Open Medicine, Vol 6, No 4 (2012)

RESEARCH

Reformulation of controlled-release oxycodone and pharmacy dispensing patterns near the US–Canada border

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ABSTRACT

Background: In August 2010, a tamper-resistant formulation of controlled-release oxycodone (OxyContin-OP) was introduced in the United States but not in Canada. Our objective was to determine whether introduction of OxyContin-OP in the United States influenced prescription volumes for the original controlled-release oxycodone formulation (OxyContin) at Canadian pharmacies near the international border.

Methods: We conducted a population-based, serial, cross-sectional study of prescriptions dispensed from pharmacies in the 3 cities with the highest volume of US–Canada border crossings in Ontario: Niagara Falls, Windsor and Sarnia. We analyzed data on all outpatient prescriptions for OxyContin dispensed by Canadian pharmacies near each border crossing between 2010 Apr. 1 and 2012 Feb. 29. We calculated and compared monthly prescription rates, adjusted per 1000 population and stratified by tablet strength.

Results: The number of tablets dispensed near 4 border crossings in the 3 Canadian cities remained stable over the study period. However, the rate of dispensing at pharmacies near the Detroit–Windsor Tunnel increased roughly 4-fold between August 2010 and February 2011, from 505 to 1969 tablets per 1000 population. By April 2011, following warnings to prescribers and pharmacies regarding drug-seeking behaviour, the dispensing rate declined to 1683 tablets per 1000 population in this area. By November 2011, the rate had returned to levels observed in early 2010. Our analyses suggest that 242 075 excess OxyContin tablets were dispensed near the Detroit–Windsor Tunnel between August 2010 and October 2011.

Conclusions: Prescribing of the original formulation of controlled-release oxycodone rose substantially near a major international border crossing following the introduction of a tamper-resistant formulation in the United States. It is possible that the restriction of this finding to the area surrounding the Detroit–Windsor Tunnel reflects specific characteristics of this border crossing, including its high traffic volume, direct access to the downtown core and drug-trafficking patterns in the Detroit area. Our findings highlight the potential impact of cross-border differences in medication availability on drug-seeking behaviour.

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Competing interests: None declared for other authors.

Contributors: All authors contributed to study conception and design. Tara Gomes and Michael Paterson acquired the data. All authors contributed to analysis and interpretation of the data. Tara Gomes drafted the manuscript, and Michael Paterson, David Juurlink, Irfan Dhalla and Muhammad Mamdani provided critical revision of the manuscript for important intellectual content. All authors provided final approval of the manuscript submitted for publication. Tara Gomes had full access to all of the study data and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Funding: This study was supported by a grant from the Ontario Ministry of Health and Long-Term Care (MOHLTC) Drug Innovation Fund and the Institute for Clinical Evaluative Sciences (ICES), a non-profit research institute sponsored by the Ontario MOHLTC. The opinions, results and conclusions reported in this paper are those of the authors and are independent from the funding sources. No endorsement by ICES or the Ontario MOHLTC is intended or should be inferred.

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In the United States, sales of opioid analgesics have risen by approximately 300% since 1999, and in 2010 the International Narcotics Control Board reported that Canada and the United States had the highest rate of opioid consumption in the world.[1,2] Although these drugs are generally taken for pain, almost 5% of the US population used an opioid analgesic for non-medical reasons in 2010, and annual US death rates from opioid overdose neared 15 000 by 2008.[1,3] Of particular concern has been the abuse of controlled-release oxycodone (OxyContin, Purdue Pharma), which for more than a decade was subject to misuse by chewing or crushing of tablets, thus circumventing the extended release properties of the drug.[4] In April 2010, the US Food and Drug Administration approved a new formulation of controlled-release oxycodone (OxyContin-OP), which was described by the manufacturer as more difficult to manipulate for the intention of misuse or abuse.[5] In particular, the tablet was reformulated to make it more difficult to be cut, broken, chewed, crushed or dissolved.[5] In August of that year, US production of the original formulation of controlled-release oxycodone ceased, and all US pharmacies were thereafter supplied with the new tamper-resistant formulation.

Because OxyContin remained available in Canada in 2010, concerns arose that Canada might serve as a de facto reservoir for the original formulation. As a result of these concerns, in March 2011 the College of Physicians and Surgeons of Ontario sent a notice to Windsor-area physicians warning of potential drug-seeking behaviour, and in April 2011 the Ontario College of Pharmacists posted a similar alert on its website.

We examined the effect of the formulation change for controlled-release oxycodone in the United States and the warnings issued by local bodies in Canada on prescriptions for the original formulation at Ontario pharmacies near US–Canada border crossings. We speculated that dispensing of OxyContin in areas of Canada close to border crossings would rise following the introduction of OxyContin-OP in the United States, with a subsequent drop after the dissemination of warnings to prescribers and pharmacists. Two small studies previously demonstrated purchasing of prescription drugs across the US–Mexico border, but they focused on purchasing behaviour related to lower medication costs among residents along this border.[6,7] We believe that the study reported here is the first to investigate prescribing trends for a medication prone to misuse with differential availability across the US–Canada border.

Methods

We conducted a population-based, serial, cross-sectional study of all controlled-release oxycodone tablets dispensed by pharmacies in Ontario, Canada, between 2010 Apr. 1 and 2012 Feb. 29. We restricted our analyses to the 3 cities in Ontario with the highest volume of private and commercial border crossings in 2011: Niagara Falls (bordering Niagara Falls, N.Y.), Windsor (bordering Detroit, Mich.) and Sarnia (bordering Port Huron, Mich.).[8] A total of 6 border crossings were identified in these cities (Table 1), and each was considered separately in the analysis, with the exception of the Rainbow and Whirlpool Rapids bridges, for which data were combined because of their close proximity. The prescribing region surrounding each border crossing was defined using the largest unit of aggregation for Canadian postal codes, and all retail pharmacies operating within each prescribing region were included in the study.

We used the IMS Brogan Canadian CompuScript database[9] to obtain data on all outpatient prescriptions for controlled-release oxycodone dispensed from Canadian retail pharmacies near each border crossing over our study period. Outpatient prescriptions are those filled by retail pharmacies for anyone who produces a valid prescription from a physician licensed to practise in Canada. The database contains prescription records collected from a sample of pharmacies drawn from an IMS panel of more than 5600 pharmacies in Canada, stratified by province and by size and type of pharmacy, and is used regularly for research purposes.[10-12] Monthly prescription volumes are projected by province and are representative of all pharmacies in Ontario. During the study period, 8 tablet strengths of controlled-release oxycodone were available in Ontario: 5 mg, 10 mg, 15 mg, 20 mg, 30 mg, 40 mg, 60 mg and 80 mg. Population estimates within each prescribing region were obtained from the 2006 Census of Canada.[13] All analyses were descriptive in nature. We calculated the total number of tablets dispensed and the number of tablets dispensed per 1000 Ontario residents at each of the border crossings each month, both overall and stratified by formulation strength.

Results

The Canadian population of the prescribing regions ranged from 26 129 people (near the Detroit–Windsor Tunnel) to 50 300 people (near the Queenston–Lewiston Bridge), and there were between 7 and 25 retail pharmacies in each area (Table 1). A total of 3 667 252 controlled-release oxycodone tablets were dispensed over the 23-month study period by pharmacies in the 5 prescribing regions, equivalent to 5239 tablets per day.

The number of tablets dispensed near 4 of the crossings remained relatively stable over the

study period: Blue Water Bridge, monthly range 754 to 1008 tablets per 1000 population; Queenston–Lewiston Bridge, monthly range 405 to 529 tablets per 1000 population; Rainbow and Whirlpool Rapids bridges, monthly range 1186 to 1437 tablets per 1000 population; and Ambassador Bridge, monthly range 513 to 638 tablets per 1000 population (Figure 1). However, near the Detroit–Windsor Tunnel, the rate of dispensing remained stable for the first 4 months of the study period (monthly range 490 to 505 tablets per 1000 population) and then increased steadily from 505 tablets per 1000 population to 1969 tablets per 1000 population between August 2010 and February 2011. This 4-fold increase was driven primarily by prescriptions for the 10-mg, 20-mg, 40-mg and 80-mg formulations; there was minimal prescribing of all other strengths (Figure 2).

Although dispensing rates near the Detroit–Windsor Tunnel remained above baseline in March 2011, by April (by which time both the physician and pharmacist self-regulatory bodies had released warnings), the rates had declined to 1683 tablets per 1000 population, and by November 2011, the rates had returned to levels observed in early 2010 (Figure 1).

Under the assumption that dispensing of OxyContin near the Detroit–Windsor Tunnel should have been relatively constant between July 2010 and November 2011, we estimated the number of excess tablets dispensed over the period August 2010 to October 2011. More specifically, a total of 13 205 tablets were dispensed in July 2010, and we determined the excess number dispensed each subsequent month by subtracting this expected monthly total from the number actually dispensed. We calculated that 242 075 excess tablets were dispensed in the region near the Detroit–Windsor Tunnel over this period.

Interpretation

In this population-based study, we found an immediate and substantial rise in dispensing of the original formulation of controlled-release oxycodone near the Detroit–Windsor Tunnel following introduction of the tamper-resistant formulation in the United States. Furthermore, following notification of prescribers and pharmacies in the Windsor area regarding potential diversion of OxyContin (the original formulation), we saw a rapid drop in the dispensing of this product. Interestingly, no similar increase was observed near the other border crossing in Windsor (the Ambassador Bridge) or in the areas surrounding other high-volume border crossings in Ontario.

The observation that increased dispensing of OxyContin was limited to the region around the Detroit–Windsor Tunnel warrants discussion. Although both Michigan and New York are identified as “high-intensity drug trafficking areas” (HIDTAs) by the US Department of Justice,[14,15] the epicentre of the Michigan HIDTA is Detroit, which serves as the primary distribution centre for the region.[14] Conversely, in New York state the regions of high drug

trafficking are located closer to New York City, farther from the US–Canada border.[15] It is more difficult to explain the differences in OxyContin dispensing patterns between the areas surrounding the Detroit–Windsor Tunnel and the Ambassador Bridge, which are approximately 3.0 km (1.9 miles) apart. The 2 regions are of similar size and population density, have a similar number of pharmacies and are located close to major thoroughfares in both Canada and the United States. Of note, however, the Detroit–Windsor Tunnel does not carry large commercial trucks and provides direct access to downtown Detroit, whereas the Ambassador Bridge is the busiest commercial border crossing in North America and connects directly to a highway. Therefore, it is possible that our findings are related to drug trafficking and transportation patterns in the Detroit area and that a small number of individuals were responsible for the large increase in dispensing on the Canadian side of the tunnel.

Several limitations to our study merit discussion. First, we do not know what proportion of the OxyContin tablets were dispensed to residents of Ontario relative to people living outside this province. Second, we were unable to study individual physicians or pharmacies and therefore could not determine whether the observed increases in OxyContin prescribing were attributable to only a select group of prescribers or pharmacies. Third, although we cannot directly attribute the drop in dispensing in April 2011 to warnings by the physician and pharmacist self-regulatory authorities, we are unaware of any other regulatory or law enforcement efforts that would have precipitated this change. Finally, because of the limited number of data points available before the introduction of the tamper-resistant formulation, we were unable to conduct a formal time-series analysis of prescribing trends.

These findings have important implications for other jurisdictions in North America, particularly with the potential introduction of new opioid formulations in the future, some of which may be tamper-resistant and others of which may still be susceptible to tampering (e.g., generic controlled-release oxycodone). It can be expected that the availability of generic drugs may differ between jurisdictions as differing regulatory and formulary decisions are made. The results of this study highlight the effect that differing availability of opioids may have on trafficking across borders and also suggest that timely notification to prescribers and dispensers about potential drug-seeking behaviour may help to mitigate the problem.

Figure 1. Number of prescriptions for controlled-release oxycodone dispensed monthly per 1000 population in selected Canadian prescribing regions near the US–Canada border [view]

Figure 2. Number of prescriptions for controlled-release oxycodone dispensed in Canada near the Detroit–Windsor Tunnel, by tablet strength [view]

Table 1. Details of border crossings and prescribing regions [view]

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