Geographical Variation in Opioid Prescribing and Opioid-Related Mortality in Ontario

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The Issue

Overdoses and deaths involving prescription opioids are a major public health concern. Recent data from the United States indicate an opioid-related death rate of 6.4 per 100,000 population annually, which exceeds the annual human immunodeficiency virus–related death rate at 4.0 per 100,000 population (Centers for Disease Control and Prevention 2009; Heron et al. 2009). Although the relationship between opioid prescriptions and the risk of adverse events is becoming more widely appreciated (Dhalla et al. 2009; Dunn et al. 2010), opioid prescribing practices, abuse and diversion have been shown to exhibit substantial geographical variability, and this may have implications for public health policy decisions and interventions (Curtis et al. 2006; Webster et al. 2009).

The Study

We sought to investigate the association between opioid prescribing and opioid-related mortality in Ontario and to examine geographical variation in these measures among Ontario's counties. The main outcome of interest for each county was the annualized age- and sex-standardized opioid-related mortality rate per 100,000 residents aged 15–64 years between January 1, 2004, and December 31, 2006. Opioid-related deaths were identified from the records of the Office of the Chief Coroner of Ontario using methodology described elsewhere (Dhalla et al. 2009), and the 2006 Statistics Canada census population was used as the standard population. Opioid prescribing rates were

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calculated for each calendar year over the study period and were defined as the total number of opioid prescriptions dispensed to Ontario Public Drug Program (OPDP) beneficiaries aged 15–64, expressed per 1,000 OPDP beneficiaries. An Ontario resident was deemed to be an OPDP beneficiary if he or she received a prescription for any drug that was paid for by the

Figure 1. Relationship between opioid prescribing rate (per 1,000 OPDP–eligible population) and opioid-related mortality rate (per 100,000 population) among Ontario counties
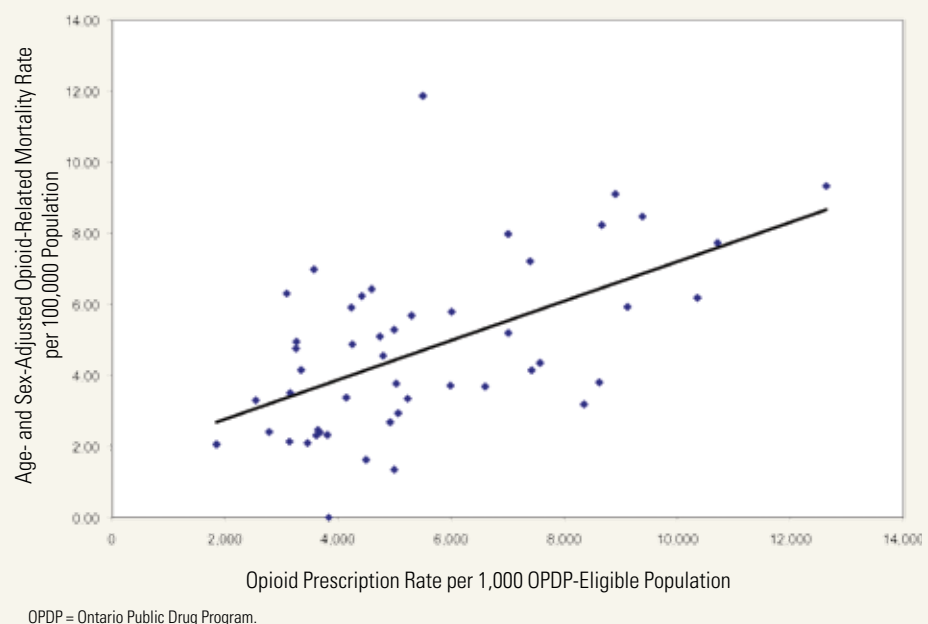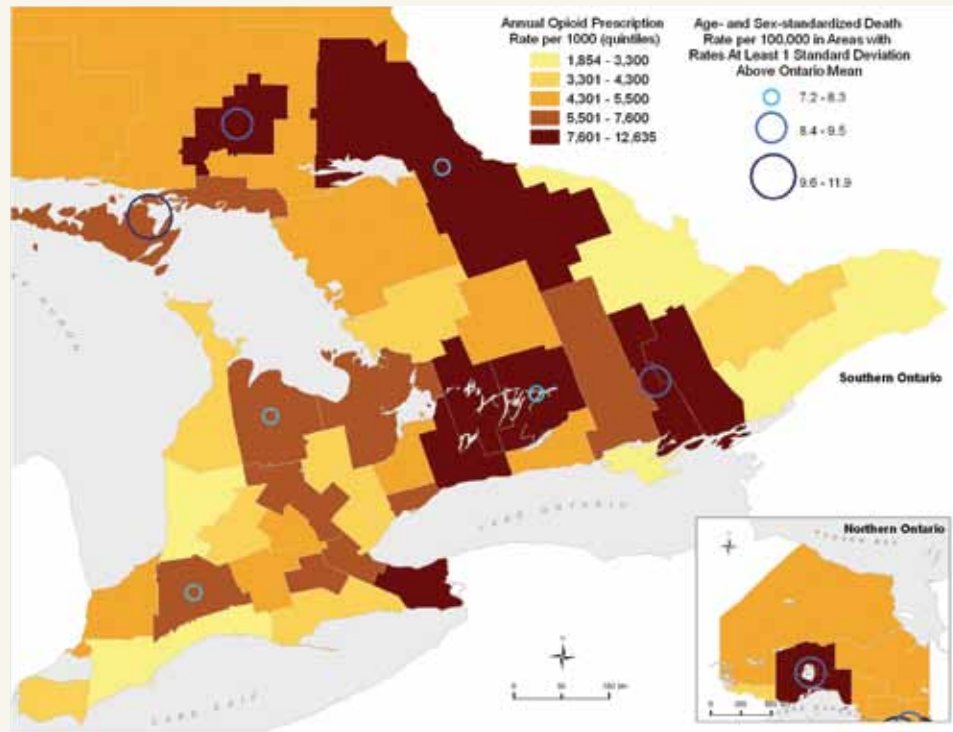
OPDP = Ontario Public Drug Program.

Figure 2. Opioid prescription rate and opioid-related death rates >1 SD above the mean in Ontario, by county, 2004–2006

SD = standard deviation.

opioid prescription dispensed per OPDP beneficiary annually, the annual opioid-related mortality rate increased by 0.54 per 100,000 residents ($p < .0001$; Figure 1). A sensitivity analysis modelling the median quantity of morphine (or equivalent) dispensed per person per day revealed consistent findings.

The spatial distribution of opioid prescription rates and high opioid-related mortality rates (defined as more than one standard deviation above the provincial mean of 4.7 per 100,000 population) is illustrated in Figure 2. Thunder Bay District had the highest prescription rate (12,635 per 1,000 OPDP eligible) and the second highest opioid-related death rate (9.3 per 100,000 population). Four other counties (the Regional Municipality of Sudbury, the County of Lennox and Addington, Nipissing District, and the County of Peterborough) also ranked in the top 10 counties with respect to both prescription and opioid-related death rates. Of note, Manitoulin District had a prescription rate that approximated the provincial average (5,502 per 1,000 OPDP eligible), yet it exhibited the highest opioid-related death rate (11.9 per 100,000 population). This may be explained by the fact that Manitoulin District is the least populous county in Ontario (the population aged 15–64 in 2005 was 9,255 [Statistics Canada 2006]), and the 95% confidence interval (CI) around the observed death rate is therefore wide (95% CI 2.3–34.7 per 100,000 population).

An important limitation of our study that merits emphasis is that we were unable to identify prescriptions paid for in cash or by another payer. However, there is no obvious reason why this should vary substantially from one jurisdiction to another. Despite this, we observed a strong correlation between opioid prescribing rates and mortality rates at the level of individual counties.

OPDP and was between the ages of 15 and 64 at the time of the prescription. Annual prescribing rates were averaged over the three-year study period in each county.

The relationship between opioid prescribing rate and opioid-related mortality was examined with linear regression, using the county as the unit of analysis and adjusting for other county-level characteristics (percentage of residents aged 15–64 who were OPDP beneficiaries, number of physicians and number of pharmacies per 1,000 OPDP beneficiaries, median family income, proportion of residents who were unemployed). The global Moran's I estimate was close to zero, indicating no significant spatial autocorrelation in the model, and the Shapiro-Wilk test statistic confirmed normality of the opioid-related mortality rate. We used backward stepwise elimination using a p value of .05 to remove non-significant covariates from the model.

Key Findings

We found a highly significant association between county-level opioid prescribing rates and opioid-related mortality. The adjusted regression analysis found that for every additional

Conclusion

In summary, we found large regional variations in opioid prescribing and outcomes and a strong association between regions with high opioid prescription utilization and those with high opioid-related death rates. Most opioid-related deaths in Ontario are unintentional and occur in individuals receiving opioids via prescription (Dhalla et al. 2009). Our findings allow clinicians and policy makers to target public health interventions and education to areas where opioid prescribing poses an especially large health risk. HQ

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