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Evidence synthesis

Using the Staircase Approach to increase movement: a systematic search and review to inform a novel sedentary behaviour intervention for older adults

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This article has been peer reviewed.

Abstract

Introduction: Traditional approaches to supporting older adults in adopting and maintaining an active lifestyle have largely failed. The previously proposed "Staircase Approach" offers a new foundation for developing interventions and public health strategies; this approach includes Step 1 (changing sedentary behaviour) and Steps 2 to 4 (incorporating more physical activity of increasing levels of intensity). In this systematic search and review, we aimed to inform the co-creation of a novel Staircase Approach intervention for community-dwelling, inactive older adults, primarily focussed on Step 1.

Methods: A systematic search was performed across six databases (MEDLINE, PsycInfo, CINAHL, Cochrane CENTRAL, SPORTDiscus and Scopus).

Results: After duplicates were removed, 3427 titles and abstracts were screened. Fourteen articles (including 17 intervention groups) were included after full-text review. Five were randomized controlled trials, three compared two interventions and six were single-arm studies. Sample sizes ranged from 9 to 176 participants, and included 617 older adults at baseline. Mean age of samples ranged from 64.3 (standard deviation [SD] 3.8) to 85.1 (SD 6.2) years, while the intervention length ranged from less than one day to 6 months. Sedentary time interventions are well accepted; most studies had completion rates above 80%. Based on findings from within-group comparisons, half of the studies showed a reduction in sedentary time (6/12 groups) and half showed an increase in physical activity (6/12 groups). Based on findings from between-group comparisons, 2 out of 5 intervention groups showed improvements in sitting time and physical activity outcomes compared to controls. Satisfaction and adherence to interventions were generally high.

Conclusion: Sedentary time interventions for older adults show promise and point to several components that may be included in an intervention focussed on Step 1 of the Staircase Approach.

Keywords: *sedentary time, sitting, physical inactivity, behaviour change, intervention strategies, intervention design*

Highlights

- Sedentary behaviour interventions for community-dwelling older adults have been positively received, and demonstrate good adherence, acceptability and completion rates.
- Past research suggests that it may be necessary to consider several intervention components when co-creating a sedentary behaviour reduction intervention specifically for older adults.
- Researchers must be more consistent in their reporting of behaviour change techniques incorporated into interventions to provide insights into the development of new interventions.

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Introduction

Older adults (aged ≥ 65 years) have the lowest reported rates of physical activity and accumulate the highest volume of sedentary time.[1,2] Global device-based data indicate that older adults are accumulating an average of nine hours of sedentary time (during waking hours) per day.[3] This high volume of sedentary time is associated with declines in important outcomes such as physical function, cognitive function, mental health, sleep quality and social engagement.[4,5]

Research suggests that high volumes of moderate-intensity physical activity (60–75 min/day) are needed to overcome the detrimental effects of sedentary time.[6] Unfortunately, only 5% to 20% of older adults are meeting minimum recommendations of physical activity (150 min/week);[1] worse still, these recommendations fall far below the volume needed to negate the effects of sedentary time. Over the past few decades, physical inactivity levels have tended to remain stable,[7] indicating that efforts to increase physical activity among older adults have been largely unsuccessful. Thus, new approaches are urgently needed to support the growing population of older adults with integrating movement into their lives.

We have previously proposed that the lack of success in increasing physical activity participation may be attributable to the magnitude of the initial goal being set.[4] Specifically, it may be prudent to start with smaller, more achievable goals related to movement that can activate individuals along a pathway to an active lifestyle using a progressive, stepwise approach. Our previously proposed "Staircase Approach" begins with focussing on reducing sedentary time by encouraging less total sitting and more interrupted sitting (e.g. increased sit-to-stand transitions; Step 1) before progressing to physical activity that ranges from light-intensity (Step 2) to moderate and vigorous intensities (Steps 3–4).[4]

This approach is distinct from previous strategies that have either focussed on these movement behaviours separately, or on both simultaneously, rather than using a sequential or stepwise approach. Older adults with multiple comorbidities or functional limitations may not be able to start with physical activity. Thus, starting with sedentary time–related goals may be more prudent.

Spending less time in sedentary behaviours may lead to health benefits. For example, a study of older adults (M 73.3, standard deviation [SD] 5.9, years) found that breaks in sedentary time were significantly associated with the arm curl, the chair stand test and composite physical function scores, even after adjusting for moderate-vigorous physical activity and total sedentary time.[8] Such findings support the importance of stressing that sitting less (Step 1) should be considered a success even if physical activity is never increased to the recommended levels. Furthermore, it has been estimated that significant economic benefits are associated with achieving this initial goal of reducing sedentary time. Specifically, it has been estimated that in Canada, a 10% decrease in excessive sedentary behaviour (from 87.7%–77.7%) would save an estimated CAD 219 million per year in related costs.[9]

The traditional approach of focussing on physical activity has led to the development of a plethora of community-based programs available to older adults.[10-12] However, there is a significant gap in programming available to support community-dwelling older adults who need interventions focussed on Step 1 before potentially progressing to Steps 2 through 4. To inform the design of an intervention for community-dwelling older adults focussed on starting with Step 1, we conducted a systematic search and review of the literature.[13] This type of review "combines strengths of critical review with a comprehensive search process" and results in a "best evidence synthesis."[13,p.95]

Previous reviews on interventions designed to reduce sedentary time in older adults have excluded older adults with common health conditions (e.g. stroke),[14] focussed primarily on cardiometabolic health markers[15] or included active older adults at baseline.[16] Our approach was focussed on community-dwelling older adults who are inactive and sedentary; the intent was to inform an intervention that could be used in this broad population of older adults. Thus, the aim of this review was to synthesize knowledge from interventions designed to decrease sedentary time in inactive, community-dwelling older adults (regardless of health status and functional autonomy) to inform the development of a progressive behaviour-change intervention.

Methods

The study protocol was registered in Open Science Framework.[17] We used the PRISMA checklist to ensure proper reporting (available from the authors upon request).[18]

Eligibility criteria

Studies were considered eligible for the current review if they fulfilled the following inclusion criteria: (1) participants were aged 60 years or older, (2) participants were living in the community, (3) participants were described as sedentary and/or inactive at baseline by study authors or as part of the eligibility criteria using either self-report or device-measured movement, (4) the study intervention was a behaviour change intervention and (5) the intervention took place in a community-based setting.

Studies were excluded if they were (1) laboratory- or gym-based, supervised exercise programs, (2) qualitative-only studies, (3) only designed to assess health-related outcomes and did not measure sedentary time/behaviour, (4) protocols, (5) editorials or opinion pieces, (6) conference abstracts, (7) dissertations or (8) written in a language in which no one from the team was fluent enough to review (i.e. languages other than English, Hindi and Greek). Nonrandomized intervention studies were included as long as they met all other inclusion and exclusion criteria.

Information sources

A systematic search of the following bibliographic databases was conducted by a health sciences librarian: (1) Ovid MEDLINE (1946 to 13 June 2023); (2) EBSCOhost CINAHL Plus with Full Text (1937 TO 14 June 2023); (3) EBSCOhost SPORTDiscus (database inception to 14 June 2023); (4) ProQuest APA PsycInfo (inception to 14 June 2023); (5) EBM Reviews - Cochrane Central Register of Controlled Trials (inception to May 2023); and (6) Scopus (inception to June 2023).

Search strategy

Searches were conducted on 14 June 2023. The librarian (MCT) developed the MEDLINE search strategy in consultation with the team. The MEDLINE strategy was peer reviewed by another expert searcher via the Peer Review of Electronic Search Strategies (PRESS) forum, revised

per feedback and adapted for each included bibliographic database. The search strategies combined relevant subject headings (e.g. MeSH) and keywords relevant to the concepts of older adults and sedentary time reduction. No language, date or study design limits were applied. Database search results were imported to Covidence[19] for deduplication and screening.

Selection process

Titles and abstracts were screened in dual reviewer mode in Covidence. All references were reviewed once by a single researcher (KK), with the second vote performed by other members of the research team (n = 3). Ties were decided by SD. For full-text screening, two researchers (SD and KK) screened articles for eligibility, and any ties were settled with discussion.

Data collection process

Data were manually extracted from each study by KK based on the items identified below. A second researcher (SD) checked all data in the extraction table. Data for development of our tables were then further extracted and verified by KK.

Data items

The following information was extracted from the studies: (1) study identification number, (2) title, (3) study aim, (4) country, (5) study design, (6) control/comparison group, (7) sample characteristics/demographics, (8) inclusion criteria, (9) exclusion criteria, (10) method of recruitment, (11) intervention description, (12) types of behaviour change techniques used, (13) main outcomes of interest, (14) other outcomes, (15) sample size of group(s) at baseline and postintervention, (16) dropouts with reasons, (17) adverse events/injuries reported, (18) percentage completers, (19) engagement, (20) compliance/adherence, (21) main findings, (22) overall conclusions, (23) limitations, (24) strengths and (25) insights from the discussion.

Data for primary outcomes—changes in movement behaviours, adherence and compliance—were identified and extracted. Changes in sitting time were reported either as total sedentary time (min/day), breaks in sedentary time (number/day), sit-to-stand transitions (number/day), or bouts of sedentary time (number/day or min/day). Changes in physical activity were reported as either changes in steps (count/day), or walking, light-intensity physical activity, moderate-intensity physical activity or vigorous-intensity physical activity (min/day). When movement behaviours were not measured using devices, self-reported data were extracted. The percentage of participants completing the intervention ("completers") was calculated as: n at baseline/n at post-study × 100. To understand which components of interventions are critical, data on behaviour change theories, behaviour change techniques and intervention characteristics used in the studies were also extracted.

Study risk of bias assessment

Using the checklist for randomized controlled trials (RCTs) provided by the Scottish Intercollegiate Guidelines Network, the overall quality of a study can be classified as high, acceptable, low or unacceptable.[20] Quality assessment is based on 10 items, with the emphasis on randomization and randomization methods. Given that this review focussed on behaviour change interventions and engagement-related outcomes, aspects of randomization such as concealment and blinding were not applicable, and in some cases, tool validity and reliability were not applicable. Thus, the risk of bias assessment was based on study design, such that RCTs were considered higher quality and non-RCTs were considered lower quality. For our classification purposes, RCTs did not include randomized studies in which a comparison to another sedentary behaviour intervention was made.

Results

Study selection

The search process yielded 5414 references from bibliographic databases, with 3427 references remaining once duplicates were removed (Figure 1). Reasons for exclusion at the title/abstract level were a lack of mention of sedentary time/behaviour as an outcome of interest, a clear focus on exercise interventions, a nonintervention design and samples younger than 60 years. No additional references were identified from other sources. After full-text review, 14 articles were included in the final tally of the current review. Of the final included articles, 17 intervention groups were available, since three articles reported data for two intervention groups.[21-23] For Tosi et al., the "control" group was included as an intervention group for the current review, since their participants were administered a sedentary behaviour intervention in the form of education.[23]

Study characteristics

The characteristics of each study can be found in Table 1. Of the 14 studies, five were RCTs,[21,24-27] three reported on the results of two interventions via two arms,[22,23,28] and six were single-arm, pre-post intervention studies with no control group.[29-34] The sample sizes of intervention groups ranged from 9 to 176 participants and included a total of 617 older adults at baseline across all studies. The mean age of the participants ranged from 64.3 (SD 3.8) to 85.1 (SD 6.2) years across studies. The primary objective of six of the studies was to assess feasibility.[21,24,29,31-33]

Results of individual studies

Changes in movement behaviour

Sedentary time was measured using devices in the majority (n = 12) of the studies; two studies reported sitting time using self-report only.[25,33] Burke et al. and Matei et al. both used the International Physical Activity Questionnaire; Matei et al. also included a second measure of sitting time using the Measure of Older Adults' Sitting Time. Both tools have established reliability and validity for use among older adults.[35,36] Changes in movement behaviours presented below were based on statistical results reported in the studies. Those that indicated changes were considered successful.

As shown in Table 2, of the 12 groups that measured and reported within-group results for the changes in sedentary time, six groups demonstrated significant within-group changes, and six groups demonstrated no significant change; five groups did not conduct within-group statistical testing after the intervention. Within-group analyses demonstrated that physical activity improved in six studies.

For between-group results of RCTs (data not shown), only two of the five RCTs showed changes in sedentary time measures in intervention versus control groups.[25,27] Burke et al. showed through regression analysis that the intervention group significantly decreased their sitting time versus controls (coefficient: −0.215, CI: −0.312 to −0.117; $p < 0.001$), while Rosenberg et al. showed a difference in mean change of −58 min/day (95% CI:

FIGURE 1
PRISMA[18] diagram of search process

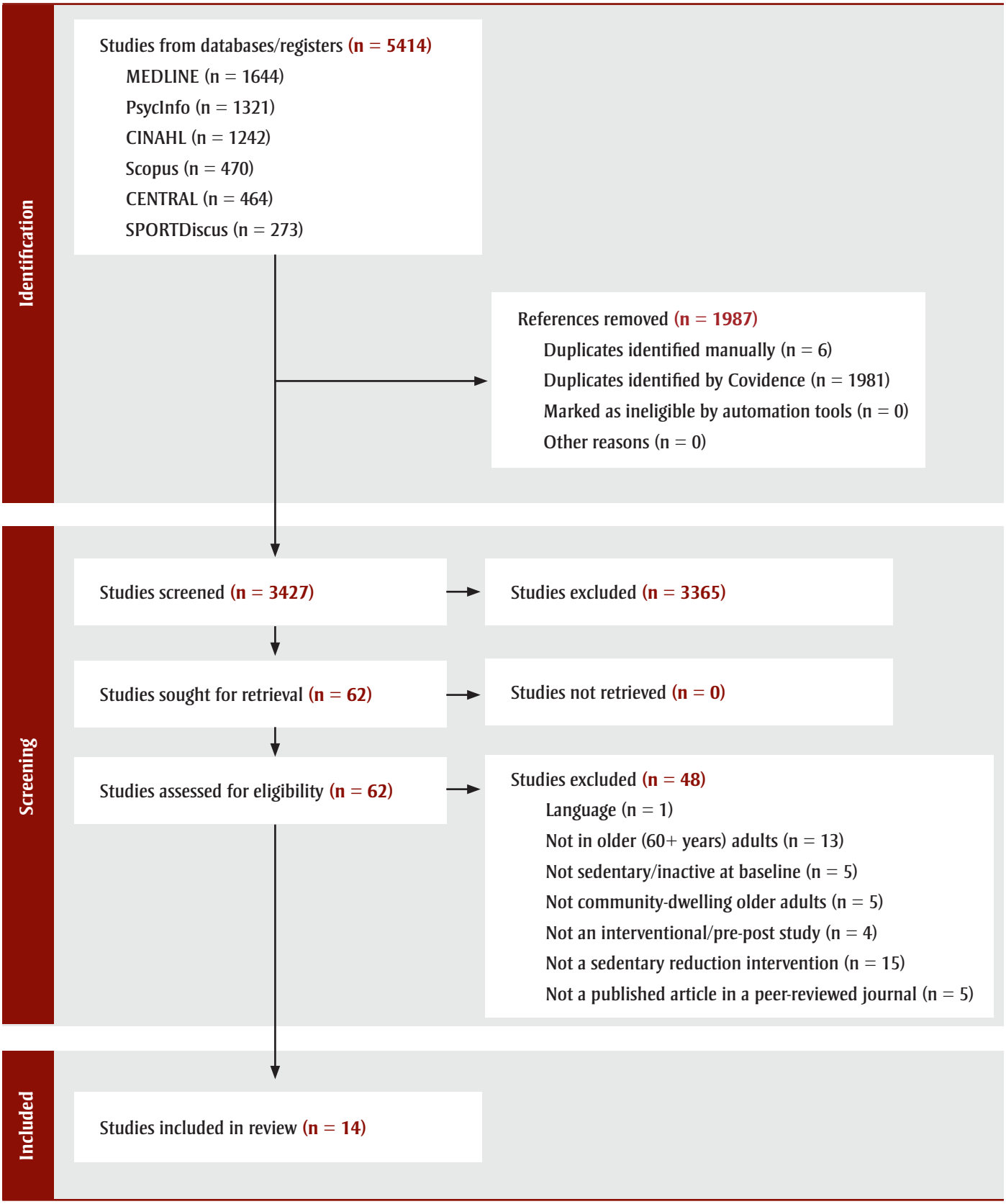


TABLE 1
Characteristics and conclusions of the studies included

Study; location	Participant characteristics	Study design	Length of intervention	Primary movement behaviour goals	Movement behaviour measure	Conclusion
Aunger 2020; Dudley, UK	n = 24 (14F, 10M); age: 73.3 (SD 5.6) y; pre-surgery population	RCT; 2 groups	8 weeks	Reduce ST via personalized consultations	ST (device-based and self-report)	Study was feasible with some modifications.
Blair 2021 (A + B); Albuquerque, US	A: Tech support group: n = 18 (8F, 10M); age: 69.6 (SD 4.5) y; B: Tech support + health coaching group: n = 18 (12F, 6M); age: 69.1 (SD 4.0) y; cancer survivors	RCT; 3 groups (2 interventions and controls)	13 weeks	Reduce ST via standing (prompt progressed from every 60 min to 30 min of prolonged sitting) and moving (steps progressed from 1000 to 3000 steps/day above baseline)	ST and PA (device-based)	Intervention was feasible and acceptable; there was no reduction in sedentary time or increase in breaks.
Burke 2013; Perth, Australia	n = 176 (83F, 93M); age: 65.8 (SD 3.0) y	RCT; 2 groups (intervention vs. controls)	6 months	Personalized goals to reduce ST/increase PA	ST and PA (self-report)	Intervention was feasible and led to improvements in some PA outcomes.
Kleinke 2021; Greifswald, Germany	n = 85 (50F, 35M); age: 70.4 (SD 4.6) y	RCT; 2 groups	6 months	Reduce ST via feedback letters based on activity monitors	ST and PA (device-based and self-report)	Intervention was not effective at changing PA levels in an active sample.
Rosenberg 2020; Seattle, US	Intervention group: n = 29 (20F, 9M); age: 69 (SD 4.7) y; BMI: 35.7 (SD 5.9) kg/m^2; Controls: n = 31 (21F, 10M); age: 67.8 (SD 5.2) y; BMI = 35.1 (SD 3.7) kg/m^2	RCT; 2 groups (intervention vs. controls)	12 weeks	Reduce ST via personalized goals of interrupting sitting and standing/ moving, aiming for reduction of sitting of 60 min/day.	ST and PA (device-based)	Sitting time was reduced by increasing standing time.
Barone Gibbs 2017; Pittsburgh, US	n = 19 (14F, 5M); age: 68.5 (SD 6.7) y	Randomized trial comparing 2 interventions	12 weeks	Reduce ST by 1 h/ day via personalized consultations	ST and PA (device-based and self-report)	Intervention can be effective to promote increases in PA; targeting SB can have unique short-term benefits (functional performance).
Compernolle 2020; Ghent, Belgium	n = 28 (15F, 13M); age: 64.3 (SD 3.8) y	Single-arm study	3 weeks	Reduce ST through self-monitoring and prompts to stand after 30 min of sitting	ST and PA (device-based)	Intervention was well received but no reduction in sitting time was found.
Fitzsimons 2013; Glasgow, UK	n = 24 (10F, 14M); age 68 (SD 6) y	Single-arm study	2 weeks	Reduce ST via personalized consultations	ST and PA (device-based and self-report)	Intervention reduced ST.
Gardiner 2011; Queensland, Australia	n = 59 (44F, 15M); age: 74.3 (SD 9.3) y	Single-arm study	One 45-min session	Reduce ST via personalized consultations; "Stand and move after 30 min of sitting"	ST and PA (device-based)	Brief behaviour change intervention can reduce ST.

Continued on the following page

TABLE 1 (continued)
Characteristics and conclusions of the studies included

Study; location	Participant characteristics	Study design	Length of intervention	Primary movement behaviour goals	Movement behaviour measure	Conclusion
Koltyn 2019 (A + B); Madison (WI), US	A: Study 1: n = 12 (10F, 2M); age: 68.86 (SD 4.53) y; B: Study 2: n = 9 (7W, 2M); age: 67.8 (SD 7.7) y	2 single-arm studies	4 weeks (Study 1) and 8 weeks (Study 2)	Study 1: stand 3–5 times/day up to 10–12 times/day Study 2: Similar to Study 1 with a refresher workshop at 6 weeks	ST and PA (device-based and self-report)	There were moderate effects for reducing ST and improving PA.
Lewis 2016; Adelaide, Australia	n = 27 (17F, 10M); age: 71.7 (SD 6.5) y	Single-arm study	6 weeks	Reduce ST via personalized consultations; stand 15 min/day the first week and progress to 90 min/day by 6 weeks via 6 steps	ST and PA (device-based and self-report)	Intervention was feasible and led to reduction in sitting time in older adults.
Matei 2015; London, UK	n = 23 (16F, 7M); age: 66.9 (SD 4.2) y	Single-arm study	8 weeks	Reduce ST by standing during commercials and after every 20 min of computer use, and increase general PA	SB and PA (self-report)	Intervention was generally acceptable and showed low attrition and moderate adherence among sedentary and inactive older adults.
Rosenberg 2015; Seattle, US	n = 23 (16F, 7M); age: 71.4 (SD 6.4) y; BMI: 34, range: 27–47	Single-arm study	8 weeks	Reduce ST via personalized goals; increase standing and moving by 2 h/day and increase sit-to-stand transitions by 15/day	ST and PA (device-based and self-report)	Intervention was feasible and effective at reducing ST.
Tosi 2021 (A + B)[a]; Sao Paulo, Brazil	A: Intervention: n = 21 (18F, 3M); age: 82.9 (SD 6.8) y; B: SB education controls: n = 22 (19F, 3M); age: 85.1 (SD 6.2) y; majority had several chronic conditions and frailty	2 single-arm studies [randomized trial: 2 groups (intervention vs. "controls" that received SB education)]	16 weeks	A: reduce ST via personalized standing exercises (up to 30 min/day; B: general information on health consequences of SB	ST (device-based)	Intervention reduced SB and showed satisfactory adherence.

Abbreviations: BMI, body mass index; F, females; h, hour(s); M, males; min, minutes; PA, physical activity; RCT, randomized controlled trial; SB, sedentary behaviour; SD, standard deviation; ST, sedentary/sitting time; US, United States; UK, United Kingdom; WI, Wisconsin; y, years.

Notes: Bold type indicates a randomized controlled trial; A/B indicates multiple intervention groups in a study.

[a] Published as an RCT, but not categorized as an RCT for the purposes of the current review.

−100.3 to −15.6; $p = 0.007$) in the intervention group versus controls. Physical activity only improved in two studies.[21,25] Blair et al. reported that their intervention group B improved moderate-vigorous physical activity guideline bouts compared to controls (16.6 min/15 hours awake, 95% CI: 4.1 to 29; $p < 0.05$). Compared to controls, Burke et al. reported via their regression analysis that the intervention group significantly increased participation in several physical activity outcomes: strength exercise (coefficient: 1.075, 95% CI: 0.559 to 1.591; $p < .001$), walking (coefficient: 0.909, 95% CI: 0.094 to 1.724; $p = 0.029$), and vigorous-intensity physical activity (coefficient: 0.664, 95% CI: 0.128 to 1.199; $p = 0.015$).

Intervention engagement

The number of participants that completed the intervention was generally high; only three studies had completion rates below 80%.[21,25,34] As shown in Table 3, ratings of satisfaction, study adherence and future commitment were also generally high. The term "future commitment" was used to describe positive answers to continuing with any part of the intervention post-study, or in recommending the intervention to others.

Intervention components

Most (11/14) studies identified at least one behaviour change theory that informed intervention design. These included the social cognitive theory,[21,25,27,31,34] self-determination theory,[24,32] habit formation theory,[33] ecological theory,[27,30] behavioural choice theory[31] and self-regulation theory.[22] Although we aimed to extract data on the specific behaviour change techniques used

TABLE 2
Changes in movement behaviours for each intervention group (within-group, pre to post)

Study	Changes in ST	Changes in PA
Aunger 2020	X	X
Blair 2021 (A)	X	X
Blair 2021 (B)	X	Steps: 1675.0/day MPA: 15.2 min/day MPA guideline bouts: 16.7 min/day[a]
Burke 2013	ST: −50.7 min/day[a]	Walking: 7.9%[a] MPA: 11.9% VPA: 8.0%[a] Strength exercises: 20.5%[a]
Kleinke 2021	X	X
Rosenberg 2020	NA[a]	NA
Barone Gibbs 2017	X	X
Compernolle 2020	X	X
Fitzsimons 2013	ST: −24 min/day	Stepping: 13 min/day
Gardiner 2011	ST: −3.2% STS/day: 4	LPA: 2.2% MVPA: 1%
Koltyn 2019: A	NA	NA
Koltyn 2019: B	NA	NA
Lewis 2016	ST: −51.5 min/day ST (%): −5.3% Sitting ≥ 30 min: −53.9 min/day # of bouts ≥ 30 mins: −0.8	X
Matei 2015	ST (IPAQ): −150.8 min/day ST (MOST): −143.4 min/day	Walking: 20.6 min/day
Rosenberg 2015	ST: −27 min/day ST (%): −3%	LPA (% of day): 3% MVPA: 3.7 min/day
Tosi 2021: A	NA	NA
Tosi 2021: B	NA	NA

Abbreviations: IPAQ, International Physical Activity Questionnaire; LPA, light-intensity physical activity; min, minutes; MOST, Measure of Older Adults' Sedentary Time; MPA, moderate-intensity physical activity; MVPA, moderate-vigorous physical activity; NA, [within-group analysis] not available; PA, physical activity; ST, sedentary/sitting time; STS, sit-to-stand transitions [or break in ST]; VPA, vigorous-intensity physical activity.

Notes: X indicates no change(s) from pre to post. A/B indicates multiple intervention groups in a study. Data provided only when changes from pre to post were statistically significant from the original study.

[a] The intervention group reported changes that were significantly different from the change in controls (RCTs only; bolded in first column).

in studies, we could not accurately do so, since labels varied across studies, authors reported the main techniques used only (without labelling specific intervention components) or techniques were simply not mentioned or not described.

Given the limitations with behaviour change techniques, we chose to focus on the intervention components. Table 4 summarizes the various intervention components used across studies. Intervention components used in "successful" and "unsuccessful" interventions were tallied. Figure 2 indicates the percentage of studies in which the various intervention components were used. The number of interventions that used a specific component was divided by the total number of successful or unsuccessful interventions. For example, individual meetings were used for sedentary time in seven of the nine groups that demonstrated changes in sedentary time.

Discussion

Our goal was to inform the co-creation of a new intervention based on the Staircase Approach.[4] We found that several feasible and acceptable interventions aimed at supporting community-dwelling older adults in reducing sedentary time do exist. However, these interventions have demonstrated limited success in impacting movement behaviours. Of the higher quality studies (RCTs), only two out of five demonstrated a change in movement behaviours when comparing between groups; of the lower quality studies, only 50% indicated a change in sedentary time and physical activity. This review has provided several critical insights that can inform the development of a new intervention targeting inactive, community-dwelling older adults.

Most of the studies in our review used a behaviour change theory to guide the design of the intervention; the social cognitive theory was most commonly reported. Although there is no consensus

TABLE 3
Intervention satisfaction, adherence and future commitment

Study	Completers (%)	Satisfaction/acceptability	Adherence/future commitment
Aunger 2020	87.5	Self-reported satisfaction (5 = very satisfied): 4.5/5 (90%)	Goal adherence: 88% completion Environmental modification adherence: 52% Achieved/exceeded step targets: 42% Completed intervention: 22/24 (92%)
Blair 2021 (A)	67.0	Acceptability: 93% (27/29) "agreed"/"strongly agreed" technology increased awareness of time sitting; 79% (23/29) "agreed"/"strongly agreed" that technology (monitor + app) was easy to use; 83% (24/29) "agreed"/"strongly agreed" that technology motivated them to decrease ST	Indicated they would use the technology (monitor + app) in the future: 79% "agreed"/"strongly agreed" Wore the Jawbone monitor: 100% "very often" Checked app daily for steps: 79% "very often" Checked app for longest sedentary bout: 24% "very often"/"often" Ignored vibration to stand up: 21% "very often," 62% "sometimes" Completed all 5 calls: 93%
Blair 2021 (B)	94.0		
Burke 2013	71.0	Booklet encouraged them to think about PA: 78%	Used the exercise chart: 74% Used the exercise chart to practise the recommended exercises: 62% Calendar reminded them to consider PA: 66% Used the pedometer: 90% Used the resistance band: 63%
Kleinke 2021	83.0	NA	NA
Rosenberg 2020	100.0	Satisfied/very satisfied: 92%	NA
Barone Gibbs 2017	100.0	Reported benefiting from the program: 100%	Would definitely continue behaviour change: 74% Intended to use the armband and interface everyday: 61% Reported wearing the armband every day: 84%
Compernolle 2020	87.0	Positive feelings (being motivated, surprised and interested): 89% Intervention was not interesting or helpful: 11%	Participant reporting of daily app access: 57% System reporting of daily usage: 29% App was accessed more at the start of the intervention (3–4x, weeks 1– 2) vs. the end (1–1.5x, weeks 20–21).
Fitzsimons 2013	100.0	NA	NA
Gardiner 2011	100.0	Rated the program 8 or higher (10 = extremely satisfied): 97%	NA
Lewis 2016	90.0	Overall program satisfaction: 82%	Would recommend program: 82% Achieved all of their goals: 81%
Matei 2015	85.0	NA	Returned at least 8 "tick sheets": 92% Adherence to tips: 58%
Rosenberg 2015	69.4	Completers who reported being "somewhat"/"very satisfied" with intervention: 100%	NA
Tosi 2021 (A)	81.0	82% showed more than 70% adherence to the program	NA
Tosi 2021 (B)	82.0	NA	NA

Abbreviations: NA, not available; PA, physical activity; ST, sitting/sedentary time.

Notes: A/B indicates multiple intervention groups in a study; bold typeface indicates a randomized controlled trial.

on which behaviour change theory is best for reducing sitting time, given our understanding of environmental influences on sedentary time and physical activity,[37,38] it was surprising that no studies used the social-ecological model to underpin their intervention. In a review by Heath et al.,[39] who aimed to understand the lessons learned from evidence-based physical activity interventions, it was noted that policy and environmental approaches are critical to intervention design. Thus, it may be important to consider the use of a more comprehensive framework to design successful interventions. For example, the Stand When You Can intervention designed for older adults in assisted living settings was based on this model that incorporated environmental cues in the residence, included staff in creating a culture of movement and used individual behaviour change strategies.[40] For older adults living in the community, the environment varies greatly, and has been shown to have a large influence on movement behaviours across different cultures and genders.[41]

Another observation that emerged during data extraction was that many studies included several behaviour change techniques in their interventions; however, these were not always clearly labelled or identified, which made analyzing these specific techniques across studies challenging. It would be helpful for researchers to describe their behaviour change

TABLE 4
Intervention components used in included studies

Study	Individual meetings	Group meetings	Home visits	Emails	Phone calls	Wearable(s)	Hardcopy materials	Mobile app	Mail received/ sent	Education (in person)	Key message/ overall goal	Incentives
Aunger 2020	✓		✓		✓	✓	✓					
Blair 2021 (A)					✓	✓	✓	✓	✓		✓	
Blair 2021 (B)					✓	✓	✓	✓	✓		✓	
Burke 2013		✓		✓	✓	✓	✓				✓	✓
Kleinke 2021	✓					✓	✓		✓			
Rosenberg 2020	✓				✓	✓	✓		✓			
Barone Gibbs 2017	✓				✓	✓		✓			✓	
Compernolle 2020	✓		✓		✓	✓	✓	✓	✓	✓		
Fitzsimons 2013	✓					✓	✓					
Gardiner 2011	✓		✓			✓	✓		✓	✓	✓	
Koltyn 2019 (A)		✓				✓	✓			✓	✓	✓
Koltyn 2019 (B)		✓				✓	✓			✓	✓	✓
Lewis 2016	✓		✓		✓		✓					
Matei 2015	✓						✓					
Rosenberg 2015	✓				✓	✓	✓		✓			✓
Tosi 2021 (A)	✓				✓		✓					
Tosi 2021 (B)	✓											

Notes: A/B indicates multiple intervention groups in a study. "Individual meetings" were face-to-face, one-on-one consultations between participant and administrator. "Group meetings" were in a workshop setting facilitated by an administrator. "Home visits" were visits attended by an administrator at the participant's home for testing/intervention purposes. "Emails" and "phone calls" indicate type of communication used for screening/contact/intervention purposes. "Wearable(s)" are any device worn by the participant for testing/intervention purposes. "Hardcopy materials" refers to any hardcopy materials used for testing/intervention purposes. "Mobile app" refers to an application on the participant's mobile device used for testing/intervention purposes. "Mail received/sent" refers to any use of postal mail for sending/receiving materials to/from participants. "Education (in person)" refers to the use of any educational material delivered to participants during in-person consultations. "Key message/overall goal" refers to brief and simple messages directed to participants, reflecting overall intervention aims. "Incentives" were monetary compensation for participants. Bold type indicates a randomized controlled trial.

interventions with reference to techniques using a universal language, for example, Michie's behaviour change techniques taxonomy,[42] to enable easier comparison and analysis of different interventions so that future synthesis can appropriately capture their impact.

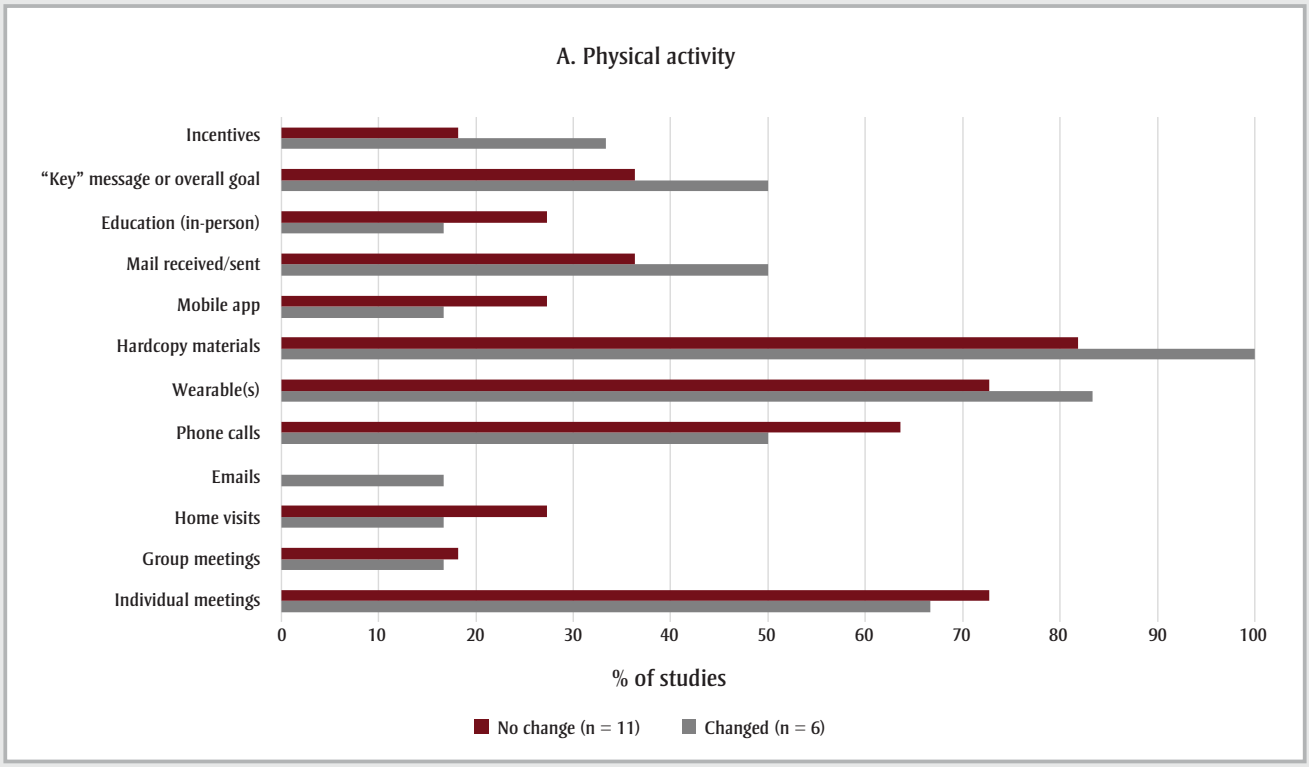
While several interventions were considered feasible and acceptable by participants, few led to significant changes in sedentary time. Interestingly, several interventions led to changes in physical activity levels despite the focus of behaviour change efforts being on sedentary time. The goal of most interventions was to reduce total sedentary time, with some also emphasizing interrupting sitting time or standing more. This is an interesting finding in light of a previous meta-analysis that found that interventions targeting sedentary behaviours led to more meaningful changes in sedentary time than interventions that included physical activity components.[43] It is clear that the interplay between movement behaviours is complex, and must be carefully considered in any intervention design. The unique needs of an older, community-dwelling population must also be considered. For example, a large proportion of older adults have complex chronic conditions, making it challenging to engage in physical activities of certain modes and intensities. Thus, the creation of interventions targeting interruptions in sedentary time may be critical for Step 1 of the Staircase Approach.[44]

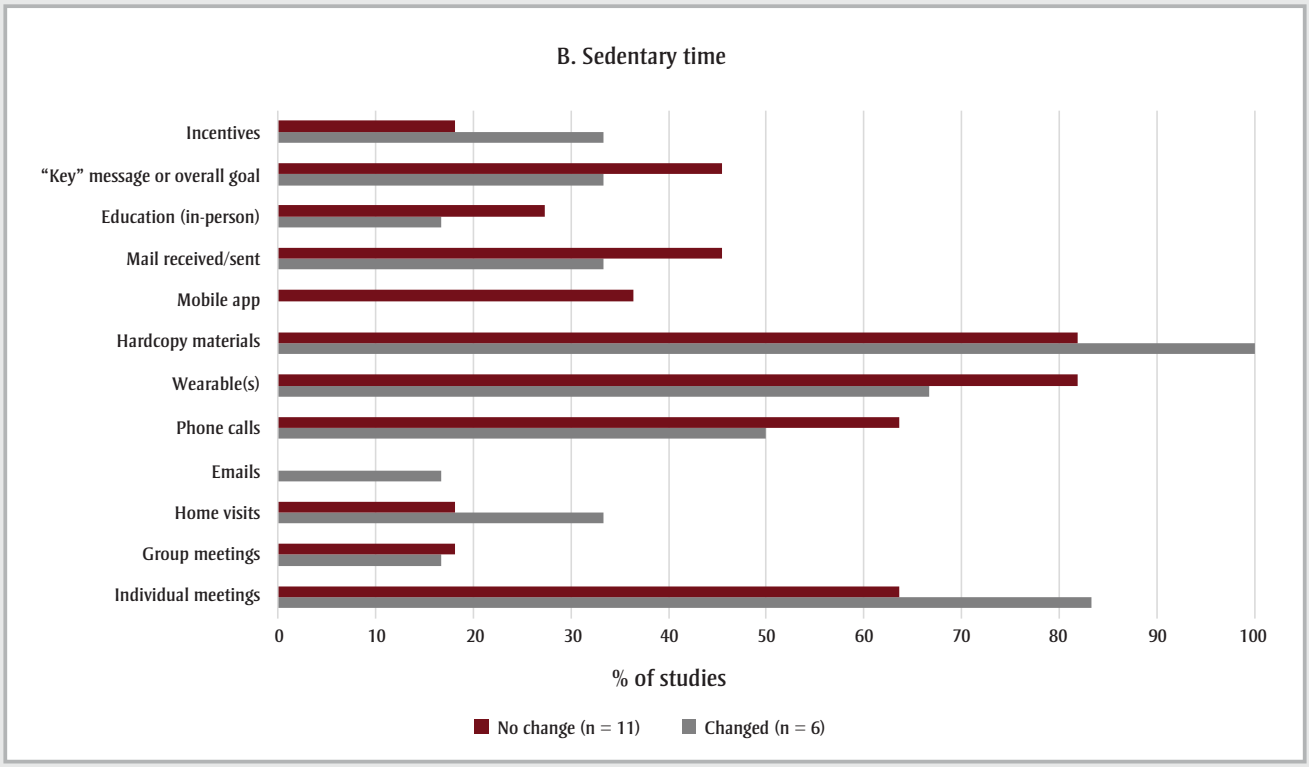
The acceptability, satisfaction, adherence and future commitment data demonstrate that sedentary behaviour interventions have high adherence and are viewed positively by older adults. In some studies, specific intervention components were examined and showed that technology and wearables were generally well accepted in this population. This is in line with previous research that shows increasing uptake and acceptability of technology that tracks physical activity among older adults, including virtual reality–based approaches.[45]

Additionally, it is also worthy of note that our preliminary analysis of intervention components from studies in which sedentary time and physical activity changed indicated that the use of wearable technologies and workbooks may be important. Individual meetings, emails and phone calls, while resource intensive and not always feasible for larger-scale implementation, may be important to include with this population as well.

Finally, providing key messages about goals may increase the success of interventions. Some key messages in the

FIGURE 2
Percentage of studies in which the intervention components were used





interventions reviewed were: "Sit less, stand more and move more, throughout the day, every day;"[21] "Stand up and move after 30 minutes of uninterrupted sitting;"[31] and "[B]reak up prolonged sitting (of 1 hour or more) by standing up 3 to 5 times per day and progressing to 10 to 12 times per day by the 4th week."[22] Inclusion of these simple messages may support meaningful changes in the early stages of behaviour change.

Strengths and limitations

One of the strengths of this review is its rigorous methodology, including the use of a librarian scientist and several databases. We also found a larger number of studies for inclusion in our review than anticipated, providing a robust dataset.

However, the findings of this literature review should also be considered in light of several important limitations. First, we did not look at sex or gender differences in our analysis. This is in part because the large majority of studies did not report results by sex or gender. Given the known differences in movement behaviour patterns and preferences in men and women,[7,46,47] this is an important future consideration for intervention design. Related to this, it is also important to note that ethnic diversity was not clearly discussed in the studies. Thus, future research is also needed to understand the impact of country and culture on the design, feasibility and uptake of such interventions.

Second, we were unable to analyze behaviour change techniques due to inconsistencies in reporting. While many researchers clearly indicated their primary behaviour change techniques, in some instances it was impossible to determine what additional techniques were used through various intervention components (e.g. workbooks). Future research is needed to better understand the most effective behaviour change techniques when working with older adults.

Third, it should also be noted that while we aimed to be comprehensive in our search of the published literature, we did not include a grey literature search. It is possible that we missed relevant studies as a result.

Conclusion

We found that past sedentary behaviour interventions aimed at reducing sedentary time in community-dwelling older adults were well accepted, but inconsistent in leading to behaviour change. Nevertheless, this systematic search and review provides several important insights that can be used in the design of a new evidence-informed intervention based on the Staircase Approach. A co-creation approach is needed to ensure that the intervention design process also considers the end users, to help with adherence, feasibility, and future scalability and implementation. Future recommendations for researchers reporting on sedentary behaviour interventions include using a universal behaviour change technique taxonomy and separating analyses by age, sex and gender to investigate potential differences in males and females.

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Conflicts of interest

The authors have no conflicts of interest to declare.

Authors' contributions and statement

KK: methodology, formal analysis, investigation, data curation, writing—original draft, writing—review and editing, visualization.

MT: conceptualization, methodology, software, writing—original draft, writing—review and editing.

SH: conceptualization, methodology, writing—review and editing.

SS: conceptualization, methodology, writing—review and editing.

BK: conceptualization, methodology, writing—review and editing.

DD: conceptualization, methodology, writing—review and editing.

DB: conceptualization, methodology, writing—review and editing.

JC: conceptualization, methodology, writing—review and editing.

SD: conceptualization, methodology, formal analysis, investigation, resources, data curation, writing—original draft, writing—review and editing, visualization, supervision, project administration, funding acquisition.

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Evidence-informed policy brief

A conceptual framework for the public health monitoring of substance-related harms

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This article has been peer reviewed.

Executive summary

The drug toxicity crisis in Canada and elsewhere has increased the need for timely and relevant data to inform policies and programs aimed at mitigating substance-related harms. While a number of monitoring systems addressing specific components of substance use and related harms in Canada exist, they are not guided by an overarching conceptual framework. This evidence-informed policy brief describes the development of a conceptual framework for the public health monitoring of substance-related harms. The resulting framework includes four primary topic areas (risk and protective factors, substance use, health supporting systems and substance-related harms and benefits); four cross-cutting topic areas (life course, equity, substance use stigma and mental and physical health and illness); and two overarching considerations (respectful use of data and engagement). This framework can be used to organize existing activities and to identify data and monitoring gaps for further development.

Keywords: *substance-related harms, opioids, overdose, substance use, surveillance, monitoring*

Highlights

- Comprehensive and timely data are essential to inform efforts to address the drug toxicity crisis and other substance-related harms. Currently, no overarching conceptual framework guides the monitoring of substance-related harms in Canada.
- A comprehensive conceptual framework for the public health monitoring of substance-related harms was developed to help guide related efforts.
- The conceptual framework described here includes four primary topic areas, four cross-cutting topic areas and two overarching considerations.

Introduction

The opioid and other drug toxicity crisis was identified in 2016 as a significant national public health concern in Canada,[1,2] leading to the creation of a federal, provincial and territorial Special Advisory Committee (SAC) on Toxic Drug Poisonings (initially called the SAC on the Epidemic of Opioid Overdoses) in December 2016.[3] The overprescription of opioids in health care settings in past decades, increasing the risk of opioid use disorder for some patients,[2] set the stage for a higher level of harms once synthetic opioids such as fentanyl and carfentanil became more available in the unregulated drug market.[1]

Tragically, the drug toxicity crisis has worsened since the onset of the COVID-19 pandemic.[3,4] At the same time, harms from other substances, such as alcohol, continue to have an important impact on population health. One component of Canada's response to the drug toxicity crisis continues to be improved data and monitoring.[5] "Surveillance" is considered a foundational activity of public health, and is defined as "the ongoing, systematic collection, analysis and interpretation of health data, essential to the planning, implementation and evaluation of public health practice, closely integrated with the dissemination of these data to those who need to know and linked to prevention and control."[6,p.3] While the term "surveillance" has a long history in public health, it is also used in other sectors, such as law enforcement and private security. Because of this, it may cause discomfort and have negative associations for some people and communities.[7,8] Thus, we have chosen to use the word "monitoring" where possible.

Throughout this paper, the terms "drugs" and "substances" are used interchangeably to refer to psychoactive substances that may be regulated (such as alcohol and cannabis), substances from the unregulated drug supply or psychoactive pharmaceutical drugs not prescribed to the individual or not used as directed by a health professional.

In 2017, the Public Health Agency of Canada (PHAC) led the development of a national surveillance system for apparent opioid related deaths (AORDs), with the

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goal of generating a timely, national picture of the public health impact of opioids in Canada.[3] This system evolved to include other types of harms including hospitalizations, emergency department visits and emergency medical services contacts, and other substances, namely stimulants.[5] While opioids, and subsequently stimulants, have been at the forefront of attention focussed on substance-related harms due to the drug toxicity crisis, there is a broad recognition that deaths, hospitalizations and emergency medical services contact for poisonings (overdoses) related to opioids and stimulants are only one subset of the information needed for a comprehensive approach to address substance-related harms from a public health perspective.[9]

Canada has a number of data and monitoring programs related to substances. For example, Health Canada supports the Canadian Alcohol and Drugs Survey, which collects data on a biennial basis about substance use among Canadian adults.[10] Data on substance use is included in many cycles of the Canadian Community Health Survey,[11] including targeted modules on special topics, such as the use of pain relieving medications that include opioids.[12] The Canadian Institute for Health Information collects, analyzes and disseminates data on hospital stays from harms due to substance use, among other substance-related harms indicators.[13] The Canadian Substance Use Costs and Harms project, a collaboration between the Canadian Centre on Substance Use and Addiction and the Canadian Institute for Substance Use Research, synthesizes data about harms and costs associated with substance use in Canada.[14] However, currently no overarching conceptual framework has been presented to guide, organize and integrate federal monitoring activities on substance-related harms, which may limit effective organization, collection, analysis and dissemination of data that can be used to inform prevention and promotion efforts.

The purpose of this evidence informed policy brief is to describe and document the development process and outcome of a conceptual framework for the public health monitoring of substance-related harms. A conceptual framework can be described as "a set of linked concepts and propositions designed to draw attention to what is important regarding a phenomenon of interest."[15,p.631] Conceptual frameworks can be used to clarify, focus, describe and organize.[16] While the outcome of this process is not meant to be prescriptive, it can be used to guide thinking about the development of future initiatives to bolster monitoring efforts in the area of substance-related harms.

Framework development

In late 2019, we conducted a literature review to identify existing conceptual frameworks for the monitoring of substance-related harms. While no conceptual frameworks were identified that focussed specifically on substance-related harms, a number of existing monitoring systems in Canada, the United States and other countries focussed on substance use and/or a limited number of related health outcomes, such as alcohol and drug use[10,17,18] or opioid- and stimulant-related harms.[5] In November 2023, we refreshed our search to identify any new conceptual frameworks focussed specifically on the monitoring of substance-related harms. At that time, we were still unable to identify any such conceptual frameworks and continued to observe that data or monitoring systems tended to focus on substance use or on a limited range of substance-related harms without guiding conceptual frameworks.

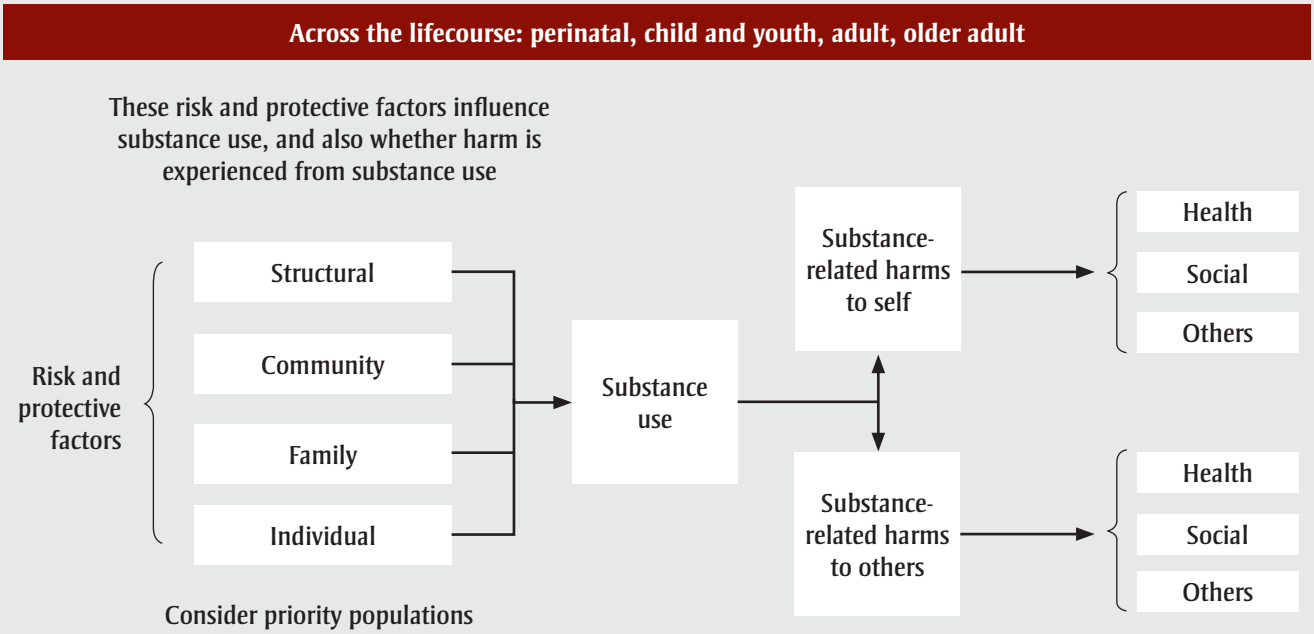
While no standard process has been articulated for the development of conceptual frameworks for public health monitoring, generally these frameworks are developed using initial literature review followed by rounds of iterative feedback from relevant stakeholder groups.[19,20] Using the results of the 2019 literature review and drawing from existing monitoring frameworks in health promotion and chronic disease prevention at PHAC[19,21] as well as the Chief Public Health Officer's 2018 report, *Preventing Problematic Substance Use in Youth,*[22] a baseline conceptual framework was developed. The initial visual framework aligned with the broad components of existing surveillance frameworks at PHAC (such as the Positive Mental Health Surveillance Indicator Framework[19] and the Suicide Surveillance Indicator Framework.[21] These frameworks identify outcomes of interest, as well as risk and protective factors at four socioecological levels; acknowledge that included constructs may vary across the life course; and emphasize that surveillance must be able to capture priority populations.

The initial framework presented substance use as distinct from substance-related harms, and identified that harms extend beyond harms to the health of the person using substances. This framework was drafted by members of the development team, based on interpreting the key findings from the literature review, establishing the scope of the framework, identifying concepts and considerations and drafting the initial visual conceptual framework to illustrate the relationships between the constructs (Figure 1).

This initial conceptual framework was presented in several iterative rounds of engagement with key internal stakeholders at PHAC and Health Canada, as well as people with lived and living experience of substance use (PWLLE). Internal stakeholders were identified as employees of groups within PHAC or Health Canada with a responsibility for or significant interest in substance-related harms. This included groups with responsibilities for policy, programs, surveillance and applied research. PWLLE were engaged through Health Canada's People with Lived and Living Experience Council. Engagement sessions were conducted online through Teams or Zoom, using the services of a professional facilitator with extensive experience conducting engagement sessions. The online visual collaboration tool, Mural, was used to facilitate visualization and collect feedback about the proposed conceptual framework during these sessions. These sessions were undertaken as part of the usual course of actions in developing approaches to federal monitoring activities.

In advance of engagement sessions, participants were provided with the most recent version of the conceptual framework for review and were asked to arrive prepared to share their thoughts and discuss their feedback. Engagement sessions lasted from 30 minutes to up to 2.5 hours, with a longer duration for larger groups. All sessions began with a description of the context and history of framework development and a walk-through of the most recent iteration of the framework. Participants in larger engagement sessions were then given an opportunity to discuss feedback in small break-out groups prior to a full group discussion, which took place for all engagement sessions. During these engagement sessions, feedback and discussion points were documented and participants were invited to follow up afterwards with any additional feedback or questions by email.

FIGURE 1
Initial conceptual framework for the surveillance of substance-related harms



Primary topic areas can be considered content areas for monitoring activities, while the cross-cutting topic areas can be considered as lenses through which primary topic areas can be viewed. Feedback from engagement sessions resulted in changes to primary and cross-cutting topic areas and overarching considerations. Additionally, we documented information that could inform the scope of a topic area or what type of information would be important within that topic area (data not shown). Additional topic areas that were incorporated based on feedback from engagement sessions included "substance-related benefits" (in addition to harms), "stigma," "mental and physical health and illness" and "health-supporting systems."

The concept that was originally termed "priority populations" was renamed as a cross-cutting topic area of "equity." Additionally, two overarching considerations were added, as they were identified as foundational to monitoring work in this area: "engagement" with PWLLE, and "respectful use of data." The resulting framework, shown in Figure 2, includes four primary topic areas, four cross-cutting topic areas and two overarching considerations. Each of these is described in detail below.

Primary topic areas

Risk and protective factors

Risk and protective factors (a Level 1 concept; see Figure 2) can occur at four socio-ecological levels (a Level 2 concept)—individual, interpersonal, community or societal.[23] Individual factors are unique to the person, and are related to biological, behavioural, demographic or socioeconomic characteristics.[24] Interpersonal factors are related to relationships with other persons. Community factors are related to groups with a shared identity or geography within the social or physical environment.[25] Societal factors are related to social, political, legal and economic structures, policies and systems, and are broadly embedded throughout society, through both formal and informal mechanisms.

Substance use

The substance use spectrum represents the use of psychoactive substances, which includes substances that "when taken in or administered into one's system, affect mental processes, e.g. cognition or affect,"[26] such as opioids, stimulants, cannabis or alcohol. Substance use (a Level 1 concept) occurs on a spectrum, which can range from non-use through beneficial use, lower-risk use and higher-risk use to addiction/dependence (substance use disorder; Level 2 concepts).[27,*]

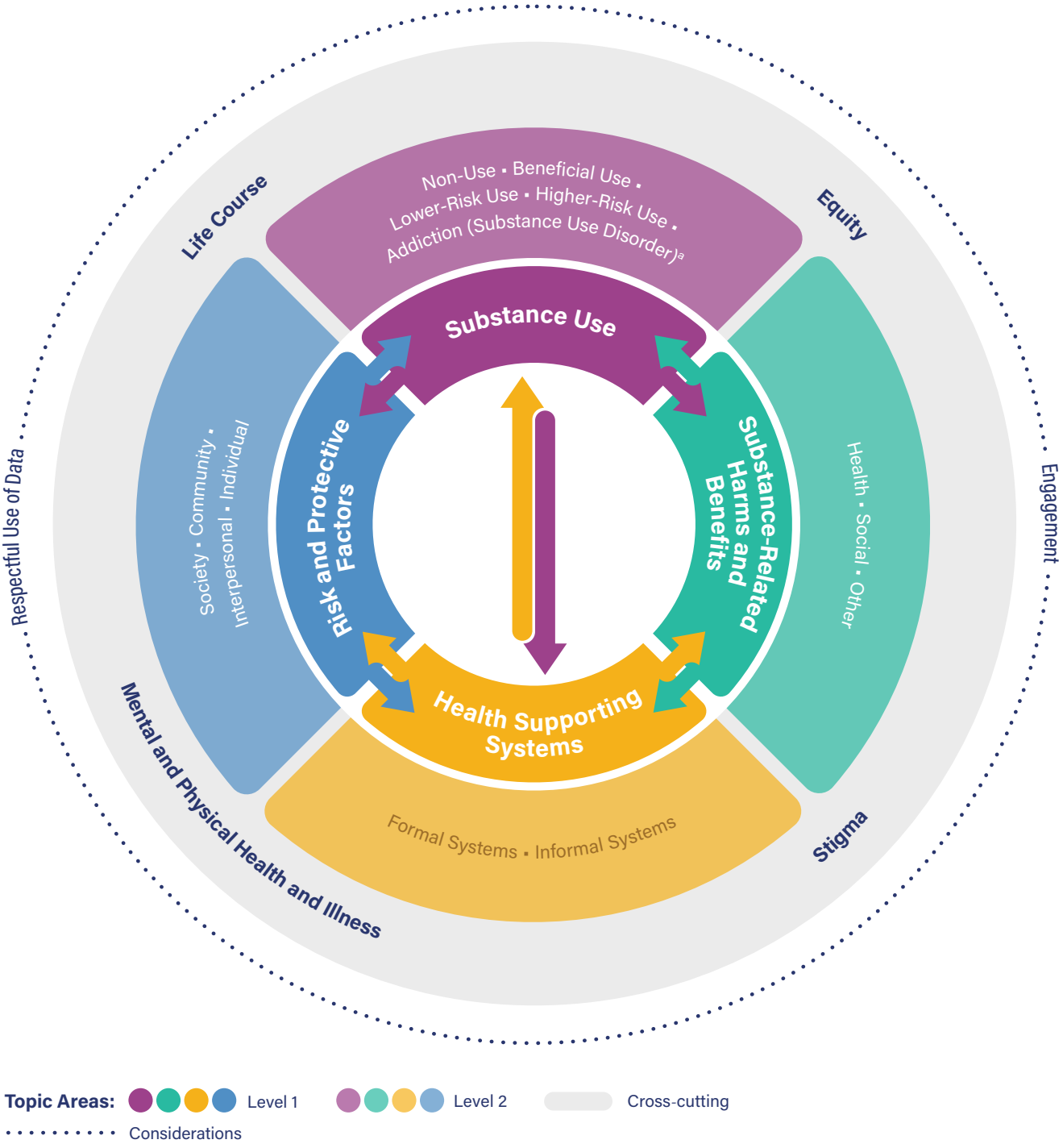
Additional characteristics of substance use could be considered, depending on the contexts and use of the monitoring system, such as length of time the substance has been used, frequency of use, mechanism of consumption, source of substance and contexts within which the substance is used, among others. While not specifically substance use, the substance supply system is an important determinant of substance use and related harms, and should be considered in conjunction with the substance use spectrum.

Health supporting systems

Health supporting systems (a Level 1 concept) include both formal and informal systems (Level 2 concepts). Formal health supporting systems refer to the organized and structured network of health services and facilities that operate within a legal and professional framework, such as hospitals, primary health care and psychological services. Informal health supporting systems, on the other hand, encompass a wide range of health-related support that exists outside the formal health care infrastructure. This may include peer-based

* The term "addiction/dependence" is used in the original spectrum; however, the preferred term is "substance use disorder."

FIGURE 2
Conceptual framework for the public health monitoring of substance-related harms



[a] Government of Canada. Substance use spectrum. Ottawa, Ontario: Government of Canada; 2022; ISBN: 978-0-660-42897-0. Available from: https://publications.gc.ca/collections/collection_2022/sc-hc/H134-21-2022-eng.pdf

support, family care and care provided by volunteers, including services for people who use substances. The language of this primary topic area is specifically worded to highlight that it is not only the formal health care system that is important for data and monitoring in this context. Other formal systems, such as the education, social services, housing or legal systems, can support (or fail to support) health. Attributes of formal health supporting systems may be characterized by accessibility, approachability, acceptability, availability and accommodation, affordability and appropriateness.[28] These attributes could be incorporated into future monitoring efforts.

Substance-related harms and benefits

Substance-related harms (a Level 1 concept) are negative effects that result from the use of psychoactive substances. In the present framework, harms are categorized as "health," "social" and "other" (Level 2 concepts). Harms can be acute (short lasting) or chronic (long lasting), proximal (close in time) or distal (far in time) to the substance use, and may be experienced by oneself or others. An example of an acute, proximal harm to oneself would be a drug poisoning (overdose), while a chronic distal harm could be the long-term effects of alcohol consumption such as alcohol-related liver cirrhosis. Someone injured in a motor vehicle accident in which the other driver was intoxicated is an example of a substance-related harm to another person.

Health harms can include negative effects on physical or mental health, or both. Social harms can include problems with one's interpersonal relationships or role functioning (i.e. the ability of an individual to perform the functions of developmentally appropriate roles such as student, parent or worker). Other harms may be economic (e.g. loss of one's employment income) or legal (e.g. interaction with the justice system).

While substance-related harms are often the focus of public health monitoring, it is important to keep in mind that there are also real or perceived benefits to substance use, which is often the reason people continue using a substance in the face of harms. Benefits that may result from the use of psychoactive substances may include health or social benefits, such as reduced pain or greater sociability.[27]

Cross-cutting topic areas

Four cross-cutting topic areas were identified as applicable across the four primary topic areas within the framework.

Life course

The life course cross-cutting topic area reflects that components of the framework may be relevant at, and vary across, multiple developmental stages.[29] The life course includes biological age and developmental stage, and also encompasses life events and transitions (e.g. pregnancy and lactation, parenthood, marriage, divorce, death of a close family member or friend, changes at work or to employment status, retirement). Certain risk and protective factors, harms and benefits may have a greater impact at a particular age and may also change over the life course. In addition, the life course must be considered within its historical, cultural and socioeconomic context, which can vary through developmental stages.

Equity

The concept of equity underpins the structure and components of the conceptual framework.[30] Substance-related harms and associated risk and protective factors, substance use behaviour, stigma and service access and provision differ between demographic and socioeconomic groups due to the impacts of cultural and structural systems that assign value and grant opportunities and privileges based on these characteristics. Data about who is most affected provides the foundation for targeted policies and programs.[31] Approaches to analyzing health inequities, such as Sex- and Gender Based Analysis Plus (SGBA +),[32] should be integrated into all substance-related harms monitoring activities, with consideration of the impact of broader systems, policies and structures that shape these inequities.

Substance use stigma

Substance use stigma "is negative attitudes, beliefs or behaviours about or towards a group of people because of their situation in life. It includes discrimination, prejudice, judgment and stereotypes, which can isolate people who use drugs."[33] Stigma can take several forms: self-stigma, in which someone internalizes within themselves negative attitudes about people who use substances; social stigma, which is others holding negative attitudes and behaviours towards people who use drugs; and structural stigma, which occurs when policies and practices reduce access to services by people who use drugs.[34] All of these types of stigma may lead to a greater chance of negative outcomes for people who use drugs.[35]

Mental and physical health and illness

Mental and physical health and illness were identified as a fourth cross-cutting topic area. While harms to health is a subtopic area under "Substance-related harms and benefits," based on feedback from engagement sessions, this additional cross-cutting topic area was added.[36-38] For example, pain resulting from acute or chronic health conditions may influence substance use as well as treatment received for substance use disorder.[36] Mental disorders and substance use disorders often co-occur;[37,38] their co-occurrence may impact access to services for both conditions.[39] A particularly novel area may be a focus on positive mental and physical health in this cross-cutting topic area. While much of the discourse related to substance use focusses on harms (or the prevention thereof), focussing on positive health may yield previously overlooked benefits. This is consistent with a substance use health perspective, which "suggests that substance use not be considered in isolation but rather as an overall component of health and well-being."[40]

Overarching considerations

Finally, the proposed framework also includes two overarching considerations: engagement with PWLLE and respectful use of data. Engagement with PWLLE is foundational to any evidence development in the area of substance use, and its related harms and benefits.[41] This stems from a foundational principle that work done in the interest of a community should actively engage that community, and that communities are experts through their lived experience.[42]

Additionally, the consideration of respectful use of data encompasses the principle that data should be collected and used in ways that will neither further stigmatize nor harm the community of people who use drugs or who are affected by substance-related harms. This is consistent with the concepts of cultural responsiveness and accessibility in order to avoid perpetuating systematic discrimination and harms.[43] Consistent with this is the identification and application of appropriate guiding frameworks, such as Ownership,

Control, Access and Possession (OCAP®) for Indigenous data[44] and Engagement, Governance, Access and Protection (EGAP) for race-based data from Black communities.[45]

Discussion

This paper presents the process we undertook to develop a conceptual framework for public health monitoring of substance-related harms, a critical component in addressing the ongoing drug toxicity crisis and broader challenges related to substance use in Canada,[46] such as those caused by alcohol. The development of this framework is timely and necessary, considering the continuing public health concerns related to substance use and its associated harms, which have been exacerbated by the COVID-19 pandemic.[4]

The framework's emphasis on a multifaceted approach, integrating risk and protective factors across four socioecological levels (individual, interpersonal, community and societal), aligns with other monitoring frameworks in chronic disease and health promotion at PHAC. This approach acknowledges the complexity of substance use and its impacts, which extend beyond individual behaviour to encompass interpersonal, community and societal influences. The framework's inclusion of a spectrum of substance use behaviours, from non-use through beneficial use, lower-risk use and higher-risk use to addiction/dependence (substance use disorder), allows for a more nuanced understanding of substance-related harms as well as benefits. This is crucial for developing universal interventions to shift the population distribution of substance-related harms broadly,[47] as well as targeted interventions that are sensitive to the varied experiences and needs of different population segments.[31]

The integration of health supporting systems into the framework underscores the vital role of both formal and informal systems in supporting the health of people who use substances and in mitigating substance-related harms. Considering aspects that affect access to services may be particularly important, given the disparities in health outcomes among different demographic groups. Disparities in health outcomes give rise to the need for the cross-cutting topic area of equity, and highlight the importance of ensuring that monitoring efforts are inclusive and address the needs of equity-seeking populations. Cross-cutting topic areas—the life course perspective, equity, stigma and mental and physical health and illness—highlight the dynamic nature of substance use and its impacts over an individual's lifespan, the importance of addressing systemic inequities and stigma, and the interplay between substance use, mental and physical health conditions and experienced harms and benefits.

Strengths and limitations

The iterative development process of the framework, involving engagement with a diverse range of stakeholders from the organizations that would use this framework to guide their efforts, and including PWLLE, adds to its robustness and relevance. This approach not only ensures that the framework is grounded in real-world experiences and needs but also should enhance buy-in and uptake across the participating organizations.

The development process of this conceptual framework, while comprehensive, has certain limitations. To begin with, the sequence of engaging a wide range of groups might have influenced the final framework: a different engagement order could have yielded an alternate framework structure.

Another limitation is the restricted range of stakeholders involved in the consultation. Input was sought from groups within the federal health portfolio as well as PWLLE of substance use. This selective approach may have overlooked diverse perspectives from stakeholders in other sectors or government levels, which could have led to a different framework structure. An example of this is that the substance supply market did not emerge as a distinct topic area. This may be because the concept of the source of substances is often coupled with measurement of substance use and substance-related harms in the public health sphere. Finally, it was not possible to include all feedback directly into the framework. Ongoing engagement with users of monitoring data is essential if these primary and cross-cutting topic areas are used to inform concrete monitoring activities, such as identifying indicators and measures.

This framework can be used by organizations to examine existing data collection activities and monitoring systems, including whether current indicators and measures may align with the primary and cross-cutting topic areas. We anticipate that this framework will be a useful tool for other organizations and levels of government to inform their own monitoring frameworks and we expect that it will be further developed in an iterative manner. Additionally, it provides a structure with which to identify gaps in these topic areas, which can be filled through the identification of relevant indicators and measures. Cross-cutting topic areas should be considered across the primary topic areas; e.g. stigma should be considered across risk and protective factors, substance use, health supporting systems and substance-related harms and benefits.

The considerations of respectful use of data and engagement with PWLLE should be taken into account at all subsequent steps of application of this conceptual framework into practical activities. Identifying these considerations within this framework is a step in the right direction, but ongoing commitment and resources to ensure these principles are upheld in practice will be required. Finally, we note that monitoring activities almost exclusively focus on the collection of data that can be summarized quantitatively—prevalences, incidences, counts and proportions, for example. However, given the rich input provided, particularly by PWLLE of substance use, those responsible for monitoring systems may find qualitative data helpful in contextualizing more traditional monitoring data sources.

Conclusion

This conceptual framework represents an additional step towards a more comprehensive approach to the public health monitoring of substance-related harms. It is a multidimensional framework that can guide future initiatives. However, its successful application will depend on continued collaboration among stakeholders, the identification of existing activities and their alignment within this framework, the identification of gap areas and potential mechanisms to fill them and a commitment to meaningful engagement of communities affected by substance use.

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Conflicts of interest

None.

Authors' contributions and statement

HMO: conceptualization, methodology, investigation, project administration, visualization writing—original draft.

AE: investigation, validation, writing—review and editing.

MS: methodology, investigation, visualization, writing—review and editing.

DG: conceptualization, investigation, visualization, project administration, writing—review and editing.

AY: investigation, writing—original draft, writing—review and editing.

SLH: investigation, writing—review and editing.

LL: investigation, writing—review and editing.

LHT: methodology, investigation, visualization, writing—original draft, writing—review and editing.

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Original quantitative research

The increase in risk classification using Canada's Guidance on Alcohol and Health: an empirical examination in a sample of community adults in Ontario

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This article has been peer reviewed.

Abstract

Introduction: The 2023 Canadian Centre on Substance Use and Addiction drinking guidelines specify a universal low-risk threshold of 2 or fewer drinks per week, lower than previous guidelines that recommended no more than 10 drinks per week or 2 per occasion for females, and 15 per week or 3 per occasion for males. This study examined the increases in risk classification and perceptions of these new guideline thresholds.

Methods: Prevalence of those exceeding the new low-risk threshold was compared with that of previous and other international guidelines in an observational cohort of community adults (N = 1502) from southern Ontario who had been followed since 2018 (11 waves of data collection). To examine awareness of the new guidelines and perceived risk of drinking beyond them, a follow-up was conducted with a subset of the cohort, three months after the release of the guidelines (April 2023).

Results: Across waves, on average, 52% exceeded the new low-risk threshold compared to 11% who exceeded previous guidelines. Other international guidelines classified, on average, 16% (US), 20% (UK) and 29% (WHO) of the sample as exceeding low-risk guidelines. Approximately half of study participants (51%) were aware of Canada's new guidelines, but 77% perceived exceeding 2 drinks per week as having little to no risk.

Conclusion: Over four times more adults exceeded the new low-risk drinking threshold compared to that of the previous Canadian guidelines. Additionally, more were classified as exceeding the new low-risk threshold compared to other international drinking thresholds. These results, combined with low perceptions of risk associated with consuming more than 2 drinks per week, suggest that many Canadians are at risk of exceeding the new guidelines.

Keywords: *drinking guidelines, alcohol consumption, patterns of alcohol use, risk perception*

Highlights

- Using the new low-risk drinking definition outlined in the recent Canada's Guidance on Alcohol and Health report, the proportion of individuals surpassing the 2-drink threshold in a sample of N = 1502 was more than a four-fold increase compared to the previous Canadian guidelines.
- Rates of drinking beyond the new guidelines in this sample were unequally distributed across sex and age, with males and adults aged 50 and older exceeding the guidelines at a higher rate compared to their counterparts.
- In a subsample of n = 1278, more than three-quarters perceived that exceeding the new 2-drink threshold had little to no risk, suggesting a need for greater public education surrounding alcohol-related harms, particularly among those who are more likely to exceed the new guidelines.

Introduction

New guidelines* on alcohol consumption were released in January 2023[1] by the Canadian Centre on Substance Use and Addiction (CCSA), providing an update to the previous drinking guidelines (DGs) from 2011. The plan to update the DGs was a collaborative effort between the CCSA, Health Canada and the Public Health Agency of Canada (PHAC) as a result of new data highlighting the risks associated with alcohol consumption,[1] although Health Canada has yet to adopt these new guidelines formally.[2,3]

With over three-quarters of Canadians consuming alcohol at least annually,[4] the new guidelines pertain to a large proportion of

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* Notably, Canada's previous guidelines (and their associated reports) were referred to as the "Low-Risk Alcohol Drinking Guidelines," while the new guidelines are called "Guidance on Alcohol and Health." Despite the shift in terminology, because a low-risk threshold was still included in the new guidance,[1] both new and previous guidelines will be referred to as "low-risk drinking thresholds" for simplicity.

the population. The aims of DGs are to educate Canadians on the risks associated with alcohol consumption by providing guidance on levels of consumption that may pose acute or chronic risks for individual health. According to the CCSA's final report, updates to the DGs are based on evidence surrounding the health impacts of alcohol, but with a focus on individual risk for morbidity and mortality.[1] The changes reflect a shift away from the notion that health benefits may possibly be associated with modest alcohol consumption, and instead emphasize recent evidence that all alcohol consumption carries risk,[5,6] especially for some population groups such as young adults.[7]

Defining drinking guidelines

Typically, DGs either define a ceiling for low-risk drinking (sometimes referred to as "drinking in moderation") or lay out a continuum of risk. The former definition utilizes a single quantitative threshold, which is used to categorize alcohol consumption either as within or in excess of that threshold (such as higher-risk drinking). The latter portrays the dose-response relationship between risks and drinking, distinguishing between low-, moderate- and high-risk drinking. Some guidelines, such as those from the World Health Organization (WHO), go further to distinguish between high- and very high-risk drinking.[8]

Guidelines also often consist of both per occasion and weekly consumption thresholds, the former pertaining to acute harms (e.g. falls, motor vehicle collisions, perpetration of violence) and the latter pertaining to chronic harms (e.g. cancer risk, liver disease risk). Evidence suggests that when used in tandem, this combination better predicts potential harm than guidelines that focus solely on one or the other.[9] Typically, weekly guidelines focus on defining an average number of drinks consumed, and per occasion guidelines address patterns of consumption. Specifically, per occasion limits address heavy episodic drinking (HED; also called "binge drinking"), which is associated with acute risks,[10] particularly for young adults.[11]

Comparing previous and current Canadian guidelines

Compared to Canada's 2011 low-risk drinking definition, the updated weekly guidelines use a continuum of risk, akin to WHO guidelines on alcohol consumption, but with a lower threshold for defining low-risk. The low-risk threshold is defined as no more than 2 standard drinks (Canadian standard drink = 13.45 g of pure ethanol alcohol) per week,[1] whereas previous DGs defined the low-risk drinking threshold as no more than 10 standard drinks per week for females, or 15 for males.[12] Additionally, a new threshold for moderate-risk drinking was added, defined as between 3 and 6 standard drinks per week.[1] These low- and moderate-risk weekly drinking thresholds are based on a 1/1000 and 1/100 lifetime risk of mortality, respectively, and take into account new evidence of alcohol-related morbidity and mortality, published after the release of the 2011 DGs.[1]

The updated per occasion drinking threshold is also lower, defined as no more than 2 standard drinks per occasion.[1] The previous Canadian guidelines defined per occasion limits of 2 drinks per occasion for females and 3 for males,[12] allowing for multiple drinking days within these per occasion limits prior to the weekly maximum limits being exceeded. However, with the new low-risk definitions, only one "per occasion" limit of 2 drinks is permissible before the weekly limits are exceeded. In this regard, the new low-risk weekly and per occasion thresholds are identical, and do not distinguish between patterns of use.

Previous Canadian guidelines also highlighted a second set of per occasion limits labelled "special occasions," which aligned with other widely used definitions of HED (i.e. limits exceeded with 4 or 5 standard drinks for females or males, respectively).[13] While the new guidelines are universal, citing negligible differences between females and males at the low end of alcohol consumption,[1] previous guidelines included sex-specific thresholds for females and males. As a result, the new low-risk drinking threshold represents a greater reduction in drinks for males (an 87% reduction of 13 drinks per week) compared to females (an 80% reduction of 8 drinks per week).

Beyond the previous Canadian guidelines, the new guidelines' thresholds are also lower than the WHO's continuum of risk, as well as other widely used international drinking definitions from countries with similar drinking climates as Canada,[14] such as the National Institute on Alcohol Abuse and Alcoholism (NIAAA) in the US, and the National Health Service (NHS) in the UK. These international drinking definitions were also chosen as a comparison to the Canadian DGs in this study, as they provide a more heterogeneous range in type of guideline. Specifically, the NIAAA definition is used to define heavy alcohol use, with the per occasion threshold leveraging the definition of binge drinking; the NHS provides a comparison definition whereby weekly and per occasion guidelines are universal for both females and males; and the WHO drinking levels provide an opportunity to compare Canada's new guidelines with another drinking risk continuum. A detailed overview of these international guidelines converted to Canadian standard drinks is provided in the Results section.

Study aims

Since the revised guidelines set a lower low-risk drinking threshold, a greater proportion of Canadians will inherently be categorized as exceeding the low-risk drinking threshold, but the magnitude of this change in proportion, and its distribution across sex and age, is not yet well understood. The aim of the current study was to quantify the increases in classification rates in an ongoing observational cohort study of Canadian adults.

Specifically, this study had three aims:

(1) to examine the average overall prevalence of those in excess of the new low- and moderate-risk DGs and compare it with both the previous Canadian DGs and drinking definitions from the NIAAA, NHS and WHO;

(2) to examine differences in prevalence by sex assigned at birth, given the change from sex-specific to universal guidelines, as well as differences in prevalence by age group, given the established differences in drinking patterns across adulthood and the large reduction in per occasion drinking limit definitions; and

(3) to measure general awareness of the new DGs released in January 2023 and perception of risk associated with the low- and moderate-drinking thresholds including risk perception by sex assigned at birth and age group. Although not an inherently longitudinal question, calculating prevalence using a longitudinal

dataset was considered beneficial to reduce the temporal specificity of findings and generate reliable estimates across a wide time window. This is particularly relevant as drinking behaviour in Canada is seasonal,[15,16] and varied over the acute phase of the COVID-19 pandemic.[17,18]

Methods

Ethics approval

This study was approved by the Hamilton Integrated Research Ethics Board (Protocol #4699).

Participants and measures

Participants were members of an ongoing longitudinal cohort study of community adults (N = 1502) from southern Ontario, first recruited from a research registry that was established between 2016 and 2018 as a one-time, in-person assessment. The registry recruited nonclinical individuals from the surrounding community via advertisements (both print and online, including social media platforms) to collect various health indicators. Previous reports provide detailed information about the cohort,[19] but the broad eligibility criteria were: age 18 to 65 years at time of enrollment; interest in participating in health research studies; and no medical conditions that would preclude participation in future research studies.

At the launch of the cohort in September 2018, participants were 59.7% female,[†] 27.3% non-White and approximately 35 years of age (mean [M]: 34.58, standard deviation [SD]: 13.93), with a median yearly household income of CAD 60 000 to 74 999, and median education of some postsecondary education. There were 11 waves of online data collection prior to the release of the updated guidelines; waves occurred every 3 or 6 months[‡] from 2018 to 2022, with high retention of the N = 1502 across survey waves (retention across waves: M: 91.3%, SD: 3.86%). To address aims 1 and 2 of the study, the percent of participants exceeding drinking definition thresholds at a given wave was first calculated and then averaged across the 11 waves. A subsample of participants (n = 1278) in the next follow-up wave of the study was assessed in April 2023 (3 months after the public release of the new DGs), providing insight on public awareness and perception of the guidelines to address aim 3 of this study. An overview of sample characteristics is given in the Results section.

Typical consumption of standard alcohol servings for each day of the calendar week was collected via the Daily Drinking Questionnaire (DDQ[20]). By asking participants to recall the number of standard drinks they typically consumed on each of the seven days of the week during the past 6 months (3 months for survey waves administered quarterly), it could be determined whether weekly limits, as well as "combined" (meaning either weekly or per occasion) limits were exceeded. To be classified as exceeding the combined drinking threshold, individuals only needed to exceed the per occasion (based on their sex assigned at birth) or the weekly low-risk thresholds, but not necessarily both. Notably, many studies may not have data on alcohol consumption per occasion; for comparability and clarity purposes, the proportion of individuals exceeding the weekly limit in this study are the main focus in the Results section. However, it is acknowledged that the combined limits leverage more information, and as such, parallel proportions of those exceeding combined weekly and/or occasional limits are provided in the tables and figures.

To assess whether the subsample of participants (n = 1278) was aware of the new guidelines, participants were asked to respond "Yes" or "No" to the question, "Are you aware of the new guidance about alcohol consumption as published in Canada's Guidance on Alcohol and Health report?" Participants were also asked two questions about the perceived risk of exceeding the new drinking thresholds: "How much do people risk harming themselves physically and in other ways when they have more than [two drinks/six drinks] of an alcoholic beverage per week?" These questions, which pertained to the low- and moderate-risk thresholds, respectively, mirror questions used in the National Survey on Drug Use and Health (NSDUH);[21] responses were "No risk," "Slight risk," "Moderate risk" and "Great risk."

Canadian standard drinks equivalency

In order to make direct comparisons across international guidelines, thresholds were translated into Canadian standard drinks, defined as 13.45 g of pure ethanol alcohol, or, as one beer or cider (12 oz. or 341 mL, at 5% alcohol); one glass of wine (5 oz. or 142 mL, at 12% alcohol); or one shot of distilled alcohol (1.5 oz. or 43 mL, at 40% alcohol).[1]

The heavy drinking definition by the NIAAA in the US (where 1 standard drink is equivalent to 1.04 standard Canadian drinks) outlines a weekly limit of 7 and 14 standard drinks and a per occasion limit of 3 and 4 standard drinks for females and males, respectively.[13,22,23] The NHS in the UK indicates a universal limit of 14 units of alcohol (1 unit is equivalent to 0.6 standard Canadian drinks) over a minimum of 3 days per week.[24,25]

The WHO utilizes a continuum of risk, expressing their DGs as the average number of drinks consumed across drinking days, with a low-risk drinking threshold defined as no more than 20 g and 40 g per drinking day, and a medium-risk drinking threshold defined as no more than 40 g and 60 g per drinking day, for females and males, respectively. The WHO also has per occasion thresholds defined as no more than 40 g for females and 60 g for males.[8]

For comparative purposes, in instances in which guidelines represent a fractionated Canadian standard drink, or when varying limits are defined (e.g. "most days" and "special occasions" definitions), lower limits rounded down (i.e. the more conservative limits) were used. Table 2 outlines the different DGs examined, converted into Canadian standard drinks.

Analyses

For aims 1 and 2 of the study, the mean average proportion of participants exceeding

[†] The congruence between sex assigned at birth and cis-gender in this sample is high (99%). Since drinking definitions are generally based on biological factors rather than sociocultural differences, sex assigned at birth was chosen for analysis. However, this is not intended to diminish gender-specific risks, or the existence of other sexes outside of the binary of female and male (and genders outside of women and men).

[‡] Each wave of data collection was scheduled to occur biannually; however, with the onset of the COVID-19 pandemic, two additional waves of data collection were added in July 2020 and January 2021, shortening the interval between adjacent assessments to 3 months.

guidelines at each wave was used to calculate the prevalence at which the sample exceeds the new guidelines relative to the previous and international guidelines. For aim 2, sex assigned at birth and age at the time of the assessment were used to classify participants into those aged under 30 years, those aged 30 to 49 and those aged 50 or older. For aim 3, logistic regression was used to calculate the odds ratio of perceiving the different thresholds as risky by sex assigned at birth and age category (based on age at assessment), while controlling for reported alcohol use, awareness of the new guidelines, education level and household income as self-reported at the time of the assessment.

Results

Overall drinking characteristics

On average, 74% (range across 11 waves: 67%–80%) of the sample reported drinking at least one standard drink per week (see Supplemental Figure S1 at https://osf.io/57e94/?view_only=a8d2ed52c74b43b1b5262f59788c0c65). Although not recruited to be a representative national sample, the prevalence of adults endorsing alcohol use in the sample reflect Ontario provincial trends (74%) and national Canadian trends of use of between 76% and 78%, as estimated by the 2019 Canadian Alcohol and Drugs Survey (CADS).[4] Among those in the sample who reported alcohol consumption, the mean average number of standard drinks consumed per week across all waves was 7.0 (mean average minimum and maximum across all waves: 6.5–7.9), and drinks were consumed across an average of 3.0 (mean average minimum and maximum across all waves: 2.8–3.4) days per week (Table 1). The highest reported per occasion consumption among those who consumed alcohol was, on average, 2.7 drinks (mean average minimum and maximum across all waves: 2.5–3.2).

Weekly and combined guideline risk thresholds

Figure 1-A reveals the prevalence of exceeding the low- and moderate-risk drinking thresholds based on the Canadian and international benchmarks in aggregate (i.e. averaged over all time points) and over time. The specific aggregated differences in prevalence between Canada's new low-risk drinking threshold and other guidelines are summarized in Table 2. (To illustrate differences in prevalence between Canada's new low-risk drinking threshold and other guidelines in the year immediately prior to the introduction of the new Canadian DGs in 2023, a summary is provided in Supplemental Table 1, with demographics provided in Supplemental Table 2). On average, across survey waves, more than half (52.2%) of the sample were classified as exceeding the new low-risk drinking threshold of 2 drinks per week, 4.6 times those classified as exceeding the previous Canadian low-risk threshold (11.3%). In comparison to international weekly DGs, the proportion of those exceeding the new low-risk threshold was 3.2 times that of the NIAAA (16.4%); 2.6 times that of the NHS (19.9%); and 1.8 times the WHO (28.7%) low-risk thresholds.

TABLE 1
Demographics and mean summary statistics of drinking-related outcomes in a sample and subsample of community adults from southern Ontario, Canada

	Overall sample (N = 1502)	Attitudes and perceptions subsample (n = 1278)
Demographics	**(Sept. 2018)**	**(Apr. 2023)**
N (%) Female	896 (59.7)	786 (61.5)
N (%) Non-White	309 (21.6)	265 (20.7)
Median yearly household income (CAD)	60 000–74 999	90 000–105 000[a]
Mean (SD) age	34.58 (13.93)	39.78 (14.14)
N (%) < 30 years of age	761 (50.67)	466 (36.46)
N (%) 30–49 years of age	423 (28.16)	469 (36.70)
N (%) 50+ years of age	318 (21.17)	343 (26.84)
Drinking-related outcomes	**Across waves (Sept. 2018–Oct. 2022)**	**(Apr. 2023)**
Drinks per week, mean (SE)	5.18 (0.18)	4.45 (0.19)
Drinking days per week, mean (SE)	2.2 (0.05)	1.93 (0.05)
Average maximum drinks per occasion, mean (SE)	2.02 (0.08)	1.81 (0.06)
Total AUDIT score,[b] mean (SE)	3.57 (0.16)	3.24 (0.11)

Abbreviations: AUDIT, Alcohol Use Disorders Identification Test; CAD, Canadian dollars; SD, standard deviation; SE, standard error.

[a] n = 1 missing.

[b] The AUDIT ranges from 0 (abstinence) to 40, with a score between 1 and 7 suggesting low-risk consumption of alcohol.

Differences in prevalence by sex and age

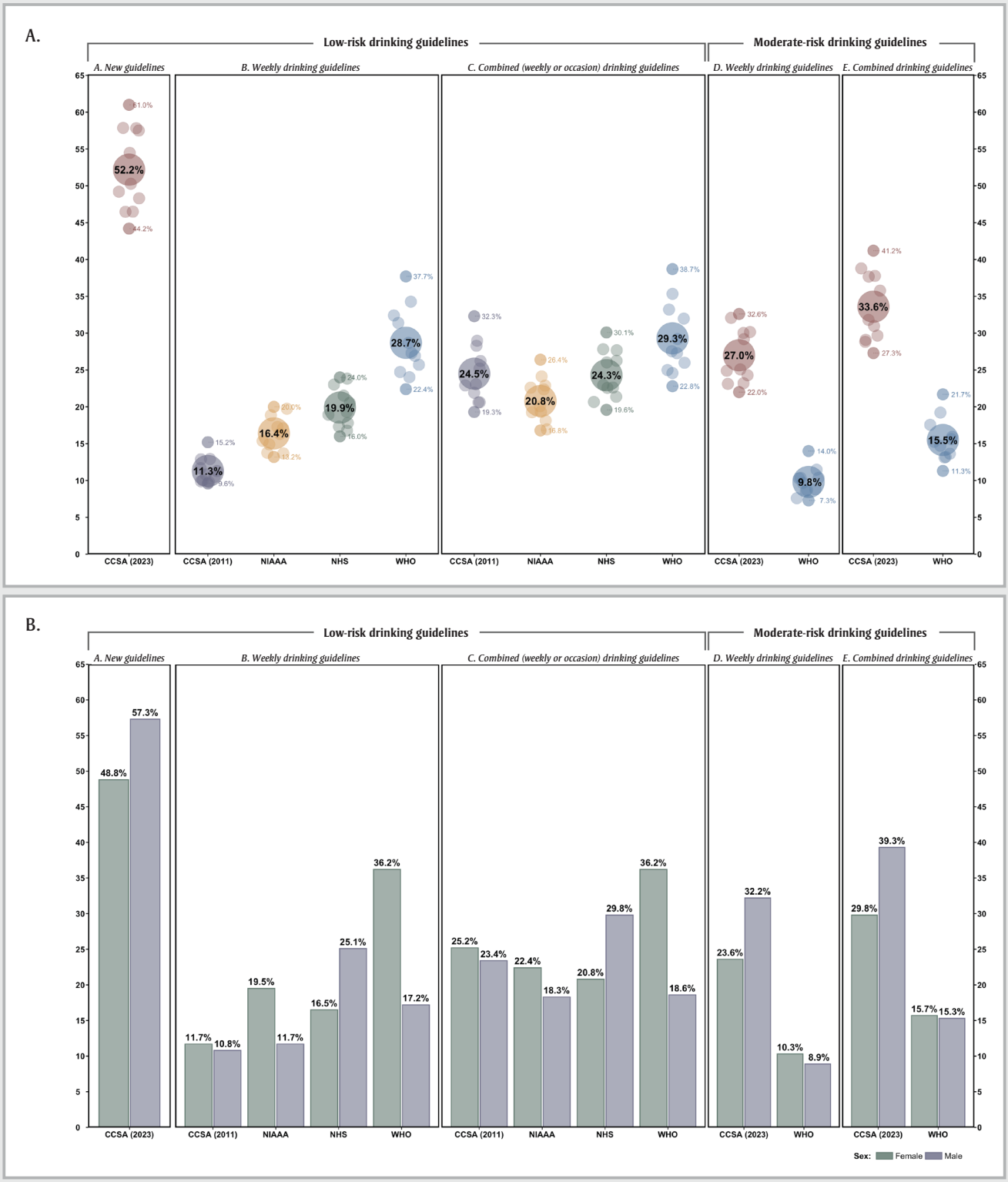
Table 3 summarizes the differences in prevalence exceeding new and previous Canadian low-risk drinking thresholds by sex and age. A higher percent of males (57.3%) exceeded the new low-risk drinking threshold than females (48.8%). This is in contrast to the previous Canadian low-risk drinking definition, which saw similar percentages of males and females exceeding the low-risk threshold (10.8% and 11.7%, respectively). This translates to a 5.3 times higher prevalence of males exceeding the new low-risk drinking threshold and a 4.2 times higher prevalence for females. Additional mean average prevalence of exceeding low- and moderate-risk Canadian and international DGs by sex can be found in Figure 1-B.

The percent of young adults (< 30 years of age) exceeding the new low-risk drinking threshold (53.5%) was similar to those aged 50 and older (52.5%), despite nearly a 9% difference between age categories using the previous combined low-risk drinking threshold (28.4% vs. 19.6%, respectively), which captures HED of young adults. The prevalence of those exceeding the low-risk drinking threshold among those under 30 years of age was 1.9 times higher compared to previous low-risk guidelines, while among those aged 50 and older it was 2.7 times higher.

Awareness and perceptions of new guidelines

Among the April 2023 subsample (n = 1278), for which awareness and perceptions were assessed, 71.0% (n = 908) reported alcohol consumption in the past month. Just over half of participants (51.1%) stated that they were aware of the new Canadian guidelines. This is lower than the 58.7%

FIGURE 1
Percentage exceeding drinking guideline thresholds overall (A) and by sex assigned at birth (B) based on a sample of N = 1502 participants from southern Ontario across 11 data-collection waves, 2018 to 2022



Abbreviations: CCSA, Canadian Centre on Substance Use and Addiction; NIAAA, National Institute on Alcohol Abuse and Alcoholism; NHS, National Health Service; WHO, World Health Organization.

Notes: In Figure 1-A, large circles represent averages across 11 survey waves (2018–2022), whereas small circles show each wave separately. Minimum and maximum values are labelled for individual waves. In Figure 1-B, bars represent averages across 11 survey waves (2018–2022). In both figures, panels are: (A) the new Canadian low-risk drinking guideline threshold; (B) weekly low-risk drinking thresholds; (C) combined (either weekly or per occasion) low-risk drinking threshold; (D) weekly moderate-risk drinking thresholds; and (E) combined (weekly or per occasion) moderate-risk drinking thresholds. Here, low-risk drinking guidelines reference the binary classification of either within or in excess of a threshold for higher-risk drinking. Guidelines that use a continuum of risk are referred to in this figure as moderate-risk drinking guidelines, as a lower-risk threshold exists below what is termed "moderate/medium" risk.

TABLE 2
Drinking guideline thresholds converted into Canadian standard drinks and prevalence multipliers based on a sample of N = 1502 participants from southern Ontario across 11 data-collection waves, 2018 to 2022

Guideline (country, year)	Weekly threshold	Per occasion threshold	Mean (min–max) prevalence multipliers[a]	
			a. Weekly	b. Combined
Low-risk				
CCSA: Guidance on Alcohol and Health—low-risk (Canada, 2023)	Maximum 2 standard drinks per week	Maximum 2 standard drinks on a given day	—	—
CCSA: Canada's Low-Risk Alcohol Drinking Guidelines (Canada, 2011)	Maximum 10 standard drinks a week for females, or 15 for men	Maximum 2 standard drinks for females, 3 for males most days Maximum 3 standard drinks for females, 4 for males for special occasions	4.6 (4.0–4.6)	2.1 (1.9–2.3)
NIAAA: Heavy Alcohol Use (US, 2009)	Maximum 7 standard drinks per week for females, or 14 for men	Maximum 3 standard drinks for females, 4 for men	3.2 (3.1–3.3)	2.5 (2.3–2.6)
NHS: Low-Risk Drinking Advice (UK, 2016)	Maximum 8.3 standard drinks	Weekly drinks are to be consumed across a minimum of 3 days (implied maximum of 3 drinks on any given occasion)	2.6 (2.5–2.8)	2.1 (2.0–2.3)
WHO: Low Risk Drinking Category (Global, 2000)	Maximum 1.5 standard drinks for females, 3.0 for males, each drinking day per week	Maximum 3.0 standard drinks for females, 4.5 or men	1.8 (1.6–2.0)	1.8 (1.6–1.9)
Moderate-risk				
CCSA: Guidance on Alcohol & Health—Moderate-Risk (Canada, 2023)	Maximum 6 standard drinks per week	Maximum 2 drinks on a given day	—	—
WHO: Medium Risk Drinking Category (Global, 2000)	Maximum 3.0 standard drinks for females, 4.5 for males each drinking day per week	Maximum 3.0 standard drinks for females, 4.5 for men	2.8 (2.3–3.0)	2.2 (1.9–2.4)

Abbreviations: CCSA, Canadian Centre on Substance Use and Addiction; NIAAA, National Institute on Alcohol Abuse and Alcoholism; NHS, National Health Service; UK, United Kingdom, US, United States of America; WHO, World Health Organization.

Notes: Drinking guideline (DG) definitions, alongside prevalence multipliers at which the guideline would exceed classifying those by either the (a) weekly drinking threshold; or (b) combined (either weekly or per occasion) drinking threshold using the new 2023 Canadian low-risk and moderate-risk drinking definitions.

[a] Prevalence multipliers can be interpreted as X number of times higher individuals in the sample would be classified as exceeding the new 2023 Canadian DGs relative to the comparison guidelines, and is calculated by dividing the average proportion of those exceeding the new 2023 drinking threshold by the average proportion of those exceeding the comparison guidelines.

of Canadians surveyed in February 2023, although that survey only measured those who reported being aware of either the new or old Canadian guidelines.[26] Furthermore, the majority (77.4%) perceived consumption of more than 2 standard drinks per week to be of no or slight risk, compared to 22.6% who perceived this to be a moderate risk or greater (Figure 2). Exceeding the moderate threshold was generally seen as risky, with 60.4% of participants endorsing more than 6 standard drinks in a week as moderately risky or greater.

Table 4 presents the odds of perceiving drinking above the low-risk (> 2 drinks) or moderate-risk (> 6 drinks) thresholds as risky (moderate or higher risk). Females were 13% (odds ratio [OR] = 1.13, 95% confidence interval [CI]: 1.07–1.19; $p < 0.001$) more likely to report more than 6 drinks a week as risky compared to males. There was no significant difference in the odds of females compared to males reporting greater than 2 drinks a week as risky (1.04, 0.99–1.09; $p > 0.05$). Those aged 50 and older were 12% less likely to report drinking in excess of the low-risk threshold as risky (0.88, 0.83–0.93; $p < 0.001$), and 14% less likely to report the moderate-risk threshold (0.86, 0.80–0.92; $p < 0.001$) as risky compared to those under 30 years of age.

Discussion

This study examined the prevalence of individuals exceeding the new Canadian DGs compared to previous Canadian guidelines and other international benchmarks in a longitudinal sample of community adults. Comparison of prevalence revealed a greater magnitude of individuals exceeding the new low-risk drinking definition, with over half (52%) of the sample above the new Canadian low-risk threshold of no more than 2 drinks per week. This finding is in alignment with the estimate of 50% from a previous survey of a representative sample of Canadians from 2019.[27] The prevalence of participants exceeding previous Canadian weekly guidelines of 11% is lower compared to the national Canadian estimate of 23%.[4] However, using the national prevalence estimate would still imply a more than doubling of the proportion of individuals being classified as exceeding the new low-risk drinking threshold relative to the previous guidelines.

Implications of universal guidelines across sex and age

A higher percentage of males (57%) versus females (49%) exceeded the new low-risk drinking threshold, despite fewer males exceeding the previous low-risk threshold compared to females. This was a logical extension of the larger reduction in drinks for males proposed by the new

TABLE 3
Percentage exceeding new 2023 Canadian drinking guideline thresholds compared to previous 2011 Canadian guidelines overall, by sex assigned at birth and age, with prevalence multipliers, based on a sample of N = 1502 participants from southern Ontario across 11 data-collection waves, 2018 to 2022

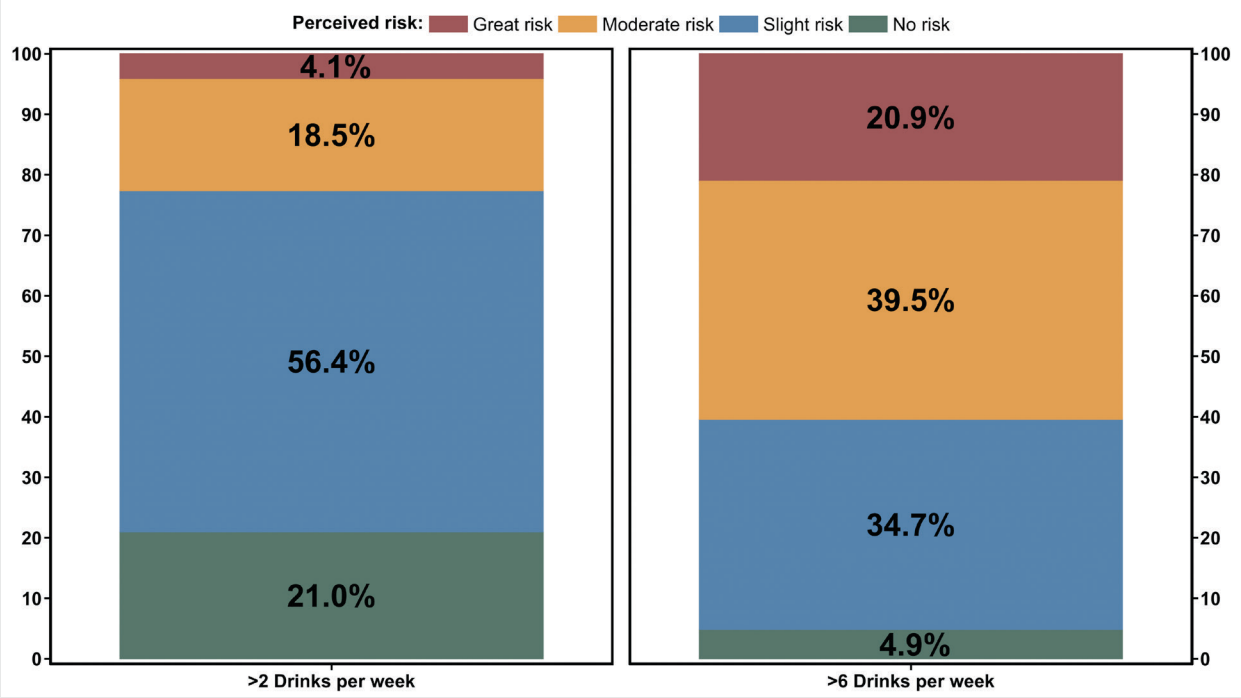
Group	2023 Guidelines	2011 Guidelines		Mean (min–max) prevalence multipliers[a]	
	% Exceeding low-risk guidelines	% Exceeding weekly guidelines	% Exceeding combined guidelines	a. Weekly	b. Combined
Overall					
	52.2	11.3	24.5	4.6 (4.0–4.6)	2.1 (1.9–2.3)
Sex					
Females	48.8	11.7	25.2	4.2 (3.7–4.2)	1.9 (1.7–2.1)
Males	57.3	10.8	23.4	5.3 (4.5–5.5)	2.4 (2.2–2.6)
Age (y)					
< 30	53.5	10.4	28.4	5.1 (4.6–6.1)	1.9 (1.7–2.2)
30–49	49.8	11.8	22.3	4.2 (3.2–4.8)	2.2 (2.2–2.4)
50+	52.5	12.3	19.6	4.3 (3.4–4.9)	2.7 (2.4–2.8)

Abbreviation: y, years.

Notes: Percentage exceeding new 2023 and previous 2011 Canadian drinking guidelines (DGs), alongside prevalence multipliers at which the previous 2011 Canadian drinking guidelines would exceed classifying those by either the (a) weekly drinking threshold or (b) combined (i.e. either weekly or per occasion) drinking threshold using the new 2023 Canadian low-risk and moderate-risk drinking definitions.

[a] Prevalence multipliers can be interpreted as X number of times higher individuals in the sample would be classified as exceeding the new 2023 Canadian DGs relative to the previous 2011 Canadian DGs, and is calculated by dividing the average proportion of those exceeding the new 2023 drinking threshold by the average proportion of those exceeding the previous 2011 guidelines.

FIGURE 2
Perceived risk of exceeding 2023 Canadian low- and moderate-risk drinking guideline thresholds based on a sample of n = 1278 participants from southern Ontario, April 2023



Note: Percentage of response, categorized by the perceived magnitude of risk, to the question "How much do people risk harming themselves physically and in other ways when they have more than [two drinks/six drinks] of an alcoholic beverage per week?", with thresholds associated with exceeding the new 2023 Canadian low-risk (> 2 drinks) and moderate-risk (> 6 drinks) weekly guidelines.

TABLE 4
Percentages and odds ratios of perceiving drinking in excess of the new 2023 Canadian low- and moderate-risk drinking guidelines as risky, by sex assigned at birth and age, in a sample of n = 1278 participants from southern Ontario, April 2023

	% Perceiving exceeding new guidelines as risky		Perceiving risk of > 2 drinks (exceeding low-risk thresholds)		Perceiving risk of > 6 drinks (exceeding moderate-risk thresholds)	
	> 2 Drinks	> 6 Drinks	OR (95% CI)[a]	*p* value	OR (95% CI)[a]	*p* value
Sex						
Females	23.9	64.8	1.04 (0.99–1.09)	0.097	1.13 (1.07–1.19)	< **0.001**
Males	20.5	53.4	1.00 (1.00–1.00)	—	1.00 (1.00–1.00)	—
Age (y)						
< 30	27.9	65.2	1.00 (1.00–1.00)	—	1.00 (1.00–1.00)	—
30–49	22.6	61.6	0.93 (0.88–0.98)	**0.009**	0.95 (0.89–1.01)	0.091
50+	15.5	52.2	0.88 (0.83–0.93)	< **0.001**	0.86 (0.80–0.92)	< **0.001**

Abbreviations: CI, confidence interval; OR, odds ratio; y, years.

Notes: Percentage of n = 1278 participants perceiving drinking in excess of the new low- and moderate-risk drinking thresholds as risky (moderate or higher risk). Statistical significance of < 0.05 denoted in bold.

[a] Adjusted ORs and 95% CIs of main effects of sex assigned at birth and age, which control for reported alcohol consumption, awareness of the new guidelines, education level and yearly household income.

guidance, combined with Canadian males typically consuming a greater volume of alcohol than females.[28] This also follows similar findings using data from the 2019 CADS, which estimated that 62% of males versus 38% of females exceed the new weekly guidelines.[27] Using the new low-risk drinking definition, which opted to omit prior sex-specific guidelines, males were found to exceed the guidelines 8.5% more than females; the previous guidelines only saw a 1% to 2% difference between the sexes.

Although the move away from a sex binary is useful as it allows for simple messaging about alcohol-related dangers, it may also unintentionally imply that the absorption and metabolism of alcohol across sex is equal. The rationale for creating a single universal guideline across sexes is due to the risks being similar for females and males when consumption is within the new low-risk limits.[1] However, with messaging focussing on a continuum of risk, emphasizing that lower consumption is safer, the differences in risk between the sexes and genders[§] as consumption increases are unintentionally minimized. Specifically, these risks relate to: the differences in body size, body composition and pharmacokinetics, all of which can lead to greater sensitivity to alcohol in females;[29] acute alcohol-related risks associated with sex and gender such as injury,[30] sexual assault and intimate partner violence;[29] and chronic risks such as a greater propensity for alcohol dependency in a shorter period of time (referred to as "telescoping") for females.[31] Therefore, stronger messaging on these sex- and gender-based risks would be beneficial.

Although there was a 9% difference in prevalence of those exceeding the low-risk threshold between young adults (< 30) and adults aged 50 and older using the combined 2011 drinking threshold, that difference is reduced to 1% using the new low-risk threshold. As adults age, their typical pattern of consumption shifts from episodic drinking to more frequent but lower-quantity per episode drinking.[32] This is pertinent because although previous guidelines might have defined frequent low-quantity drinking as low-risk (e.g. one drink/day), the new low-risk guidelines classify this pattern as exceeding both low- and moderate-risk thresholds. Notably, the lesser difference between young and older adult drinking patterns using the new guidelines demonstrates the potential for inherent differences in patterns of consumption to become muddled between these groups. From a public health perspective, the new DGs may be more pertinent for those aged 55 and older, given acute age-specific risks such as interactions with medication;[33] accidents and falls;[34] cognitive impairments;[35] and other age-related physiological changes that reduce the ability to metabolize and protect against the negative effects of alcohol.[36]

Universal messaging on the harms of alcohol consumption emphasizes that any amount of alcohol consumption carries risk for all persons. Despite the inclusivity and simplicity of this message, the literature has highlighted that there should be a balance with specificity on the types of acute and chronic risks by sex/gender and age.[37] As this study has exhibited, the prevalence of exceeding the new Canadian low-risk drinking threshold, unlike that of the previous guidelines, is not distributed evenly across either sex or age, so there may be a benefit for differential messaging in future public health efforts. Moreover, this study has also demonstrated that researchers should be cautious when leveraging the new low-risk drinking threshold; the high proportion of people exceeding the threshold alongside the potential to mask important differences in drinking patterns between subgroups may limit the utility of the new threshold in research contexts.

[§] The CCSA's technical report on the new guidelines highlights established risks of alcohol consumption by sex and gender, but these risks are not included in the more public-facing communications (e.g. summary infographic).

Considerations for lower thresholds in research

In addition to chronic risks related strictly to HED such as morbidity and mortality,[38] HED also involves acute dose-dependent risks such as alcohol-attributed injuries resulting in emergency-room visits;[39] suicide attempts;[40] violence;[41,42] and increases in alcohol-related problems.[43] Thus, the use of both average weekly consumption and per occasion drinking thresholds provides a better estimate of risky drinking than just one metric alone.[9,32]

However, unlike other benchmarks, the new low-risk drinking definition utilizes the same 2-drink limit for both weekly and per occasion thresholds. The new guidelines emphasize that beyond 2 standard drinks, there is an increasing risk of acute harm coinciding with an increase in one's blood alcohol concentration (BAC). Depending on biological factors and the timeframe in which the drinks are consumed, a BAC of 0.05% or higher** with just 3 standard drinks consumed across 2 hours is possible for some.[44] Although it is beneficial that the new guidelines highlight the existence of acute risks at the lower per occasion threshold, particularly as intoxicated individuals have a tendency to underestimate their level of intoxication,[45] this also introduces more variability into the measure of acute risk prevalence, since body composition and timeframe of consumption may mean individuals retain a low BAC beyond 2 drinks. Therefore, researchers focussing on acute risks of HED may continue to leverage other established benchmarks such as the NIAAA binge drinking definition†† of 4+ and 5+ drinks for females and males, respectively, for which there is greater certainty that most individuals meeting this threshold would experience substantive psychoactive effects and be legally defined as intoxicated (with a BAC of 0.08%) when drinks are consumed over approximately 2 hours.[13]

Another potential research-related consideration of the new weekly and per occasion guidelines being quite different from previous Canadian or international guidelines is that comparisons to historical or international trends for population surveillance may prove more difficult. This is particularly true in research that may have only collected data on the percentage of people exceeding low-risk drinking definitions. Therefore, fine-grained alcohol use measures that can calculate various percentages of weekly and per occasion limits for use in future research studies would be most useful, such as the DDQ[20] or Timeline Follow Back (TLFB[46]). This would allow for various thresholds of weekly averages and per occasion patterns (e.g. legal intoxication) to be calculated, ensuring future comparability of prevalence over time.

Public awareness and perceptions

Alcohol consumption is highly prevalent in Canada, so the substantial change in public health guidance present in the new guidelines may not resonate with many Canadians. Media coverage after the new DGs were released echoed this concern, with reports of hesitancy, and many people reporting that they do not plan on decreasing their alcohol consumption as a result of the new guidelines.[47,48] Consistent with this, less than a quarter of the sample perceived there to be a moderate or higher risk in consuming more than 2 alcoholic beverages per week. Although risk perception alone may not necessitate changes in behaviour,[49] change is unlikely in the absence of a perception of alcohol-related harms. Anticipation of reduced drinking as a result of the new guidelines alone, therefore, absent extensive public awareness and education efforts, appears unlikely. Thus, if the goal is for these guidelines to have a national impact, additional strategies such as warning labels[50,51] or DG promotional campaigns may be needed.

Other strategies that can help lower higher-risk drinking within a population are limitations on access to alcohol,[52] restrictions on advertising[52] and an increase in taxation.[52,53] Indeed, these interventions are highlighted by the WHO's SAFER initiative as cost-effective strategies to reduce the harm and burden of disease attributed to alcohol.[52] Similarly, greater availability of alcohol due to the relaxation of legislation has been linked to increases in alcohol-related mortality,[54] emergency-room visits[55] and HED by young adults,[56] all which have considerable health care and other costs to society.[57,58]

Across Canada, there is variability when it comes to restricting access to alcohol. In Ontario, the government has recently expanded access to alcohol by allowing the sale of alcohol in convenience and grocery stores, resulting in an estimated 8500 additional retail locations.[59] Additionally, the Ontario government has halted an increase in taxes on alcohol since 2018 until at least 2026.[59] The privatization of alcohol sales, which is expected to lower prices,[54] may also result in an increase in alcohol consumption for Ontarians. If the goal of the new Canadian DGs is to lower population-level alcohol consumption to reduce alcohol-related harms, then provincial policies making alcohol easier to access and more affordable are in direct opposition of this goal, particularly as three-quarters of participants perceived more than 2 drinks per week as having little or no risk.

Strengths and limitations

These findings must be considered in the context of several strengths and limitations. First, the risk of temporal specificity of these findings has been reduced due to a large number of waves of data with high participant retention. Next, this study leveraged a relatively large longitudinal sample of nonclinical community adults that is fairly consistent with Canadian population demographics,[60] albeit with more conservative rates of alcohol consumption and prevalence exceeding previous weekly guidelines than measured in the general population.[4] However, despite similarities, the cohort is not a nationally representative sample, as evidenced by the lack of elevated rate of risky drinking among males that is present in population-based data,[4,61] resulting in a lack of generalizability. In studies focussing on subgroups whose consumption of alcohol is much higher (e.g. youth, people with alcohol use disorder, etc.), the prevalence of those exceeding the low-risk drinking threshold will likely be even greater.

The capturing of both typical frequency and drinking patterns among participants

** A BAC of 0.08% (the legal definition of intoxication) can also be possible. For example, using the NIAAA BAC calculator, the estimated BAC for a woman who weights 165 pounds and consumes 3 standard drinks over 2 hours is 0.08%.[44]

†† The technical CCSA report does make reference to the HED definition of 4+/5+ drinks for females/males, but it is not emphasized in any public-facing communication. This is logical, given that identifying an occasion limit that exceeded the weekly limit of 2 drinks would be counterintuitive to consumers.

by the DDQ instrument was another strength of this study, representing an advantage over studies that typically use more succinct but less granular questions that ask about consumption over a specific threshold or ask participants to select their use pattern from a range of frequencies.[62] Neither of these methods allows for a detailed examination of various drinking thresholds, nor do they allow for the combined limits to be examined.

However, the DDQ instrument cannot capture those who consume alcohol intermittently, and thus more participants may surpass the per occasion drinking threshold, but on a less-than-weekly basis (e.g. such as every fortnight). Indeed, rates of underreporting due to imperfect measures have been quantified by researchers who found discrepancies between rates of drinking among the Canadian population and alcohol sales in Canada, estimating that over 50% of Canadians would exceed the moderate-risk weekly drinking threshold.[27]

Conclusion

These findings indicate that in a sample of community adults over a four-year period (2018–2022), the new Canadian DGs more than quadruple the number of participants classified as exceeding low-risk thresholds compared to the previous guidelines, and increase the proportion relative to other international guidelines. The findings also reveal unequal risk of exceeding the new low- and moderate-risk drinking thresholds by sex, a result of omitting sex-specific guidelines and risks associated with patterns of use (e.g. HED). Findings also indicate that more than three-quarters of individuals perceived alcohol consumption in excess of the new 2-drink weekly limit as posing little to no risk. Those with a greater risk of exceeding the new DGs relative to previous guidelines are less likely to perceive consuming beyond drinking thresholds as risky, potentially exacerbating alcohol-related harms. Collectively, these results suggest that, if it is hoped that Canadians will adopt this guidance, major public education initiatives on the rationales for and importance of the new DGs will be necessary.

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Conflicts of interest

JM is a senior scientist and principal in BEAM Diagnostics, Inc., and has served as a consultant to Clairvoyant Therapeutics, Inc. There are no other conflicts of interest to declare.

Authors' contributions and statement

KB: conceptualization, methodology, investigation, data curation, formal analysis, writing—original draft, writing—review and editing.

AD: conceptualization, methodology, investigation, writing—original draft, writing—review and editing.

JM: conceptualization, methodology, investigation, writing—review and editing, funding acquisition, supervision.

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Original quantitative research

Ontario healthcare workers who sought treatment for their mental health during the first five waves of the COVID-19 pandemic: a snapshot of self-referrals across the province

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Abstract

Introduction: Healthcare workers (HCWs) have reported COVID-19 pandemic-related adverse mental health impacts. We examined the demographic profile of HCWs who self-referred for mental health treatment, how referrals changed over time in relation to waves of COVID-19, what the main problem was for which HCWs sought treatment, and how this changed during the pandemic.

Methods: Five major healthcare institutions provided mental health supports to HCWs across Ontario during the pandemic. Data from May 2020 to March 2022 were collected from 2725 HCW self-referrals regarding referral frequency, main presenting mental health problem and demographic information including ethnicity, gender, age, healthcare setting, profession and whether the HCW had a prior mental health diagnosis or had received prior mental health treatment.

Results: Treatment-seeking HCWs who self-referred predominantly self-identified as female and White. Almost half were nurses, and almost half had received previous mental health treatment; a slightly higher percentage reported a prior mental health diagnosis. Over 60% of the overall sample of HCWs worked in hospitals. The timing of increases and decreases in monthly new referrals roughly aligned with the onset and ending, respectively, of COVID-19 waves. The top five most common presenting problems for treatment-seeking were generalized anxiety/worry symptoms, depression, situational crisis/acute stress response, difficulty with stress/occupational or financial, and posttraumatic stress symptoms.

Conclusion: Ontario HCWs self-referred to access mental health supports during the COVID-19 pandemic. The majority sought treatment for generalized anxiety/worry or depression symptoms. Results of this study may inform system planning for future pandemics, as well as for HCW wellness programs for continued workplace stress in the postpandemic period.

Highlights

- Ontario HCWs accessed flexibly available, low-barrier mental health supports during the COVID-19 pandemic.
- Ontario HCWs most commonly accessed mental health supports during the COVID-19 pandemic for generalized anxiety/worry symptoms and depression symptoms.
- The timing of increases and decreases in monthly new referrals roughly aligned with the onset and ending, respectively, of COVID-19 waves.
- Treatment-seeking HCWs who self-referred predominantly were nurses, worked in a hospital setting and self-identified as female; almost 40% of participants identified as belonging to a racialized group.

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Keywords: *healthcare worker, COVID-19, mental health, treatment, anxiety, depression*

Introduction

In addition to the physical toll of the COVID-19 pandemic, there have been widespread negative mental health effects on Canadians.[1] These effects were even more pronounced in healthcare workers (HCWs). Eighty-four percent of HCWs in the United Kingdom reported higher psychological distress than the general public during the pandemic,[2] and a systematic review of research from around the world reported depression in 33% and anxiety in 42% of HCWs.[3]

HCWs faced unique stressors. Canadian HCWs have reported eight themes of stressful events, including managing patients dying alone; administering care perceived to be futile; feeling their professional opinions were disregarded; observing patient harm; experiencing bullying, violence and divided professional opinions; issues with resources and personal protective equipment; increased workload in the context of staffing shortages; and being in situations where personal and institutional values were conflicting.[4] These themes were also consistent across HCWs at the global level.[5] Many HCWs reported discrimination and/or stigma due to working with patients infected with COVID-19[6] and this was compounded by the impact of social distancing restrictions. Redeployment in healthcare settings also led some to feel inadequately prepared for new work assignments.

Mental health symptoms have been well documented among HCWs during the COVID-19 pandemic, and include anxiety, distress, stress, insomnia, depression, health anxiety/somatization, posttraumatic stress symptoms and fears about COVID-19.[7-10] In addition, many correlates of mental health symptoms were directly related to unique aspects of HCWs' work, including higher COVID-19 infection risk,[11] fears of exposing family to COVID-19,[7] increased workload and separation from family members.[12]

Individual and demographic characteristics were also associated with HCWs' mental health during the pandemic. Nurses were more negatively affected than other professionals and had the highest level of burnout.[12] Females tend to be overrepresented in studies of HCW distress during the pandemic[7] and in treatment studies,[8,13] although this may not be surprising given that nurses are still predominantly female (91% of regulated nurses in Canada were female in 2021[14]) and nurses represent the largest proportion of HCWs in most studies.[8] Younger age predicted worse mental health symptoms in HCWs during the pandemic,[15] as did history of mental health disorder,[8] being frontline staff and female gender.[16] These findings underscore the variability in adverse mental health impacts across a range of individual variables.

Mental health challenges also varied during the pandemic, as each wave of COVID-19 was associated with different public health measures, individual contextual factors and impacts on the healthcare workplace. During July to December 2021, for example, symptoms of fatigue, stress/burnout, insomnia, absenteeism, functional impairment and quality of life worsened in HCWs.[17] Depression and health anxiety/somatization were more frequent in HCWs at the COVID-19 peak compared to the initial phase,[10] and depression and anxiety symptoms reported by HCWs lessened as the epidemic eased.[18] Researchers examining HCWs four times over 12 months found emotional exhaustion and psychological distress peaked in spring 2021, and neither rose monotonically.[9] Emotional exhaustion decreased during periods of low rates of COVID-19-related hospitalizations and new community cases.[9] HCW self-referral for psychiatric care was highest at the start of the pandemic, whereas psychological care requests increased in the summer of 2020.[19] One study reported that treatment referral waves corresponded to COVID-19 community case waves, in which the highest levels of referrals were in May 2020, January 2021 and May 2021.[19]

More research is necessary to understand how mental health challenges reported by HCWs, and the extent of their treatment seeking, fluctuated over the phases of the COVID-19 pandemic. The majority of research outlined above occurred outside of North America, few studies involved Canadian HCWs and many longitudinal studies were restricted to durations of 6 to 18 months. Further, much of the research did not involve treatment-seeking HCWs, who may differ from those solely responding to general surveys about their mental health. Research in the above areas may inform system planning for future pandemics, and for worker wellness planning in healthcare organizations during continued workplace stress in the postpandemic period (e.g. critical staffing shortages, supply chain challenges of medications and equipment, etc.)

Our study examined the following in Ontario HCWs over a 22-month period:

(1) Demographics. What is the demographic profile of HCWs who self-referred for treatment, including race/ethnicity, gender, age, health care setting, profession and prior mental health diagnosis and/or treatment?

(2) Trends in help seeking behaviour. How many HCWs self-referred for mental health support, and did the degree of help-seeking change over time in relation to the COVID-19 waves? Did health care setting and profession vary over time?

(3) Clinical presentations. For which main presenting problems did HCWs seek treatment, and did this change over time?

Methods

Ethics approval

This research was approved by the hospitals' Research Ethics Boards (CAMH REB #086/2020, consent form requirement waived; SJHH REB #12842, written consent obtained) or exemption was provided (Ontario Shores, Royal, Waypoint).

Mental health supports for HCWs—recruitment

Five major healthcare institutions were funded by the Ontario government to provide mental health services to frontline HCWs in healthcare and community care settings across the province. The five hospitals offered self-referral, rapid access to free, confidential, mostly virtual services provided by trained multidisciplinary mental health professionals. Services were developed to support coping with COVID-19-related stress and its impacts on personal well-being, and were available to individuals identifying as working in a healthcare or community care setting. The five hospitals agreed on common approaches to intake and assessment, and hospital

representatives regularly met as a working group to address program needs and ways to meet them.

This initiative was complementary to other local, regional and national programs and services. The initiative was advertised broadly both within the institutions and externally (via social media, hospital websites and regional outreach efforts with partners and stakeholders). HCWs could access the program by connecting to one of the five hospitals through their website or by phone. The treatment was offered virtually and in person, in English, French or other languages, using interpretation services as needed.

Participants

Data were collected from 2725 HCW self-referrals across Ontario, Canada, who self-referred for treatment for their mental health during the pandemic. The five hospitals involved in the HCW initiative were: The Centre for Addiction and Mental Health (CAMH, n = 1124), St. Joseph's Healthcare Hamilton (SJHH, n = 595), The Royal Ottawa Mental Health Centre (Royal, n = 585), Waypoint Centre for Mental Health Care (WCMH, n = 261) and Ontario Shores Centre for Mental Health Sciences (Ontario Shores, n = 160). Demographic characteristics for the treatment-seeking HCWs can be seen in Table 1 by hospital site, and overall findings are listed in the Results section.

Each hospital site provided a variety of mental health services for HCWs, including internet-based cognitive behavioural therapy, single-session psychotherapy, a brief course of coping-focussed psychotherapy (4–8 sessions depending on site), medication consultation and various other services. The data for this paper include HCWs self-referring for any type of treatment.

Measures

Referral frequency

Each site calculated the total number of cumulative referrals, as well as monthly new referrals over time.

Demographic information

Participants reported race/ethnicity, gender, age, healthcare setting, profession, whether they had a prior mental health diagnosis (yes/no) and whether they had received prior mental health treatment (yes/no). The assessing clinician reported one main presenting problem (selected from a list); only the Royal site included all problems that applied.

Procedure

Data were collected separately by each institution and sent monthly to a coordinator who maintained a master database for storage and analysis. The five institutions launched their HCW initiatives on different dates between early April (CAMH, WCMH, Ontario Shores) and May (SJHH, Royal) 2020. The present analysis describes data collected from May 2020 to the end of March 2022, by the beginning of the sixth COVID wave in Ontario. In Ontario, wave 1 took place from mid-March to mid-July 2020; wave 2 from mid-October 2020 to mid-February 2021; wave 3 from early April to mid-July 2021; wave 4 from mid-August to late October 2021; and wave 5 from mid-December 2021 to late February 2022).[20]

Data analysis

Data were collected cumulatively and without unique identifiers, precluding analysis either between or within individuals. Therefore, all analyses presented are descriptive in nature.

Results

Core demographic variables for each of the five sites are presented in Table 1.

The overall sample was predominantly female (87.0%) and White (61.6%), with a mean age of 36.33 (SD = 10.49). Approximately half (50.2%) of the individuals who self-referred had received previous treatment for a mental health issue, and a slightly higher percentage (54.2%) had received a past formal diagnosis of a mental health condition. Table 1 shows the self-referrals breakdown by hospital site, over the period of May 2020 to March 2022.

Total referrals

Figure 1 represents the cumulative referrals to all five sites from May 2020 to March 2022, and the change in new referrals seen each month as the COVID-19 pandemic progressed from the end of the peak of the first wave to the beginning of the sixth wave in Ontario. The mean monthly referrals over the entire period was 118.5 (SD = 80.64), with a range of 13 (in September 2021) to 334 (in May 2021). As represented in Figure 1, the timing of increases and decreases in monthly new referrals roughly aligned with the onset and ending, respectively, of COVID-19 waves, indicating greater seeking of mental health services by health professionals as COVID-19 cases increased.

Presenting problem

Data on presenting problem were available for n = 1266 of the total referrals. Figure 2 displays frequencies for monthly new referrals of the top five most common presenting problems seen upon initial referral across all sites. As seen in Figure 2, generalized anxiety/worry symptoms were the most prevalent, with 414 individuals, who accounted for 32.7% of the total referrals. Depression was the next most common, with 214 individuals, who accounted for 16.9% of the total cumulative referrals. The next most common presenting problems were situational crisis/acute stress response (n = 180; 14.2%), difficulty with stress/occupational or financial (n = 150; 11.9%) and post-traumatic stress symptoms (n = 60; 4.7%). These were consistently the top five presenting problems over the entire period.

Although they were reported, symptoms of health anxiety (1.2% of the sample) and difficulty with stress/positive testing for COVID-19 (2.0% of the sample) were relatively infrequent. Other low frequency presenting problems included obsessive-compulsive symptoms (reported by 0.9% of the sample), adjustment disorders (reported by 2.2% of the sample), substance use disorder symptoms (reported by 1.8% of the sample), alcohol use disorder symptoms (reported by 1.0% of the sample), avoidance due to anxiety symptoms (reported by 0.5% of the sample), symptoms of bereavement/grief and loss (reported by 0.6% of the sample) and symptoms of social anxiety disorder (reported by 1.0% of the sample). Finally, a further n = 105 individuals or 8.3% of the sample reported miscellaneous/other symptoms (e.g. insomnia, eating disorder symptoms, difficulty with relationships/family).

Profession

Data on profession were available for n = 2311 of the total referrals. Figure 3 represents the monthly new self-referrals for each of the five most common professions observed among all referrals. As

TABLE 1
Demographics of HCW self-referrals for mental health treatment during the COVID-19 pandemic at five health care institutions, May 2020 to March 2022, Ontario, Canada

Variable	CAMH		Royal		Ontario Shores		SJHH		WCMH	
	N	Frequency (%)	*N*	Frequency (%)	*N*	Frequency (%)	*N*	Frequency (%)	*N*	Frequency (%)
Total referrals	1124	—	585	—	160	—	595	—	261	—
Age, mean (SD)[a]	1087	34.2 (10.7)	539	35.4 (12.6)	158	37.2 (11.4)	514	36.7 (10.7)	243	39.7 (11.4)
Missing	37	—	0	—	2	—	81	—	18	—
Self-reported gender	1124	—	431	—	116	—	520	—	242	—
Female	978	87.0	365	84.7	107	92.2	455	87.5	211	87.2
Male	136	12.1	57	13.2	9	7.8	62	11.9	29	12.0
Genderqueer/ non-binary	1	0.8	1	0.2	NA	NA	3	0.6	2	0.8
Prefer not to disclose	9	0.1	8	1.9	NA	NA	NA	NA	NA	NA
Missing	0	—	108	—	44	—	75	—	19	—
Ethnicity	366	—	427	—	116	—	511	—	176	—
Asian (East, South, Southeast)	95	26.0	16	3.7	21	18.1	34	6.7	5	2.8
Black	14	3.8	14	3.2	2	1.8	8	1.6	4	2.3
Indigenous	NA	NA	7	1.6	1	0.9	NA	NA	3	1.7
Latin American	NA	NA	2	0.4	1	0.9	8	1.6	3	1.7
Middle Eastern	16	4.4	4	0.9	5	4.3	7	1.3	1	0.6
Mixed heritage	20	5.6	11	2.6	5	4.3	7	1.3	4	2.3
White	200	54.6	341	79.9	80	69.0	216	42.3	146	83.0
Other	21	5.7	32	7.5	1	0.9	231	45.2	10	5.7
Missing	758	—	112	—	44	—	84	—	85	—
Past mental health diagnosis	1123	—	432	—	NA	NA	375	—	138	—
Yes	530	47.2	216	50.0	NA	NA	198	52.8	95	68.8
No	593	52.8	216	50.0	NA	NA	177	47.2	43	31.2
Missing	1	—	107	—	NA	NA	220	—	123	—
Received past treatment	1123	—	431	—	NA	NA	361	—	132	—
Yes	579	51.6	292	67.7	NA	NA	143	39.6	96	72.7
No	544	48.4	139	32.3	NA	NA	218	60.4	36	23.3
Missing	1	—	108	—	NA	NA	234	—	129	—

Abbreviations: CAMH, The Centre for Addiction and Mental Health; HCW, healthcare worker; NA, not available; Ontario Shores, Ontario Shores Centre for Mental Health Sciences; Royal, The Royal Ottawa Mental Health Centre; SD, standard deviation; SJHH, St. Joseph's Healthcare Hamilton; WCMH, Waypoint Centre for Mental Health Care.

Notes: Data are reported as available with *n* reported for each variable. Previous treatment and previous diagnosis data were unavailable for Ontario Shores Mental Health Services.

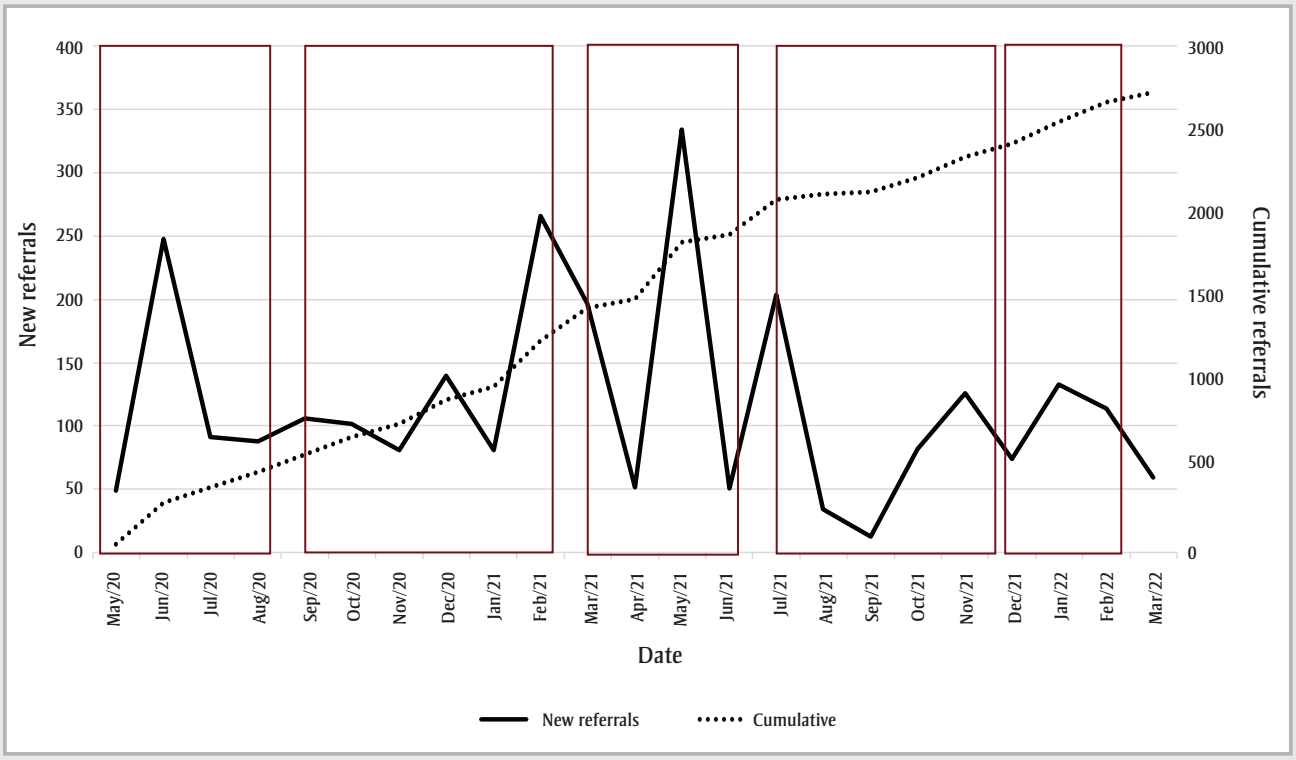
[a] Age is approximated based on year of birth only.

seen in Figure 3, nurses were highly represented in the sample relative to other professions, making up n = 1129 (48.9%) of the total cumulative referrals; the next most common professions were health professionals (n = 221; 9.6%), physicians (n = 159; 6.9%), personal support workers (n = 158; 6.8%) and administrative/ clerical staff (n = 158; 6.8%). Social workers were also relatively well represented in the sample, at n = 103 (4.5%) of the total cumulative referrals. Community service/support workers (n = 96; 4.2%) and facilities/environmental service employees (n = 48; 2.1%) were also seen with less frequency. A further n = 239 individuals (10.3%; e.g. chaplains, laboratory technicians, research personnel, or other professions) were referred from other areas of healthcare institutions.

Setting

Data on participants' healthcare setting were available for n = 2124 individuals. Figure 4 represents the monthly new referrals for the five most commonly reported healthcare settings in which individuals were working at the time of referral. As seen in Figure 4, referrals came most frequently from hospitals by a large margin, with n = 1322 individuals, representing 62.2% of the total cumulative referrals. Of these, 570 (43.1%) were working in inpatient wards, with a further n = 291 (22.0%) working in intensive care units. The majority of the remaining HCWs who

FIGURE 1
Cumulative and monthly new self-referrals[a] of healthcare workers seeking mental health treatment during the COVID-19 pandemic, May 2020 to March 2022, Ontario, Canada



Notes: Boxed areas represent approximate timing of COVID-19 waves 1 to 5 (from left to right) in Ontario, as reported by Public Health Ontario.[20] The earliest data available from The Centre for Addiction and Mental Health and Ontario Shores Centre for Mental Health Sciences are from June 2020.

[a] Participants self-referred to one of five Ontario healthcare institutions: The Centre for Addiction and Mental Health, St. Joseph's Healthcare Hamilton, The Royal Ottawa Mental Health Centre, Waypoint Centre for Mental Health Care or Ontario Shores Centre for Mental Health Sciences.

self-referred were working in long-term care (n = 255; 12.0%), community care centres (n = 212; 10.0%), primary care (n = 127; 6.0%) or retirement homes (n = 51; 2.4%). The less frequently observed healthcare settings included home and community care (n = 13; 0.6%) and public health (n = 4; 0.2%), with the remaining n = 140 (6.6%) working in other healthcare or related settings.

Discussion

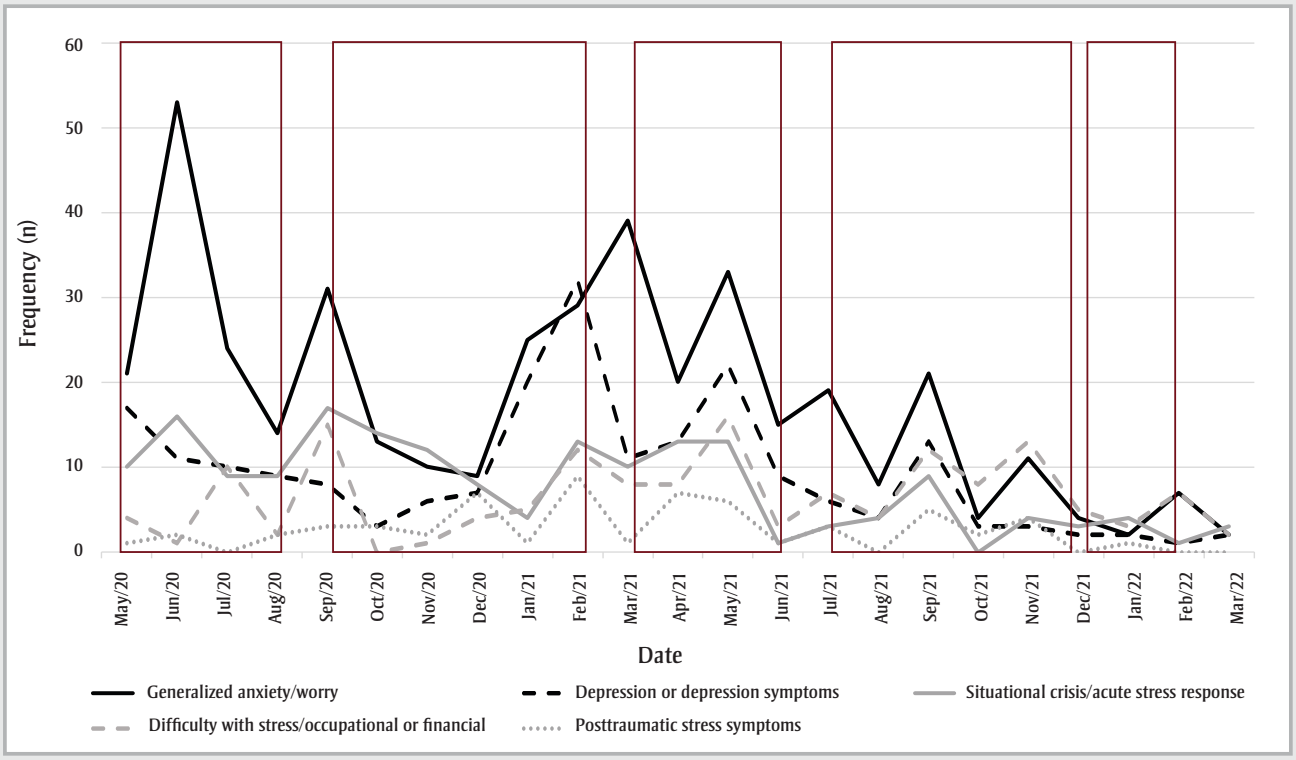
We examined the demographic profile of treatment-seeking HCW self-referrals during the COVID-19 pandemic, the mental health problem for which they sought treatment and how treatment referrals fluctuated over 22 months of the COVID-19 pandemic. The most common presenting concern was generalized anxiety/worry symptoms. The timing of increases and decreases in monthly new referrals roughly aligned with the onset and ending, respectively, of COVID-19 waves.

The demographic data revealed that the HCWs who self-referred for treatment were predominantly female, White and nurses, and this was not unique to the Canadian context. These findings are consistent with a larger body of research showing that nurses were more negatively impacted during the pandemic than other professions[12] and had high burnout levels;[9] and that nurses, and females more generally, tend to seek treatment more often.[8,13] However, it is also true that the majority of healthcare staff in hospital settings are nurses, and that nurses are predominantly female.[14] Physicians were a small but significant referral stream.

The average age of treatment-seeking HCWs was in the mid-thirties, in line with multiple studies showing an association between younger age and greater mental health symptoms among HCWs during the pandemic.[7] Approximately half of the HCW self-referrals had received previous treatment for a mental health issue, and reported a prior mental health diagnosis. This finding is similarly consistent with previous work,[8,21,22] and also highlights the large number of HCWs who sought treatment for the first time during the pandemic. Almost two-thirds of treatment-seeking HCW self-referrals came from hospital settings, in keeping with the high emotional toll of being a frontline HCW.[16] Approximately 10% of HCW self-referrals in hospital support positions (administration/clerical, facilities/environmental) sought treatment, highlighting the importance of mental health treatment programs for HCWs being inclusive of a variety of professional roles. Overall, these findings underscore the variability in the adverse mental health impacts of the pandemic across a range of individual variables, and are markedly consistent with findings of prior research.

Our study identified types of mental health issues for which HCWs self-referred for treatment. In concordance with systematic reviews showing the ubiquitous nature of anxiety and depression symptoms among HCWs during the pandemic,[3] the top two most common presenting problems for which HCWs sought treatment were generalized anxiety/worry

FIGURE 2
Monthly new self-referrals[a] for the five most commonly reported presenting problems of healthcare workers seeking mental health treatment during the COVID-19 pandemic, May 2020 to March 2022, Ontario, Canada



Notes: Data only available for n = 1266 (46.5%) of all total referrals. Boxed areas represent approximate timing of COVID-19 waves 1 to 5 (from left to right) in Ontario, as reported by Public Health Ontario.[20]

[a] Participants self-referred to one of five Ontario healthcare institutions: The Centre for Addiction and Mental Health, St. Joseph's Healthcare Hamilton, The Royal Ottawa Mental Health Centre, Waypoint Centre for Mental Health Care or Ontario Shores Centre for Mental Health Sciences.

symptoms and depression, with these two areas representing half of the HCWs self-referrals in this study. This Canadian finding is in contrast to research done in other countries, which found that depression (Mexico[10]) or distress (US[7]), instead of anxiety, was the most common reason for seeking treatment. A meta-review of systematic reviews found that during the pandemic in the United Kingdom, HCWs most commonly reported anxiety as the reason for seeking treatment, whereas in the Eastern Mediterranean region the presenting problem was most often stress, and in the Middle East, HCWs most often reported depression as the reason for seeking treatment.[23]

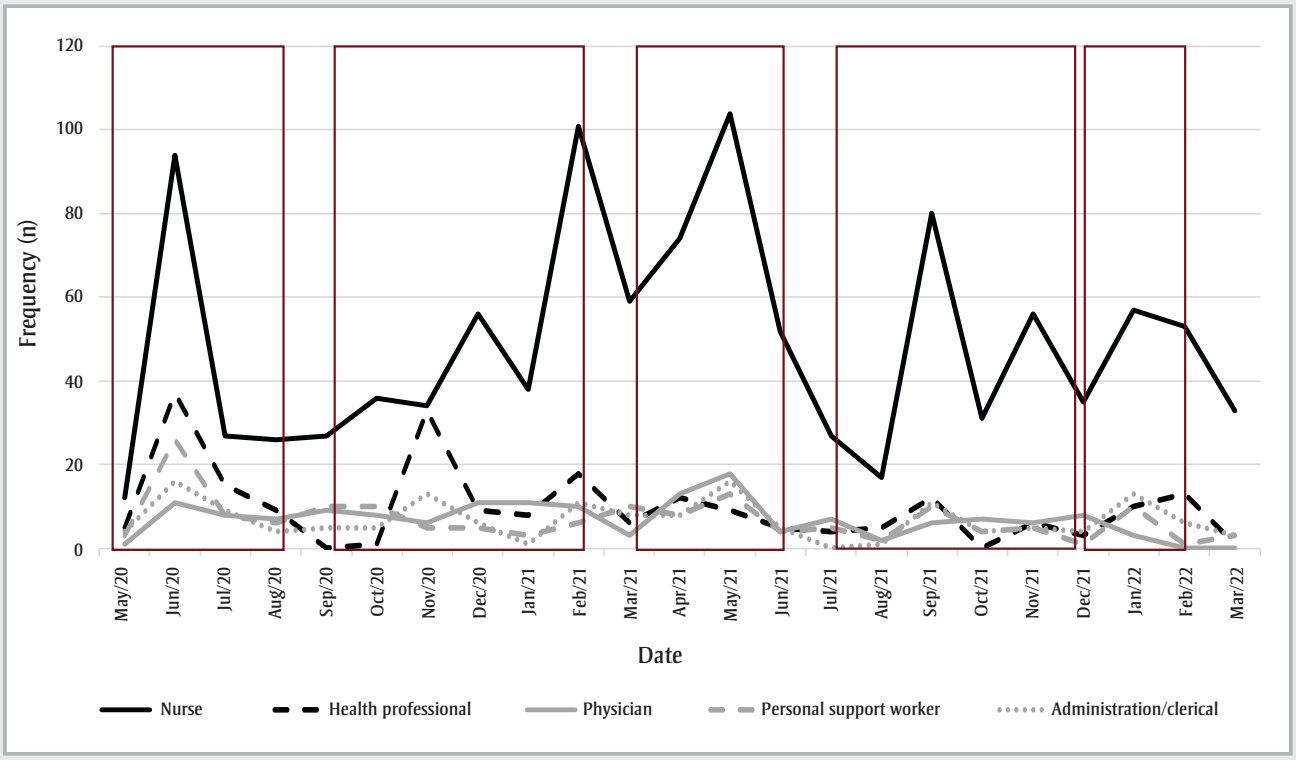
Notably, in our study, treatment seeking for worry symptoms peaked in the first COVID-19 wave, whereas treatment seeking for depression symptoms did not peak until late in the second wave. Throughout the 22 months, very rarely did the demand for depression-related treatment surpass the demand for treatment for generalized anxiety/worry. During the pandemic, there was a marked increase in research on HCWs' mental health. Pre-pandemic, the majority of the research in this area involved physicians, nurses and emergency services workers. In a pre-pandemic study of over 37 000 HCWs (representing several occupations) in the US, insufficient sleep (41%) and depression (18.9%) were the most common conditions, although the study did not assess anxiety.[24] It is nevertheless interesting to contrast this to our study's finding that during the pandemic 32.7% sought treatment for generalized anxiety/worry and 16.9% for depression.

The three next most common presenting problems were situational crisis/acute stress response, difficulty with stress/occupational or financial and posttraumatic stress symptoms. These findings supplement cross-sectional studies of symptoms reported by HCWs, with information on problems for which HCWs actually sought treatment. This is vital, as many affected HCWs do not seek treatment. Future studies could include burnout and moral injury as specific presenting concerns.

With respect to changes in HCW self-referrals over time, on average, over 100 HCWs self-referred each month over the course of the pandemic. However, there was a large range, with a high of 334 in May 2021, down to a low of 13 in September 2021. The timing of increases and decreases in monthly new referrals roughly aligned with the onset and ending, respectively, of COVID-19 waves, indicating greater seeking of mental health services as COVID-19 cases increased.

There is convergence with prior Canadian HCW studies, namely that psychological distress and emotional exhaustion peaked in spring 2021, and the latter decreased during periods of low COVID-19 hospitalization and community case rates,[9] and that two of the three highest HCW treatment referral rates were in May 2020 and May 2021.[19] In contrast to Sheehan et

FIGURE 3
Monthly new self-referrals[a] for the five most commonly reported professions of healthcare workers seeking mental health treatment during the COVID-19 pandemic, May 2020 to March 2022, Ontario, Canada



Notes: Data only available for n = 2311 (84.8%) of all total referrals. Boxed areas represent approximate timing of COVID-19 waves 1 to 5 (from left to right) in Ontario, as reported by Public Health Ontario.[20]

[a] Participants self-referred to one of five Ontario healthcare institutions: The Centre for Addiction and Mental Health, St. Joseph's Healthcare Hamilton, The Royal Ottawa Mental Health Centre, Waypoint Centre for Mental Health Care or Ontario Shores Centre for Mental Health Sciences.

al.,[19] who found a high referral peak in January 2021, we found the second highest referral rate occurred in March 2021, slightly after the end of the second wave of the pandemic.

Despite the ongoing nature of the pandemic, it was striking to see a large drop in HCW self-referrals in the fourth and fifth waves of the pandemic, when there were lower referral rates than in the first three waves. This may be partially explained by the more widely available COVID-19 vaccinations, the increased knowledge of COVID-19 and how to manage it, and the easing of some government and hospital physical distancing restrictions by that time.

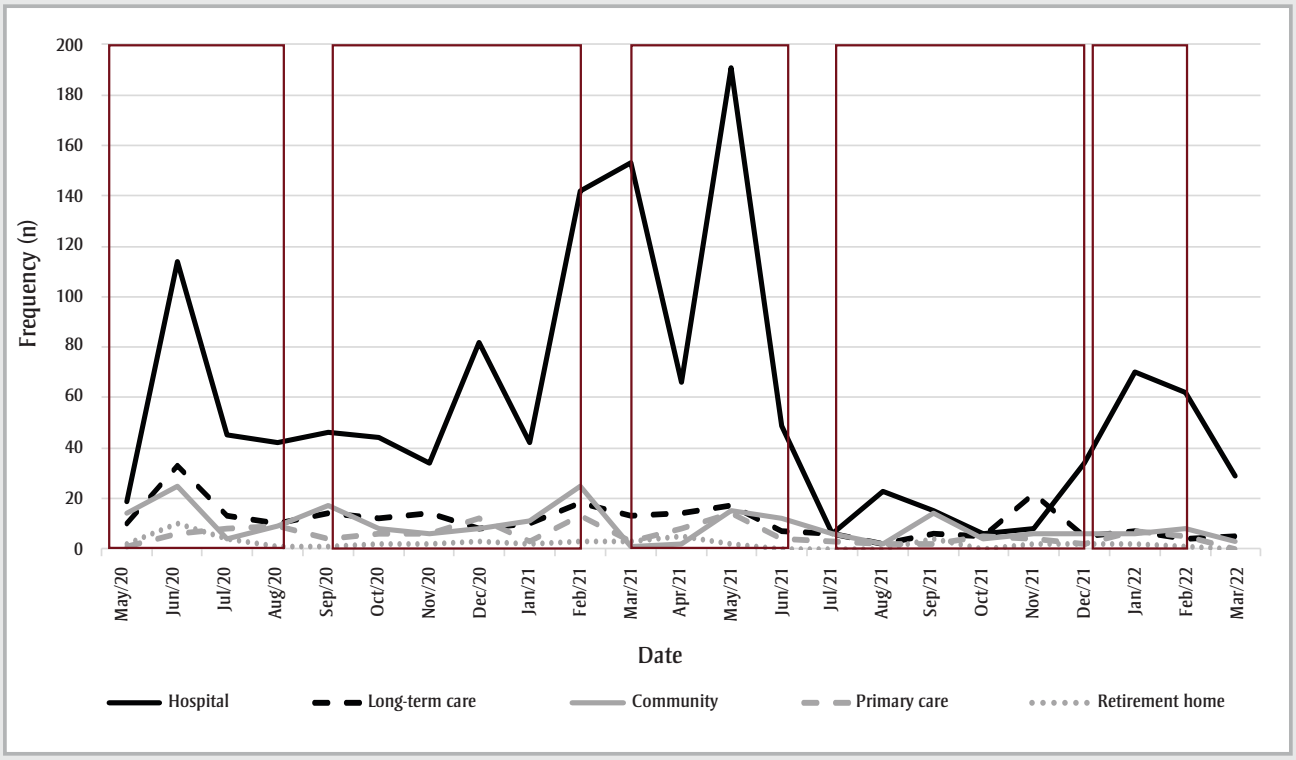
There were several system-level lessons learned from this multihospital initiative, which was mobilized within weeks of the pandemic onset. First, as the HCW program was designed to cover the province and had a standardized intake process, the totality of resources across the five sites could be shared or distributed across the province. Second, providing virtual services further facilitated the sharing of resources, and had two significant benefits. One benefit was that HCWs had access to services outside their home institution, thus facilitating a greater degree of confidentiality. HCWs often preferred to access programming outside of their own local area (even though it was virtual), and staff of the five hospitals often sought care from facilities other than where they worked. The other benefit was that having the hospitals work together and share intake responsibilities enabled timely access to care even when the demand rose; wait times were kept as low as possible by pooling resources and monitoring waits, ensuring rapid treatment access (from no to very short wait-times). The virtual format meant no matter where people lived, if they had phone or internet access, they could access services equitably. Third, self-referral removed an access barrier.

Despite other support programs being available, such as Employee Assistance Programs, the hospital initiatives were well accessed. The sector-specific nature (i.e. the healthcare sector) of the care that was provided was an important asset, and should be present in mental health support programs for HCWs. The clinicians' ability to understand the context of the work and the types of challenges that HCWs were experiencing was a key to success. Anecdotally, it is likely that the services of this program enabled HCWs to continue to work as opposed to taking a leave, and those who did take a leave still required support as they returned to the workplace. As with other healthcare services, human resources was a challenge, with programs sometimes needing to "borrow" clinicians from other areas to meet the need posed by the HCW treatment program.

Strengths and limitations

Strengths of the current study include its multisite nature, the large sample of treatment-seeking HCWs, the collection of data throughout a 22-month period and

FIGURE 4
Monthly new self-referrals[a] for the five most commonly reported healthcare settings, whose healthcare workers sought mental health treatment during the COVID-19 pandemic, May 2020 to March 2022, Ontario, Canada



Notes: Data only available for n = 2124 (77.9%) of all total referrals. Boxed areas represent approximate timing of COVID-19 waves 1 to 5 (from left to right) in Ontario, as reported by Public Health Ontario.[20]

[a] Participants self-referred to one of five Ontario healthcare institutions: The Centre for Addiction and Mental Health, St. Joseph's Healthcare Hamilton, The Royal Ottawa Mental Health Centre, Waypoint Centre for Mental Health Care or Ontario Shores Centre for Mental Health Sciences.

the ability to compare treatment-seeking referrals to community COVID-19 waves.

Limitations include that the data were collected without unique identifiers, which precluded analysis between or within individuals. The study therefore combined all treatment-seeking HCWs; unique identifiers would have been needed to explore which HCWs requested the different types of mental health assistance, why they chose the type of treatment they did and the outcomes of those various treatment options (see Laposa et al.,[8] for an evaluation of the HCW brief treatment).

Although the sample in this study is large, some data are missing, and many HCWs whose mental health was negatively affected during the pandemic may not have self-referred for treatment, to this program or to something else. Theoretically, a HCW could have self-referred for treatment more than once; however, anecdotal reports from staff would indicate that it was very rare, as once the HCWs were enrolled in treatment, if they needed something more than the brief intervention, they would be connected to one of the clinic program standard pathways, or to other community resources. Finally, the majority of the hospital sites reported that only 12% of the treatment-seeking HCW self-referrals were male; therefore, the findings may not be representative of this group.

More work is needed to understand which HCWs do not seek treatment and why, so that programs can be tailored with successful outreach initiatives.

Conclusion

This study provides a profile of HCWs who self-referred for mental health supports during the pandemic through a coordinated, rapid-access service provided by five major hospitals in Ontario. The majority of HCWs who accessed the service were female (as are most HCWs), came from a nursing background and had prior mental health diagnoses and/or prior treatment. When setting up similar services in the future, based on treatment-seeking patterns, one might particularly consider a target audience of these groups.

The structure of the program allowed for more equitable and timely access to services by virtually "pooling" the resources across the five sites. The virtual delivery of care meant that access and wait times were not dependent upon where one lived in the province, and conferred the further benefit of prioritizing participant choice of treatment site, which was particularly important when that individual worked at one of the sites providing mental health treatment and preferred to go elsewhere to preserve privacy or confidentiality.

Finally, identifying the top presenting concerns of the HCWs who self-referred in this study—namely, generalized anxiety/worry, depression, situational crisis/acute stress response, difficulty with stress/occupational or financial, and posttraumatic stress symptoms—may inform planning for ongoing HCW mental health supports in the post-pandemic period.

The study findings suggest we should expect HCWs to seek treatment for their mental health during outbreak conditions, and highlight the need for corresponding supports to be available for HCWs during those times.

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Conflicts of interest

The authors declare that there are no conflicts of interest.

Authors' contributions and statement

JL, RM, DC: conceptualization.

JL, RM, DC, KC, KR, SDLS, LF, KCT, NQ, VS, SC: implementation.

JL, RM, DC: analysis.

JL, RM, DC: writing—original draft.

JL, RM, DC, KC, KR, SDLS, LF, KCT, NQ, VS, SC, PK, HB, AS: writing—review and editing.

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