Opioid-related Poisoning Deaths in Québec: 2000 to 2009

INSTITUT NATIONAL
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Direction de l'analyse et de l'évaluation
des systèmes de soins et services

Direction de la santé environnementale
et de la toxicologie

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SUMMARY

Overview

Prescription opioid use has increased in Québec in recent years. In view of the serious consequences stemming from drug misuse in this pharmacological class, it is possible that the increase has affected the temporal trend in opioid-related poisoning deaths.

Objectives

Determine the opioid-related poisoning death rates in Québec and describe the temporal evolution of the phenomenon by age, gender of the deceased, manner of death, and type of opioid involved.

Method

Type of study and population

A retrospective trend analysis of poisoning-related death rates from 1990 to 2009 in the population 20 years of age or over.

Data

The death registry of the Registre des événements démographiques and the computerized database of the Bureau du coroner en chef du Québec.

Statistical analysis

A Joinpoint Regression analysis used to determine whether significant changes occurred during the period under study and to estimate average annual percentage changes to describe temporal trends.

Key measurements

The adjusted rate and specific mortality rate attributable to poisoning.

Findings

The medical and non medical drug-related poisoning death rates increased in the 2000s. The increase mainly reflects the rise in fatal opioid poisoning both among men (+9.4% on average per year) and women (+10.2% on average per year). The adjusted mortality rate attributable to opioid poisoning among men increased from 1.9 to 3.7 deaths per 100 000 population between 2000 and 2009. The rate among women rose from 1.0 to 2.2 deaths per 100 000 population during the same period. The pace of the increase appears higher among individuals between 50 and 64 years of age (+20.9% on average per year among men and +13.7% on average per year among women) and is related essentially to poisoning by prescription opioids.

Conclusion

Based on data from the death registry of the Registre des événements démographiques and the Bureau du coroner en chef du Québec, the opioid-related poisoning deaths increased appreciably in Québec between 2000 and 2009. The increase is statistically significant and does not appear to be abating. Physicians, pharmacists, nurses and other professionals working in the field of prevention must be informed of these observations, along with the users of prescription and over-the-counter opioid drugs. The strategies aimed at minimizing the risk of opioid overdoses should be reasserted and, if need be, new strategies could be elaborated.

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GLOSSARY

Drug

A medical or non-medical substance that is used abusively for non-medical purposes that can lead to dependence.

Poisoning

A condition or physiological state produced by the action of one or more toxic substances in the body.

Medication

A substance or composition that displays curative or preventive properties with respect to diseases or that can be administered to establish a medical diagnosis.

Misuse

Medication use for purposes other than the one for which they are usually prescribed, which includes obtaining drugs from illicit sources and at-risk consumption habits such as the formulation alteration, modifications in the route of administration or dose, and so on.

Opioid

Compound that works by binding to endogenous opioid receptors in order to generate their therapeutic or toxic effects, e.g. codeine, buprenorphine, heroin, hydromorphone, fentanyl, methadone, morphine and oxycodone.

Prescription opioids

Opioid medication is legal solely by prescription from an authorized health professional for the person for whom it was prescribed and according to the prescribed dosage. Such medications are usually used to treat acute or chronic pain, relieve coughs, control diarrhœa and, in the case of methadone, as a part of the opioid dependence treatment. Heroin (diacetylmorphine) is excluded from this category since it is not deemed to be a medication but a drug of abuse.

1 INTRODUCTION

Poisoning-related mortality from widely prescribed medications and, more specifically, opioids[3-5], has increased in the United States since the late 1990s.[1;2] The increase apparently reflects the broader availability of such substances on the American market.[4-6]

In Canada, the per capita consumption of opioids is among the highest in the world.[7] Moreover, the use of opioid medication increased between 2005 and 2010 both in Canada and in Québec.[8] Given the serious consequences of their misuse,[9] an examination of temporal trends in mortality attributable to opioid poisoning might allow us to determine whether a problem related to this type of substance is emerging in Québec, in order to inform agencies responsible for protecting population health.

The objective of this study is to determine the opioid-related poisoning death rate in Québec and to describe its temporal evolution by age, gender of the deceased, manner of death, and type of opioid involved. In order to distinguish the impact of mortality attributable to opioid poisoning, mortality trends by poisoning in general and trends linked to medications and drugs from 1990 to 2009 are also presented.

2 METHODOLOGY

A descriptive analysis has been used to describe the trends of opioid-related poisoning death rate that occurred between 1990 and 2009. In view of the limited number of deaths by poisoning among children and adolescents, the analysis has been confined to Québec's population 20 years of age or over.

2.1 DATA USED

The data used are drawn from the Registre des événements démographiques - Fichier des décès (RED/D) of the Ministère de la Santé et des Services sociaux du Québec (MSSS) for the years 1990 to 2009. The RED/D is the main data source used to obtain an exhaustive breakdown of the causes of death. However, this type of file provides few details on the circumstances surrounding poisoning deaths.[10] To overcome this limitation, the computerized data bank of the Bureau du coroner en chef du Québec (BDIBCQ) was used at the same time to obtain a more detailed picture of the substances involved in fatal poisonings that occurred between 2000 and 2009.[1]

Between 1990 and 1999, the 9th revision of the International Classification of Diseases (ICD-9) was used to codify causes of death in the RED/D. Since 2000, the rules of the 10th revision (ICD-10) have been in force to codify the causes of death in the RED/D and the BDIBCQ. Between 1990 and 1999, only one additional cause could be added to the underlying cause of death, specifically in the case of injuries and poisonings. Since 2000, it has been possible to record in the RED/D one underlying cause of death and as many as 10 causes that contributed to death (secondary causes). As for the BDIBCQ, since 2000, the underlying cause of death has been accompanied by a complementary cause, specifically in the case of fatal poisonings.

2.2 IDENTIFICATION OF OPIOID-RELATED POISONING DEATHS

In the RED/D, poisoning produced by the ingestion, injection or inhalation of a deleterious agent in an involuntary, deliberate or indeterminate manner were sought. Such deaths were identified, respectively, using codes E850-E869, E950-E952 and E980-E982 from the ICD-9 for the years 1990 to 1999. The codes X40-X49, X60-X69 and Y10-Y19 from the CID-10 were used to identify poisoning cases that have occurred since 2000. Poisonings inflicted by another person with intent to causing harm were not selected because they are limited in number. Tables A and B in the appendix indicate the codes used.

[1] Starting in 2000, the codification that the BDIBCQ employs makes it possible to distinguish opioid medications from other types of opioids, in particular heroin.

2.3 IDENTIFICATION OF DEATHS ATTRIBUTABLE TO POISONING LINKED TO MEDICATIONS AND DRUGS

Among the fatal poisonings, those linked to medications and drugs were identified by means of the codes 960-979 recorded as the underlying cause of death for the years 1990 to 1999, while the codes T36-T50 recorded among the secondary causes of death made it possible to pinpoint this type of poisoning for the years 2000 to 2009.

2.4 IDENTIFICATION OF DEATHS ATTRIBUTABLE TO OPIOID POISONING

The BDIBCQ was consulted to identify opioid poisonings (codes T40.0-T40.4 and T40.6) in the poisoning by medications and drugs category for the years 2000 to 2009. The deaths attributable to poisoning by prescription opioids (codes T40.2-T40.4 and T40.6) were distinguished from heroin- (code T40.1) or opium-related poisoning (code T40.0).[2]

2.5 STATISTICAL ANALYSES

The numbers and annual mortality rates attributable to poisoning were calculated. The rates were produced using Québec's population for the years 1990 to 2009.[11] The rates were expressed per 100 000 person-years and indicate the number of deaths that occurred during a given year, reported on the population 20 years of age or over as of July 1 in the corresponding year. The rates presented for the overall population selected have been standardized for age using the direct method in order to limit the confounding effect stemming from differences related to demographic structure and to allow for comparisons over time. Québec's population in 2001 was adopted as the reference population. The specific rates by age group were also calculated. To mitigate annual fluctuations and facilitate the graphic illustration of trends, 5-year weighted moving averages were calculated according to the Kernel approach.[12]

A Joinpoint Regression model[13] was used to ascertain whether significant changes occurred in the trend of the annual mortality rate attributable to poisoning. Since different trends between men and women were reported,[1] the analyses have been stratified by gender. This type of non-linear modelling makes it possible to confirm whether a model comprising several segments affords a better statistical adjustment than a model based on a simple straight line.[13] The model adopted makes it possible to distinguish significant changes that have occurred. In the final model, a parameter associated with the average annual percent change (AAPC) is presented for each segment in order to describe the temporal trend, accompanied by 95% confidence interval (CI). Statistical analyses were conducted using version 9.2 of SAS software and version 3.3.1 of Joinpoint Regression software (http://srab.cancer.gov/joinpoint/).

[2] No death attributable to opium poisoning was identified.

3 FINDINGS

Table 1 indicates the key characteristics of poisoning-related deaths that occurred between 1990 and 2009. This type of death is more frequent among men in general and in the population (men and women) between 35 and 49 years of age. Intentional self-inflicted poisonings occurred more frequently although the number of unintentional poisonings increased between 1990-1994 and 2005-2009. During the study period, the average annual number of deaths by poisoning involving a medication or a drug rose, which the number of deaths linked to gases and vapours fell. While the number of deaths for each substance category increased, opioid-related poisoning deaths augmented the most markedly. Moreover, among fatal poisonings caused by a medication or a drug, opioids (40.9%) were the most frequently reported substance category between 2005 and 2009. Poisoning by prescription opioids appeared to be the main type of opioids involved (91.3%) during this period.

Table 1 Average annual number of poisoning-related deaths by selected characteristics, Québec, 1990-1994 to 2005-2009

	1990 to 1994		1995 to 1999		2000 to 2004		2005 to 2009	
	Number*	%	Number*	%	Number*	%	Number*	%
Total	**400**	**100**	**419**	**100**	**400**	**100**	**504**	**100**
Sex								
Men	281	70.3	289	68.8	260	65.1	316	62.7
Women	119	29.8	131	31.2	140	34.9	188	37.3
Age group								
20-34 years of age	136	34.0	113	26.9	77	19.4	80	15.9
35-49 years of age	161	40.3	188	44.8	180	45.1	208	41.3
50-64 years of age	72	17.9	79	18.8	106	26.5	169	33.4
65 years of age or over	31	7.9	40	9.5	36	9.1	47	9.4
Manner of death								
Unintentional	101	25.4	116	27.6	127	31.8	207	41.1
Intentional	276	69.1	287	68.5	240	59.5	253	50.2
Undetermined intent	22	5.6	17	4.0	35	8.8	44	8.7
Substances reported†								
Medications and drugs	210	52.5	239	56.9	251	62.8	388	76.9
Gases and fumes	159	39.8	154	36.7	100	25.0	76	15.0
Other substances	31	7.8	27	6.3	65	16.4	96	19.0
Medications and drugs‡								
Opioids					94	35.6	152	40.9
Prescription opioids					*82*	*85.3*	*139*	*91.3*
Heroin					*14*	*14.7*	*13*	*8.7*
Cocaine					45	17.2	73	19.6
Sedative-hypnotics					17	6.7	26	7.0
Antidepressants					52	20.1	60	16.1
Other medications or drugs					53	20.3	61	16.4

* Average annual number during the period.

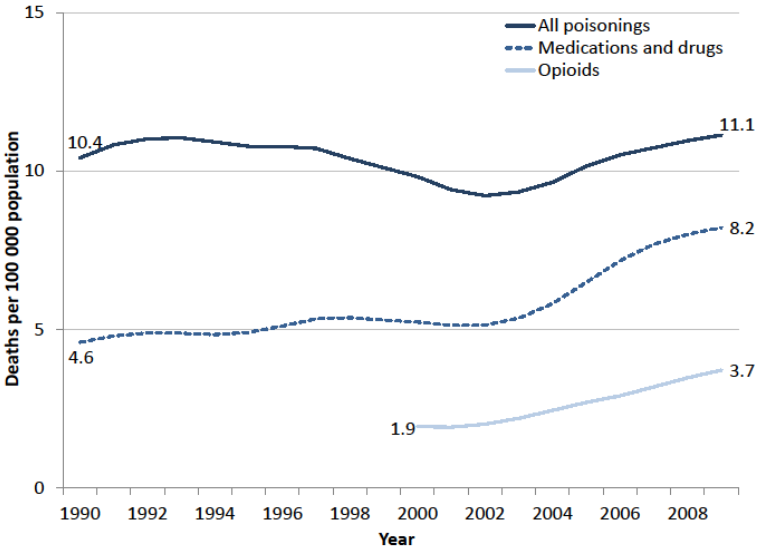
† Medical cause and multiple causes of death in the RED – death registry.

‡ Medical cause of death in the computerized data bank of the Bureau du coroner du Québec.

3.1 CHANGE IN THE TREND IN THE POISONING-RELATED DEATH RATE

Among men, the slight drop observed since 1990 in the poisoning-related death rate (AAPC -1.4%) reversed itself in the early 2000s, when the upward trend linked to medications and drugs accelerated (AAPC +8.7%). The increase coincides with the rise in opioid-related poisoning death rate, which rose by 9.4% on average per year (Figure 1A and Table 2). A similar trend is apparent among women starting in 2000 (Figure 1B and Table 2).

A) Men



B) Women

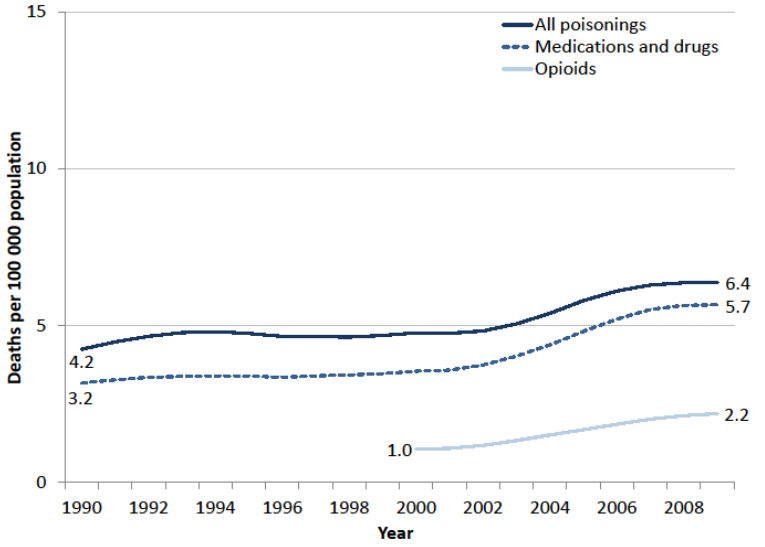


Figure 1 Weighted moving average of the adjusted poisoning-related death rate in the population 20 years of age or over according to type by gender, Québec, 1990 to 2009

Table 2 Average annual percent change in the poisoning-related death rate according to type by gender, population 20 years of age or over, Québec, 1990 to 2009

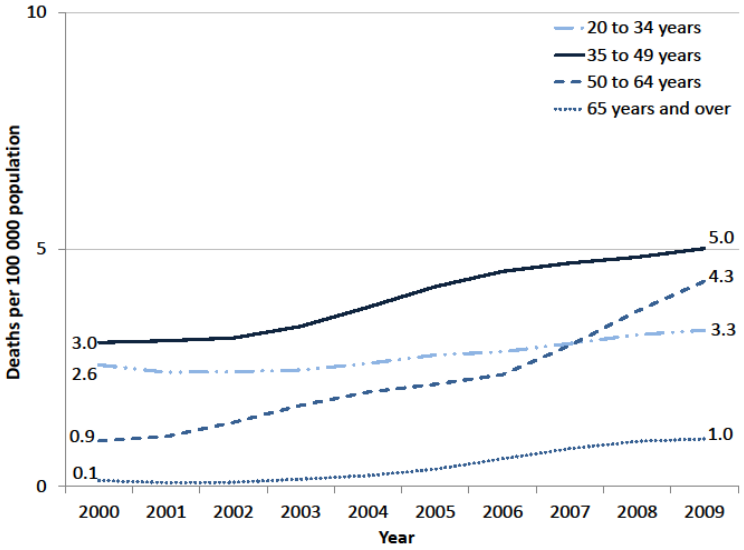
Men	Segment	AAPC[†]	95% CI
All poisonings	1990 to 2003	-1.4%*	(-2.5% to -0.2%)
	2003 to 2009	+3.3%	(-0.3% to +7.1%)
Poisoning by medications and drugs	1990 to 2003	+1.0%	(-0.4% to +2.4%)
	2003 to 2009	+8.7%*	(+4.9% to +12.6%)
Opioid poisoning[‡]	2000 to 2009	+9.4%*	(+6.7% to +12.1%)
Women			
All poisonings	1990 to 2009	+2.1%*	(+1.4% to +2.9%)
Poisoning by medications and drugs	1990 to 2000	+0.6%	(-1.6% to +2.8%)
	2000 to 2009	+6.5%*	(+4.2% to +8.8%)
Opioid poisoning[‡]	2000 to 2009	+10.2%*	(+6.8% to +13.7%)

* A statistically significant trend, i.e. the slope is different from 0 for the segment.

† Calculated on the annual rate adjusted for age, not on the moving averages of the rates.

‡ Trend modelled for the period from 2000 to 2009 only.

A) Men



B) Women

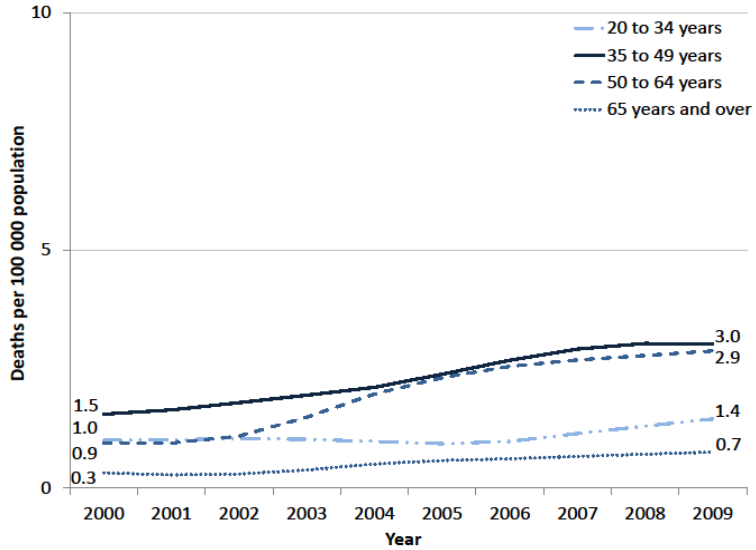


Figure 2 **Weighted moving average of the poisoning-related death rate in the population 20 years of age or over according to age group by gender, Québec, 2000 to 2009**

Table 3 Average annual percent change in the opioid-related poisoning death rate according to age group by gender, population 20 years of age or over, Québec, 2000 to 2009

Men	Segment	AAPC†	95% CI
20-34 years	2000 to 2009	+3.3%	(-1.8% to +8.8%)
35-49 years	2000 to 2009	+7.5%*	(+4.4% to +10.6%)
50-64 years	2000 to 2009	+20.9%*	(+13.0% to +29.4%)
65 years and over	-	-	-
Women			
20-34 years	2000 to 2009	+5.4%	(-4.4% to +16.3%)
35-49 years	2000 to 2009	+9.5%*	(+5.6% to +13.5%)
50-64 years	2000 to 2009	+13.7%*	(+5.9% to +22.0%)
65 years and over	2000 to 2009	+7.1%*	(+0.1% to +14.5%)

* A statistically significant trend, i.e. the slope is different from 0 for the segment.

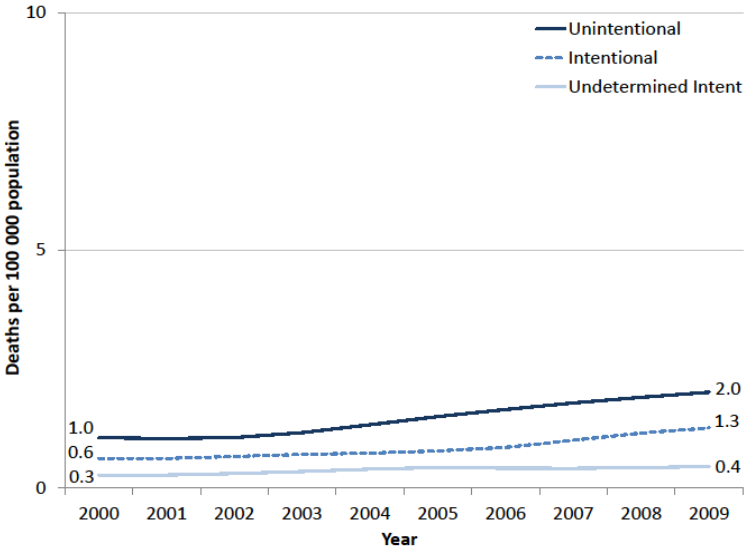
† Calculated on the annual rate, not on the moving averages of the rates.

‡ Non-modelled trend. No fatal opioid poisoning was recorded between 2001 and 2003.

§ Modelled trend with the exception of 2002, when no fatal opioid poisoning was recorded.

While the opioid-related poisoning mortality rate is higher in the 35-49 age group, the increase observed is the sharpest among individuals between 50 and 64 years of age (AAPC +20.9% among men and +13.7% among women) (Figure 2A, Figure 2B and Table 3). The increase in the opioid-related poisoning mortality rate is quite similar regardless of the manner of death (Figure 3A, Figure 3B and Table 4).

A) Men



B) Women

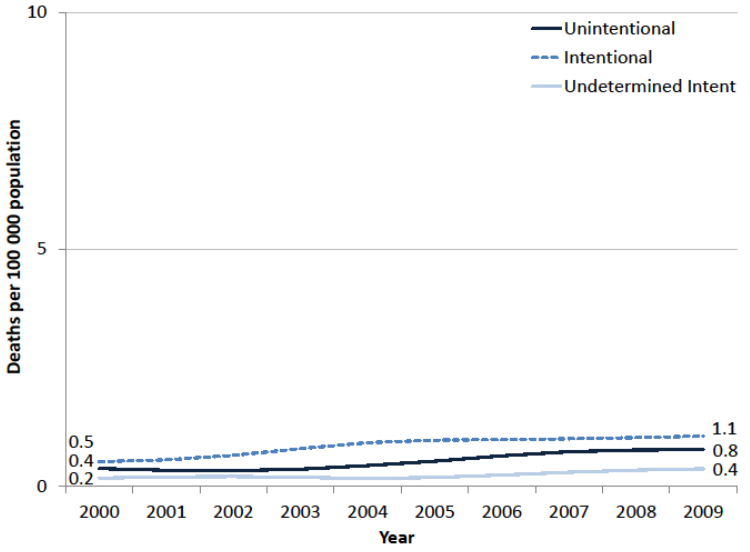


Figure 3 **Weighted moving average of the adjusted opioid-related poisoning death rate in the population 20 years of age or over by manner of death and gender, Québec, 2000 to 2009**

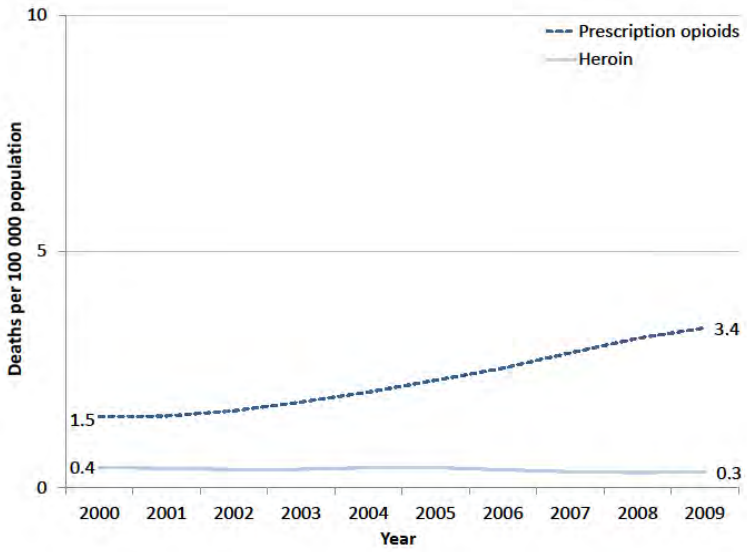
Table 4 Average annual percent change in the opioid-related poisoning death rate according to manner of death by gender, population 20 years of age or over, Québec, 2000 to 2009

Men	Segment	AAPC†	95% CI
Unintentional	2000 to 2009	+9.5%*	(+6.7% to +12.4%)
Intentional	2000 to 2009	+10.0%*	(+4.9% to +15.2%)
Undetermined intent	2000 to 2009	+6.1%	(-2.5% to +15.5%)
Women			
Unintentional	2000 to 2009	+11.6%*	(-3.9% to +19.9%)
Intentional	2000 to 2009	+8.3%*	(+3.1% to +13.6%)
Undetermined intent	2000 to 2009	+8.7%	(-3.2% to +22.4%)

* A statistically significant trend, i.e. the slope is different from 0 for the segment.

† Calculated on the adjusted annual rates, not on the moving averages of the rates.

A) Men



B) Women

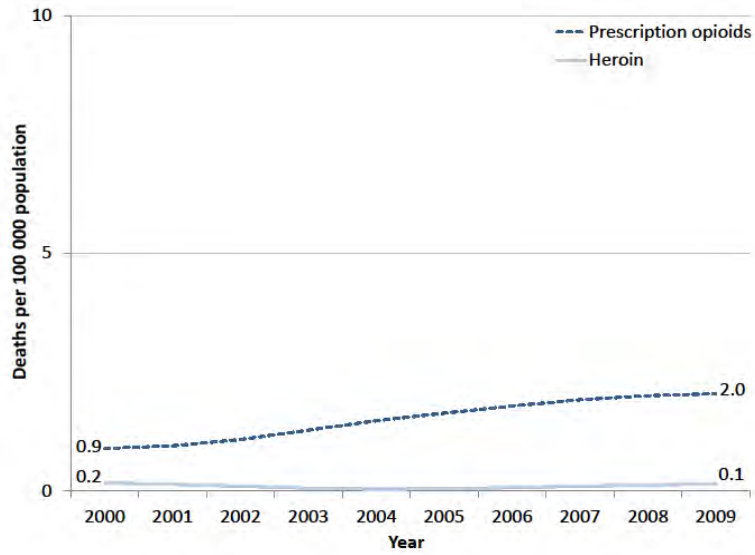


Figure 4 **Weighted moving average of the adjusted opioid-related poisoning death rate in the population 20 years of age or over by type of opioid and gender, Québec, 2000 to 2009**

Table 5 Average annual percent change in the opioid-related poisoning death rate according to type of opioid by gender, population 20 years of age or over, Québec, 2000 to 2009

Men	Segment	AAPC†	95% CI
Prescription opioids	2000 to 2009	+11.6%*	(+8.7% to +14.9%)
Heroin	2000 to 2009	-1.6%	(-9.2% to +6.5%)
Women			
Prescription opioids	2000 to 2009	+10.9%*	(+7.0% to +14.9%)
Heroin‡	2000 to 2009	-4.6%	(-21.6% to +16.0%)

* A statistically significant trend, i.e. the slope is different from 0 for the segment.

† Calculated on the adjusted annual rates, not on the moving averages of the rates.

‡ Modelled trend with the exception of 2002, when no fatal heroin poisoning was recorded.

While the mortality rate attributable to poisoning by heroin remained stable between 2000 and 2009, the mortality rate attributable to poisoning by prescription opioids rose (AAPC +11.6% among men and +10.9% among women) (Figure 4A, Figure 4B and Table 5).

4 DISCUSSION

Between 1990 and 2009, the fatal poisoning rate linked to medications and drugs increased in Québec's population 20 years of age or over. The increase in the medications and drugs related poisoning rate accelerated markedly in the early 2000s, in all likelihood because of the increase in opioid-related poisoning deaths among both men and women. The extent of the increase appears to be more sustained among individuals between 50 and 64 years of age and seems to stem essentially from prescription opioids poisoning.

A similar increase in opioid-related poisoning deaths was reported in Ontario,[14] the United States,[3;4;15] Australia[16] and the United Kingdom.[17] While the roots of the increase in opioid-related poisoning deaths are uncertain, the rise has been linked to the broader availability of opioids on the market.[5;6;14-17] Opioids are used for various medical reasons, in particular to treat non-cancerous chronic pain.[18] The medical use of opioids is regulated[19-23] because of the potentially serious adverse reactions associated with them[9] and the risk of developing dependence.[24] While opioid prescriptions in Canada apparently increased between 2005 and 2009,[8], the proportion of Canadians who reported that they suffer from chronic pain did not change significantly.[25] The risk of fatal poisoning among patients receiving opioid-based drug treatment under medical or pharmaceutical supervision to alleviate chronic pain is estimated at 0.04%.[26] It is possible that opioids are now more extensively prescribed than previously and that the increase in deaths attributable to opioid medication poisoning reflects this trend. Furthermore, the growing prevalence of long-term use of opioid medication is higher among individuals between 45 and 64 years of age.[27] In our study, this demographic group displays the biggest increase in mortality rate attributable to opioid poisoning.

The pace of the increase in the opioid-related poisoning mortality rate reported in our study is similar, regardless of manner of death. Indeed, it is sometimes difficult to determine the intent of a death attributable to poisoning.[28] On the one hand, individuals suffering from chronic pain are more susceptible to depression,[29] one of the key risk factors for suicide.[30] On the other hand, individuals with a history of depression are more likely to use opioids to treat chronic pain and to take a higher daily dose.[31] Accordingly, it is possible that the increase observed in intentional and unintentional poisonings reflects a unique phenomenon overshadowed by the difficulty in determining the intent of a death attributable to poisoning.[32]

Because of their psychoactive properties, prescription opioids are likely to be used for non-medical purposes. In West Virginia, for example, a prescription was documented for less than half of the deaths attributed to opioid-related poisoning.[33] In Canada, while data are fragmented, some sources have reported that the non-medical use of opioids increased in the adult population in general during the first half of the 2000s[34] and that such use is increasingly frequent among drug users.[35;36] The non-medical use of opioids is linked to increased risk for a fatal overdose.[33] Accordingly, it is possible that the increase in opioid-related poisoning deaths observed in Québec is affected by an increase in the non-medical use of opioids. In this perspective, opioid addiction treatment needs should be re-examined.

4.1 STRENGTHS AND LIMITATIONS OF THE STUDY

This study focuses on all deaths attributable to poisoning, especially by opioids, that occurred in Québec in the population 20 years of age or over between 1990 and 2009. The data used include the multiple causes of death compiled in the death registry of the RED and information drawn from the BDIBCQ, in accordance with what was recommended elsewhere.[37] While the data used were hardly affected by the advent of a new version of the classification of deaths,[38] it should be remembered that the temporal trends reported here may have risen through the enhancement in the 2000s of the scope and sensitivity of the analytical methods used to detect opioids during toxicological tests. Lastly, the data used here contain valuable, but limited, information. Data collection related to the use of opioids, their source and the medical indication of the pharmacological treatment received by the deceased individual was not carried out for this study. Other studies focusing on this information would make it possible to determine more accurately the risk factors related to the current problem and the population to be targeted from the standpoint of prevention.

5 CONCLUSION

Medications and drugs related poisoning death rate has increased since the early 2000s, spurred by the increase in deaths attributable to opioid poisoning. The relative extent of the increase is especially striking among individuals between 50 and 64 years of age. Physicians, pharmacists, nurses and other professionals working in the field of prevention must be informed of these observations, along with the users of prescription opioids. The strategies aimed at minimizing the risk of opioid overdoses should be reasserted and, if need be, new strategies could be elaborated.

REFERENCES

[1] Bohnert AS, Fudalej S, Ilgen MA. Increasing poisoning mortality rates in the United States, 1999-2006. Public Health Reports. 2010;125(4):542-7.

[2] Warner M, Chen LH, Makuc DM. Increase in fatal poisonings involving opioid analgesics in the United States, 1999-2006. NCHS Data Brief. 2009;22(1):1-8.

[3] Calcaterra S, Glanz J, Binswanger IA. National trends in pharmaceutical opioid related overdose deaths compared to other substance related overdose deaths: 1999-2009. Drug and Alcohol Dependence. 2013;131(3):263-70.

[4] Paulozzi LJ, Budnitz DS, Xi Y. Increasing deaths from opioid analgesics in the United States. Pharmacoepidemiology and Drug Safety. 2006;15(9):618-27.

[5] Paulozzi LJ, Ryan GW. Opioid analgesics and rates of fatal drug poisoning in the United States. American Journal of Preventive Medicine. 2006;31(6):506-11.

[6] Okie S. A flood of opioids, a rising tide of deaths. New England Journal of Medicine. 2010;363(21):1981-5.

[7] Organe international de contrôle des stupéfiants. Évaluations des besoins du monde pour 2013. Statistiques pour 2011. New York: United Nations; 2012: 246 pages + appendices.

[8] Fischer B, Jones W, Krahn M, Rehm J. Differences and over-time changes in levels of prescription opioid analgesic dispensing from retail pharmacies in Canada, 2005-2010. Pharmacoepidemiology and Drug Safety. 2011;20(12):1269-77.

[9] White JM, Irvine RJ. Mechanisms of fatal opioid overdose. Addiction. 1999;94(7): 961-72.

[10] Warner M, Chen LH. Surveillance of Injury Mortality, in Injury Research: Theories, Methods, and Approaches. Guohua Li & Susan P. Baker (editors). New York: Springer; 2012. p. 3-21.

[11] Ministère de la Santé et des Services sociaux. La population du Québec par territoire des centres locaux de services communautaires, par territoire des réseaux locaux de services et par région sociosanitaire, de 1981 à 2031. Édition 2010. Service du développement de l'information: Publication du Québec; 2010.

[12] Devine O. Exploring temporal and spatial patterns in public health surveillance date, in Monitoring the health of populations. Statistical principles and methods for public health surveillance. Ron Brookmeyer & Donna F. Stroup (editors). New York: Oxford University Press; 2004. p. 71-98.

[13] Kim HJ, Fay MP, Feuer EJ, Midthune DN. Permutation tests for joinpoint regression with applications to cancer rates. Statistics in Medicine. 2000;19(3):335-51.

[14] Dhalla IA, Mamdani MM, Sivilotti ML, Kopp A, Qureshi O, Juurlink DN. Prescribing of opioid analgesics and related mortality before and after the introduction of long-acting oxycodone. CMAJ. 2009;181(12):891-6.

[15] Warner M, Chen LH, Makuc DM, Anderson RN, Minino AM. Drug poisoning deaths in the United States, 1980-2008. NCHS Data Brief. 2011;(81):1-8.

[16] Rintoul AC, Dobbin MD, Drummer OH, Ozanne-Smith J. Increasing deaths involving oxycodone, Victoria, Australia, 2000-09. Injury Prevention. 2011. 17(4):254-9.

[17] Giraudon I, Lowitz K, Dargan PI, Wood DM, Dart RC. Prescription Opioid Abuse in the United Kingdom. British Journal of Clinical Pharmacology. 2013. 76(5):823-4.

[18] Furlan AD, Sandoval JA, Mailis-Gagnon A, Tunks E. Opioids for chronic noncancer pain: a meta-analysis of effectiveness and side effects. CMAJ. 2006;174(11):1589-94.

[19] Boulanger A, Provost M. Douleur chronique et opioïdes : l'essentiel. Lignes directrices. 2009. Collège des médecins du Québec.

[20] Kahan M, Wilson L, Mailis-Gagnon A, Srivastava A. Canadian guideline for safe and effective use of opioids for chronic noncancer pain: Clinical summary for family physicians. Part 2: special populations. Canadian Family Physician. 2011;57(11): 1269-76.

[21] Kahan M, Mailis-Gagnon A, Wilson L, Srivastava A. Canadian guideline for safe and effective use of opioids for chronic noncancer pain: Clinical summary for family physicians. Part 1: general population. Canadian Family Physician. 2011;57(11): 1257-66.

[22] Manchikanti L, Abdi S, Atluri S, Balog CC, Benyamin RM *et al.* American Society of Interventional Pain Physicians (ASIPP) guidelines for responsible opioid prescribing in chronic non-cancer pain: Part 2--guidance. Pain Physician. 2012;15(3 Suppl):S67-116.

[23] Manchikanti L, Abdi S, Atluri S, Balog CC, Benyamin RM *et al.* American Society of Interventional Pain Physicians (ASIPP) guidelines for responsible opioid prescribing in chronic non-cancer pain: Part I--evidence assessment. Pain Physician. 2012;15(3 Suppl):S1-65.

[24] Dowell D, Kunins HV, Farley TA. Opioid analgesics--risky drugs, not risky patients. JAMA. 2013;309(21):2219-20.

[25] Reitsma ML, Tranmer JE, Buchanan DM, VanDenKerkhof EG. The prevalence of chronic pain and pain-related interference in the Canadian population from 1994 to 2008. Chronic Diseases and Injuries in Canada. 2011;31(4):157-64.

[26] Bohnert AS, Valenstein M, Bair MJ, Ganoczy D, McCarthy JF, Ilgen MA, Blow FC. Association between opioid prescribing patterns and opioid overdose-related deaths. JAMA. 2011;305(13):1315-21.

[27] Campbell CI, Weisner C, Leresche L, Ray GT, Saunders K, Sullivan MD, Banta-Green CJ, Merrill JO, Silverberg MJ, Boudreau D, Satre DD, Von KM. Age and gender trends in long-term opioid analgesic use for noncancer pain. American Journal of Public Health. 2010;100(12):2541-7.

[28] Donaldson AE, Larsen GY, Fullerton-Gleason L, Olson LM. Classifying undetermined poisoning deaths. Injury Prevention. 2006;12(5):338-43.

[29] Ashburn MA, Staats PS. Management of chronic pain. Lancet. 1999;353(9167):1865-9.

[30] Hawton K, van HK. Suicide. Lancet. 2009;373(9672):1372-81.

[31] Braden JB, Sullivan MD, Ray GT, Saunders K, Merrill J, Silverberg MJ, Rutter CM, Weisner C, Banta-Green C, Campbell C, Von KM. Trends in long-term opioid therapy for noncancer pain among persons with a history of depression. General Hospital Psychiatry. 2009;31(6):564-70.

[32] Rockett IR, Hobbs G, De LD, Stack S, Frost JL, Ducatman AM, Kapusta ND, Walker RL. Suicide and unintentional poisoning mortality trends in the United States, 1987-2006: two unrelated phenomena? BMC Public Health. 2010;10:705.

[33] Hall AJ, Logan JE, Toblin RL, Kaplan JA, Kraner JC, Bixler D, Crosby AE, Paulozzi LJ. Patterns of abuse among unintentional pharmaceutical overdose fatalities. JAMA. 2008;300(22):2613-20.

[34] Fischer B, Rehm J, Patra J, Cruz MF. Changes in illicit opioid use across Canada. CMAJ. 2006;175(11):1385-7.

[35] Fischer B, Argento E. Prescription opioid related misuse, harms, diversion and interventions in Canada: a review. Pain Physician. 2012;15(3 Suppl):ES191-ES203.

[36] Leclerc P, Roy É, Morissette C, Alary M, Parent R, Blouin K. Surveillance des maladies infectieuses chez les utilisateurs de drogue par injection. Épidémiologie du VIH de 1995 à 2010 – Épidémiologie du VHC de 2003 à 2010. Institut national de santé publique du Québec; 2012. N° de publication : 1569.

[37] Landen MG, Castle S, Nolte KB, Gonzales M, Escobedo LG, Chatterjee BF, Johnson K, Sewell CM. Methodological issues in the surveillance of poisoning, illicit drug overdose, and heroin overdose deaths in new Mexico. American Journal of Epidemiology. 2003;157(3):273-8.

[38] Statistics Canada. Comparability of ICD-10 and ICD-9 for Mortality Statistics in Canada. Ottawa; 2005. Publication No. 84-548-XWE.

APPENDIX 1

CODES USED TO ELABORATE THE VARIABLES ASSOCIATED WITH POISONING DEATHS ACCORDING TO THE 9TH REVISION OF THE INTERNATIONAL CLASSIFICATION OF DISEASES (1990 TO 1999)

Table A Codes used to elaborate the variables associated with poisoning deaths according to the 9th revision of the International Classification of Diseases (1990 to 1999)

	External cause	Description
Manner of death		
	E850-E869	Unintentional poisoning
	E950-E952	Intentional poisoning
	E980-E982	Poisoning of undetermined intent
Substances reported[†]		
	960-979	Toxic effects of medications and drugs
	986-987	Toxic effects of gases, fumes and vapours
	980-985, 988-990	Toxic effects of other substances

[†] Underlying cause of death in the RED – death registry.

APPENDIX 2

CODES USED TO ELABORATE THE VARIABLES ASSOCIATED WITH POISONING DEATHS ACCORDING TO THE 10TH REVISION OF THE INTERNATIONAL STATISTICAL CLASSIFICATION OF DISEASES AND RELATED HEALTH PROBLEMS (2000 TO 2009)

Table B Codes used to elaborate the variables associated with poisoning deaths according to the 10th revision of the International Statistical Classification of Diseases and Related Health Problems (2000 to 2009)

	Underlying cause	Description
Manner of death		
	X40-X49	Unintentional poisoning
	X60-X69	Intentional poisoning
	Y10-Y19	Poisoning of undetermined intent
Type of substances reported[†]		
	T36-T50	Toxic effects of medications and drugs
	T58-T59	Toxic effects of gases, fumes and vapours
	T51-T57 T60-T65	Toxic effects of other substances
Medications and drugs[‡]		
	T40 (.0-.4, .6)	Opioids
	T40.5	Cocaine
	T42.3-T42.7	Sedative-hypnotics
	T43 (.0-.5, .7-.9)	Antidepressants
	T36-T39, T40.7-T40.9, T41, T42.0-T42.2, T43.6, T44-T50	Other substances
Opioids[‡]		
	T40.0	Opium
	T40 (.2-.4, .6)	Prescription opioids
	T40.1	Heroin

[†] Among one of the 10 possible medical causes of death in the RED – death registry.

[‡] Adopted as the medical cause of death in the computerized data bank of the Bureau du coroner du Québec.

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