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ORIGINAL RESEARCH

Cold-related injuries among patients experiencing homelessness in Toronto: a descriptive analysis of emergency department visits

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Abstract

Purpose Homelessness increases the risk of cold-related injuries. We examined emergency department visits for cold-related injuries in Toronto over a 4-year period, comparing visits for patients identified as homeless to visits for patients not identified as homeless.

Methods This descriptive analysis of visits to emergency departments in Toronto between July 2018 and June 2022 used linked health administrative data. We measured emergency department visits with cold-related injury diagnoses among patients experiencing homelessness and those not identified as homeless. Rates were expressed as a number of visits for cold-related injury per 100,000 visits overall. Rate ratios were used to compare rates between homeless vs. not homeless groups.

Results We identified 333 visits for cold-related injuries among patients experiencing homelessness and 1126 visits among non-homeless patients. In each of the 4 years of observation, rate ratios ranged between 13.6 and 17.6 for cold-related injuries overall, 13.7 and 17.8 for hypothermia, and 10.3 and 18.3 for frostbite. Rates per 100,000 visits in the fourth year (July 2021 to June 2022) were significantly higher than in the pre-pandemic period. Male patients had higher rates, regardless of homelessness status; female patients experiencing homelessness had higher rate ratios than male patients experiencing homelessness.

Conclusion Patients experiencing homelessness visiting the emergency department are much more likely to be seen for cold-related injuries than non-homeless patients. Additional efforts are needed to prevent cold-related exposure and consequent injury among people experiencing homelessness.

Keywords Homelessness · Cold-related injuries · Emergency department

Résumé

Objectif L'itinérance augmente le risque de blessures liées au froid. Nous avons examiné les visites aux urgences pour des blessures liées au froid à Toronto sur une période de quatre ans, en comparant les visites de patients en situation d'itinérance aux visites de patients pas en situation d'itinérance.

Méthodes Cette analyse descriptive des visites aux services d'urgence à Toronto entre juillet 2018 et juin 2022 a utilisé des données administratives de santé liées. Nous avons mesuré les visites aux services d'urgence avec un diagnostic de blessure liée au froid parmi les patients en situation d'itinérance et ceux pas en situation d'itinérance. Les taux ont été exprimés en

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nombre de visites pour les blessures liées au froid par 100 000 visites au total. Le rapport de taux ont été utilisés pour comparer les taux entre les groupes en situation d'itinérance et ceux pas en situation d'itinérance.

Résultats Nous avons identifié 333 visites pour des blessures liées au froid chez les patients en situation d'itinérance et 1126 chez les patients pas en situation d'itinérance. Au cours de chacune des quatre années d'observation, les rapports de taux variaient entre 13,6 et 17,6 pour l'ensemble des blessures liées au froid, 13,7 et 17,8 pour l'hypothermie et 10,3 et 18,3 pour les engelures. Les taux par 100 000 visites au cours de la quatrième année (de juillet 2021 à juin 2022) étaient considérablement plus élevés que pendant la période précédant la pandémie. Les patients de sexe masculin affichaient des taux plus élevés, peu importe leur statut d'itinérance; les patients de sexe féminin en situation d'itinérance affichaient des rapports de taux plus élevés que les patients de sexe masculin en situation d'itinérance.

Conclusion Les patients en situation d'itinérance qui se rendent à l'urgence sont beaucoup plus susceptibles d'être vus pour des blessures liées au froid que les autres. Des efforts supplémentaires sont nécessaires pour prévenir l'exposition au froid et les blessures qui en découlent chez les personnes en situation d'itinérance.

Mots clés L'itinéranc · Blessures liées au froid · Service des urgences

Clinician's capsule

What is known about the topic?
People experiencing homelessness are at disproportionate risk for cold-related injuries, but the rate since the COVID-19 pandemic began is unknown.

What did this study ask?
What is the rate of cold-related injury ED visits occurring among patients experiencing homelessness compared to non-homeless patients?

What did this study find?
Patients experiencing homelessness have 14 to 18 times more cold-related injuries compared to non-homeless patients; Rates increased during the pandemic.

Why does this study matter to clinicians?
Additional efforts are needed to prevent cold-related exposure and consequent injury among people experiencing homelessness.

Introduction

Emergency medicine professionals play a crucial role in addressing the healthcare needs of individuals experiencing homelessness, who have a disproportionate reliance on emergency department (ED) resources [1] and face an elevated risk of preventable injuries, particularly cold-related injuries [2–6]. In Toronto, Canada, the risk of cold-related injuries remains significant even during conditions locally considered to be mild [7, 8]. Recently, healthcare organizations have reported a concerning increase in the utilization of local EDs by individuals experiencing homelessness during the cold season [9, 10].

The COVID-19 pandemic has greatly exacerbated the potential risk for cold-related injury in this group. More individuals than ever are living in encampments or are otherwise unsheltered [11]. Furthermore, with the end of pandemic-related funding, the City of Toronto has closed many of the single-occupancy shelter hotel spaces it had created, starting in the spring of 2022 [12, 13]. While efforts are underway to increase capacity elsewhere [13, 14], there is currently an insufficient number of spaces to accommodate all those seeking shelter [12–15]. In concert, these circumstances that increase the likelihood of cold exposure may have led to an exacerbation of ED utilization for cold-related injuries by people experiencing homelessness in Toronto.

For this reason, healthcare organizations, medical professionals and housing advocates have been urging the City of Toronto to implement additional measures to protect individuals experiencing homelessness during the winter months [9, 10]. Short-term recommendations include increasing the availability and accessibility of winter-related services, such as 24-h drop-in warming centers. However, timely evidence regarding the extent and burden of cold-related injuries among people experiencing homelessness is essential to substantiate the need for additional services. We aim to fill this gap by analyzing Ontario health administrative data to measure cold-related injury visits among patients experiencing homelessness who sought care in Toronto-based EDs between July 1 2018 and June 30 2022. Additionally, we compare these rates to those of patients not identified as experiencing homelessness.

Methods

Study design and setting

We conducted this descriptive analysis in Toronto, Ontario's largest city, using health administrative data from between July 1 2018 and June 30 2022. Years were defined as July 1 to June 30 to integrate cold months into a single year. Datasets were linked using unique encoded identifiers and analyzed at ICES (formerly known as the Institute for Clinical Evaluative Sciences) [16], an independent, non-profit research institute whose legal status under Ontario's health information privacy law allows it to collect and analyze healthcare and demographic data, without explicit consent, for health system evaluation and improvement.

Population and data source

We obtained visits to all 18 Toronto-based EDs between July 1 2018 and June 30 2022 from the Canadian Institute for Health Information's (CIHI) National Ambulatory Care Reporting System (NACRS) database. No exclusions were applied.

Patients attending Toronto-based EDs were classified into two groups. The first group was patients experiencing homelessness ("patients experiencing homelessness"). This group was defined as anyone with at least one visit during the year with International Classification of Diseases, 10th Revision (ICD-10-CA) diagnosis codes Z590 ('Homelessness') or Z591 ('inadequate housing'); whose residential type was listed as 'Homeless' or 'Shelter'; or who provided a postal code that uniquely identifies a shelter (that is, the postal code does not identify other residences). These identifiers were previously validated [17] and show that identification across a year improves sensitivity without reducing specificity. The second group was patients not identified as experiencing homelessness ("non-homeless patients"), defined as anyone not identified in the first group.

We further classified groups by sex. Sex for patients with valid Ontario health insurance was derived from the ICES Registered Persons Database; for patients without Ontario health insurance, it was derived from the hospital record.

Outcomes

We ascertained cold-related injuries as any visit coded with ICD-10-CA codes T33 ('Superficial frostbite'), T34 ('Frostbite with tissue necrosis'), T35 ('Frostbite involving multiple body regions and unspecified frostbite'), or T68 ('Hypothermia') or T69 ('Other effects of reduced temperature') when combined with external code X31 ('Exposure to excessive natural cold'). Secondary outcomes of interest included frostbite (ICD-10-CA codes T33, T34 or T35) and hypothermia (ICD-10-CA T68 or T69 when combined with external code X31). We considered any diagnosis code as sufficient evidence for the outcome of interest, to avoid missing cases when injuries were not deemed the most responsible diagnosis.

Statistical analysis

We describe characteristics from the visit record, by group membership (however, some important social determinants of health such as race/ethnicity, income level, or educational background, were unavailable). We further determined counts (provided in supplement tables) and rates of each outcome per 100,000 visits, by group, year, and sex. 95% confidence intervals (CI) for rates in the supplements were calculated from the gamma distribution. We also calculated rate ratios and 95% CIs to summarize the excess burden of visits by homeless patients as compared to non-homeless patients.

Finally, we conducted a post-hoc z-score test comparing proportions to assess the significance of a change in cold-related injuries among patients experiencing homelessness between 2018/2019 and 2019/2020 and the pandemic period (2021/2022). We a priori excluded 2020/2021 from this test, as there was a significant drop in emergency department (ED) visits in Ontario during the early pandemic [18], artificially reducing the denominator and rendering this data point non-comparable to the others.

Cells with fewer than six visits were suppressed to protect patient privacy. All analyses were conducted using SAS enterprise guide v7.1 [19]. This study followed the Reporting of Studies Conducted Using Observational Routinely Collected Data (RECORD) reporting guidelines (Supplement Table 1).

Ethical review

The use of data in this project was authorized under Sect. 45 of Ontario's *Personal Health Information Protection Act*, which does not require review by a research ethics board.

Results

Between July 1 2018 and June 30 2022, we identified 4,872,279 ED visits to Toronto-based hospitals (Table 1). 90,165 (1.9%) visits were for patients experiencing homelessness, who were disproportionately 25 to 54 years old and male (73.3%). Visits by patients experiencing homelessness were twice as likely to be 15 or more hours long and more than twice as likely to have arrived by ambulance (47.7%

Table 1 Characteristics of visits, by group membership (patients experiencing homelessness vs. patients not experiencing homelessness)

	Visits from patients identified as experiencing homelessness (90,165)	Visits from patients not identified as experiencing homelessness ($N=4,782,114$)
Year of visit, %		
July 2018 to June 2019	25.3%	28.0%
July 2019 to June 2020	27.6%	25.4%
July 2020 to June 2021	23.2%	21.9%
July 2021 to June 2022	23.8%	24.7%
Age at visit		
Median (IQR)	40 (31–53)	43 (25–64)
%, 0–24 years old	10.3%	24.0%
%, 25–44 years old	49.0%	27.5%
%, 45–54 years old	18.2%	11.9%
%, 55 + years old	21.8%	36.5%
% Unknown/missing	0.8%	0.0%
Sex, %		
Male	73.3%	48.0%
Female	26.7%	52.0%
Other/missing	0.1%	0.0%
Visit duration in hours		
Median (IQR)	5 (3–10)	4 (3–7)
%, 0- < 4 h	9.6%	9.6%
%, 4- < 10 h	11.4%	10.8%
%, 10- < 15 h	2.9%	1.6%
%, 15 + hours	4.4%	2.1%
Patient arrived by ambulance, %	47.7%	20.0%
Triage level, %		
Non-urgent	4.2%	3.5%
Less-urgent	13.4%	13.8%
Urgent	48.7%	53.9%
Emergent	29.5%	27.3%
Resuscitation	3.9%	1.5%
Unknown	0.2%	0.1%
Visit for cold-related injury, %	0.37%	0.02%

vs 20.0%). Despite this, they exhibited similar CTAS triage levels. Over the 4-year period, we found 333 cold-related injury visits among patients experiencing homelessness, representing 0.37% of their visits overall, compared to 1,126 cold-related injury visits among non-homeless patients, representing 0.02% of their overall visits.

Cold-related injury rates (per 100,000 visits) among patients experiencing homelessness ranged between a low of 268.9 visits/100,000 (in 2019/2020) and a high of 483.9 visits/100,000 (in 2021/2022) (Table 2 and Supplement Table 1). By contrast, rates among non-homeless patients ranged between 15.8 and 30.0 visits/100,000. Rates among patients experiencing homelessness significantly increased ($p < 0.01$) during the pandemic period (2021/2022) from the pre-pandemic period (2018/2019 and 2019/2020). Overall, patients experiencing homelessness were between 13.6 and 17.6 times more likely to visit EDs for cold-related injuries compared to non-homeless patients (Fig. 1). While female patients experiencing homelessness had lower visit rates than male patients experiencing homelessness, they had higher rate ratios due to the more acute sex disparity present among non-homeless patients.

Supplement table 3 and Fig. 2 summarize visits with coding for hypothermia. Patients experiencing homelessness had visit rates ranging between 256.9 and 479.3 visits/100,000, while non-homeless patients had visit rates ranging between 14.7 and 28.8 visits/100,000. As with cold-related injuries generally, patients experiencing homelessness were much more likely to visit EDs for hypothermia compared to non-homeless patients.

Table 2 Rate per 100,000 visits (95% CI) of emergency department visits to Toronto-based hospitals for cold-related injury, by group, subgroup and year

	Patients experiencing homelessness, Rate per 100,000 visits (95% CI)	Patients not experiencing homelessness, Rate per 100,000 visits (95% CI)	Rate ratio (95% CI)
Overall			
2018/2019	407.0	30.0	13.6 (10.8–17.0)
2019/2020	268.9	15.8	17.0 (12.9–22.5)
2020/2021	330.0	19.8	16.7 (12.7–21.9)
2021/2022	483.9	27.5	17.6 (14.1–21.9)
Female			
2018/2019	243.4	15.2	16.0 (9.2–30.0)
2019/2020	153.7	9.5	16.2 (8.3–31.6)
2020/2021	264.3	10.9	24.2 (13.8–42.7)
2021/2022	375.6	19.2	19.6 (12.5–30.6)
Male			
2018/2019	462.4	46.3	10.0 (7.8–12.8)
2019/2020	310.0	22.5	13.8 (10.1–18.8)
2020/2021	354.6	29.4	12.1 (8.8–16.5)
2021/2022	527.7	36.5	14.4 (11.2–18.7)

[1]Years grouped from July 1st to June 30th the following year to group together winter seasons. CI = Confidence Interval. *95% confidence interval calculated from the gamma distribution. Source: Golding H, and Saskin R. Cold-related injuries among people experiencing homelessness visiting Toronto-area hospitals, Applied Health Research Questions (AHRQ) #0950 144 000. Toronto: Institute for Clinical Evaluative Sciences; 2023

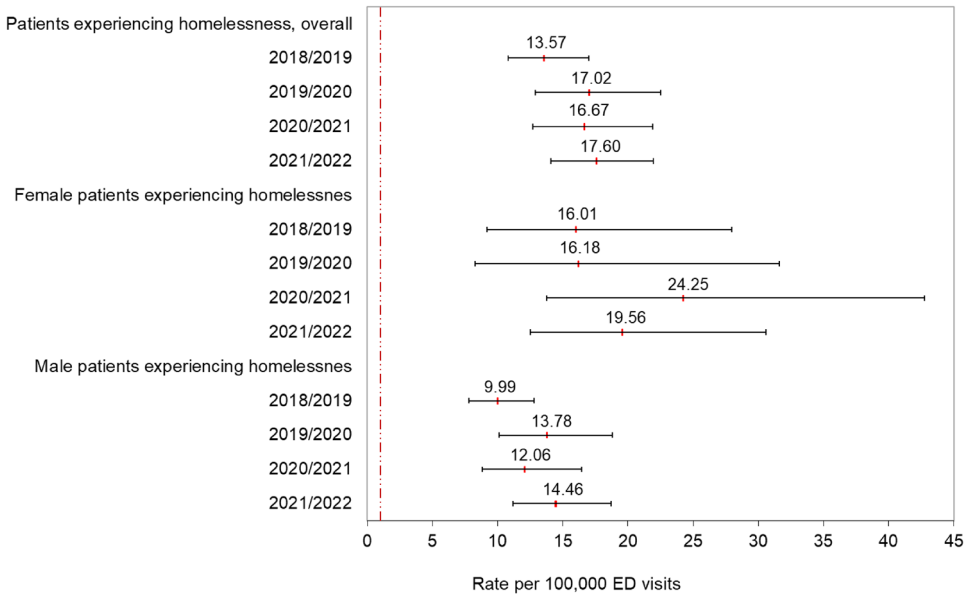

Fig. 1 Rate ratio[1] of cold-related injury visits among patients experiencing homelessness compared to patients not experiencing homelessness, overall and among male or female subgroups, by year. [1]Rate ratio is the rate (per 100,000 visits) of cold-related injury visits by people experiencing homelessness divided by the rate (per 100,000 visits) of cold-related injury visits by people not experiencing homelessness. The vertical axis (1.0) represents the point of parity between groups. Source: Golding H, and Saskin R. Cold-related injuries among people experiencing homelessness visiting Toronto-area hospitals, Applied Health Research Questions (AHRQ) #0950 144 000. Toronto: Institute for Clinical Evaluative Sciences; 2023

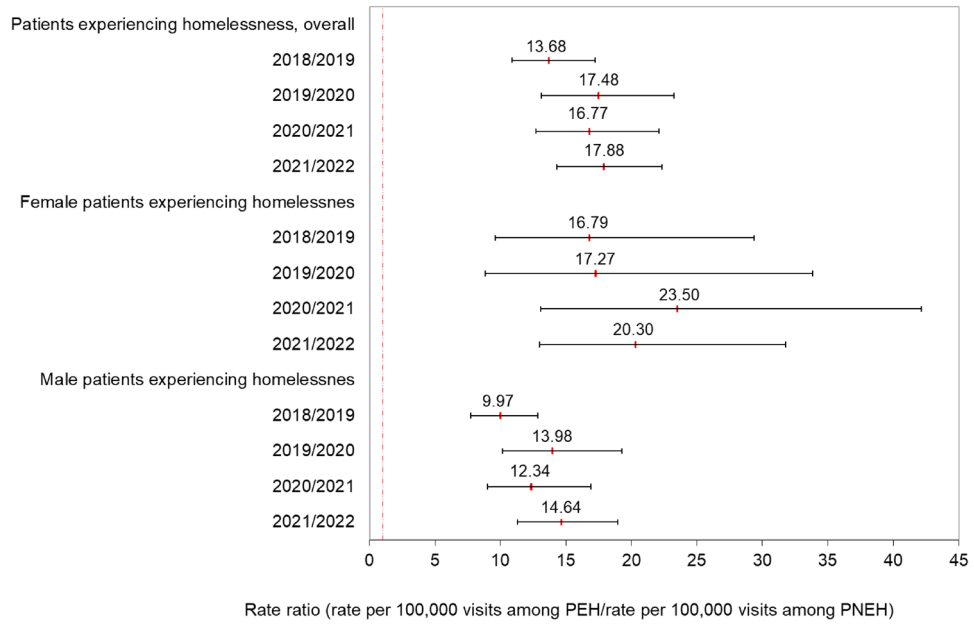

Fig. 2 Rate ratio[1] of hypothermia-related visits among patients experiencing homelessness compared to patients not experiencing homelessness, overall and among male or female subgroups, by year. [1]Rate ratio is the rate (per 100,000 visits) of hypothermia-related visits by people experiencing homelessness divided by the rate (per 100,000 visits) of hypothermia-related visits by people not experiencing homelessness. The vertical axis (1.0) represents the point of parity between groups. Source: Golding H, and Saskin R. Cold-related injuries among people experiencing homelessness visiting Toronto-area hospitals, Applied Health Research Questions (AHRQ) #0950 144 000. Toronto: Institute for Clinical Evaluative Sciences; 2023

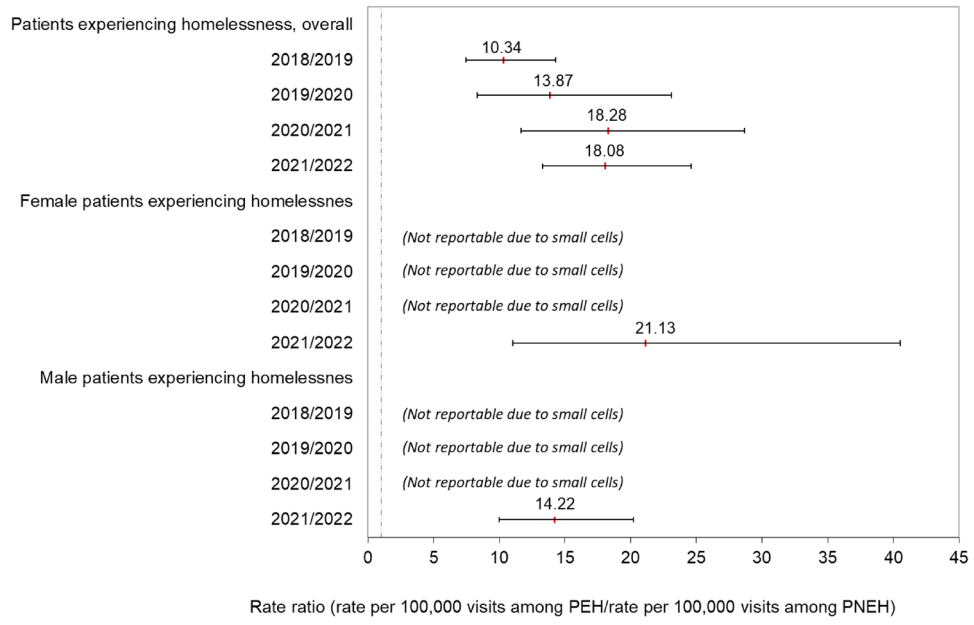

Fig. 3 Rate ratio[1] of frostbite-related visits among patients experiencing homelessness compared to patients not experiencing homelessness, by year, overall and among male or female subgroups. [1]Rate ratio is the rate (per 100,000 visits) of frostbite-related visits by people experiencing homelessness divided by the rate (per 100,000 visits) of frostbite-related visits by people not experiencing homelessness. The vertical axis (1.0) represents the point of parity between groups. Source: Golding H, and Saskin R. Cold-related injuries among people experiencing homelessness visiting Toronto-area hospitals, Applied Health Research Questions (AHRQ) #0950 144 000. Toronto: Institute for Clinical Evaluative Sciences; 2023

Supplement table 4 and Fig. 3 summarize visits coded for frostbite. Fewer patients had visits coded with frostbite than for hypothermia; however, trends between groups persisted. Visit rates for patients experiencing homelessness ranged between 76.3 and 251.3 visits/100,000, compared to 5.5 and 18.2 visits/100,000 among non-homeless patients. Patients experiencing homelessness were between 10.3 and 18.3 times more likely to visit the ED for frostbite compared to non-homeless patients. In the final year (2021/2022), female patients experiencing homelessness were over 21 times more likely to receive care for frostbite compared to female non-homeless patients; Male patients experiencing homelessness were 14.2 times more likely to receive care for frostbite compared to male non-homeless patients.

Discussion

Interpretation

We found that ED visits for cold-related injuries were significantly higher (between 13.6 and 17.6 times higher) among patients experiencing homelessness than non-homeless patients between 2018 and 2022. Our findings suggest that homelessness is a major risk factor for this outcome, both due to the higher prevalence of underlying conditions exacerbating risk (for example, substance use or mental health concerns) and far greater exposure to environmental cold stress. We also found that male patients experiencing homelessness had higher visit rates, but that female patients experiencing homelessness have consistently higher rate ratios, indicating that inequity in the risk for females to be particularly acute. Finally, we found that rates increased in the final year of observation compared to the pre-pandemic period. This might have been due to the lower number of ED visits overall, as patients continued to be relatively avoidant of hospitals due to the perceived risk of COVID-19 infection [18]. It is also possible that 2021/2022 winter had particularly severe winter weather, although summary data does not suggest this to be likely [20]. Finally, recent changes to social and policy conditions in Toronto may have made avoiding cold-exposure increasingly challenging for people experiencing homelessness. Many indoor spaces, like 24-h drop-ins and Out Of The Cold programs, were shut down in response to pandemic-related safety guidelines [21]; distancing between shelter beds increased, which reduced shelter capacity until shelter hotels were leased [13]; and, numerous individuals resided in encampments as they felt unsafe in shelters and shelter hotels [11].

Previous studies

These results extend previous work showing disparities in Toronto existing in prior decades [1, 7], as well as elsewhere [3–6]. In France, 61.7% of medical charts with a primary diagnosis of hypothermia were for individuals experiencing homelessness [3], with 6.4 times risk of death from this injury [6]. In New York, three times more individuals experiencing homelessness were hospitalized for cold-related injury than housed comparators [4]. In Northeastern Poland, deaths caused by hypothermia were thirteen times more frequent among people experiencing homelessness than housed counterparts [5]. In Toronto between 2005 and 2009, there was on average 4.8 cold-related injury visits per 1000 person-years of observation [2]. Our results are not directly comparable to this literature, as our study denominator was ED visits by patients experiencing homelessness (rather than a cohort of participants experiencing homelessness who may not have used hospital-based care, or individuals who died). However, our annual rates expressed per 1000 visits (ranging between 2.7 per 1000 visits in 2019/2020 and 4.8 in 2021/2022) is in the same range as prior work in Toronto [2].

Strengths and limitations

This study benefits from the use of NACRS, which provides standardized ED abstracts across Toronto over the observation period. The use of administrative data to identify homelessness also dramatically increased our sample as compared to studies leveraging primary research data and prevented issues with participation bias common in studies involving people experiencing homelessness.

We also note the following limitations. First, our case definition of homelessness is highly specific but relatively insensitive [17]. Although we restricted our analysis to the period during which coding for homelessness became mandatory [17], it is possible the case definition undercounted visits where homelessness was not documented in the chart. Consequently, our results may underestimate cold-related injuries among patients experiencing homelessness and overestimate them among patients not experiencing homelessness.

Second, this analysis only considered ED care related to cold-related injuries. Every winter, an estimated 15% of ED visits by individuals experiencing homelessness in Toronto are for seeking warmth, and occur due to a lack of alternatives such as shelters and warming centres [22, 23]. As a result, the true level of ED usage for cold exposure by people experiencing homelessness is likely much higher than our analysis indicates.

Third, our results are limited to individuals receiving healthcare at emergency departments and is reflected in our

rate being per 100,000 visits as opposed to rates per 1000 person-years of observation. People experiencing homelessness are disproportionately likely to avoid hospital-based care due to previous stigmatizing experiences and other factors [24]. Thus, any injuries that might have been treated in outpatient clinic settings were missed. This is unlikely to have affected our measured rates and rate ratios; nevertheless, results should only be generalized to homeless patients who use hospital-based healthcare.

Finally, our finding that ED visits significantly increased during the pandemic is based on a post-hoc test that does not account for the large confidence intervals in our measured rates; therefore, this finding should be interpreted with caution until future work can substantiate the result.

Clinical implications

The disproportionate burden of cold-related injuries among people experiencing homelessness is an equity issue of significant relevance for emergency medicine. If we treat the rate of cold-related injuries among non-homeless patients as a baseline level, excess visits for people experiencing homelessness represent avoidable morbidity and strain on emergency departments. To mitigate the risk of recurring morbidity, particularly in cases of frostbite, clinicians treating these injuries must attempt to ensure continuity of services in the community prior to discharge. Yet, this presents a major challenge due to ED surge pressures and the severe, consistent shortage of shelter space to which to discharge patients. Ultimately, individuals experiencing homelessness and the emergency departments that treat them both bear the consequences of policy decisions that fail to prioritize the provision of sufficient, accessible emergency shelter services within the community, such as an adequate number of shelter beds and drop-in warming services. Addressing these issues is vital for the welfare of those experiencing homelessness and the effectiveness of emergency medical care.

Research implications

The use of emergency departments by people experiencing homelessness for avoiding cold exposure is a greatly underexplored topic given its relevance in the pandemic era in Canada. We show that cold-related injuries, acute clinical manifestations of cold-exposure, are vastly overrepresented among patients experiencing homelessness, with female patients bearing the worst inequities. To gain a comprehensive understanding of the impact of homelessness on the preventable use of ED resources, future studies should endeavor to estimate the overall and gender-specific ED usage related to all cold exposure. These studies should also estimate the economic costs associated with excess ED utilization for cold exposure; this measurement would enable meaningful comparisons between the cost of avoidable healthcare for cold exposure and the cost of providing sufficient community-based services providing emergency shelter.

Conclusions

Cold-related injuries related to cold exposure are largely preventable. People experiencing homelessness in Toronto remain at much higher risk for such injuries compared to their housed counterparts, including after the onset of the COVID-19 pandemic. The findings of this study strongly suggest the need to provide additional alternative services such as shelter beds for all individuals experiencing homelessness seeking shelter and 24-h, accessible and low-barrier warming centres throughout the cold season.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s43678-023-00546-7.

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Data availability The dataset from this study is held securely in coded form at ICES. While legal data sharing agreements between ICES and data providers (e.g., healthcare organizations and government) prohibit ICES from making the dataset publicly available, access may be granted to those who meet pre-specified criteria for confidential access, available at www.ices.on.ca/DAS (email: das@ices.on.ca). The full dataset creation plan and underlying analytic code are available from the authors upon request, understanding that the computer programs may rely upon coding templates or macros that are unique to ICES and are therefore either inaccessible or may require modification.

Declarations

Conflict of interest The study authors declare no competing interests.

References

1. Vohra N, Paudyal V, Price MJ. Homelessness and the use of emergency department as a source of healthcare: a systematic review. Int J Emerg Med. 2022;15(1):1–22. https://doi.org/10.1186/s12245-022-00435-3.
2. Zhang P, Bassil B, Gower S, et al. Cold-related injuries in a cohort of homeless adults. J Soc Distress Homeless. 2019;28(1):85–9. https://doi.org/10.1080/10530789.2018.1523103.
3. Rouquette A, Mandereau-Bruno L, Baffert E, et al. Winter surveillance of cold exposure effects on health among the homeless

population in the Paris area: data from the coordinated health surveillance of emergency department network (organisation de la surveillance coordonnée des urgences [Oscour(®)]). Revue d'Épidémiologie et de Santé Publique. 2011;59(6):359–68.
4. Frencher SK, Benedicto CMB, Kendig TD, et al. A comparative analysis of serious injury and illness among homeless and housed low income residents of New York City. J Trauma Acute Care Surg. 2010;69(4):S191–9. https://doi.org/10.1097/TA.0b013e3181f1d31e.
5. Romaszko J, Cymes I, Draganska E, et al. Mortality among the homeless : causes and meteorological relationships. PLoS ONE. 2017;12(12):e0189938. https://doi.org/10.1371/journal.pone.0189938.
6. Vuillermoz C, Aouba A, Grout L, et al. Mortality among homeless people in France, 2008–10. Eur J Pub Health. 2016;26(6):1028–33. https://doi.org/10.1093/eurpub/ckw083.
7. Zhang P, Wiens K, Wang R, et al. Cold weather conditions and risk of hypothermia among people experiencing homelessness: implications for prevention strategies. Int J Environ Res Pub Health. 2019;16:3259. https://doi.org/10.3390/ijerph16183259.
8. City of Toronto. Extreme Cold Weather. 2023 [cited 2023 Feb 28]. Available from: https://www.toronto.ca/community-people/health-wellness-care/health-programs-advice/extreme-cold-weather/.
9. Unity Health Toronto. A statement from Unity Health Toronto on winter, homelessness and the care we all deserve. 2023 [cited 2023 Feb 28]. Available from: https://unityhealth.to/2023/01/statement-on-homelessness/.
10. Zaheer J., Snider C., von Vopelius-Feldt J., et al. [Letter to Mayor John Tory and Toronto City Council encouraging them to vote in favour of the motion allocating funds for expanding the number of 24-hour, accessible and low-barrier warming centres during winter months]. Retrieved from CAMH. 2023 [cited 2023 Feb 28]; Available from: https://www.camh.ca/-/media/files/pdfs---public-policy-submissions/eds-letter-to-mayor-and-councillors---final2-pdf.pdf.
11. Inner City Health Associates. Statement by Inner City Health Associates: Toronto Homeless Encampments and the Right to Housing. 2021 [cited 2023 Feb 28]. Available from: https://www.icha-toronto.ca/statement-by-inner-city-health-associates-toronto-homeless-encampments-and-the-right-to-housing.
12. Hayes M. Winter closing of Toronto shelter hotel presents impossible decision for residents. 2022 [cited 2023 Feb 28]. Globe and Mail. Available from: https://www.theglobeandmail.com/canada/article-winter-closing-of-toronto-shelter-hotel-will-be-a-big-change-for/.
13. City of Toronto. Temporary Shelter Transition & Relocation Plan. 2022 [cited 2023 Feb 28]. Available from: https://www.toronto.ca/community-people/community-partners/emergency-shelter-operators/about-torontos-shelter-system/new-shelter-locations/temporary-covid-19-shelter-sites/shelter-transition-relocation-plan/.
14. City of Toronto. City of Toronto's 2022/23 Winter Services Plan for people experiencing homelessness. 2022 [cited 2023 Feb 28]. Available from: https://www.toronto.ca/news/city-of-torontos-2022-23-winter-services-plan-for-people-experiencing-homelessness/.
15. City of Toronto. 2023 Operating Budget & 2023–2032 Capital Budget & Plan: Shelter, Support and Housing Administration. 2023 [cited 2023 Feb 28]. Available from: https://www.toronto.ca/legdocs/mmis/2023/bu/bgrd/backgroundfile-230766.pdf.
16. ICES Ontario. www.ices.on.ca/About-ICES.
17. Richard L, Hwang SW, Forchuk C, et al. Validation study of health administrative data algorithms to identify individuals experiencing homelessness and estimate population prevalence of homelessness in Ontario, Canada. BMJ Open. 2019;9(10):e030221. https://doi.org/10.1136/bmjopen-2019-030221.
18. Canadian Institute for Health Information. COVID-19's impact on emergency departments [story]. 2021 [cited 2023 Feb 28]. Available online: https://www.cihi.ca/en/covid-19-resources/impact-of-covid-19-on-canadas-health-care-systems/emergency-departments.
19. SAS Institute Inc., SAS Enterprise Guide, v7.1. Cary, NC
20. Toronto Weather Statistics Dashboard. Toronto Historical Number of Days with a Temperature < 0°C. [cited 2023 May 3]. Available from: https://toronto.weatherstats.ca/metrics/count_temp_0.html.
21. Lavoie, J. Toronto's homeless community shares stories of struggles experienced during COVID-19 pandemic. CTV News Toronto. 2022 [cited 2023 Feb 28]. Available online: https://toronto.ctvnews.ca/toronto-s-homeless-community-shares-stories-of-struggles-experienced-during-covid-19-pandemic-1.6147721.
22. Gibson, V. On the front lines of the homelessness crisis, a downtown ER tries a novel new approach. Toronto Star. 2023 [cited 2023 Mar 21]. Available online: https://www.thestar.com/news/gta/2023/01/30/on-the-front-lines-of-the-homelessness-crisis-a-downtown-er-tries-a-novel-new-approach.html.
23. Rider D, Hasham A. Open warming centres 24–7, Toronto board of health urges. Toronto Star. 2023 [cited 2023 Feb 28]. Available online: https://www.thestar.com/news/city_hall/2023/01/16/open-warming-centres-24-7-toronto-board-of-health-urges-calling-lack-of-cold-weather-services-a-crisis.html?rf.
24. Reilly J, Ho I, Williamson A. A systematic review of the effect of stigma on the health of people experiencing homelessness. Health Soc Care Community. 2022;30(6):2128–41. https://doi.org/10.1111/hsc.13884.