opioid users
Dunn et al. [2010]	A sample of 9,940 people from a large health plan who were diagnosed with chronic non-cancer pain between 1997 and 2005, and who had 3 or more prescriptions filled for opioids in the first 90 days of their episode. Follow up was conducted through 2006	Not assessed	During the follow-up period (mean of 42 months), the mean daily MED was 13.3 mg
Sullivan et al. [2008]; Braden et al. [2008]	The sample included 115,914 individuals in 2000 and 127,866 individuals in 2005 from the Arkansas Medicaid plan and 2,716,163 individuals in 2000 and 3,768,223 individuals in 2005 from commercial health plan	Among the Medicaid population, the use of opioids for non-cancer pain was 25.5% in 2000 and 29.9% in 2005. Among the commercial health plan population, the use of opioids for non-cancer pain was 13.6% in 2000 and 17.0% in 2005	In the Medicaid population, the mean daily MED was 54.3 mg in 2000 and 50.2 mg in 2005. In the commercial health plan population, mean daily MED was 53.5 mg in 2000 and 53.1 mg in 2005
Von Korff et al. [2008]	Records for over 3 million episodes of opioid use for non-cancer pain between 1997 and 2005 were obtained for two large health plans in the Western U.S	Not assessed	At one health plan in Washington State, the mean daily MED ranged from 24.3 mg for acute pain episodes (12–14 days on average) to 57.8 mg for long-term pain with high dose treatment. At a health plan in California, the mean daily MED ranged from 36.5 mg for acute pain episodes (12–14 days on average) to 51.0 mg for long-term pain with high dose treatment

TABLE III. Opioid Use in the Ohio BWC System

	FY 2008	FY 2009	FY 2008–2009
Active claims	279,865	299,835	579,700
Claims involving use of opioids	57,914	53,545	111,459
Prevalence of opioid use (%)	20.7	17.9	19.2
Mean daily MED (mg) per claimant	56.8	58.7	57.7
Median daily MED (mg) per claimant	37.5	37.8	37.6
Mean cumulative MED per claimant	1,357	1,445	1,401
Mean cost per opioid prescription	$81.47	$92.49	$86.47
Mean cost per opioid claimant	$734.94	$895.23	$807.65

TABLE V. Claimants' Mean Daily MED, by the Number of Pharmacies Used to Fill Opioid Prescriptions, FY 2008–2009

Number of pharmacies used by claimants to fill opioid prescriptions	Percent distribution	Mean daily MED (mg)
One pharmacy	72.2	33.4
Two pharmacies	17.6	46.8
Three pharmacies	5.9	87.6
Four pharmacies	2.3	100.5
Five pharmacies	1.0	135.9
Six or more pharmacies	0.9	235.6

DISCUSSION

This study provides new information relevant to understanding the use of opioid prescription medications in WC populations. Pain management experts and clinician researchers differ in their opinions about what daily MED value is considered to constitute a high-risk dose. However, recent guidelines issued in 2008 by the Agency Medical Directors in Washington State and dosing recommendations issued in 2010 by the Centers for Disease Control and Prevention [CDC, 2010] both consider 120 mg daily MED as the ''yellow flag'' dose level at which physicians should seek a consult from a pain specialist if the patient's pain and function have not improved substantially [AMDG, 2010]. One recent study [Dunn et al., 2010] found that patients taking 100 mg or more daily MED were nine times more likely to have an overdose than a comparison group who did not use opioids. In our study, 20% of Ohio WC claimants prescribed opioids had an average daily MED exceeding 72 mg and approximately 9.2% of claimants prescribed opioids had an average daily MED exceeding the ''yellow flag'' level of 120 mg.

The mean daily MED levels found in Ohio among WC claimants using opioids was 57.7 mg, which in comparison is higher than the average of 47.8 mg that was found in the review of studies in WC settings from other states and higher than the average of 41.8 mg found in the review of population-based studies outside of WC. There are likely a variety of reasons to account for the generally higher dosages of opioids found in the WC context than in non-WC settings. Most notably, WC insurance coverage generally provides first-dollar coverage without copayments or deductibles. This eliminates, or at least reduces, much of the financial burden faced by claimants in purchasing opioid prescriptions. Additionally, because of the nature of occupational exposures, a high proportion of WC claims are related to acute back pain and chronic musculoskeletal disorders, which commonly are treated with prescription opioids. Moreover, authorities have observed that the chronic disability and work loss which is characteristic of WC injuries serves to intensify the illness experience and likelihood for prolonged opioid usage [Volinn et al., 2009].

TABLE IV. Distribution of daily MED, by quintile (FYs 2008–2009)

	Lowest value cut point (mg)	Mean (mg)
1st quintile (0–20%)	0	16.1
2nd quintile (20–40%)	23	28.3
3rd quintile (40–60%)	34	39.3
4th quintile (60–80%)	47	55.8
5th quintile (80–100%)	72	188.3

Daily MED dosage levels in Ohio were also higher, on average, than have been reported in other state WC settings. This differential may reflect, in part, the extremely broad discretion that Ohio WC claimants can exercise over the choice of provider and pharmacy, compared to many other states. Although the Ohio BWC provides care through contracts with 17 managed care organizations, there is no use of designated provider networks in Ohio for WC care, potentially allowing for increased discretion by patients seeking a provider who will treat them in a desired manner. In addition, the Ohio WC system has not promulgated pain management treatment protocols or pharmaceutical usage guidelines which must be adhered to by community-based providers. While there is some case management for serious injuries in the Ohio WC system, there is comparatively less case management of chronic disorders involving opioid use than exists in other states. One of the BWC's motivations in commissioning this study was to identify potential strategies for better identifying and controlling cases of long-term opioid use and avoiding potential overuse.

Although MED dosage levels appeared to be somewhat higher than in other settings, it was interesting that the prevalence of WC claimants receiving opioid prescriptions in Ohio was found to be lower (19.2%) than in other

locations (mean of 31.8%), and about the same as that (17.9%) found in non-WC populations. However, the mean prevalence of 31.8% determined from the literature review included several studies that were restricted to WC claims to those involving only musculoskeletal disorders. Our study covered treatment for all injuries, not just musculoskeletal conditions which would be expected to have a relatively greater usage of opioids, compared to non-musculoskeletal injuries. The data from the Ohio BWC information warehouse was not coded in a way that allowed us to perform an analysis restricted to musculoskeletal conditions. We presume that if such an analysis could be performed in Ohio, the prevalence of claims with opioid usage would be greater than 19.2%.

One of the primary aims of this study was to identify cases with especially high use of opioids. Indeed, our analysis found that there was a substantial proportion of cases (9.2% of all opioid claims) that met the CDC criteria of 120 mg daily MED for indicating a dosing threshold that warrants medical evaluation and potential referral to a pain specialist. Also, there was a surprising number of cases (120) with extremely high dosage levels exceeding 1,000 mg/day. The data did not allow us to identify the particular medical conditions and treatment histories for those extreme cases. It is possible that claims with such high doses may have involved patients with occupationally induced cancer or other very serious end-stage illnesses. Alternatively, such high dosages could be indicative of drug diversion or abuse. The Ohio BWC pharmacy department is collaborating with the fraud and abuse unit at the BWC to be able to better understand the circumstances underlying these type of high-dosage cases.

Data from this study suggest that there is a potential association between claimants' average daily dosage of opioids and the number of pharmacies used to fill the opioid prescriptions. Unfortunately, information residing in the BWC database did not permit a more detailed analysis of the reasons for this apparent association. It may be that cases with high average daily dosages are those that extend over a prolonged time period, increasing the chances that claimants could have moved residences or that nearby pharmacies may have opened or closed during the course of the claim. It might also be that the use of multiple pharmacies involving higher opioid dosages is indicative, in some cases, of fraud, abuse, or other illicit activity. There are other potential explanations for use of more than one pharmacy that need to be considered. For example, not all pharmacies carry the specific opioid in the dose prescribed. Chain pharmacies typically are limited in the amount of opioids that they may order, thus impacting when and where an individual can get a prescription. In addition, some retail pharmacies provide customers incentives to patronize their stores.

Data from our analysis also suggests that mean daily higher opioid dosage levels are associated with claims involving more days of work disability. This finding is consistent with other studies linking opioid use and disability duration. For example, Mahmud et al. [2000] found that use of opioids for acute disabling work-related back pain for more than 7 days was associated with significantly greater length of work disability. Franklin et al. [2008] also found that use of opioids for more than 1 week following injury was associated with an increased likelihood of continued work disability after 1 year.

While the primary aim of this research was not specifically to study trends in cost of opioids over time, it was, nevertheless, interesting to note that between FY 2008 and FY 2009 the mean cost of an opioid prescription rose by 11.5% (from $81.47 to $92.49) and the mean annual opioid costs among claimants using opioids rose by 21.8% (from $734.94 to $895.23). Indeed, total opioid expenditures within the Ohio BWC increased 12.6% from $42.6 million to $47.9 million during this period. By comparison, overall pharmaceutical expenditures in the U.S. grew by 5.1% between 2008 and 2009 [Berkrot, 2010].

Although some of the overall increase in Ohio's WC system is undoubtedly attributable to increased opioid pricing, the differential between the 11.5% increase in price per prescription and the 21.8% rise in total costs per claimant indicates that a portion of the overall increase is likely due to greater utilization of opioids by injured workers.

Our research plan was limited to examining opioid use among claims that were active during the study period of July 1, 2007 through June 30, 2009. In this preliminary cross-sectional study, we therefore intentionally chose not to evaluate MED dosage over the entire duration of each claim. However, in examining claims that were active (i.e., with current payments) as of FY 2008 and FY 2009, we discovered that many of those claims had been originally filed many years ago. Specifically, a simple examination of the data revealed that among active claims involving opiate usage, 45.3% had been open for at least 6 years and 28.5% had been open for at least 10 years. By contrast, among active claims not involving opiate usage, only 22.9% had been open for at least 6 years and 12.1% had been open for at least 10 years.

We found it intriguing that such a substantial proportion of the opioid-use claims had been open for that long and that claimants were still continuing to make claims for opioid prescriptions even after so many years. It suggests that a considerable amount of opioid use in the WC system may be associated with these long-term chronic cases. If so, then WC officials might need to develop special measures (e.g., intensive case management) to periodically review those claims and reconsider medical options.

Additional research will be necessary to explore the full implications of this preliminary finding.

Limitations

This study examined opioid use with a single large state WC system. As indicated earlier, conditions in Ohio may be different in important respects from other states, thereby limiting the generalizability of the study findings. While we were fortunate to have a large set of data available for analysis from the BWC's data warehouse, there were some key data elements that were not available for use in our analysis. For instance, coding practices within the BWC system did not allow us to be able to reliably specify the primary type of injury associated with a particular claim or claimant. Pharmaceutical information was available only for prescriptions filled in pharmacies; prescription medication use provided in inpatient settings was not available for inclusion in the analysis. In addition, prescription drug information and claims data was not available for self-insured employers in Ohio, which account for about one-third of the state's workforce. However, there is no reason to believe that the opioid usage patterns among claimants from self-insured employers differ substantially from workers covered by the BWC.

The primary purpose of this study was to determine the extent and type of opioid usage in the state WC system. Future studies should examine the more complex question of how specifically various types of opioid usage affect the outcomes of care and vocational function of injured workers. A study of that type will need to assess the relative contribution of numerous factors on determining the ultimate outcomes of care and work performance.

A related important question for the future is to determine how the timing and strength of initial opioid usage after injury affects subsequent dose escalation and the ultimate medical and vocational outcomes for injured workers. Because we restricted this study to a 2-year assessment period, we were unable in this analysis to construct long-term dosing histories to study chronic opioid use and to identify the determinants of high opioid use. Additional analyses could be conducted to follow a cohort of claimants over time. Further studies are also needed to determine how particular factors (e.g., worker occupation, gender, and age) modify or affect opioid usage and outcomes among WC claimants.

Finally, this study was also limited by the availability of information concerning medical providers. The data made available to the researchers through the Ohio BWC information warehouse did not permit us to associate an opioid-using claimant with a treating medical provider or to gather salient information about the providers' professional experience, practice setting, or demographic attributes.

Conclusions and Policy Implications

These analyses provide benchmarking data on WC opioid usage that can be used by WC officials in other states concerned about prescription drug safety and treatment appropriateness in WC systems. Additional research will be needed to assess patterns of opioid dosage over time, determinants of high-dosage use, and physician prescribing behavior. State WC agencies need to determine the extent to which opioids are being used by injured workers and take measures to identify and better manage cases that have the potential for dependency and abuse. Indeed, initiatives are underway in many locations to address this issue. In 2004, the Washington State Department of Labor and Industries sent a letter to 10,000 physicians warning them about the dangers of over-prescribing opioid medications [Franklin et al., 2005]. State WC agencies in several states (e.g., Oklahoma and Washington) have adopted guidelines for the prescription of opioid medications that require a consultation with a pain management specialist under certain conditions. Oklahoma's guideline, for instance, mandates that a pain management specialist be consulted if (a) pain and functional status have not substantially improved after 2–4 months of opioid treatment, (b) the patient has a history of chemical dependency, (c) the patient appears to have a borderline and/or antisocial personality disorder or psychosis, (d) there is evidence of active alcohol or other substance abuse, or (e) the patient appears to have significant problems with depression, anxiety, or irritability [Physician's Advisory Committee, 2007]. Chronic pain guidelines promulgated by the American College of Occupational and Environmental Medicine in 2008 advised against the routine use of opioid medications for treatment of back injuries and other noncancer pain, while acknowledging that selected patients could benefit from opioid usage with appropriate medical evaluation and monitoring [ACOEM, 2008].

Authorities have proposed a variety of control strategies for effectively managing opioid usage to optimize clinical care and avoid undesired outcomes, including dependency and chronicity [Robinson, 2008; Brown and Roper, 2010]. These strategies include early identification of patients at risk using predictive modeling algorithms and surveillance of claims to spot unusual trends (e.g., prescription fills at multiple pharmacies) or especially high-dose opioid use at an early stage. Timely interventions could include assignment of a case manager familiar with opioid therapy, communication with prescribing providers, patient education, and/or referrals to behavioral health professionals [Robinson, 2008]. Education of prescribing physicians is also important. New regulations introduced in 2011 by the U.S. Food and Drug Administration's Opioids Risk Evaluation and Mitigation Strategy require manufacturers to develop educational materials for

medical providers about safe use of long-acting and extended-release prescription opioids [Ram, 2011].

Ohio already has a prescription drug monitoring program called the Ohio Automated Rx Reporting System (OARRS), designed to allow prescribers and pharmacists access to a complete record of patients' medication usage in the interest of safety and quality. The OARRS also permits law enforcement officials to identify and investigate suspicious drug-seeking behaviors. Additionally, in April 2010, Ohio's governor established an interagency task force on prescription drug abuse, including participation by the Ohio BWC, to coordinate efforts to address drug abuse, opioid addiction therapies, and additional regulatory oversight for pain clinics in the state.

A July 2011 report from the U.S. Institute of Medicine (*Relieving Pain in America*) described what it called "The Conundrum of Opioids"; that is, the need to make appropriate opioid pain medications readily available to those who need and can benefit from them, while putting measures into place to ensure that opioid use is safe and will not lead to overuse or abuse. The IOM report emphasizes the need for appropriate pain management by a qualified practitioner or interdisciplinary provider team applying an integrated approach that includes comprehensive pain assessments, patient and provider education, drug utilization monitoring, care coordination and referral, when indicated, to pain specialists, physical therapists, and or mental health providers [IOM, 2011]. The IOM report further cites the need for enhanced pain prevention, development of safer drug formulations, tighter regulation of opioid distributors, and expanded use of evidence-based clinical protocols for opioid therapy for chronic non-cancer pain. WC officials, medical providers, and other stakeholders can draw upon these state and federal strategies to develop measures that will help ensure safe and effective use of opioid medications in their state's WC system.

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