American Pain Society
RESEARCH
EDUCATION
TREATMENT
ADVOCACY
PUBLISHED BY ELSEVIER

The Journal of Pain, Vol 14, No 12 (December), 2013: pp 1620-1628
Available online at www.jpain.org and www.sciencedirect.com

Changes in Opioid Prescribing for Washington Workers' Compensation Claimants After Implementation of an Opioid Dosing Guideline for Chronic Noncancer Pain: 2004 to 2010

Renu K. Garg,* Deborah Fulton-Kehoe,† Judith A. Turner,‡,§ Amy M. Bauer,‡ Thomas Wickizer,‖ Mark D. Sullivan,‡ and Gary M. Franklin†,‖,¶,**

*Departments of *Epidemiology, †Environmental and Occupational Health Sciences, ‡Psychiatry and Behavioral Sciences, §Rehabilitation Medicine, ‖Health Services, and ¶Neurology, University of Washington, Seattle, Washington. **Washington State Department of Labor and Industries, Olympia, Washington.*

Abstract: **An opioid overdose epidemic emerged in the United States following increased opioid prescribing for chronic noncancer pain. In 2007, Washington State agencies implemented an opioid dosing guideline on safe prescribing for chronic noncancer pain. The objective of this population-based observational study was to evaluate opioid use and dosing before and after guideline implementation. We identified 161,283 workers aged 18 to 64 years with ≥1 opioid prescriptions in Washington Workers' Compensation, April 1, 2004, to December 31, 2010. Prevalence and incidence rates of opioid use were assessed. We compared pre- and postguideline chronic and high-dose use (≥120 mg/d) among incident users. The mean monthly prevalence of opioid use declined by 25.6% between 2004 (14.4%) and 2010 (10.7%). Fewer incident users went on to chronic opioid therapy in the postguideline period (4.7%; 95% confidence interval [CI], 4.5–5.0%) than in the preguideline period (6.3%; 95% CI, 6.1–6.6%). Compared with preguideline incident users, postguideline incident users were 35% less likely to receive high doses (adjusted odds ratio = .65; 95% CI, .59–.71). Although the extent to which decreases were due to the guidelines is uncertain, to our knowledge, this is the first report of significant decreases in chronic and high-dose prescription opioid use among incident users.**

Perspective: ***Evidence-based strategies for opioid risk management are needed to help abate the epidemic of opioid-related morbidity and mortality. The study findings suggest that opioid dosing guidelines that specify a "yellow flag" dosing threshold may be a useful tool in preventing escalation of doses into ranges associated with increased mortality risk.***

Key words: *Opioids, dosing, trends, guideline, chronic pain.*

Opioid analgesics were increasingly prescribed for long-term treatment of chronic noncancer pain (CNCP)[7,9,20,23] following advocacy for greater attention to pain and its relief by pain management leaders and subsequent changes in state laws and regulations.[4] In recent years, there has been a national epidemic of overdose deaths and morbidity related to prescription opioids.[33] Accidental poisonings have become the leading cause of unintentional injury death in the United States, largely owing to the rise in deaths associated with prescription opioids.[33] In 2008, the opioid-related mortality rate in the U.S. was 4.8 per 100,000[33] whereas the rate in Washington State was more than 50% higher (7.4 per 100,000).[36] The number of opioid-related deaths among Washington residents increased from under 50 in 1995 to over 500 in 2008.[36]

Parallel trends were evident in the Washington workers' compensation (WC) system, with more than 100 deaths due to accidental overdose from opioids between 2000 and 2010.[20] Prescriptions for Schedule II

Received January 14, 2013; Revised July 19, 2013; Accepted July 28, 2013.
Study Sponsor and Support: Centers for Disease Control and Prevention, Grant number: 5R21CE001850-01, 09/01/2010 – 08/31/2012.
The Centers for Disease Control and Prevention had no involvement in the design and conduct of the study; collection, management, analysis, and interpretation of the data; and preparation, review, or approval of the manuscript.
None of the authors have any financial or nonfinancial conflicts in regard to this work.
Address reprint requests to Renu K. Garg, MPH, Department of Epidemiology, University of Washington, 130 Nickerson St, Suite 212, Seattle, WA 98109. E-mail: rkgarg@uw.edu
1526-5900/$36.00

http://dx.doi.org/10.1016/j.jpain.2013.08.001

opioids (the most potent opioids) in WC nearly tripled between 1996 and 2006,[17,20] and mean daily doses for long-acting Schedule II opioids were as high as 140 mg morphine-equivalent dose (MED)/d in 2006.[17] Multiple studies have found that opioid-related morbidity and mortality rates were highest among high-dose users.[5,14,22]

In response to the emerging epidemic of unintentional poisonings, the Washington Agency Medical Directors' Group (AMDG) collaborated with clinical and academic pain experts to develop and implement the *Interagency Guideline on Opioid Dosing for Chronic Non-Cancer Pain* in 2007.[20,48] The goal of the Guideline was to assist primary care providers in more safely and effectively prescribing opioids to CNCP patients initiating opioid therapy and to prevent these new patients from escalating to high-dose opioid use if they were not benefiting from opioid therapy. The Guideline was intended as a resource for primary care providers who do not specialize in pain medicine. A key feature was the recommendation that providers not exceed a dosing threshold of 120 mg MED/d for patients who did not have clinically meaningful improvement in pain and function without first obtaining a pain specialist consultation.

The AMDG Guideline was the first to provide specific prescription opioid dosing guidance.[20] The Guideline also included recommendations for best practices for patient selection and risk assessment, initiating and discontinuing opioid therapy, and transitioning to chronic opioid therapy. Following its online release in 2007, dissemination of the Guideline also included numerous presentations to provider groups, free web-based training for continuing medical education credits, and access on the National Guideline Clearinghouse[1] and Washington Medical Association websites.

We previously reported that the number of Washington WC opioid prescriptions, the mean daily long-acting opioid dose, the percentage of claimants receiving work disability benefits with doses ≥120 mg MED/d, and the number of unintentional opioid poisoning deaths all decreased after 2007.[20] However, in that study, examination of high-dose opioid use was restricted to long-acting opioids and claimants receiving work disability compensation, incident and chronic opioid use were not assessed, and pre- versus post-Guideline prescribing patterns were not compared statistically.

The current study expanded on this prior work to more closely examine opioid use and dosing patterns in the Washington WC population before and after Guideline implementation by assessing the incidence of opioid use, chronic use among incident opioid users, and high-dose opioid use, including all prescription opioids and all claimants. Because the main emphasis of the AMDG Guideline was to prevent potentially unsafe opioid dose escalation among patients initiating opioid therapy, we also compared pre- and post-Guideline rates of chronic and high-dose opioid use among incident users to determine whether these rates decreased after Guideline implementation.

Methods

Study Setting and Population

The Washington Department of Labor and Industries (DLI) is the sixth largest WC insurer in the U.S. and the sole regulator of WC in Washington. DLI reviews as many as 130,000 claims for work-related injuries and illnesses in 1 year. The DLI State Fund is the direct insurer for approximately 2.3 million covered workers who account for two-thirds of the non-Federal Washington workforce. The remaining one-third work for and are covered by approximately 350 large, self-insured companies. For this study, we examined State Fund claims data. Complete claims data from the self-insured companies are not available for use. Approved State Fund claims typically remain open until a provider certifies that the worker's injury has healed or would not likely benefit from further medical care. The DLI administrative database, the Medical Information Payment System (MIPS), tracks all requests for billing and payment of health care services directly related to the covered injury or illness. The extensive database contains computerized billing data for all allowed claim-related hospital, outpatient medical, and pharmacy services allowed under injury claims and is commonly used for research purposes.[16-20,39] The MIPS point-of-sale pharmacy database captures complete information on outpatient prescriptions, including drug name, strength, quantity, days' supply, national drug code, and dispense date for each medication dispensed. We obtained MIPS data for all opioid prescriptions in 2004 to 2010. The study was approved by the University of Washington institutional review board. Because the research involved no more than minimal risk and included a large number of individuals, the requirement for informed consent was waived.

We identified 161,283 workers in Washington WC aged 18 to 64 years with an accepted DLI injury claim and at least 1 paid opioid prescription (oral or transdermal) dispensed between April 1, 2004, and December 31, 2010. Workers who had a medical bill containing an *International Classification of Diseases, Ninth Revision, Clinical Modification* code for cancer other than nonmelanoma skin cancer were excluded. For individuals with multiple injury claims, we aggregated prescriptions across all claims.

Opioid-Related Measures

We grouped opioids by generic, short- versus long-acting properties, and Drug Enforcement Administration schedule. This schedule ranks controlled substances with recognized medical uses on a scale of II through V, with Schedule II having the highest abuse potential (Schedule I drugs cannot be legally prescribed). We further categorized opioids as short-acting Schedule II, long-acting Schedule II, or non–Schedule II (including nonscheduled tramadol).[46]

The first opioid prescription dispensed during the study period for each worker was defined as the *index*

prescription. For each prescription, we defined the *start date* as the dispense date and the *end date* as the dispense date plus days' supply minus 1. The dates encompassed by a prescription were counted as the days covered by opioids. If an individual had 2 or more prescriptions with days' supply covering the same dates, the overlapping dates were counted as 1 covered day.

We defined a worker as an *incident user* if no opioid prescriptions were dispensed in the 3 months prior to the index prescription. For users with an index prescription in April–June 2004 (the first 3 months of our study), the 3-month pre-prescription window included the relevant dates in January-March 2004. An *incident-chronic user* was defined as an incident user who had at least 90 days (consecutive or nonconsecutive) covered by opioids in the 180 days after the index prescription start date.

The prevalence of opioid use among all workers in Washington WC aged 18 to 64 years was determined for each year and each quarter as the mean of the monthly rates in each time segment. To obtain monthly prevalence, we divided the number of all opioid users in that month by the total number of claimants with an open claim that month (estimated by DLI). The mean monthly prevalence for a quarter was calculated as the sum of the 3 monthly rates in that quarter divided by 3. The mean monthly prevalence for a year was calculated as the sum of the 12 monthly rates in that year divided by 12 (the calculation for 2004 used 9 monthly rates and divided by 9 since the study began in April 2004). We assessed the quarterly rate of incident users who became chronic by dividing the number of incident-chronic users by the total number of incident users in the quarter.

We computed a worker's daily dose for each opioid prescription as the total number of pills (or patches) dispensed multiplied by the drug strength, divided by the days' supply. Daily doses were then converted to MED using published conversion factors.[45,46,48] If an individual had prescriptions with overlapping dates, the daily dose was defined as the sum of the doses from the different prescriptions for the same day. We estimated the daily dose per quarter for an individual as the sum of the doses on the days in the quarter divided by the number of days in that quarter covered by opioid prescriptions.

For each year, we determined the proportions of incident users and of incident-chronic users who received high daily opioid doses on any 30 days (consecutive or nonconsecutive) within 1 year of the index prescription (ie, the index prescription start date plus 365 days). We included prescriptions dispensed in 2011 for workers with an index prescription in 2010. We defined 3 high-dose categories: ≥60, ≥90, and ≥120 mg MED/d.

Pre- and Post-Guideline Implementation Time Periods

The Washington Guideline was released online on March 22, 2007, but for purposes of the study we considered April 1, 2007, as the implementation date. We defined the pre-Guideline period as April 2004 to March 2007 and the post-Guideline period as April 2007 to December 2010.

Statistical Analysis

Descriptive statistics were used to characterize opioid users, prescriptions, and doses in 2004 to 2010. To compare the rate of incident users who became chronic users in the pre- versus post-Guideline time periods, we conducted an interrupted time series analysis using a segmented linear regression model.[47] This model allowed us to compare the pre- and post-Guideline trends in quarterly rates while accounting for underlying changes in rates that would be expected had there been no policy change. The model included a linear term for the quarter, an indicator for whether the quarter was before or after Guideline implementation, and a linear term for the time since Guideline implementation. We obtained 95% confidence intervals (CIs) and performed the Durbin-Watson test[47] for autocorrelation.

We constructed a logistic regression model to compare pre- versus post-Guideline incident users on the odds of receiving ≥120 mg MED/d on any 30 days within the first year, adjusting for worker age and gender. Workers who received their first opioid prescription in April 2006 to March 2007 were excluded from this model to ensure that the 1-year follow-up did not extend beyond the Guideline implementation date. All analyses were conducted using Stata Statistical Software Release 12 (StataCorp, College Station, TX).[38]

Results

Among the 161,283 injured workers with a dispensed opioid prescription, the mean (SD) age was 39.2 (11.7) years and the majority were male (68.9%). The annual number of opioid prescriptions ranged from a high of 165,017 in 2006 to a low of 101,278 in 2010 (Table 1). Opioid prescriptions consisted mostly of non–Schedule II medications across all years (57.4–62.4%). The proportion of prescriptions that were for long-acting Schedule II opioids peaked at 8.6% in 2007, then decreased to a low of 4.1% in 2010. The proportion of prescriptions that were for short-acting Schedule II opioids increased over those years from 32.5% to 38.4%.

Temporal Trends in Opioid Use

Overall, the mean monthly prevalence of opioid use declined by 24.3% between 2004 (14.4%) and 2010 (10.9%) (Table 2). The decrease in prevalence was greatest (24.3%) between 2008 Quarter 1 and 2010 Quarter 4 (Fig 1). Mean monthly incidence rates of opioid use were low across all years (2.9–4.1%) (Table 2), but decreased by 26.8% overall between 2004 and 2010.

As illustrated in Fig 2, the proportion of incident users who became chronic users decreased overall by 52.7% between 2004 Quarter 1 (7.4%) and 2010 Quarter 4 (3.5%). Results from the segmented regression analysis showed that, on average, significantly fewer incident

Table 1. Opioid Prescriptions and Users, Washington WC, 2004 to 2010

		Opioid Prescriptions			Opioid Users	
	Total	Short-Acting Schedule II	Long-Acting Schedule II	Non–Schedule II	Total	Incident
Year	N	n (%)	n (%)	n (%)	n	n
2004	120,300*	38,365 (31.9)	6,778 (5.6)	75,157 (62.5)	30,208*	21,590*
2005	163,318	53,227 (32.6)	11,027 (6.8)	99,064 (60.7)	36,412	24,759
2006	165,017	51,631 (31.3)	14,064 (8.5)	99,322 (60.2)	37,127	23,501
2007	156,992	50,960 (32.5)	13,473 (8.6)	92,559 (59.0)	34,812	20,621
2008	155,903	54,318 (34.8)	9,227 (5.9)	92,358 (59.2)	37,953	22,850
2009	125,290	46,594 (37.2)	6,667 (5.3)	72,029 (57.5)	33,753	19,362
2010	101,278	38,977 (38.5)	4,132 (4.1)	58,169 (57.4)	31,127	18,481

*Totals for 2004 are based on Quarters 2 to 4 (study did not include Quarter 1).

users became chronic in the post-Guideline period (4.7%, 95% CI = 4.5–5.0%) than in the pre-Guideline period (6.3%, 95% CI = 6.1–6.6%; $P < .001$). Rates of incident-chronic use significantly decreased per quarter in both the pre-Guideline period (−.10, 95% CI = −.17, −.03; $P = .01$) and the post-Guideline period (−.18, 95% CI = −.23, −.13; $P < .001$). Although the rate of decrease was greater in the post-Guideline period, the comparison between the pre- and post-Guideline trends did not reach statistical significance in the segmented linear regression model ($P = .07$). No significant autocorrelation was present in the data (Durbin-Watson test,[47] $P = .84$); thus, further adjustment was not necessary.

High-Dose Use

The median (interquartile range) daily opioid dose in each quarter remained fairly stable over the study period, ranging from 36.5 (23.3–58.7) to 37.5 (23.6–60.0) mg MED. For incident users, the median (interquartile range) daily dose in the first quarter of use changed little over time with doses between 33.3 (25.0–50.0) and 37.5 (25.0–56.3) mg MED.

Between 2004 and 2010, high-dose use among incident users similarly decreased for daily doses of ≥60, ≥90, and ≥120 mg MED (Table 3). In 2004, 1.8% of incident users reached daily doses of ≥120 mg MED/d on 30 days or more within 1 year. By 2010, the rate of opioid use at this level decreased by 55.6% among incident users to .8%. After adjusting for age and gender, post-Guideline incident users were 34.9% less likely to receive doses of ≥120 mg MED/d, as compared with pre-Guideline incident users (odds ratio = .65; 95% CI = .59–.71, $P < .001$). Among incident-chronic users, the proportion with doses ≥120 mg MED/d was highest in 2006 (18.7%) and remained above 15% until dropping to 13.6% in 2010.

Table 2. Prevalence and Incidence of Opioid Use, Washington WC, 2004 to 2010

	Mean Monthly Total WC Claimants*	Mean Monthly Total Opioid Users	Mean Monthly Incident Opioid Users
Year	N	n (%)	n (%)
2004	58,311	8,375 (14.4)	2,399 (4.1)
2005	59,013	8,507 (14.4)	2,063 (3.5)
2006	60,248	8,648 (14.4)	1,958 (3.3)
2007	59,620	8,170 (13.7)	1,718 (2.9)
2008	57,691	8,212 (14.2)	1,904 (3.3)
2009	51,634	6,623 (12.8)	1,614 (3.1)
2010	50,729	5,429 (10.7)	1,540 (3.0)

*Claimants from the overall WC population were included if they had an open claim at any time during the month.

Discussion

This study builds on our previous research in the Washington WC population and contributes new information on trends in prevalent, incident, incident-chronic, and high-dose opioid use in Washington WC between 2004 and 2010, encompassing periods before and after dissemination of the Washington Opioid Dosing Guideline. Both prevalence and incidence rates of opioid use decreased by 24% between 2004 and 2010. Most dramatically, the proportion of incident users who transitioned to chronic opioid use declined by more than half. Compared with the pre-Guideline period, incident-chronic use, on average, was significantly lower following release of the Guideline. Incident users in the post-Guideline period were also less likely to reach high daily doses than were pre-Guideline incident users. Although a substantial minority of incident-chronic users received high opioid doses across study years, the data revealed a decrease in 2010. To our knowledge, this study is the first report of significant decreases in chronic and high-dose use among incident prescription opioid users.

Few studies have examined population-based prescription opioid use rates. In Arkansas Medicaid, 30% of enrollees received opioids in 2005 compared with 26% in 2000.[40] Incident opioid use among enrollees in a Washington nonprofit health care system increased from 15% in 1997 to 16% in 2005, and the rate of incident-chronic use was 5% in 2005.[6] Rates in this study appear to be higher than rates in Washington WC. However, unlike our study, the health care system members could have multiple incident episodes of opioid use, were counted as chronic if they used opioids episodically

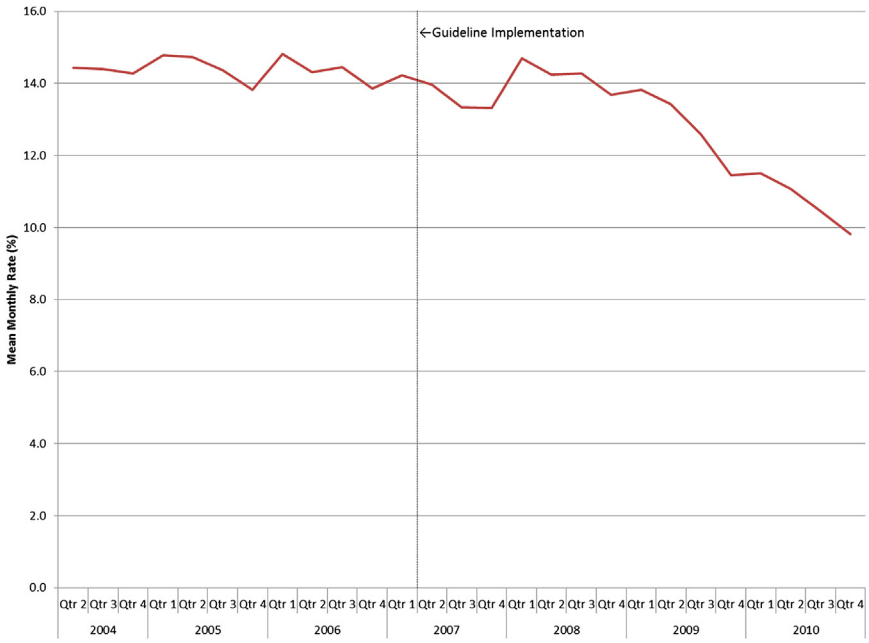

Figure 1. Prevalence of opioid use among injured workers, mean monthly rates per quarter, Washington WC, 2004 to 2010. The prevalence of opioid use (%) per quarter among all workers in Washington WC aged 18 to 64 years. Quarterly rates of opioid use were estimated as the mean of the monthly rates in that quarter.

before transitioning to chronic use, and tended to have long-term enrollment that permitted extensive follow-up. In Ohio WC, a reported 19% of claimants in 2008 to 2009 received opioids,[13] but this was likely an underestimate because it excluded non–Schedule II opioids, which are the most frequently prescribed opioids in the U.S.[12] and comprised more than half the opioid prescriptions in our study. Another study methodological difference is that we calculated rates of opioid use per month rather than per year to account for changes in the WC population resulting from individuals' claims opening and closing at various intervals. By capturing the population in a shorter time increment, we could better quantify the impact of the Guideline at a specific point in time.

The decline in chronic opioid therapy among incident users may be due, in part, to possible improvements in patient selection and risk assessment using best practices widely recommended for chronic opioid therapy.[8,11,21,28]

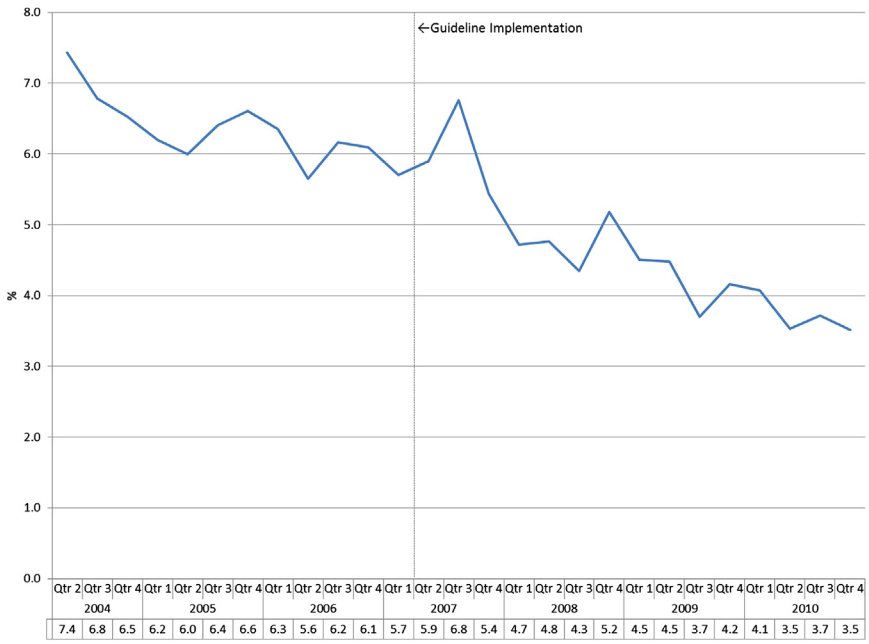

Figure 2. Rate of incident users who became chronic users, mean monthly rates per quarter, Washington WC, 2004 to 2010. The quarterly rate of incident users who became chronic (%) among Washington WC adults aged 18 to 64 years. Incident-chronic users had ≥90 days (consecutive or nonconsecutive) covered by opioids in the 180 days after their first opioid prescription was dispensed.

Table 3. High-Dose Opioid Use Among Incident and Incident-Chronic Users in the First Year of Use, Washington WC, 2004 to 2010

		Workers Who Reached Specified Dose on 30 or More Days*		
		≥60 mg MED	≥90 mg MED	≥120 mg MED
Year of Incident Use	N	n (%)	n (%)	n (%)
All incident users				
2004	21,590†	1,069 (5.0)	610 (2.8)	388 (1.8)
2005	24,759	1,117 (4.5)	617 (2.5)	382 (1.5)
2006	23,501	1,025 (4.4)	589 (2.5)	384 (1.6)
2007	20,621	811 (3.9)	454 (2.2)	289 (1.4)
2008	22,850	825 (3.6)	452 (2.0)	260 (1.1)
2009	19,362	658 (3.4)	346 (1.8)	226 (1.2)
2010	18,481	512 (2.8)	239 (1.3)	145 (.8)
Incident-chronic users				
2004	1,496†	603 (40.3)	375 (25.1)	264 (17.6)
2005	1,559	628 (40.3)	382 (24.5)	260 (16.7)
2006	1,425	595 (41.8)	385 (27.0)	266 (18.7)
2007	1,225	455 (37.1)	280 (22.9)	189 (15.4)
2008	1,082	418 (38.6)	268 (24.8)	167 (15.4)
2009	814	308 (37.8)	194 (23.8)	135 (16.6)
2010	685	249 (36.4)	141 (20.6)	93 (13.6)

*Days were within 1 year of the index prescription start date and could be consecutive or nonconsecutive.
†Totals for 2004 are based on Quarters 2 to 4 (study did not include Quarter 1).

Providers are advised to discontinue therapy if pain and function are not improving or the patient displays aberrant drug-related behaviors or other significant adverse effects. It is plausible that the reduction in incident-chronic use after Guideline implementation may have prevented dose escalation and severe opioid-related adverse events. Lowered incident-chronic use may have also reflected growing concerns regarding the risks of chronic opioid therapy.[3,35,37] In a survey of Washington primary care providers related to Guideline implementation, 54% of the respondents reported concerns over development of opioid dependence, tolerance, or addiction and 30% reported prescribing opioids less frequently.[29] As many as one-third of primary care physicians in low-income clinics in the U.S. reported discontinuing opioid prescribing for CNCP altogether.[26]

Dose escalation is common among chronic users and can result in high prescribed doses[2,19,25] associated with increased risk of fatal and nonfatal overdose.[5,14,22] The AMDG's main objective for the Guideline was to reduce the risk of opioid overdose in CNCP patients by preventing high-dose use in incident opioid users. Incident users were targeted in an attempt to deter dose escalation among patients beginning chronic opioid therapy. Our finding of a significantly reduced likelihood of reaching ≥120 mg MED/d among post-Guideline incident users is consistent with the possibility that the Guideline was successful in reducing dose escalation in the target population and may mitigate known risks of high-dose opioid use. Consistent with the Guideline-recommended dosing threshold, the best current evidence supports 100 to 120 mg MED/d as a "yellow flag" dosage at which the risk of morbidity and mortality rises significantly.[5,14,22] Two of these studies also reported increased risk at lower doses (50–100 mg MED/d).[5,14] These results emphasize the importance of screening for risk before starting chronic opioid therapy, and continuous monitoring throughout the course of therapy.

The decrease we observed in high-dose use among incident users coincided with reductions (in 2010) in mean daily dose of long-acting Schedule II opioids and in opioid-related mortality in Washington WC.[20] Our current findings suggest that high-dose use among incident-chronic users may also be decreasing. However, prescribed daily doses still reached 120 mg MED/d for 13% of incident-chronic users in 2010. High doses have also been reported in WC populations in other states. In Ohio WC, 9.2% of Schedule II opioid users in 2008 to 2009 received doses ≥120 mg MED/d (ever) during the 2 years.[13] Among workers in Louisiana WC with injuries during 1999 to 2002, average daily doses were as high as 145.7 mg MED/d 1 year after injury.[42]

We cannot rule out changes in opioid use and dosing after Guideline implementation resulting from general increased awareness of the risk of opioid overdose related to medical and nonmedical opioid use. Professional societies, emergency departments, and other organizations have promoted clinical guidelines for opioid prescribing.[11,21,32,43,44] The Centers for Disease Control and Prevention (CDC) has been active in educating individuals, providers, health insurers, and state policy makers.[33] The Food and Drug Administration and state and local health departments have also aimed to improve opioid safety.[15,24,27,31] National media coverage and scientific journal articles have brought much attention to the rising rates of opioid overdose and prescription opioid abuse.

Some limitations in our study are inherent in use of pharmacy claims data. We could not determine actual medication intake or duration of use. We assumed patients took medications at the maximum rate allowed as calculated by the dispensing pharmacist, which may have overestimated daily dose and underestimated days used. Also, the prescription dispense date may not reflect the actual timing of medication use. Opioid use may be underestimated as a result of prescriptions that were denied, charged to other insurance, or paid for out-of-pocket. Because we could not determine prior opioid use for claimants new to the WC system, incident and incident-chronic use may be overestimated. For future studies, data on all legally dispensed opioids in Washington will be available through the new Washington Prescription Monitoring Program (PMP).[49]

Another limitation is the lack of patient-reported outcomes. Although the Guideline underscores the need for monitoring improvements in patient pain and function, our study could not address the impact of the observed prescribing changes on pain-related outcomes. Little is known concerning the effectiveness of chronic opioid therapy for improving pain and function long-term. In a previous Washington WC study, the average opioid dose significantly increased by 62% among claimants receiving opioid therapy throughout the year after injury, yet only 27% showed a clinically meaningful improvement in pain and only 16% showed a clinically meaningful improvement in function.[19] In a randomized trial comparing stable opioid dose versus escalating dose prescribing strategies, there was no difference on the primary outcomes of usual pain and functional disability.[30] A recent study found no correlation between changes in dose and pain.[10] A stronger evidence base regarding safety and effectiveness of opioid therapy, and comparative effectiveness of chronic opioid therapy versus alternative therapies for chronic pain, is needed to optimize CNCP patient care, risk management, and health policy decision making.

Urgent action is needed to prevent additional harms from prescription opioid use that have become a public health crisis.[33] State and federal governmental agencies have an instrumental role in strategic planning for opioid risk management. The CDC has adopted the Washington Guideline dosing criteria and advocates its application in practice.[33,34] Under new regulations in Washington for CNCP management, the 5 Boards and Commissions representing prescribers licensed to prescribe controlled substances now have the authority to enforce best practice use, including attention to the dosing threshold.[50] These regulations also repealed earlier permissive legislation that removed limitations on dose and duration of opioid therapy.[41] Similar laws in other states and collaborations among government agencies may reduce opioid-related morbidity and mortality. State PMPs could be a valuable resource for comprehensive opioid prescribing data that can be used to identify statewide opioid trends, high-risk populations, and inappropriate opioid use. Improved registration, interoperability, and use of PMPs among prescribers may help maximize the benefits of PMPs.

The findings from this study suggest that clinical opioid dosing guidelines for CNCP that specify a "yellow flag" dosing threshold may be a useful tool for improving the safety of opioid prescribing practices by discouraging further dose escalation. Both chronic and high-dose opioid use rates declined among incident users after the Washington Guideline implementation. Although the extent to which these decreases may have been due to the Guideline cannot be established, these findings contribute to the evidence base concerning risk management strategies that may help to abate the national epidemic of opioid-related morbidity and mortality among patients with CNCP. Further research is needed on risk factors for opioid-related adverse events, as well as on optimal treatment strategies in chronic opioid therapy.

References

1. Agency for Healthcare Research and Quality: National Guideline Clearinghouse: Guideline summary. Available at: http://guideline.gov/content.aspx?id=23792. Accessed May 1, 2013

2. Ballantyne JC, Mao J: Opioid therapy for chronic pain. N Engl J Med 349:1943-1953, 2003

3. Barry DT, Irwin KS, Jones ES, Becker WC, Tetrault JM, Sullivan LE, Hansen H, O'Connor PG, Schottenfeld RS, Fiellin DA: Opioids, chronic pain, and addiction in primary care. J Pain 11:1442-1450, 2010

4. Bloodworth D: Opioids in the treatment of chronic pain: Legal framework and therapeutic indications and limitations. Phys Med Rehabil Clin N Am 17:355-379, 2006

5. Bohnert AS, Valenstein M, Bair MJ, Ganoczy D, McCarthy JF, Ilgen MA, Blow FC: Association between opioid prescribing patterns and opioid overdose-related deaths. J Am Med Assoc 305:1315-1321, 2011

6. Boudreau D, Von Korff M, Rutter CM, Saunders K, Ray GT, Sullivan MD, Campbell CI, Merrill JO, Silverberg MJ, Banta-Green C, Weisner C: Trends in long-term opioid therapy for chronic non-cancer pain. Pharmacoepidemiol Drug Saf 18: 1166-1175, 2009

7. Brixner DI, Oderda GM, Roland CL, Rublee DA: Opioid expenditures and utilization in the Medicaid system. J Pain Palliat Care Pharmacother 20:5-13, 2006

8. Cantrill SV, Brown MD, Carlisle RJ, Delaney KA, Hays DP, Nelson LS, O'Connor RE, Papa A, Sporer KA, Todd KH, Whitson RR: Clinical policy: Critical issues in the prescribing of opioids for adult patients in the emergency department. Ann Emerg Med 60:499-525, 2012

9. Caudill-Slosberg MA, Schwartz LM, Woloshin S: Office visits and analgesic prescriptions for musculoskeletal pain in US: 1980 vs. 2000. Pain 109:514-519, 2004

10. Chen L, Vo T, Seefeld L, Malarick C, Houghton M, Ahmed S, Zhang Y, Cohen A, Retamozo C, St Hilaire K, Zhang V, Mao J: Lack of correlation between opioid dose adjustment and pain score change in a group of chronic pain patients. J Pain 14:384-392, 2013

11. Chou R, Fanciullo GJ, Fine PG, Adler JA, Ballantyne JC, Davies P, Donovan MI, Fishbain DA, Foley KM, Fudin J, Gilson AM, Kelter A, Mauskop A, O'Connor PG, Passik SD, Pasternak GW, Portenoy RK, Rich BA, Roberts RG, Todd KH, Miaskowski C: Clinical guidelines for the use of chronic opioid therapy in chronic noncancer pain. J Pain 10: 113-130, 2009

12. Cook JD: Twelve year prescribing trends for fifteen different opioid, benzodiazepine, amphetamine, and barbiturate prescription drugs correlated with reports of prescription medication abuse and diversion. Substance Abuse and Mental Health Services Administration (SAMHSA). Available at: http://nac.samhsa.gov/DTAB/presentations/Jan12/Cook%20drugs.pdf. Accessed May 1, 2013

13. Dembe A, Wickizer T, Sieck C, Partridge J, Balchick R: Opioid use and dosing in the workers' compensation setting. A comparative review and new data from Ohio. Am J Ind Med 55:313-324, 2012

14. Dunn KM, Saunders KW, Rutter CM, Banta-Green CJ, Merrill JO, Sullivan MD, Weisner CM, Silverberg MJ, Campbell CI, Psaty BM, Von Korff M: Opioid prescriptions for chronic pain and overdose: A cohort study. Ann Intern Med 152:85-92, 2010

15. FDA: Timeline of selected FDA activities & significant events addressing opioid misuse & abuse. Available at: http://www.fda.gov/downloads/Drugs/DrugSafety/InformationbyDrugClass/UCM332288.pdf. Accessed May 1, 2013

16. Franklin GM, Fulton-Kehoe D: Outcomes research in Washington state workers' compensation. Am J Ind Med 29:642-648, 1996

17. Franklin GM, Mai J, Wickizer T, Turner JA, Fulton-Kehoe D, Grant L: Opioid dosing trends and mortality in Washington State workers' compensation, 1996-2002. Am J Ind Med 48:91-99, 2005

18. Franklin GM, Stover BD, Turner JA, Fulton-Kehoe D, Wickizer TM: Early opioid prescription and subsequent disability among workers with back injuries: The Disability Risk Identification Study Cohort. Spine 33:199-204, 2008

19. Franklin GM, Rahman EA, Turner JA, Daniell WE, Fulton-Kehoe D: Opioid use for chronic low back pain: A prospective, population-based study among injured workers in Washington state, 2002-2005. Clin J Pain 25:743-751, 2009

20. Franklin GM, Mai J, Turner J, Sullivan M, Wickizer T, Fulton-Kehoe D: Bending the prescription opioid dosing and mortality curves: Impact of the Washington State opioid dosing guideline. Am J Ind Med 55:325-331, 2012

21. Furlan AD, Reardon R, Weppler C: Opioids for chronic noncancer pain: A new Canadian practice guideline. CMAJ 182:923-930, 2010

22. Gomes T, Mamdani MM, Dhalla IA, Paterson JM, Juurlink DN: Opioid dose and drug-related mortality in patients with nonmalignant pain. Arch Intern Med 171: 686-691, 2011

23. Kenan K, Mack K, Paulozzi L: Trends in prescriptions for oxycodone and other commonly used opioids in the United States, 2000–2010. Open Med 6:41-47, 2012

24. Kuehn BM: FDA opioid safety plan promotes patient, physician education to prevent abuse. J Am Med Assoc 304:845, 2010

25. Laws C: NCCI Research Brief: Narcotics in Workers Compensation 2012 Update. National Council on Compensation Insurance (NCCI). Available at: https://www.ncci.com/documents/narcotics-wc.pdf. Accessed October 31, 2012

26. Leverence RR, Williams RL, Potter M, Fernald D, Unverzagt M, Pace W, Parnes B, Daniels E, Skipper B, Volk RJ, Brown AE, Rhyne RL: Chronic non-cancer pain: A siren for primary care—A report from the PRImary Care Multi-Ethnic Network (PRIME Net). J Am Board Fam Med 24: 551-561, 2011

27. Manchikanti L: Prescription drug abuse: What is being done to address this new drug epidemic? Testimony before the Subcommittee on Criminal Justice, Drug Policy and Human Resources. Pain Physician 9:287-321, 2006

28. Manchikanti L, Abdi S, Atluri S, Balog CC, Benyamin RM, Boswell MV, Brown KR, Bruel BM, Bryce DA, Burks PA, Burton AW, Calodney AK, Caraway DL, Cash KA, Christo PJ, Damron KS, Datta S, Deer TR, Diwan S, Eriator I, Falco FJ, Fellows B, Geffert S, Gharibo CG, Glaser SE, Grider JS, Hameed H, Hameed M, Hansen H, Harned ME, Hayek SM, Helm S 2nd, Hirsch JA, Janata JW, Kaye AD, Kaye AM, Kloth DS, Koyyalagunta D, Lee M, Malla Y, Manchikanti KN, McManus CD, Pampati V, Parr AT, Pasupuleti R, Patel VB, Sehgal N, Silverman SM, Singh V, Smith HS, Snook LT, Solanki DR, Tracy DH, Vallejo R, Wargo BW: American Society of Interventional Pain Physicians (ASIPP) guidelines for responsible opioid prescribing in chronic non-cancer pain: Part 2–guidance. Pain Physician 15:S67-S116, 2012

29. Morse JS, Stockbridge H, Egan KB, Mai J, Wickizer T, Franklin GM: Primary care survey of the value and effectiveness of the Washington State Opioid Dosing Guideline. J Opioid Manag 7:427-433, 2011

30. Naliboff BD, Wu SM, Schieffer B, Bolus R, Pham Q, Baria A, Aragaki D, Van Vort W, Davis F, Shekelle P: A randomized trial of 2 prescription strategies for opioid treatment of chronic nonmalignant pain. J Pain 12:288-296, 2011

31. Nelson LS, Perrone J: Curbing the opioid epidemic in the United States: The risk evaluation and mitigation strategy (REMS). J Am Med Assoc 308:457-458, 2012

32. Neven DE, Sabel JC, Howell DN, Carlisle RJ: The development of the Washington State emergency department opioid prescribing guidelines. J Med Toxicol 8:353-359, 2012

33. Paulozzi LJ, Jones CM, Mack K, Rudd RA: Vital signs: Overdoses of prescription opioid pain relievers—United States, 1999–2008. MMWR Morb Mortal Wkly Rep 60: 1487-1492, 2011

34. Paulozzi LJ, Baldwin G, Franklin G, Kerlikowske RG, Jones CM, Ghiya N, Popovic T: CDC grand rounds: Prescription drug overdoses—A U.S. epidemic. MMWR Morb Mortal Wkly Rep 61:10-13, 2012

35. Richarz U, Jacobs A, Spina E: How frequently are contraindicated or warned against combinations of drugs prescribed to patients receiving long-term opioid therapy for chronic pain? Pharmacoepidemiol Drug Saf 21:453-462, 2011

36. Sabel J: Unintentional Prescription Opioid Overdose Deaths Washington 1995-2010. Washington State Department of Health. Available at: http://www.wspha.org/wp-content/uploads/2011/12/Prescription-Drug-Epidemic.pdf. Accessed October 31, 2011

37. Slevin KA, Ashburn MA: Primary care physician opinion survey on FDA opioid risk evaluation and mitigation strategies. J Opioid Manag 7:109-115, 2011

38. StataCorp: Stata Statistical Software: Release 12. College Station, TX, StataCorp LP, 2011

39. Stover BD, Turner JA, Franklin G, Gluck JV, Fulton-Kehoe D, Sheppard L, Wickizer TM, Kaufman J, Egan K: Factors associated with early opioid prescription among workers with low back injuries. J Pain 7:718-725, 2006

40. Sullivan MD, Edlund MJ, Fan MY, Devries A, Brennan Braden J, Martin BC: Trends in use of opioids for noncancer pain conditions 2000-2005 in commercial and Medicaid insurance plans: The TROUP study. Pain 138: 440-449, 2008

41. Sullivan MD: Limiting the potential harms of high-dose opioid therapy: Comment on "Opioid dose and drug-related mortality in patients with nonmalignant pain." Arch Intern Med 171:691-693, 2011

42. Tao XG, Lavin RA, Yuspeh L, Bernacki EJ: Natural history of opioid dosage escalation post-injury: A cohort study of injured workers in the state of Louisiana. J Occup Environ Med 54:439-444, 2012

43. Trafton JA, Martins SB, Michel MC, Wang D, Tu SW, Clark DJ, Elliott J, Vucic B, Balt S, Clark ME, Sintek CD, Rosenberg J, Daniels D, Goldstein MK: Designing an automated clinical decision support system to match clinical practice guidelines for opioid therapy for chronic pain. Implement Sci 5:26, 2010

44. Trescot AM, Helm S, Hansen H, Benyamin R, Glaser SE, Adlaka R, Patel S, Manchikanti L: Opioids in the management of chronic non-cancer pain: An update of American Society of the Interventional Pain Physicians' (ASIPP) Guidelines. Pain Physician 11:S5-S62, 2008

45. Vieweg WV, Lipps WF, Fernandez A: Opioids and methadone equivalents for clinicians. Prim Care Companion J Clin Psychiatry 7:86-88, 2005

46. Von Korff M, Saunders K, Ray GT, Boudreau D, Campbell C, Merrill J, Sullivan MD, Rutter CM, Silverberg MJ, Banta-Green C, Weisner C: De facto long-term opioid therapy for noncancer pain. Clin J Pain 24: 521-527, 2008

47. Wagner AK, Soumerai SB, Zhang F, Ross-Degnan D: Segmented regression analysis of interrupted time series studies in medication use research. J Clin Pharm Ther 27: 299-309, 2002

48. Washington State Agency Medical Directors' Group: Interagency Guideline on Opioid Dosing for Chronic Non-Cancer Pain. Olympia, WA, Washington State Agency Medical Directors' Group, 2010. Available at: http://www.agencymeddirectors.wa.gov/opioiddosing.asp

49. Washington State Department of Health: Washington State Department of Health Prescription Monitoring Program (PMP). Available at: http://www.doh.wa.gov/PublicHealthandHealthcareProviders/HealthcareProfessionsandFacilities/PrescriptionMonitoringProgramPMP.aspx. Accessed October 5, 2012

50. Washington State Department of Health: Pain management—Adopted rules. Available at: http://www.doh.wa.gov/PublicHealthandHealthcareProviders/HealthcareProfessionsandFacilities/PainManagement/AdoptedRules.aspx. Accessed May 31, 2013