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Self-poisoning among British Columbian children and youth: Demographic and geographic characteristics

A study on the alarmingly high rates and increasing trends of self-poisoning among children and youth in BC found that 10- to 19-year-olds living in rural neighborhoods with poor access to local mental health services are at highest risk.

ABSTRACT

Background: Poisoning is a common self-harm method, but the magnitude of the problem in British Columbia is unclear. This study aimed to review self-poisoning hospitalization trends in BC, with a focus on 10- to 19-year-olds.

Methods: Self-poisoning hospitalization rates were calculated by age group, sex, and year for the fiscal periods 2009–10 to 2016–17. Among 10- to 19-year-olds, rates by census division for the fiscal periods 2012–13 to 2016–17 were calculated and compared to the availability of local mental health services.

Results: There were 20 413 self-poisoning hospitalizations (55.8 per 100 000 population) in BC, including 3842 among 10- to 19-year-olds (92.9 per 100 000 population). Rates significantly increased 2.7-fold for 10- to 14-year-olds (24.0 to 64.7 per 100 000 population) and 1.7-fold for 15- to 19-year-olds (103.9 to 180.1 per 100 000 population) over the study period. Rates were highest in rural areas with poorly distributed mental health services, relative to urban regions.

Conclusions: These findings highlight the need to tailor prevention strategies for youth and increase access to mental health services throughout BC.

Newfoundland and Labrador, self-poisoning hospitalizations among 12- to 17-year-olds increased 2.7-fold.³ Meanwhile, previous research by our group indicated that in British Columbia, 15- to 19-year-old females had the highest self-poisoning hospitalization rate (191.6 per 100 000 population) compared to all other age groups.⁴ These findings are highly concerning because self-poisoning is associated with greater risks of suicide and accidental death.⁵

With increasing trends in self-poisoning and the significant cost of treating such injuries, the Canadian health care system is facing a growing burden. Per patient, self-poisoning hospitalizations are more expensive than other self-inflicted injuries such as cutting, hanging, and jumping.⁶ Annually, suicide and self-harm costs in Canada exceed \$76 million for 10- to 14-year-olds and \$426 million for 15- to 19-year-olds.^{7,8} The per capita cost of suicide and self-harm in BC is higher for youth than for adults,^{6,9} at \$216 among 15- to 24-year-olds and \$137 among 25- to 64-year-olds.^{8,9}

Child and youth self-poisoning is highly taxing economically and socially, which makes it of utmost importance that action be taken to reduce occurrences of these preventable injuries.

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Background

Self-poisoning is a major public health concern in Canada, particularly among children and youth. Among 10- to 17-year-old Canadians, 2140 young people were hospitalized due to self-poisoning during the 2013–14 fiscal year, which accounted for 87% of hospitalizations due to self-inflicted injuries.¹ Parachute and Alberta's Injury Prevention Centre found that between the 2008–09 and 2018–19 fiscal periods, 10- to 14-year-old and 15- to 19-year-old Canadians had the largest percent increases in self-poisoning hospitalizations, with an average yearly increase of 12.6% and 6.9%, respectively.² Between 2008 and 2013 in

Reasons for the increase in self-poisoning among children and youth are unknown, although a mental health diagnosis is a factor.³ In 2003, the BC Ministry of Children and Family Development introduced the Child and Youth Mental Health Plan¹⁰ to provide free mental health services for children and young people up to 18 years old in BC, although a 2019 BC Coroners Service report recommended that youth mental health services be expanded in nonurban areas.¹¹ While these services are imperative to support the positive well-being of young British Columbians, it is unknown whether proximity to them reduces local rates of child and youth self-harm.

To explore gaps in existing literature and to inform youth self-harm prevention strategies, our study had two goals. The first was to explore detailed epidemiological self-poisoning hospitalization trends in BC; the second was to describe rates among 10- to 19-year-olds by geographic region in relation to accessibility of local mental health resources.

Methods

Self-poisoning hospitalization data in BC from the 2009–10 to 2016–17 fiscal years were retrospectively described in terms of epidemiological trends and patterns. This study was approved by the University of British Columbia/Children's and Women's Health Centre of British Columbia Research Ethics Board (#H13-01321).

From 1 April 2009 to 31 March 2017, hospitalization data for all ages were obtained from the Discharge Abstract Database, BC Ministry of Health. From 1 April 2012 to 31 March 2017, hospitalizations were extracted from the database by dissemination area (DA: a geographic area with approximately 400 to 700 residents¹²) for 10- to 19-year-olds, and were converted to census divisions (CD: a group of neighboring municipalities comprised of numerous DAs¹²). Data were extracted using the most responsible diagnosis codes for intent (X60 to X69), as well as poisoning (T36 to T65), as per the International Statistical Classification of Diseases and Related Health Problems, Canadian version 10 (ICD-10-CA).¹³ The geocode location of all public youth mental health services in BC, including interventional,

preventive, diagnostic, and multidisciplinary programs, as well as a map of the province divided by CD, were acquired from the BC Data Catalogue.¹⁴ BC population data by DA were collected from Statistics Canada's 2011 and 2016 Census Profiles.¹⁵

Among all British Columbians, 15- to 19-year-olds had the highest rate of self-poisoning, with significantly greater rates for females compared to males.

Descriptive statistics and Wald's 95% confidence intervals were calculated. Hospitalization rates per 100 000 population were calculated by age group, using the total number of poisoning events over the study period divided by the respective age group population and then multiplied by 100 000. Poisoning rates among 10- to 14-year-olds and 15- to 19-year-olds were compared with other age groups by year of occurrence and sex. Results were considered significant if the 95% confidence intervals did not overlap.

Rates of self-poisoning hospitalizations per 100 000 population of children and youth were calculated for each CD. These rates were displayed as a heat map of BC using the Quantum Geographic Information System software (QGIS; version 3.6.2-Noosa). The density of youth mental health services was calculated for each CD by adding the number of services per CD, divided by the 10- to 19-year-old population of that CD, and multiplying by 100. These values were overlaid on the heat map. Using QGIS, the distribution of clusters of youth mental health services was also included on the map.

Results

Between 1 April 2009 and 31 March 2017, there were 20 413 (55.8 per 100 000 population) self-poisoning hospitalizations in BC, 3842 of which were among 10- to 19-year-olds (92.9 per 100 000 population). Six self-poisonings (0.03% of cases) were excluded due to a missing sex identifier.

Among all British Columbians, 15- to 19-year-olds had the highest self-poisoning rate; the rate among 10- to 14-year-olds was relatively moderate. For both children and youth, rates were significantly greater for females compared to male age-mates [Figure 1].

During the 2009–10 to 2016–17 fiscal periods, 10- to 14-year-olds and 15- to 19-year-olds demonstrated the greatest increases in

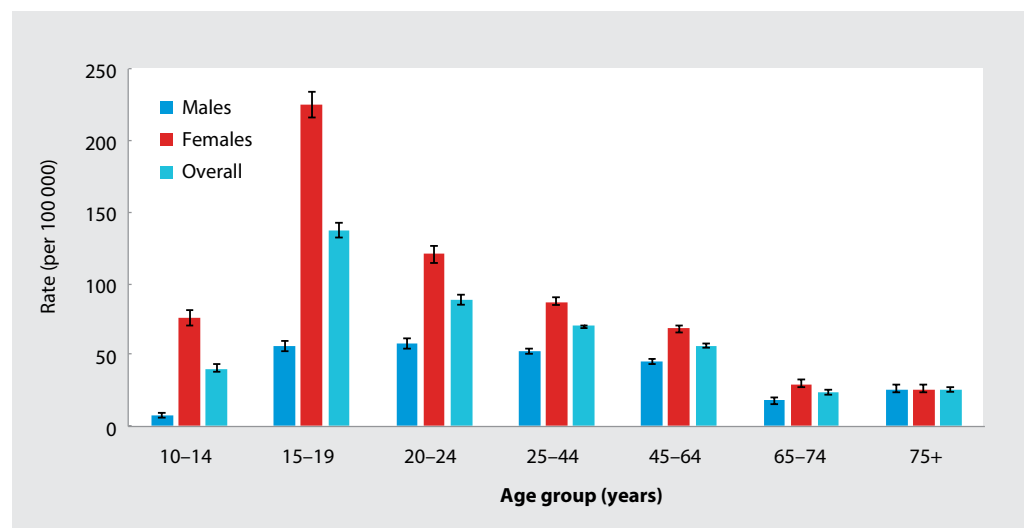


FIGURE 1. Self-poisoning hospitalization rates per 100 000 population in BC, 2009–10 to 2016–17 fiscal years, by age group and sex, with 95% confidence intervals. Note: 0- to 9-year-olds were excluded because there were fewer than 5 cases.

self-poisoning hospitalization rates compared with all other age groups [Figure 2A]. Rates increased 2.7-fold from 24.0 (17.9–30.0) to 64.7 (54.3–75.0) per 100 000 population among 10- to 14-year-olds, and 1.7-fold from 103.9 (91.9–115.8) to 180.1 (164.2–196.0) per 100 000 population among 15- to 19-year-olds. Among children and youth, increases were largely among females [Figure 2B]. Self-poisoning hospitalization rates increased 1.3-fold from 8.5 (3.5–13.5) to 10.9 (5.0–16.8) per 100 000 population for 10- to 14-year-old

males, and 3.0-fold from 40.6 (29.3–52.0) to 121.9 (101.5–142.3) per 100 000 population for 10- to 14-year-old females. Among 15- to 19-year-olds, rates increased 1.5-fold from 46.2 (35.1–57.3) to 69.8 (56.0–83.6) per 100 000 population for males, and 1.8-fold from 166.2 (144.4–188.0) to 297.2 (267.9–326.6) per 100 000 population for females.

Between 1 April 2012 and 31 March 2017, of the 29 CDs in BC, those with the highest child and youth self-poisoning rates were Skeena–Queen Charlotte (422.9 per 100 000

population), Central Coast (337.4 per 100 000 population), and Northern Rockies (328.4 per 100 000 population) [Figure 3]. Those with the lowest rates were Stikine (0 cases), Mount Waddington (< 5 cases), and Kootenay Boundary (39.7 per 100 000 population).

In terms of mental health service density for children and youth, Stikine, Mount Waddington, and Kitimat–Stikine had the most services, with 20.0, 2.9, and 2.5 per 100 population of 10- to 19-year-olds, respectively, while Capitol, Fraser Valley, and Central Okanagan had the fewest services, with 0.6 per 100 population of 10- to 19-year-olds. Census divisions with the high rates of self-poisoning, such as Skeena–Queen Charlotte, Central Coast, and Northern Rockies, had small clusters of mental health services, with poor coverage in many rural areas [Figure 3].

Conclusions

Self-poisoning is a considerable issue in BC, where high rates and increasing trends among children and youth are alarming. In surveys administered to a large representative sample of young people age 14 to 21 in Victoria, BC, in 2003 and 2005, 17% of participants admitted to performing at least one act of nonsuicidal self-harm.¹⁶ More recently, our study has highlighted that self-poisoning is a significant and growing problem, particularly for BC children and youth. The exceptionally high self-poisoning rates among females age 10 to 14 and 15 to 19 are striking, which is consistent with research that has found higher self-poisoning rates among female youth compared with males.³ Although self-poisoning is more severe among young females, in the 2016–17 fiscal year, self-poisoning hospitalization rates among males age 15 to 19 in BC surpassed those of all other male age groups.

The growing number of 10- to 19-year-old self-poisonings in BC is of great concern. The factors driving these increases are mostly speculative, although depression—a demonstrated risk factor for adolescent self-poisoning in Newfoundland and Labrador³—could also be central to the issue in BC. There is an absence of literature regarding the impact of geography of residence and availability of local mental health services on self-poisoning rates among

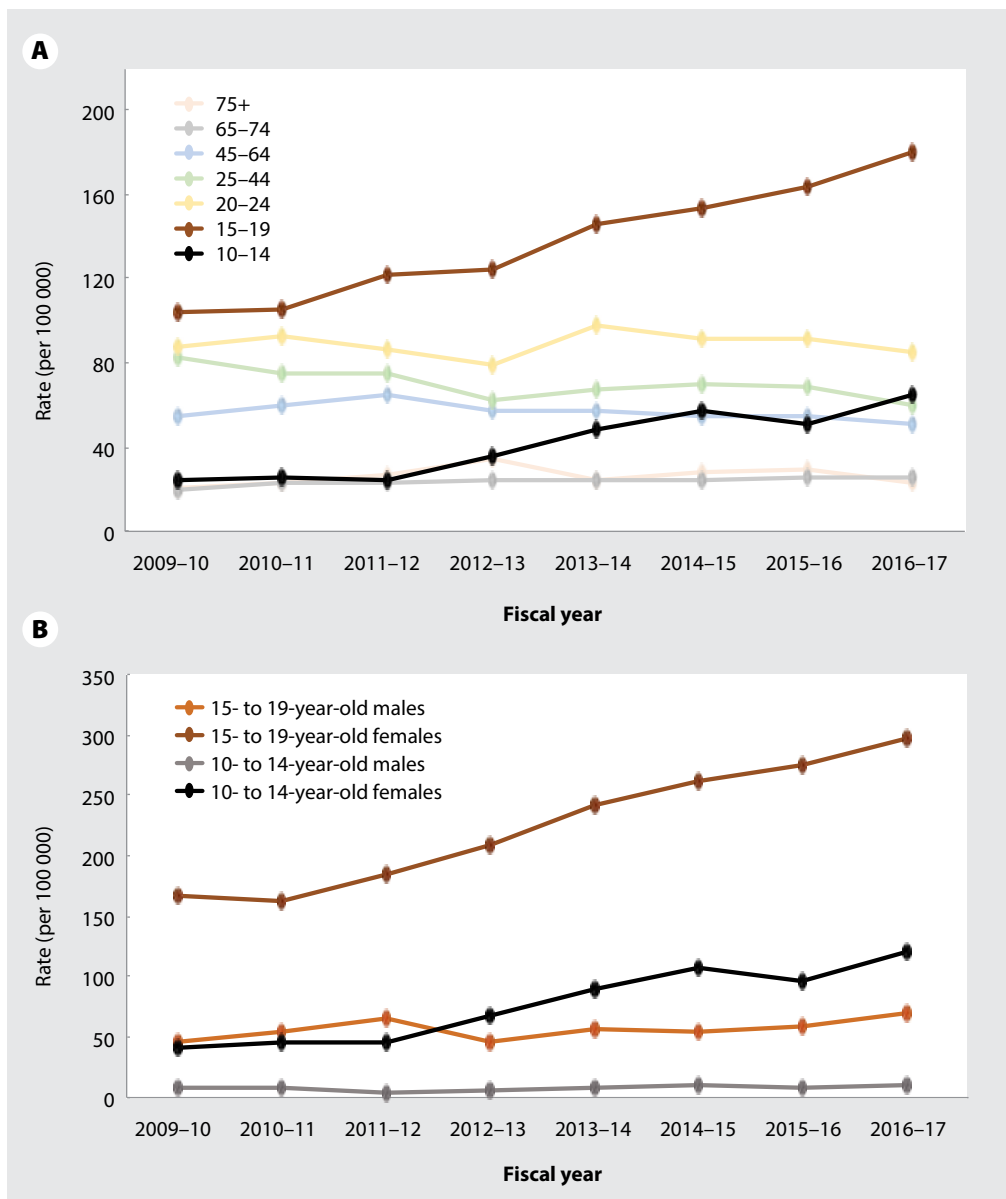


FIGURE 2. Self-poisoning hospitalization rates per 100 000 population in BC, 2009–10 to 2016–17 fiscal years, for (A) all age groups, and (B) children and youth by sex.

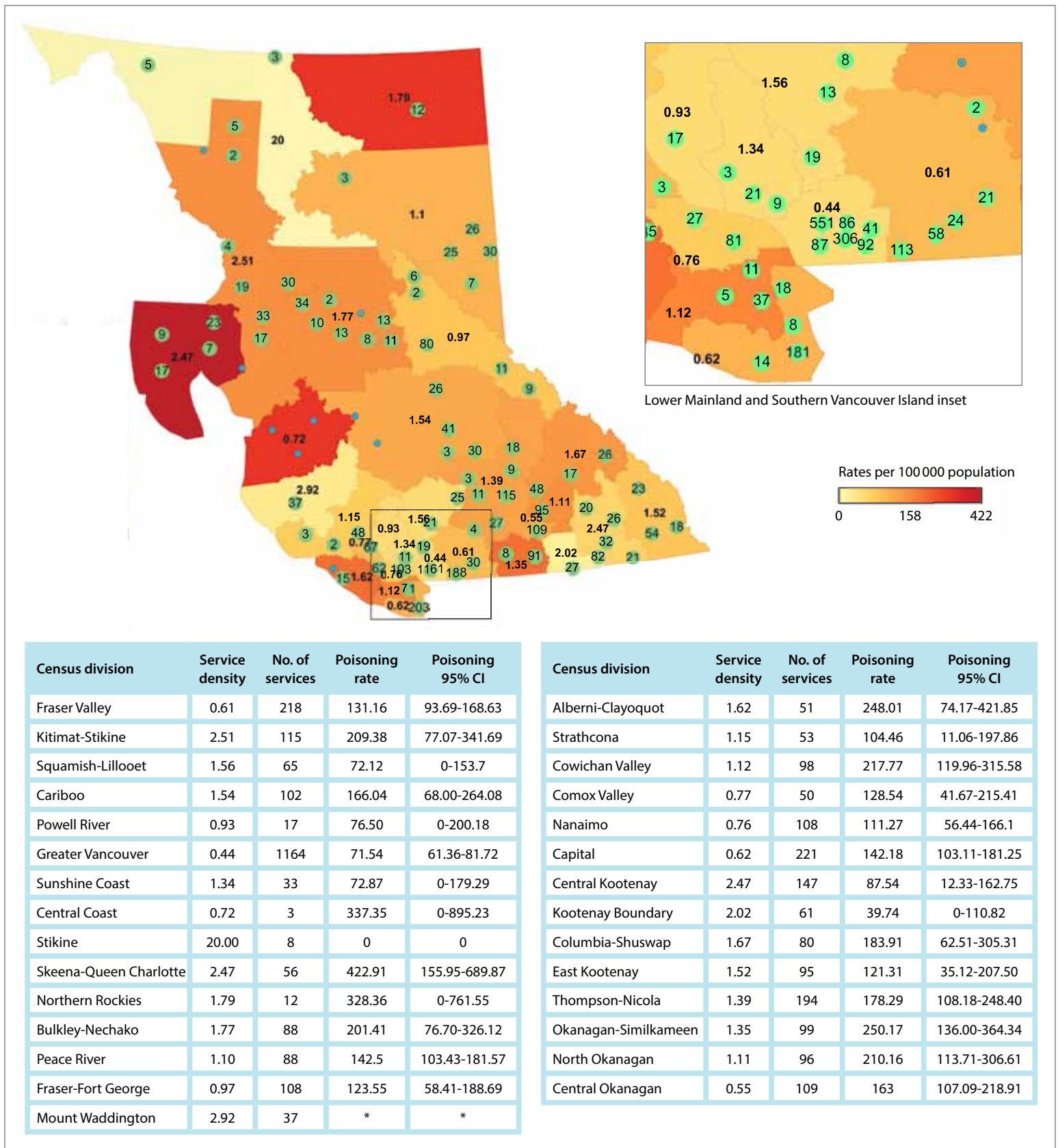


FIGURE 3. BC heat map of child and youth self-poisoning rates per 100 000 population by census division for 10- to 19-year-olds, 2012–13 to 2016–17 fiscal years, overlaid by youth mental health services per 100 population of 10- to 19-year-olds (service density) and service clusters. Numbers in green circles represent the number of local services. Asterisks represent more than 0 but fewer than 5 cases.

BC children and youth. Our findings have addressed these gaps by demonstrating that young people age 10 to 19 living in rural neighborhoods with poor access to local mental health services are at higher risk for self-poisoning than those living elsewhere.

Given the recent increases in depression diagnoses and antidepressant prescriptions for females age 12 to 19,¹⁷ mental health and antidepressant accessibility may have contributed to increased self-poisoning rates among female youths. Mental health and the use of antidepressants, however, are complicated subjects in relation to self-harm and suicide. Although Health Canada has not approved the use of any antidepressants by minors, and antidepressants increase young people's risk of suicide ideation, the benefits of antidepressant treatment greatly outweigh the potential dangers.¹⁸ For physicians who prescribe off-label antidepressants to children and youth, close monitoring is essential. The most common reason for adolescent self-harm is the desire to relieve psychological pain.¹⁹ With patients at high risk for self-harm, physicians can discuss healthier methods of expressing emotions, such as exercising, listening to music, or calling a friend.²⁰

Existing self-harm prevention methods include gatekeeper training, screening for high-risk individuals, encouraging help-seeking behavior, and providing access to crisis lines and online resources.²¹ Evidence supports the importance of self-harm screening and risk assessment.²² For this to be effective, the BC Ministry of Children and Family Development recommends that family physicians regularly repeat training for the recognition and treatment of depression.²³

To help address this issue in BC, not only should physicians familiarize themselves with the signs associated with high risk of self-harm, but they can also discuss depression and anxiety with their child and youth patients, and refer those patients to pediatricians, psychiatrists, or local mental health services if necessary. Although improved mental health screening and treatment in BC may reduce self-poisoning incidents among children and youth, not all 10- to 19-year-olds who poison themselves are mentally ill, and many will not take the initiative to address their concerns with a health care practitioner.

An additional screening opportunity exists within emergency departments. With development led at BC Children's Hospital, the HEARTSMAP mental health assessment tool is used throughout much of BC by emergency department clinicians to screen children and youth who present with mental health emergencies.²⁴ An adapted version

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called myHEARTSMAP, a self-assessment tool that was validated among young people age 10 to 17 in Western Canada, was used to pronounce psychosocial challenges among emergency department patients with nonmental health presentations and provide treatment recommendations when needed.²⁴ Upon comparing myHEARTSMAP results to those from HEARTSMAP assessments conducted by research nurses, 92.7% of youth were able to identify their own psychiatric issues. Of all participating patients, 36.4% were determined to have psychosocial concerns, which is higher than what has been observed across Canada.²⁴ Accordingly, employing myHEARTSMAP in BC emergency departments is expected to improve detection of mental health concerns among high-risk children and youth, and provide customized care plans to potentially reduce rates of self-harm among young people age 10 to 19 throughout the province.

In focus groups held in 2010 and 2015 for 12- to 22-year-olds in rural and urban BC, a key suggestion for improving youth health was to increase accessibility to mental health counselors.²⁵ In 2013, focus groups were held with youth age 15 to 25 in rural and urban BC,

who discussed the experiences they had as 16- to 18-year-olds involved with mental health services (15-year-olds shared their expectations).²⁶ Main talking points also included the lack of services in rural BC, as well as fears that relocating in order to access services leads to isolation from support systems, and thus causes more harm than benefit. Those who moved back to their rural communities after receiving mental health care in urban centres often mentioned that services and follow-up care were not available locally. Our study found that many census divisions with the greatest density of youth mental health services had the lowest self-poisoning rates, which suggests that greater availability of mental health services may be associated with improved mental health and, therefore, fewer acts of self-harm.

To improve health care in high-risk regions, the Ontario Hospital Association launched Local Health Hubs for Rural and Northern Communities,²⁷ which provide comprehensive health care in one rural location. Mental health services are incorporated into this model, with the aim to improve screening and treatment.²⁸ Local Health Hubs liaise with larger health care centres to facilitate referrals and telemedicine for patients, and provide mental health education and support for rural physicians.²⁸ Having Local Health Hubs in northern and rural BC may improve mental health services for children and youth residing in those locations, although the efficacy of this system has not yet been proven due to its novelty in Canada.²⁸

The BC Child and Youth Mental Health Plan states that all children, from birth to 18 years old, should have access to basic mental health services,¹⁰ but there are inconsistencies in the services provided to children and youth in different regions of the province. Furthermore, by mapping the distribution of youth mental health services, we found that services are scarce in several areas. For example, in the Northern Rockies, all 12 youth mental health services are located in Fort Nelson,¹⁴ which has an area of 13 km² and a 10- to 19-year-old population of 400 individuals.¹⁵ The rest of the census division has an area of 85 098 km² and a 10- to 19-year-old population of 270 individuals,¹⁵ meaning that many children and

youth living in northeastern BC (where there is no public transit) have to drive for hours to access mental health services. Often, this is simply not feasible. Of all 29 census divisions, the Northern Rockies had the third highest rate of self-poisoning hospitalizations among children and youth age 10 to 19.

The situation was similar for the Central Coast census division, which had the second highest rate of self-poisoning among 10- to 19-year-olds, yet just three youth mental health services. Due to the rugged landscape of the Central Coast, modes of travel are costly and time-consuming, which makes it nearly impossible for many children and youth to obtain in-person mental health treatment. This emphasizes the need for implementation of, and improved access to, additional services in rural and isolated areas of BC. While under-used across Canada during the study period,²⁹ telehealth provides a potential solution. More recently, the COVID-19 pandemic has resulted in a shift to telehealth use, which removes many barriers to accessing health care; for example, by eliminating the need to travel to urban centres. However, limitations still exist, including insufficient bandwidth and inadequate access to technology. Key locations of focus identified in this study include rural areas in the Northern Rockies, Central Coast, Skeena-Queen Charlotte, Kitimat-Stikine, and Bulkley-Nechako, which were census divisions with high rates of self-poisoning among children and youth age 10 to 19.

Child and youth self-poisoning needs to be urgently addressed. Our study identified critical rural areas in BC that would benefit from more accessible youth mental health services, and highlighted the need for self-harm prevention strategies in those areas. Ultimately, it is ideal to prevent self-harm among children and youth by employing a layered strategy with multiple approaches that reduce risk and promote positive well-being. A valuable opportunity exists for public health officials, policymakers, clinicians, and mental health workers to develop and amend self-harm reduction strategies for children and youth, thereby reducing the burden that these preventable injuries have on British Columbians, our economy, and our health care system.

Data limitations

Since there were no personal identifiers in the available data, hospital readmissions and transfers could not be excluded. We estimate that approximately 4% of self-poisoning hospitalizations were either readmissions or transfers, meaning that the number of double-counted individuals represents a small proportion of

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the total number of cases. On the other hand, the data are not all encompassing, in that they include only cases for which poisoning was the primary cause, not those for which poisoning was a contributing factor. Therefore, this study likely underrepresented the total number of self-poisoning hospitalizations in BC.

Factors that vary across geographic regions, such as economic conditions, the nature of jobs, types and availability of social supports, ethnic composition, and culture, could not be accounted for in this study. It is challenging to compare youth mental health services availability among census divisions because the characteristics of each varies greatly with another. For example, Stikine had a small population of only 40 children and youth age 10 to 19, which could account for the high density of youth mental health services—nearly tenfold higher than any other census division. If Stikine and Greater Vancouver were each 10 000 km², they would have 6 and 920 636 residents aged 10 to 19 years, respectively.¹⁵ With these different population densities, a greater density of youth mental health services does not equate to easier access, use, or equitable or culturally safe access within that region, particularly in remote census divisions that have small populations dispersed over large geographic areas.

Finally, due to coding limitations of the hospitalization data, this study could not differentiate between suicide attempts and nonsuicidal self-injury, but rather grouped these behaviors as self-poisonings.

Summary

Self-poisoning is an ongoing issue for children age 10 to 14 and youth age 15 to 19. From 1 April 2009 to 31 March 2017, the children and youth in this age range in BC demonstrated high rates of self-poisoning hospitalizations, which unlike any other age group, increased throughout the study period. It is important to assess potential risk factors that are contributing to the increased self-poisoning rates among children and youth, and to explore reasons for higher rates among females age 10 to 19 compared with males, including the role of mental health. Children and youth age 10 to 19 living in rural neighborhoods that have low accessibility to mental health services are the most vulnerable to self-poisoning. This reveals an urgent public health issue in BC—one that medical practitioners can act on by advocating for more and/or greater access to youth mental health services in high-risk regions. In the meantime, physicians should monitor young patients for signs of mental health concerns, and closely follow up with those who have been prescribed antidepressants. With patients who might be at high risk of self-harm, physicians can also discuss alternative coping strategies to help reduce the number of self-harm cases among young British Columbians. Still, future research should be conducted to explore the efficacy of existing self-harm prevention strategies and youth mental health services in high-risk areas. ■

Competing interests

None declared.

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