Impact of a Prescription Monitoring Program on the Prevalence of Inappropriate Prescriptions for Monitored Drugs

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ABSTRACT

Background

The misuse of prescription drugs has important clinical and public health implications. We assessed the impact of the Ontario Narcotics Strategy, which included new legislation and a centralized prescription monitoring system (implemented November 2011 and May 2012, respectively), on the dispensing of prescriptions suggestive of misuse.

Methods

We conducted a time series analysis of all publically-funded prescriptions for opioids, benzodiazepines and stimulants dispensed monthly from January 2007 to May 2013. In the primary analysis, a prescription was deemed inappropriate if it was dispensed within 7 days of an earlier prescription for at least 30 tablets of a drug in the same class and originated from a different physician and different pharmacy.

Results

The prevalence of inappropriate opioid prescriptions decreased by 12.1% after enactment of the new legislation ($p<0.001$) and by a further 26.4% after the introduction of the narcotic monitoring system (NMS) ($p=0.05$; from 0.82% in October 2011 to 0.53% in May 2013). Inappropriate benzodiazepine prescribing was not significantly influenced by the legislation; but was influenced by the NMS, which reduced inappropriate prescribing by 48.5% (from 0.33% in April 2012 to 0.17% in May 2013, $p=0.006$).

Similarly, the prevalence of inappropriate prescribing of stimulants fell 60.3% (from 0.68% in April 2012 to 0.27% in May 2013) following introduction of the NMS (p=0.02).

Interpretation

For a select group of drugs prone to misuse and diversion, legislation and implementation of a prescription monitoring program dramatically reduced the prevalence of prescriptions highly suggestive of misuse.

Introduction

Misuse of drugs, including opioid analgesics, sedative-hypnotics and stimulants can have serious consequences, with more than 20,000 deaths in the US ascribed to prescription drug overdose each year.[1] As governments and policy makers attempt to curb inappropriate use of prescribed drugs, the regulation and monitoring of prescription medications has become increasingly important. Prescription monitoring programs that track detailed patient and prescriber information for controlled substances have been implemented in many jurisdictions across North America, with varying degrees of success.[2-5] Although some studies suggest a significant impact of these programs on the supply of monitored drugs and rates of drug abuse and misuse[6-8], their success relies on a variety of factors, including the accessibility of data to healthcare providers, pharmacist engagement, and the involvement of law enforcement.[4;6;9;10]

In November 2011, the Narcotics Safety and Awareness Act (NSAA) was implemented in Ontario, Canada, requiring that physicians identify themselves by their College registration number, and that pharmacists record and verify patient information (including name, address, age, gender, and government issued identification number) on prescriptions for all narcotics and controlled substances dispensed in the province. Furthermore, this information must be disclosed to government officials upon request.[11] Another key component of this legislation is the Narcotics Monitoring System (NMS), which captures prescriber, pharmacist and patient information for all narcotics and other controlled drugs dispensed in Ontario. The NMS was created to provide provincial policy-makers with the tools to identify potentially inappropriate prescribing of monitored drugs. This information could lead to educational interventions, and the reporting of

potential misconduct or criminal activity to regulatory and law enforcement agencies.[12] Although the full NMS system is not accessible to physicians and pharmacists, the integration of expanded information in Drug Utilization Review (DUR) messages warns pharmacists of potential overuse or misuse of monitored drugs, and provides them with information on the conflicting drugs, quantities and dispensing pharmacies.[12] The NMS was phased in gradually, with full implementation in May 2012.

The objective of this study was to evaluate the impact of the enactment of the NSAA and the implementation of the NMS on the rate of dispensing of monitored drugs among public drug plan beneficiaries in Ontario that was highly likely to represent misuse.

Methods

We conducted a population-based, cross-sectional time-series analysis of all publically-funded prescriptions dispensed in Ontario for drugs monitored by the NMS between January 1, 2007 and May 31, 2013. Ontario residents are eligible for public drug coverage if they are unemployed or disabled, have high prescription drug costs in relation to their net household income, receive home care, reside in a long-term care facility or are 65 years of age or older. All Ontario residents have universal access to hospital care and physician services. This project was approved by the Research Ethics Board of Sunnybrook Health Sciences Centre, Toronto.

Drug Exposure

We used the computerized records of the Ontario Public Drug Benefit Database to identify all prescriptions dispensed to Ontario public drug plan beneficiaries for drugs

monitored by the NMS. This database contains information on the date, quantity and days supplied for each prescription, and encrypted patient, prescriber and pharmacy identifiers. It has an error rate of less than 1%[13] and is regularly used to study drug utilization at the population level. To restrict to adults receiving these drugs in the community, we excluded prescriptions dispensed to residents in long-term care homes, and those younger than 18 years of age. We restricted our analysis to opioids (oxycodone, codeine, morphine, hydromorphone and fentanyl), benzodiazepines (flurazepam, diazepam, chlordiazepoxide, oxazepam, lorazepam, triazolam, nitrazepam, temazepam, bromazepam, alprazolam and clonazepam) and stimulants (methylphenidate, dextroamphetamine, amphetamine, lisdexamfetamine) monitored by the NMS, and excluded non-tablet formulations with the exception of fentanyl. To test the robustness of our analysis, we also examined prescriptions for non-steroidal anti-inflammatory drugs (NSAIDs), which are not monitored by the NMS, reasoning that the rate of inappropriate prescribing of these medications should not change because they are not prone to abuse.

Definition of Inappropriate Prescribing

We defined inappropriate prescriptions of monitored drugs as those we believed were highly likely to represent misuse. This was measured in two ways. In our primary analysis, we defined a prescription as inappropriate according to the following set of criteria, as done previously.[7] We first identified all prescriptions for a monitored drug where at least 30 tablets (or 6 transdermal fentanyl patches) were dispensed. We then identified all prescriptions for drugs within the same drug class (e.g. opioid, benzodiazepine, stimulant or NSAID) that were dispensed in the 7 days following the

initial prescription. This subsequent prescription was deemed inappropriate if it was issued by a different physician and dispensed at a different pharmacy than the initial prescription.

In a secondary analysis, we defined inappropriate prescribing using the Drug Utilization Review (DUR) criteria incorporated into the NMS. These criteria warn pharmacists of potential multi-doctoring and poly-pharmacy based on prescription patterns over a 28 day period. Specifically, a prescription leads to a warning for multi-doctoring if a given patient obtains any combination of monitored drugs prescribed by 3 or more different physicians over a 28-day period. Similarly, the poly-pharmacy warning flags monitored drugs dispensed by 3 or more different pharmacies over 28 days. We defined potentially inappropriate prescriptions as those that would have led to the issuance of both a double-doctoring warning and poly-pharmacy warning.

Statistical Analysis

We calculated the monthly number and prevalence of inappropriate prescriptions (defined as the percentage of all prescriptions dispensed each month that were deemed to be inappropriate), by drug class. We used interventional autoregressive integrated moving average (ARIMA) models to examine the impact of the enactment of the Narcotics Safety and Awareness Act (November 2011) and the full implementation of the Narcotics Monitoring System (May 2012) on the prevalence of inappropriate prescribing of monitored drugs in Ontario. The effects of the NSAA and NMS were assessed using a ramp intervention function in the ARIMA model. The autocorrelation, partial autocorrelation, and inverse autocorrelation functions were

assessed for model parameter appropriateness and seasonality, and stationarity was examined using autocorrelation functions and the augmented Dickey-Fuller test. Finally, the presence of white noise was assessed by examining the autocorrelations at various lags with the use of the Ljung-Box chi-square statistic. All analyses used a type 1 error rate of 0.05 as the threshold for statistical significance and were performed using SAS statistical software (version 9.3; SAS Institute Inc, Cary, North Carolina).

Results

Over the 77-month study period, 19,614,918 opioid prescriptions, 21,107,302 benzodiazepine prescriptions and 1,066,834 stimulant prescriptions were dispensed to 1,586,404, 919,065, and 34,902 public drug plan beneficiaries, respectively. Of these, 165,344 (0.8%) of opioid prescriptions, 74,306 (0.4%) of benzodiazepine prescriptions, and 7,794 (0.7%) of stimulant prescriptions were deemed to be inappropriate.

Primary Analysis

Prior to enactment of the NSAA (January 2007 to October 2011), a monthly average of 0.94% of opioid prescriptions, 0.92% of stimulant prescriptions, and 0.39% of benzodiazepine prescriptions were deemed inappropriate according to our primary definition (Figure 1). The prevalence of inappropriate opioid prescriptions decreased 35.4% between October 2011 (prior to any regulatory changes) and the end of our study period. In particular, this prevalence fell by 12.1% following the enactment of the NSAA, from 0.82% (N=2,329 prescriptions) in October 2011 to 0.72% (N=1,966 prescriptions) in April 2012 ($p<0.001$), and fell another 26.4% following the

implementation of the NMS, reaching 0.53% (N=1,670 prescriptions) in May 2013 (p=0.05). In comparison, the prevalence of inappropriate prescriptions for benzodiazepines and stimulants did not decrease significantly following the regulatory requirements imposed in November 2011 (p=0.22 and p=0.06, respectively), but did significantly decrease following the implementation of the NMS. Specifically, the prevalence of inappropriate benzodiazepine prescriptions decreased 48.5%, from 0.33% (N=960) prescriptions in April 2012 to 0.17% (N=549 prescriptions) in May 2013 (p=0.006). Similarly, the prevalence of inappropriate stimulant prescriptions decreased 60.3%, from 0.68% (N=138 prescriptions) in April 2012 to 0.27% (N=67 prescriptions) in May 2013 (p=0.02).

The prevalence of inappropriate NSAID prescribing was low over the entire study period, with an average of 0.11% (range 0.09% to 0.14%). As expected, we found no change in rates of inappropriate NSAID prescribing following the introduction of both the NSAA and the implementation of the NMS (Figure 1; p=0.29 and p=0.94, respectively).

Secondary Analysis: DUR Warnings

The findings of a secondary analysis of the prevalence of prescriptions triggering DUR warnings for both poly-pharmacy and multi-doctoring were generally consistent with our primary analyses. Overall, the prevalence of opioid prescriptions that would have triggered both DUR warnings decreased 19.0% following the enactment of the NSAA, from 2.1% (N=16,060 prescriptions) in October 2011 to 1.7% (N=13,420 prescriptions) in April 2012 (p<0.001). This prevalence dropped a further 31.1% following the implementation of the NMS, to 1.2% (N=11,062 prescriptions) in May 2013

(p<0.001; Figure 2). Similarly, the 36.5% reduction in benzodiazepine prescriptions that would have triggered both DUR warnings (from 0.8%, N=2,312 in October 2011 to 0.5%, N=1,609 prescriptions in May 2013) was driven by both the enactment of the NSAA (19.1% reduction from October 2011 to April 2012; p=0.01) and the implementation of the NMS (21.5% reduction from April 2012 to May 2013; p=0.02). Finally, the prevalence of stimulant prescriptions that would have triggered both DUR warnings decreased 41.8% following the regulatory changes in November 2011 (from 2.8%, N=546 in October 2011 to 1.7%, N=334 in April 2012; p=0.04), but was not affected by the implementation of the NMS (prevalence 1.4%; N=354 in May 2013; p=0.13).

Interpretation

In this population-based study, we found that both a legislative intervention and the introduction of a prescription monitoring program specifically developed for opioids and controlled substances resulted in significant reductions in the prevalence of inappropriate prescribing of monitored drugs in Ontario, ranging between 35% and 60%. Due to our strict definitions of misuse, the monthly prevalence of inappropriate prescriptions rarely exceeded 1%. However, more than 40 million prescriptions for monitored drugs were dispensed over the 6.5 year study period; of these, more than 200,000 were deemed highly likely to represent misuse. Given our conservative definitions, the absolute number of inappropriate prescriptions is likely to be even higher. As a result, despite the relatively small absolute prevalence of inappropriate

prescriptions observed in this study, the public health impact of reductions in this prevalence is substantial. These findings demonstrate the potential for regulatory interventions driven by policy-makers to influence prescribing and dispensing patterns of controlled substances, and suggest that the impacts of these interventions can be quickly realized.

The findings of this study align with another Canadian study that used similar methods to assess the impact of the implementation of British Columbia's (BC) PharmaNet system in 1995 on inappropriate prescribing.[7] Although the BC PharmaNet system captures all drugs (compared to the limited list of drugs monitored by the Ontario NMS), Dormuth et al. reported a 32.8% reduction in inappropriate opioid prescribing and a 48.6% reduction in inappropriate benzodiazepine prescribing, which is consistent with our findings of 35.4% and 48.5%, respectively. This suggests that, although the products available and the rates of use and abuse of these drugs (particularly opioids) have changed substantially since that time,[14] the value of prescription monitoring programs that allow pharmacists access to real-time data on patient prescribing history remains high.

Several limitations of the analyses merit emphasis. First, our findings are limited to patients eligible for publically funded prescription drug coverage, and may not be generalizable to the entire population. However, because the NMS tracks prescriptions for all monitored drugs dispensed in Ontario, it is likely that these findings also extend to those paying through private insurance or out of pocket. Regardless, because we only identify publically-funded prescriptions, the number of inappropriate prescriptions estimated in this study is likely a substantial underestimate of the true number of

inappropriate prescriptions dispensed in Ontario, highlighting the public health importance of these findings. Second, defining inappropriate prescriptions using administrative databases can be difficult, and it is possible that some prescriptions defined as inappropriate were caused by appropriate switching of medications. However, we expect that this would apply equally prior to, and following the implementation of the NMS. Therefore, this limitation will not likely influence the trends observed in this study. We developed two definitions of inappropriate prescribing that incorporated early prescription refills, multi-doctoring, and poly-pharmacy. These definitions were designed to be conservative and specific, and are likely to misclassify prescriptions of shorter duration, or those that met only one of the multi-doctoring or poly-pharmacy requirements. Therefore, our study likely underestimates the true prevalence of inappropriate prescribing of monitored drugs in Ontario. However, the consistency of findings between the two definitions of inappropriate use, along with the null finding among our tracer drug class (NSAIDs) suggest a true association between regulatory and prescription monitoring changes in Ontario and reductions in inappropriate prescribing. Finally, we did not assess whether these changes in prescribing patterns resulted in fewer hospitalizations or deaths related to drug overdoses. Studies evaluating the impact of the legislation and NMS on patient outcomes should be done as soon as sufficient data are available.

Conclusions

The enactment of legislation requiring patient identification on prescriptions for monitored drugs, and a prescription monitoring program providing real-time data access to pharmacists led to significant reductions in the prevalence of prescriptions for opioids

and controlled substances that were highly likely to represent misuse. Given that tens of thousands of inappropriate prescriptions for these drugs are dispensed each year in Ontario, these findings highlight the important impacts that drug policy decision makers, legislators and front-line healthcare professionals can have in reducing harmful prescribing behaviors.

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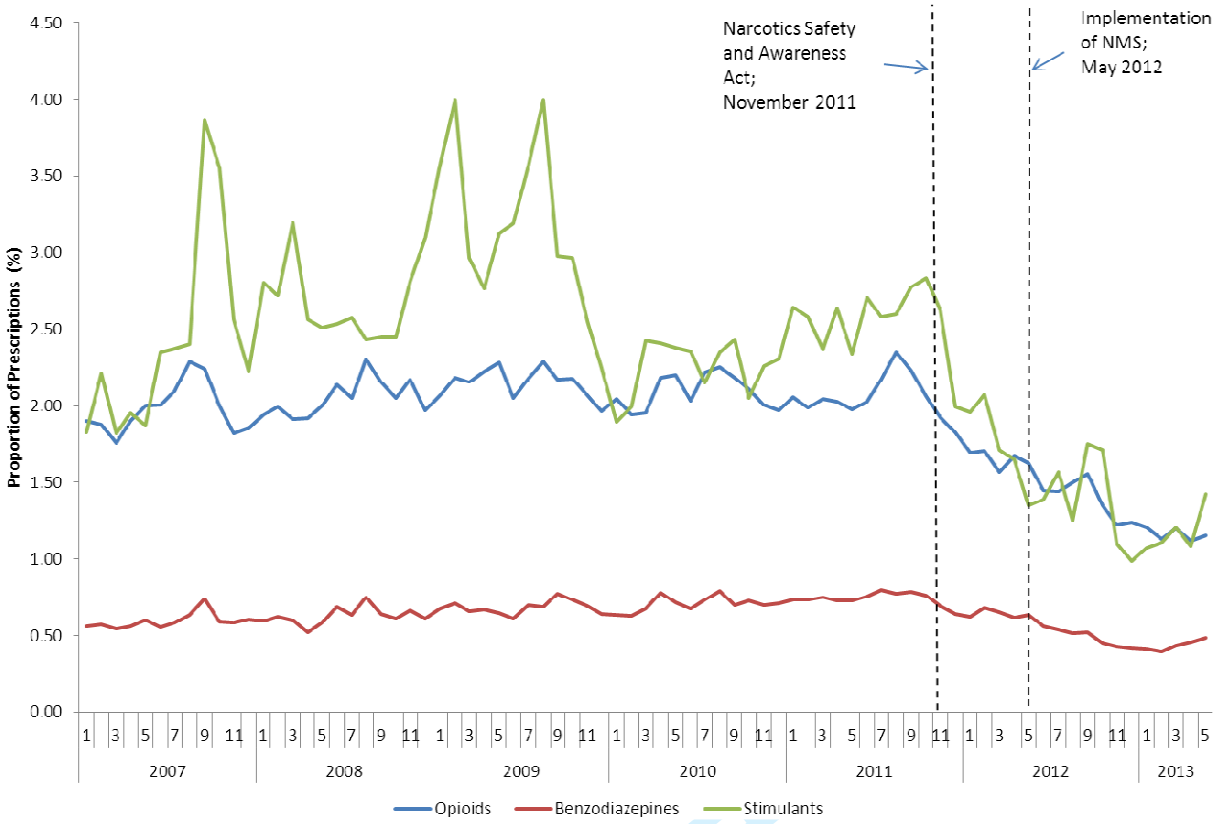
Figure 1: Prevalence of inappropriate prescribing, by monitored drug

Legend: Proportion of all publically-funded prescriptions for opioids, benzodiazepines, stimulants and NSAIDs that are deemed to be inappropriate, by month in Ontario, Canada. January 2007 to May 2013.

Figure 2: Prevalence of warnings for both poly-pharmacy and multi-doctoring among monitored drugs



Legend: Proportion of all publically-funded prescriptions for opioids, benzodiazepines and stimulants that would have triggered both a poly-pharmacy and multi-doctoring Drug Utilization Review warning in Ontario, Canada. January 2007 to May 2013.