

Social and economic characteristics of those experiencing hospitalizations due to opioid poisonings

by Gisèle Carrière, Rochelle Garner and Claudia Sanmartin

Abstract

Hospitalizations due to opioid poisonings are increasing. While considerable information is available on the demographic and geographic distribution of opioid-related events, national data on the social and economic circumstances of those experiencing these events are limited. This study uses data from the National Household Survey (2011) linked to the Discharge Abstract Database (2011 to 2016) to provide the first national-level estimates of the socio-economic characteristics of individuals experiencing opioid-related hospitalizations. Results reveal elevated hospitalization rates among people who have lower levels of income and education, are unemployed or out of the labour force, identify as Indigenous, live in lone-parent households, and spend more than 50% of their household income on housing. Understanding the circumstances of individuals who experienced adverse opioid events will help inform policies addressing potential determinants.

Keywords: opioid poisonings, hospitalization, linked health data

Canada is currently experiencing an opioid crisis. The number of opioid-related deaths continues to rise, reaching close to 4,000 in 2017.¹ Problematic opioid use also affects hospital utilization.² According to a report by the Canadian Institute for Health Information (CIHI), the rate of hospitalization due to opioid poisoning (HOP) rose by 56% between 2007/2008 and 2016/2017 to 15.6 per 100,000 population, with almost half the increase occurring in the last three years. While rates were highest among people aged 45 or older (about 20 per 100,000 population), the greatest increase was among 15- to 24-year-olds, from 6.5 to 13.3 per 100,000. During the last decade, rates were higher among females than males until 2016/2017, when the rate among males (15.8 per 100,000) surpassed that among females (15.5 per 100,000). Rates were higher in western provinces (Saskatchewan, Alberta and British Columbia) and the territories than in eastern provinces.³

Information is available about the demographic and geographic distribution of opioid-related events in Canada, but national data on the social and economic conditions of those experiencing these events are limited. A recent review of provincial and territorial surveillance reports by the Public Health Agency of Canada identified several groups as being most impacted by the opioid crisis, including those who are homeless, inmates, and First Nations people.⁴ While the focus has generally been on the immediate need for prevention and treatment, attention is turning toward potential determinants (for example, poverty, housing, unemployment) of this crisis.^{5,6} Understanding the circumstances of those experiencing adverse opioid events will help inform the development of policies addressing upstream factors.

This study uses newly linked data that bring together comprehensive socio-economic information and hospital administrative data to describe the characteristics of individuals experiencing opioid-related hospitalizations.

Methods

Data linkage

Data from the 2011 National Household Survey (NHS) were linked to CIHI's Discharge Abstract Database (DAD) and the Canadian Vital Statistics Death Database (CVSD), using Statistics Canada's Social Data Linkage Environment (SDLE). SDLE helps to create linked population data files for social analysis through linkage to the Derived Record Depository (DRD), a dynamic relational database containing only basic personal identifiers.⁷ Survey and administrative data are linked to the DRD using G-Link, a SAS-based generalized record linkage software that supports deterministic and probabilistic linkage developed at Statistics Canada.⁸ The linkage was approved by Statistics Canada's senior management⁹ and is governed by the Directive on Microdata Linkage.¹⁰

The NHS is a voluntary survey, conducted in May 2011, of approximately 4.5 million (30%) private dwellings randomly selected from the 2011 Census of Population. The NHS covers all persons who usually live in Canada, including permanent and non-permanent residents, and individuals living on First Nations reserves, Métis settlements or Inuit communities. There were 36 incompletely enumerated First Nations reserves in the 2011 NHS.¹¹ In 13 such communities, enumeration was delayed because of forest fires in Northern Ontario and occurred at a later date. The NHS excludes residents of institutions (for example, hospitals, nursing homes, penitentiaries) and collective dwellings (for example, work camps, hotels, shelters). The information

Authors: Gisèle Carrière (gisele.carriere@canada.ca) and Rochelle Garner are with the Health Analysis Division and Claudia Sanmartin is with the Analytical Studies Branch at Statistics Canada, Ottawa, Ontario.

provided by the survey includes labour force participation, education, income, housing, visible minority status, and self-reported Indigenous status.¹¹

Records for approximately 6.7 million NHS respondents were eligible for linkage; 97% linked to the DRD using a probabilistic approach based on telephone number, surnames, given names, birthdate, and place of residence.¹² No differences in linkage rates were found by collection mode, province, sex, or birth decade.¹² To ensure representativeness of the linked cohort, weights were calculated to adjust for non-linkage.

The DAD contains demographic, administrative, and clinical data for all acute care (and some psychiatric, chronic rehabilitation, and day-surgery) hospital discharges for all provinces and territories, except Quebec.¹³ Data are provided annually to Statistics Canada by CIHI. Hospital discharges that occurred from April 1, 1994 to March 31, 2017 were eligible for linkage (n = 84.8 million); 91% linked to the DRD using a deterministic approach based on birthdate, postal code, sex, and health insurance number. Analysis of linked versus non-linked DAD records found no evidence of bias, with similar distributions of individual-level characteristics (age, sex, province and territory of residence).¹⁴

The CVSD contains information on all deaths in Canada. Data are obtained annually from provincial and territorial vital statistics registries.¹⁵ Mortality records up to December 31, 2016 were eligible for linkage; 90% linked to the DRD using a probabilistic approach based on surname, given names, birthdate, and geography (province, city, postal code).¹⁶

Study cohort

The study cohort consists of all NHS respondents (excluding Québec residents) who linked to the DRD (n = 4,900,320). Opioid-related hospitalizations of cohort members between April 1, 2011 and December 31, 2016 (n = 3,200, representing 17,480 hospitalizations during the six-year period) were identified using a protocol developed

by CIHI that included the following International Statistical Classification of Diseases and Related Health Problems—Canada, Tenth Revision (ICD-10-CA) codes that identify poisonings relevant to opioids: T40.0, T40.1, T40.2, T40.3, T40.4, T40.6. Further diagnostic codes were applied to ensure that only hospitalizations representing significant opioid poisonings were included.¹⁷ Deaths of study cohort members (all causes) between 2011 and 2016 (n = 159,105) were used to adjust the denominator for rate calculations.

Covariates

The socio-economic characteristics of individuals who experienced a HOP were derived from the 2011 NHS.

Place of residence was categorized by population size: large urban area (100,000 or more population), medium-size urban area (30,000 to 99,999), small urban area (fewer than 30,000), and rural.

Respondents self-identified as visible minorities as defined by the Employment Equity Act (excluding Indigenous peoples). Separately, respondents self-identified as First Nations, Métis, or Inuit. Geographic location was used to classify First Nations persons as living on or off reserve.

Income quintiles were derived at the census metropolitan area level, based on total after-tax income adjusted for household size. Education refers to the highest level attained among those aged 15 or older.

Labour force participation (respondents aged 15 or older) was based on employment in the week before the survey: employed (worked for pay or self-employed); unemployed (without paid work or self-employment but available for work); or not in the labour force (neither employed nor unemployed). The last category was subdivided by age (younger than 65 versus 65 or older) to identify those potentially retired. Among the employed, occupational group was determined using the 2011 National Occupational Classification code.

Living arrangements refer to the relationship between household members.

The ratio of shelter costs to total household income was calculated, with ratios of 0.30 or greater reflecting housing unaffordability. For ease of interpretation, categories for this ratio were created at 15%, 30%, and 50%. More information on the NHS variable concepts is available elsewhere.¹⁸

Statistical methods

Crude and age-standardized hospitalization rates (ASHRs) per 100,000 population and rate ratios were calculated. Rates were based on the total count of HOPs across all fiscal years (numerator) and the total NHS population counts per fiscal year minus deaths (denominator). Age-standardization used the direct method, applying the 2011 Census of Population age structure for the following age groups: younger than 15, 15 to 24, 25 to 44, 45 to 64, and 65 or older. All analyses were weighted for sample and linkage effects.

Results

Sex, age, and residence

Crude and age-standardized rates of HOP were higher for females than males, and among people aged 45 or older compared with younger age groups (Table 1). Rates were relatively high in western provinces (Saskatchewan, Alberta and British Columbia) and the territories, and low in Manitoba and Newfoundland and Labrador (data not shown). Rates were 2.4 times higher among individuals living in medium-size urban areas than among residents of large urban areas (Table 1).

Visible minority and Indigenous identity

Age-standardized rates of HOP were lower among visible minorities than among people who were not members of visible minority groups (2.9 versus 13.0 per 100,000). Compared with the non-Indigenous population, rates were higher for all Indigenous populations, particularly among First Nations people living on reserve (5.6 times higher than the non-Indigenous population) (Table 1).

Table 1
Crude and age-standardized rates of hospitalization due to opioid poisoning, by demographic, geographic and identity characteristics, Canada excluding Quebec, 2011 to December 31, 2016

Demographic, geographic and identity characteristics	Crude rate per 100,000	95% confidence interval		Age-standardized rate per 100,000	95% confidence interval		Age-standardized rate ratio	95% confidence interval	
		from	to		from	to		from	to
Canada excluding Quebec	11.8	11.1	12.5	12.0	11.3	12.7	...	...	...
Gender									
Male	10.0	9.1	11.0	10.2	9.3	11.2	†	...	...
Female	13.5	12.4	14.6	13.6	12.5	14.7	1.3	1.2	1.5
Age group									
Younger than 15	3.1	2.2	3.9	...	...	...	...	...	...
15 to 24	10.5	8.8	12.3	...	...	...	...	...	...
25 to 44	10.0	8.8	11.2	...	...	...	...	...	...
45 to 64	16.8	15.1	18.5	...	...	...	...	...	...
65 or older	17.7	15.2	20.2	...	...	...	...	...	...
Place of residence									
Large urban population centre	9.3	8.5	10.1	9.6	8.8	10.5	†	...	...
Medium-size population centre	23.1	19.3	26.8	23.4	19.6	27.3	2.4	2.2	2.7
Small population centre	14.0	11.9	16.1	14.2	12.1	16.3	1.5	1.3	1.6
Rural area	13.0	11.3	14.8	12.7	11.1	14.4	1.3	1.2	1.4
Visible minority									
Visible minority	2.6	2.0	3.1	2.9	2.2	3.5	0.2	0.2	0.2
Not visible minority	13.2	12.3	14.2	13.0	12.0	13.9	†	...	...
Indigenous identity group (single response)									
First Nations	30.8	26.6	35.1	38.4	30.5	46.3	3.5	3.3	3.8
On reserve	47.6	42.7	52.5	61.2	54.5	68.0	5.6	5.3	6.0
Off reserve	26.4	20.2	32.6	30.9	23.2	38.6	2.8	2.7	3.0
Métis	24.8	15.3	34.3	34.3	15.0	53.6	3.2	2.9	3.4
Inuit	11.8	11.1	12.5	35.1	-9.3	79.5	3.2	3.0	3.5
Non-Indigenous	10.8	10.1	11.5	10.9	10.1	11.6	†	...	...

... not applicable
 † reference category

Source: 2011 National Household Survey linked to Discharge Abstract Database (2011/2012 to 2016/2017).

Income and education

The crude rate of HOPs was inversely related to household income, with rates ranging from 23.4 per 100,000 among people in the lowest income quintile to 6.6 per 100,000 among those in the highest (Table 2). The rate among those in the lowest income quintile rose slightly when adjusted for age (25.8 per 100,000), as did the rate for those in the second-lowest quintile (13.6 per 100,000).

Educational attainment was also inversely related to the rate of HOP; the ASHR among people without a high school diploma was 2.1 times greater than the ASHR for those with a college diploma or university education below a bachelor's degree (Table 2).

Employment

Age-standardized rates of HOP were highest among people who were unemployed (17.0 per 100,000) and people

younger than 65 who were not in the labour force (22.5 per 100,000). Variation was observed by type of employment. Crude rates were highest among people in “trades, transport equipment operators, and related occupations,” “sales and service,” and health. However, the highest age-standardized rate was among those in manufacturing- and utility-related occupations (10.5 per 100,000) (Table 2).

Living arrangements and housing

Age-standardized rates of HOP were highest among parents and children in lone-parent households. Renters' ASHR was 2.8 times that of homeowners. A positive association was observed between ASHRs and shelter costs relative to income (Table 3).

Discussion

This study represents the first national level information regarding the

socio-economic characteristics of those living in private dwellings who experienced HOPs based on linked survey and hospital data. The demographic and geographic distributions are similar to findings published by CIHI based on hospital data alone. This suggests that the linked data are a valid source of information for the study of opioid-related hospitalizations.

The higher rates of HOP among Indigenous and low-income people are consistent with patterns observed for overdoses and deaths in selected provinces. For example, in British Columbia, First Nations people were five times more likely to experience an opioid overdose, and three times more likely to die of an apparent opioid overdose, compared with non-First Nations people.¹⁹ Similar trends were observed in Alberta.²⁰ Higher rates of substance use in Indigenous communities have been associated with the effects of colonization, racism,

intergenerational trauma, and reduced access to mental health services.^{19,21} In Alberta, higher rates of opioid-related deaths were observed in lower- to middle-income neighbourhoods.²²

Little information is available about the relationship between problematic opioid use and employment status. Results of the U.S. National Survey on Drug Use and Health revealed that people who were unemployed and those not in the workforce had higher odds of nonmedical use of prescription opioids and stimulants, respectively, compared with people who were employed.²³ Similarly, this analysis found higher age-standardized rates of HOP among people who

were unemployed and those younger than 65 who were not in the labour force. Clearly, more data are needed to better understand these associations.

Limitations

The results of this study should be considered in the context of several limitations.

First, the analysis is based on hospitalizations of residents of private dwellings in 2011. HOPs among individuals who were institutionalized, incarcerated, living in collective dwellings (shelters, nursing homes), or homeless, or who arrived in Canada or were born after May

2011 are not captured. Consequently, rates of HOP may be underestimated among key subgroups (for instance, low income) who are more likely to be represented in the excluded populations.

Second, hospital data for Quebec were not available for linkage. The absence of such data will affect the present study to the extent that factors associated with HOP differ in Quebec, compared with the rest of the country.

Third, the characteristics of people hospitalized because of opioid poisoning are based on values in 2011; changes during follow-up (for example, place of residence, income) will not be reflected in the analyses.

Table 2
Crude and age-standardized rates of hospitalization due to opioid poisoning, by income, education and employment characteristics, Canada excluding Quebec, 2011 to December 31, 2016

Income, education and employment characteristics	Crude rate per 100,000	95% confidence interval		Age-standardized rate per 100,000	95% confidence interval		Age-standardized rate ratio	95% confidence interval		
		from	to		from	to		from	to	
Household income quintile										
Quintile 1 (lowest)	23.4	21.0	25.8	25.8	23.2	28.5	3.9	3.4	4.6	
2	12.7	10.9	14.5	13.6	11.5	15.6	2.1	1.8	2.4	
3	9.0	7.6	10.4	9.3	7.8	10.7	1.4	1.2	1.6	
4	7.0	5.9	8.1	7.2	6.0	8.4	1.1	0.9	1.3	
Quintile 5 (highest)	6.6	5.5	7.8	6.6	5.6	7.6	†	...	...
Highest level of educational attainment (15 or older)										
No certificate, diploma or degree	23.0	20.4	25.7	22.0	19.3	24.7	2.1	1.9	2.4	
High school diploma (or equivalent) and/or trade certificate	14.3	12.8	15.8	12.2	10.9	13.5	1.2	1.0	1.3	
College diploma or university below bachelor's level	12.7	11.1	14.4	10.4	9.0	11.8	†	...	...
University degree	5.5	4.3	6.7	4.9	3.7	6.0	0.5	0.4	0.5	
Labour force status (15 or older)										
Employed	6.5	5.8	7.2	5.5	4.9	6.2	†	...	...
Unemployed	20.1	14.5	25.6	17.0	11.6	22.5	3.1	2.8	3.5	
Not in labour force (younger than 65)	30.8	27.8	33.7	22.5	20.3	24.7	4.1	3.6	4.6	
Not in labour force (65 or older)	19.6	16.6	22.5	2.8	2.4	3.2	0.5	0.5	0.6	
Occupation (based on 2011 National Occupational Classification) (15 or older)										
Management	5.1	2.8	7.4	5.4	3.0	7.7	0.7	0.6	0.9	
Business, finance and administration	7.3	5.6	8.9	5.9	4.5	7.2	0.8	0.6	0.9	
Natural and applied sciences and related	3.0	1.9	4.0	2.3	1.3	3.3	0.3	0.2	0.4	
Health	9.2	5.7	12.8	6.9	4.3	9.6	0.9	0.7	1.1	
Education, law, social, community, and government services	6.8	5.0	8.6	5.5	4.1	7.0	0.7	0.6	0.9	
Art, culture, recreation, sport	6.1	3.6	8.6	5.8	2.9	8.8	0.8	0.6	0.9	
Sales and service	9.5	7.7	11.3	7.6	6.0	9.2	†	...	...
Trades, transport, equipment operators, and related	9.7	7.9	11.5	8.0	6.4	9.5	1.0	0.9	1.3	
Natural resources, agriculture, and related production	7.1	4.0	10.2	5.5	2.9	8.0	0.7	0.6	0.9	
Manufacturing, and utilities	8.2	5.2	11.2	10.6	2.0	19.3	1.4	1.1	1.7	

... not applicable

† reference category

Source: 2011 National Household Survey linked to Discharge Abstract Database (2011/2012 to 2016/2017).

Table 3
Crude and age-standardized rates of hospitalization due to opioid poisoning, by household and housing characteristics, Canada excluding Quebec, 2011 to December 31, 2016

Household and housing characteristics	Crude rate per 100,000	95% confidence interval		Age-standardized rate per 100,000	95% confidence interval		Age-standardized rate ratio	95% confidence interval	
		from	to		from	to		from	to
Household living arrangements									
Married spouse or common-law partner (with or without children)	9.8	8.9	10.7	8.2	7.1	9.3	†	...	...
Lone parent	25.5	21.1	30.0	23.3	18.4	28.2	2.9	2.5	3.3
Child of couple	5.5	4.6	6.5	16.9	6.6	27.2	2.1	1.8	2.4
Child of lone parent	12.6	9.5	15.8	25.1	14.2	36.0	3.1	2.7	3.5
Person living alone	25.1	21.2	29.0	19.6	15.9	23.4	2.4	2.1	2.7
Person living with others	20.2	16.7	23.7	21.0	16.8	25.1	2.6	2.2	2.9
Tenure of housing									
Band Housing	53.8	47.2	60.4	71.9	61.9	82.0	8.4	7.8	9.0
Owned by household member	8.6	7.9	9.3	8.6	7.9	9.2	†	...	...
Rented	21.3	19.0	23.5	24.0	21.3	26.6	2.8	2.6	3.0
Shelter-cost-to-income ratio									
Less than 15%	8.7	7.8	9.6	8.5	7.6	9.4	0.7	0.6	0.8
15% to less than 30%	11.0	9.8	12.1	12.0	10.7	13.3	†	...	...
30% to less than 50%	14.3	11.9	16.8	15.6	12.9	18.3	1.3	1.2	1.4
50% to less than 100%	23.9	18.8	28.9	26.2	20.6	31.8	2.2	2.0	2.4
100% or more	18.3	13.5	23.0	18.9	12.6	25.2	1.6	1.4	1.8

... not applicable

† reference category

Source: 2011 National Household Survey linked to Discharge Abstract Database (2011/2012 to 2016/2017).

Fourth, this study pertains only to individuals who were admitted to hospital; opioid overdoses or deaths that were not captured in hospital data will be missed.

Conclusion

Understanding social determinants associated with problematic opioid use is critical to inform policies aimed at

addressing determinants. While administrative health data, including hospital records and mortality statistics, provide a comprehensive picture of the demographic and geographic dimensions of the situation, they lack information on social and economic characteristics. By linking survey and hospital data, it is possible to address this gap.

This study is the first of several that use linked data to examine the social determinants of opioid-related hospitalizations using linked data. Future studies will focus on monitoring trends over time and on multivariate analyses to understand how the combination of factors affects the risk of adverse outcomes, and which factors predominate as contributors. ■

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