Association between opioid use disorder and palliative care: a cohort study using linked health administrative data in Ontario, Canada

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Abstract

Background: People with opioid use disorder (OUD) are at risk of premature death and can benefit from palliative care. We sought to compare palliative care provision for decedents with and without OUD.

Methods: We conducted a cohort study using health administrative databases in Ontario, Canada, to identify people who died between July 1, 2015, and Dec. 31, 2021. The exposure was OUD, defined as having emergency department visits, hospital admissions, or pharmacologic treatments suggestive of OUD within 3 years of death. Our primary outcome

was receipt of 1 or more palliative care services during the last 90 days before death. Secondary outcomes included setting, initiation, and intensity of palliative care. We conducted a secondary analysis excluding sudden deaths (e.g., opioid toxicity, injury).

Results: Of 679 840 decedents, 11 200 (1.6%) had OUD. Compared with people without OUD, those with OUD died at a younger age and were more likely to live in neighbourhoods with high marginalization indices. We found people with OUD were less likely to receive palliative care at the end of their lives (adjusted relative

risk [RR] 0.84, 95% confidence interval [CI] 0.82–0.86), but this difference did not exist after excluding people who died suddenly (adjusted RR 0.99, 95% CI 0.96–1.01). People with OUD were less likely to receive palliative care in clinics and their homes regardless of cause of death.

Interpretation: Opioid use disorder can be a chronic, life-limiting illness, and people with OUD are less likely to receive palliative care in communities during the 90 days before death. Health care providers should receive training in palliative care and addiction medicine to support people with OUD.

Between 1990 and 2016, the number of people with opioid use disorder (OUD) worldwide increased from 18.2 million to 26.8 million people.[1,2] As this population ages, more people with OUD will require access to palliative care at the end of their lives. In addition to the risk of dying from opioid poisoning, people with OUD who survive nonfatal opioid poisoning can have severe complications such as hypoxic brain injury, as well as serious infections from injecting opioids.[3,4] Socioeconomic inequities and comorbidities are also more prevalent among people with OUD, contributing further to premature death.[5,6] A Norwegian cohort study found that 45% of people with OUD died of chronic illnesses such as cancer, cardiovascular diseases, and liver diseases.[7]

Palliative care improves quality of life for people with life-limiting illnesses through symptom management and psychosocial support.[8] National data indicate that 62%–89% of people in Canada who die can benefit from receiving palliative care,[9] but the number of people with OUD who receive palliative care at the

end of their lives is unknown. As the drug toxicity crisis continues, there is an urgent need to understand and support this population. Therefore, we sought to compare palliative care provision at the end of life between people with and without OUD.

Methods

Study setting and design

All registered Ontario residents are provided publicly funded hospital and physician services. People are provided drug insurance coverage if they are older than 65 years; live in either a long-term care home, a home for special care, or a Community Home for Opportunity; are aged 24 years or younger and do not have a private drug insurance plan; receive professional home and community care services; receive benefits from Ontario Works or Ontario Disability Support Program; or are enrolled in the Trillium Drug Program.[10]

We conducted a population-level retrospective cohort study of Ontario decedents, comparing palliative care provision for those with OUD with all other decedents.

Study population

We identified people between the ages of 18 and 104 years who died between July 1, 2015, and Dec. 31, 2021, in Ontario. We excluded people with missing or invalid data for sex or postal code, non-Ontario residents at the index date (90 d before date of death), those ineligible for public health insurance during the 3 years before the index date, and those whose date of last contact with the health care system was 5 years or more after the index date.

Exposure

We defined OUD as at least 1 emergency department visit or hospital admission associated with *International Disease Classification, 10th Revision* codes for OUD (F11.0–F11.9), or a prescription for opioid agonist treatment, within 3 years before the index date.[11,12] The definition of OUD was based on case-finding algorithms developed in British Columbia.[13,14] Appendix 1, available at www.cmaj.ca/lookup/doi/10.1503/cmaj.231419/tab-related-content, provides additional details about this definition of OUD and the results of sensitivity analyses we conducted, varying the definition.

Data sources

We used health administrative data sets linked by unique, encoded identifiers at ICES (Appendix 2, available at www.cmaj.ca/lookup/doi/10.1503/cmaj.231419/tab-related-content). The Registered Persons Database, the Ontario Marginalization Index, and the Immigration, Refugees and Citizenship Canada database were used to identify demographic, socioeconomic and immigration status, respectively. Hospital admissions, emergency department visits, mental health admissions, and prescriptions for opioid agonist treatment were identified using the Canadian Institute for Health Information's Discharge Abstract Database, National Ambulatory Care Reporting System, Ontario Mental Health Reporting System, and Narcotic Monitoring System, respectively. The Ontario Health Insurance Plan (OHIP) database, Ontario HIV Database, and Ontario Drug Benefits database were used to determine the decedents' comorbidities, substance use history, and the diagnoses associated with palliative care assessments conducted by physicians. Cause of death was determined using the Ontario Vital Statistics Deaths Registry and the Drug- and Drug/Alcohol-Related Death Database.

Cohort characteristics

We determined demographic characteristics at the index date and clinical characteristics during the 3 years before the index date, including 13 of the most common chronic conditions (Appendix 3, available at www.cmaj.ca/lookup/doi/10.1503/cmaj.231419/tab-related-content).[15–29] We used the Charlson Comorbidity Index as a composite measure of comorbidity. We also identified whether the decedents experienced serious infections associated with injection drug use (i.e., infective endocarditis, hepatitis C, and HIV),[30,31] and harms from benzodiazepine,

stimulant, and alcohol use (Appendix 4, available at www.cmaj.ca/lookup/doi/10.1503/cmaj.231419/tab-related-content).[1]

Outcomes

The primary outcome was receipt of 1 or more publicly funded palliative care services during the end-of-life period, which we defined as the last 90 days of life, when death is most predictable and palliative care is most often provided.[32] Secondary outcomes included palliative care setting, timing of initiation, and intensity. We classified setting as palliative care provided in clinics, homes (physician visits and OHIP funded non-physician home care), acute care hospitals (emergency department and inpatient units) and long-term care institutions (nursing homes and complex continuing care facilities) (Appendix 5, available at www.cmaj.ca/lookup/doi/10.1503/cmaj.231419/tab-related-content). For palliative care initiation, we looked back 365 days from time of death to identify the number of decedents who received their first palliative care service during end of life. We defined intensity as the number of days where palliative care was provided in any care setting during end of life. Among those who received palliative care, we identified the most common diagnoses associated with palliative care assessments conducted by physicians.

Statistical analysis

We matched people with OUD to those without OUD on age (± 2 yr). We used absolute standardized differences to compare baseline characteristics between age-matched exposure groups, with differences greater than 0.1 representing meaningful imbalances.[33–37] We used modified Poisson regression models to estimate the relative risk (RR) of receiving palliative care, overall and by setting, among those with OUD compared with those without OUD after matching 1:4 on age (± 2 yr).[38] We used zero-truncated negative binomial regression to calculate incidence rate ratios (IRRs) and to assess the association between OUD and palliative care intensity among those who received palliative care. We selected the following covariates based on clinical importance and adjusted for their potential confounding effects in our models: year at index date, sex, rurality, income quintile, dependency quintile, immigrant status, Charlson Comorbidity Index, presence of specific medical conditions (asthma, HIV, hepatitis C, infective endocarditis, cancer, congestive heart failure, chronic obstructive pulmonary disease [COPD], renal disease, and osteoarthritis) and history of harms from nonopioid substances (stimulants, benzodiazepines, alcohol). Using variance inflation factors, we did not identify any issues with multicollinearity between the covariates.

In a secondary analysis, we evaluated the impact of the COVID-19 pandemic by comparing the absolute and relative risks of receiving palliative care for decedents with and without OUD before the COVID-19 pandemic (July 1, 2015, to Dec. 31, 2019) and during the COVID-19 pandemic (Jan. 1, 2020, to Dec. 31, 2021).

We conducted another secondary analysis excluding decedents who had end-of-life illness trajectories associated with sudden death, identified using cause of death from the Ontario Vital Statistics — Deaths Registry (data available until December 2018) and established algorithms.[32] We defined sudden deaths as those

that progressed "from normal function to death with little fore-warning."[39] We then compared palliative care provision at the end of life between age-matched people with and without OUD. We conducted this secondary analysis because palliative care provision may not be feasible or indicated for people who die from sudden causes like opioid toxicity or injury.

Ethics approval

This study did not require ethics approval. Use of data was authorized under section 45 of Ontario's *Personal Health Information Protection Act*.

Results

During the study period, 679 840 adults died, including 11 200 (1.6%) with a history of OUD (Figure 1). Among people with OUD, 5449 (48.7%) were only prescribed opioid agonist treatment for OUD; 3227 (28.8%) had OUD-related emergency department visits or hospital admissions; and 2524 (22.5%) had both opioid agonist treatment for OUD and OUD-related hospital admissions or emergency department visits. Of the 11 200 people with OUD, we
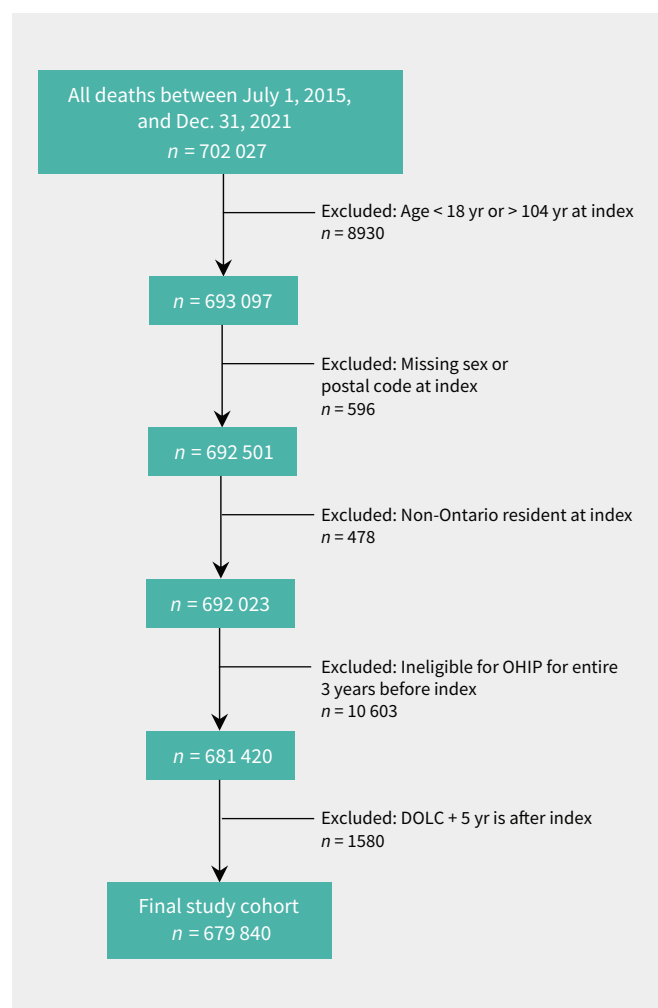
Figure 1: Study flowchart. Note: DOLC = date of last contact, OHIP = Ontario Health Insurance Plan.

matched 11 096 to at least 1 person without OUD (99.1%) on age. Of the 11 096 people with OUD, 9332 (84.1%) were matched with 4 people without OUD.

Demographics and clinical characteristics

Among all decedents, the mean age at death was 77.0 (standard deviation [SD] 15.1) years and 49% were female. People with OUD died at a much younger age than those without OUD (49.8 yr v. 77.5 yr, standardized difference 1.75). After matching for age, the baseline characteristics and medical histories of people with OUD differed from those who did not have OUD in several ways (Table 1 and Table 2); people with OUD were more likely to live in neighbourhoods with the lowest income (37.9% v. 25.2%; standardized difference 0.28), highest material deprivation (39.5% v. 27.5%, standardized difference 0.26), and highest household and dwellings marginalization (42.8% v. 29.4%, standardized difference 0.28).

People with OUD had higher prevalence of several clinical diagnoses, particularly hepatitis C (14.9% v. 1.3%, standardized difference 0.51), mood disorders (54.7% v. 33.1%, standardized difference 0.45), and other mental health disorders (39.3% v. 18.8%, standardized difference 0.47). People with OUD were also more likely to have a history of harms associated with alcohol (17.8% v. 7.6%, standardized difference 0.31) and stimulants (9.6% v. 1.3%, standardized difference 0.37). Appendix 6, available at www.cmaj. ca/lookup/doi/10.1503/cmaj.231419/tab-related-content, provides the top 10 specific causes of death for people with and without OUD.

Palliative care

We found 5063 people with OUD (45.2%) received palliative care in the last 90 days of life and, of these, 4392 (86.7%) received it in acute care hospitals (Table 3). In the age-matched cohort, and after adjustment for covariates, we found people with OUD were 16% less likely to receive palliative care than those without OUD (adjusted RR 0.84, 95% confidence interval [CI] 0.82–0.86). Specifically, people with OUD were less likely to receive palliative care in acute care hospitals (adjusted RR 0.87, 95% CI 0.85–0.89), in clinics (adjusted RR 0.68, 95% CI 0.64–0.71), at home (adjusted RR 0.62, 95% CI 0.59–0.66), and in long-term care facilities (adjusted RR 0.84, 95% CI 0.74–0.94). Palliative care intensity was 16% lower for people with OUD than those without OUD at the end of life (mean 14.3 v. 17.4 d, standardized difference 0.15; IRR 0.84, 95% CI 0.80–0.89). The most common diagnoses associated with palliative care assessments by physicians for decedents with OUD were lung cancer (8.3%), other cancers (5.3%), liver cirrhosis (3.4%), sepsis (3.4%), and pneumonia (2.7%). Appendix 7, available at www.cmaj.ca/lookup/doi/10.1503/cmaj.231419/tab-related-content, provides the top 10 diagnoses associated with palliative care assessments conducted by a physician for decedents with and without OUD.

When we looked back 1 year from death for the people who received palliative care (*n* = 489 135), we found that palliative care was started earlier for people with OUD than for those without OUD (mean 174.9 d [SD 129.1] v. 141.3 d [SD 125.4] before death, standardized difference 0.26). People with OUD were less likely to have palliative care started within the last 90 days of their lives (34.2% v. 46.4%; standardized difference 0.25) (Table 4).

Table 1 (part 1 of 2): Baseline characteristics of decedent cohort, comparing those with a history of opioid use disorder (OUD) to those without OUD

Characteristic	No. (%) of decedents*							Std Diff‡
	Total $n = 679\,840$	No OUD, total $n = 668\,640$	OUD, total $n = 11\,200$	OUD, hospital admissions or ED visits only $n = 3227$	OUD, OAT only $n = 5449$	OUD, hospital admissions or ED visits and OAT $n = 2524$	No OUD, age-matched† $n = 41\,325$	OUD, age-matched† $n = 11\,096$	
Sex									
Female	333 133 (49.0)	329 138 (49.2)	3995 (35.7)	1453 (45.0)	1666 (30.6)	876 (34.7)	16 215 (39.2)	3957 (35.7)	0.07
Male	346 707 (51.0)	339 502 (50.8)	7205 (64.3)	1774 (55.0)	3783 (69.4)	1648 (65.3)	25 110 (60.8)	7139 (64.3)	0.07
Age, yr									
18–44	25 595 (3.8)	20 978 (3.1)	4617 (41.2)	762–766§	2400 (44.0)	1451–1455§	14 917 (36.1)	4513 (41.2)	0.09
45–54	29 758 (4.4)	27 557 (4.1)	2201 (19.7)	444 (13.8)	1268 (23.3)	489 (19.4)	8656 (20.9)	2201 (19.7)	0.03
55–64	73 187 (10.8)	70 866 (10.6)	2321 (20.7)	678 (21.0)	1214 (22.3)	429 (17.0)	9369 (22.7)	2321 (20.7)	0.04
65–74	121 294 (17.8)	120 186 (18.0)	1108 (9.9)	552 (17.1)	430 (7.9)	126 (5.0)	4525 (10.9)	1108 (9.9)	0.03
75–84	173 942 (25.6)	173 365 (25.9)	577 (5.2)	442 (13.7)	111 (2.0)	24 (1.0)	2288 (5.5)	577 (5.2)	0.02
≥ 85	256 064 (37.7)	255 688 (38.2)	376 (3.4)	345–349§	26 (0.5)	1–5§	1570 (3.8)	376 (3.4)	0.02
Age, yr, mean ± SD	77.0 ± 15.1	77.5 ± 14.7	49.8 ± 16.8	59.6 ± 19.1	47.2 ± 13.9	42.9 ± 13.6	51.4 ± 16.7	50.0 ± 16.8	0.08
Income quintile									
Q1 (lowest)	157 655 (23.2)	153 422 (22.9)	4233 (37.8)	1074 (33.3)	2145 (39.4)	1014 (40.2)	10 398 (25.2)	4201 (37.9)	0.28
Q2	130 599 (19.2)	128 479 (19.2)	2120 (18.9)	593 (18.4)	1069 (19.6)	458 (18.1)	7853 (19.0)	2096 (18.9)	0.003
Q3	110 484 (16.3)	109 069 (16.3)	1415 (12.6)	414 (12.8)	646 (11.9)	355 (14.1)	6833 (16.5)	1404 (12.7)	0.11
Q4	96 892 (14.3)	95 904 (14.3)	988 (8.8)	323 (10.0)	465 (8.5)	200 (7.9)	5543 (13.4)	976 (8.8)	0.15
Q5 (highest)	90 785 (13.4)	89 899 (13.4)	886 (7.9)	282 (8.7)	416 (7.6)	188 (7.4)	5150 (12.5)	873 (7.9)	0.15
Rurality									
Rural	90 337 (13.3)	88 922 (13.3)	1415 (12.6)	502 (15.6)	659 (12.1)	254 (10.1)	5363 (13.0)	1403 (12.6)	0.01
Urban	586 415 (86.3)	576 773 (86.3)	9642 (86.1)	2686 (83.2)	4741 (87.0)	2215 (87.7)	35 777 (86.6)	9654 (86.1)	
Missing	3088 (0.5)	2945 (0.4)	143 (1.3)	39 (1.2)	49 (0.9)	55 (2.2)	185 (0.4)	143 (1.3)	0.09
Age and labour force marginalization quintile									
Missing	8667 (1.3)	8247 (1.2)	420 (3.8)	103 (3.2)	194 (3.6)	123 (4.9)	818 (2.0)	417 (3.8)	0.11
Q1 (lowest)	85 736 (12.6)	83 798 (12.5)	1938 (17.3)	480 (14.9)	972 (17.8)	486 (19.3)	8396 (20.3)	1916 (17.3)	0.08
Q2	101 996 (15.0)	99 772 (14.9)	2224 (19.9)	578 (17.9)	1105 (20.3)	541 (21.4)	7923 (19.2)	2195 (19.8)	0.02
Q3	109 042 (16.0)	107 154 (16.0)	1888 (16.9)	503 (15.6)	953 (17.5)	432 (17.1)	7307 (17.7)	1866 (16.8)	0.02
Q4	127 464 (18.7)	125 521 (18.8)	1943 (17.3)	546 (16.9)	979 (18.0)	418 (16.6)	7360 (17.8)	1931 (17.4)	0.01
Q5 (highest)	246 935 (36.3)	244 148 (36.5)	2787 (24.9)	1017 (31.5)	1246 (22.9)	524 (20.8)	9521 (23.0)	2771 (25.0)	0.05

Table 1 (part 2 of 2): Baseline characteristics of decedent cohort, comparing those with a history of opioid use disorder (OUD) to those without OUD

Characteristic	No. (%) of decedents*								Std Diff‡
	Total n = 679 840	No OUD, total n = 668 640	OUD, total n = 11 200	OUD, hospital admissions or ED visits only n = 3227	OUD, OAT only n = 5449	OUD, hospital admissions or ED visits and OAT n = 2524	No OUD, age-matched† n = 41 325	OUD, age-matched† n = 11 096	
Material resources marginalization quintile									
Missing	8667 (1.3)	8247 (1.2)	420 (3.8)	103 (3.2)	194 (3.6)	123 (4.9)	818 (2.0)	417 (3.8)	0.11
Q1 (lowest)	118 678 (17.5)	117 556 (17.6)	1122 (10.0)	374 (11.6)	508 (9.3)	240 (9.5)	6397 (15.5)	1111 (10.0)	0.16
Q2	126 149 (18.6)	124 709 (18.7)	1440 (12.9)	515 (16.0)	625 (11.5)	300 (11.9)	6888 (16.7)	1427 (12.9)	0.11
Q3	130 445 (19.2)	128 835 (19.3)	1610 (14.4)	489 (15.2)	746 (13.7)	375 (14.9)	7446 (18.0)	1591 (14.3)	0.1
Q4	137 919 (20.3)	135 735 (20.3)	2184 (19.5)	616 (19.1)	1101 (20.2)	467 (18.5)	8426 (20.4)	2165 (19.5)	0.02
Q5 (highest)	157 982 (23.2)	153 558 (23.0)	4424 (39.5)	1130 (35.0)	2275 (41.8)	1019 (40.4)	11 350 (27.5)	4385 (39.5)	0.26
Racialized and newcomer populations marginalization quintile									
Missing	8667 (1.3)	8247 (1.2)	420 (3.8)	103 (3.2)	194 (3.6)	123 (4.9)	818 (2.0)	417 (3.8)	0.11
Q1 (lowest)	151 479 (22.3)	149 330 (22.3)	2149 (19.2)	703 (21.8)	1002 (18.4)	444 (17.6)	8068 (19.5)	2130 (19.2)	0.01
Q2	145 980 (21.5)	143 657 (21.5)	2323 (20.7)	722 (22.4)	1129 (20.7)	472 (18.7)	7879 (19.1)	2301 (20.7)	0.04
Q3	128 117 (18.8)	125 797 (18.8)	2320 (20.7)	643 (19.9)	1170 (21.5)	507 (20.1)	7601 (18.4)	2298 (20.7)	0.06
Q4	121 977 (17.9)	119 781 (17.9)	2196 (19.6)	543 (16.8)	1101 (20.2)	552 (21.9)	7761 (18.8)	2174 (19.6)	0.02
Q5 (highest)	123 620 (18.2)	121 828 (18.2)	1792 (16.0)	513 (15.9)	853 (15.7)	426 (16.9)	9198 (22.3)	1776 (16.0)	0.16
Household and dwellings marginalization quintile									
Missing	8667 (1.3)	8247 (1.2)	420 (3.8)	103 (3.2)	194 (3.6)	123 (4.9)	818 (2.0)	417 (3.8)	0.11
Q1 (lowest)	79 601 (11.7)	78 848 (11.8)	753 (6.7)	224 (6.9)	363 (6.7)	166 (6.6)	5795 (14.0)	743 (6.7)	0.24
Q2	104 479 (15.4)	103 321 (15.5)	1158 (10.3)	373 (11.6)	549 (10.1)	236 (9.4)	6505 (15.7)	1147 (10.3)	0.16
Q3	125 049 (18.4)	123 504 (18.5)	1545 (13.8)	486 (15.1)	766 (14.1)	293 (11.6)	7215 (17.5)	1523 (13.7)	0.10
Q4	151 855 (22.3)	149 314 (22.3)	2541 (22.7)	757 (23.5)	1236 (22.7)	548 (21.7)	8840 (21.4)	2518 (22.7)	0.03
Q5	210 189 (30.9)	205 406 (30.7)	4783 (42.7)	1284 (39.8)	2341 (43.0)	1158 (45.9)	12 152 (29.4)	4748 (42.8)	0.28
Immigrant status									
Immigrant	49 635 (7.3)	49 264 (7.4)	371 (3.3)	114 (3.5)	187 (3.4)	70 (2.8)	4976 (12.0)	366 (3.3)	0.33
Non-immigrant and missing	630 205 (92.7)	619 376 (92.6)	10 829 (96.7)	3113 (96.5)	5262 (96.6)	2454 (97.2)	36 349 (88.0)	10 730 (96.7)	

Note: ED = emergency department, OAT = opioid agonist treatment, SD = standard deviation, Std Diff = standardized difference.
*Unless otherwise indicated.
†Decedents with OUD were matched to decedents without OUD group on age (± 2 yr).
‡Compares age-matched decedents with and without OUD.
§Ranges presented to prevent back-calculation of small cell counts (≤ 5).

Table 2 (part 1 of 2): Characteristics of decedent cohort related to comorbidities and chronic conditions, comparing those with a history of opioid use disorder (OUD) to those without OUD

Characteristic	No. (%) of decedents*								Std Diff‡
	Total n = 679 840	No OUD, total n = 668 640	OUD, total n = 11 200	OUD, hospital admissions or ED visits only n = 3227	OUD, OAT only n = 5449	OUD, hospital admissions or ED visits and OAT n = 2524	No OUD, age-matched† n = 41 325	OUD, age-matched† n = 11 096	
No. of active comorbidities									
0	53 388 (7.9)	51 807 (7.7)	1581 (14.1)	121 (3.7)	1178 (21.6)	282 (11.2)	7898 (19.1)	1553 (14.0)	0.14
1	114 010 (16.8)	111 744 (16.7)	2266 (20.2)	356 (11.0)	1383 (25.4)	527 (20.9)	10 298 (24.9)	2233 (20.1)	0.12
2	137 374 (20.2)	134 883 (20.2)	2491 (22.2)	583 (18.1)	1219 (22.4)	689 (27.3)	9417 (22.8)	2457 (22.1)	0.02
3	125 009 (18.4)	123 347 (18.4)	1662 (14.8)	520 (16.1)	704 (12.9)	438 (17.4)	5815 (14.1)	1656 (14.9)	0.02
4	97 588 (14.4)	96 420 (14.4)	1168 (10.4)	481 (14.9)	434 (8.0)	253 (10.0)	3579 (8.7)	1165 (10.5)	0.06
5	67 604 (9.9)	66 782 (10.0)	822 (7.3)	419 (13.0)	258 (4.7)	145 (5.7)	2062 (5.0)	822 (7.4)	0.1
6	42 681 (6.3)	42 150 (6.3)	531 (4.7)	294 (9.1)	146 (2.7)	91 (3.6)	1155 (2.8)	531 (4.8)	0.1
≥ 7	42 186 (6.2)	41 507 (6.2)	679 (6.1)	453 (14.0)	127 (2.3)	99 (3.9)	1101 (2.7)	679 (6.1)	0.17
Charlson Comorbidity Index									
0	68 277 (10.0)	65 974 (9.9)	2303 (20.6)	655 (20.3)	891 (16.4)	757 (30.0)	4485 (10.9)	2271 (20.5)	0.27
1	76 864 (11.3)	75 580 (11.3)	1284 (11.5)	419 (13.0)	449 (8.2)	416 (16.5)	2629 (6.4)	1278 (11.5)	0.18
≥ 2	252 507 (37.1)	249 095 (37.3)	3412 (30.5)	1713 (53.1)	993 (18.2)	706 (28.0)	13 103 (31.7)	3405 (30.7)	0.02
Mean ± SD	2.75 ± 2.34	2.76 ± 2.34	2.21 ± 2.45	2.76 ± 2.55	1.91 ± 2.32	1.76 ± 2.31	3.01 ± 2.58	2.22 ± 2.45	0.31
Median (IQR)	2 (1–4)	2 (1–4)	1 (0–3)	2 (1–4)	1 (0–3)	1 (0–3)	2 (1–6)	1 (0–3)	0.34
Chronic conditions									
Coronary artery disease	108 272 (15.9)	107 434 (16.1)	838 (7.5)	455 (14.1)	265 (4.9)	118 (4.7)	2991 (7.2)	837 (7.5)	0.01
Cancer	272 410 (40.1)	270 244 (40.4)	2166 (19.3)	984 (30.5)	883 (16.2)	299 (11.8)	14 127 (34.2)	2161 (19.5)	0.34
Chronic heart failure	144 859 (21.3)	143 613 (21.5)	1246 (11.1)	718 (22.2)	324 (5.9)	204 (8.1)	3460 (8.4)	1246 (11.2)	0.1
COPD	104 362 (15.4)	102 433 (15.3)	1929 (17.2)	867 (26.9)	694 (12.7)	368 (14.6)	3373 (8.2)	1929 (17.4)	0.28
Dementia	89 297 (13.1)	89 155 (13.3)	142 (1.3)	121–125**	16 (0.3)	1–5**	987 (2.4)	142 (1.3)	0.08
Diabetes	212 955 (31.3)	210 788 (31.5)	2167 (19.3)	1016 (31.5)	772 (14.2)	379 (15.0)	8768 (21.2)	2165 (19.5)	0.04
Hepatitis C§	5561 (0.8)	3891 (0.6)	1670 (14.9)	336 (10.4)	631 (11.6)	703 (27.9)	550 (1.3)	1658 (14.9)	0.51
HIV†	1653 (0.2)	1416 (0.2)	237 (2.1)	54 (1.7)	88 (1.6)	95 (3.8)	282 (0.7)	236 (2.1)	0.12
Infective endocarditis	1784 (0.3)	1430 (0.2)	354 (3.2)	77 (2.4)	66 (1.2)	211 (1.2)	125 (0.3)	354 (3.1)	0.22

Table 2 (part 2 of 2): Characteristics of decedent cohort related to comorbidities and chronic conditions, comparing those with a history of opioid use disorder (OUD) to those without OUD

Characteristic	Total n = 679 840	No OUD, total n = 668 640	OUD, total n = 11 200	OUD, hospital admissions or ED visits only n = 3227	OUD, OAT only n = 5449	OUD, hospital admissions or ED visits and OAT n = 2524	No OUD, age-matched† n = 41 325	OUD age-matched† n = 11 096	Std Diff‡
Mental health disorder	96 529 (14.2)	92 124 (13.8)	4405 (39.3)	1535 (47.6)	1565 (28.7)	1305 (51.7)	7752 (18.8)	4363 (39.3)	0.47
Mood disorder	162 726 (23.9)	156 599 (23.4)	6127 (54.7)	1836 (56.9)	2695 (49.5)	1596 (63.2)	13 671 (33.1)	6068 (54.7)	0.45
Renal disease	127 363 (18.7)	125 533 (18.8)	1830 (16.3)	949 (29.4)	444 (8.1)	437 (17.3)	4698 (11.4)	1824 (16.4)	0.15
Stroke	41 541 (6.1)	41 279 (6.2)	262 (2.3)	137 (4.2)	80 (1.5)	45 (1.8)	1204 (2.9)	261 (2.4)	0.04
Other harmful substance use									
Benzodiazepine	732 (0.1)	516 (0.1)	216 (1.9)	54 (1.7)	64 (1.2)	98 (3.9)	148 (0.4)	215 (1.9)	0.15
Stimulant	2115 (0.3)	1030 (0.2)	1085 (9.7)	312 (9.7)	273 (5.0)	500 (19.8)	548 (1.3)	1069 (9.6)	0.37
Alcohol	27 036 (4.0)	25 048 (3.7)	1988 (17.8)	724 (22.4)	613 (11.2)	651 (25.8)	3161 (7.6)	1970 (17.8)	0.31

Note: COPD = chronic obstructive pulmonary disease, ED = emergency department, IQR = interquartile range, OAT = opioid agonist treatment, SD = standard deviation, Std Diff = standardized difference.
*Unless otherwise indicated.
†Decedents with OUD were matched to decedents without OUD group on age (± 2 yr).
‡Compares age-matched decedents with and without OUD.
§Lookback period of 5 years before index (90 d before death).
¶Lookback for any HIV diagnosis from birth to index (90 d before death).
**Ranges presented to prevent back-calculation of small cell counts (≤ 5).

Secondary analyses

Before the COVID-19 pandemic (July 1, 2015, to Dec. 31, 2019), we identified a total of 480 368 decedents. Of these decedents, 6940 (1.4%) had OUD. Among the decedents with OUD, 3369 (48.5%) received palliative care in the last 90 days of life, whereas, among 473 428 decedents without OUD, 342 856 (72.4%) received palliative care in the last 90 days of life for an absolute difference of 23.9%. The relative risk of receiving palliative care was 0.67 (95% CI 0.65–0.68), indicating a 33% lower risk of receiving palliative care for people with OUD compared with those without OUD.

During the COVID-19 pandemic (Jan. 1, 2020, to Dec. 31, 2021), we identified a total of 199 472 decedents. Of these decedents, 4260 (2.1%) had OUD. Among the decedents with OUD, 1694 (39.8%) received palliative care in the last 90 days of life, whereas, among 195 212 decedents without OUD, 141 216 (72.3%) received palliative care in the last 90 days of life for an absolute difference of 32.6%. The relative risk of receiving palliative care was 0.55 (95% CI 0.53–0.57), indicating a 45% lower risk of receiving palliative care for people with OUD compared with those without OUD.

Between July 1, 2015, and Dec. 31, 2018, we identified 323 727 people who did not die suddenly, of whom 2732 (0.84%) had a history of OUD. With the exclusion of sudden deaths, we found that people with and without OUD had similar risk of receiving any palliative care at the end of their lives (adjusted RR 0.99, 95% CI 0.96–1.01) and of receiving palliative care in long-term care facilities (adjusted RR 0.98, 95% CI 0.83–1.15). People with OUD were, however, still less likely to receive palliative care in clinics (adjusted RR 0.79, 95% CI 0.74–0.85) and at home (adjusted RR 0.75, 95% CI 0.70–0.81). Palliative care intensity at the end of life also remained lower for people with OUD than for those without OUD (IRR 0.90, 95% CI 0.83–0.98). When we looked back 1 year from death for the people who received palliative care (n = 255 233), those with OUD had palliative care started, on average, 35.8 days earlier than those without OUD (mean 178.0 d v. 142.3 d, standardized difference 0.28). Appendix 8, available at www.cmaj.ca/lookup/doi/10.1503/cmaj.231419/tab-related-content, presents this subcohort's demographics and medical histories, including the top 10 causes of death, and models that evaluated the associations between OUD and palliative care receipt, setting, and intensity.

Interpretation

In this population-based study, we comprehensively described the characteristics of people with OUD at the end of their lives and evaluated the association between OUD and receipt of palliative care. Compared with people without OUD, we found that people with OUD died at a younger age and were more likely to have neighbourhood indices associated with high marginalization. Although palliative care was started, on average, 33.6 days earlier for people with OUD in the last year of life than those without OUD,

Table 3: Palliative care received overall and stratified by setting, and the intensity of palliative care received in the last 3 months of life, comparing those with a history of opioid use disorder (OUD) to those without OUD*

	No. (%) of decedents†						
Variable	**Total** *n* = 679 840	**No OUD, total** *n* = 668 640	**OUD, total** *n* = 11 200	**No OUD, age-matched‡** *n* = 41 325	**OUD, age-matched‡** *n* = 11 096	**Unadjusted RR for all decedents (95% CI)**	**Adjusted RR for all decedents (95% CI)**
Any palliative care received	489 135 (71.9)	484 072 (72.4)	5063 (45.2)	23 502 (56.9)	5029 (45.3)	0.80 (0.78–0.82)	0.84 (0.82–0.86)
Palliative care setting							
Home						0.51 (0.48–0.54)	0.62 (0.59–0.66)
Home care§	154 703 (22.8)	153 575 (23.0)	1128 (10.1)	9105 (22.0)	1125 (10.1)		
Home MD visits	132 425 (19.5)	131 528 (19.7)	897 (8.0)	6337 (15.3)	895 (8.1)		
Clinic	186 169 (27.4)	184 610 (27.6)	1559 (13.9)	10 174 (24.6)	1557 (14.0)	0.57 (0.54–0.60)	0.68 (0.64–0.71)
Acute care hospital	346 405 (51.0)	342 013 (51.2)	4392 (39.2)	19 032 (46.1)	4359 (39.3)	0.85 (0.83–0.88)	0.87 (0.85–0.89)
Long-term care institute	82 091 (12.1)	81 772 (12.2)	319 (2.8)	1573 (3.8)	318 (2.9)	0.75 (0.67–0.85)	0.84 (0.74–0.94)
Intensity of palliative care, d, mean ± SD	14.7 (20.0)	14.7 (20.0)	14.3 (20.7)	17.4 (21.1)	14.3 (20.8)	0.79 (0.75–0.84)	0.84 (0.80–0.89)

Note: CI = confidence interval, RR = relative risk, SD = standard deviation.
*Covariates in modified Poisson regression models were year at index, sex, rurality, income quintile, age and labour force marginalization quintile, immigrant status, Charlson Comorbidity Index, asthma, HIV, hepatitis C, infective endocarditis, cancer, congestive heart failure, chronic obstructive pulmonary disease, renal disease, osteoarthritis, and history of harms from non-opioid substances (stimulants, benzodiazepines, alcohol). Interaction terms were used to evaluate whether associations between OUD and each variable differed by cancer status.
†Unless indicated otherwise.
‡Decedents with OUD were matched to decedents without OUD group on age (± 2 yr).
§Palliative home care is publicly funded home-based palliative care services including case coordinator, nurse, personal support worker, occupational therapy, physiotherapy, and equipment. It does not include physician visits.

we found that people with OUD were 16% less likely to receive any palliative care at the end of life, after matching for age and adjusting for potentially confounding demographic and clinical variables. This finding is most likely owing to the high proportion of people with OUD who suddenly die from drug poisonings;[40] we found that people with and without OUD had similar likelihood of receiving palliative care after we excluded sudden deaths from our cohort. Regardless of cause of death, we identified that people with OUD were less likely to receive palliative care in their homes and in clinics. These findings suggest that people with OUD are likely not receiving palliative care that is meeting all their end-of-life needs, especially considering their complex health and social profiles. The COVID-19 pandemic further exacerbated inequities in palliative care between people with and without OUD.

Opioid use disorder is a life-limiting condition that results in considerable functional impairment and distress. Use of opioids from the unregulated drug supply is associated with serious medical issues that require emergent attention, which may explain why people with OUD are accessing palliative care earlier and more often in acute care hospitals. Consistent with existing evidence, our study found that the most common indications for people with OUD to receive palliative care were cancer, liver cirrhosis, sepsis, and pneumonia.[7,40–43] Although sepsis and pneumonia are acute conditions, patients with poor prognoses, comorbid life-limiting conditions, or history of multiple hospital admissions can benefit

from palliative care to assist them with symptom management and goals-of-care discussions.[44,45] We identified that people with OUD were 17%–38% less likely to receive palliative care in clinics, in their homes and in long-term care facilities. Stigma toward people who have substance use disorders can contribute to late referrals and missed opportunities to receive palliative care in the community.[46]

Our study demonstrated that the known socioeconomic inequities experienced by people living with OUD persist until the end of their lives.[13] People with OUD are more likely to experience structural vulnerability than the general population, even with publicly funded social assistance programs in Canada.[47] As in other studies, we found that people with OUD were more likely to have worse mental health and higher chronic morbidity.[7,41] All of these factors likely contributed to our findings that people with OUD died at a young age for all causes of death, not just drug toxicity.

In our analysis, we matched people with and without OUD on age and controlled for factors like income and comorbid substance use to focus on the association between OUD and palliative care. The reality, however, is that palliative care for people with OUD needs to be viewed through the lens of intersectionality rather than isolating for a particular relationship. Although most people in Canada state that they want to die at home,[48] those with OUD who have limited social supports, limited finances, and unstable housing will experience challenges with accessing palliative care in the community. If people have serious mental illness or are actively

Table 4: Timing of palliative care among all decedents who received palliative care within 365 days of death, comparing those with a history of opioid use disorder (OUD) to those without OUD

Characteristic	No. (%) of decedents*								Std Diff‡
	Total n = 521 452	No OUD, total n = 515 220	OUD, total n = 6232	OUD, hospital admissions or ED visits only n = 2370	OUD, OAT only n = 2400	OUD, hospital admissions or ED visits and OAT n = 1462	No OUD, age-matched† n = 25 353	OUD, age-matched† n = 6186	
Palliative care started within last 90 d before death	258 612 (49.6)	256 478 (49.8)	2134 (34.2)	576 (24.3)	1183 (49.3)	375 (25.6)	11 768 (46.4)	2114 (34.2)	0.25
Setting for palliative care, if started within last 90 d before death									
Acute care	169 992 (32.6)	168 097 (65.5)	1895 (88.8)	468 (81.3)	1067 (90.2)	360 (96.0)	9087 (77.2)	1876 (88.7)	0.31
Clinic	19 898 (3.8)	19 822 (7.7)	76 (3.6)	28 (4.9)	38–42§	3–7§	885 (7.5)	76 (3.6)	0.17
Home	39 191 (7.5)	39 054 (15.2)	137 (6.4)	57 (9.9)	73 (6.2)	7 (1.9)	1490 (12.7)	136 (6.4)	0.21
Long-term care	29 531 (5.7)	29 505 (11.5)	26 (1.2)	23 (4.0)	1–5§	1–5§	306 (2.6)	26 (1.2)	0.1
Setting for palliative care, if started before 91–365 d before death									
Acute care	129 839 (24.9)	126 740 (49.0)	3099 (75.6)	1259 (70.2)	874 (71.8)	966 (88.9)	7771 (57.2)	3074 (75.5)	0.39
Clinic	27 071 (5.2)	26 768 (10.3)	303 (7.4)	134 (7.5)	128 (10.5)	41 (3.8)	2093 (15.4)	303 (7.4)	0.25
Home	81 917 (15.7)	81 310 (31.4)	607 (14.8)	332 (18.5)	201 (16.5)	74 (6.8)	3320 (24.4)	607 (14.9)	0.24
Long-term care	24 013 (4.6)	23 924 (9.2)	89 (2.2)	69 (3.8)	14 (1.2)	6 (0.6)	401 (3.0)	88 (2.2)	0.05
Timing of starting palliative care (0–365 d before death), d, mean ± SD									
Overall	134.9 ± 126.1	134.4 ± 126.0	174.6 ± 129.1	201.6 ± 124.1	135.9 ± 128.1	194.3 ± 123.0	141.3 ± 125.4	174.9 ± 129.1	0.26
Acute care	188.6 ± 129.1	188.3 ± 129.1	239.6 ± 125.0	252.8 ± 118.9	212.2 ± 133.1	268.8 ± 108.8	194.1 ± 128.8	239.8 ± 124.8	0.36
Clinic	112.9 ± 116.1	112.1 ± 115.8	160.1 ± 126.1	186.9 ± 121.7	117.5 ± 120.7	187.6 ± 122.2	118.3 ± 118.1	160.3 ± 126.1	0.34
Home	151.7 ± 125.5	151.2 ± 125.3	223.2 ± 121.4	229.4 ± 119.4	210.8 ± 125.0	246.2 ± 111.7	183.7 ± 119.8	223.2 ± 121.4	0.33
Long-term care	121.1 ± 134.8	120.9 ± 134.8	221.5 ± 130.7	212.7 ± 132.8	265.3 ± 99.9	239.9 ± 153.1	150.6 ± 136.7	220.8 ± 131.0	0.52

Note: ED = emergency department, OAT = opioid agonist treatment, SD = standard deviation, Std Diff = standardized difference.
*Unless indicated otherwise. We identified a total of 521 452 decedents who received palliative care within 365 days of death.
†Decedents with OUD were matched to decedents without OUD group on age (± 2 yr).
‡Compares age-matched decedents with and without OUD.
§Ranges presented to prevent back-calculation of small cell counts (≤ 5).

using substances, their access to home care services can be limited because their homes may be deemed unsafe.[49] Further, people in the community who are focused on surviving and meeting their basic needs report that they do not prioritize advance care planning and accessing palliative care until they are admitted to acute care.[49] To help people with OUD overcome these barriers, health care providers, particularly those in acute care hospitals, should consider assessing for structural vulnerability using tools like the Structural Vulnerability Assessment Tool[50] and prioritize addressing inequities

in social determinants of health as much as symptom management. Health care providers should receive training in palliative care and addiction medicine to provide equitable end-of-life care for people with OUD and other substance use disorders.[51]

Limitations

We used Ontario health administrative databases to identify those with OUD based on previous health care use and use of opioid agonist treatment. This definition may underestimate the population at risk,

as some people with substance use disorders avoid receiving care because of barriers like stigma experienced in health care.[52] Thus, generalizability of our findings is limited to those who access health care at the end of their lives. The ICES databases do not have data about gender and have only neighbourhood-level marginalization indices rather than individual-level data about housing status, race, and income. Previous studies demonstrated that OUD is disproportionally concentrated among structurally vulnerable groups, including people living in poverty and homelessness, who often also experience racism and trauma.[49] Gender disparities also exist, with men more likely to die from opioid poisoning.[53] Given these important limitations, we are conducting a qualitative study to analyze the impact of these factors on palliative care for people with OUD.

Conclusion

We identified important differences in palliative care provided at the end of life between people with and without OUD. People with OUD were less likely to receive palliative care despite accessing palliative care earlier, which may reflect their end-of-life illness trajectories and underlying structural vulnerability that may prompt them to receive palliative care primarily in acute care. Health care providers should receive training in palliative care and addiction medicine to support people with OUD. Future work is needed to evaluate the impact of palliative care on opioid prescribing, health care use, and place of death for people with OUD, and to explore the end-of-life experiences of people with OUD and their caregivers.

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