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by Stephenson Strobel, Ivana Burcul, Jia Hong Dai, Zechen Ma, Shaila Jamani, and Rahat Hossain

Release date: January 20, 2021



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**DOI:** <https://www.doi.org/10.25318/82-003-x202100100002-eng>

## ABSTRACT

### Background

Data on people experiencing homelessness often come from time- and labour-intensive cross-sectional counts and surveys from selected samples. This study uses comprehensive administrative health data from emergency department (ED) visits to enumerate people experiencing homelessness and characterize demographic and geographic trends in the province of Ontario, Canada, from 2010 to 2017.

### Data and methods

People experiencing homelessness were identified by their postal code, designated as "XX." Outcomes included the number of people experiencing homelessness stratified by year and week, gender and age plotted annually, the location of each ED visit, and composition changes in demographics and geographic distribution.

### Results

Over seven years, 39,408 individuals were identified as experiencing homelessness. The number of ED visits increased over the study period in all of Ontario. The average peak in the number of visits occurred annually in September, with the fewest visits in January. Rises in overall homelessness were secondary to increases in working-age homelessness. ED presentations were concentrated in urban centres. The total proportion of patients experiencing homelessness became less concentrated in Toronto, decreasing from 60% to 40% over the study period, with a shift toward EDs outside the city.

### Interpretation

This study shows that administrative health data can provide comprehensive information on demographics and other characteristics analyzed over time. Surveillance can be conducted cost-effectively, and changes can be tracked in real time to allow for services to be coordinated and implemented in a time-sensitive manner.

### Keywords

Homelessness, demography, administrative data, emergency department

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### ***What is already known on this subject?***

- Enumeration of people experiencing homelessness varies methodologically, with the use of survey studies, Point-in-Time Counts and—very recently—the novel use of administrative health data.
- Current “gold standard” surveillance methods introduce the risk of biased estimates from convenience sampling and have limitations such as surveying only specific communities or surveying people only on specific dates.
- Accurate estimates of the number of people experiencing homelessness and their demographic and geographic characteristics are not currently available for planning and policy purposes in Ontario, Canada.

### ***What does this study add?***

- An analysis of province-wide administrative health data from emergency department visits produces an estimate of 39,408 people experiencing homelessness from 2010 to 2017 in Ontario.
- The number of people experiencing homelessness who visited emergency departments increased significantly from 2014 to 2017, with the maximum number of individuals presenting in September each year.
- People younger than 40 have become the predominant demographic among those experiencing homelessness. The proportion of this population in Toronto, Ontario, has also decreased from 60% to 40% and moved toward Local Health Integration Networks in other areas of the province.

Homelessness is a widespread social concern in Canada and many other developed countries. More than 235,000 people in Canada experience homelessness in any given year, and 25,000 to 35,000 people may be experiencing homelessness on any given night.<sup>1,2</sup> Homelessness can encompass a range of circumstances, including living on the streets or in places not meant for habitation; staying in overnight or emergency shelters; living temporarily as a “hidden” homeless person with friends, family or strangers, or in motels, hostels or rooming houses; and residing in precarious or inadequate housing.<sup>3</sup> Understanding the composition of this population, whether homelessness is increasing, and where homelessness is a problem is important for planning and policy. However, there are numerous challenges in performing a census of people experiencing homelessness, and these can generate doubts about the quality of actionable information.

The current “gold standard” enumeration method is Point-in-Time (PiT) Counts, which identify the number of people experiencing homelessness on a single night once every two years.<sup>2</sup> PiT Counts occur within designated communities and are consequently geographically limited to specific municipalities or regions. As a result, PiT Counts may miss a proportion of people experiencing homelessness because of seasonal variations and migration between communities. PiT Counts also require significant resources, relying on volunteers to observe people on the street and to administer surveys. Research studies using surveys can supplement PiT Counts but have similar issues, often targeting specific shelters or community organizations.<sup>1,2,4-6</sup> These samples may produce biased estimates of how many people are experiencing homelessness by using subpopulations of convenience such as

those residing in shelters. This presents a limitation for generalizability. Despite the importance of collecting data on this marginalized population, the currently available data may not be comprehensive, timely or fully accurate.

Resources to combat homelessness should be allocated based on good data to maximize the impact of scarce resources. Moreover, policy needs to be nimble and responsive to changes in the patterns of homelessness. When data are collected sporadically and are not representative, making appropriate decisions for programs and services is extremely difficult. As medical care is universal in Canada and the emergency department (ED) is a main point of contact for people experiencing homelessness,<sup>7-9</sup> one solution may be to use data on all patient visits to the ED to better track this population.

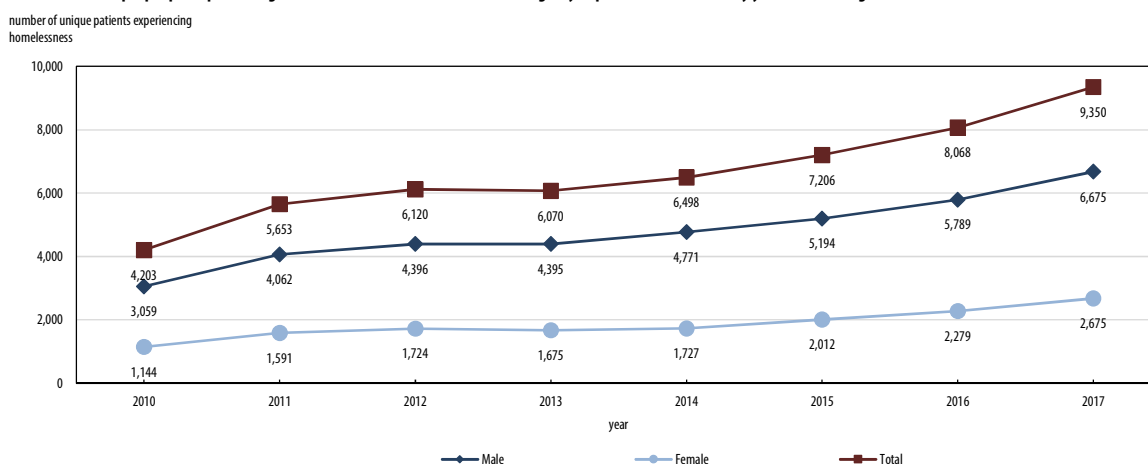
This study leverages comprehensive administrative health data from ED visits by people experiencing homelessness to better enumerate and characterize this population in the province of Ontario, Canada, from 2010 to 2017. This study illustrates several trends in the demographic information and geographic distribution of these patients and aims to demonstrate that surveillance in this manner may provide rapid, inexpensive and relatively granular information to policy makers and health care providers for planning purposes.

## **Methods**

### **Study design and setting**

This serial cross-sectional study examines administrative health data from the population of people experiencing homelessness

**Figure 1**  
Time series of unique people experiencing homelessness based on visits to all emergency departments in Ontario by year of visit and gender



Source: National Ambulatory Care Reporting System for Ontario from 2010 to 2017.

in Ontario who visited an ED from 2010 to 2017. It uses routinely collected administrative health data housed at ICES ([www.ices.on.ca](http://www.ices.on.ca)), an independent, non-profit research institute funded by the Ontario Ministry of Health and Long-Term Care. Ontario’s *Personal Health Information Protection Act* authorizes ICES to collect personal health information, without consent, for the purpose of analysis or for compiling statistical information with respect to managing and planning for the Ontario health system. The main data sources are the Ontario Health Insurance Plan Registered Persons Database, which captures information such as demographics and place of residence for all Ontarians covered by provincial health insurance, and the Canadian Institute for Health Information’s (CIHI) National Ambulatory Care Reporting System (NACRS), which captures demographic and other information about all ED visits in Ontario. These datasets were linked using unique encoded identifiers and then analyzed at the individual patient-visit level. The study population was created by ICES analysts prior to analysis by the investigators.

**Participants**

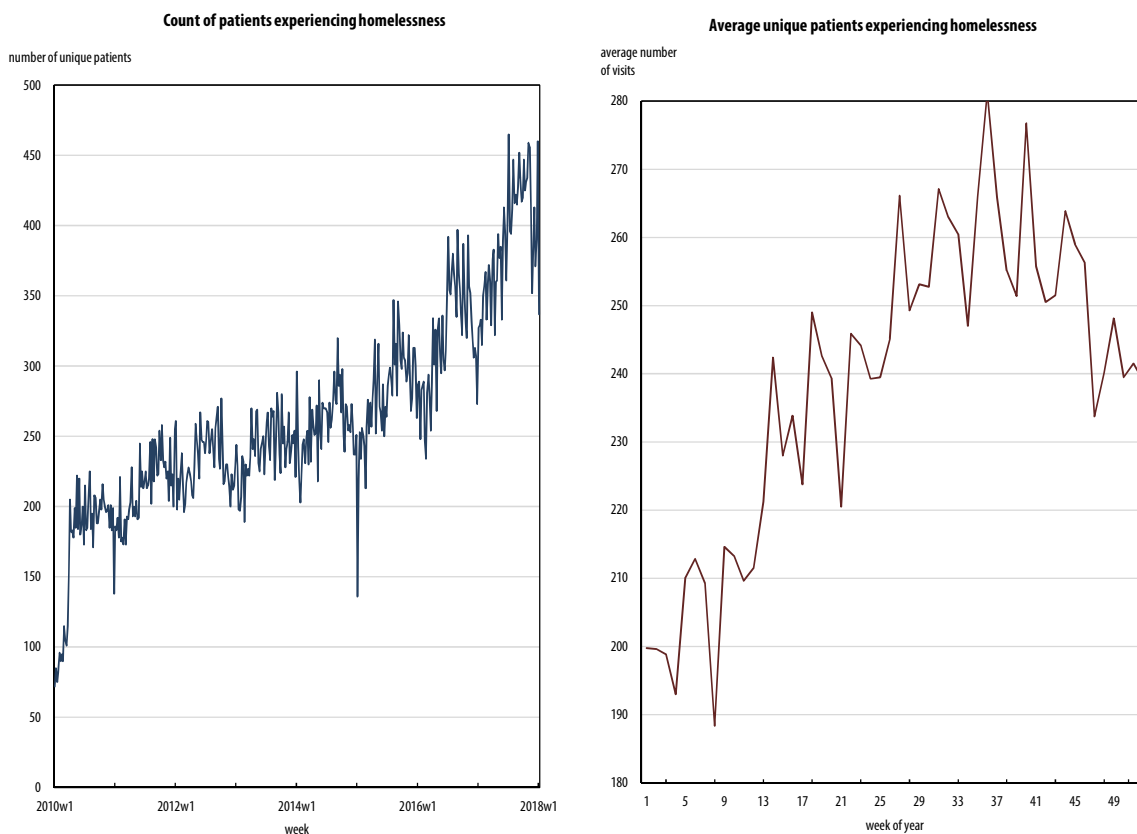
The study population consisted of all ED contacts by people experiencing homelessness within the study period in the province of Ontario. All patients in Ontario who were unable to provide a valid residential address for at least one visit to the ED from 2010 to 2017 were included. Registration personnel assign these individuals a postal code of “XX” at the time of registration in the ED instead of a valid six-character postal code.<sup>10</sup> The XX entry signifies that no fixed address was provided, and it functions as a classification for those who are experiencing homelessness in the NACRS database. Only individuals with an XX identifier at the time of the ED visit were classified as experiencing homelessness; individuals with any postal code, including those of homeless shelters or other

institutions, were not classified as experiencing homelessness. When registration personnel indicate the residence type (i.e., residential status at the time of the visit), there is also a code for “homeless” (i.e., a value of 3) and a separate value for those residing in a shelter (i.e., 4). A postal code of XX requires a residence type code of 3 and vice versa; otherwise, an error will be indicated to the coder.<sup>10</sup> Consequently, those classified as residing in a shelter are not classified as homeless. However, optimized sensitivity, specificity and positive predictive value to identify an episode of homelessness have been found using any CIHI database housing status indicator, including the NACRS database.<sup>11</sup> These indicators demonstrate low sensitivity but excellent specificity and positive likelihood ratios for identifying individuals experiencing homelessness.<sup>11</sup> The XX postal code was not recorded in NACRS prior to 2009, and this limits analysis to the most recent seven years, representing a complete dataset.<sup>12</sup> These data include all visits by people who experienced homelessness at any point during the study period, even if they subsequently or previously provided a valid address. Full data are available only for patients presenting with a valid Ontario health card.

**Outcomes and analysis**

The primary outcome is the number of people identified as experiencing homelessness who visited an ED in Ontario stratified by year and by week from 2010 to 2017. This is used to produce an estimate of the population of people experiencing homelessness in Ontario in a given week or year. When a person presents with at least one visit with an XX postal code during a week or year, they are classified as a unique person

**Figure 2**  
Weekly number of visits to emergency departments and average number of visits by week of the year in Ontario



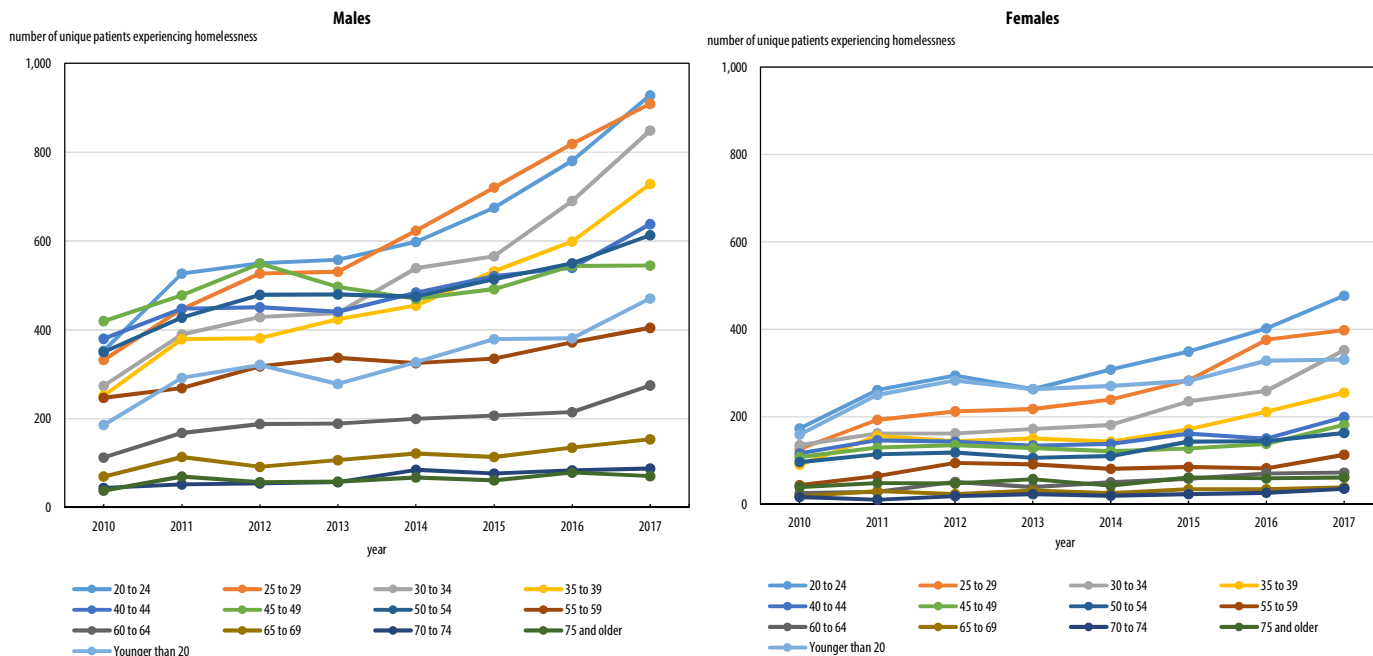
Source: National Ambulatory Care Reporting System for Ontario from 2010 to 2017.

experiencing homelessness during that period. When a person who previously presented with an XX postal code later presents with a valid postal code during a given time period, they are not identified and counted as experiencing homelessness during that period. For example, a person with at least one XX postal code occurrence in 2015 but a valid postal code in 2016 would be counted as a unique person experiencing homelessness in 2015 but not in 2016. A person presenting with at least one XX postal code occurrence in week 15 of 2015 but a valid postal code in week 16 of 2015 would be counted as a unique person experiencing homelessness in the former period but not in the latter. This definition of the study population contrasts with outcomes such as the total number of visits to EDs by people experiencing homelessness or the total number of visits by people who have been homeless at any point during a given study period. These are not examined in the current paper.

Beyond an enumeration of the overall population of people experiencing homelessness, it may also be important for planners to understand more about specific demographic groups and direct policy toward them. For example, surges in the number of young individuals experiencing homelessness may reflect poor income supports for this population and suggest areas for policy intervention; similarly, increases in the population experiencing homelessness in certain geographic

areas may be important for efficiently targeting resources such as shelter beds. This paper examines additional outcomes, including the gender and age categories of the population experiencing homelessness, which are plotted annually over the study period to assess longitudinal trends. Gender outcomes are categorized as male or female. Age outcomes are binned in five-year blocks and truncated to all visits by people younger than 20 and older than 75. Geographic information on this population is also ascertained using the location of each ED visit analyzed at the level of the Local Health Integration Network (LHIN). LHINs are the health authorities responsible for administering public health services in Ontario. They include Erie St. Clair, Waterloo Wellington, Central West, Toronto Central, Central East, Champlain, North East, South West, Hamilton Niagara Haldimand Brant, Mississauga Halton, Central, South East, North Simcoe Muskoka and North West. Changes in the age and gender composition of the study population, as well as shifts in the distribution of the population across the LHINs, are examined from 2010 to 2017. As these are population-based metrics, confidence intervals are not required because sampling error is absent.

**Figure 3**  
Time series of number of unique people experiencing homelessness by year and by age group



Source: National Ambulatory Care Reporting System for Ontario from 2010 to 2017.

**Ethics approval**

This study was submitted for ethics approval to the Hamilton Integrated Research Ethics Board (HiREB #7450-C). HiREB deemed the study exempt from review based on the regulation and oversight of data held by ICES and on the basis that the study does not require access to locally held data or participant contact.

**Results**

From 2010 to 2017, 39,408 unique individuals were identified as experiencing homelessness. The annual number of patients experiencing homelessness who presented to an ED in Ontario was relatively flat from 2011 to 2014. After 2014, the number of unique patients visiting the ED increased until the last year of observation in 2017, during which 9,350 unique people experiencing homelessness visited an ED in Ontario (Figure 1).

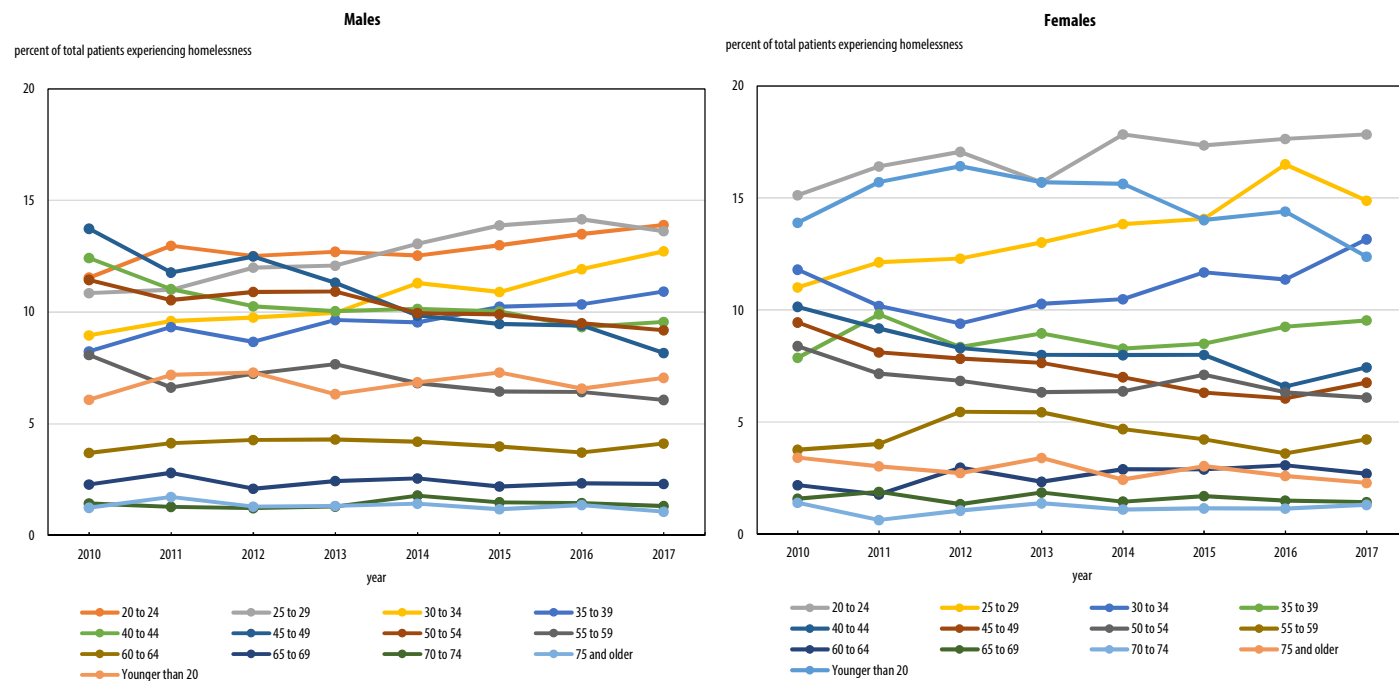
The demand for ED visits by this population fluctuated considerably throughout a given year. Weekly visits by unique patients experiencing homelessness exhibit cyclicity corresponding to the seasons of the year. The average peak in the number of visits occurred in September, with over 280 unique patients per week. The minimum number of visits occurred in January, with 200 visits per week (Figure 2).

The rise in the number of unique patients experiencing homelessness was not uniform but rather was concentrated in

specific age cohorts. This is most prominent in cohorts of working-age individuals younger than 40 (Figure 3), with an inverse correspondence between age and increase in homelessness. Homelessness among men became a much younger phenomenon through the period of observation, and especially after 2014. The modal person experiencing homelessness in 2010 was a male in the 50-to-54 age category. By 2017, the modal person experiencing homelessness had become a male in the 25-to-29 age category. The number of unique male patients per year more than doubled for males in the younger-than-20, 20-to-24, 25-to-29, 30-to-34 and 35-to-39 age categories over the period of observation. The number of unique female patients per year similarly doubled in the 20-to-24, 25-to-29 and 30-to-34 age categories, although the modal female was in the 20-to-24 age category in both 2010 and 2017. People in these younger categories made up a greater percentage of the overall population of people experiencing homelessness as time passed, relative to those in the 40-to-55 age categories (Figure 4).

The geographic distribution of unique patients experiencing homelessness also changed over time across Ontario. The modal person experiencing homelessness presented to EDs in the Toronto Central LHIN in both 2010 and 2017. Although the number of patients experiencing homelessness increased across all LHINs (Figure 5), there was a proportional increase in the number of unique patients experiencing homelessness in LHINs outside Toronto through the study period (Figure 6). From 2010 to 2017, the proportion of unique patients experiencing homelessness in Toronto decreased from 60% to just over 40%

**Figure 4**  
Time series of unique people experiencing homelessness by year and by age group as a percentage of the total male or female population that year



Source: National Ambulatory Care Reporting System for Ontario from 2010 to 2017.

of the total population of this group. Conversely, relative increases in the number of patients experiencing homelessness who visited EDs in the LHINs that include Hamilton and Windsor led to an increase in the overall proportion of patients experiencing homelessness in these regions.

## Discussion

This study characterizes the demographics and geographic distribution of people experiencing homelessness who visited EDs in Ontario, Canada. There are four key results on homelessness. First, the overall number of people experiencing homelessness who visited EDs increased. Second, this rise was concentrated in the working-age population, specifically in younger adults. Third, there were geographic shifts toward areas outside the historical centre of homelessness, Toronto, during the period of observation. Lastly, the weekly count of homelessness fluctuated significantly over the year, with peaks in the fall and troughs in the winter.

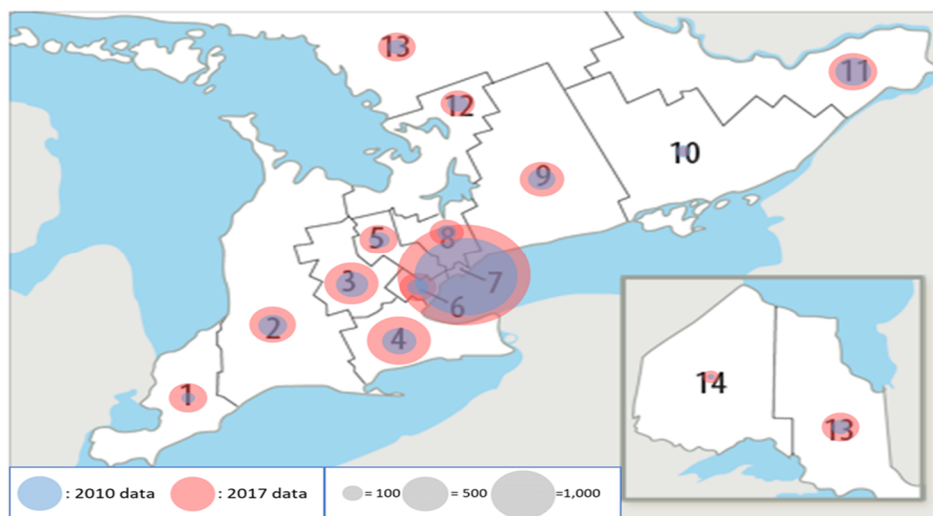
This study adds to a young literature that uses administrative health data to assess the population of people experiencing homelessness.<sup>13</sup> A previous study of homelessness using a similar approach identified 11,731 people in Ontario who experienced homelessness in 2016 and an estimate of 54,873 across the 10-year study period.<sup>11</sup> This contrasts with the 8,068 people experiencing homelessness identified in 2016 and the 39,408 individuals who were observed in the province from

2010 to 2017 in the current study. An optimal algorithm for generating provincial estimates includes the use of any CIHI database indicator;<sup>11</sup> however, the sensitivity of case ascertainment in the current study may have been diminished by the inability to extend the time intervals for each reference year.<sup>11</sup> The overall number of the study population is also higher than any of the annual numbers of unique individuals in the current study. This may be an artifact of how homelessness is assessed, as people require contact with an ED to be counted. Alternatively, this difference may also suggest a turnover of people experiencing homelessness in Ontario. The modal person who experienced homelessness was a man of working age presenting in Toronto; the possibility of these patients moving in and out of homelessness at a relatively rapid rate is congruent with previous findings that most single men stay in the shelter system only briefly.<sup>5</sup>

The finding that homelessness in Ontario rose over time is consistent with other literature that found that homelessness has been increasing across Canada.<sup>2,14</sup> This study found that this rise occurred almost exclusively in younger populations, especially people younger than 40. This may be the result of several factors, including a lack of affordable housing,<sup>1,15-19</sup> increasingly unstable work arrangements,<sup>14,20</sup> and rises in mental illness and substance use.<sup>21</sup> The cause is not necessarily clear, but these results provide evidence on the demographic policy makers need to target to reduce homelessness and reverse this trend.



**Figure 5**  
 Number of unique people experiencing homelessness who visited emergency departments in 2010 and 2017 for each Local Health Integration Network



Source: National Ambulatory Care Reporting System for Ontario from 2010 to 2017.

Policy makers also need to know where homelessness is a problem to target resources for reducing its prevalence. These results delineate two salient facts on the geography of homelessness in Ontario. As demonstrated in other literature,<sup>1</sup> Toronto is the centre of homelessness in Ontario. However, homelessness became less geographically concentrated over the study period. At the beginning of 2010, the proportion of people experiencing homelessness in Toronto represented approximately 60% of the total in Ontario. This proportion decreased to just over 40% by 2017, while the LHINs that include the municipalities of Windsor and Hamilton simultaneously demonstrated the largest increases outside Toronto. This decrease suggests the possible displacement of people experiencing homelessness to areas outside Toronto, where housing and living costs have been rising rapidly.<sup>22</sup> The increasing proportion of homelessness in Hamilton may follow the city's population growth rates, which rose from 0.2% to 0.85% from 2006 to 2015, driven largely by increasing net migration from other communities in Ontario.<sup>23</sup> Windsor's growth rate also went from among the lowest in the province in 2006/2007 to among the highest, following increased international migration and availability of affordable housing.<sup>24</sup>

Lastly, the ED is a major potential location where interventions targeting homelessness might be initiated. Patients experiencing homelessness may have more complex needs and require more specialized health care than the general population. Standard ED resources may be unable to adequately address these needs. These data provide information on when this population could be expected to increase its health care use, enabling potential interventions to be targeted to help increase resources. Care-seeking behaviour in the ED appears highly correlated with seasonality for people experiencing homelessness, particularly

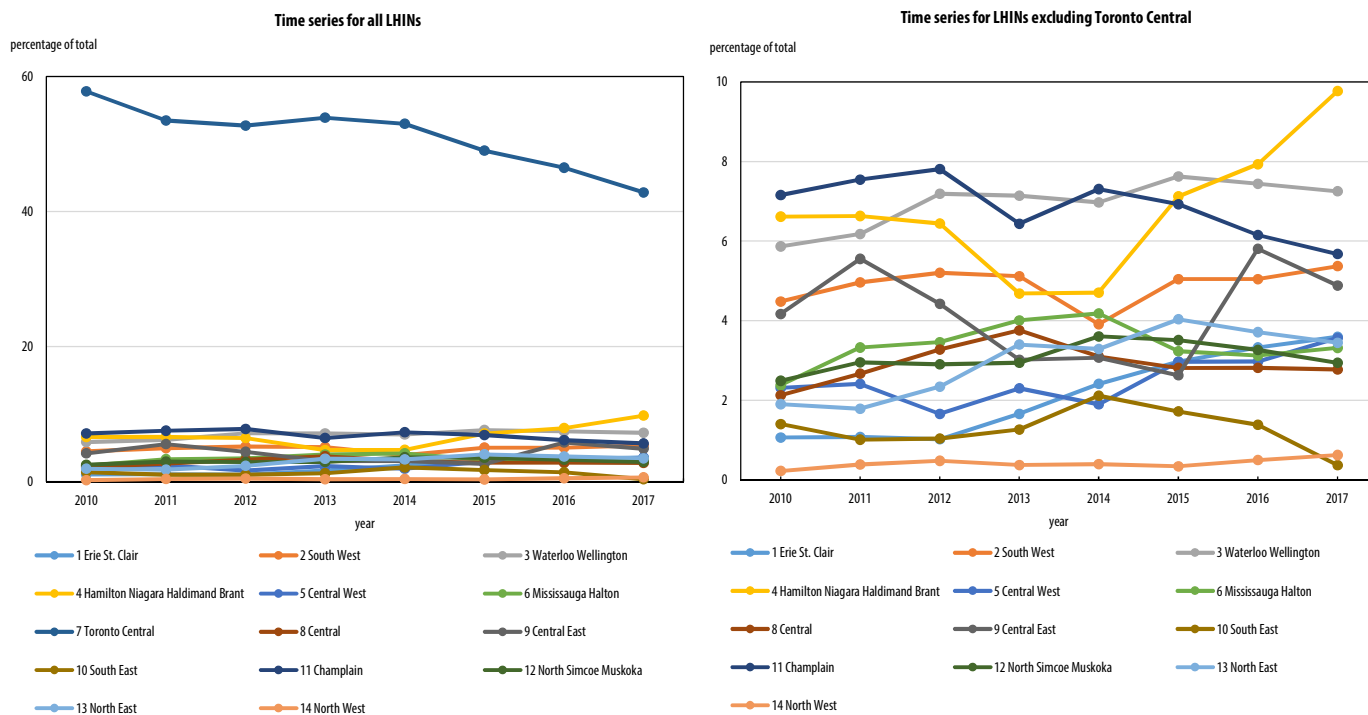
with increased presentations during the summer and fall. Prior analysis of the effect of the season on ED use has been limited and conflicting, with reports that the season both does and does not affect ED use among pediatric patients.<sup>25,26</sup> However, particular types of users, such as lower-acuity adult patients, may increase their use during warmer times of the year.<sup>27</sup> The periods of peak demand for ED services by this population could be targeted to maximize the impact of specialized health care and conduct studies for new interventions.

### Limitations

This method of surveillance does have some limitations. Most notably, this study may undercount people experiencing homelessness. Previous research has suggested that administrative health data have very good specificity but very poor sensitivity, leading to undercounting.<sup>11</sup> These results likely undercount those experiencing hidden homelessness, and this may not be an insubstantial number. In 2014, 8% of Canadians aged 15 and older reported that they had lived with family, with friends or in their car at some point because they had nowhere else to stay.<sup>28</sup> This problem is not exclusive to this study; the demographics of people experiencing hidden homelessness have been historically difficult to analyze as they are excluded from enumeration and shelter survey data.<sup>2,6,19,29</sup> As women are also at increased risk for hidden homelessness, the inability to account for this hard-to-reach subgroup may compound the inequities experienced by women who are homeless in the planning and provision of services.<sup>30,31</sup>

This method of surveillance may also suffer from shifts in the health of people experiencing homelessness. When someone has enough health "capital," they do not need to visit an ED to

**Figure 6**  
Geographic location of unique people experiencing homelessness as a percent of total patients in each year



Note: LHIN: Local Health Integration Network.  
Source: National Ambulatory Care Reporting System for Ontario from 2010 to 2017.

improve their health and so are not captured as homeless by this method; however, a “depreciation” in health can cause them to visit an ED, and this increases the observed number of people experiencing homelessness, but not the true number. While examining the health characteristics of this population is a consideration for future research, two current findings suggest that shifts in health status are possibly not underlying the results of the current study. First, worsening health status would be more likely to affect older age categories of people experiencing homelessness, resulting in more unique individuals from older cohorts presenting over time. This is not evident in these results. Second, females are more likely to use health resources than males in general (though contrasting evidence has been found in emergency settings).<sup>32,33</sup> There were no disproportionate increases in unique female patients visiting EDs in Ontario, a situation that might occur if the health of the population experiencing homelessness were worsening.

Future research should focus on five broad avenues using administrative health data. A first research goal is to map these population estimates onto PiT Counts; this would provide a check on the fidelity of the data. People experiencing homelessness also have two to five times the mortality rate of the general population.<sup>34</sup> Administrative health data may enable a better understanding of these health and mortality risks. Further analysis of health service use, including ED visits and wait times, may help to improve the quality of care in emergency settings. Previous literature has suggested that

people experiencing homelessness may be categorized based on degree of geographical transience and that these subgroups may have differing health and service needs.<sup>4,35-37</sup> Further analysis of ED visit data may provide information on patterns of migration between regions in Ontario. Lastly, transitions into and out of homelessness may be analyzed using ED visit data to assess the stability or precarity of homelessness in Ontario.

### Conclusion

This study suggests that homelessness in Ontario has been worsening over time, has been affecting younger cohorts, and has shifted geographically to smaller but rapidly growing municipalities. People experiencing homelessness represent a vulnerable population that is growing in size and need, and data to guide important health and social policy decisions are incomplete. These findings support the idea that policy makers can improve their surveillance of this population using high-fidelity information that may lead to more efficient and better-tailored interventions. Policy makers can also obtain homelessness data relatively inexpensively from within existing administrative health databases, especially when compared with the cost of conducting PiT Counts. This study demonstrates that routinely collected administrative health data can provide rapid, comprehensive and cost-effective information on the demographics and other characteristics of this vulnerable population.

## **Acknowledgements**

This study used de-identified data from the ICES Data Repository, which is managed by ICES with support from its funders and partners: Canada's Strategy for Patient-Oriented Research (SPOR), the Ontario SPOR Support Unit, the Canadian Institutes of Health Research and the Government of Ontario. The opinions, results and conclusions reported are those of the authors. No endorsement by ICES or any of its

funders or partners is intended or should be inferred. Parts of this material are based on data and information compiled and provided by CIHI. However, the analyses, conclusions, opinions and statements expressed herein are those of the authors, and not necessarily those of CIHI. The authors would like to thank the Emergency Medicine Researchers of Niagara and Dr. Larry Chambers for important feedback in the development of this paper.

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