

Foreword

From pandemic to endemic: learning from the past and preparing for the future

MGen Marc Bilodeau, CD, QHP, MD, Surgeon General of the Canadian Armed Forces

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After two years of navigating the COVID-19 pandemic, we still have a lot to learn. Like all Canadians, Canadian Armed Forces (CAF) members have been profoundly impacted by SARS-CoV-2 and its variants in almost every facet of their lives. Beyond the impact of public health measures on everyday life, thousands of our members have now been infected with the SARS-CoV-2 virus.

Despite these challenges, one principle that remains is our resolve to maintain a state of readiness to serve our country whenever and wherever we are called upon by our government. To date, CAF personnel have been deployed to long-term care facilities in Quebec and Ontario and to support northern and remote communities. CAF members have also assisted the Public Health Agency of Canada in managing and distributing personal protective equipment and vaccines and provided support with contact-tracing efforts.

This pandemic has, once again, reminded us of the importance of using science to inform decisions. The pivotal role that science plays in vaccine development, epidemiological methods used to monitor and contain the spread of the outbreak and in translating this knowledge to inform decisions in establishing public health guidelines in an effort to minimize transmission is paramount. At the Department of National Defence (DND), we have also relied on scientific evidence to protect our staff and CAF members. Peer-reviewed evidence has been invaluable in obtaining reliable intelligence to navigate through the peaks and valleys of the different waves as the pandemic continues to unfold.

While we all hope for a clean resolution to the pandemic, the recent emergence of the Delta and Omicron variants reminds us

that we still have work to do. To this end, staff at DND have initiated a number of projects specifically related to the COVID-19 pandemic, four of which are part of this themed issue of *Health Promotion and Chronic Disease Prevention in Canada* dedicated to COVID 19-related research at DND:

(1) Dubiniecki and colleagues¹ describe a web-based tool (Canadian Armed Forces Surveillance and Outbreak Management System [CAF SOMS]) currently being evaluated for use in collecting and disseminating real-time data and collating it using a centralized electronic data management system. This tool is suitable for both disease surveillance and outbreak management and will enhance outbreak management capability beyond COVID-19.

(2) Fikretoglu and colleagues² describe the challenges faced in conducting research during the COVID-19 pandemic, based on their longitudinal study of CAF members deployed on the Operation (Op) LASER mission to provide support to civilian staff at long-term care facilities in Ontario and Quebec impacted by COVID-19 outbreaks.

(3) Lee and colleagues³ conducted a survey to examine the concerns and general well-being of Canadian Armed Forces personnel and civilian Defence Team members as they adjust to the new working environment imposed by the COVID-19-related public health measures.

(4) Finally, Sudom and colleagues⁴ investigated behaviours that were associated with higher levels of health and well-being of Canadian Armed Forces Regular Force members during the COVID-19 pandemic.

Two years into the COVID-19 pandemic, and, with endemicity a likely endpoint,

we still have a lot to learn. Working together, sharing knowledge and continuing to contribute to the growing body of scientific evidence will help to pave the way to recovery and increase our resilience for the future.

References

1. Dubiniecki C, Gottschall S, Praught J. Development and formative evaluation of the Canadian Armed Forces Surveillance and Outbreak Management System (CAF SOMS): applications for COVID-19 and beyond. *Health Promot Chronic Dis Prev Can.* 2022; 42(3):96-9. <https://doi.org/10.24095/hpcdp.42.3.02>
2. Fikretoglu D, Thompson M, Hendriks T, Nazarov A, Michaud K, Born J, Sudom KA, Bélanger S, Jetly R. Conducting research during the COVID-19 pandemic: the Op LASER study. *Health Promot Chronic Dis Prev Can.* 2022;42(3):100-3. <https://doi.org/10.24095/hpcdp.42.3.03>
3. Lee JEC, Goldenberg I, Blais AR, Comeau C, Daugherty C, Guérin E, Frank C, LeBlanc MM, Peach J, Pearce K, Sudom K, Wang Z. Trials and tribulations among members of Canada's Defence Team early in the pandemic: key insights from the COVID-19 Defence Team Survey. *Health Promot Chronic Dis Prev Can.* 2022;42(3):104-12. <https://doi.org/10.24095/hpcdp.42.3.04>
4. Sudom KA, Lee JEC. Well-being of Canadian Armed Forces members during the COVID-19 pandemic: the influence of positive health behaviours. *Health Promot Chronic Dis Prev Can.* 2022;42(3):113-21. <https://doi.org/10.24095/hpcdp.42.3.05>

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At-a-glance

Development and formative evaluation of the Canadian Armed Forces Surveillance and Outbreak Management System (CAF SOMS): applications for COVID-19 and beyond

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Abstract

The COVID-19 pandemic highlighted limitations in the current public health data infrastructure, and the need for a comprehensive, real-time, centralized, user-friendly data management system suitable for both disease surveillance and outbreak management. To address these issues, the Canadian Forces Health Services Group developed the web-based Canadian Armed Forces Surveillance and Outbreak Management System (CAF SOMS). This paper details the development of the CAF SOMS, provides formative evaluation results and includes a discussion of the lessons learned and intent to use the CAF SOMS in future to enhance the CAF's disease surveillance and outbreak management capability beyond COVID-19.

Keywords: *surveillance, COVID-19, SARS-CoV-2, information management, data systems, contact tracing, data infrastructure, public health, case and contact management, outbreak management, pandemic, epidemic, evaluation*

The COVID-19 pandemic and the Canadian Armed Forces

During the early stages of the COVID-19 pandemic, outbreak management relied on traditional public health measures, such as case isolation and contact tracing.^{1,2} The Canadian Forces Health Services Group (CF H Svcs Gp) operates a separate medical and public health system for Canadian Armed Forces (CAF) personnel. As part of its public health program, the CAF has developed its own contact tracing capability, which is run in coordination with local public health authorities across Canada and abroad.³⁻⁵ To meet the growing information management needs associated with case and contact management, the CF H Svcs Gp's National Contact Tracing Team developed the Canadian Armed Forces Surveillance and Outbreak Management System (CAF SOMS), a centralized, secure, relational database designed to facilitate contact tracing

efforts while also providing real-time disease surveillance.

COVID-19 data management: systems and information gaps

Case and contact management for COVID-19 requires multipurpose health data collection tools that can be used for clinical case management, contact tracing, surveillance and epidemiological research. A comprehensive data management system can enable timely and effective follow-up, describe disease transmission dynamics, identify disease clusters and evaluate outbreak management effectiveness.

The COVID-19 pandemic highlighted existing limitations in the Canadian public health data infrastructure that impacted the efficiency and effectiveness of measures taken to control the COVID-19 outbreak.⁶⁻⁸ These limitations include poorly designed

Highlights

- The Canadian Armed Forces Surveillance and Outbreak Management System (CAF SOMS) was developed to address gaps in information management identified during the COVID-19 pandemic.
- Integrating a formative evaluation in the phased development and implementation helped to address issues with the system prior to its national roll-out.
- Lessons learned from its development, implementation and evaluation can inform further refinement and future applications of the CAF SOMS, and potentially of other public health information systems.
- Increased uptake of the system, integration with electronic records and alignment with the pan-Canadian Health Data Strategy may enhance responses to disease threats and improve CAF health outcomes.

data collection tools, non-interoperability of systems across jurisdictions, inadequate data sharing policies and regulations, nonintegration with electronic medical records and laboratory data, and nonstandardized data. To overcome these difficulties, several provinces, municipalities and the CAF have separately developed COVID-19 case and contact management information technology solutions.⁶

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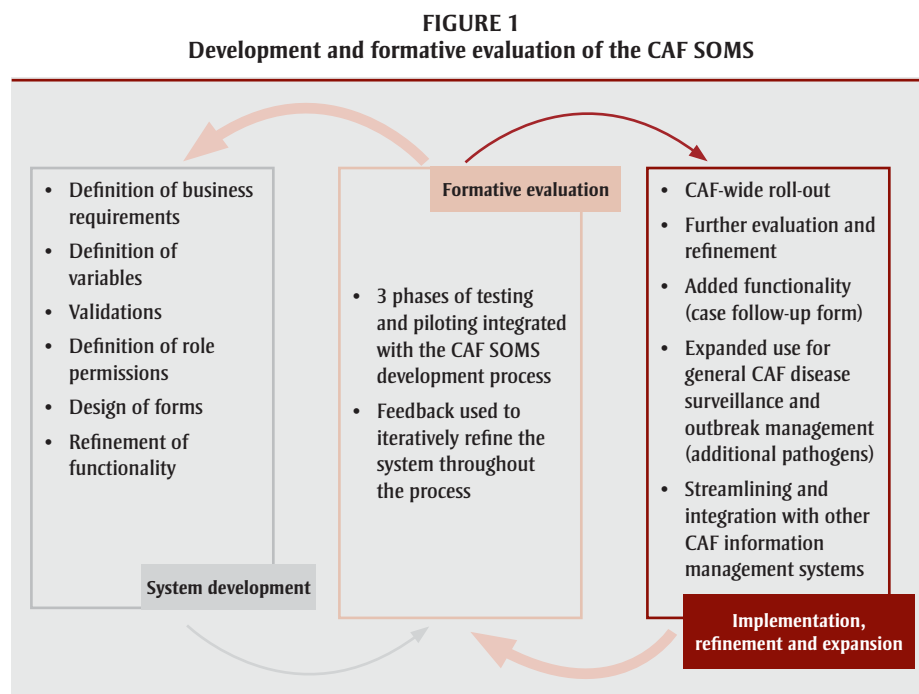
During the early phases of the pandemic, an urgent need for a comprehensive data management tool specific to CAF contact tracing was identified. The main goal was to replace spreadsheets that were cumbersome to complete, file, track and collate. These issues resulted in poor data quality and limited real-time CAF COVID-19 situational awareness beyond case monitoring. Also, it was recognized that this system should collect additional demographic, clinical and risk factor information to improve understanding of disease trends among population subgroups. To overcome these limitations, the National Contact Tracing Team worked with the Health Informatics team to design a centralized, easy-to-use, secure, relational database that linked case and contact data, allowed for multiple follow-up entries, improved data quality and could streamline data collection for current and future CAF disease surveillance, beyond COVID-19.

Development and formative evaluation of the CAF SOMS

The CAF SOMS was developed, evaluated and implemented in three stages, the last of which is ongoing (Figure 1).

The design of the CAF SOMS included four separate data entry forms: (1) case details (e.g. demographic and contact information, symptoms, comorbidities, risk factors or exposures, isolation period); (2) contact elicitation (e.g. demographic and contact information, diagnostic status, date of last exposure, risk category); (3) contact notification (e.g. symptoms if applicable, self-isolation period, supports required if applicable, contact status); and (4) contact follow-up (e.g. symptoms if applicable, contact status, supports required if applicable, self-isolation period, isolation day). Features were embedded to allow navigation between forms for related cases and contacts using a unique identification code, as well as line listing functionality to subset case-contact relationships.

A formative evaluation was employed to inform further development and implementation of the system through two waves of testing during December 2020 and January 2021, and through the piloting of the system in February and March 2021. The first testing was completed by five members of the National Contact Tracing Team using a prespecified test plan developed by the Health Informatics team to assess the basic functioning of the



Abbreviation: CAF SOMS, Canadian Armed Forces Surveillance and Outbreak Management System.

database. The second wave of testing was completed by four CAF-trained contact tracers at a single CAF base using scenario data to simulate real-world contact tracing. The CAF SOMS was then piloted using real data at two bases to assess the real-world performance of the system. Contact tracers involved in the second wave of testing and the pilot of the system were emailed 22 open-ended survey questions and asked to provide feedback on the CAF SOMS functionality and data flow and the utility of an embedded user guide (Table 1). The results of the testing and piloting were used to refine the system for each subsequent stage of the formative evaluation and implementation.

The final phase of the development and evaluation process was a national roll-out of the CAF SOMS in April 2021. A short user feedback survey was also sent to the broader CAF contact tracing community, and analyses are underway to validate the accuracy and completeness of COVID-19 cases and contact data to identify strengths and weaknesses.

Lessons learned

The preliminary results of the formative evaluation are promising and suggest that the CAF SOMS is an effective tool for contact tracing. User perceptions of the system were positive, and some suggested improvements could be acted on immediately during the phased development and

implementation of the system (e.g. providing additional response options in drop-down menus, correcting the auto-calculations for self-isolation periods, using additional variables for filtering and searching for records and searching for contacts directly rather than through case files, simplifying the process to close contact records separately from cases). Although some feedback could not be addressed prior to the national roll-out (e.g. include checkboxes to indicate “no change” for contact follow-up, add case follow-up forms), these items may be addressed in future versions of the database, and the changes that were prioritized and carried out were well received.

Overall, a key lesson learned is that newly developed outbreak management information systems must be continually evaluated to proactively ensure they function adequately as new information and shifting priorities emerge. In this regard, our preliminary formative evaluation results suggest that the built-in flexibility of the CAF SOMS design supports the ability to make critical system modifications as required to meet changing outbreak management needs.

COVID-19 and beyond: recommendations and future directions

The COVID-19 pandemic has underscored the need for better disease surveillance

TABLE 1
Open-ended survey questions given to contact tracers testing and piloting the CAF SOMS

Does the CAF SOMS contain the correct field and variable options to adequately document case and contact information?
<ul style="list-style-type: none"> • Were there any data entry fields you felt were missing? • Were there any data entry fields you felt were not necessary? If so, please explain. • Were there any missing/incorrect field choices (i.e. missing/incorrect information in drop-down menus)?
Are there any variables or fields that are unclear in terms of what information should be inputted?
<ul style="list-style-type: none"> • If yes, please identify these variables/fields and explain.
Is it easy to navigate between forms in the CAF SOMS?
Is it easy to enter information directly into the CAF SOMS while conducting case/contact interviews?
<ul style="list-style-type: none"> • If no, please explain.
Do you find it easy to search for specific case and contact files?
<ul style="list-style-type: none"> • Can you easily find contacts that need to be followed up on using the filtering functions? • Are there any filtering functions at the top of case/contact lists you feel would be helpful to improve search capability and to manage daily contact tracing work?
Approximately how long did it take you to enter the data in the database for each scenario, on average?
<ul style="list-style-type: none"> • Do you have any suggestions that might make the process of entering the information in the database faster? If yes, please describe.
Did the process of entering data in the database flow well based on how the different screens and data entry fields were linked?
<ul style="list-style-type: none"> • If no, please describe the issues that you noticed with the flow of the process.
Do you feel the Excel spreadsheet reports are (1) easy-to-interpret and (2) helpful for contact tracing work?
Did you find the user guide was easy to follow and contained the information you needed to understand how to use the system?
<ul style="list-style-type: none"> • Is there any other information that you think should be added to improve the user guide?
Are there additional features that you think would help to make the CAF SOMS more user-friendly?
<ul style="list-style-type: none"> • If yes, please describe the features that you would recommend adding.

Abbreviation: CAF SOMS, Canadian Armed Forces Surveillance and Outbreak Management System.

and outbreak management systems that allow for timely, informed and agile public health management of disease threats.^{7,9} As the emergence of COVID-19 has demonstrated, the ability to respond quickly by continually incorporating updated knowledge into systems and processes is crucial for managing a novel and emerging disease that may not be fully understood. Evidence has shown that contact tracing, when performed quickly, can be one of the most effective strategies for disease containment.⁸ This is especially true for COVID-19, since it is estimated that approximately 40%, and possibly up to 70%, of disease transmission occurs when cases are presymptomatic or asymptomatic.^{8,10}

While the CAF SOMS was initially designed to respond to the current public health crisis, the intent is to further scale and develop the system for future pandemic preparedness. Thus, the system was designed to be flexible and adaptable, and to allow for the easy incorporation of updated public health guidance and epidemiology regarding COVID-19, as well as for other diseases. Expansion of the system to capture other diseases is planned

for the next phase of system development, as well as the inclusion of other functionality based on feedback from the formative evaluation.

Additionally, there are several challenges that need to be addressed to maximize the uptake and utility of the system moving forward. These include streamlining CAF data collection mechanisms, integrating the system with electronic medical records and improving internal and external data sharing capabilities. To streamline CAF data collection and reduce redundancies, it will be necessary to collaborate with key stakeholders and system end users. Increased promotion of the CAF SOMS, along with training and strong leadership support can accelerate this type of organizational change. Dedicated resources and continuing multilevel health informatics support are key to ensuring sustainability of the system, as are efforts to find solutions to create a seamless and connected data management system that services the entire continuum between clinical care and public health. These efforts include exploring ways to transfer critical public health data, such as case and laboratory reports, between the CAF SOMS and

electronic medical records, since the latter system was not designed for public health and epidemiological purposes.

Lastly, since diseases are not constrained by jurisdictional boundaries, options should be explored to develop a consistent approach with external Canadian public health agencies. Enhanced data sharing would be beneficial for minimizing gaps in public health coverage and ensuring continuity in case and contact management. To this end, alignment with the vision of the pan-Canadian Health Data Strategy to create an effective, interoperable, integrated health data ecosystem that is continually optimized could provide additional direction for correcting some of the CAF's current health data management limitations, and would ensure a consistent and collaborative approach with Canadian public health partners.⁸

Conclusion

The results of the CAF SOMS formative evaluation demonstrated the information system's potential as a tool to improve the CAF's disease surveillance and outbreak management capability. The system's

success will depend on effective organizational change, continued leadership support, and adequate resourcing. Further alignment with the vision of the pan-Canadian Health Data Strategy, along with improved data management and collaboration with external public health agencies, can help to increase pandemic preparedness and improve outcomes.

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Conflicts of interest

The authors have no conflicts of interest to disclose.

Authors' contributions and statement

CD and SG: conceptualization, data collection and analysis, methodology and writing—review and editing; JP: conceptualization, data collection, methodology and writing—review and editing.

The content and views expressed in this article are those of the authors and do not necessarily reflect those of the Government of Canada.

References

1. World Health Organization (WHO). Contact tracing in the context of COVID-19 [Internet]. Geneva (CH): WHO; [modified 2021 Feb 16; cited 2021 Mar 11]. Available from: <https://www.who.int/publications/i/item/contact-tracing-in-the-context-of-covid-19>
2. Public Health Agency of Canada (PHAC). Updated: public health management of cases and contacts associated with COVID-19 [Internet]. Ottawa (ON): PHAC; [modified 2021 Nov 2; cited 2021 Jun 28]. Available from: <https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/health-professionals/interim-guidance-cases-contacts.html#a7>
3. Directorate of Force Health Protection. Business requirements for CAF Surveillance and Outbreak Management System (CAF SOMS) Version 1.0. Ottawa (ON): Department of National Defence; 2020. 43 p.
4. Directorate of Force Health Protection. Contact tracing for COVID-19. [Instruction 6635-33]. Ottawa (ON): Department of National Defence; 2021. 9 p.
5. Directorate of Force Health Protection. COVID-19: Force health protection recommendations. [Advisory 6636-80]. Ottawa (ON): Department of National Defence; 2020 [updated 2021 Oct 28]. 9 p.
6. Bhatia D, Vaga K, Roerig M, Pawa J, Allin S, Marchildon G. COVID-19 case and contact management strategies in Canada. [Rapid Review No. 27]. Toronto (ON): North American Observatory on Health Systems and Policies; 2020. 46 p.
7. Pan-Canadian Health Data Strategy Expert Advisory Group. Pan-Canadian Health Data Strategy: expert advisory group report 1: charting a path toward ambition. Ottawa (ON): Public Health Agency of Canada. 14 p. Available from: <https://www.canada.ca/en/public-health/corporate/mandate/about-agency/external-advisory-bodies/list/pan-canadian-health-data-strategy-reports-summaries/expert-advisory-group-report-01-charting-path-toward-ambition.html>
8. Kretzschmar ME, Rozhnova G, Bootsma MC, van Boven M, van de Wijkstra JH, Bonten MJ. Impact of delays on effectiveness of contact tracing strategies for COVID-19: a modelling study. *Lancet Public Health*. 2020;5(8):e452-e459. [https://doi.org/10.1016/S2468-2667\(20\)30157-2](https://doi.org/10.1016/S2468-2667(20)30157-2)
9. Mathews Burwell S, Fragos Townsend F, Bollyky TJ, Patrick SM. Improving pandemic preparedness: lessons from COVID-19. [Independent Task Force Report No. 78]: New York (NY): Council on Foreign Relations. 158 p. Available from: https://www.cfr.org/report/pandemic-preparedness-lessons-COVID-19/pdf/TFR_Pandemic_Preparedness.pdf
10. Buitrago-Garcia D, Egli-Gany D, Counotte MJ, et al. Occurrence and transmission potential of asymptomatic and presymptomatic SARS-CoV-2 infections: a living systematic review and meta-analysis. *PLoS Med*. 2020; 17(9):e1003346. <https://doi.org/10.1371/journal.pmed.1003346>

At-a-glance

Conducting research during the COVID-19 pandemic: the Op LASER study

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Abstract

The Canadian Armed Forces (CAF) deployed 2595 regular and reserve force personnel on Operation (Op) LASER, the CAF's mission to provide support to civilian staff at long-term care facilities in Ontario and in the Centres d'hébergement de soins de longue durée in Quebec. An online longitudinal survey and in-depth virtual discussions were conducted by a multidisciplinary team of researchers with complementary expertise. This paper highlights the challenges encountered in conducting this research and their impact on the design and implementation of the study, and provides lessons learned that may be useful to researchers responding to similar public health crises in the future.

Keywords: *military personnel, mental health, moral injury*

Introduction

The Canadian Armed Forces (CAF) deployed 2595 regular and reserve force personnel to support civilian staff at long-term care facilities (LTCF) and Centres d'hébergement de soins de longue durée (CHSLD) in Ontario and Quebec as one component of Operation (Op) LASER. The Op LASER deployment involved noncombat deployment experiences that can be associated with decreases in psychological well-being,¹ including short-notice deployment, quickly developed training, uncertain deployment roles and end dates, working extremely long hours over multiple days and, for some, being away from family, which past CAF research has shown accounted for most of the burden of mental illness.² Op LASER to LTCF and CHSLD also involved novel stressors, including the risk of exposure to a largely unknown, highly contagious virus (i.e.

COVID-19), and for many personnel, working with vulnerable and ill elderly populations.^{3,4} Indeed, CAF Op LASER reports^{5,6} documented military personnel witnessing some residents being handled roughly, being denied food or not being fed properly, as well as extensive staffing shortages and problems and significant infection control issues.

Given the extraordinary nature of this operation, the CAF Surgeon General and Chief of Military Personnel requested research support to (1) understand the impact of this mission on the mental health and well-being of Op LASER personnel; (2) assess operational recovery; and (3) identify the risk and resilience factors that may affect the impact of this mission on mental health and well-being. Findings would inform preparation, training and support for similar missions—especially important as public health and

Highlights

- There are a number of challenges involved in conducting longitudinal research in an applied military setting during a global public health crisis such as the COVID-19 pandemic.
- These challenges include but are not limited to a sudden transition to a distributed remote work environment, tight timelines, the need to obtain approvals from different agencies and departments, having to prioritize multiple study objectives, and survey fatigue.
- To overcome these challenges in future public health crises, it is important to (1) develop and maintain collaborative networks across government, academia and industry; (2) develop a standard set of pre-deployment demographic and health indicators to establish a baseline; and (3) use mixed methods approaches for a richer understanding of mental health trajectories following stressful events.

infectious disease experts predict future pandemics.⁷

This research request was addressed via an online longitudinal survey and in-depth virtual discussions (Figure 1) conducted

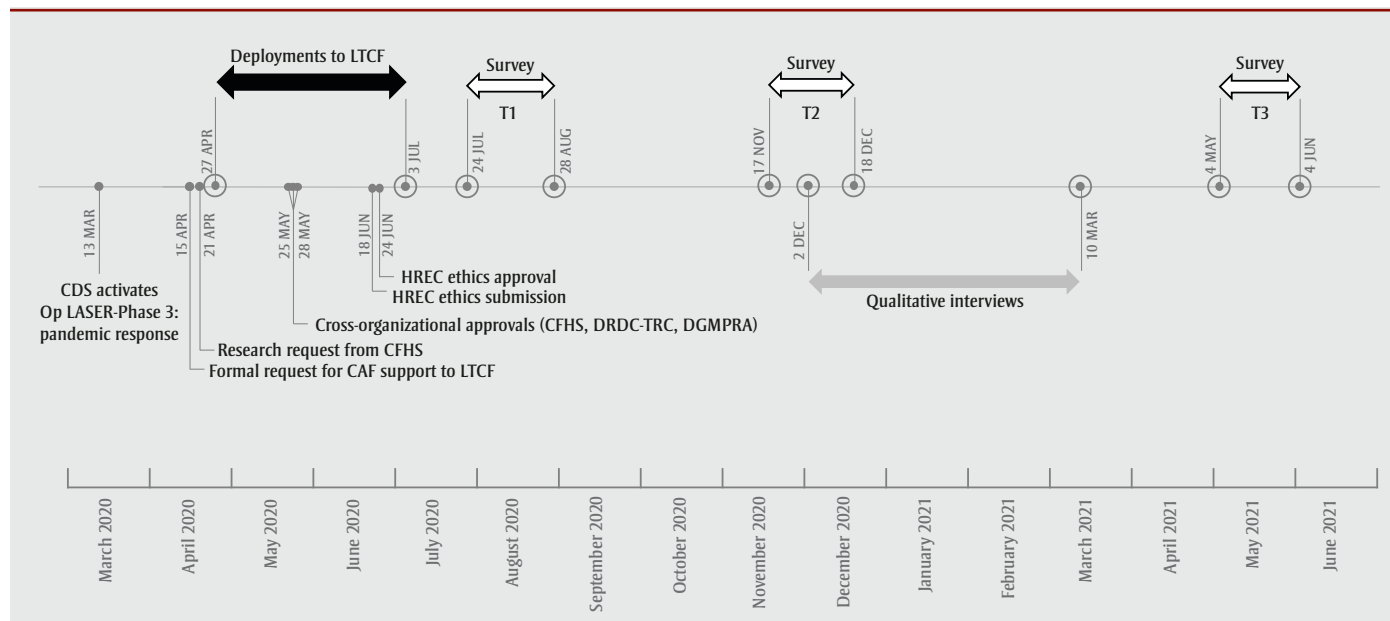
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FIGURE 1
Decision dates, deployment and data-collection timelines for Op LASER study



Abbreviations: CAF, Canadian Armed Forces; CDS, Chief of Defence Staff; CFHS, Canadian Forces Health Services; DGMPPRA, Director General Military Personnel Research and Analysis; DRDC-TRC, Defence Research and Development Canada—Toronto Research Centre; HREC, Human Research Ethics Committee; LTCF, long-term care facility.

Notes: Survey data were collected over multiple points (T1–T3) to allow for longitudinal analysis. Positive and negative mental health outcomes, moral distress, moral injury, moral injury outcomes, coping and social support were repeated at all three timepoints to assess long-term impacts of Op LASER, while demographic and military characteristics and help-seeking for mental health concerns were included only in one or two time-point(s), as appropriate.

by a multidisciplinary team of researchers from Defence Research and Development Canada—Toronto Research Centre, Director General Military Personnel Research and Analysis (DGMPPRA), Canadian Forces Health Services Group, Royal Military College of Canada, and HumanSystems Inc., with complementary expertise in mental health, including moral injury, and organizational psychology. This paper briefly highlights the challenges we encountered and the impact of these challenges on the design and implementation of our study, and provides lessons learned that may be useful to researchers responding to similar missions in the future.

Challenges

1. Sudden transition to a distributed, remote work environment to comply with recommended public health measures

The key challenge was designing and implementing our study during a pandemic, while transitioning to a distributed, remote work environment. Initially, access to infrastructure, software and hardware, and other tools for sharing information across multiple organizations was not ideal, with limited guidance around best

practices, although Department of National Defence (DND) Information Technology Support services worked very hard to facilitate this transition. Team members also had to juggle care of their dependents, overseeing virtual learning of their school-aged children, and other responsibilities while supporting the study requirements.

2. Tight timelines

The short span of time between the provincial requests for military support to LTCFs and the start of Op LASER meant that the study had to be designed and implemented very quickly (Figure 1). Indeed, as the research team was still working to obtain organizational approvals, the military client informed the research team that the first wave of Op LASER personnel sent to the LTCFs would be completing their deployment within a week or two. The fact that the information requested on the mental health and well-being of Op LASER personnel had to be collected right away contributed to additional time pressures.

3. Levels of approval across organizations

Our team members belong to multiple organizations, each with its own process

of project approval and funding and resource allocation. Usually, during program formulation and project planning, sufficient time, i.e. up to a few months, is set aside to obtain all organizational approvals (i.e. client, organizational, funding, ethics review and public opinion research*). For the Op LASER study, these approvals had to be obtained within a matter of weeks.

4. Need for virtual platform

Given the active community transmission of a new infectious disease, both the survey and the discussions had to be implemented virtually. Virtual platforms meeting or exceeding government and DND security directives to protect sensitive personal and health data had to be quickly identified and implemented. This particularly delayed the development of the discussion methodology by several weeks.

5. Prioritizing multiple study objectives

The request from the Surgeon General and the Chief of Military Personnel had several components, encompassing multiple outcomes and numerous risk and resilience factors operating at multiple (individual,

* All DND survey research must be reviewed and approved by the Assistant Deputy Minister (Public Affairs).

team and organizational) levels. Research suggests there may be greater response burden (and higher dropout towards the end) for longer surveys.⁸ Hence, measuring multiple constructs within a reasonable survey length posed challenges.

6. Operational demands that may necessitate less than optimal study design

High operational tempo related to the mission delayed the obtaining of demographic information for the full cohort from administrative databases to inform a probability sampling strategy. This delay necessitated the use of poststratification weighting methods that may be less robust in controlling for nonresponse bias.

7. Baseline indicators

Ideally, to obtain a measure of the positive or negative mental health impact of Op LASER, our team would have measured and controlled for baseline mental health prior to the start of the mission. Unfortunately, the short timelines made this impossible. The lack of baseline measures prevented us from linking observed negative health outcomes to the stressors of Op LASER in a more definitive manner and limited our ability to identify different trajectories of health and ill-health that may require different supports.⁹

8. Survey dissemination and reach

While the list of names and email addresses of military personnel provided to us was close to complete, 13% of the e-mail addresses were organizational (Defence Wide Area Network) email addresses that are less accessible to part-time (Class A) military members. After Op LASER, many military members who participated in the mission took leave, went on training or deployed to other missions; many reservists returned to civilian life, which may have limited our ability to reach them or their willingness or availability to respond.

9. Survey fatigue/low response rates/respondent retention

Several factors may have further impacted survey response and retention rates. Our first survey was launched soon after another DND-wide survey (the COVID-19 Defence Team Survey) concluded; survey fatigue potentially reduced response rates. Military personnel may have been too fatigued or emotional to revisit their experiences by participating in our first survey

soon after their deployment ended. Repetition of key measures across three assessment points may have reduced retention rates. Time 1 (T1) and Time 2 (T2) surveys had response rates of approximately 42% and 23%, respectively. T1 and T2 samples were representative of deployment province but not military rank, with junior non-commissioned members (NCMs) underrepresented. Ongoing analyses are exploring representativeness based on additional demographic and military variables using administrative data. These analyses will culminate in poststratification weighting to correct for sampling bias. At T1 and T2, participants were mostly male, mostly of junior NCM rank and evenly split between regular forces and reservists. Twice as many participants had deployed to Quebec as had deployed to Ontario.

Of note, response rates for the discussions exceeded expectations: we received expressions of interest from 200 personnel. We invited 52 of these to participate in a 60-minute, semi-structured discussion. Discussion participants were selected to be representative on key characteristics (i.e. Op LASER role, gender, rank, province). On average, discussions lasted 90 minutes.

Lessons learned

During the course of this study, we learned three important lessons that can be applied to future research.

1. Existing capability and established collaborative networks facilitate timely design and implementation of research

Our research organizations have a history of collaborative projects, which greatly facilitated the formation of a multidisciplinary study team with complementary areas of expertise. A strong capability in online survey programming and implementation in one of our organizations (DGMFRA) facilitated the online survey's timely launch. Still, institutionalizing ways to minimize organizational approvals would facilitate timely study design and implementation in similar missions in future.

2. Developing a standard set of pre-deployment demographic and health indicators facilitates timely research design, data collection, interpretation and generalization

It may also be useful to explore developing a standard set of pre-deployment

demographic and health indicators that could be collected in parallel to, or as part of, standard deployment readiness verification processes (e.g. Deployment Assistance Group screening). These indicators could then be accessed as a baseline for short-fuse research such as Op LASER.

3. Using mixed methods approaches facilitates gathering richer information and developing more robust recommendations

Quantitative data obtained with surveys give an indication of how individuals are doing, and are usually very appealing to senior military leadership. One-on-one discussions provide additional depth and context, although they take longer, as does transcription, translation, coding and analysis.

Conclusion

In this paper, we briefly summarized the challenges we encountered in designing and implementing the Op LASER research project in the midst of a pandemic. Some of these challenges were common to research in applied military settings whereas others were unique to the COVID-19 context.

Our experience in trying to overcome these challenges under very tight time constraints while respecting public health measures highlights several key recommendations, including the importance of (1) developing and maintaining robust collaborative networks across government, academia and industry; (2) having simplified and streamlined and harmonized processes for organizational approvals of research requiring quick implementation; and (3) using mixed methods approaches for a richer understanding of trajectories of good health and ill-health following stressful events. Investing in improvements in these key areas will benefit future research efforts to support the mental health and well-being of military personnel.

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Conflicts of interest

None.

Authors' contributions and statement

DF: drafting and revising paper; MMT: drafting and revising paper; KM: editing and revising paper; TH: editing and revising paper; AN: editing and revising paper; JB: editing and revising paper; KS: editing and revising paper; SB: editing and revising paper; RJ: review of paper.

The content and views expressed in this article are those of the authors and do not necessarily reflect those of the Government of Canada.

References

1. Watkins K. Deployment stressors: a review of the literature and implications for members of the Canadian Armed Forces. *Res Militaris*. 2014 Summer-Autumn [cited 2021 Feb 19]; 4(2). Available from: https://resmilitaris.net/wp-content/uploads/2021/09/res_militaris_article_watkins_deployment_stressors_literature_review.pdf
2. Born JA, Zamorski MA. Contribution of traumatic deployment experiences to the burden of mental health problems in Canadian Armed Forces personnel: exploration of population attributable fractions. *Soc Psychiatry Psychiatr Epidemiol*. 2019;54(2):145-56. <https://doi.org/10.1007/s00127-018-1562-6>
3. Chew NW, Lee GK, Tan BY, et al. A multinational, multicentre study on the psychological outcomes and associated physical symptoms amongst healthcare workers during COVID-19 outbreak. *Brain Behav Immun*. 2020; 88:559-65. <https://doi.org/10.1016/j.bbi.2020.04.049>
4. Zhang SX, Liu J, Jahanshahi AA, et al. At the height of the storm: healthcare staff's health conditions and job satisfaction and their associated predictors during the epidemic peak of COVID-19. *Brain Behav Immun*. 2020; 87:144-6. <https://doi.org/10.1016/j.bbi.2020.05.010>
5. Arsenault TM. Observations sur les centres d'hébergement de soins longue durées de Montréal. 3350-Op LASER (G35) [Report]. Montréal (QC): Commandement de la composante terrestre, Force opérationnelle interarmées - Est; 2020.
6. Mialkowski C. Op LASER—JTFC observations in long-term care facilities in Ontario. 3350-Op LASER 20-01 (COS) [Report]. Toronto (ON): Headquarters, 4th Canadian Division Joint Task Force (Central); 2020.
7. Morse SS, Mazet JA, Woodhouse M, et al. Prediction and prevention of the next pandemic zoonosis. *Lancet*. 2012;380(9857):1956-65. [https://doi.org/10.1016/s0140-6736\(12\)61684-5](https://doi.org/10.1016/s0140-6736(12)61684-5)
8. Rolstad S, Adler J, Rydén A. Response burden and questionnaire length: is shorter better? A review and meta-analysis. *Value Health*. 2011;14(8):1101-8. <https://doi.org/10.1016/j.jval.2011.06.003>
9. Mancini AD, Littleton HL, Grills AE. Can people benefit from acute stress? Social support, psychological improvement, and resilience after the Virginia Tech campus shootings. *Clin Psychol Sci*. 2016;4(3):401-17. <https://doi.org/10.1177/2167702615601001>

Original quantitative research

Trials and tribulations among members of Canada's Defence Team early in the pandemic: key insights from the COVID-19 Defence Team Survey

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Abstract

Introduction: Due to the unprecedented impact of COVID-19, there is a need for research assessing pandemic-related challenges and stressors. The current study aimed to assess key concerns and general well-being among members of Canada's Defence Team, including Canadian Armed Forces personnel and members of the Department of National Defence (DND) Public Service.

Methods: The COVID-19 Defence Team Survey was administered electronically to Defence Team staff in April and May of 2020 and was completed by 13 688 Regular Force, 5985 Reserve Force and 7487 civilian DND Public Service personnel. Along with demographic information, the survey included assessments of work arrangement, pandemic-related concerns, general well-being and social and organizational support. Weighted data (to ensure representation) were used in all analyses.

Results: The majority of respondents were working from home, with a small minority unable to work due to restrictions. Though many concerns were endorsed by a substantial proportion of respondents, the most prevalent concerns were related to the health and well-being of loved ones. The majority of respondents reported their partner, family, supervisors, friends, colleagues and children provided general support. Half of the civilian defence staff and one-third of military respondents reported a decline in mental health. Women, younger respondents, those with dependents and, in some cases, those who were single without children were at risk of lower well-being.

Conclusion: The pandemic has negatively impacted a substantial portion of the Defence Team. When responding to future crises, it is recommended that leaders of organizations provide additional supports to higher-risk groups and to supervisors who are ideally positioned to support employees during challenging times.

Keywords: COVID-19, workplace, military personnel, survey

Introduction

Since being declared on 11 March 2020, the COVID-19 pandemic has substantially altered the way individuals both live and work, requiring organizations and personnel

to rapidly adapt. In the final week of March 2020, a reported 2.8 million Canadians were away from their jobs for reasons related to the pandemic, and those who continued to work were adapting to working from home.¹ Similarly,

Highlights

- Top concerns reported by all groups centred on the health and well-being of loved ones, with civilian Defence Team personnel reporting higher levels of concern compared to Regular and Reserve Force personnel.
- Over 75% of all participants agreed that their spouse/partner provided them with significant support. Family members, supervisors and friends were also commonly perceived as providing significant support (57%–66%).
- A decline in mental health was reported by almost half of civilian Defence Team personnel and approximately one-third of military personnel.
- Women, younger respondents and those with dependents appear to be at risk for lower levels of well-being during the pandemic.

within the Department of National Defence (DND) and the Canadian Armed Forces (CAF), which make up Canada's Defence Team, many individuals were required to engage in telework or alternative work arrangements at levels not previously experienced, with minimal time to prepare or acclimatize. Moreover, personnel faced significant new stressors in their personal lives, including concerns over

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the health and welfare of their families, and the care of those around them.

The unprecedented social and economic impacts of the COVID-19 pandemic fuelled an extraordinary demand for real-time, high-quality data on Canada's people, society and economy. In light of this demand, many organizations (e.g. Statistics Canada, the Canadian Institutes of Health Research and a number of federal departments and agencies)¹⁻⁴ accelerated data collection and the dissemination of insights on the impacts of COVID-19 on individuals and organizations. Accordingly, the COVID-19 Defence Team Survey was administered to military personnel and civilian public service employees within the DND/CAF to better understand Defence Team members' experiences and needs related to the pandemic, and to provide key insights that might enable the DND/CAF to implement timely measures to address the concerns of personnel and identify potential areas of future concern.

Past research has shed light on the impact of disease outbreaks on individuals' lives, and on the segments of the population that are particularly affected, such as women or people with dependent children.^{5,6} However, these observations may not generalize to the current context, given the unique nature of the COVID-19 pandemic. An exploratory analysis of the COVID-19 Defence Team Survey was therefore conducted to identify some of the top challenges that Defence Team personnel faced in various domains of their lives (e.g. work, family, health and well-being) in the early months of the pandemic, and to identify particular sociodemographic groups within the workforce who may be at risk when facing such challenges.

Methods

The anonymous, cross-sectional COVID-19 Defence Team Survey was administered electronically from 29 April to 22 May 2020 and was made available to Defence Team personnel through an internet link that was promoted and shared in

Defence Team newsletters, and on websites, social media and other applications. Participation was voluntary, with informed consent obtained by having participants review an information sheet before proceeding with the survey. Participants could complete the survey in either French or English. All survey materials and procedures were approved by the DND Social Science Research Review Board (SSRRB #895/20F).

Participants

Over 27 000 Defence Team personnel completed the survey, including 13 688 Regular Force, 5052 members of the Primary Reserve* and 7487 DND Public Service personnel.[†]

The survey reached the desired population. The sample was also generally representative across key demographic variables, including gender, age and first official language, when compared to information contained in human resources records, although there was an underrepresentation of non-commissioned members (NCMs). It was not possible to calculate a response rate because probability sampling was not used and there were no means to track the number of Defence Team members who received the survey link.

A summary of participants' basic demographic characteristics is provided in Table 1. In addition (results not shown), the majority (95%) of DND Public Service personnel were indeterminate (permanent) employees. Regular Force personnel and Primary Reserve personnel were predominantly NCMs, as opposed to officers (Regular Force: 49% junior NCM, 24% senior NCM, 15% junior officer, 13% senior officer; Primary Reserve: 61% junior NCM, 17% senior NCM, 14% junior officer, 8% senior officer). Participants were from across Canada and working at varying levels within the reporting structure. Roughly half of Regular Force (53%), two-fifths of Primary Reserve (42%) and one-third of DND Public Service (31%)

personnel indicated that they supervised personnel.

Measures

The survey was developed based on existing surveys and approaches, as well as discussions with key stakeholders within the DND/CAF. Over 70 questions were included to examine a wide range of themes (e.g. work arrangement, financial concerns, well-being); however, only measures used in the present analyses are presented here.

Personal characteristics

Information was collected on a wide range of demographic and work characteristics. However, only gender, age group, status regarding the supervision of personnel and family status were considered in the present analyses, as similar variables have been linked with psychosocial impacts in past outbreaks.^{5,6} Family status was assessed based on participants' marital status (single—never married; separated/divorced or widowed; married/common-law) and whether they had any dependent children under the age of 18 years living in their household part-time or full-time. This resulted in four categories: single (including separated/divorced or widowed)—no dependent children; single (including separated/divorced or widowed)—dependent children; married/common-law—no dependent children; and married/common-law—dependent children.

Work context

To provide a general overview of the work context, participants were asked to identify their primary work arrangement as of 14 March 2020 (e.g. working from home; working at my usual location; not working—tasks cannot be performed from home; not working—no network access; not working—COVID-19 related reasons; not working—reasons unrelated to COVID-19 [e.g. parental leave, seasonal job, illness or disability other than COVID-19, caring for children or elderly relatives unrelated to COVID-19]; other).

* Only Primary Reserve members of the Reserve Force were included in this analysis, although a total of 5985 Reserve Force personnel completed the survey. Primary Reserve members serve full- or part-time on short-term contracts, and may volunteer in domestic or international operations. Other components of the Reserve Force include the Supplementary Reserve (who are inactive members of the CAF who can serve when requested), the Cadet Organizations Administration and Training Service (who train members of the Canadian Cadet Organizations and Junior Canadian Rangers), and the Canadian Rangers (who survey and patrol Canada's arctic and remote areas). Due to the unique nature of Reserve Force respondents who are not in the Primary Reserve, their results will be reported separately.

[†] Regular Force, Primary Reserve and DND Public Service personnel were treated as distinct groups throughout the paper, in light of important differences across the groups. In particular, military personnel may distinguish themselves from DND Public Service personnel, who are generally civilian, owing to their training and the high-risk nature of their occupation. There are also important differences among military personnel groups; notably, Primary Reserve personnel may also hold civilian employment and are not necessarily eligible for the same services and benefits as Regular Force members. Furthermore, the demographic profile of each group differs in important ways, with a more even gender distribution among DND Public Service personnel compared to the military groups, and a generally younger age among Primary Reserve personnel compared to Regular Force personnel.

TABLE 1
Basic demographic characteristics of respondents (%), unweighted,
COVID-19 Defence Team Survey, April to May 2020

Characteristic	Regular Force	Primary Reserve	DND Public Service
Gender			
Men	82.0	80.1	49.7
Women	16.8	18.9	49.6
Gender diverse	0.2	0.2	0.2
Prefer not to say	1.0	0.7	0.5
Age (years)			
Up to 24	12.1	32.5	2.0
25–34	34.6	27.3	11.6
35–44	30.2	15.4	23.5
45–54	18.7	16.4	32.9
55 and over	4.4	8.3	29.9
First official language			
English	69.0	78.0	69.2
French	31.0	22.0	30.8

Abbreviation: DND, Department of National Defence.

Pandemic-related concerns

Participants reported their degree of concern (“not at all”, “somewhat”, “very” or “extremely concerned”; not applicable) with 31 items in the context of the pandemic. Items were generated based on existing measures (e.g. Walter Reed Army Institute of Research [WRAIR] Behavioral Health Advisory Team – COVID-19 Assessment,⁷ Canadian Perspectives Survey Series [CPSS]) and reflected a range of potential challenges. These touched on multiple domains of life, including health (e.g. “Contracting COVID-19”), family (e.g. “Family stress due to confinement”) and work (e.g. “Increase in my work volume”). The total number of items participants reported as very or extremely concerning was calculated, producing an overall indicator of pandemic-related concerns.

Well-being

The approach used in the CPSS³ to assess the health impacts of COVID-19 on Canadians was adapted by asking participants to rate their current mental health compared to before the start of the pandemic on a 5-point scale (“significantly worse”, “slightly worse”, “the same”, “slightly better” or “significantly better”). In addition, participants were asked to indicate the extent to which “feeling lonely” and “feeling emotionally drained” had bothered them over the last two

weeks on a 4-point scale (“not at all”, “several days”, “more than half the days” or “nearly every day”).

Support

Participants’ access to various sources of support was assessed by asking them to indicate if they had received significant levels of support from various individuals since the start of the pandemic (e.g. spouse/partner, friends and acquaintances, supervisor). The type of support received was not specified in this question. Perceptions regarding the level of support received from the immediate supervisor were also assessed using items adapted from a number of other sources (e.g. WRAIR Behavioral Health Advisory Team – COVID-19 Assessment,⁷ Royal Ottawa Hospital COVID-19 Survey⁸). Specifically, participants used a 6-point scale (“strongly disagree”, “disagree”, “somewhat disagree”, “somewhat agree”, “agree” or “strongly agree”; not applicable) to indicate the extent to which they agreed with seven statements about their supervisor (e.g. “Emphasizes taking care of ourselves mentally/physically during the COVID-19 pandemic”). Items demonstrated very high internal reliability (Cronbach’s alphas ranging from 0.93 to 0.95 across the three Defence Team groups); thus, mean scores were generated by calculating the mean of ratings across the seven items.

Analysis

To ensure results were representative of the three major groups (i.e. Regular Force, Primary Reserve and DND Public Service), data were weighted to correct for demographic differences, or misrepresentation, between the sample and the population (e.g. underrepresentation of NCMs). Specifically, the data were weighted by the following variables: organizational division within the DND/CAF, first official language, sex, rank (for military personnel) and employment status (for civilian personnel).

Given the unique context and demographic profiles of each of the three groups, analyses were presented separately for Regular Force, Primary Reserve and DND Public Service personnel (although statistical differences between the groups were not tested). Past findings indicate that not all people are impacted to the same extent during crises (e.g. there may be greater impacts among children, older adults and those who may be socially or medically vulnerable⁹). Differences across subgroups (i.e. gender, age, status regarding the supervision of personnel and family status) were therefore investigated using unadjusted logistic regression (for binary variables, e.g. worse mental health), Poisson regression (for count variables, e.g. number of pandemic-related concerns) or linear regression (for continuous variables, e.g. supervisor support) analyses.

Results

Work context

As a result of physical distancing measures, drastic changes were made to work arrangements across the Defence Team. Accordingly, only approximately one-quarter of the military members (27% Regular Force and 23% Primary Reserve) and 14% of DND Public Service personnel were working at their usual work location. Approximately half of the military members (49% Regular Force and 52% Primary Reserve) and 70% of DND Public Service personnel were working from home (part-time, full-time or flex-time). As well, 15%, 11% and 8% of Regular Force, Primary Reserve and DND Public Service personnel, respectively, reported not working

[†] Only a small proportion of participants reported the other work arrangements (i.e. not working—no network access, not working—COVID-19-related reasons, not working—reasons unrelated to COVID-19, other); results are not reported.

because their tasks could not be performed from home.[†]

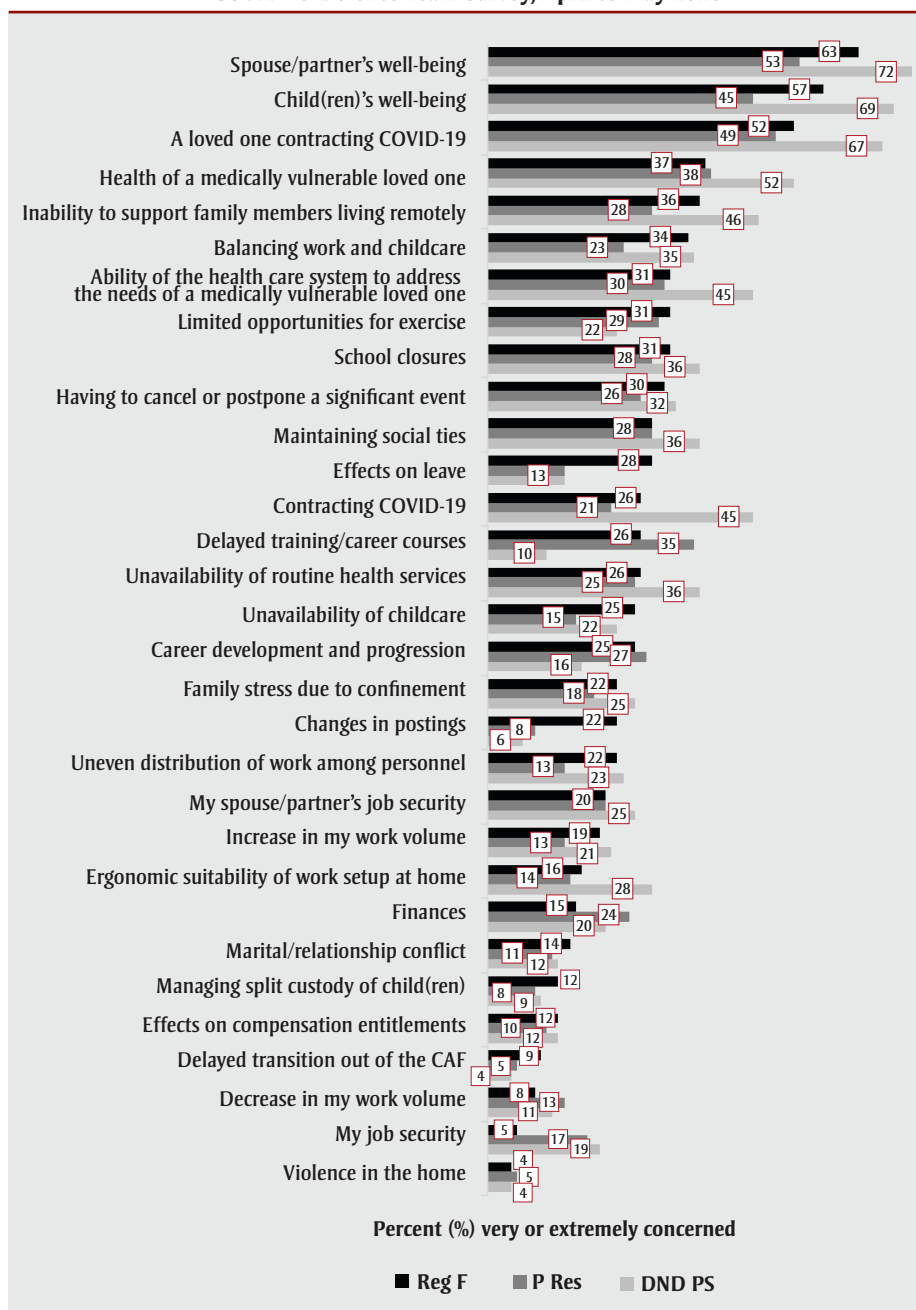
Further analyses revealed that women in the Regular Force had higher odds of working at their usual location than men (odds ratio [OR]_{woman} = 1.76; 95% confidence interval [CI]: 1.54–2.01), which may reflect their overrepresentation in occupations that are deemed essential, such as health care or service delivery. No such differences were observed among Primary Reserve or DND Public Service personnel. Older age groups also generally had higher odds of working at their usual location relative to those aged 24 years and under (Regular Force: OR_{25-34yrs} = 2.65 [2.19–3.21], OR_{35-44yrs} = 2.41 [1.99–2.93], OR_{45-54yrs} = 2.51 [2.06–3.07], OR_{55+yrs} = 2.20 [1.68–2.87]; Primary Reserve: OR_{25-34yrs} = 1.36 [1.12–1.64], OR_{35-44yrs} = 1.55 [1.25–1.94], OR_{45-54yrs} = 1.86 [1.50–2.29], OR_{55+yrs} = 2.28 [1.72–3.02]; DND Public Service: OR_{25-34yrs} = 2.12 [1.08–4.16]). This was also the case for participants who supervise personnel compared to those who do not (Regular Force: OR_{supervisor} = 1.60 [1.44–1.77]; Primary Reserve: OR_{supervisor} = 1.24 [1.08–1.44]; DND Public Service: OR_{supervisor} = 1.20 [1.00–1.43]). Differences were also noted according to family status, although no discernable pattern emerged; these results are not reported.

Pandemic-related concerns

In addition to drastic changes to their work arrangements, Defence Team personnel reported many concerns due to the pandemic, which spanned multiple domains of their work and home life. As shown in Figure 1, the top concerns generally touched on the health and well-being of a loved one, including the well-being of one's spouse/partner or child(ren), a loved one contracting COVID-19 and the health of a medically vulnerable loved one, irrespective of whether participants were Regular Force, Primary Reserve or DND Public Service personnel. DND Public Service personnel generally reported concerns in higher proportion, although apparent differences between the three groups are likely attributable to their distinct sociodemographic profiles and should be interpreted with caution.

The mean number (standard error) of pandemic-related concerns reported by participants was 6.82 (0.05) in the Regular Force, 5.79 (0.07) in the Primary Reserve, and 7.50 (0.06) in the DND Public Service.

FIGURE 1
Percent reporting pandemic-related concerns,
COVID-19 Defence Team Survey, April to May 2020



Abbreviations: CAF, Canadian Armed Forces; DND PS, Department of National Defence Public Service; P Res, Primary Reserve; Reg F, Regular Force.

Although there were some exceptions, results of Poisson regression analyses generally pointed to higher rates of concerns among women relative to men, all age groups relative to those aged 24 years and under, participants who supervise personnel relative to those who do not and participants who have dependent children (whether or not they are married) relative to those who are single with no dependent children (Table 2). Notably, similar rates of concerns were observed between

men and women among Regular Force personnel. As well, similar rates were observed between participants in the youngest and oldest age groups, and between single and married participants without dependent children among DND Public Service personnel.

Well-being

In light of the various challenges and stressors reported by Defence Team

TABLE 2
Results of unadjusted Poisson regressions examining the associations of demographic factors with pandemic-related concerns, COVID-19 Defence Team Survey, April to May 2020

	Regular Force	Primary Reserve	DND Public Service
	IRR (95% CI)	IRR (95% CI)	IRR (95% CI)
Gender			
Men	Ref	Ref	Ref
Women	1.03 (0.99–1.06)	1.16 (1.10–1.24)	1.04 (1.00–1.07)
Age (years)			
Up to 24	Ref	Ref	Ref
25–34	1.41 (1.29–1.53)	1.30 (1.21–1.39)	1.23 (1.09–1.39)
35–44	1.55 (1.46–1.64)	1.57 (1.46–1.69)	1.36 (1.21–1.53)
45–54	1.73 (1.64–1.82)	1.48 (1.37–1.60)	1.15 (1.03–1.30)
55 and over	1.41 (1.33–1.49)	1.12 (1.01–1.25)	0.96 (0.86–1.08)
Supervising personnel			
No	Ref	Ref	Ref
Yes	1.23 (1.20–1.27)	1.13 (1.07–1.19)	1.07 (1.03–1.10)
Family status			
Single—no dependent child(ren)	Ref	Ref	Ref
Single with dependent child(ren)	1.49 (1.40–1.58)	1.11 (1.02–1.21)	1.36 (1.27–1.47)
Married—no dependent child(ren)	1.22 (1.18–1.27)	1.11 (1.03–1.18)	1.02 (0.97–1.07)
Married with dependent child(ren)	1.64 (1.59–1.70)	1.57 (1.48–1.67)	1.41 (1.34–1.47)

Abbreviations: CI, confidence interval; DND, Department of National Defence; IRR, incidence rate ratio; Ref, reference category.

Note: Bolded values are significant at $p < 0.05$.

personnel, it is not surprising that notable impacts on well-being were reported. In terms of specific aspects of mental health, just over 1 in 10 personnel reported feeling lonely half the days or more in the past two weeks (11% Regular Force, 12% Primary Reserve and 11% DND Public Service personnel). As well, 15% of Regular Force, 14% of Primary Reserve and 21% of DND Public Service personnel reported feeling emotionally drained half the days or more in the past two weeks.

As shown in Table 3, differences in these aspects of mental health were also noted between groups. Specifically, women were consistently more likely than men to report feeling lonely. Regular Force and Primary Reserve members aged 25 years or older had decreased odds of feeling lonely compared to those aged 24 years and under, as did DND Public Service personnel aged 35 years or older compared to those aged 24 years and under. Supervisors also consistently showed decreased odds of feeling lonely compared to participants who did not supervise personnel. Finally, participants who were married—regardless of whether they had any dependent children—showed decreased odds of

feeling lonely compared to those who were single without any dependent children.

In accordance with findings above, women consistently showed greater odds of feeling emotionally drained. Differences were also found across other groups, although with less consistency. Regarding age, findings generally pointed to increased odds of feeling emotionally drained for participants who were in their mid-forties or younger, and decreased odds for participants who were older compared to those aged 24 years and under. These findings may be related to the degree of childcare burden faced by participants in these age groups. Indeed, increased odds of feeling emotionally drained were also observed among Regular Force participants with dependent children compared to those who were single without any dependent children. Finally, Regular Force and DND Public Service participants who supervise personnel had elevated odds of feeling emotionally drained compared to those who do not.

In terms of broad impacts on mental health (results not shown), almost half of DND Public Service personnel (48%) and approximately one-third of military

personnel (36% Regular Force and 32% Primary Reserve) reported that their mental health had gotten worse since the start of the pandemic. In particular, 6% of Regular Force, 5% of Primary Reserve and 8% of DND Public Service personnel reported that their mental health had gotten significantly worse since the start of the pandemic.

Support

As shown in Figure 2, Defence Team personnel most often reported receiving significant support from their spouse/partner (76%–79% across the three groups). Still, roughly 60% also reported that their family, friends and, notably, work supervisor were significant sources of support. The latter is supported by other findings from this survey; specifically, the vast majority of personnel indicated that their supervisor was supportive in various ways during the pandemic (Figure 3). The mean ratings (standard errors) assigned by participants across the seven items shown in Figure 3 were 4.73 (0.01) in the Regular Force, 4.81 (0.01) in the Primary Reserve and 4.84 (0.01) in the DND Public Service.

Although perceived supervisor support was very high, a few group differences were noted (results not shown). Specifically, supervising personnel was associated with lower support scores among CAF personnel (Regular Force: $B_{supervisor} = -0.05$ [95% CI: -0.10 to -0.002]; Primary Reserve: $B_{supervisor} = -0.13$ [-0.20 to -0.06]), as was being a woman in the Regular Force ($B_{woman} = -0.15$ [-0.22 to -0.07]). Some differences by age group were also observed, though a clear pattern was difficult to discern. For example, being between the ages of 35 and 44 years was associated with decreased scores among both Regular Force ($B_{35-44yrs} = -0.09$ [-0.16 to -0.01]) and DND Public Service personnel ($B_{35-44yrs} = -0.21$ [-0.41 to -0.02]). However, other findings were mixed (Regular Force: $B_{25-34yrs} = -0.16$ [-0.23 to -0.09], $B_{55+yrs} = 0.20$ [0.08 to 0.31]; Primary Reserve: $B_{45-54yrs} = 0.12$ [0.03 to 0.21]; DND Public Service: $B_{45-54yrs} = -0.24$ [-0.43 to -0.05]). No differences were observed according to family status.

Discussion

The COVID-19 Defence Team Survey was developed to assess Defence Team members' experiences and needs related to the COVID-19 pandemic in key areas of their

TABLE 3
Results of unadjusted logistic regressions examining the associations of demographic factors with well-being indicators, COVID-19 Defence Team Survey, April to May 2020

	Feeling lonely			Feeling emotionally drained		
	Regular Force	Primary Reserve	DND Public Service	Regular Force	Primary Reserve	DND Public Service
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Gender						
Men	Ref	Ref	Ref	Ref	Ref	Ref
Women	1.50 (1.27–1.78)	1.48 (1.17–1.87)	2.04 (1.70–2.46)	2.12 (1.84–2.45)	2.05 (1.64–2.57)	1.92 (1.67–2.21)
Age (years)						
Up to 24	Ref	Ref	Ref	Ref	Ref	Ref
25–34	0.75 (0.61–0.90)	0.70 (0.56–0.88)	0.69 (0.41–1.16)	1.23 (0.99–1.51)	1.19 (0.95–1.51)	1.15 (0.70–1.88)
35–44	0.55 (0.45–0.67)	0.50 (0.35–0.70)	0.51 (0.31–0.85)	1.76 (1.43–2.17)	1.34 (1.01–1.78)	1.18 (0.73–1.89)
45–54	0.47 (0.37–0.61)	0.26 (0.18–0.37)	0.34 (0.21–0.56)	1.18 (0.94–1.50)	0.77 (0.57–1.03)	0.70 (0.43–1.11)
55 and over	0.30 (0.12–0.46)	0.18 (0.10–0.34)	0.27 (0.17–0.45)	0.72 (0.50–1.03)	0.38 (0.22–0.65)	0.42 (0.26–0.68)
Supervising personnel						
No	Ref	Ref	Ref	Ref	Ref	Ref
Yes	0.73 (0.64–0.84)	0.60 (0.48–0.74)	0.72 (0.59–0.87)	1.35 (1.20–1.52)	0.90 (0.74–1.09)	1.18 (1.02–1.36)
Family status						
Single—no dependent child(ren)	Ref	Ref	Ref	Ref	Ref	Ref
Single with dependent child(ren)	0.83 (0.66–1.05)	0.79 (0.61–1.03)	1.07 (0.77–1.50)	1.54 (1.20–1.97)	0.99 (0.75–1.30)	1.28 (0.95–1.72)
Married—no dependent child(ren)	0.33 (0.27–0.40)	0.33 (0.23–0.47)	0.27 (0.22–0.34)	0.89 (0.76–1.05)	0.74 (0.56–0.98)	0.54 (0.45–0.65)
Married with dependent child(ren)	0.27 (0.22–0.32)	0.30 (0.21–0.44)	0.34 (0.27–0.43)	1.33 (1.15–1.53)	1.13 (0.88–1.46)	1.03 (0.86–1.24)

Abbreviations: CI, confidence interval; DND, Department of National Defence; OR, odds ratio; Ref, reference category.

Note: Bolded values are significant at $p < 0.05$.

well-being. Together, results highlight some of the central challenges that personnel have faced as a result of the pandemic, many of which might have stemmed from the substantial changes to work arrangements, concern for family members and added pressure faced by personnel having to navigate daycare and school closures.

Not surprisingly, many challenges reported by Defence Team personnel crossed over multiple domains of their work and home life. This finding accords with research conducted during past outbreaks, which highlighted the impacts of confinement on family members, challenges related to school closures and balancing childcare and work-related responsibilities.^{6,10-12} Furthermore, issues surrounding the impact of physical distancing measures on work-life spillover have been documented. Early in the pandemic, results of the CPSS indicated that 40% of Canadians who were new to working from home as a result of COVID-19 were also living with a child under 18 years of age.¹

Given the pervasiveness of such impacts, it is not surprising that concerns with health and family and issues related to

mental health and well-being were prominent among Defence Team personnel. Similar to these findings, results of the CPSS administered in late March to early April of 2020 showed that just over half of Canadians indicated that their mental health had gotten worse since the start of the pandemic.²

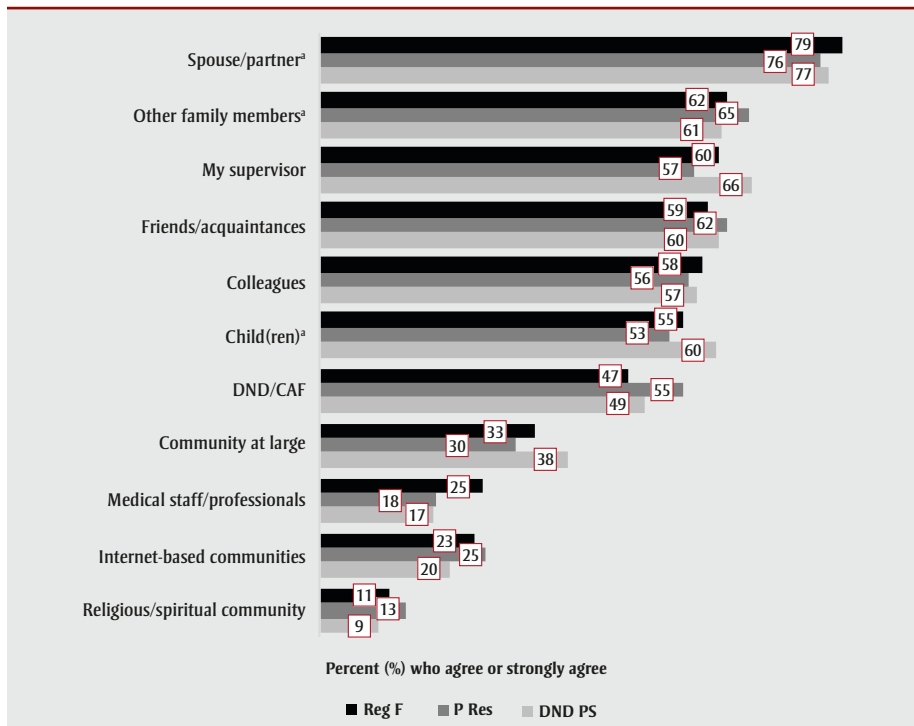
Beyond underlining key challenges faced by members of the Defence Team, results of the survey emphasize that not all of them were impacted in the same way by the pandemic. To summarize, women experienced more concerns, felt lonelier and more emotionally drained and experienced less supervisor support. Older personnel were more likely to work at their usual location, had more concerns, were less lonely and were more emotionally drained. Defence Team members who supervised personnel were more likely to be working at their usual location, had more concerns and were more emotionally drained; however, they were less lonely, possibly as a result of greater contact with others through their work with subordinates. Married personnel with dependent children had more concerns than single personnel with no dependent

children. Married Regular Force personnel felt less lonely, but those with dependent children felt more emotionally drained.

Combined, these results indicate that women, younger personnel and personnel with dependent children were often negatively impacted by the pandemic, consistent with findings based on the general population in other countries.^{13,14} Defence Team personnel within these groups may have been more likely to face challenges posed by the closure of schools and daycares, which placed a significant amount of added pressure on them.¹⁵ Notwithstanding the importance of such challenges, results also underline the negative impacts of the pandemic on the well-being of single Defence Team personnel without any dependent children, especially in terms of loneliness. Indeed, social isolation may be especially pronounced among those who live alone or away from loved ones,¹⁶ and has been linked with poorer mental health.¹⁷

In addition to supporting past research,^{5,6,9,17} the findings regarding group differences underscore the importance of adopting a gender-based analysis plus (GBA+) lens

FIGURE 2
Percent reporting significant levels of support from various sources,
COVID-19 Defence Team Survey, April to May 2020



Abbreviations: CAF, Canadian Armed Forces; DND, Department of National Defence; DND PS, DND Public Service; P Res, Primary Reserve; Reg F, Regular Force.

^a Percentage based only on those to whom item applied. “Spouse/partner” percentages are based on subsamples of $n = 10\ 119$, $n = 3253$ and $n = 5985$ for Regular Force, Primary Reserve and DND Public Service personnel, respectively; “Other family members” percentages are based on subsamples of $n = 11\ 907$, $n = 4401$ and $n = 6521$ for Regular Force, Primary Reserve and DND Public Service personnel, respectively; and “Child(ren)” percentages are based on subsamples of $n = 6656$, $n = 1683$ and $n = 5021$ for Regular Force, Primary Reserve and DND Public Service personnel, respectively.

to account for the unique challenges of individual Defence Team members in the development of organizational practices, policies and programs.¹⁸ In particular, it is important for leaders of organizations to assess and understand the many ways in which diverse individuals might be impacted when facing a crisis, and to carefully consider this information when developing policies and support services to better serve all members of the workforce. Indeed, the present findings further illustrate how different sociodemographic groups may experience the same crisis in varying ways and thereby have distinct support needs.

The fact that perceived supervisor support was high is encouraging, and may relate to the position of supervisors as key players in monitoring well-being and supporting their personnel. Interestingly, Defence Team members who supervise personnel expressed lower levels of perceived supervisor support compared to those who do not, perhaps due to a greater desire or need for support as they navigated the

new and unique challenges of supervising. Z are ideally positioned to reduce employees’ uncertainty and bolster morale in times of crisis;²⁰ efforts should be made to engage supervisors at all levels in organizational endeavours to address the impacts of crises on the workforce. In order to ensure that they are well-equipped for this, it is recommended that organizations pay close attention to the well-being of personnel who are in supervisory positions, as they are a key source of support for their personnel in times of crisis in spite of potentially facing many of the same challenges themselves.

Strengths and limitations

The COVID-19 Defence Team Survey was developed and administered over a brief period of time, allowing it to provide key insights on Defence Team members’ well-being early in the pandemic. Its strengths include the large sample size and wealth of novel information it generated regarding the workforce in a pandemic context. As a cross-sectional survey, however, results

represent a snapshot of Defence Team members’ experiences and may not adequately reflect the experiences of today. Results are also subject to limitations inherent to self-reported data, including recall biases and social desirability. As an initial step, analyses only explored very general group differences in pandemic-related concerns. Further analysis is needed to assess group differences regarding more specific concerns, such as those involving health, work or family. Nevertheless, results to date have provided the DND/CAF with valuable information on how to best address Defence Team members’ needs in this challenging context.

Conclusion

Together, results of the COVID-19 Defence Team Survey underscore the critical role of organizational initiatives for addressing the many challenges personnel may face as they strive to be productive while coping with the threat of infection, new ways of working and the increasingly blurred line between their work and personal spaces. In view of the pervasive and evolving nature of COVID-19 restrictions in all spheres of life, continued efforts to ensure supportive leadership, supportive human resources practices and safe work conditions will be critical to the successful reintegration of personnel into the workforce as the crisis subsides.

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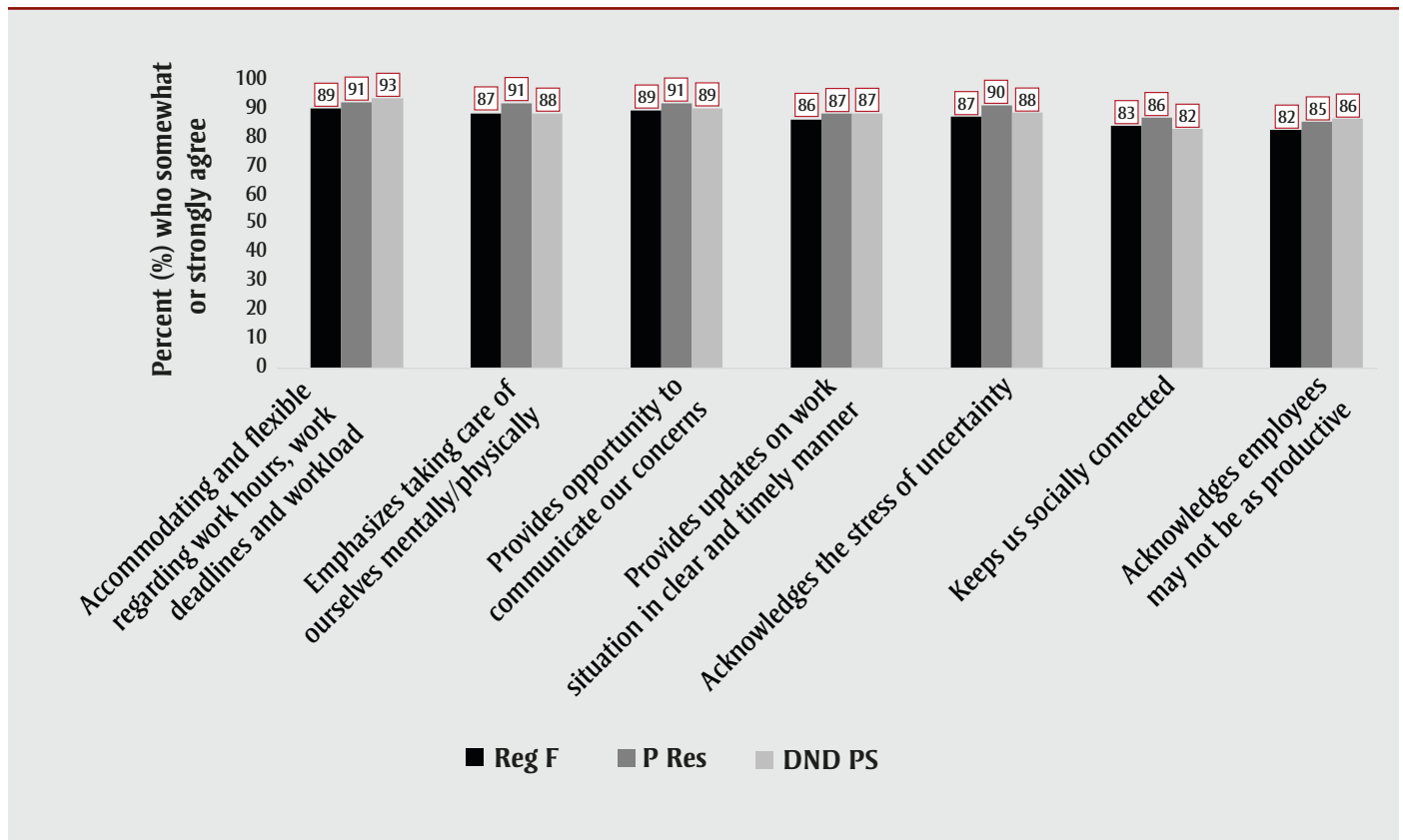
Conflicts of interest

The authors have no conflicts of interest to declare.

Authors’ contributions and statement

JECL was involved in the design and conceptualization of the work, analysis and

FIGURE 3
Percent agreement with supervisor support statements, COVID-19 Defence Team Survey, April to May 2020



Abbreviations: DND PS, Department of National Defence Public Service; P Res, Primary Reserve; Reg F, Regular Force.

interpretation of the data, drafting and revising the paper and approval of the final manuscript for submission. IG was involved in the design and conceptualization of the work, interpretation of the data, drafting and revising the paper and approval of the final manuscript for submission. All remaining authors were involved in the design and conceptualization of the work, analysis of the data, review of the paper and approval of the final manuscript for submission.

The content and views expressed in this article are those of the authors and do not necessarily reflect those of the Government of Canada.

References

1. Statistics Canada. Canadian Perspectives Survey Series 1: COVID-19 and working from home, 2020 [Internet]. Ottawa (ON): Statistics Canada; 2020 [cited 2021 Jun 30]. Available from: <https://www150.statcan.gc.ca/n1/daily-quotidien/200417/dq200417a-eng.htm>
2. Statistics Canada. How are Canadians coping with the COVID-19 situation? [Internet]. Ottawa (ON): Statistics Canada; 2020 [cited 2021 Jun 30]. Available from: <https://www150.statcan.gc.ca/n1/pub/11-627-m/11-627-m2020029-eng.htm>
3. Statistics Canada. Canadian Perspectives Survey Series 2: Monitoring the effects of COVID-19, May 2020. Ottawa (ON): Statistics Canada [The Daily]; 2020 Jun 4. Available from: <https://www150.statcan.gc.ca/n1/en/daily-quotidien/200604/dq200604b-eng.pdf?st=x-5hztDP>
4. Canadian Institutes of Health Research [CIHR], Research Nova Scotia, New Brunswick Health Research Foundation. In progress: organizational response to disease outbreak [Internet]. Ottawa (ON): CIHR; 2020 [cited 2021 Jun 30]. Available from: <https://www.ohpdata.com/covid-19>
5. Maunder R. The experience of the 2003 SARS outbreak as a traumatic stress among frontline healthcare workers in Toronto: lessons learned. *Philos Trans R Soc Lond B Biol Sci.* 2004;359(1447):1117-25. <https://doi.org/10.1098/rstb.2004.1483>
6. Wenham C, Smith J, Morgan R. COVID-19: the gendered impacts of the outbreak. *Lancet.* 2020;395(10227):846-8. [https://doi.org/10.1016/S0140-6736\(20\)30526-2](https://doi.org/10.1016/S0140-6736(20)30526-2)
7. Walter Reed Army Institute of Research (WRAIR). Behavioral Health Advisory Team - COVID-19 Assessment [survey questionnaire]. Silver Spring (MD): WRAIR; 2020. Available from: https://www.army.mil/article/235636/behavioral_health_assessment_team_bhat_covid_19_assessment
8. Robillard R, Saad M, Edwards J, et al. Social, financial and psychological stress during an emerging pandemic: observations from a population survey in the acute phase of COVID-19. *BMJ Open.* 2020;10(12):e043805. <https://doi.org/10.1136/bmjopen-2020-043805>

9. Substance Abuse and Mental Health Services Administration (SAMHSA). Challenges and considerations in disaster research. [Disaster Technical Assistance Center supplemental research bulletin]. Rockville (MD): SAMHSA; 2016. 13 p. Available from: <https://www.samhsa.gov/sites/default/files/dtac/supplemental-research-bulletin-jan-2016.pdf>
10. Liu JJ, Bao Y, Huang X, Shi J, Lu L. Mental health considerations for children quarantined because of COVID-19. *Lancet Child Adolesc Health*. 2020;4(5):347-9. [https://doi.org/10.1016/S2352-4642\(20\)30096-1](https://doi.org/10.1016/S2352-4642(20)30096-1)
11. O'Sullivan TL, Amaratunga C, Phillips KP, et al. If schools are closed, who will watch our kids? Family caregiving and other sources of role conflict among nurses during large-scale outbreaks. *Prehosp Disaster Med*. 2009;24(4):321-5. <https://doi.org/10.1017/s1049023x00007044>
12. Sprang G, Silman M. Posttraumatic stress disorder in parents and youth after health-related disasters. *Disaster Med Public Health Prep*. 2013;7(1):105-10. <https://doi.org/10.1017/dmp.2013.22>
13. Chandola T, Kumari M, Booker C, Benzeval M. The mental health impact of COVID-19 and lockdown-related stressors among adults in the UK. *Psychol Med*. 2020;1-10. <https://doi.org/10.1017/S0033291720005048>
14. Hamel L, Lopes L, Muñana C, Kates J, Michaud J, Brodie M. KFF coronavirus poll: March 2020 [Internet]. San Francisco (CA): KFF; 2020 [cited 2021 Jun 30]. Available from: <https://www.kff.org/global-health-policy/poll-finding/kff-coronavirus-poll-march-2020>
15. Power K. The COVID-19 pandemic has increased the care burden of women and families. *Sustain Sci Prac Pol*. 2020;16(1):67-73. <https://doi.org/10.1080/15487733.2020.1776561>
16. Guérin E, Price J, Lee JEC. The human dimensions of COVID-19: (3) Managing family stress. [Briefing note ref. no. DRDC-RDDC-2020-B012]. Ottawa (ON): Director General Military Personnel Research and Analysis; 2020. 3 p.
17. Leigh-Hunt N, Bagguley D, Bash K, et al. An overview of systematic reviews on the public health consequences of social isolation and loneliness. *Public Health*. 2017;152:157-71. <https://doi.org/10.1016/j.puhe.2017.07.035>
18. Johnstone R, Momani B. Gender mainstreaming in the Canadian Armed Forces and the Department of National Defence: lessons on the implementation of gender-based analysis plus (GBA+). *Armed Forces Soc*. 2020;62(3):500-19. <https://doi.org/10.1177/0095327X20956722>
19. Forbes S, Birkett H, Evans L, Chung H, Whitman J. Managing employees during the COVID-19 pandemic: flexible working and the future of work. Birmingham (UK): Work Inclusivity Research Centre, University of Birmingham; 2020. 33 p. Available from: <https://www.birmingham.ac.uk/Documents/college-social-sciences/business/research/responsible-business/managerial-experiences-during-covid19-2020-accessible.pdf>
20. Charoensukmongkol P, Phungsoonthorn T. The effectiveness of supervisor support in lessening perceived uncertainties and emotional exhaustion of university employees during the COVID-19 crisis: the constraining role of organizational intransigence. *J Gen Psychol*. 2021;148(4):431-50. [Epub 2020 Jul ahead of print.] <https://doi.org/10.1080/00221309.2020.1795613>

Original quantitative research

Well-being of Canadian Armed Forces members during the COVID-19 pandemic: the influence of positive health behaviours

Kerry A. Sudom, PhD; Jennifer E.C. Lee, PhD

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Abstract

Introduction: The COVID-19 pandemic has been linked to increased depression, anxiety and other adverse mental health outcomes. Understanding the behaviours that positively influence health is important for the development of strategies to maintain and improve well-being during the pandemic.

Methods: This study focussed on Canadian Armed Forces Regular Force members (N = 13 668) who participated in the COVID-19 Defence Team Survey, administered between April and May 2020. The use of positive health behaviours and the extent to which such behaviours were associated with anxiety, depression and self-reported change in health and stress levels compared to before the pandemic were examined.

Results: Depression and anxiety were experienced by 14% and 15% of the sample, respectively, while 36% reported that their mental health had gotten worse since the pandemic started, and close to half reported worse physical health and stress levels. The most common behaviours respondents reported engaging in to maintain or improve their health were exercising outdoors, healthy eating and connecting with loved ones. Although most behaviours were associated with better health outcomes, meditation and connecting with loved ones showed associations with worse health.

Conclusion: Engaging in behaviours such as exercise and healthy eating was generally associated with better health outcomes. Unexpected relationships of meditation and connecting with loved ones are discussed in terms of their use in stressful times among those with mental health issues, past research on coping strategies and impacts of the pandemic and physical distancing on social connections. The findings may have implications for strategies to promote healthy behaviours during the remainder of the pandemic and similar crises in the future.

Keywords: *mental health, coping, positive health behaviours, military, COVID-19, stress, depression, anxiety*

Introduction

Research conducted since early in the COVID-19 pandemic has shown its substantial impacts on mental health. For example, increased depression and anxiety among Canadians were reported early in the pandemic,¹ and fewer Canadians reported good or excellent mental health compared to before the pandemic.² In addition, declines in mental health compared

to before the pandemic were found in United States military veterans.³

Health-promoting behaviours, or those activities engaged in to maintain or improve one's health, can have a positive impact on well-being in normal times. However, the public health measures taken to curb the spread of the virus, including stay-at-home orders, limitations on social gatherings and restricted access

Highlights

- This study examined health behaviours and indicators among Canadian military personnel early in the COVID-19 pandemic.
- The most common behaviours used to improve or maintain health were exercising, healthy eating and getting enough sleep. Many of these behaviours were associated with more favourable mental and physical health and lower stress levels.
- Results provide valuable information on the prevalence of health-promoting behaviours and their associations with indicators of well-being.
- The findings point to key areas that could be targeted in future health promotion programs and interventions to preserve or improve health and to maintain operational readiness among military personnel.

to recreational resources, may have affected the ability or motivation to engage in such behaviours, with subsequent impacts on mental and physical health. Although much of the research on the individual consequences of the pandemic has focussed on its effects on mental health, less attention has been paid to health-promoting behaviours, including the extent to which the pandemic and associated public health measures have affected engagement in behaviours to promote or maintain health. Given the increasing evidence of the mental health toll of the pandemic, it is important to

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focus efforts on mitigating the mental health impact and managing psychological health over the longer term.

A wealth of research has underscored the importance of positive health behaviours for mental and physical health and well-being. For example, physical activity is associated with lower levels of stress, depression and anxiety,⁴ and has shown efficacy as a treatment for depression and anxiety.^{5,6} Higher fruit and vegetable consumption is associated with lower risk of cardiovascular disease, cancer and depression, as well as greater psychological well-being.⁷ Sleep is particularly important for health, as poorer sleep health has been found to be associated with a greater risk of anxiety and depression.⁸ Social behaviours are also important to both physical and mental health,⁹ and social health can buffer against adverse mental and physical health outcomes in the face of stress.¹⁰ Indeed, lack of social support was one of the key factors associated with increased severity of mental health issues among military veterans during the pandemic,¹¹ and larger pre-pandemic social network size was protective of increased psychological distress among veterans during the pandemic.³ Other behaviours, including meditation and connecting with one's spirituality, have also been associated with positive health outcomes.¹²⁻¹⁴

Health-promoting behaviours can have positive impacts on the maintenance or improvement of mental and physical health. However, changes in these behaviours may have occurred during the pandemic due to disruptions in normal activities, such as limitations on social gatherings and closures of fitness and recreational facilities, including those normally used by military members. Several studies have found both positive and negative changes in health behaviours during the pandemic, although most have assessed them retrospectively. For example, while several studies found increases in healthy eating,¹⁵⁻¹⁷ other research suggested increased consumption of junk food and reduced physical activity early in the pandemic.¹⁸

As well, several studies have found decreased physical activity compared to before the pandemic.¹⁹⁻²¹ In addition, increased sedentary behaviour and social isolation were found early in the pandemic,¹⁹ as well as negative changes in sleep.²² In fact, studies show a notable

proportion of individuals have been impacted by sleep problems during the pandemic: a systematic review estimated the global pooled prevalence of sleep problems during the pandemic at 35.7%.²³

Decreased engagement in positive behaviours can have subsequent impacts on health. For example, reduced physical activity and sleep since the pandemic began have been associated with greater symptoms of depression, anxiety and stress.²² Decreased physical activity has also been linked to worse psychological well-being²⁰ and increased feelings of loneliness,²⁴ while increased sedentary behaviour has been associated with worse physical and mental health.²⁵ Among military health care workers in China, poor sleep quality and duration during the pandemic have been identified as major risk factors for depression, generalized anxiety and somatic symptoms.²⁶ Negative changes in diet and physical activity during the pandemic have also been associated with worse subjective well-being.¹⁵

On the other hand, increased engagement in such behaviours can result in positive changes in health. Inactive people who spent more time in outdoor physical activity during the pandemic showed reduced anxiety,²⁷ and increased physical activity during the pandemic has also been associated with better physical health.²⁵ Healthy eating and physical activity were protective factors for adverse mental health outcomes in a sample of health care workers during the pandemic.²⁸ As well, physical activity, diet and sleep were all found to be protective for mental well-being early in the pandemic in a university sample, with physical activity being the strongest predictor.²⁹

It is clear from research carried out over the past year that the COVID-19 pandemic has had substantial impacts on mental health, as well as on engagement in health-promoting behaviours. However, there has been little research conducted specifically on mental health and health behaviours of actively serving military personnel during the pandemic. Importantly, recent prospective research has shown that mental health of military veterans declined during the pandemic.³ Although the military faced many of the same public health restrictions as the general population, including physical distancing requirements, restricted travel and reduced

access to fitness amenities, members of the military also faced unique issues that might have made them more vulnerable to mental health difficulties. For example, many were deemed to be in "essential" positions, which required them to continue to work at their usual location. Others faced being deployed or preparing to deploy on operations including those in support of the long-term care facilities in various parts of the country where they might be expected to face emotionally difficult situations.

Understanding the prevalence of health-promoting behaviours and their associations with indicators of well-being can provide insight into key areas that can be targeted in health promotion programs and interventions in order to maintain health and operational readiness among military members throughout this pandemic and other significant potentially stressful events. To this end, the goal of this study was to examine the engagement in positive health behaviours by Canadian Armed Forces (CAF) Regular Force members early in the COVID-19 pandemic, and the association of behaviours with indicators of well-being including depression, anxiety and perceived changes in mental health, physical health and stress levels since the start of the pandemic.

Methods

Participants

This study focussed on Regular Force members (N = 13 668) who completed the COVID-19 Defence Team Survey. Demographic and military characteristics of the sample are shown in Table 1. Most respondents were men (82.0%), between 25 and 44 years old (64.8%), and married or living common-law (61.6%). Approximately half of the sample consisted of junior non-commissioned members (NCMs). A small percentage was deployed in support of the long-term care facilities in Ontario and Quebec (Operation LASER; 7.0%) or on another operation (1.2%). Approximately half had children aged under 18 years at home.

Procedure

A convenience sampling strategy was used to collect data between April and May 2020, whereby members of the Defence Team (i.e. CAF members and civilian employees of the Department of

TABLE 1
Descriptive characteristics of the Regular Force sample (N = 13 668) responding to the COVID-19 Defence Team Survey, April to May 2020

Characteristics	n	%
Gender		
Men	11 252	82.0
Women	2 285	16.8
Gender diverse	167	1.2
Age (years)		
≤ 24	1 644	12.1
25–34	4 719	34.6
35–44	4 114	30.2
45–54	2 552	18.7
≥ 55	601	4.4
Dependent children		
No	6 072	50.5
Yes	5 940	49.5
Marital status		
Married/common-law	8 400	61.6
Single/divorced/widowed	5 233	38.4
Rank		
Junior NCM	6 622	48.6
Senior NCM	3 226	23.7
Junior officer	2 082	15.3
Senior officer	1 700	12.5
Deployment status		
Not currently deployed	12 510	91.8
Deployed on Operation LASER	957	7.0
Deployed on another domestic or international operation	163	1.2

Abbreviation: NCM, non-commissioned member.

National Defence [DND]) were invited via several means, including chain of command emails and departmental website links, to participate in an online survey. Consent to participate in the anonymous survey was implied. The research was approved by the DND Social Science Research Review Board.

Measures

Positive health behaviours were assessed using 10 items adapted from Statistics Canada’s “Impacts of COVID-19 on Canadians” Data Collection Series.³⁰ Respondents rated whether, since the start of the pandemic, they had been doing any of the behaviours (i.e. meditation, exercise, healthy eating, getting enough sleep, artistic expression, connecting with loved ones, connecting with spirituality and

learning something new) for their mental health, physical health or both. Responses were dichotomized into “yes” (i.e. engaging in the behaviour for their health) or “no” (i.e. not engaging in that behaviour).

Anxiety was assessed using the 2-item Generalized Anxiety Disorder scale (GAD-2).³¹ Respondents were asked how often during the last two weeks they had been bothered by the symptoms “feeling nervous, anxious or on edge” and “not being able to stop or control worrying.” Depression was assessed using the 2-item Patient Health Questionnaire (PHQ-2).³² Respondents were asked how often during the last two weeks they had been bothered by the symptoms “little interest or pleasure in doing things” and “feeling down, depressed or hopeless.” For both scales, established cut-off scores of 3 or

greater were used to indicate probable anxiety and probable depression.

Perceived changes in mental health, physical health and stress levels were assessed by single items asking respondents to rate their mental health, physical health and stress levels, respectively, compared to before the start of the pandemic.³⁰ Since the main goal of this analysis was to examine the association of behaviours with worse health outcomes, responses were dichotomized into “significantly worse than before/slightly worse than before” versus “the same as before/slightly better than before/significantly better than before,” in order to examine the predictors of perceived decline in health since the beginning of the pandemic.

Analyses

The data were weighted by sex, rank, first official language and respondents’ organization to ensure that the sample was representative of the CAF Regular Force population. Multivariate logistic regression analyses were used to explore the association between the independent variables (i.e. engagement in health behaviours) and the outcome variables (depression, anxiety, worse mental health, worse physical health and worse stress levels). Sociodemographic covariates that were expected to be associated with the outcomes of interest (i.e. gender, age, dependent children, marital status and rank) were included in the first step. Multicollinearity was examined using variance inflation factors and correlation coefficients; neither indicated the presence of multicollinearity.

Results

The prevalence of anxiety, depression and self-rated changes in health and stress levels since the pandemic began are shown in Table 2. Overall, 14.3% and 14.5% of the sample screened positive for depression and anxiety, respectively. Slightly over one-third (36.3%) reported worse mental health since the outset of the pandemic, and close to half reported worse physical health (46.9%) and worse stress levels (45.3%).

The prevalence of engagement in positive health behaviours is shown in Table 2. The most common behaviours respondents reported engaging in for their

TABLE 2
Prevalence of health indicators and engagement in health-promoting behaviours among Regular Force respondents to the COVID-19 Defence Team Survey, April to May 2020

Health indicators	n	%
Probable depression	1 953	14.3
Probable anxiety	1 978	14.5
Mental health worse ^a since pandemic	4 947	36.2
Physical health worse ^a since pandemic	6 401	46.9
Stress levels worse ^a since pandemic	6 184	45.3
Behaviours		
Exercising outdoors	11 522	86.8
Healthy eating	11 022	83.2
Connecting with loved ones	10 573	79.9
Getting sufficient sleep	10 046	75.7
Exercising indoors	9 840	74.3
Learning something new	5 765	43.7
Artistic expression	4 039	30.6
Meditation	2 870	21.9
Connecting with my spirituality	2 258	17.2
Other	1 245	11.5

^a Includes response options “Slightly worse than before” and “Significantly worse than before.”

mental health, physical health or both were exercising outdoors (86.8%), healthy eating (83.2%) and connecting with loved ones (79.9%). Getting sufficient sleep and exercising indoors were also reported by approximately three-quarters of respondents. Learning something new was reported by close to half of respondents, while artistic expression, meditation and connecting with spirituality were less frequently endorsed.

Table 3 presents the adjusted odds ratios (aORs) for predicting depression and anxiety, with all variables included in the model. Odds of depression were higher among those who were younger, without children and junior non-commissioned members (NCMs). Anxiety was higher among women, those with children and those in the middle age group (i.e. 35–44). Engaging in exercise, healthy eating, getting enough sleep, connecting with loved ones and learning something new were all associated with lower odds of depression, while those who reported meditating for their health were 2.15 times more likely to meet the cut-off for depression (95% confidence interval [CI]: 1.88–2.46). Exercise, getting enough sleep and learning something new were associated with lower odds of anxiety, while those who reported

meditating were 2.19 times more likely to experience anxiety (95% CI: 1.92–2.50).

Table 4 presents the aORs for predicting self-rated worse mental health, physical health and stress levels since the start of the pandemic, with all variables included in the model. Odds of reporting worse mental health were higher for women, the middle age group (35–44) and for officer ranks. Odds of reporting worse physical health were greater for the older age groups, those without children and officer ranks. Odds of worse stress levels since the pandemic were higher for women, age groups older than 24, those with dependent children at home, married respondents and junior NCMs. Exercising indoors and getting enough sleep were associated with better outcomes across all three dependent variables. Outdoor exercise was associated with better physical health and stress levels, while healthy eating was associated with better mental and physical health. Artistic expression was associated with better physical health. Connecting with one’s spirituality was associated with better mental health, while learning something new was associated with better mental health and stress levels. Those who reported engaging in meditation were more likely to report

worse mental health (aOR = 1.49; 95% CI: 1.34–1.65) and stress levels (1.42; 1.28–1.57) since the start of the pandemic. Similarly, those who reported connecting with loved ones reported worse health outcomes across all three variables, with adjusted odds of 1.28 (1.15–1.42), 1.16 (1.05–1.28) and 1.15 (1.03–1.27) for worse mental health, physical health and stress levels, respectively.

Discussion

This study examined behaviours in which CAF Regular Force personnel engaged to maintain or improve their health early in the pandemic. Results indicated that the most common behaviours were exercising, healthy eating and getting enough sleep. Not surprisingly, many of these behaviours were associated with more favourable mental and physical health and lower stress levels. Notable exceptions included meditation, which was associated with greater likelihood of depression and anxiety symptoms, as well as a worsening of mental health and stress levels since the pandemic, and connecting with loved ones, which was associated with a worsening of mental health, physical health and stress levels.

In order to sustain operational readiness, military personnel are expected to maintain high levels of physical fitness and health. It is therefore not surprising that a large majority reported exercising (74.3% indoors, 86.8% outdoors) and healthy eating (83.2%) in order to improve their health, and in seemingly greater proportions than members of the Canadian general population. For instance, results of a Canadian survey conducted around the same time indicated that only 40% of Canadians had exercised indoors, 57% had exercised outdoors and 23% had changed their food choices to improve their physical or mental health.³⁰ High levels of engagement in such behaviours may have in part related to operational training or ongoing efforts to maintain operational readiness among CAF members. However, motivations for engaging in such behaviours may also have been based on a variety of other factors. In a US study, the primary factors reported as motivations for increased engagement in positive health behaviours included having more time and the need for stress relief. On the other hand, decreased engagement in positive health behaviours was also

TABLE 3
Associations of health behaviours with depression and anxiety among Regular Force respondents to the COVID-19 Defence Team Survey, April to May 2020

Characteristic	Model 1: Depression	Model 2: Anxiety
	aOR (95% CI)	aOR (95% CI)
Gender		
Men	Ref	Ref
Women	1.14 (0.99–1.32)	1.88 (1.65–2.15)
Age (years)		
≤ 24	Ref	Ref
25–34	0.93 (0.76–1.15)	1.26 (0.99–1.61)
35–44	1.12 (0.89–1.40)	1.43 (1.11–1.85)
45–54	0.87 (0.68–1.12)	1.25 (0.95–1.64)
≥ 55	0.69 (0.47–1.00)	1.13 (0.78–1.65)
Dependent children		
No	Ref	Ref
Yes	0.86 (0.76–0.98)	1.21 (1.07–1.37)
Marital status		
Married/common-law	Ref	Ref
Single/divorced/widowed	1.34 (0.99–1.30)	0.95 (0.83–1.10)
Rank		
Junior NCM	Ref	Ref
Senior NCM	0.66 (0.56–0.78)	0.92 (0.78–1.08)
Junior officer	0.77 (0.66–0.90)	0.91 (0.78–1.06)
Senior officer	0.62 (0.49–0.78)	0.97 (0.79–1.20)
Health behaviours		
Meditation	2.15 (1.88–2.46)	2.19 (1.92–2.50)
Exercising outdoors	0.75 (0.65–0.87)	0.77 (0.67–0.90)
Exercising indoors	0.78 (0.69–0.89)	0.81 (0.72–0.92)
Healthy eating	0.85 (0.74–0.98)	1.04 (0.90–1.21)
Getting sufficient sleep	0.34 (0.30–0.38)	0.35 (0.31–0.40)
Artistic expression	0.97 (0.85–1.11)	1.13 (0.99–1.28)
Connecting with loved ones	0.83 (0.73–0.96)	0.94 (0.82–1.08)
Connecting with my spirituality	0.97 (0.83–1.14)	1.00 (0.85–1.17)
Learning something new	0.75 (0.66–0.85)	0.72 (0.64–0.81)

Abbreviations: aOR, adjusted odds ratio; CI, confidence interval; NCM, non-commissioned member; Ref, reference category.

Note: Bolded results are statistically significant.

commonly attributed to increased worry or stress.²¹

The associations of many of the behaviours with more favourable health and well-being are in line with results of multiple studies. Regarding exercise, an Australian study found that negative changes in physical activity and sleep were associated with a higher likelihood of reporting symptoms of depression, anxiety and stress.²² Similarly, the association of change in physical activity with well-being among Canadians has been examined,²⁷ although

the researchers explored such associations among participants identified as either active or inactive based on reported levels of physical activity and found that changes in physical activity were only associated with well-being outcomes among Canadians who were not generally physically active. Specifically, physically inactive Canadians who became more active reported higher levels of social, emotional and psychological well-being.

Getting enough sleep yielded the strongest associations with health and well-being

indicators. Sleep is now recognized as a fundamental component of optimal health. Inadequate sleep has been found to be involved in the onset or exacerbation of several chronic illnesses.³³ Accordingly, ensuring sleep health has been identified as a critical measure for preserving overall health during the pandemic.⁸

Despite many studies pointing to the beneficial effects of meditation on well-being,¹³ use of meditation was found to be associated with poorer, rather than better, mental health. One possible interpretation for this is that Regular Force personnel who were experiencing worse mental health were engaging in meditation to manage their symptoms. A US population study indeed found that use of mindfulness or spiritual meditation was more likely among individuals with depression.³⁴ This same study also found that close to one-third of those who practised mindfulness meditation did so to treat a specific condition, and the vast majority (i.e. just over 90%) did so for stress management or emotional well-being. Meditation is also increasingly being integrated into clinical practice to treat mental health conditions.³⁵ Thus, its observed link with poorer mental health in our study may reflect a greater adoption of meditation among personnel who were more prone to experiencing, or were experiencing, poorer mental health more so than reflecting a negative impact of meditating on health and well-being.

Like meditation, social connectedness has been linked with better well-being, including lower levels of psychological stress during the COVID-19 lockdown.³⁶ Yet, connecting with loved ones was found to be associated with higher odds of reporting worse health and stress. While we initially assumed that connecting with loved ones could serve as a proxy for social connectedness, it is possible that this indicator fell short in this regard. Research on social support has emphasized the importance of considering not only the quantity, but also the quality of social support that individuals receive, with evidence suggesting that quality of support is more important as a protective factor against depression.^{9,37} Thus, CAF members may have spent a considerable amount of time connecting with loved ones, but it is not clear whether the quality of these connections met their needs, particularly early in the pandemic when many connections

TABLE 4
Associations of health behaviours with self-reported changes in health and stress levels since before the pandemic among Regular Force respondents to the COVID-19 Defence Team Survey, April to May 2020

Characteristics	Model 3: Worse mental health	Model 4: Worse physical health	Model 5: Worse stress levels
	aOR (95% CI)	aOR (95% CI)	aOR (95% CI)
Gender			
Men	Ref	Ref	Ref
Women	1.24 (1.12–1.39)	1.10 (0.99–1.22)	1.36 (1.23–1.52)
Age (years)			
≤ 24	Ref	Ref	Ref
25–34	1.17 (0.99–1.37)	0.95 (0.82–1.11)	1.30 (1.11–1.53)
35–44	1.21 (1.01–1.44)	0.86 (0.73–1.01)	1.51 (1.27–1.79)
45–54	1.07 (0.89–1.30)	0.75 (0.63–0.90)	1.41 (1.17–1.71)
≥ 55	0.94 (0.73–1.22)	0.76 (0.60–0.97)	1.42 (1.11–1.83)
Dependent children			
No	Ref	Ref	Ref
Yes	1.02 (.93–1.12)	0.85 (0.78–0.93)	1.34 (1.23–1.47)
Marital status			
Married/common-law	Ref	Ref	Ref
Single/divorced/widowed	0.98 (0.89–1.09)	0.92 (0.84–1.01)	0.79 (0.71–0.87)
Rank			
Junior NCM	Ref	Ref	Ref
Senior NCM	1.00 (0.89–1.13)	0.92 (0.82–1.03)	1.12 (1.00–1.26)
Junior officer	1.34 (1.20–1.50)	1.14 (1.02–1.27)	1.30 (1.16–1.45)
Senior officer	1.41 (1.21–1.64)	1.28 (1.10–1.48)	1.67 (1.43–1.94)
Health behaviours			
Meditation	1.49 (1.34–1.65)	1.10 (0.99–1.22)	1.42 (1.28–1.57)
Exercising outdoors	0.92 (0.82–1.04)	0.73 (0.65–0.82)	0.84 (0.74–0.94)
Exercising indoors	0.84 (0.77–0.92)	0.64 (0.58–0.70)	0.79 (0.72–0.86)
Healthy eating	0.83 (0.74–0.93)	0.47 (0.42–0.53)	1.03 (0.92–1.15)
Getting sufficient sleep	0.39 (0.35–0.42)	0.60 (0.55–0.66)	0.39 (0.36–0.43)
Artistic expression	1.01 (0.92–1.11)	0.90 (0.82–0.99)	1.06 (0.96–1.16)
Connecting with loved ones	1.28 (1.15–1.42)	1.16 (1.05–1.28)	1.15 (1.03–1.27)
Connecting with my spirituality	0.87 (0.77–0.98)	1.00 (0.89–1.12)	0.97 (0.86–1.09)
Learning something new	0.75 (0.68–0.82)	1.01 (0.93–1.10)	0.73 (0.67–0.79)

Abbreviations: aOR, adjusted odds ratio; CI, confidence interval; NCM, non-commissioned member; Ref, reference category.

Notes: Worse mental health, physical health and stress levels includes response options “Slightly worse than before” and “Significantly worse than before.”

Bolded results are statistically significant.

were likely virtual due to physical distancing requirements.

Further, researchers have noted the importance of social relationships for mood, describing it as a “two-way street” between the person and his or her social network.^{38,p.300} To the extent that CAF members’ discussions with loved ones centred on stressors associated with the pandemic and the influx of information from media, these interactions may have exacerbated negative emotions. This may

especially have been the case among CAF members who used social media to connect with loved ones, as frequent interactions with social media during the pandemic have been associated with depression and anxiety.³⁹

Strengths and limitations

Beyond its large sample size, the strengths of this study include its focus on a large range of health-promoting behaviours and health indicators, including validated

measures for depression and anxiety symptoms.^{31,32} This was also the first study to examine health behaviours and indicators among Canadian military personnel early in the pandemic and capture the impacts when public health measures to restrict the spread of COVID-19 were newly in place. Nevertheless, a few limitations must be noted.

As the survey was intended to be broad in scope and focussed on a range of topics in addition to mental health, in order to keep

it at a reasonable length and reduce the burden to participants, only abbreviated measures and select questions were included. As a result, health behaviours were assessed using single items that did not reflect frequency or duration of engagement. No additional information was collected on pre-existing behaviours or conditions, making it impossible to assess change in health-promoting behaviours. In terms of the health indicators used as outcomes in this study, a positive screen on the PHQ-2 or GAD-2 does not necessarily indicate a diagnosis of depression or anxiety, as these are intended to be brief screening tools,^{31,32} while self-reported changes in mental health, physical health and stress levels were based on retrospective recall. Future research using more detailed measures of health behaviours, including variables to assess the extent and frequency of such behaviours, is needed.

As illustrated in the preceding discussion on the unexpected associations of meditation and connecting with loved ones with poorer health and well-being, the cross-sectional nature of the survey poses a considerable challenge for the interpretation of findings. Without a clear sense of the direction of associations, including the direction of the relationship between positive behaviours and mental health, the specific mechanisms and pathways linking health behaviours and indicators remain unclear. Longitudinal research is needed in order to determine the causality of relationships between the variables, as well as the impact of the pandemic itself on health behaviours and mental health.

Due to time constraints, we did not use probabilistic sampling, limiting our ability to make inferences about the CAF population. However, the demographic composition of the sample reflected the population well, and statistical weights were applied to account for differences. In addition, the study focussed only on Regular Force members and is therefore not generalizable to all military personnel within the CAF. Further research will focus on members of the Reserve Force as well as civilian Defence Team employees. Finally, the survey was administered early in the pandemic when physical distancing and other public health measures were only recently in place. Findings may therefore only reflect the context at that specific point in time.

Conclusion

This was the first study to examine health behaviours and indicators among Canadian military personnel in a pandemic context. Results provide valuable information on the prevalence of health-promoting behaviours and their associations with indicators of well-being, thereby shedding light on key areas that could be targeted in future health promotion programs and interventions. Behaviours found to have the strongest associations with well-being hold promise as modifiable factors that could be leveraged to preserve or improve health and maintain operational readiness among military personnel in a pandemic context.

Conflicts of interest

The authors have no conflicts of interest to declare.

Authors' contributions and statement

KS and JL were involved in conceptualizing the study design. KS conducted the analysis of the data, and both authors were involved in interpretation of the results. Both authors contributed to drafting and revising the paper and approval of the final manuscript for submission.

The content and views expressed in this article are those of the authors and do not necessarily reflect those of the Government of Canada.

References

1. Dozois DJ. Anxiety and depression in Canada during the COVID-19 pandemic: a national survey. *Can Psychol.* 2020;62(1):136-42. <https://doi.org/10.1037/cap0000251>
2. Findlay L, Arim R. Statistics Canada. Canadians report lower self-perceived mental health during the COVID-19 pandemic. Ottawa (ON): Statistics Canada; 2020. 6 p. [Statistics Canada Catalogue No.: 45280001]. Available from: https://www150.statcan.gc.ca/n1/en/pub/45-28-0001/2020001/article/00003-eng.pdf?st=3GIUQH_D
3. Hill ML, Nichter B, Na PJ, et al. Mental health impact of the COVID-19 pandemic in U.S. military veterans: a population-based, prospective cohort study.

Psychol Med. 2021:1-12. [Epub ahead of print.] <https://doi.org/10.1017/S0033291721002361>.

4. Chekroud SR, Gueorguieva R, Zheutlin AB, et al. Association between physical exercise and mental health in 1.2 million individuals in the USA between 2011 and 2015: a cross-sectional study. *Lancet Psychiatry.* 2018; 5(9):739-46. [https://doi.org/10.1016/S2215-0366\(18\)30227-X](https://doi.org/10.1016/S2215-0366(18)30227-X)
5. Carek PJ, Laibstain SE, Carek SM. Exercise for the treatment of depression and anxiety. *Int J Psychiatry Med.* 2011;41(1):15-28. <https://doi.org/10.2190/PM.41.1.c>
6. Conn VS. Anxiety outcomes after physical activity interventions: meta-analysis findings. *Nurs Res.* 2010; 59(3):224-31. <https://doi.org/10.1097/NNR.0b013e3181dbb2f8>
7. Blanchflower DG, Oswald AJ, Stewart-Brown S. Is psychological well-being linked to the consumption of fruit and vegetables? *Soc Indic Res.* 2013; 114(3):785-801. <https://doi.org/10.1007/s11205-012-0173-y>
8. Yuksel D, McKee GB, Perrin PB, et al. Sleeping when the world locks down: correlates of sleep health during the COVID-19 pandemic across 59 countries. *Sleep Health.* 2021;7(2):134-42. <https://doi.org/10.1016/j.sleh.2020.12.008>
9. Santini ZI, Koyanagi A, Tyrovolas S, Mason C, Haro JM. The association between social relationships and depression: a systematic review. *J Affect Disord.* 2015;175:53-65. <https://doi.org/10.1016/j.jad.2014.12.049>
10. Thoits PA. Mechanisms linking social ties and support to physical and mental health. *J Health Soc Behav.* 2011; 52(2):145-61. <https://doi.org/10.1177/0022146510395592>
11. Murphy D, Williamson C, Baumann J, Busuttill W, Fear NT. Exploring the impact of COVID-19 and restrictions to daily living as a result of social distancing within veterans with pre-existing mental health difficulties. *BMJ Mil Health.* 2020 Nov 26. [Epub ahead of print.] <https://doi.org/10.1136/bmjmilitary-2020-001622>.

12. Fischer R, Bortolini T, Karl JA, et al. Rapid review and meta-meta-analysis of self-guided interventions to address anxiety, depression, and stress during COVID-19 social distancing. *Front Psychol.* 2020;11:563876. <https://doi.org/10.3389/fpsyg.2020.563876>
13. Matiz A, Fabbro F, Paschetto A, et al. Positive impact of mindfulness meditation on mental health of female teachers during the COVID-19 outbreak in Italy. *Int J Environ Res Public Health.* 2020;17(18):6450. <https://doi.org/10.3390/ijerph17186450>
14. Roman NV, Mthembu TG, Hoosen M. Spiritual care – ‘a deeper immunity’ – a response to Covid-19 pandemic. *Afr J Prm Health Care Fam Med.* 2020;12(1):a2456. <https://doi.org/10.4102/phcfm.v12i1.2456>
15. Hu Z, Lin X, Chiwanda Kaminga A, Xu H. Impact of the COVID-19 epidemic on lifestyle behaviors and their association with subjective well-being among the general population in mainland China: cross-sectional study. *J Med Internet Res.* 2020;22(8):e21176. <https://doi.org/10.2196/21176>
16. Flanagan EW, Beyl RA, Fearnbach SN, Altazan AD, Martin CK, Redman LM. The impact of COVID-19 stay-at-home orders on health behaviors in adults. *Obesity (Silver Spring).* 2021; 29(2):438-45. <https://doi.org/10.1002/oby.23066>
17. Wang X, Lei SM, Le S, et al. Bidirectional influence of the COVID-19 pandemic lockdowns on health behaviors and quality of life among Chinese adults. *Int J Environ Res Public Health.* 2020;17(15):5575. <https://doi.org/10.3390/ijerph17155575>
18. Carroll N, Sadowski A, Laila A, et al. The impact of COVID-19 on health behavior, stress, financial and food security among middle to high income Canadian families with young children. *Nutrients.* 2020;12(8):2352. <https://doi.org/10.3390/nu12082352>
19. Weaver RH, Jackson A, Lanigan J, et al. Health behaviors at the onset of the COVID-19 pandemic. *Am J Health Behav.* 2021;45(1):44-61. <https://doi.org/10.5993/AJHB.45.1.4>
20. Maugeri G, Castrogiovanni P, Battaglia G, et al. The impact of physical activity on psychological health during Covid-19 pandemic in Italy. *Heliyon.* 2020;6(6):e04315. <https://doi.org/10.1016/j.heliyon.2020.e04315>
21. Knell G, Robertson MC, Dooley EE, Burford K, Mendez KS. Health behavior changes during COVID-19 pandemic and subsequent “stay-at-home” orders. *Int J Environ Res Public Health.* 2020;17(17):6268. <https://doi.org/10.3390/ijerph17176268>
22. Stanton R, To QG, Khalesi S, et al. Depression, anxiety and stress during COVID-19: associations with changes in physical activity, sleep, tobacco and alcohol use in Australian adults. *Int J Environ Res Public Health.* 2020; 17(11):4065. <https://doi.org/10.3390/ijerph17114065>
23. Jahrami H, BaHammam AS, Bragazzi NL, Saif Z, Faris M, Vitiello VM. Sleep problems during the COVID-19 pandemic by population: a systematic review and meta-analysis. *J Clin Sleep Med.* 2021;17(2):299-313. <https://doi.org/10.5664/jcsm.8930>
24. Meyer J, McDowell C, Lansing J, et al. Changes in physical activity and sedentary behavior in response to COVID-19 and their associations with mental health in 3052 US adults. *Int J Environ Res Public Health.* 2020; 17(18):6469. <https://doi.org/10.3390/ijerph17186469>
25. Cheval B, Sivaramakrishnan H, Maltagliati S, et al. Relationships between changes in self-reported physical activity, sedentary behaviour and health during the coronavirus (COVID-19) pandemic in France and Switzerland. *J Sports Sci.* 2021;39(6): 699-704. <https://doi.org/10.1080/02640414.2020.1841396>
26. Pan X, Xiao Y, Ren D, et al. Prevalence of mental health problems and associated risk factors among military healthcare workers in specialized COVID-19 hospitals in Wuhan, China: a cross-sectional survey. *Asia Pac Psychiatry.* 2020:e12427. <https://doi.org/10.1111/appy.12427>
27. Lesser IA, Nienhuis CP. The impact of COVID-19 on physical activity behavior and well-being of Canadians. *Int J Environ Res Public Health.* 2020;17(11):3899. <https://doi.org/10.3390/ijerph17113899>
28. Tran TV, Nguyen HC, Pham LV, et al. Impacts and interactions of COVID-19 response involvement, health-related behaviours, health literacy on anxiety, depression and health-related quality of life among healthcare workers: a cross-sectional study. *BMJ Open.* 2020;10(12):e041394. <https://doi.org/10.1136/bmjopen-2020-041394>
29. Kilani HA, Bataineh MF, Al-Nawayseh A, et al. Healthy lifestyle behaviors are major predictors of mental well-being during COVID-19 pandemic confinement: a study on adult Arabs in higher educational institutions. *PLoS ONE.* 2020;15(12):e0243524. <https://doi.org/10.1371/journal.pone.0243524>
30. Statistics Canada. Impacts of COVID-19 on Canadians: data collection series [Internet]. Ottawa (ON): Statistics Canada; 2020 [cited 2021 Jun 1]. Available from: <https://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&Id=1280907>
31. Kroenke K, Spitzer RL, Williams JB, Monahan PO, Löwe B. Anxiety disorders in primary care: prevalence, impairment, comorbidity, and detection. *Ann Intern Med.* 2007;146(5): 317-25. <https://doi.org/10.7326/0003-4819-146-5-200703060-00004>
32. Kroenke K, Spitzer RL, Williams JB. The Patient Health Questionnaire-2: validity of a two-item depression screener. *Med Care.* 2003;41(11):1284-92. <https://doi.org/10.1097/01.MLR.0000093487.78664.3C>
33. von Ruesten A, Weikert C, Fietze I, Boeing H. Association of sleep duration with chronic diseases in the European Prospective Investigation into Cancer and Nutrition (EPIC)-Potsdam study. *PLoS ONE.* 2012;7(1): e30972. <https://doi.org/10.1371/journal.pone.0030972>

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34. Burke A, Lam CN, Stussman B, Yang H. Prevalence and patterns of use of mantra, mindfulness and spiritual meditation among adults in the United States. *BMC Complement Altern Med.* 2017;17:316. <https://doi.org/10.1186/s12906-017-1827-8>
 35. Soares EE, Thrall JN, Stephens TN, Biglieri RR, Consoli AJ, Bunge EL. Publication trends in psychotherapy: bibliometric analysis of the past 5 decades. *Am J Psychother.* 2020; 73(3):85-94. <https://doi.org/10.1176/appi.psychotherapy.20190045>
 36. Nitschke JP, Forbes PA, Ali N, et al. Resilience during uncertainty? Greater social connectedness during COVID-19 lockdown is associated with reduced distress and fatigue. *Br J Health Psychol.* 2021;26(2):553-69. <https://doi.org/10.1111/bjhp.12485>
 37. Vandervoort D. Quality of social support in mental and physical health. *Current Psychol.* 1999;18:205-21. <https://doi.org/10.1007/s12144-999-1029-8>
 38. Bastiampillai T, Allison S, Chan S. Is depression contagious? The importance of social networks and the implications of contagion theory. *Aust N Z J Psychiatry.* 2013;47(4):299-303. <https://doi.org/10.1177/0004867412471437>
 39. Okabe-Miyamoto K, Lyubomirsky S. Social connection and well-being during COVID-19. In: Helliwell J, Layard R, Sachs JD, De Neve J-E, Akinin L, Wang S, editors. *World Happiness Report 2021*. New York (NY): Sustainable Development Solutions Network, 2021:131-152. Available from: <https://worldhappiness.report/ed/2021/social-connection-and-well-being-during-covid-19/>

Release notice

Autism Spectrum Disorder: Highlights from the 2019 Canadian Health Survey on Children and Youth

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The Public Health Agency of Canada is pleased to announce the release of the report [Autism Spectrum Disorder: Highlights from the 2019 Canadian Health Survey on Children and Youth](#).

The report uses data from the 2019 Canadian Health Survey on Children and Youth (CHSCY), a national survey that collected health-related information on children and youth aged 1 to 17 years who were living in private dwellings in Canada's ten provinces and three territories.

The findings presented in the report provide new evidence on prevalence, health status and daily life experiences in Canadian children and youth with diagnosed autism spectrum disorder (ASD) prior to the COVID-19 pandemic.

Key highlights

According to the 2019 CHSCY, 1 in 50 (or 2.0%) Canadian children and youth aged 1 to 17 years were diagnosed with ASD. Of these individuals:

- males were diagnosed approximately four times more frequently than females;
- just over half (53.7%) were diagnosed before the age of five;
- fewer, compared to those without ASD, reported having optimal general health (59.3% vs. 89.5%) and optimal mental health (39.0% vs. 84.1%);
- over two-thirds (68.7%) had another long-term health condition, with attention deficit disorder/attention deficit hyperactivity disorder, learning disability/disorder and anxiety disorder being the most common;
- close to three-quarters (73.3%) of those aged 2 to 17 years had difficulty in at least one functional domain, with communication, accepting change and making friends being among the most common;
- more than three-quarters (78.1%) of those attending school had special education needs.

Additional statistics on Canadian children and youth with ASD can be found in the [report](#).



With thanks to our 2021 peer reviewers

We are grateful to the following individuals for their significant contribution to *Health Promotion and Chronic Disease Prevention in Canada* as peer reviewers in 2021. Their expertise ensures the quality of our journal and promotes the sharing of new knowledge among peers in Canada and internationally.

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Gisèle Contreras	Katerina Maximova	Laura Struik
Angela M. Coppola	Osnat Melamed	Molly Sweeney-Magee
Añiela dela Cruz	Éric Mercier	François Thériault
Colleen Dell	Leia Minaker	Hannah Thompson
Jean Deschamps	Annie Montreuil	Karlijn Thoonen
Carolyn S. Dewa	Meghan Bridgit Moran	Joslyn Trowbridge
Jennifer Donnan	Howard Morrison	Karen Urbanoski
Olivier Drouin	Elena Neiterman	Sol Vidal Almela
David Dunstan	Chantal Nelson	Elaine Waddell
Robert Gabrys	Bruce Newbold	Lan Wei
Ryan Gage	Stephanie Nishi	Robert J. Wellman
Amélie Gauthier-Beaupré	Behdin Nowrouzi-Kia	Jennifer Wild
Klaus Gebel	Joyce Obeid	Kevin D. Willison
Winta Ghidei	Timothy Olds	Jennifer Yessis

Other PHAC publications

Researchers from the Public Health Agency of Canada also contribute to work published in other journals. Look for the following articles published in 2021:

Barnett TA, Ghenadenik AE, Van Hulst A, **Contreras G**, et al. Neighborhood built environment typologies and adiposity in children and adolescents. *Int J Obes*. 2021. <https://doi.org/10.1038/s41366-021-01010-1>

Clarke AE, Carson V, Chaput JP, [...] **Roberts KC**, et al. Meeting Canadian 24-Hour Movement Guideline recommendations and risk of all-cause mortality. *Appl Physiol Nutr Metab*. 2021;46(12):1487-94. <https://doi.org/10.1139/apnm-2021-0010>

Mathews B, MacMillan HL, Meinck F, [...] **Tonmyr L**, et al. The ethics of child maltreatment surveys in relation to participant distress: implications of social science evidence, ethical guidelines, and law. *Child Abuse Negl*. 2022;123:105424. <https://doi.org/10.1016/j.chiabu.2021.105424>

Mitchell RHB, Ani C, Cyr C, [...] **Skinner R**, et al. Near-fatal self-harm among Canadian adolescents. *Can J Psychiatry*. 2021. <https://doi.org/10.1177/070674372111058602>

O'Neill CD, Vidal Almela S, Terada T, [...] **Prince SA**, et al. Moving together while staying apart: practical recommendations for 24-hour home-based movement behaviours for those with cardiovascular disease. *CJC Open*. 2021. <https://doi.org/10.1016/j.cjco.2021.08.010>

Pratt M, Forbes JD, **Knox NC**, Bernstein CN, **Van Domselaar G**. Microbiome-mediated immune signaling in inflammatory bowel disease and colorectal cancer: support from meta-omics data. *Front Cell Dev Biol*. 2021;9:716604. <https://doi.org/10.3389/fcell.2021.716604>

Prince SA, Lancione S, Lang JJ, Amankwah N, de Groh M, Garcia AJ, [...] **Geneau R**. Are people who use active modes of transportation more physically active? An overview of reviews across the life course. *Transp Rev*. 2021. <https://doi.org/10.1080/01441647.2021.2004262>

Tremlett H, Zhu F, Arnold D, [...] **Bonner C**, [...] **Graham M**, [...] **Knox NC**, [...] **Van Domselaar G**, et al. The gut microbiota in pediatric multiple sclerosis and demyelinating syndromes. *Ann Clin Transl Neurol*. 2021. <https://doi.org/10.1002/acn3.51476>

Wasfi R, Stephens ZP, Sones M, et al. Recruiting participants for population health intervention research: effectiveness and costs of recruitment methods for a cohort study. *J Med Internet Res*. 2021;23(11):e21142. <https://doi.org/10.2196/21142>

Yong SJ, **Liu S**. Proposed subtypes of post-COVID-19 syndrome (or long-COVID) and their respective potential therapies. *Rev Med Virol*. 2021. <https://doi.org/10.1002/rmv.2315>

