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Disparities in positive mental health of sexual and gender minority adults in Canada

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Abstract

Introduction: The goal of this study was to examine potential disparities in positive mental health (PMH) among adults in Canada by sexual orientation and gender modality.

Methods: Using 2019 Canadian Community Health Survey (CCHS) Annual Component data (N = 57 034), we compared mean life satisfaction and the prevalence of high self-rated mental health (SRMH), happiness and community belonging between heterosexual and sexual minority adults, and between cisgender and gender minority adults. We used 2019 CCHS Rapid Response on PMH data (N = 11 486) to compare the prevalence of high psychological well-being between heterosexual and sexual minority adults. Linear and logistic regression analyses examined the between-group differences in mean life satisfaction and the other PMH outcomes, respectively.

Results: Sexual minority (vs. heterosexual) adults reported lower mean life satisfaction (B = −0.7, 95% CI: −0.8, −0.5) and were less likely to report high SRMH (OR = 0.4, 95% CI: 0.3, 0.5), happiness (OR = 0.4, 95% CI: 0.3, 0.5), community belonging (OR = 0.6, 95% CI: 0.5, 0.7) and psychological well-being (OR = 0.4, 95% CI: 0.3, 0.6). Differences were not always significant for specific sexual minority groups in sex-stratified analyses. Gender minority adults reported lower mean life satisfaction and were less likely to report high SRMH and happiness than cisgender adults.

Conclusion: Future research could investigate how these PMH disparities arise, risk and protective factors in these populations, how other sociodemographic factors interact with sexual orientation and gender identity to influence PMH and changes in disparities over time.

Keywords: sexual orientation, gender identity, health inequalities, positive mental health, life satisfaction, happiness, psychological well-being, community belonging

Highlights

- We investigated disparities in positive mental health (PMH) between sexual minority and heterosexual adults and between gender minority and cisgender adults in Canada in 2019.
- Mean life satisfaction was significantly lower among sexual minority adults than among heterosexual adults.
- Prevalence of high self-rated mental health, happiness, community belonging and psychological well-being were also significantly lower among sexual minority adults than among heterosexual adults.
- Mean life satisfaction and prevalence of high self-rated mental health and happiness were also significantly lower among gender minority adults than among cisgender adults.

Introduction

In 2015–2018, 3.2% of individuals in Canada aged 15 years and older identified as gay, lesbian or bisexual,[1] while in 2021, 0.3% identified as transgender or nonbinary.[2] Sexual orientation and gender modality (i.e. the congruence or incongruence between gender identity and sex assigned at birth[3]) are sociodemographic characteristics that can have wide-ranging implications for health.[4,5] Research shows that Two-Spirit, lesbian, gay, bisexual, transgender, queer, and additional people who identify as part of sexual and gender diverse communities (2SLGBTQ+)* individuals are at greater risk of negative psychological outcomes compared to their heterosexual and cisgender peers,[6,7] including higher prevalence rates of depression and anxiety disorders, and of suicidal ideation and attempts among sexual minority[6,8-10] and transgender[7] individuals. Non-suicidal self-injury is also more prevalent among sexual and gender minority (SGM) people.[11] Disparities in negative psychological outcomes between sexual minority and heterosexual

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* Canada's first Federal 2SLGBTQI+ Action Plan (https://women-gender-equality.canada.ca/en/free-to-be-me/federal-2slgbtqi-plus-action-plan/federal-2slgbtqi-plus-action-plan-2022.html) was launched in 2022 to improve data collection, analysis, research and knowledge on 2SLGBTQI+ people in Canada. Consistent with Statistics Canada's approach (https://www.statcan.gc.ca/o1/en/plus/4313-improving-data-2slgbtq-populations), the acronym "2SLGBTQ+" is being used here rather than "2SLGBTQI+", as this was the scope of the survey at the time.

people have also been observed in Canadian population health surveys.[12-16]

These inequalities are often explained using minority stress theory—namely, that SGM people experience worse mental health on average due to the excess stress caused by the stigma, prejudice and discrimination they face and by the internalization of negative societal attitudes.[17,18] Supporting this theory, stigmatizing events, internalized transphobia or homophobia, expectations of rejection and identity concealment have been associated with negative psychological outcomes among 2SLGBTQ + individuals.[19-22]

While existing research may provide insights into the experience of mental illness and distress in 2SLGBTQ + populations, these outcomes do not encompass all aspects of mental health. The World Health Organization defines health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity."[23] This definition implies that mental health spans beyond mental illness (i.e. *ill*-being) and emphasizes the importance of the positive aspects of mental health (i.e. *well*-being). Based on the dual-continuum model of mental health, positive mental health (PMH) and mental illness do not fall on opposing ends of a single continuum but are distinct (albeit related) constructs.[24,25] Accordingly, an individual may live with a mental illness, but still have relatively high PMH.[26] Thus, to fully understand the mental health of SGM people, it is important to also examine their emotional, psychological and social well-being.[27] A focus on PMH can move us beyond traditional biomedical and deficit-based approaches to a more strengths-based understanding of the mental health of SGM individuals.[28]

Some previous studies have investigated the overall PMH of sexual minority people in Canada using data from large population health surveys.[13,29,30] For instance, analyses of data from the 2012 Canadian Community Health Survey (CCHS) – Mental Health indicates that sexual minority individuals had lower PMH than heterosexual individuals,[29,30] while analyses from the 2015 CCHS only showed significant disparities in PMH among bisexual individuals.[13] These studies examined PMH as a single broad construct in analyses; however, multiple PMH outcomes can be investigated to obtain a more fine-grained and nuanced understanding of different aspects of well-being in and between populations.[31-33] Indeed, the Public Health Agency of Canada (PHAC) monitors the PMH of adults in Canada using five outcomes in its Positive Mental Health Surveillance Indicator Framework (PMHSIF): self-rated mental health (SRMH), happiness, life satisfaction, psychological well-being and community belonging.[31,32]

More generally, little is known about the PMH of gender minority individuals in Canada given that questions distinguishing between sex at birth and gender identity only began to be included in more recent population health surveys.[34]

Finally, there are indications that some PMH outcomes like high SRMH have been decreasing in prevalence in Canada since 2015;[35] inequalities in PMH outcomes may have changed if temporal trends were not identical in both 2SLGBTQ + and non-2SLGBTQ + populations. To address these gaps, we used more recent data from 2019 to comprehensively examine disparities in PMH by sexual orientation and by gender modality across PMH outcomes from the PMHSIF.[31,32]

Methods

Data and participants

Data for four out of five PMH outcomes came from the 2019 CCHS Annual Component,[34] which was collected from January to December 2019. The fifth PMH outcome, psychological well-being, was measured in the Rapid Response component of the 2019 CCHS,[36] administered to respondents who participated in January to March 2019. Statistics Canada excluded from the target population of the 2019 CCHS full-time members of the Canadian Armed Forces as well as individuals living on First Nations reserves and other Indigenous settlements in the provinces, in institutions, in foster care if aged 12 to 17 years, or in two specific health regions in Quebec; less than 3% of individuals in Canada aged 12 years and older are represented in these exclusions. Individuals living in the territories were excluded from the target population for the Rapid Response component; territorial data were collected but unavailable in the 2019 Annual Component as these data are only representative after 2 years of data collection. The sampling frame used for the Labour Force Survey was also used in the 2019 CCHS for adults living in the provinces.

Respondents completed the 2019 CCHS via computer-assisted telephone or in-person interviews. The 2019 CCHS collected data from individuals aged 12 years and older, although only those aged 15 years and older were asked about their sexual orientation. Nevertheless, we excluded youth aged 12 to 17 years from our study because different measures are used to monitor some indicators of PMH in the youth version of PMHSIF.[32] Moreover, we only had access to data from respondents who agreed to share their data with PHAC and Health Canada. As illustrated in Figure 1, these restrictions led to sample sizes of 57 034 for the Annual Component and 11 486 for the Rapid Response.

Measures

Positive mental health outcomes
Of the five PMH outcomes included in the adult PMHSIF,[32,33] SRMH, happiness, life satisfaction and community belonging were captured in the Annual Component. Psychological well-being was only measured in the Rapid Response. Our coding of high PMH was based on the cut-offs used in the PMHSIF.[32]

SRMH was assessed with the question, "In general, would you say your mental health is…?" Response options included "excellent," "very good," "good," "fair" and "poor." We dichotomously coded individuals who responded "excellent" or "very good" as having high SRMH. This type of question has been recommended as a measure of general mental health status by the OECD.[25] Responses to this question have been associated with a wide range of physical and mental health outcomes.[37]

Happiness was assessed with the question, "Would you describe yourself as being usually…?" Response options included "happy and interested in life," "somewhat happy," "somewhat unhappy," "unhappy with little interest in life" and "so unhappy, that life is not worthwhile." We dichotomously coded individuals who responded "happy and interested in life" as having high levels of happiness.

Life satisfaction was assessed with the question, "Using a scale of 0 to 10, where 0 means 'very dissatisfied' and 10 means 'very satisfied,' how do you feel about your life as a whole right now?" In the

FIGURE 1
**Flow chart depicting sample size reductions in the 2019 Canadian Community
Health Survey Annual Component and Rapid Response component**
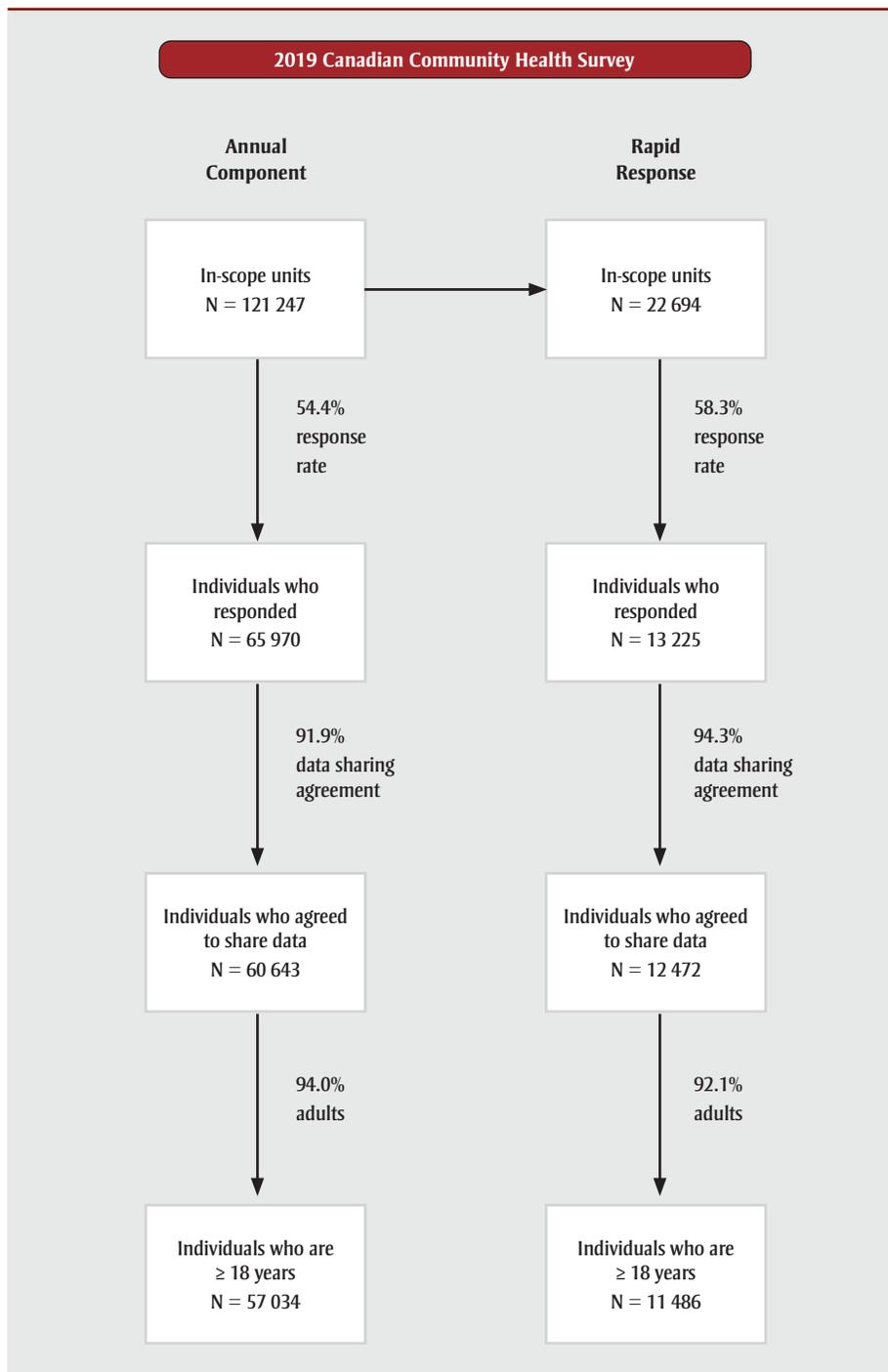
which can be considered part of eudaimonic well-being or the positive functioning component of PMH (along with psychological well-being).[27,38]

Psychological well-being was measured using the six items from the psychological well-being subscale of the Mental Health Continuum—Short Form.[39] Respondents were asked how often in the past month they felt (1) that they liked most parts of their personality; (2) good at managing the responsibilities of their daily life; (3) that they had warm and trusting relationships with others; (4) that they had experiences that challenged them to grow and become a better person; (5) confident to think or express their own ideas and opinions; and (6) that their life had a sense of direction or meaning to it. These questions are designed to measure the six components of psychological well-being identified by Ryff[40]: self-acceptance, environmental mastery, positive relations with others, personal growth, autonomy and purpose in life. We recoded the following response options to represent the number of days in the past month: "every day" (28 days = 7 days per week × 4 weeks); "almost every day" (20 days = 5 days per week × 4 weeks); "about 2 or 3 times a week" (10 days = 2.5 days per week × 4 weeks); "about once a week" (4 days = 1 day per week × 4 weeks); "once or twice" (1.5 days) and "never" (0 days).[41] We averaged the recoded responses and dichotomously coded respondents with a mean score of 20 or higher as having high psychological well-being.

Sexual orientation

Respondents were asked, "What is your sexual orientation?" Response options were "heterosexual," "homosexual," "bisexual" and "please specify." Individuals who specified a sexual orientation that could be classified as one of the existing response options were recoded into that category by Statistics Canada. We coded individuals who identified as homosexual (gay/lesbian), bisexual/pansexual or another sexual orientation as a sexual minority.

Gender modality

Respondents were asked, "What was your sex at birth?" Response options included "male" and "female." This was followed by the question, "What is your gender?" Response options included "male," "female" and "please specify." When responses for sex at birth and gender were the same, we coded the individual as cisgender; when

current research we treated this as a numerical variable and report on mean life satisfaction. Happiness and life satisfaction are core aspects of hedonic well-being or the positive feeling component of PMH.[27,38]

Community belonging was assessed with the question, "How would you describe your sense of belonging to your local community? Would you say it is…?" Response options included "very strong," "somewhat strong," "somewhat weak" and "very weak." We dichotomously coded individuals who responded "very strong" or "somewhat strong" as having high community belonging. This question captures the social integration aspect of social well-being,

responses differed, we coded the individual as a gender minority.

Analysis

Using Annual Component data, we estimated mean life satisfaction and the percentage of high SRMH, happiness and community belonging by sexual orientation (heterosexual or sexual minority) and gender modality (cisgender or gender minority). We also obtained overall and sex-stratified estimates of these PMH outcomes for specific sexual minority groups (i.e. gay/lesbian and bisexual/pansexual); we did not separately report on PMH outcomes among those who identified as having another sexual orientation beyond heterosexual, gay/lesbian or bisexual/pansexual given the difficulty in interpreting findings for such a heterogeneous group.

We estimated the percentage of high psychological well-being using the Rapid Response data for individuals by sexual orientation (heterosexual or sexual minority). We also obtained overall and sex-stratified estimates of high psychological well-being for specific sexual minority groups (i.e. gay/lesbian and bisexual/pansexual). The estimate of psychological well-being for gender minority adults is not reported because it was not releasable (i.e. coefficient of variation [CV] > 35).

To determine whether the above estimates were significantly different, we conducted logistic regression analyses for the dichotomized PMH outcomes and linear regression analyses for life satisfaction. We used dummy coding for the linear regression analyses so that—similar to the logistic regression analyses—"heterosexual adults" was the reference group in the sexual orientation analyses and "cisgender adults" was the reference group in the gender identity analyses. We interpreted odds ratios (OR) with 95% confidence intervals (CIs) that did not include 1.0 as statistically significant in the logistic regression analyses. We interpreted coefficients with 95% CIs that did not include zero as statistically significant in the linear regression analyses.

For the overall comparisons of sexual minority adults to heterosexual adults, we also statistically controlled for a number of sociodemographic characteristics in follow-up logistic regression analyses for the dichotomized PMH outcomes and linear regression analyses for life satisfaction. Covariates included the individual's sex at birth, age group, marital status (married/common law, single/never married, divorced/widowed/separated), highest educational attainment (high school or lower, postsecondary), racialized background (yes, no) and household income quintile.

In line with other analyses,[42-44] we coded the age of adults into four groups: young adults (18–34 years), younger middle-aged adults (35–49 years), older middle-aged adults (50–64 years) and older adults (65+ years). We grouped marital status and highest educational attainment into broad categories following previous analyses[45] and given the size of the sexual minority groups. There were minor discrepancies in how we coded racialized background due to different derived variables provided by Statistics Canada in each dataset at the time of analysis (see the Table 1 notes for more information).

Household income data were obtained by Statistics Canada from linked tax records, imputations or self-reports. Consistent with recommendations from Statistics Canada and given that income can have a nonlinear association with PMH outcomes,[46] we coded the household income values into quintiles. We also included place of residence (population centre, rural area) as a covariate in the analyses except for the one involving psychological well-being because it was not provided as a derived variable in the Rapid Response dataset by Statistics Canada. Population centres were defined by Statistics Canada as continuously built-up areas with populations of 1000+ and densities of 400+ per km². Due to small sample sizes, we do not report follow-up logistic or linear regression analyses that control for covariates in comparisons involving specific sexual minority groups or gender minority adults.

All estimates were adjusted using sampling weights provided by Statistics Canada and variance was estimated using the bootstrap resampling method with 1000 replications. The sampling weights take into account non-response during the recruitment phase and non-sharing of data with PHAC and Health Canada by respondents. We dealt with missing data by using pairwise deletion to maximize the sample size for each analysis. Estimates with CVs between 15% and 35% (flagged with an "E") should be interpreted with caution due to high sampling variability; estimates with CVs above 35% (flagged with an "F") are suppressed. Analyses were conducted in SAS Enterprise Guide version 7.1 (SAS Institute, Cary, NC, USA).

Results

Based on the Annual Component data, 0.2%[E] of adults in the Canadian provinces in 2019 were a gender minority and 3.9% were a sexual minority, with 1.7% identifying as gay/lesbian, 2.0% as bisexual/pansexual and 0.2% as another sexual orientation (Table 1).

Sexual orientation and PMH

Sexual minority adults reported lower mean life satisfaction ($B = -0.7$, 95% CI: $-0.8, -0.5$) and were less likely to report high SRMH (OR = 0.4, 95% CI: 0.3, 0.5), high levels of happiness (OR = 0.4, 95% CI: 0.3, 0.5), high community belonging (OR = 0.6, 95% CI: 0.5, 0.7) and high psychological well-being (OR = 0.4, 95% CI: 0.3, 0.6) than heterosexual adults (Table 2). These differences were statistically significant even after controlling for covariates.

Overall, gay/lesbian and bisexual/pansexual adults reported significantly lower mean life satisfaction ($B = -0.4$, 95% CI: $-0.6, -0.2$; $B = -0.9$, 95% CI: $-1.1, -0.7$, respectively) and were significantly less likely to report high SRMH (OR = 0.7, 95% CI: 0.5, 0.9; OR = 0.3, 95% CI: 0.2, 0.4, respectively), high levels of happiness (OR = 0.6, 95% CI: 0.4, 0.8; OR = 0.3, 95% CI: 0.2, 0.4, respectively), high community belonging (OR = 0.6, 95% CI: 0.5, 0.8; OR = 0.6, 95% CI: 0.4, 0.7, respectively) and high psychological well-being (OR = 0.4, 95% CI: 0.2, 0.8[E]; OR = 0.5, 95% CI: 0.3, 0.7, respectively) than heterosexual adults (Table 3).

Significant differences across those five PMH outcomes were observed for both bisexual males and bisexual females in the sex-stratified analyses. Gay males were significantly less likely than heterosexual males to report high SRMH (OR = 0.7, 95% CI: 0.5, 0.9) and community belonging (OR = 0.5, 95% CI: 0.4, 0.7), but significant disparities were not observed for high levels of happiness, high psychological well-being or mean life satisfaction. In contrast, compared to heterosexual females, lesbian females reported significantly lower

TABLE 1
Sociodemographic characteristics, 2019 CCHS Annual Component and Rapid Response on PMH

Sociodemographic characteristics	2019 CCHS Annual Component Percentage, %[a]	2019 CCHS Rapid Response PMH Percentage, %[a]
Sex	N = 57 034	N = 11 486
Male	49.2	49.2
Female	50.8	50.8
Age group, years	N = 57 034	N = 11 486
18–34	28.4	28.4
35–49	24.6	24.6
50–64	25.6	25.7
65+	21.5	21.3
Highest level of education	N = 56 318	N = 11 336
High school graduate or lower	34.4	35.9
Postsecondary graduate	65.6	64.1
Marital status	N = 56 974	N = 11 475
Married or common law	62.5	63.2
Single or never married	25.0	23.9
Divorced, widowed or separated	12.5	12.9
Racialized background[b]	N = 56 416	N = 11 396
No	74.3	72.4
Yes	25.7	27.6
Place of residence[c]	N = 57 034	–
Population centre	82.9	–
Rural area	17.1	–
Sexual orientation	N = 54 356	N = 11 069
Heterosexual	96.1	96.6
Sexual minority	3.9	3.4
Gay/lesbian	1.7	–[d]
Bisexual/pansexual	2.0	–[d]
Other	0.2	–[F]
Gender modality	N = 57 021	–
Cisgender	99.8	–[d]
Gender minority	0.2[E]	–[F]

Sources: 2019 CCHS Annual Component[34]; 2019 CCHS Rapid Response on PMH[36].

Abbreviations: CCHS, Canadian Community Health Survey; PMH, positive mental health.

[a] Percentages were weighted to be representative of the target population.

[b] There were minor discrepancies in how we coded racialized background due to different derived variables provided by Statistics Canada in each dataset at the time of analysis. For the Rapid Response, we coded the non-racialized group as just including non-Indigenous individuals who only identified as White; if an individual identified as Indigenous or indicated any other background besides or in addition to White then we coded them as having a racialized background. For the Annual Component, the non-racialized group more broadly included all non-Indigenous non-visible minorities; if an individual identified as Indigenous or could be classified as a visible minority then we coded them as having a racialized background.

[c] Estimates for place of residence are not reported for the 2019 CCHS Rapid Response on PMH as Statistics Canada did not include a relevant derived variable in that dataset.

[d] These estimates are not reported because they could be used with the reported estimate to calculate the suppressed estimate.

[E] Estimate should be interpreted with caution due to high sampling variability (coefficient of variation between 15% and 35%).

[F] Estimate suppressed due to a coefficient of variation greater than 35%.

mean life satisfaction ($B = -0.6$, 95% CI: -0.9, -0.3) and were significantly less likely to report high levels of happiness (OR = 0.5, 95% CI: 0.3, 0.7); however, significant disparities were not found for high SRMH, community belonging or psychological well-being (Table 3).

Gender modality and PMH

Gender minority adults reported significantly lower mean life satisfaction ($B = -1.7$, 95% CI: -2.6, -0.9) and were significantly less likely to report high SRMH (OR = 0.2, 95% CI: 0.1, 0.5)[E] and high levels of happiness (OR = 0.2, 95% CI: 0.1, 0.4)[E] than cisgender adults, but a significant disparity in high community belonging was not observed (Table 4).

Discussion

This study documents the PMH of SGM adults across numerous outcomes in Canada in 2019, and investigates disparities in these PMH outcomes compared to heterosexual and cisgender adults. Overall, inequalities in PMH were common. Sexual minority adults reported lower mean life satisfaction and were less likely to report high SRMH, high levels of happiness, high community belonging and high psychological well-being compared to heterosexual adults. Similarly, gender minority adults had lower odds of reporting high SRMH and high levels of happiness, and tended to be less satisfied with life than cisgender adults.

These inequalities tended to be relatively large in magnitude when compared to disparities in PMH outcomes previously observed for other sociodemographic characteristics.[45] For instance, the percentage difference in high SRMH was 21.4 for sexual minority (vs. heterosexual) individuals and 36.0[E] for gender minority (vs. cisgender) individuals in the current study, while the percentage difference in high SRMH did not exceed 14.1 in 2019 for comparisons by age group, racialized group membership, immigrant status, household income, place of residence, educational attainment, parental status, living alone, marital status, official language minority or Indigenous identity in previous analyses.[45] Moreover, the difference in mean life satisfaction was 0.7 for sexual minority (vs. heterosexual) individuals and 1.7 for gender minority (vs. cisgender) individuals in the current study, while the highest mean difference in all

TABLE 2
PMH outcomes in sexual minority versus heterosexual adults, 2019 CCHS Annual Component and Rapid Response on PMH

PMH outcomes	Prevalence, % (95% LCL, 95% UCL)	OR (95% LCL, 95% UCL)	aOR (95% LCL, 95% UCL)
High SRMH			
Sexual minority	46.3 (42.4, 50.2)	**0.4 (0.3, 0.5)**	**0.5 (0.4, 0.6)**
Heterosexual	67.7 (67.0, 68.4)	(Ref.)	(Ref.)
High levels of happiness			
Sexual minority	56.4 (52.5, 60.4)	**0.4 (0.3, 0.5)**	**0.5 (0.4, 0.6)**
Heterosexual	76.8 (76.1, 77.3)	(Ref.)	(Ref.)
High community belonging			
Sexual minority	56.8 (52.6, 61.1)	**0.6 (0.5, 0.7)**	**0.7 (0.6, 0.9)**
Heterosexual	68.9 (68.2, 69.6)	(Ref.)	(Ref.)
High psychological well-being			
Sexual minority	57.4 (48.7, 66.0)	**0.4 (0.3, 0.6)**	**0.5 (0.4, 0.8)**
Heterosexual	75.2 (73.7, 76.7)	(Ref.)	(Ref.)
	M (95% LCL, 95% UCL)	*B* (95% LCL, 95% UCL)	Adjusted *B* (95% LCL, 95% UCL)
Mean life satisfaction			
Sexual minority	7.4 (7.3, 7.6)	**−0.7 (−0.8, −0.5)**	**−0.5 (−0.7, −0.4)**
Heterosexual	8.1 (8.1, 8.1)	(Ref.)	(Ref.)

Sources: 2019 CCHS Annual Component[34]; 2019 CCHS Rapid Response on PMH[36].

Abbreviations: aOR, adjusted odds ratio; *B*, unstandardized regression coefficient; CCHS, Canadian Community Health Survey; LCL, lower confidence limit; *M*, mean; OR, odds ratio; PMH, positive mental health; Ref., reference group; SRMH, self-rated mental health; UCL, upper confidence limit.

Notes: All estimates were weighted. Analyses involving high psychological well-being used data from the 2019 CCHS Rapid Response on PMH, while analyses involving all other PMH outcomes used data from the 2019 CCHS Annual Component. Adjusted regression analyses included sex, age group, highest education level, racialized background, household income quintile and marital status as covariates. Place of residence was also included as a covariate except for the analysis involving high psychological well-being. Due to varying rates of missing data, the sample size ranged from 52 929 to 54 280 for the Annual Component analyses and from 10 393 to 10 531 for the Rapid Response analyses. Odds ratios that are bolded have confidence intervals that exclude 1.0 and are considered statistically significant. Regression coefficients that are bolded have confidence intervals that exclude 0 and are considered statistically significant.

the sociodemographic comparisons listed above was 0.6 in 2019.[45] The especially sizable inequalities in PMH in SGM populations identify a high priority for mental health promotion activities, as well as other interventions aimed at addressing potential determinants of PMH.[47,48]

Beyond these overall inequalities, it is also important to acknowledge the heterogeneity that exists within SGM groups. Although PMH tended to be less prevalent among SGM individuals compared to heterosexual and cisgender individuals, there were still large portions of SGM individuals who reported high levels of PMH. For example, high community belonging was reported by the majority of gay, lesbian, bisexual/pansexual and gender minority individuals. Investigations into risk and protective

factors that distinguish SGM individuals who report high PMH from those who do not could be important for understanding and promoting individual and community resilience in these populations.[49] For instance, greater self-compassion appears to be a protective factor as it has been linked to lower minority stress and better well-being among SGM populations.[50] In contrast, SGM people in Canada are more likely to report experiencing violent victimization,[51] which is a risk factor of lower PMH;[31-33] safer and more 2SLGBTQ + friendly communities are likely an important social determinant for these populations and a potential target for more systemic-level interventions.[47]

There were differences in the consistency by which inequalities in PMH outcomes

were observed in this study, with disparities between bisexual/pansexual versus heterosexual adults being the most robust. This is in line with previous research findings that the risk of negative psychological outcomes is often highest for bisexual individuals compared to heterosexual or gay/lesbian individuals.[6,8,10,11,52] The distinctive prejudice and discrimination that can be experienced by bisexual people has been offered as an explanation for their heightened risk, including the negative societal attitudes about bisexuality, the invisibility and erasure of bisexual people in wider society, and the lack of affirmative support for bisexual individuals.[52] Indeed, a recent environmental scan only found one program in Canada that was exclusively dedicated to addressing the

TABLE 3
PMH outcomes by detailed sexual orientation categories, overall and stratified by sex, 2019 CCHS Annual Component and Rapid Response on PMH

PMH outcomes	Overall		Male		Female	
	Prevalence, % (95% LCL, 95% UCL)	OR (95% LCL, 95% UCL)	Prevalence, % (95% LCL, 95% UCL)	OR (95% LCL, 95% UCL)	Prevalence, % (95% LCL, 95% UCL)	OR (95% LCL, 95% UCL)
High SRMH						
Gay/lesbian	59.1 (53.0, 65.1)	**0.7 (0.5, 0.9)**	60.6 (52.7, 68.5)	**0.7 (0.5, 0.9)**	56.4 (46.7, 66.1)	0.7 (0.5, 1.0)
Bisexual/pansexual	37.1 (32.0, 42.2)	**0.3 (0.2, 0.4)**	47.4 (37.7, 57.0)	**0.4 (0.3, 0.6)**	32.0 (26.2, 37.7)	**0.2 (0.2, 0.3)**
Heterosexual	67.7 (67.0, 68.4)	(Ref.)	70.0 (69.0, 71.0)	(Ref.)	65.5 (64.5, 66.5)	(Ref.)
High levels of happiness						
Gay/lesbian	66.3 (59.7, 72.8)	**0.6 (0.4, 0.8)**	68.6 (60.3, 76.9)	0.7 (0.5, 1.1)	62.3 (52.6, 72.0)	**0.5 (0.3, 0.7)**
Bisexual/pansexual	50.3 (45.3, 55.4)	**0.3 (0.2, 0.4)**	48.3 (38.2, 58.4)	**0.3 (0.2, 0.5)**	51.4 (45.3, 57.4)	**0.3 (0.2, 0.4)**
Heterosexual	76.8 (76.1, 77.4)	(Ref.)	75.6 (74.6, 76.5)	(Ref.)	78.0 (77.1, 78.8)	(Ref.)
High community belonging						
Gay/lesbian	57.9 (51.3, 64.5)	**0.6 (0.5, 0.8)**	51.3 (42.7, 59.9)	**0.5 (0.4, 0.7)**	69.2 (60.7, 77.7)	1.0 (0.7, 1.4)
Bisexual/pansexual	55.5 (50.0, 60.9)	**0.6 (0.4, 0.7)**	50.7 (40.9, 60.4)	**0.5 (0.3, 0.7)**	57.9 (51.9, 63.9)	**0.6 (0.5, 0.8)**
Heterosexual	68.9 (68.2, 69.6)	(Ref.)	68.0 (66.9, 69.0)	(Ref.)	69.8 (68.8, 70.8)	(Ref.)
High psychological well-being						
Gay/lesbian	55.0 (38.2, 71.8)[E]	**0.4 (0.2, 0.8)[E]**	55.2 (32.1, 78.2)[E]	0.4 (0.1, 1.1)[E]	54.7 (33.2, 76.1)[E]	0.4 (0.2, 1.1)[E]
Bisexual/pansexual	59.3 (49.0, 69.5)	**0.5 (0.3, 0.7)**	57.1 (38.5, 75.7)[E]	**0.4 (0.2, 0.9)[E]**	60.4 (48.0, 72.9)	**0.5 (0.3, 0.9)**
Heterosexual	75.2 (73.7, 76.7)	(Ref.)	76.3 (74.2, 78.4)	(Ref.)	74.2 (72.0, 76.3)	(Ref.)
	M (95% LCL, 95% UCL)	*B* (95% LCL, 95% UCL)	*M* (95% LCL, 95% UCL)	*B* (95% LCL, 95% UCL)	*M* (95% LCL, 95% UCL)	*B* (95% LCL, 95% UCL)
Mean life satisfaction						
Gay/lesbian	7.7 (7.5, 7.9)	**−0.4 (−0.6, −0.2)**	7.8 (7.5, 8.1)	−0.3 (−0.6, 0.1)	7.6 (7.2, 7.9)	**−0.6 (−0.9, −0.3)**
Bisexual/ pansexual	7.2 (7.0, 7.4)	**−0.9 (−1.1, −0.7)**	7.2 (6.9, 7.6)	**−0.8 (−1.2, −0.5)**	7.1 (6.9, 7.4)	**−1.0 (−1.2, −0.8)**
Heterosexual	8.1 (8.1, 8.1)	(Ref.)	8.1 (8.0, 8.1)	(Ref.)	8.1 (8.1, 8.2)	(Ref.)

Sources: 2019 CCHS Annual Component[34]; 2019 CCHS Rapid Response on PMH[36]

Abbreviations: *B*, unstandardized regression coefficient; CCHS, Canadian Community Health Survey; LCL, lower confidence limit; *M*, mean; OR, odds ratio; PMH, positive mental health; Ref., reference group; SRMH, self-rated mental health; UCL, upper confidence limit.

Notes: All estimates were weighted. Analyses involving high psychological well-being used data from the 2019 CCHS Rapid Response on PMH, while analyses involving all other PMH outcomes used data from the 2019 CCHS Annual Component. Due to varying rates of missing data in the Annual Component, the sample size ranged from 53 713 to 54 168 for the overall analyses, from 24 356 to 24 571 for the male-stratified analyses and from 29 357 to 29 597 for the female-stratified analyses. We do not report sample sizes for the analyses using the Rapid Response data as they could be used with sample sizes reported elsewhere to calculate suppressed values. Adults who reported another sexual orientation were excluded from these analyses. Odds ratios that are bolded have confidence intervals that exclude 1.0 and are considered statistically significant. Regression coefficients that are bolded have confidence intervals that exclude 0 and are considered statistically significant.

[E] Estimate should be interpreted with caution due to high sampling variability (coefficient of variation between 15% and 35%).

TABLE 4
PMH outcomes by gender modality, overall, 2019 CCHS Annual Component

PMH outcomes	Prevalence, % (95% LCL, 95% UCL)	OR (95% LCL, 95% UCL)
High SRMH		
Gender minority	30.8 (13.2, 48.4)[E]	**0.2 (0.1, 0.5)**[E]
Cisgender	66.8 (66.1, 67.5)	(Ref.)
High levels of happiness		
Gender minority	34.4 (16.3, 52.5)[E]	**0.2 (0.1, 0.4)**[E]
Cisgender	75.5 (74.9, 76.1)	(Ref.)
High community belonging		
Gender minority	51.9 (34.2, 69.6)[E]	0.5 (0.2, 1.0)[E]
Cisgender	68.4 (67.7, 69.1)	(Ref.)
	M (95% LCL, 95% UCL)	*B* (95% LCL, 95% UCL)
Mean life satisfaction		
Gender minority	6.4 (5.5, 7.2)	**−1.7 (−2.6, −0.9)**
Cisgender	8.1 (8.1, 8.1)	(Ref.)

Source: 2019 CCHS Annual Component.[34]

Abbreviations: *B*, unstandardized regression coefficient; CCHS, Canadian Community Health Survey; LCL, lower confidence limit; *M*, mean; OR, odds ratio; PMH, positive mental health; Ref., reference group; SRMH, self-rated mental health; UCL, upper confidence limit.

Notes: All estimates were weighted. Due to varying rates of missing data, the sample size ranged from 54 664 to 56 868. Odds ratios that are bolded have confidence intervals that exclude 1.0 and are considered statistically significant. Regression coefficients that are bolded have confidence intervals that exclude 0 and are considered statistically significant.

[E] Estimate should be interpreted with caution due to high sampling variability (coefficient of variation between 15% and 35%).

social determinants of health among bisexual persons.[47]

Disparities in PMH also tended to be prominent for gender minority adults. Beyond community belonging, only around one-third of gender minority adults reported high SRMH and high levels of happiness, and they rated their life satisfaction 1.7 points lower, on average, than did cisgender individuals. These findings expand previous research on the prevalence of negative psychological outcomes in the transgender population.[7,11] Reducing distal stressors (i.e. being the target of transphobic behaviours) and proximal stressors (i.e. expectations of rejection or discrimination, transgender identity concealment and internalized transphobia) could be important for mental health promotion, as these experiences have been associated with depression and suicidal ideation among gender minority individuals.[19] Future research could explore risk and protective factors of PMH for gender minority people.

Strengths and limitations

By using data from large population health surveys, we were able to investigate numerous PMH outcomes in the overall SGM populations as well as in specific sexual minority groups. The examination of PMH among gender minority individuals is an especially important contribution as the inclusion of questions asking about both sex and gender is a recent development in Statistics Canada surveys. In addition, our strengths-based focus on PMH allowed us to document that—despite population disparities—many SGM individuals report experiencing well-being in their lives.

Nevertheless, there are limitations that warrant mention. First, we identified many disparities in PMH and offered potential explanations for the results based on minority stress theory and previous research, but we did not directly examine why the disparities exist. The inequalities across the PMH outcomes persisted for sexual minority adults compared to heterosexual adults when we statistically controlled for various sociodemographic characteristics; however, distinct groups were broadly coded into one category for some of the covariates and only unadjusted regression analyses for PMH outcomes were reported for comparisons involving specific sexual minority groups and gender minority adults due to small sample sizes. The small sample sizes also resulted in some relatively wide CIs and likely affected the statistical power to detect significant differences. In addition, the small number of gender minority adults in the dataset restricted our ability to examine specific gender identities (e.g. transgender men, transgender women, nonbinary individuals). The oversampling of SGM individuals in future population health surveys could allow for more comprehensive examinations of specific SGM identities, as well as the disaggregation of results by other potentially important sociodemographic factors.[53] For instance, age breakdowns could be informative; experiences of discrimination and disparities in mental health have been found to vary across the life course among sexual minority individuals in other countries.[54,55]

Self-reported responses to questionnaires may be subject to recall bias and social desirability bias.[56] Further, the unwillingness of some respondents to disclose their sexual orientation or gender modality could have resulted in some misclassification.[57] While respondents were asked to report on their sexual identity, there are other important dimensions of sexual orientation that could have been assessed (i.e. sexual attraction and sexual behaviour).[53,58] Moreover, the survey question on gender included "male" and "female" as response options instead of the more relevant "man" and "woman."[59] Finally, we may be missing data from the most at-risk SGM individuals (e.g. those who are experiencing homelessness).[60]

Conclusion

We found that PMH tended to be less common among SGM adults than among heterosexual and cisgender adults in 2019. Future research could explore the mechanisms by which SGM people experience

lower PMH, risk and protective factors of PMH in SGM populations, how PMH might depend on the interaction between sexual orientation and gender modality with other sociodemographic characteristics, and how the observed disparities in PMH may have changed over time.

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Conflicts of interest

The authors have no conflicts of interest.

Authors' contributions and statement

SH: Writing – original draft, writing – review & editing.

CAC: Conceptualization, methodology, writing – original draft, writing – review & editing.

LL: Methodology, formal analysis, writing – review & editing.

All authors approved the manuscript for publication.

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Original quantitative research

Substance-related poisoning hospitalizations and homelessness in Canada: a descriptive study

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This article has been peer reviewed.

Abstract

Introduction: The objective of this analysis is to describe patient demographics, the context, characteristics and outcomes of a substance-related poisoning, and the recorded mental disorder of people with housing and those experiencing homelessness.

Methods: Hospitalization data for Canada (except Quebec) from 1 April 2019 to 31 March 2020 were retrieved from the Canadian Institute for Health Information (CIHI) Discharge Abstract Database using ICD-10-CA codes for up to 25 diagnoses for substance-related poisonings, homelessness status and other characteristics relevant to the patient's hospitalization. We compared the characteristics of people experiencing homelessness with those of people who were housed, and their substance-related poisoning hospitalizations, using chi-square, *t* tests and Fisher exact test.

Results: There was a higher proportion of males, younger individuals and people with recorded mental disorders among people experiencing homelessness hospitalized for a substance-related poisoning than among their housed counterparts. Substance-related poisonings among people experiencing homelessness were more likely to be accidental, involve opioids and stimulants (most frequently fentanyl and its analogues and heroin), result in lengthier hospitalizations and end with leaving the hospital against medical advice.

Conclusion: These findings can be used to strengthen strategies and interventions to reduce substance-related harms in priority populations, particularly those experiencing homelessness.

Keywords: opioids, overdose, fentanyl, housing, mental disorder, hospitalization

Highlights

- People who are homeless were vastly overrepresented among people hospitalized for substance-related poisonings.
- In fiscal year 2019/2020, people experiencing homelessness who were hospitalized for substance-related poisonings spent, on average, about 4 days longer in hospital than people with housing.
- Almost one-quarter (23%) of the hospitalizations of people experiencing homelessness ended with the patients leaving against medical advice, compared to 8% of hospitalizations for people with housing.
- An important area for future research would be to identify ways in which hospitals can retain and treat this at-risk population.
- Research can also help inform additional prevention and harm reduction activities.

Introduction

Canada continues to experience an overdose crisis, with substance-related morbidity and mortality increasing significantly since 2016.[1] Between January 2016 and December 2020, there were 24 671 opioid-related and 11 176 stimulant-related poisoning hospitalizations in Canada (excluding Quebec).[1] Although most regions of the country have been affected, British Columbia, Alberta and Ontario continue to have the most opioid and stimulant-related poisoning hospitalizations.[1] Some subpopulations appear to be disproportionately affected by the overdose crisis, including people experiencing homelessness and housing insecurity.[2]

The rates of substance use are disproportionally high among people experiencing homelessness, and they are at a greater risk of substance-related harms compared to people with housing.[3-7] People who are homeless are also more likely than people with housing to be diagnosed with a mental health disorder, remain hospitalized for longer, and be readmitted within 30 days following discharge.[4-9]

On average, at least 235 000 people experience homelessness in a given year in Canada, and at least 35 000 on a given

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night.[2] Across the country, an additional 50 000 people could be experiencing hidden homelessness every night, that is, staying temporarily with friends, relatives or others because they have no other housing option and no immediate prospect of permanent housing.[2] The number of people experiencing homelessness in Canada is very difficult to estimate, but it is thought to be increasing, possibly also as a result of job losses and evictions during and since the COVID-19 pandemic.[2,10,11]

The objective of this analysis is to describe patterns of substance-related poisoning hospitalizations in Canada (excluding Quebec) among people with housing and people experiencing homelessness, using the Canadian Institute for Health Information (CIHI) Discharge Abstract Database (DAD) during the pre-pandemic year of 1 April 2019 to 31 March 2020. This study also examines patterns by patient demographics (sex and age); context of the poisoning (substances involved and intention of the poisoning); hospitalization characteristics and outcomes (length of stay, intensive care unit admission and discharge disposition); and recorded mental disorders.

To our knowledge, this is the first study comparing the characteristics of those experiencing homelessness and those who are housed among people hospitalized for a substance-related poisoning across Canada using this data source. The results of this study can be used to better understand the intersection of homelessness, mental health and substance-related harms and how hospital care is experienced differently by people who are homeless.

Methods

Data source

We obtained data from the DAD, which captures acute inpatient discharge records for hospitalizations across Canada, excluding Quebec. In 2019–2020, the DAD had full coverage for acute inpatient care, except from one facility that did not submit data for six periods (an estimated total of 1100 missing abstracts).[12] Data were presented for the time from 1 April 2019 to 31 March 2020. *International Classification of Diseases and Related Health Problems, Tenth Revision, Canada* (ICD-10-CA) codes were used to capture up to 25 diagnoses from the patient's hospitalization.

Identifying the study sample

The methodology used to identify substance-related poisonings was adapted from existing CIHI methods.[13,14] Trained coders reviewed medical records and assigned substance specific ICD-10-CA codes according to CIHI coding directives.[13,15] Substance-related poisonings may be recorded in a patient's chart based on toxicological analyses, self-report and/or responsiveness to treatment received (for instance, reversal of an opioid poisoning after being administered naloxone). Poisonings of interest were included if they were due to the following substances: opioids (T40.0, T40.1, T40.2, T40.20–T40.23, T40.28, T40.3, T40.4, T40.40, T40.41, T40.48, T40.6); stimulants (T40.5, T43.6); cannabis (T40.7); hallucinogens (T40.8, T40.9); alcohol (T51); other depressants (T42.3, T42.4, T42.6, T42.7); and psychotropic drugs (T43.8, T43.9).

This analysis was limited to significant poisonings, defined as cases where the poisoning influenced the duration of the time the patient spent in hospital and the treatment they received. Secondary diagnoses and unconfirmed or query diagnoses were excluded.

Additional variables

Homelessness status

Any mention of the ICD-10-CA code Z59.0 on a patient discharge abstract was used to note confirmed or unconfirmed and suspected instances of homelessness status. Homelessness status upon admission to hospital is mandatory to code when mentioned in physician documentation or noted on routine review of the medical record.

Intention of poisoning

Intention of the poisoning was identified in line with CIHI coding standards, where coders assign an external cause ICD-10-CA code indicating whether the poisoning was accidental (X41, X42, X45), intentional (X61, X62, X65) or undetermined (Y11, Y12, Y15). Confirmed and suspected diagnoses were included in the intention analysis. Records containing one or more poisonings with a missing associated external cause code were excluded from analyses of intention.

Recorded mental disorders

Consistent with CIHI methodology, recorded mental disorders were identified using any relevant ICD-10-CA diagnoses recorded on the patient discharge abstract during their stay for the substance-related poisoning.[15,16] It is mandatory to record the diagnosis of a mental disorder if having this disorder significantly affects the treatment received, requires treatment beyond maintenance of the pre-existing disorder or increases the length of stay in hospital by at least 24 hours.

All ICD-10-CA codes for a mental disorder on the patient discharge abstract were captured, including confirmed and suspected diagnoses. The following were included: substance-related and addictive disorders (F10–F19, F55, F63.0); schizophrenia and other psychotic disorders (F20–F25, F28, F29); mood disorders (F30–F34, F38, F39, F53.0, F53.1); anxiety disorders (F40, F41, F93.0–F93.2, F94.0); selected disorders of personality and behaviour (F60–F62, F68 [excluding F68.1], F69); and other mental disorders (F42–F45, F48.0, F48.1, F48.8, F48.9, F50–F52, F53.8, F53.9, F54, F59, F63 [excluding F63.0], F68.1, F90–F92, F93.3, F93.8, F93.9, F94.1, F94.2, F94.8, F94.9, F95, F98.0, F98.1–F98.5, F98.8, F98.9, F99, O99.3). Some examples of "other mental disorders" covered by these ICD-10-CA codes include hypochondriacal disorder, eating disorders, nonorganic sleep disorders, conduct disorders, and posttraumatic stress disorder.

Length of stay in hospital and discharge disposition

Total length of stay in hospital was calculated as the sum of the number of days a patient was in acute inpatient care and alternate level of care. Acute inpatient care length of stay describes when a patient is receiving necessary treatment for a disease or severe episode of illness for a short period; alternate level of care describes when a patient is occupying a bed, but not requiring the intensity of services provided in that care setting.

Discharge disposition refers to the status of the patient upon discharge or where the patient is discharged to, and is identified by examining the patient's hospitalization record.

Analysis

We conducted descriptive analyses of substance-related poisoning hospitalizations among people experiencing homelessness as well as among housed people (in order

to have a reference category). Percentages of substance-related poisoning hospitalizations with a specific recorded mental disorder were calculated based on the denominator of the total study population; these may exceed 100% when summed because of polysubstance poisonings and diagnoses of multiple mental disorders. Counts of less than five per disaggregated category were suppressed in accordance with the CIHI privacy policy.[17]

We used a Pearson chi-square test to determine significant associations between housing status and categorical variables, and a Fisher exact test when expected counts for cells were less than five. A Satterthwaite t test was used to test differences by housing status for continuous variables.

All analyses were completed using statistical package SAS Enterprise Guide version 7.1 (SAS Institute Inc., Cary, NC, US).

Results

Between April 2019 and March 2020, there were 10 659 substance-related poisoning hospitalizations in Canada (excluding Quebec). Approximately 6% (623) of these were recorded among people experiencing homelessness.

Patient demographics

Among those hospitalized for substance-related poisonings, there was a higher proportion of males experiencing homelessness (71%) than females (29%), while among those with housing, slightly more females (53%) than males (47%) were hospitalized (Table 1). Of those hospitalized for substance-related poisoning, the mean age of people experiencing homelessness was lower than the mean age of their housed counterparts (39.2 vs. 42.5 years; $p < 0.001$) (Figure 1).

Hospitalization characteristics and outcomes

People who were homeless stayed for a significantly longer time in hospital for a substance-related poisoning than those with housing (11.0 vs. 6.6 days; $p < 0.05$) (Table 2). The proportions of hospitalizations admitted into intensive care did not differ between the two population groups, but people experiencing homelessness had a higher mean length of stay in alternate level of care than those with housing (3.7 vs. 0.8 days; $p < 0.05$). Among individuals with housing, 8% discharged themselves from the hospital against medical advice, whereas 23% of individuals who were homeless did the same ($p < 0.001$). There was no difference between the two population groups in the proportions who died while hospitalized for a substance-related poisoning.

The majority (68%) of people with housing who were hospitalized for substance-related poisoning were discharged home. In comparison, 49% of hospitalizations of people experiencing homelessness on admission and who refused shelter upon discharge were "discharged home," suggesting that this finding should be interpreted with caution.

Substances involved in poisoning hospitalization

Opioids were the most common type of substance involved in hospitalizations for a substance-related poisoning (Table 3), but to a greater extent among people experiencing homelessness than among people with housing (61% vs. 40%; $p < 0.001$). Stimulants, such as cocaine and methamphetamine, were also involved in a greater proportion of hospitalizations of people who were homeless (29%) compared to people with housing (29% vs. 19%; $p < 0.001$). In contrast, other depressants, for example, benzodiazepines and other sedatives, were more common in hospitalizations of people with housing compared to those experiencing homelessness (39% vs. 19%; $p < 0.001$).

Where an opioid was involved in a poisoning hospitalization, fentanyl and its analogues (34% vs. 20%; $p < 0.001$) and heroin (15% vs. 7%; $p < 0.001$) were more prevalent in higher proportions of people experiencing homelessness than of people with housing. In contrast, oxycodone, codeine and hydromorphone were significantly more prevalent in hospitalizations of people with housing.

The percentage of substance-related poisoning hospitalizations that involved one, two or three or more substances did not differ by housing status.

Intention of the poisoning

Higher proportions of substance-related poisoning hospitalizations were recorded as accidental among people who were homeless than among people with housing (62% vs. 45%; $p < 0.001$) (Table 4). People with housing had a higher proportion of such hospitalizations recorded as intentional self-harm (46% vs. 26% for people experiencing homelessness; $p < 0.001$). This pattern was also observed among

TABLE 1
Demographics of patients hospitalized for a substance-related poisoning, by people experiencing homelessness and people with housing, Canada (excluding Quebec), April 2019 to March 2020

Demographics	People experiencing homelessness, % (n)	People with housing, % (n)	t statistic (df)	X^2 statistic (df)
Sex, % (n)**				132.8 (1)
Female	29 (182)	53 (5316)	–	–
Male	71 (441)	47 (4715)	–	–
Mean age, years**	39.2	42.5	5.88 (803.49)	–
Median age, years	37	40	–	–

Abbreviations: X^2, chi-square; df, degrees of freedom.

*$p < 0.05$.

**$p < 0.001$.

FIGURE 1

FIGURE 1
Age groups of patients hospitalized for a substance-related poisoning, by people experiencing homelessness and people with housing, Canada (excluding Quebec), April 2019 to March 2020
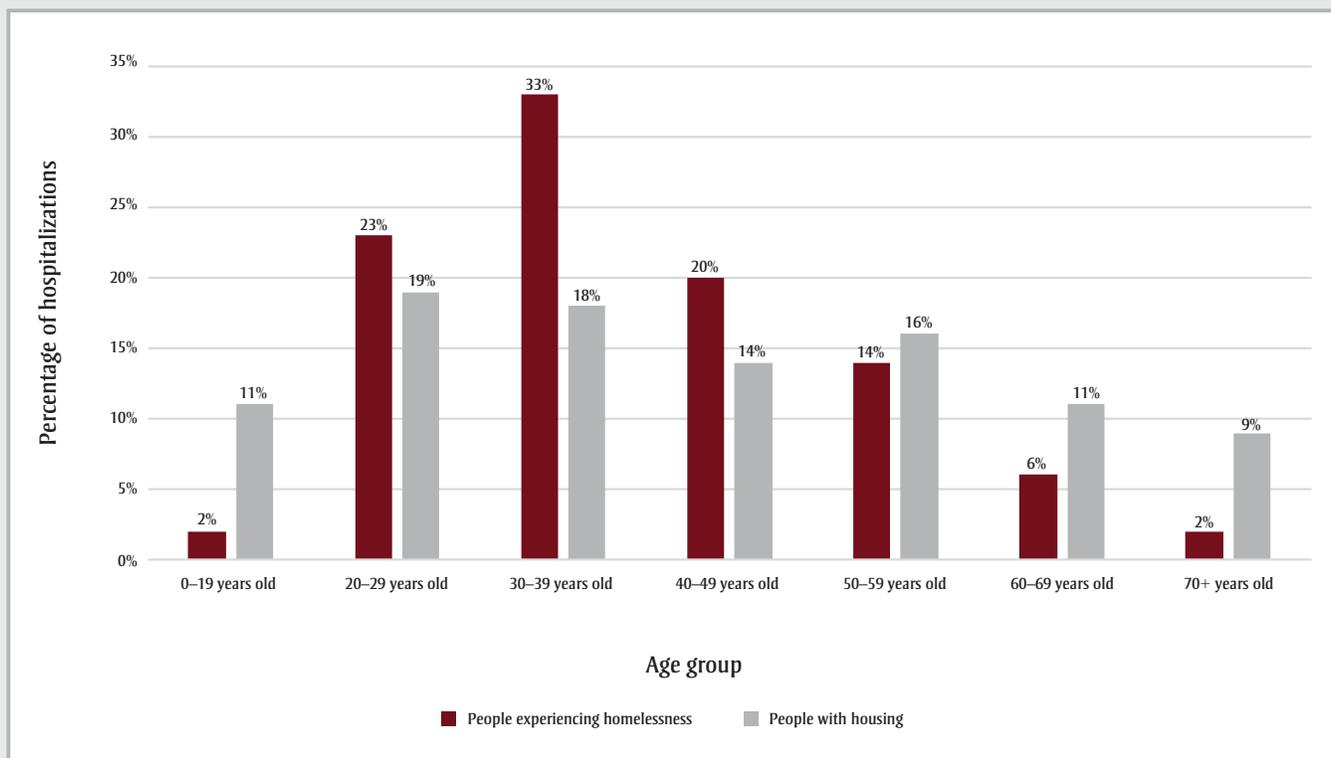
TABLE 2
Substance-related poisoning hospitalization characteristics and outcomes among people experiencing homelessness and people with housing, Canada (excluding Quebec), April 2019 to March 2020

Characteristics and outcomes	People experiencing homelessness	People with housing	t statistic (df)	X² statistic (df)
Mean length of stay (SD), days				–
Acute inpatient care*	7.3 (13.9)	5.8 (12.3)	−2.58 (683.31)	
Alternate level of care*	3.7 (35.7)	0.8 (9.0)	−2.05 (626.94)	
Total length of stay*	11.0 (40.7)	6.6 (17.5)	−2.68 (636.32)	
Intensive care unit admission, %	38	36	–	0.7 (1)
Discharge disposition, % (n)				
Home[a]**	49 (306)	68 (6829)		95.0 (1)
Transferred[b]*	24 (149)	21 (2069)		3.9 (1)
Left against medical advice, absent or did not return from pass**	23 (142)	8 (786)		165.2 (1)
Died in hospital	4 (26)	4 (352)		0.8 (1)

Abbreviations: X², chi-square; df, degrees of freedom; SD, standard deviation.

[a] Includes hospital discharges of people experiencing homelessness on admission who refuse shelter upon discharge. Interpret with caution.

[b] Includes transfers to shelters or supportive/transitional housing.

*p < 0.05.

**p < 0.001.

	People experiencing homelessness, % (n)	People with housing, % (n)	X^2 statistic (df)
Substance involved			
Opioid**	61 (377)	40 (4056)	97.6 (1)
CNS stimulant**	29 (182)	19 (1953)	34.8 (1)
Other CNS depressant**	19 (118)	39 (3897)	98.8 (1)
Alcohol*	18 (114)	23 (2300)	7.1 (1)
Cannabis*	4 (24)	6 (594)	4.6 (1)
Hallucinogen	–[a]	<1 (35)	–
Other/unspecific psychotropic drug	–[a]	1 (67)	–
Opioid involved			
Fentanyl and analogues**	34 (130)	20 (792)	46.8 (1)
Heroin**	15 (57)	7 (272)	35.5 (1)
Methadone	6 (22)	8 (341)	3.0 (1)
Oxycodone**	3 (13)	10 (393)	16.2 (1)
Codeine**	3 (11)	10 (424)	22.1 (1)
Hydromorphone**	2 (7)	10 (393)	25.8 (1)
Tramadol	–[a]	3 (115)	–
Morphine	–[a]	7 (284)	–
Opium[b]	0 (0)	<1 (8)	–
Other/unspecified*	41 (154)	35 (1415)	5.4 (1)
Number of substances involved			
1	74 (463)	77 (7702)	1.9 (1)
2	20 (126)	19 (1870)	1.0 (1)
≥3	5 (34)	5 (464)	0.9 (1)

Abbreviations: X^2, chi-square; CNS, central nervous system; df, degrees of freedom.

[a] Data are suppressed because of small sample sizes (in accordance with the Canadian Institute for Health Information privacy policy[17]).

[b] Fisher exact test used when counts for cells were less than 5.

*$p < 0.05$.

**$p < 0.001$.

females and males separately, although the magnitude of the differences varied.

Recorded mental disorders

People experiencing homelessness who were hospitalized for substance-related poisonings had a higher proportion of mental disorders recorded during their hospital stay than those with housing (61% vs. 52%; $p < 0.001$) (Table 5). The most commonly recorded mental disorders for both populations were substance-related and addictive disorders, although a significantly greater proportion of people who were homeless than people with housing had this diagnosis (51% vs. 25%; $p < 0.001$). People with housing who were hospitalized for substance-related poisonings had a higher proportion of recorded mood disorders (21% vs. 11%; $p < 0.001$) and of recorded anxiety disorders (9% vs. 3%; $p < 0.001$) than their counterparts who were experiencing homelessness.

Stratification by sex showed significant differences in the distribution of substance-related poisoning hospitalizations with various mental disorders. Females experiencing homelessness were significantly more likely to have substance-related and addictive disorders (48% vs. 21%; $p < 0.001$) and schizophrenia and other psychotic disorders recorded (5% vs. 2%; $p < 0.05$) compared to their housed counterparts. Conversely, housed females were more likely to have mood (26% vs. 15%; $p < 0.001$) and anxiety disorders recorded (11% vs. 6%; $p < 0.05$) compared to females who were homeless.

A similar trend was observed among males, with the most substantial difference between the two populations in diagnosed substance-related and addictive disorders. Among males experiencing homelessness, 53% had such a diagnosis compared to 29% of housed males ($p < 0.001$). Housed males were more likely to have mood disorders (15% vs. 9%; $p < 0.001$) and anxiety disorders recorded (6% vs. 2%; $p < 0.001$) and less likely to have selected disorders of personality and behaviour (3% vs. 6%; $p < 0.001$) compared to males who were homeless.

Discussion

Among hospitalizations for substance-related poisonings, males and younger adults were disproportionately represented

TABLE 4
Intention of poisoning among hospitalizations for a substance-related poisoning of people experiencing homelessness and of people with housing, Canada (excluding Quebec), April 2019 to March 2020

Intention[a]	Hospitalizations of people experiencing homelessness, % (n)	Hospitalizations of people with housing, % (n)	X^2 statistic (df)
Total			
Accidental**	62 (382)	45 (4519)	62.5 (1)
Intentional self-harm**	26 (162)	46 (4551)	90.2 (1)
Undetermined*	12 (76)	10 (949)	5.0 (1)
Females			
Accidental**	54 (97)	38 (1986)	18.6 (1)
Intentional self-harm**	37 (67)	56 (2928)	24.6 (1)
Undetermined	10 (18)	8 (398)	1.4 (1)
Males			
Accidental**	65 (285)	54 (2532)	19.8 (1)
Intentional self-harm**	22 (95)	35 (1620)	29.9 (1)
Undetermined	13 (58)	12 (550)	0.9 (1)

Abbreviations: X^2, chi-square; df, degrees of freedom.

[a] Poisonings were classified as accidental unless there was documentation clearly recording other intentions, which has potentially led to an overrepresentation of accidental poisonings.

*$p < 0.05$.

**$p < 0.001$.

among people experiencing homelessness, as compared to the housed population. Higher proportions of homelessness among men than among women have been previously reported.[2,18] However, recent evidence suggests that many more women than men may be experiencing hidden homelessness, resulting in misclassification of housing status among females.[19] The younger mean age of people experiencing homelessness hospitalized for substance-related poisoning observed in this study likely reflects the younger age of people who are homeless.[2]

We found that a higher proportion of substance-related poisoning hospitalizations among people experiencing homelessness were recorded as accidental rather than intentional self-harm, and that opioids and stimulants, notably fentanyl and its analogues and heroin, were most commonly involved in poisonings leading to hospitalizations. The large proportion of these poisonings being accidental is likely due to the increase in fentanyl and its analogues in the illicit (unregulated) drug supply. These substances have high potencies and are increasingly being combined with other controlled substances.[20-22] The people who were hospitalized may not have known that the substance they were taking also contained fentanyl and/or its analogues, they may have combined substances to alleviate withdrawal symptoms

or to enhance their experience,[23] or the dose may have been higher than expected, leading to an accidental poisoning.

Hospitalizations for substance-related poisonings among people experiencing homelessness were longer than for those who were housed, with total lengths of stay averaging 11 and 6.6 days, respectively. This finding may be explained by the higher rates of infectious diseases, chronic diseases and long-term physical health conditions prevalent among people who are homeless[24,25] as well as higher rates of mental disorders, as observed in our study. Hospitalized individuals may have also received treatment for comorbidities, resulting in increasing lengths of stay. Further, the lengths of stay for alternate level of care may have differed between the two populations because hospitals may not have options for discharging patients experiencing homelessness.

Lastly, people who were homeless were more likely than those with housing to leave the hospital against medical advice or before being formally discharged by a health care professional. This finding is consistent with previous literature that people who are discharged against medical advice are more likely to be young, male and experiencing homelessness.[26,27] Choi et al.[26] found that people who are discharged against medical advice had

higher rates of both readmission within 14 days and mortality within 12 months. This particular finding has important implications for clinical care settings looking for ways to decrease the number of patients leaving hospital against medical advice and thus reduce harms, mortality and associated costs and increase health care satisfaction.

Strengths and limitations

To our knowledge, this analysis is the first to examine characteristics of substance-related poisoning hospitalizations of people experiencing homelessness across Canada. The DAD includes inpatient acute hospitalization discharges from all provinces and territories except Quebec and therefore has substantial coverage of the population of interest in this study.

There are, however, limitations. First, this analysis only examined acute inpatient hospitalizations, and patterns of substance-related poisonings may vary across different health care settings. For example, individuals with less severe poisonings may be treated through emergency medical services or in the emergency department; not including these health care settings could lead to underestimating the overall prevalence of substance-related poisonings. Moreover, if the pattern of where people seek health care for such

TABLE 5
TABLE 5
Mental disorder recorded during hospitalizations for substance-related poisoning of people experiencing homelessness and of people with housing, Canada (excluding Quebec), April 2019 to March 2020

Mental disorder	People experiencing homelessness, % (n)	People with housing, % (n)	X^2 statistic (df)
Total			
Any mental disorder**	61 (380)	52 (5196)	20.0 (1)
Substance-related and addictive disorders[a]**	51 (319)	25 (2509)	206.6 (1)
Mood disorders[b]**	11 (68)	21 (2122)	37.6 (1)
Anxiety disorders[c]**	3 (18)	9 (865)	25.4 (1)
Schizophrenia and other psychotic disorders[d]**	4 (28)	2 (236)	11.2 (1)
Selected disorders of personality and behaviour[e]	8 (51)	7 (694)	1.5 (1)
Other mental disorder[f]*	9 (53)	12 (1232)	7.9 (1)
Females			
Any mental disorder*	64 (117)	56 (2971)	5.0 (1)
Substance-related and addictive disorders[a]**	48 (87)	21 (1135)	71.2 (1)
Mood disorders[b]**	15 (27)	26 (1392)	11.9 (1)
Anxiety disorders[c]*	6 (11)	11 (592)	4.7 (1)
Schizophrenia and other psychotic disorders[d,g]*	5 (9)	2 (96)	
Selected disorders of personality and behaviour[e]	14 (25)	11 (565)	1.8 (1)
Other mental disorders[f]	14 (25)	15 (814)	0.4 (1)
Males			
Any mental disorder**	60 (263)	47 (2223)	25.2 (1)
Substance-related and addictive disorders[a]**	53 (232)	29 (1373)	103.8 (1)
Mood disorders[b]**	9 (41)	15 (729)	12.1 (1)
Anxiety disorders[c]**	2 (7)	6 (273)	13.9 (1)
Schizophrenia and other psychotic disorders[d]	4 (19)	3 (140)	2.4 (1)
Selected disorders of personality and behaviour[e]**	6 (26)	3 (128)	14.1 (1)
Other mental disorders[f]	6 (28)	9 (417)	3.2 (1)

Abbreviations: X^2, chi-square; df, degrees of freedom; ICD-10-CA, *International Classification of Diseases and Related Health Problems, Tenth Revision, Canada*[15].

[a] ICD-10-CA codes F10–F19, F55 and F63.0.

[b] ICD-10-CA codes F30–F34, F38, F39, F53.0 and F53.1.

[c] ICD-10-CA codes F40, F41, F93.0–F93.2 and F94.0.

[d] ICD-10-CA codes F20–F25, F28 and F29.

[e] ICD-10-CA codes F60–F62, F68 (excluding F68.1) and F69.

[f] ICD-10-CA codes F42–F45, F48.0, F48.1, F48.8, F48.9, F50–F52, F53.8, F53.9, F54, F59, F63 (excluding F63.0), F68.1, F90–F92, F93.3, F93.8, F93.9, F94.1, F94.2, F94.8, F94.9, F95, F98.0, F98.1–F98.5, F98.8, F98.9, F99 and O99.3.

[g] Fisher exact test used when counts for cells were less than 5.

*$p < 0.05$.

**$p < 0.001$.

poisonings and who is admitted to hospital varies by housing status, these results may not adequately reflect true differences.

Also not captured were data on people who died before being admitted to hospital, which potentially focused this analysis on less severe cases or instances where help was more readily available.

The unit of analysis was hospital discharge and not at the person level or for entire episodes of care. People could have been readmitted multiple times during the study period, which would be counted as multiple hospitalizations. People with multiple admissions may have unique characteristics that are not presented in this study.

Another limitation was that identification of homelessness status may have relied on self-reported information. It is possible that some patients may not have disclosed their homelessness status, or were unable to due to disability or death, which could have resulted in their being misclassified. Similarly, it was only possible to examine housing status as a binary term, as either experiencing homelessness, or not. More nuance is required by including unstable housing, poor housing quality, overcrowding or former homelessness to fully understand the impact of housing status. It is a relatively new requirement to record homelessness status on hospital discharge records and therefore a trend analysis was not possible.

Identifying intention of the poisoning also relied on self-reported information, which can introduce bias if patients are unwilling or unable to disclose this information. Poisonings were classified as accidental unless other intentions were clearly documented, potentially leading to an over-representation of accidental poisonings. Throughout this analysis it was not possible to determine which poisonings were a result of pharmaceutical or illicit (or unregulated) opioids, or a combination of both, which hinders the ability to develop targeted interventions to reduce harms associated with substances from different sources.

The estimates of recorded mental disorders did not reflect the overall prevalence of mental disorders among those hospitalized for substance-related poisonings; rather, the mental disorders that were

recorded were relevant to the patient's stay in hospital.

Lastly, Canadian Armed Forces veterans are two to three times more likely to experience homelessness than the general population, and the absence of military status in these data hinders the ability to provide a comprehensive understanding of the relationships between military service, housing status and substance-related poisonings.[28]

Implications

The COVID-19 pandemic has widened health disparities, particularly among hard-to-reach populations.[2-4] There has also been an increase in the number of people experiencing homelessness, as well as an increase in the number of substance-related poisonings across the country.[2,10,11] Although we examined a pre-pandemic period, the results of this study could be used to support actions to reduce substance-related harms by strengthening public health and social infrastructure as people continue to experience the long-term impacts associated with the COVID-19 pandemic as well as other economic impacts.

These findings highlight the need for health care professionals, researchers and policy makers to better understand the intersection of homelessness, mental illness and substance-related harms. They can also inform sectors that interact with vulnerably housed individuals. In particular, these findings demonstrate how substance-related harms and care in hospital settings may differ for people with housing compared to people experiencing homelessness, as exhibited by the high proportion of substance-related poisoning hospitalizations that ended with leaving against medical advice. This difference in care may be due to a variety of factors, such as care not meeting the needs of this population or due to a lack of trust or stigma, and may warrant further investigation to reduce barriers to care for people who are homeless.

Conclusion

Compared to people with housing, unhoused people hospitalized for a substance-related poisoning are more likely to be younger, male and with a recorded mental disorder. A higher proportion of substance-related poisoning hospitalizations of

unhoused people were accidental and involving opioids and stimulants, particularly fentanyl and its analogues and heroin. Lastly, substance-related poisoning hospitalizations of unhoused people lasted longer and were more likely to end with leaving the hospital against medical advice.

These findings emphasize the importance of acknowledging the intersectionality of mental illness, substance use and housing status when considering options to address substance-related harms. Future studies should aim to determine how care in hospital settings and other social services can optimize support, in order to prevent further substance-related harms.

Conflicts of interest

None to declare.

Authors' contributions and statement

RP: Investigation, data curation, methodology, formal analysis, writing – original draft.

RW: Investigation, data curation, methodology, formal analysis, writing – review & editing.

HO: Conceptualization, supervision, writing – review & editing.

VG: Conceptualization, supervision, validation, writing – review & editing.

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Original mixed methods research

Public health communication professional development opportunities and alignment with core competencies: an environmental scan and content analysis

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Abstract

Introduction: Communication is vital for effective and precise public health practice. The limited formal educational opportunities in health communication render professional development opportunities especially important. Competencies for public health communication describe the integrated knowledge, values, skills and behaviours required for practitioner and organizational performance. Many countries consider communication a core public health competency and use communication competencies in workforce planning and development.

Methods: We conducted an environmental scan and content analysis to determine the availability of public health communication professional development opportunities in Canada and the extent to which they support communication-related core competencies. Three relevant competency frameworks were used to assess the degree to which professional development offerings supported communication competency development.

Results: Overall, 45 professional development offerings were included: 16 "formalized offerings" (training opportunities such as courses, webinars, certificate programs) and 29 "materials and tools" (resources such as toolkits, guidebooks). The formalized offerings addressed 25% to 100% of the communication competencies, and the materials and tools addressed 67% to 100%. Addressing misinformation and disinformation, using current technology and communicating with diverse populations are areas in need of improved professional development.

Conclusion: There is a significant gap in public health communication formalized offerings in Canada and many of the materials and tools are outdated. Public health communication professional development offerings lack coordination and do not provide comprehensive coverage across the communication competencies, limiting their utility to strengthen the public health workforce. More, and more comprehensive, professional development offerings are needed.

Keywords: health communication, core competencies' professional development, workforce planning

Highlights

- There have been widespread calls to transform the public health workforce in Canada.
- We conducted an environmental scan and content analysis to determine current professional development opportunities in public health communication and investigate how well they support communication-related core competencies.
- We found 45 professional development offerings relevant to public health communication in Canada, with varying coverage of the core competencies.
- Addressing misinformation and disinformation, the use of current technology and communicating with diverse populations are areas in need of improved professional development.
- This snapshot of the current state of public health communication professional development shows that coverage across the competencies is neither coordinated nor comprehensive.

Introduction

With the field of public health constantly evolving due to new knowledge from research and practice and changing technology, effective communication is critical, especially during crises.[1] Effective communication is also central to the design and implementation of public health initiatives, which impact adoption of recommended health behaviours, especially among those in underserved population groups.[2]

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There have been widespread calls to improve the Canadian public health system, including updating core competencies for public health and related professional development opportunities[1,3-5] as well as public health communication.[6,7] Changes in the information ecosystem have altered methods of communication and increased the threat of misinformation, undermining trust in public health communication.[8,9] This is especially apparent in the context of social media, which is an important tool for delivering public health messages.[1,9]

Without the opportunities to continually update and adapt their communication competencies and skills, public health practitioners risk losing their credibility and the public's trust, negatively affecting the health of Canadians.[1] Professional development allows for the enhancement of existing skills and behaviours and acquisition of new knowledge and attitudes in order to meet workforce demands.

In 2008, the Public Health Agency of Canada (PHAC) published *Core Competencies for Public Health: Release 1.0* ("PHAC core competencies") after extensive consultation with public health researchers and practitioners across the country.[10] The 36 PHAC core competencies are organized into seven categories, one of which is communication.[10] At the time of writing, the PHAC core competencies were undergoing renewal and modernization. Because of the age of the current PHAC core competencies, other public health competency frameworks may help inform Canadian public health workforce planning.

Health Promotion Canada has a framework for discipline-specific competencies for health promotion ("HPC competencies") based on the PHAC core competencies.[11] The Council on Linkages Between Academia and Public Health Practice ("Council on Linkages") in the USA has foundational core competencies for public health practitioners;[12] these core competencies have been regularly revised since their release in 2001 and provide an up-to-date framework that reflects modern communication requirements, including addressing the infodemic and culturally appropriate communication.[12]

There are similarities across the three competency frameworks, including tailoring communication to various audiences, choosing the right communication channel(s),

mobilizing communities and using technology effectively. The extent to which communication competencies from these frameworks inform professional development opportunities for public health communication is unknown.

Gaps have been identified in the public health communication courses offered by the master of public health programs in Canada.[13,14] Also, research into online continuing education programs found that only about half the courses offered in 2015 included communication as a topic.[15] Although several online courses are available for public health professionals in Canada, Jung et al.[15] found that these did not provide comprehensive coverage of the PHAC core competencies, including within the communication domain; nor were they readily accessible through a central online database.

Given the significance of communication in public health practice and its focus in public health competency frameworks, it is important to understand the opportunities and resources currently available and how these align with the relevant competency frameworks. Identifying current professional development offerings for public health practitioners will also highlight the opportunities for building workforce competence and communication capacity.

This current research aims to determine the availability of public health communication professional development opportunities and the extent to which they support core competencies in communication. The objectives of this research include:

- using an environmental scan to identify currently available Canadian professional development opportunities relevant to public health communication; and

- conducting a content analysis to describe how these identified professional development opportunities align with communication competencies from the relevant frameworks (PHAC core competencies, HPC competencies, and Council on Linkages competencies).

Methods

We conducted an environmental scan to determine the current professional development landscape that supports public health communication competencies in

the Canadian workforce. Our search methods were guided by previous research on competencies for public health and continuing education.[16,17] Following the steps outlined by Bengtsson[18] and Krippendorff,[19] we analysed the content of all the professional development opportunities identified in the scan to determine their nature and the degree to which they support the development of public health communication competency.

Search strategy

First, the research team searched, by way of a Google site search (site:URL search terms) using the term "health communication," the entire contents of websites of public health organizations known to them.

Next, we conducted an Internet search using the Google search engine and the following search terms: "health communication," "public health," "continuing education," "Canada." A subsequent search used the search terms "health communication," "public health," "course," "Canada." Consistent with methodological examples and recommendations, we reviewed the first 10 pages of results of each search.[17,20] The same two searches were also run using the Ontario Public Health Libraries Association custom Google search engine,[21] the grey literature database CABI Global Health[22] and the custom Google search engine developed by Queen's University Library.[23] Other resources known to the research team were also included.

Search criteria

Two researchers (MM and JEM) independently reviewed the professional development offerings for relevance to the following inclusion and exclusion criteria and resolved all conflicts by discussion. For a professional development opportunity to be included, it had:

- to be offered or be available within the last 12 months (materials and tools may still be available online long after their initial publication);

- to be widely available and applicable to Canadian public health practitioners;

- to reoccur as a multistep program offered to different public health organizations and/or allow repeated access through online platforms;

- to be in English;
- to be offered in Canada or be available to Canadians;
- to be relevant to Canadian public health infrastructure and governance; and
- to be related to public health communication.

Included were "formalized offerings," that is, training opportunities such as certificate programs, courses, graduate programs, summer institutes, webinars and online learning programs, and "materials and tools," that is, resources such as guidebooks, white papers, expert panel reports, toolkits, guidelines and briefing notes, conference proceedings, blog posts, factsheets, toolkits and websites.

Offerings were excluded if they were single occurrence webinars, conferences or workshops; and/or limited in geographical relevance or offered in a relatively small geographical area or organization (e.g. one local public health unit).

Data collection

One researcher (HW) collected the data between 13 November 2022 and 6 December 2022 and recorded the information on an Excel spreadsheet.[24] The following information was collected for each formalized offering: name, description, type (e.g. certificate program, webinar), format (e.g. hybrid, online), intended audience, time commitment, cost, the institution providing the offering, the country providing the offering and its geographical reach, date last offered, currently offered (Y/N), the URL, the search date and the search source. The following information was collected for materials and tools: title, author, description, type (e.g. guidebook, toolkit), intended audience, location, date, the URL, the search date and the search source.

Content analysis

The communication-related competencies from the PHAC core competencies,[10] the HPC competencies[11] and the Council on Linkages[12] were used to assess the degree to which the professional development offerings support public health communication competencies (Table 1).

Three researchers (MM, HW and JEM) created a codebook describing key variables identified during data collection and the communication-related competencies from the frameworks described above. (This codebook is available at https://osf.io/fjtdc/.) Subvariables for each competency that reflected the named audiences, channels, tools and techniques were also captured. Professional development opportunities could be coded for the overall competency and may or may not be coded for the various subvariables depending on whether the specific audiences, channels, tools and techniques were covered. The codebook was validated prior to coding. Two researchers (HW and MM), working independently, coded the full dataset, discussing and resolving all conflicts along the way.

Statistical analysis

Descriptive statistics (frequencies) were calculated using Excel[24] to assess how each of the professional development opportunities support the communication competencies. We used RAWGraphs[25] to present the data visually.

Results

The environmental scan uncovered a total of 45 professional development opportunities related to public health communication. Of these, 16 (36%) were formalized offerings and 29 (64%) were materials and tools. Three of the 16 formalized offerings were available and analyzed in full. The remaining 13 were analyzed based on the summary information available (most often because they were behind a paywall). All materials and tools were available and analyzed in full.

For details on the formalized offerings and materials and tools, refer to https://osf.io/fjtdc/.

Characteristics of professional development opportunities

Just over half of the 16 formalized offerings (n = 9; 56%) and most of the 29 materials and tools (n = 26; 90%) originated from Canada (Table 2). While all the formalized offerings were offered in the last 12 months (and thus met our inclusion criteria), only one (3%) set of materials and tools was published in the last 12 months and only six (21%) in the

last 5 years, although all were available online within the last 12 months, thus meeting our inclusion criteria.

Just over two-thirds of the formalized offerings (n = 11; 69%) and all the materials and tools (n = 29; 100%) were offered online asynchronously; 13 of the formalized offerings (81%) and 28 of the materials and tools (97%) focused on general public health practitioners. The most common formalized offerings were courses (n = 6; 38%); were focused on knowledge mobilization (n = 5; 31%); and were offered by academic institutions (n = 4; 14%). The most common materials and tools were resources (n = 12; 41%); were focused on general health communication (n = 10; 34%); and were offered by arms-length organizations (n = 8; 28%).

Professional development opportunities were delivered by various organizations and institutions. Formalized offerings were mostly offered by academia (n = 6; 38%), government-funded arms-length institutions (n = 3; 19%) and hospitals (n = 3; 19%). Materials and tools were mostly offered by government-funded arms-length institutions (n = 8; 28%), provincial governments (n = 8; 28%) and academia (n = 4; 14%) (Table 1; Figure 1). No formalized offerings were provided by public health units, NGOs or provincial governments, and very few materials and tools were offered by public health units and professional associations (n = 1 each; 3%) (Table 1; Figure 1).

Competencies within professional development opportunities

Overall, across the professional development opportunities (formalized offerings and materials and tools combined; see Table 1), competencies related to tailoring information (n = 44; 98%), using different communication strategies (n = 43; 96%) and communicating with internal and external audiences (n = 42; 93%) were the most supported; competencies related to misinformation and disinformation (n = 12; 27%), current technology (n = 25; 56%) and using media (n = 33; 73%) were the least supported (data not shown). Figure 2 shows the alignment of the professional development offerings with the competency frameworks broken down by formalized offerings (n = 16) and materials and tools (n = 29).

TABLE 1
Summary of communication competency statements from three frameworks

Competency short name / framework	Competency statement
Public Health Agency of Canada	
Communication skills	6.1 Communicate effectively with individuals, families, groups, communities and colleagues.
Interpret information	6.2 Interpret information for professional, non-professional and community audiences.
Mobilize people	6.3 Mobilize individuals and communities by using appropriate media, community resources and social marketing techniques.
Current technology	6.4 Use current technology to communicate effectively.
Health Promotion Canada	
Tailor information	7.1 Provide information tailored to specific audiences (e.g. professional, community groups, general population) on population health status and health promotion action.
Communication methods	7.2 Apply communication methods and techniques to the development, implementation and evaluation of health promotion action.
Media use	7.3 Use the media, information technologies and community networks to receive and communicate information.
Diverse populations	7.4 Communicate with diverse populations in a culturally appropriate manner.
Council on Linkages Between Academia and Public Health Practice[a]	
Communication strategies	3.1 Determine communication strategies.
Internal/external audiences	3.2 Communicate with internal and external audiences.
Mis/dis/information	3.3 Respond to information, misinformation and disinformation.
Facilitates communication	3.4 Facilitate communication between individuals, groups and organizations.

Sources: Public Health Agency of Canada[10]; Pan-Canadian Committee on Health Promoter Competencies[11]; Council on Linkages Between Academia and Public Health Practice[12].

[a] The Council on Linkages Between Academia and Public Health Practice[12] suggests that public health professionals require four overall communication skills. These are made up of 23 subcompetencies. For ease of use, these subcompetencies have been combined into the four overall competencies shown.

Alignment with PHAC communication competencies

On average, formalized offerings covered 2.25 (range: 0–4) out of the 4 communication-related PHAC core competencies and materials and tools covered 3.55 out of these 4 competencies (range: 2–4) per professional development offering. The PHAC core competency most commonly supported by professional development opportunities was interpreting information, which was addressed by all 29 of the materials and tools and three-quarters (n = 12; 75%) of formalized offerings (Table 3). Communication skills was similarly supported by all of the materials and tools and almost two-thirds (n = 10; 63%) of formalized offerings. Mobilizing people was slightly less supported with 90% (n = 26) of materials and tools and 50% (n = 8) of formalized offerings addressing it. The least supported competency was current technology with 66% (n = 19) of materials and tools and 38% (n = 6) of formalized offerings addressing it.

The types of intended audiences were less frequently addressed by formalized offerings compared to materials and tools (Table 3), with colleagues the least addressed audience type. Professional development opportunities most often addressed interpreting information for communities, while professional audiences were least covered. Further, social marketing techniques for mobilizing individuals and communities were not well addressed by the professional development opportunities. Finally, formalized offerings infrequently covered specific technologies identified in the competencies, while materials and tools addressed using websites and social media in approximately half of the resources that addressed this competency.

TABLE 2
Overview of characteristics associated with formalized offerings and materials and tools

Characteristics	Formalized offerings N = 16, n (%)[a]	Materials and tools N = 29, n (%)[a]
Country		
Canada	9 (56)	26 (90)
USA	5 (31)	3 (10)
Canada and USA	2 (13)	0
Time since offered/developed, years		
<5	16 (100)	6 (21)
5–10	0	9 (31)
11–15	0	10 (34)
>15	0	2 (7)
No date	0	2 (7)
Delivery		
Online asynchronous	11 (69)	29 (100)
Online synchronous	3 (16)	0
In person	1 (6)	0
Hybrid (in person and online)	1 (6)	0

Continued on the following page

Characteristics	Formalized offerings N = 16, n (%)[a]	Materials and tools N = 29, n (%)[a]
Format		
Courses	6 (38)	0
Webinars	5 (31)	2 (7)
Certificate programs	3 (19)	0
Graduate programs	1 (6)	0
Summer institutes	1 (6)	0
Resources	0	12 (41)
Toolkits	0	4 (14)
Guidebooks	0	3 (10)
Expert panel reports	0	2 (7)
Websites	0	1 (3)
Guidelines	0	1 (3)
Factsheets	0	1 (3)
Conference proceedings	0	1 (3)
Briefing notes	0	1 (3)
Blog posts	0	1 (3)
Offered by		
Academia	6 (38)	4 (14)
Arms-length institutions (government funded)	3 (19)	8 (28)
Federal government	2 (13)	2 (7)
Hospitals	3 (19)	3 (10)
Professional associations	2 (13)	1 (3)
Provincial government	0	8 (28)
Non-government organizations	0	2 (7)
Public health units	0	1 (3)
Intended audience(s)[b]		
Public health practitioners	13 (81)	28 (97)
Health care providers	9 (56)	16 (55)
Academia and researchers	7 (44)	13 (45)
Public health leadership	6 (38)	26 (90)
Main focus/topic		
Knowledge mobilization	5 (31)	3 (10)
General health communication	3 (19)	10 (34)
Health literacy	3 (19)	5 (17)
Risk or crisis communication	2 (13)	4 (14)
Using technology	1 (6)	3 (10)
Evidence-informed decision-making	1 (6)	0
Other	1 (6)	4 (14)
Informatics	0	0
Social marketing	0	0
Targeting and tailoring communications	0	0

[a] Percentages were rounded to the nearest whole number; category totals may not add to 100%.

[b] Because multiple subvariables were possible, totals can exceed 100%.

Alignment with HPC communication competencies

Overall, materials and tools were strongly aligned with all the HPC communication competencies (Table 4). Tailoring information to specific audiences was the most widely addressed competency by both formalized offerings and materials and tools. Coverage of the different communication methods varied, with the media (traditional and new media) addressed by seven (44%) formalized offerings and 19 (66%) materials and tools, and information technologies addressed by just two (13%) formalized offerings and 10 (34%) materials and tools. While communicating with diverse populations was well supported by formalized offerings (n = 7; 44%) and materials and tools (n = 27; 93%), it was often addressed exclusively in the context of health literacy (n = 2/7 [29%] formalized offerings; n = 15/27 [52%] of materials and tools).

Alignment with Council on Linkages communication competencies

Overall, the materials and tools had more comprehensive alignment with the Council on Linkages communication competencies based on the information available, except for addressing misinformation and disinformation (Table 5). This competency subvariable had the lowest support from professional development opportunities with only four (25%) of formalized offerings and eight (28%) of materials and tools addressing misinformation and disinformation.

Although the remaining three competencies (communication strategies, internal/external audiences, facilitate communication) were broadly addressed by many professional development opportunities, there was less focus on some key elements. Specifically, while 17 (59%) of materials and tools addressed communicating with internal audiences, only two (13%) formalized offerings addressed this element of the competency.

Discussion

This study examined the professional development opportunities for public health communication widely available currently or within the last 12 months, in English, to Canadians or relevant to Canadian public health, and how closely aligned they are with public health

FIGURE 1
Formalized offerings and materials and tools by host organization and delivery mode
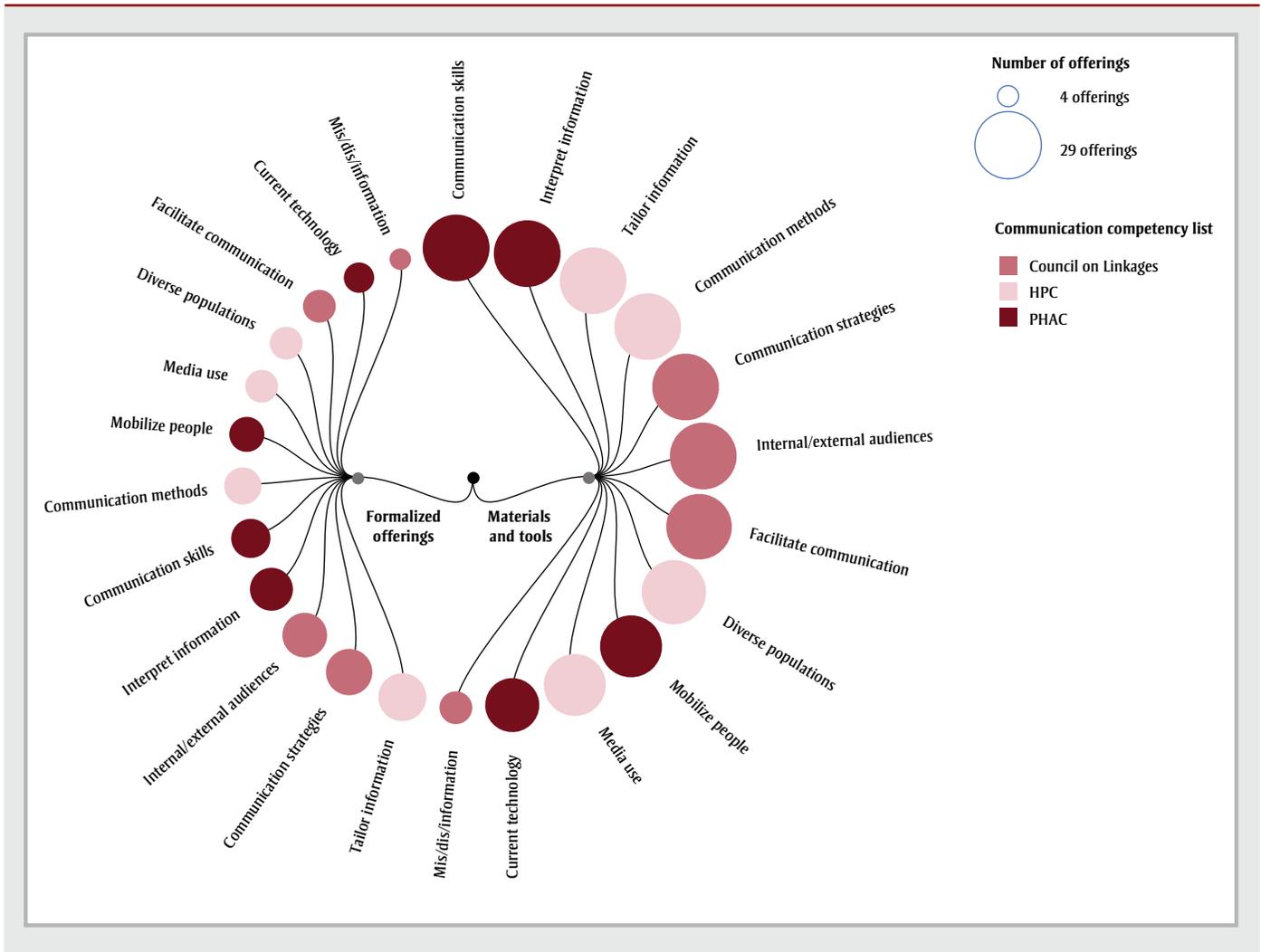
Abbreviations: Council on Linkages, Council on Linkages Between Academia and Public Health Practice; HPC, Health Promotion Canada; PHAC, Public Health Agency of Canada.

Notes: The legend provides two reference points (smallest circle = 4 offerings; largest circle = 29 offerings) visualized in the figure.

Formalized offerings: certificate (programs), courses, graduate programs, summer institutes, webinars.

Materials and tools: conference proceedings, blog posts, briefing notes, expert panel reports, factsheets, guidebooks, toolkits, websites, guidelines.

communication competencies relevant in Canada (PHAC and HPC) and the USA (Council on Linkages).

We found 45 offerings related to public health communication of which 16 were formalized offerings (training opportunities, e.g. certificate programs, courses, webinars) and 29 were materials and tools (resources, e.g. guidebooks, toolkits, reports). Less than one-quarter of the materials and tools were published in the last 5 years. The older age of some materials and tools may have contributed to the competency gaps in current technology and in addressing misinformation and disinformation. Most often, formalized offerings focussed on knowledge mobilization while materials

and tools focussed on general health communication.

Professional development offerings were not developed or coordinated by a governing body, but were offered by different organizations and agencies across Canada and the USA. Overall, the formalized offerings address fewer competencies relative to the materials and tools; however, this may be, at least in part, because we were only able to analyze summary materials for the majority of formalized offerings whereas all materials and tools were available and analyzed in full.

Competencies are the integrated knowledge, skills, attitudes/values and behaviours

that public health practitioners and organizations must possess for effective public health practice.[26] Public health organizations can take competencies into account when recruiting personnel, assessing job performances and identifying professional development needs.[26] Workforce training and continuing education are an essential part of competency development, especially when there is a lack of graduate training options in communication and other competencies, as was found in Canada.[14,15] The Canadian Public Health Association has recommended workforce training in modernized competencies as key for strengthening the public health system.[1,27] PHAC used to offer Skills Online, an eight-module professional development

FIGURE 2
Alignment of professional development opportunities (formalized offerings and materials and tools combined)
with communication competencies
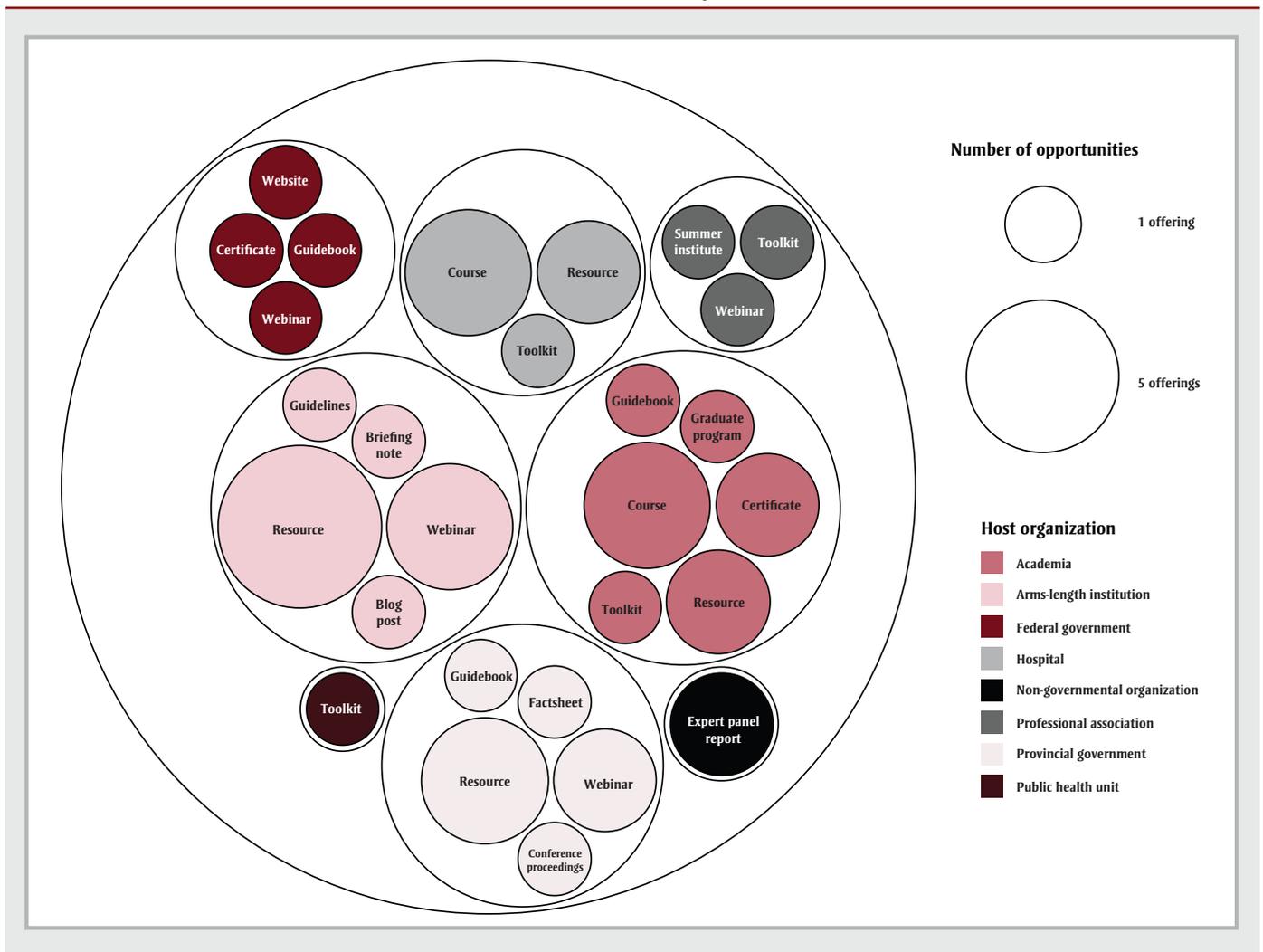
Note: The legend provides two reference points (smallest circle = 1 offering, and largest circle = 5 offerings) visualized in the figure.

program that directly supported the core competency categories.[28] The results of this study show that the professional development opportunities currently available do not cover all the PHAC core competencies, with formalized offerings averaging 2.25 competencies per opportunity and materials and tools averaging 3.55 competencies per opportunity. No equivalent comprehensive training program fills this gap.

Our research was specific to the public health communication categories; in fact, we found that there is no comprehensive professional development program for public health communication. What is available is a range of programs offered by many different types of organizations and agencies, some of which may not be up-to-date and which do not comprehensively support current communication competency development needs. While a comprehensive federal training program such as Skills Online[28] may provide coordinated training across the full range of core competencies (including communication), the smaller professional development offerings could not be expected to be equally comprehensive. Rather, the professional development offerings provided by the various organizations and institutions were more targeted and not designed to cover the full range of communication competencies. Examining the professional development opportunities collectively allows for understanding what is available, how the opportunities support the development of communication competencies, and what areas of opportunity exist for public health communication in the absence of a comprehensive competency-based federal training program.

Compared to the formalized offerings, the materials and tools were more aligned with the communication-related core competencies; however, practitioners need to seek out these resources, without the benefit of a facilitated structure such as could be expected from a course. Diverse effective training includes online courses, mentorship, just-in-time training and community-engaged training, through academia, government, community and other partnerships.[29] Materials and tools for public health communication would be less likely to reflect these pedagogical practices.

Further, recent research found that fewer than half of the master of public health

TABLE 3
Alignment between professional development opportunities and PHAC communication competencies and subvariables including specific audiences, channels, techniques and tools in each competency

Competency	Formalized offerings, n (%)	Materials and tools, n (%)
Communication skills[a]	10 (63)	29 (100)
Colleagues	1 (6)	17 (59)
Families	4 (25)	21 (72)
Communities	7 (44)	24 (83)
Groups	4 (25)	26 (90)
Individuals	4 (25)	27 (93)
Interpreting information[a]	12 (75)	29 (100)
Professional	6 (38)	12 (41)
Non-professional	7 (44)	15 (52)
Community	10 (63)	28 (97)
Mobilizing people[a]	8 (50)	26 (90)
Social marketing techniques	2 (13)	9 (31)
Community resources	3 (19)	19 (66)
Media	6 (38)	19 (66)
Current technology[a]	6 (38)	19 (66)
Software	0	4 (14)
Webinar	0	5 (17)
Websites	2 (13)	12 (41)
Social media	4 (25)	16 (55)

Source: Public Health Agency of Canada.[10]

Abbreviation: PHAC, Public Health Agency of Canada.

[a] Because multiple subvariables were possible, totals can exceed 100%.

programs in Canada offer courses that focus on health communication, and none specialize in health communication.[14] As with professional development, a systematic approach to enhancing communication competence in the public health workforce is needed, and master of public health programs should include targeted health communication education taught by faculty members with the relevant expertise. In addition, curricula need to be regularly reviewed to make sure they are aligned with contemporary competencies and current public health needs.

Comprehensive professional development opportunities that address contemporary public health communication needs will strengthen our capacity and ensure the availability of a skilled workforce. In contrast to current offerings in Canada, the selection of trainings in public health communication for students and practitioners in the USA is large and comprehensive. The Public Health Foundation offers the TRAIN Learning Network; the foundation and the New England Public Health Training Center have a number of courses related to communication that are mapped to the Council on Linkages' core competencies for public health professionals.[12,30] There are also 65 schools in the USA that, between them, offer 77 programs on health communication.[31] They could also provide a roadmap for comprehensive training and professional development aligned with core competencies and pedagogy for effective training in Canada.

Overall, the professional development offerings had strong alignment with the communication-related PHAC core competencies, with nearly half (49%) addressing all four competencies. One communication core competency, the PHAC core competency, "current technology" (#6.4), was not widely addressed by formalized offerings but had better coverage within materials and tools, although leveraging technology rather than teaching practitioners how to effectively use it tended to be mentioned. Digital technologies are vital to public health communication, as was evidenced during the COVID-19 pandemic when social media, online big data sources, data visualization, artificial intelligence and digital platforms (e.g. video conferencing software) became increasingly important.[32] Thus, it is critical that the core competencies not only reflect the scope and complexity of digital technologies that should be used by public health in communication initiatives but also that they be mapped to professional development opportunities that teach the technologies to practitioners.

As previously mentioned, the PHAC core competencies are undergoing renewal and modernization, with an estimated launch scheduled for 2024. The Chief Public

TABLE 4
Alignment between professional development opportunities and HPC communication competencies and subvariables, including specific audiences, channels, techniques and tools in each competency

Competency	Formalized offering, n (%)	Materials and tools, n (%)
Tailoring information[a]	15 (94)	29 (100)
Communication methods[a]	9 (56)	29 (100)
Development	6 (38)	28 (97)
Implementation	3 (19)	19 (66)
Evaluation	3 (19)	19 (66)
Using media[a]	8 (50)	25 (86)
Media	7 (44)	19 (66)
Information technologies	2 (13)	10 (34)
Community networks	4 (25)	21 (72)
Diverse populations[a]	7 (44)	27 (93)
Health literacy only	2 (13)	15 (52)

Source: Pan-Canadian Committee on Health Promoter Competencies.[11]

Abbreviation: HPC, Health Promotion Canada.

[a] Because multiple subvariables were possible, totals can exceed 100%.

TABLE 5
Alignment between professional development opportunities and Council on Linkages communication competencies and subvariables, including specific audiences, channels, techniques and tools in each competency

Competency	Formalized offering, n (%)	Materials and tools, n (%)
Communication strategies[a]	14 (88)	29 (100)
Internal/external audiences[a]	13 (81)	29 (100)
Internal	2 (13)	17 (59)
External	12 (75)	29 (100)
Mis/dis/information[a]	4 (25)	8 (28)
Information	3 (19)	7 (24)
Misinformation	4 (25)	8 (28)
Disinformation	3 (19)	6 (21)
Facilitates communication[a]	7 (44)	28 (97)
Individuals	3 (19)	28 (97)
Groups	6 (38)	23 (79)
Organizations	3 (19)	15 (52)

Source: Council on Linkages Between Academia and Public Health Practice.[12]

Abbreviation: Council on Linkages, Council on Linkages Between Academia and Public Health Practice.

[a] Because multiple subvariables were possible, totals can exceed 100%.

Health Officer's 2021 report identified several areas related to communication that must be addressed through the updated competencies and workforce training: addressing misinformation and disinformation; codesigning health information with communities; culturally appropriate communication; enhanced risk and crisis communication; and tailoring information to communities' values and needs.[33] Our research found that most of the professional development offerings did not address misinformation and disinformation, although most did address tailoring communication and communicating with diverse populations. Within the context of communicating with diverse populations, however, the focus was usually on health literacy rather than on cultural competency. These results show opportunities for strengthening our professional development in areas vital to public health communication.

The Canadian public health workforce can be enhanced and supported by building stronger linkages between practice and education, including partnerships between public health schools and public health organizations and associations to co-develop and customize education and training opportunities, including specialized subdisciplines, for public health practitioners and students. Public health organizations and associations play key roles in workforce development and are aware of community-level needs and practitioner competencies through their connection to the field and monitoring and evaluating of key issues. As such, they are in the best position to clarify the public health needs of today and anticipate the needs of tomorrow. Public health schools, meanwhile, bring expertise in pedagogy and competency-based education. Such partnerships would help produce training opportunities that are tailored to organization and practitioner needs, including format, timing and focuses. Further, public health organizations and associations could provide comments and input to public health schools on what they anticipate needing in the future, which is important because of the lead time required to build curriculum and expertise in the future public health workforce.

Strengths, limitations and future research

The search strategy was designed to capture as many professional development offerings meeting our inclusion criteria as possible. The search consisted of English language results only, and some web content was inaccessible without an organization membership. Access to the full details of formalized offerings was often not possible without enrolling in the course; therefore relevant data were mostly extracted from summary information, which may have biased the results given that materials and tools often presented information in full. Further, while formalized offerings needed to be offered within the last 12 months, materials and tools needed to be available online within the last year, but could have been published even 15 years earlier.

Our search and data retrieval processes were also limited by challenges inherent to online research. For example, broken links due to inconsistencies in Internet archival processes were common. Also, our search results may have been biased and influenced in unknown ways by Google's algorithms.[34]

With the PHAC core competencies currently being renewed, this environmental scan provides a valuable snapshot of what is available and how it corresponds to current communication core competencies within the health communication discipline of public health. This scan does not describe other professional development opportunities within other specializations or competency domains. Similar environmental scans of professional development offerings should be completed in the future and results assessed with the updated communication competencies.

Conclusion

The field of public health is constantly changing as a result of new knowledge from research and practice, the changing communication ecosystem and the complexity of problems facing public health practitioners. This flux is heightening the critical role of professional development opportunities for public health practitioners to build and maintain communication-related competencies. Public health core competencies guide workforce planning, job performance assessment and professional development. These competencies are fundamental to public health capacity and contribute to improved population health.

Our findings underscore the need for more training opportunities in public health communication and a comprehensive and coordinated approach to competency-based professional development in Canada. Although the available professional development offerings are relatively well-aligned with the PHAC core competencies, misinformation and disinformation, using current technology and communication with diverse audiences are areas with far fewer opportunities for professional development. By addressing the current gaps and

aligning professional development with updated competencies, public health practitioners will be able to enhance their knowledge, values, skills and behaviours for a more effective and precise public health practice.

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Conflicts of interest

The authors have no conflicts of interest to declare.

Author contributions

MM: Conceptualization, methodology, formal analysis, funding acquisition, investigation, validation, visualization, writing – original draft, writing – review & editing.

DM: Formal analysis, investigation, visualization, writing – original draft, writing – review & editing.

HW: Formal analysis, investigation, methodology, writing – review & editing.

LEG: Funding acquisition, writing – review & editing.

AP: Funding acquisition, writing – review & editing.

JEM: Conceptualization, formal analysis, funding acquisition, methodology, project administration, supervision, validation, writing – review & editing.

All authors have read and agreed to the published version of the manuscript.

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At-a-glance

Provincial and territorial congenital anomalies surveillance: a summary of surveillance programs across Canada

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Abstract

The Canadian Congenital Anomalies Surveillance Network was established in 2002 to address gaps in the national surveillance of congenital anomalies (CAs) and support the sustainability of high-quality, population-based, CA surveillance systems within provinces and territories. This paper highlights the methodologies of each local CA surveillance system, noting similarities and variabilities between each system, to contribute to enhanced national CA surveillance efforts.

Introduction

Congenital anomalies (CAs) are the leading cause of infant deaths in Canada[1] and one of the most frequent causes worldwide.[2] Congenital anomalies surveillance systems were established globally after the thalidomide tragedy, including in Canada, with the national Canadian Congenital Anomalies Surveillance System (CCASS).[3,4]

However, gaps exist in the CCASS data and there are opportunities to address the limitations.[4] Historically, administrative health data ascertained from the Canadian Institute for Health Information (CIHI) Discharge Abstract Database (DAD) have been exclusively used for CCASS.[3,4] The CIHI-DAD comprises hospital discharge data for all provinces and territories, except for Quebec, and is used to identify cases with CAs.[5] The Public Health Agency of Canada (PHAC) developed linkage methodologies to follow up infant

admissions that occur up to one year of age; however, this is not sufficient for complete ascertainment of CAs in Canada, as data may be incomplete.[6] There are limitations in the CIHI-DAD for stillbirths, elective termination of pregnancies for fetal anomalies (ETOPFA), environmental exposures, and individual risk factors, all of which also impact the completeness of the CCASS.

The Canadian Congenital Anomalies Surveillance Network was established in 2002, within the Canadian Perinatal Surveillance System. The goal of this network is to enhance CA surveillance data. Members include clinicians, academics and public health professionals from across Canada.

The *Action Plan to Protect Human Health from Environmental Contaminants,* announced by the Government of Canada in 2008, is a federal initiative designed to

protect the health of Canadians from harmful environmental contaminants.[6] Under this action plan, PHAC, with support from the Canadian Congenital Anomalies Surveillance Network, works with provinces

Highlights

- The Canadian Congenital Anomalies Surveillance Network was established in 2002 under the umbrella of the Canadian Perinatal Surveillance System to support high-quality, population-based congenital anomalies surveillance systems in Canada. Each local congenital anomalies surveillance system covers diverse populations and geography, operates under different structures and has varying program maturity.
- Engagement of every jurisdiction is essential for sustaining local and national CA surveillance.
- Provincial and territorial CA surveillance systems are uniquely positioned to support public health priorities.

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and territories to establish or enhance local CA surveillance systems to improve CA surveillance in Canada. This will address gaps in national CA surveillance, since local data are more complete and accurate.[7] The objective of this paper is to provide an overview of each provincial and territorial CA surveillance system that supports enhanced local and national surveillance activities.

Methods

The Canadian Congenital Anomalies Surveillance Network Data Publication Working Group conducted a survey based on the National Birth Defects Prevention Network's State Birth Defects Surveillance Program Directory.[8] This survey was modified to ascertain program level details across jurisdictions as shown in Table 1.

Every province and territory (British Columbia [BC], Alberta [AB], Saskatchewan [SK], Manitoba [MB], Ontario [ON], Quebec [QC], New Brunswick [NB], Prince Edward Island [PE], Nova Scotia [NS], Newfoundland and Labrador [NL], Yukon [YT], Northwest Territories [NT] and Nunavut [NU]) had opportunities to respond to the survey via email correspondence or through one-on-one interviews in May 2023. Only one representative from each jurisdiction was eligible to respond to the survey, with completion implying consent. Qualitative data were analyzed using thematic analysis and constant comparison methodology.[9]

Health Research Ethics Board (HREB) review and approval were not required, as it was considered a quality assurance project and fell within the scope of CA surveillance practice, and no identifiable registry data were accessed.[10]

Results

Representatives from nine provinces and three territories completed the survey, for a completion rate of 92%. The results of the survey provide an overview of the current state and activities of CA surveillance for each jurisdiction (Table 1).

All local systems report on births occurring within their mother's place of residence. However, two have the capacity to report on out-of-province births. All include live births and stillbirths in their case definition, with half routinely ascertaining early ETOPFAs (i.e. delivered < 20 weeks gestational age). Two additional provinces

(ON and NL) have limited ascertainment for early ETOPFAs. One year after delivery is the case ascertainment limit for most jurisdictions, except for NT (18 years), QC (13 years), ON (discharge from a neonatal intensive care unit) and YT (at birth).

Every system is population-based, with seven using a hybrid method of ascertainment. For instance, they passively receive case notifications and actively ascertain cases using additional data sources such as health records to contribute to completeness and accuracy of CAs within their jurisdiction. The remaining five rely on passive methods. All jurisdictions use multiple data sources, while nine out of 12 verify cases using additional clinical data (e.g. pediatric cardiology).

The reporting of CAs is mandated with supporting legislation in only two jurisdictions (BC and NT). While all programs have undergone privacy and/or ethical reviews, 10 out of 12 have completed a full privacy impact assessment. Three-quarters (9/12) share de-identified record–level data with PHAC, while the remaining share aggregate data. Funding from PHAC helps support 11 out of 12 systems, and 8 out of 12 receive provincial/territorial and/or in-kind supports.

Discussion

The Public Health Agency of Canada, with the support of the Canadian Congenital Anomalies Surveillance Network, has actively engaged each province and territory to establish or enhance local CA surveillance to strengthen national surveillance efforts under the *Action Plan to Protect Human Health from Environmental Contaminants*.[6] Each jurisdiction began at a different stage, with some already operating CA surveillance systems, and others needing to be established or revamped. As highlighted in Table 1, each program is unique and incorporates local diverse populations and geography.

The ascertainment and reporting of out-of-province cases are substantially limited. Provinces and territories report a wide range in the percentage of deliveries that occur outside of their jurisdiction— anywhere from less than 1% up to 75% (data not shown). Due to existing local case definitions and the lack of interjurisdictional data sharing agreements, births or deliveries outside of the mother's place of residence with CAs are missed. Thus, it

is difficult to report on the true burden of CAs. This supports the need for inter-provincial and -territorial data sharing agreements to enhance local surveillance efforts.

The ascertainment of ETOPFAs significantly improves data quality (i.e. completeness), particularly when those less than 20 weeks gestational age are included. Many pregnancies with lethal or severe anomalies (e.g. anencephaly) are terminated early and are not included in most passive systems.[11,12] Two-thirds of local systems include at least limited data for early ETOPFAs, which provides more accurate estimates, particularly for more severe CAs, compared to those that do not include early ETOPFAs. It is also important to distinguish spontaneous stillbirths from ETOPFA at or greater than 20 weeks gestational age. The current definition of stillbirths needs updating to reflect this key distinction, as it has a significant impact on CA and stillbirth surveillance efforts.[13] Nine jurisdictions have the capacity to distinguish spontaneous stillbirths from ETOPFA at or greater than 20 weeks gestational age (data not shown).

All local systems use multiple data sources, including some with clinical data, to contribute to the verification of cases. The capacity to use both passive and active components for CA surveillance, and to verify data using multiple data sources, increases confidence in data quality. This differs from CCASS, which is a passive system that has historically primarily used one health administrative data source for reporting[6] and research.[14,15] Administrative health data are not collected for the purpose of CA surveillance; thus, there are data quality limitations. A previous comparison of CCASS with a provincial CA surveillance system showed that although there was satisfactory agreement between the two systems for some major anomalies, there was often an overestimation of anomalies in CCASS due to a lack of validation and issues with classification and coding.[16] This limitation was also reported when comparing administrative health datasets with dedicated local CA surveillance systems.[17,18] Although hybrid case ascertainment is more resource intensive, it results in more complete and accurate data. This is particularly relevant for rare anomalies and jurisdictions with lower population numbers, as the misclassification and coding of cases can significantly impact prevalence.

TABLE 1
Overview of provincial and territorial congenital anomalies registry and surveillance programs in Canada

Program characteristics	Province/territory[a]											
	BC	**AB**	**MB**	**ON**	**QC**	**NB**	**PE**	**NS**	**NL**	**YT**	**NT**	**NU**
First year of available data	1952	1980	2010	2012	2008	2015	2016	1988	2012	2001	2011	2010
Population reported[b]	BC residents at time of delivery and BC delivery	AB residents at time of delivery and AB delivery	MB residents at time of delivery and MB delivery	ON residents at time of delivery and ON delivery	QC residents at time of delivery and QC delivery	NB residents at time of delivery and NB delivery	PE residents at time of delivery and PE delivery	NS residents at time of delivery and NS delivery	NL residents at time of delivery and NL delivery	YT residents at time of delivery	NT residents at time of delivery	NU residents and NU delivery
Case definition												
LB+SB	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ETOPFA < 20 weeks GA[c]	✓	✓	X	Limited ascertainment	X	✓	✓	✓	Limited ascertainment	X	✓	X
Spontaneous abortion	X	✓	X	X	X	X	Limited ascertainment	✓	✓	X	X	X
Ascertainment limit	1 year	1 year	1 year	Until NICU discharge	13 years	1 year	1 year	1 year	1 year	At birth	18 years	1 year
Total births/year (LB+SB)	≈ 43 700	≈ 50 000	≈ 17 542	≈ 140 000	≈ 80 000	≈ 6200	≈ 1350	≈ 8000	≈ 3800	≈ 425	≈ 590	≈ 810
Population-based system	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Collection methods	Hybrid	Hybrid	Passive	Passive	Passive	Hybrid	Passive	Hybrid	Hybrid	Passive	Hybrid	Hybrid
Legal/privacy considerations												
Reporting of CA mandated	✓	X	X	X	X	X	X	X	X	X	✓	X
PIA required	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	X
Type of data shared with PHAC	Aggregate	Aggregate	De-identified record level	De-identified record level	Aggregate	De-identified record level	De-identified record level	De-identified record level	De-identified record level	De-identified record level	De-identified record level	De-identified record level

Program characteristics	Province/territory[a]											
	BC	AB	MB	ON	QC	NB	PE	NS	NL	YT	NT	NU
Type of funding												
CA surveillance system supported by PHAC funding	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Provincial funding and/or in-kind support	In-kind support from the Provincial Advisory Committee, and the Office of the Public Health Officer	Supported by Alberta Health Services and in-kind support from Alberta Health	In-kind support	BORN funding	X	PerinatalNB resources	In-kind support	In-kind support from IWK Health	Provincially funded	X	X	X
Data sources used for routine ascertainment and verification												
Discharge abstract[d]	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓
Vital events (LB, SB, deaths)	✓	✓	X	X	✓	X	✓	✓	✓	X	✓	✓
Physician billing claims	Limited ascertainment	X	✓	X	X	X	X	✓	X	✓	X	✓
Perinatal database	✓	X	X	✓	X	✓	X	✓	✓	X	X	X
Clinical genetics and/or cytogenetics data	✓	✓	X	✓	X	X	X	X	✓	X	X	X

Program characteristics	Province/territory[a]											
	BC	AB	MB	ON	QC	NB	PE	NS	NL	YT	NT	NU
Other data[e]	Imaging data, pediatric cardiology clinic at BC Children's Hospital	Congenital Anomaly Reporting Form, Newborn screening, pathology reports, provincial electronic clinical information system	None	BORN Information System includes pregnancy, birth and neonatal outcomes	None	Hospital chart review, and MFM chart review, which includes genetics and autopsy results if requested by physician	National Ambulatory Care Reporting System, RIS/ PACS DI System, and Cerner Clinical Information System	Fetal Anomaly Database, IWK Cardiology Database, Medical Services Insurance Claims, DAD for anomaly-related admissions up to 1 year	Outpatient clinics, reports from: x-ray, echocardio-graph, autopsy, maternal fetal assessment unit, genetics	LB with a defect flagged by maternity care providers at discharge. Child with a birth defect flagged by pediatricians, Q and O-35 ICD-10 codes flagged in 3M at Whitehorse General Hospital NACRS	NT Congenital Anomalies Reporting Form; health insurance	None
Multiple data sources used for verification	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Capacity for chart review	✓	✓	X	X	X	✓	X	X	✓	X	✓	✓
Confirmation of common aneuploidies with cytogenetics	✓	✓	X	✓	X	✓	X	X	✓	X	X	X

Source: Survey conducted in 2023 by the Canadian Congenital Anomalies Surveillance Network Data Publication Working Group.

Abbreviations: CA, congenital anomalies; DAD, Discharge Abstract Database; DI, diagnostic imaging; ETOPFA, elective termination of pregnancies for fetal anomalies; GA, gestational age; IWK, Izaak Walton Killam Hospital for Children; LB, live birth; MED-ECHO, maintenance et exploitation des données pour l'étude de la clientèle hospitalière; MFM, maternal fetal medicine; NACRS, National Ambulatory Care Reporting System; NICU, neonatal intensive care unit; PBD, physician billing database; PHAC, Public Health Agency of Canada; PACS, Picture Archiving and Communications System; PIA, privacy impact assessment; RIS, radiology information system; SB, stillbirth.

[a] Province/territory registry/surveillance program: AB, Alberta Congenital Anomalies Surveillance System (ACASS); BC, Enhanced British Columbia Congenital Anomalies Surveillance System (BCCASS); MB, Manitoba Congenital Anomalies Surveillance System (MCASS); NB, PerinatalNB; NL, Perinatal Program Newfoundland and Labrador/Newfoundland and Labrador Health Services (NLCASS); NS, Surveillance of Congenital Anomalies in Nova Scotia (SCANS); NT, NWT Congenital Anomalies Registry; NU, Nunavut Congenital Anomalies Surveillance System; ON, Better Outcomes Registry & Network Ontario (BORN Ontario); PE, Congenital Anomaly Surveillance (PEICANS); QC, Système de surveillance des anomalies congénitales au Québec; YT, Congenital Anomalies Support Yukon. No current information from Saskatchewan was provided.

[b] For NT and YT, residency determines population reporting, no matter where delivery occurred.

[c] For NL, limited ascertainment only if specified in notes of anomalies.

[d] QC uses MED-ECHO.

[e] 3M is a health record management software that includes ICD-10 codes.

Many local programs collaborate with and are supported by experts in a variety of specialties (e.g. maternal fetal medicine, genetics) and their provincial or territorial advisory group (where they exist). Local CA surveillance systems are better positioned to respond to cluster investigations, program planning and resource allocation and to support local interests and needs than a national level system.

Dedicated PHAC funding has provided opportunities for most local systems to establish or enhance CA surveillance within their jurisdiction and contribute to national CA surveillance activities. Funding from health authorities, provincial and territorial governments, and in-kind supports also contribute to local CA surveillance activities. For some programs, dedicated provincial or territorial funding is essential to support operations and sustainability over time.

Strengths and limitations

Almost all provinces and territories completed the survey and reflect the status of CA surveillance across Canada. Representatives from Saskatchewan were invited to participate; however, they were not able to provide any current information. Engagement with provinces and territories, the Canadian Congenital Anomalies Surveillance Network and PHAC contribute to a strengthened CCASS.

Addressing the diversity of each province and territory with a relatively short survey was challenging, and highlights the need for continued engagement and standardization across the country.

Conclusion

The engagement and investment to date from PHAC, provincial and territorial governments, and health authorities have been essential to sustain local and national CA surveillance, as were the efforts and dedication of the Congenital Anomalies Surveillance Network. While national CA surveillance can be reliable in smaller countries, such reliability and accuracy are challenging to achieve in geographically larger countries, highlighting the need for local systems to strengthen national surveillance in Canada.[3,7] To further enhance CA surveillance in Canada, interjurisdictional data sharing agreements are required.

Authors' contributions and statement

CN, CC, QM, KJ, KD, LR, MJ, TB, YN—conceptualization.

CC, QM, KJ, KD, LR, MJ, TB, YN—analysis.

CN, CC, QM, KJ, KD, LR, MJ, TB, YN—writing—original draft.

The content and views expressed in this article are those of the authors and do not necessarily reflect those of local health agencies, provincial and territorial governments, and the Government of Canada.

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Letter to the Editor

Re: Rates of out-of-home care among children in Canada: an analysis of national administrative child welfare data

Chandrakant P. Shah, MD, FRCPC, SM (Hyg), Dr Sc (Hon), OOnt (1,2)

Dear Editor,

I recently read in your journal the article by Pollock et al. titled "Rates of Out-of-Home Care Among Children in Canada: An Analysis of National Administrative Child Welfare Data."[1] I commend the authors for their work. For the past 40 years, the public health and health care professions have increasingly paid attention to the social determinants of health and the upstream approaches to prevention; however, they have neglected children in out-of-home care for too long, as evidenced by the paucity of literature on this vulnerable population. I believe that the majority of the public, including health professionals, assumed that the children who were removed from their homes and placed under the care of government-appointed agencies (mostly Children's Aid Societies or some form of group home) were generally well looked after in terms of their mental, physical and cognitive health. However, this view is not always supported by evidence,[2] and my own experiences also tell a different story.

In the early 1970s, when I was the inaugural full-time medical director for the Children's Aid Society of Vancouver, I was shocked by what I learned. I conducted several studies and wrote papers outlining the dire situation of these vulnerable children and proposed solutions. For example, one-third of the children coming into care had physical, emotional or cognitive disabilities.[3-5] There was a shortage of habilitation services in their communities, which forced children with disabilities to be admitted to foster care. Still, no health histories were available when the children were admitted into care, and there were no transmissions of health histories back to their primary care physicians when they were discharged. There was no uniform system of payment, a shortage of foster homes and a lack of training for foster families caring for children with disabilities, leading to frequent breakdowns of placement and resulting in some children having to move from one foster home to another 10 to 12 times in as little as 12 months.[6] In those days, about 30–40% of children in care were Indigenous and living far from their communities in non-Indigenous foster homes. Thanks to the campaign spearheaded by Dr. Cindy Blackstock, the Executive Director of the First Nations Child and Family Caring Society of Canada, Indigenous children in need of foster care are now being looked after in their home communities. However, due to the lack of facilities in the Indigenous communities in north, many youths with mental health issues are still being placed in private group homes, hundreds of kilometers south away from their communities and are considered by some group homeowners as 'money-makers,' as recently reported by Global News.[7]

Have things changed over the last 50 years? At least the number of children receiving out-of-home care has gone down from approximately 100 000 to 61 000.[1] However, are they receiving appropriate care for their needs? I cannot answer that, but I doubt it. But we now have a unique opportunity to address this issue by linking administrative data from child welfare agencies to our health insurance database to evaluate our programs. I challenge the authors and others in the field to expand their research and enlighten us all on the plight of these most vulnerable children! As an 87-year-old, I know that it is time for us to act.

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Call for papers: Generating stronger evidence to inform policy and practice: natural experiments on built environments, health behaviours and chronic diseases

Guest editors: Dr. Stephanie Prince Ware (Public Health Agency of Canada), Dr. Gavin McCormack (University of Calgary)

HPCDP Journal Editors: Robert Geneau and Margaret de Groh (Public Health Agency of Canada)

Where we work, learn, play, eat and live has important implications for health. The built environment has been associated with the development of chronic disease, and with health behaviours often seen as critical pathways for this relationship.[1,2] Built environments refer to components of the physical environment that are human-made or human-modified and include structures and buildings, recreation facilities, green spaces and parks, transportation systems and community design.

Natural experiments are interventions that occur without a researcher's ability to manipulate the intervention or exposure to the intervention.[3,4] Natural experiments offer the opportunity to evaluate the effects of "naturally occurring" interventions such as changes to the built environment (e.g. creation of a new bike path, park improvements, infrastructure changes to schools or workplaces, construction of a new recreation facility or grocery store) on health behaviours and chronic disease risk. Natural experiments are often more practical for investigating the health impacts of environmental interventions when compared to traditional experimental studies (e.g. randomized controlled trials). Compared to cross-sectional studies, natural experiments provide a means to generate rigorous evidence to better establish causality, as well as to understand the implementation of interventions in "real-world" scenarios.

This special issue answers the 2017 Canadian Public Health Officer annual report's call to further evaluate the health impacts of community design features in Canada.[5] This special issue resonates with the expanding scholarly and policy-oriented interest in the utility of natural experiments as a critical tool in advancing the body of evidence and for informing interventions to improve public and population health.[6,7] Specifically, the objective of this special issue on natural experiments is to provide timely evidence to further understand the effectiveness of built environment interventions on health behaviours and chronic disease prevention in a Canadian context.

Health Promotion and Chronic Disease Prevention in Canada: Research, Policy and Practice is seeking relevant topical research articles that present new findings or synthesize/review existing evidence on natural experiments of the built environment (or related policies) that influence health behaviours with implications for chronic disease prevention in Canada.

Relevant topic areas include, but are not limited to:

- Built environments, including community or neighbourhoods, workplaces, schools, transportation infrastructure, home environments, recreation environments, parks, playgrounds, green spaces, public open spaces, natural environments and seniors' residences.

- All health-related behaviours, including physical activity, sedentary behaviour, sleep, food consumption, smoking and substance use.

- Chronic diseases and health-related outcomes, including body mass index, fitness, blood pressure, blood lipids, blood sugar, injuries, falls, mental health, stress, depression, anxiety, Alzheimer's disease, dementia, obesity, metabolic syndrome, cardiovascular disease, cancer, diabetes and lung disease.

International submissions will be considered if they include Canadian data, results (e.g. as part of multi-country studies or global comparisons) and/or evidence-based discussion of implications for community or population health in Canada.

Consult the Journal's website for information on article types and detailed submission guidelines for authors. Kindly refer to this call for papers in your cover letter.

All manuscripts should be submitted using the Journal's ScholarOne Manuscripts online system. Pre-submission inquiries and questions about suitability or scope can be directed to HPCDP.Journal-Revue.PSPMC@phac-aspc.gc.ca.

Submission deadline: November 30, 2024

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Other PHAC publications

Researchers from the Public Health Agency of Canada also contribute to work published in other journals and books. Look for the following articles published in 2024:

Hassen N, Lacaille D, Xu A, […], **Lang JJ**, et al. National burden of rheumatoid arthritis in Canada, 1990–2019: findings from the Global Burden of Disease Study 2019 – a GBD collaborator-led study. RMD Open. 2024;10:e003533. https://doi.org/10.1136/rmdopen-2023-003533

Idzerda L, Corrin T, Lazarescu C, Couture A, Vallières E, Khan S, […], Garcia AJ. Public policy interventions to mitigate household food insecurity in Canada: a systematic review. Public Health Nutr. 2024;27(1):e83. https://doi.org/10.1017/S1368980024000120

Pagaduan JE, Lazarescu C, Vallieres E, […], Zuckermann AME, Idzerda L. The impacts of the Nutrition North Canada program on the accessibility and affordability of perishable, nutritious foods among eligible communities: a scoping review. Int J Circumpolar Health. 2024;83(1):2313255. https://doi.org/10.1080/22423982.2024.2313255

Prince SA, Dempsey PC, Reed JL, […], **Merucci K, Lang JJ.** The effect of sedentary hehaviour on cardiorespiratory fitness: a systematic review and meta-analysis. Sports Med. 2024. https://doi.org/10.1007/s40279-023-01986-y

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