

Associations between Longer-term Symptoms after COVID-19 and Sociodemographics, Health Characteristics, Period of Infection, and Vaccination Status in Canadian Adults, January 2020 to August 2022

Context

Coronavirus Disease 2019 (COVID-19), caused by an infection with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has had a substantial impact in Canada. [COVID-19 was the third leading cause of death in Canada](#) in 2020 after cancer and heart disease, and significantly increased the demand for intensive care unit resources: from March 2020 to June 2021, there were almost [14,000 additional respiratory admissions in intensive care units](#) compared with the pre-pandemic period (excluding Quebec). The indirect effects of the COVID-19 pandemic on other health conditions were also considerable with almost 560,000 fewer surgeries from March 2020 to June 2021 compared with the pre-pandemic period (excluding Quebec).

As of December 23, 2022, about 4.5 million infections, confirmed by polymerase chain reaction (PCR), had been officially reported to the Public Health Agency of Canada by the provinces and territories. This number, however, understates the true number of infected Canadians as it excludes those who test positive using rapid antigen tests (RAT) only, and those who did not get tested or may not have been aware of their infection, particularly if they were asymptomatic. Recent Canadian data indicates that the [use of RATs rose during the Omicron wave](#) and that about 35% of adults with a current or recent SARS-CoV-2 infection were [unaware they had the virus](#).

In addition to any symptoms experienced during the acute phase of infection, some people may experience persistent, recurring, or new symptoms beyond the acute stage. These longer-term, wide ranging symptoms, which can [negatively impact daily activities, work and school](#), are commonly known as “post COVID-19 condition” or

“long COVID” when not resolved within three months of infection. Some of the more commonly reported symptoms include fatigue, coughing, shortness of breath, brain fog, and general weakness. With such a large number of infected Canadians, the potential burden of longer-term symptoms on individuals and their families, the healthcare system, and the economy through lost productivity, could be substantial.

Research published to date indicates that females and people who experience a more severe initial SARS-CoV-2 infection are at higher risk of developing longer-term symptoms. The virulence of the SARS-CoV-2 variant may also affect the risk of developing longer-term symptoms with [Omicron variant infections being associated with a lower risk](#) than earlier variants. With respect to protective factors, emerging evidence suggests that vaccination with two or more doses of COVID-19 vaccine prior to infection may reduce the risk of developing longer-term symptoms. Much, however, remains unknown regarding vulnerable populations, and risk and protective factors.

To address these and other information gaps, the Public Health Agency of Canada partnered with Statistics Canada to conduct the 2nd cycle of the [Canadian COVID-19 Antibody and Health Survey \(CCAHS-2\)](#). The CCAHS-2 is a cross-sectional multi-stage sample of the Canadian adult population, aged 18+ years, living in private dwellings in the 10 provinces. As part of the survey, respondents completed an electronic questionnaire that captured information about SARS-CoV-2 infections and COVID-19 vaccinations since the start of the pandemic, as well as other health-related and sociodemographic characteristics. The questionnaires were completed between April 1, 2022 and August 31, 2022.



This publication focusses on identifying population subgroups disproportionately affected by longer-term symptoms, as well as the risk and protective factors associated with experiencing longer-term symptoms (e.g., sociodemographic determinants of health, chronic conditions, health behaviours, time period of infection, and vaccination status). Longer-term symptoms are defined as self-reported persistent, recurring, or new symptoms 3 or more months after a confirmed (via PCR or RAT) or suspected SARS-CoV-2 infection. This definition aligns with the World Health Organization’s post COVID-19 condition case definition, with the exception that the latter requires a symptom duration of at least 2 months. Accordingly, the majority of results presented below are based on adults reporting an infection 3 or more months prior to completing their questionnaire. Individuals who suspected an infection, without confirmation through testing, were included because of the difficulty in accessing tests at certain time periods during the COVID-19 pandemic.

To allow more informed, timely decision-making during the COVID-19 pandemic, three provisional data releases from CCAHS-2 were disseminated by Statistics Canada

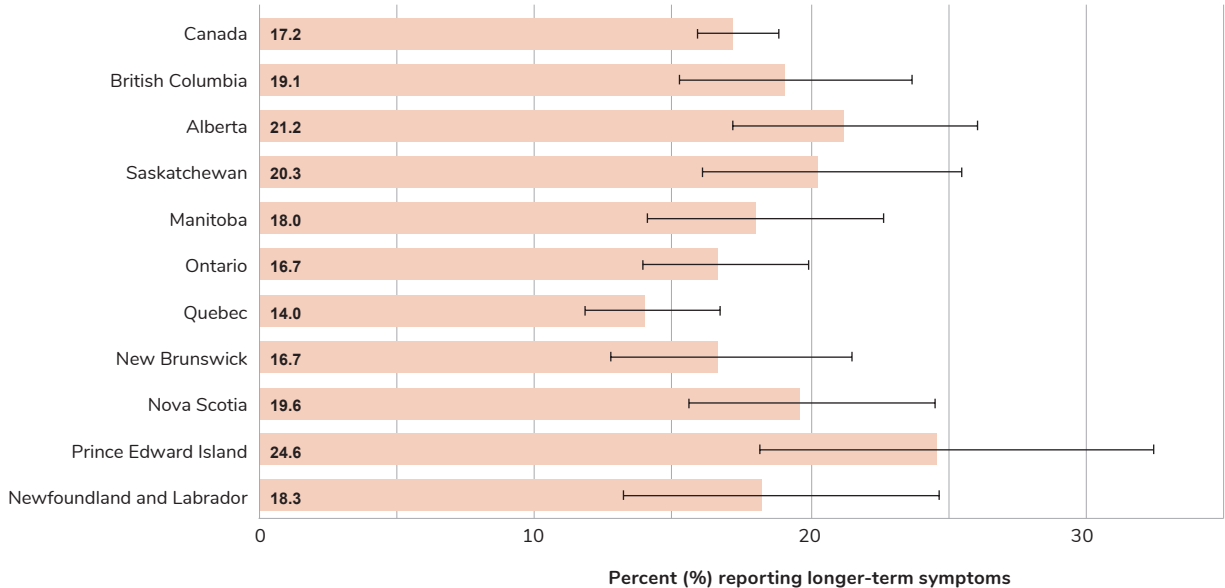
over the course of 2022: September 6, October 17, and December 8. This publication presents a descriptive summary of the self-administered questionnaire data from the 3rd provisional release. As a result, updated estimates provided in this report may differ somewhat from those previously released. Further, it is important to note that the factors examined in this report may be related to each other, and this may obscure or exaggerate the importance attributed to any one factor examined in isolation. Future analyses using CCAHS-2 data will include more complex multivariable analyses to help identify which factors are most strongly associated with the occurrence of longer-term symptoms.

CCAHS-2 is part of the Government of Canada’s comprehensive approach to improving our understanding of and addressing the longer-term health impacts of COVID-19. In addition to the CCAHS-2, other efforts include investments in research through the:

- › [Canadian Institutes of Health Research \(CIHR\)](#)
- › [Task Force on Post COVID-19 condition](#)

For more information, please visit our [post COVID-19 condition](#) page.

Figure 1: Percent of Adults (Aged 18+) Self-reporting Longer-term Symptoms after a Positive COVID-19 Test or Suspected Infection by Province, Canada, January 2020 to August 2022



Source: Canadian COVID-19 Antibody and Health Survey—Cycle 2.
Note: Longer-term symptoms are defined as self-reported persistent, recurring, or new symptoms 3 or more months after a positive COVID-19 test or suspected infection. The estimate for Canada excludes the territories. COVID-19 = Coronavirus Disease 2019.

Prevalence of Longer-term Symptoms after a Positive COVID-19 Test or Suspected Infection

Between April 1, 2022 and August 31, 2022, 29.5% (95% CI: 28.6%, 30.3%) of Canadian adults self-reported ever testing positive for COVID-19 (via PCR or RAT) and an additional 9.2% (95% CI: 8.6%, 9.9%) suspected they had been infected, resulting in an overall self-reported infection rate of 38.7% (95% CI: 37.8%, 39.7%). Among adults who reported being infected 3 or more months prior to completing their questionnaire, about 17.2% (95% CI: 15.8%, 18.7%) experienced longer-term symptoms.

Regional Variation in Longer-term Symptoms

The percent of adults reporting longer-term symptoms after infection varied across the provinces from a low of 14.0% (95% CI: 11.7%, 16.6%) in Quebec to a high of 24.6% in Prince Edward Island (95% CI: 18.0%, 32.2%) (Figure 1). However, provincial rates were not significantly different from the Canada rate.

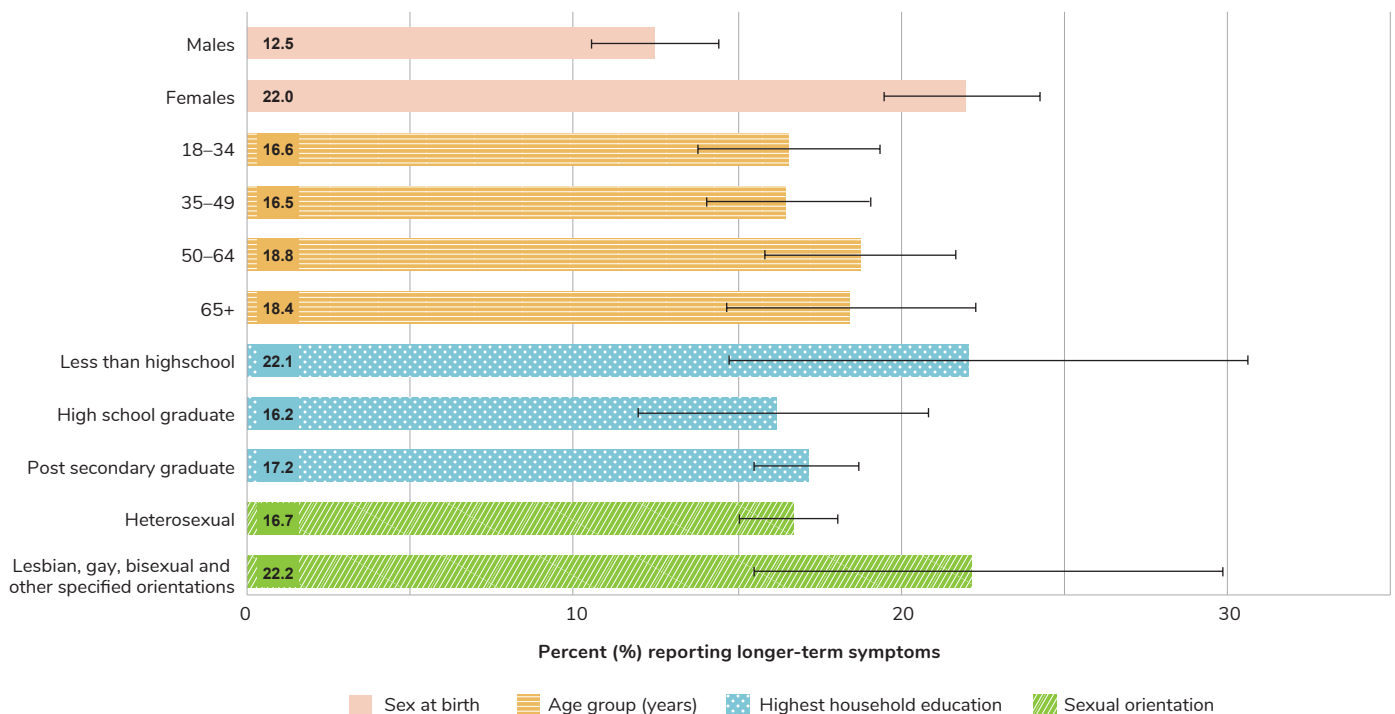
Socio-demographic Factors Associated with Longer-term Symptoms

Sex at birth was significantly associated with reporting longer-term symptoms: 22.0% of females (95% CI: 19.7%, 24.4%) reported longer-term symptoms compared to 12.5% of males (95% CI: 10.6%, 14.5%) (Figure 2). No statistically significant associations were found between longer-term symptoms and age group, highest attained education in the household, and sexual orientation. Ethnicity and socio-economic factors will be examined in greater depth in future publications.

Chronic Conditions Associated with Longer-term Symptoms

Research to date has indicated that people with certain underlying chronic conditions appear to be at increased risk of more severe COVID-19, but the relationship between chronic conditions and longer-term symptoms after a SARS-CoV-2 infection is less clear. CCAHS-2 captured information on 21 self-reported chronic conditions diagnosed by a health professional as well

Figure 2: Percent of Adults (Aged 18+) Self-reporting Longer-term Symptoms after a Positive COVID-19 Test or Suspected Infection by Sociodemographics, Canada, January 2020 to August 2022

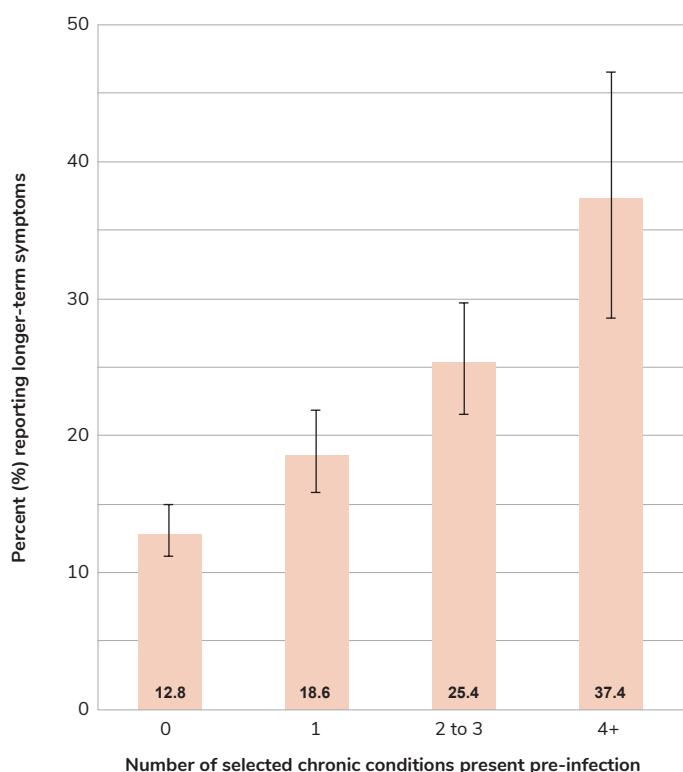


Source: Canadian COVID-19 Antibody and Health Survey—Cycle 2.

Note: Longer-term symptoms are defined as self-reported persistent, recurring, or new symptoms 3 or more months after a positive COVID-19 test or suspected infection. Education refers to the highest certificate, diploma, or degree completed by anyone in the household. Estimates exclude the territories. COVID-19 = Coronavirus Disease 2019.

as the date of diagnosis (see [technical notes](#)). Chronic conditions were defined as health conditions lasting or expected to last at least 6 months. The survey indicated that the percentage of adults reporting longer-term symptoms significantly increased with the number of chronic conditions existing pre-infection: from 12.8% (95% CI: 11.1%, 14.8%) of adults with no chronic conditions to 37.4% (95% CI: 28.6%, 46.7%) of adults with 4 or more chronic conditions (Figure 3). The percentage of adults reporting longer-term symptoms also varied by pre-existing chronic condition: from a low of 15.9% (95% CI: 6.0%, 31.8%) of adults with chronic kidney disease to a high of 39.3% (95% CI: 24.8%, 55.3%) of adults with chronic heart disease (Figure 4).

Figure 3: Percent of Adults (Aged 18+) Self-reporting Longer-term Symptoms after a Positive COVID-19 Test or Suspected Infection by Number of Selected Chronic Conditions Present Pre-infection, Canada, January 2020 to August 2022



Source: Canadian COVID-19 Antibody and Health Survey—Cycle 2.

Note: Longer-term symptoms are defined as self-reported persistent, recurring, or new symptoms 3 or more months after a positive COVID-19 test or suspected infection. Chronic conditions were defined as health conditions expected to last or lasting 6 months or more that were diagnosed by a health professional. See the technical notes for the list of 21 conditions examined. Estimates exclude the territories. COVID-19 = Coronavirus Disease 2019.

The examination of specific chronic conditions in isolation should be interpreted cautiously as comorbidities may also be contributing to the experience of longer-term symptoms. In fact, almost half of adults (47.1%, 95% CI: 44.2%, 50.0%) reporting a chronic condition prior to infection had more than 1 condition.

Cancer was evaluated separately from the other chronic conditions because a date of diagnosis was not available to establish a temporal relationship with the self-reported SARS-CoV-2 infection date. Longer-term symptoms were reported by a greater percentage of adults with a past cancer diagnosis (28.0%, 95% CI: 18.8%, 38.7%) and an uncertain cancer status (24.2%, 95% CI: 16.5%, 33.4%) relative to adults never having cancer (16.4%, 95% CI: 15.0%, 18.0%). Interestingly, those who had cancer at the time of completing their questionnaire were not more likely to report having experienced longer-term symptoms (16.4%, 95% CI: 8.1%, 28.3%) relative to adults who never had cancer (Figure 5).

Selected Risk Factors Associated with Longer-term Symptoms

Severity of initial infection symptoms, body mass index (BMI) category, and disability status were all associated with longer-term symptoms while current smoking status was not (Figure 6).

- › The percentage of adults reporting longer-term symptoms increased with the severity of initial infection symptoms: from 2.3% (95% CI: 1.0%, 4.6%) of asymptomatic adults to 44.7% (95% CI: 27.7%, 62.7%) of adults hospitalized for COVID-19.
- › 27.3% (95% CI: 21.4%, 33.9%) and 30.6% (95% CI: 22.5%, 39.7%) of adults with a BMI classified as obese-class II (35.0 kg/m² to 39.9 kg/m²) and class III (40+ kg/m²), respectively, reported longer-term symptoms compared to 16.2% (95% CI: 13.5%, 19.2%) of adults classified as having normal weight (see technical notes for details regarding BMI).
- › 28.3% (95% CI: 20.2%, 37.5%) of adults identifying as having a disability experienced longer-term symptoms compared to 16.3% (95% CI: 14.8%, 17.8%) of adults not identifying as having a disability.

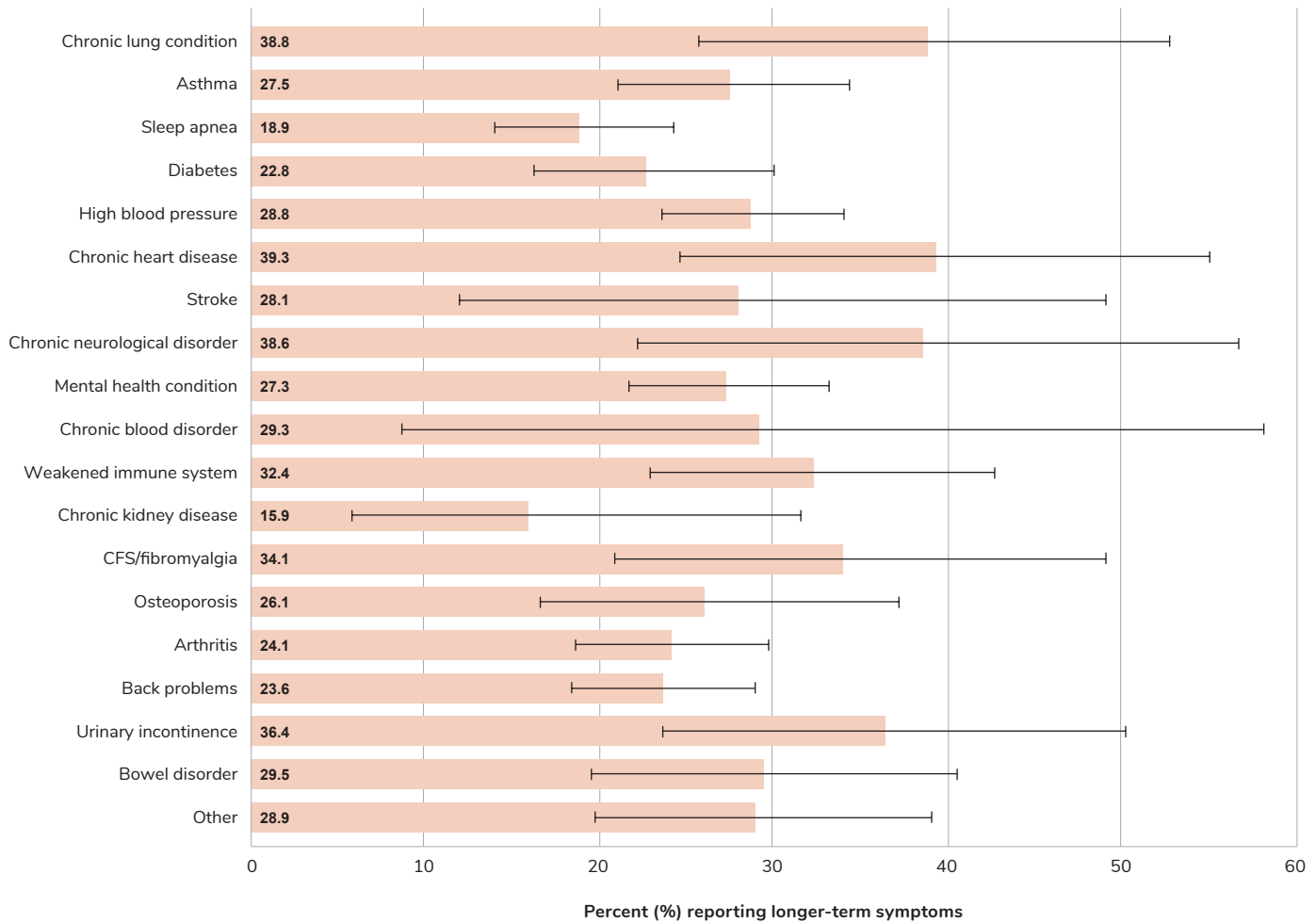
Association between Time Period of Infection and Longer-term Symptoms

CCAHS-2 captured information about the first SARS-CoV-2 infection with a positive test or, in the absence of a positive test, the first suspected infection. These infections occurred between the start of the pandemic and the end of the data collection period on August 31, 2022. Over this time period, several variants of SARS-CoV-2 with varying virulence and contagiousness have emerged and evolved, most notable being the less virulent and highly contagious Omicron variant around December of 2021. In addition, COVID-19 vaccination programs launched in December 2020 and a growing percentage of the Canadian population has

since been vaccinated. To more accurately ascertain the separate impacts of emerging variants and vaccination status on longer-term symptoms, while acknowledging the limitations of sample size, the pandemic period was broken down into four meaningful intervals that captured the growing proportion of vaccinated adults and the emergence of the Omicron variant (Figure 7). The data indicate that adults infected in July 2021 or later were significantly less likely to report longer-term symptoms compared to adults infected earlier in the pandemic.

- › 27.3% (95% CI: 23.5%, 31.3%) of adults infected in 2020 reported longer-term symptoms. During this time period the Canadian population was unvaccinated and exposed to virulent strains.

Figure 4: Percent of Adults (Aged 18+) Self-reporting Longer-term Symptoms after a Positive COVID-19 Test or Suspected Infection by Chronic Conditions Present Pre-infection, Canada, January 2020 to August 2022



Source: Canadian COVID-19 Antibody and Health Survey—Cycle 2.

Note: Longer-term symptoms are defined as self-reported persistent, recurring, or new symptoms 3 or more months after a positive COVID-19 test or suspected infection. Chronic conditions were defined as health conditions expected to last or lasting 6 months or more that were diagnosed by a health professional. Respondents can report more than one chronic condition. A total of 21 chronic conditions were examined. Chronic conditions with too few respondents to report include: Alzheimer's disease or other dementia, and liver disease. Estimates exclude the territories. CFS = chronic fatigue syndrome, COVID-19 = Coronavirus Disease 2019.

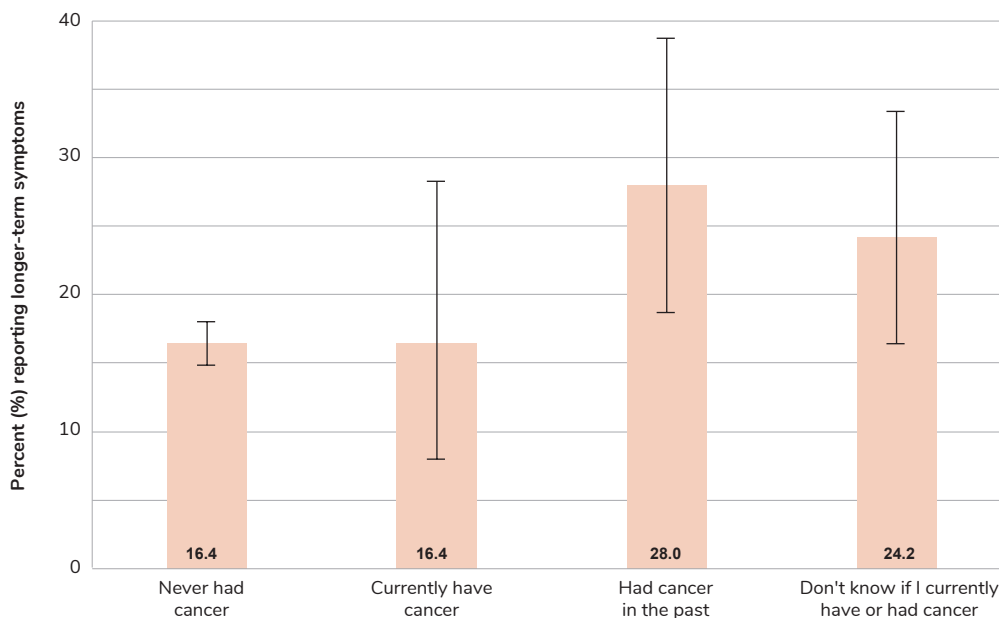
- › 26.7% (95% CI: 20.7%, 33.5%) of adults infected between January 2021 and June 2021 reported longer-term symptoms. Over this time period, virulence remained high with the emergence of the Delta variant, and vaccination programs that initially targeted older and vulnerable populations were launched. As of early June 2021, **72.1% of Canadian adults had received at least 1 COVID-19 vaccine dose and 9.8% had completed their primary series.**
- › 14.5% (95% CI: 9.3%, 21.0%) of adults infected between July 2021 and November 2021 reported longer-term symptoms. Within this time period, the percent of Canadian adults completing their primary vaccination series grew rapidly: **from 43.2% in early July 2021, to 69.2% by the end of July 2021, to 86.7% by the end of Nov 2021.**
- › 12.7% (95% CI: 11.1%, 14.4%) of adults infected between December 2021 and May 2022 reported longer-term symptoms. During this time period, a highly vaccinated adult population was exposed to the less virulent Omicron variant and medications designed to reduce the severity of COVID-19 episodes were being approved and recommended for use with vulnerable populations (e.g., Paxlovid).

The relationship between more recent periods of infection, not covered by CCAHS-2, and longer-term symptoms should not be inferred from these findings due to the potential for waning immunity and emergence of additional variants of concern.

Association between Vaccination Status and Longer-term Symptoms

SARS-CoV-2 vaccination rates were high among Canadian adults who had been infected 3 or more months prior to completing their questionnaire: 93.5% (95% CI: 83.8%, 98.3%) reported receiving at least 1 dose of COVID-19 vaccine at the time of questionnaire completion. Due to the timing of widespread vaccination programs, respondents had received 0-3 vaccine doses prior to being infected. Consistent with other emerging evidence, results indicate that the number of vaccine doses received prior to infection was associated with longer-term symptoms: adults who received 2 or 3 vaccine doses prior to infection were about half as likely to report longer-term symptoms as adults who were unvaccinated prior to infection (Figure 8).

Figure 5: Percent of Adults (Aged 18+) Self-reporting Longer-term Symptoms after a Positive COVID-19 Test or Suspected Infection by Cancer Status, Canada, January 2020 to August 2022



Source: Canadian COVID-19 Antibody and Health Survey—Cycle 2.

Note: Longer-term symptoms are defined as self-reported persistent, recurring, or new symptoms 3 or more months after a positive COVID-19 test or suspected infection. Estimates exclude the territories. COVID-19 = Coronavirus Disease 2019.

- 13.2% (95% CI: 11.3%, 15.3%) of adults receiving 2 vaccine doses and 12.2% (95% CI: 9.2%, 15.7%) of adults receiving 3 vaccine doses prior to infection reported longer-term symptoms compared to 25.0% (95% CI: 21.5%, 28.8%) of adults who were unvaccinated prior to infection.

Although receiving 1 vaccine dose prior to infection was not statistically significantly associated with a lower risk of longer-term symptoms relative to receiving 0 doses prior to infection, the estimate was based on a relatively small number of adults who had received one dose prior to infection, as reflected by the wide confidence interval.

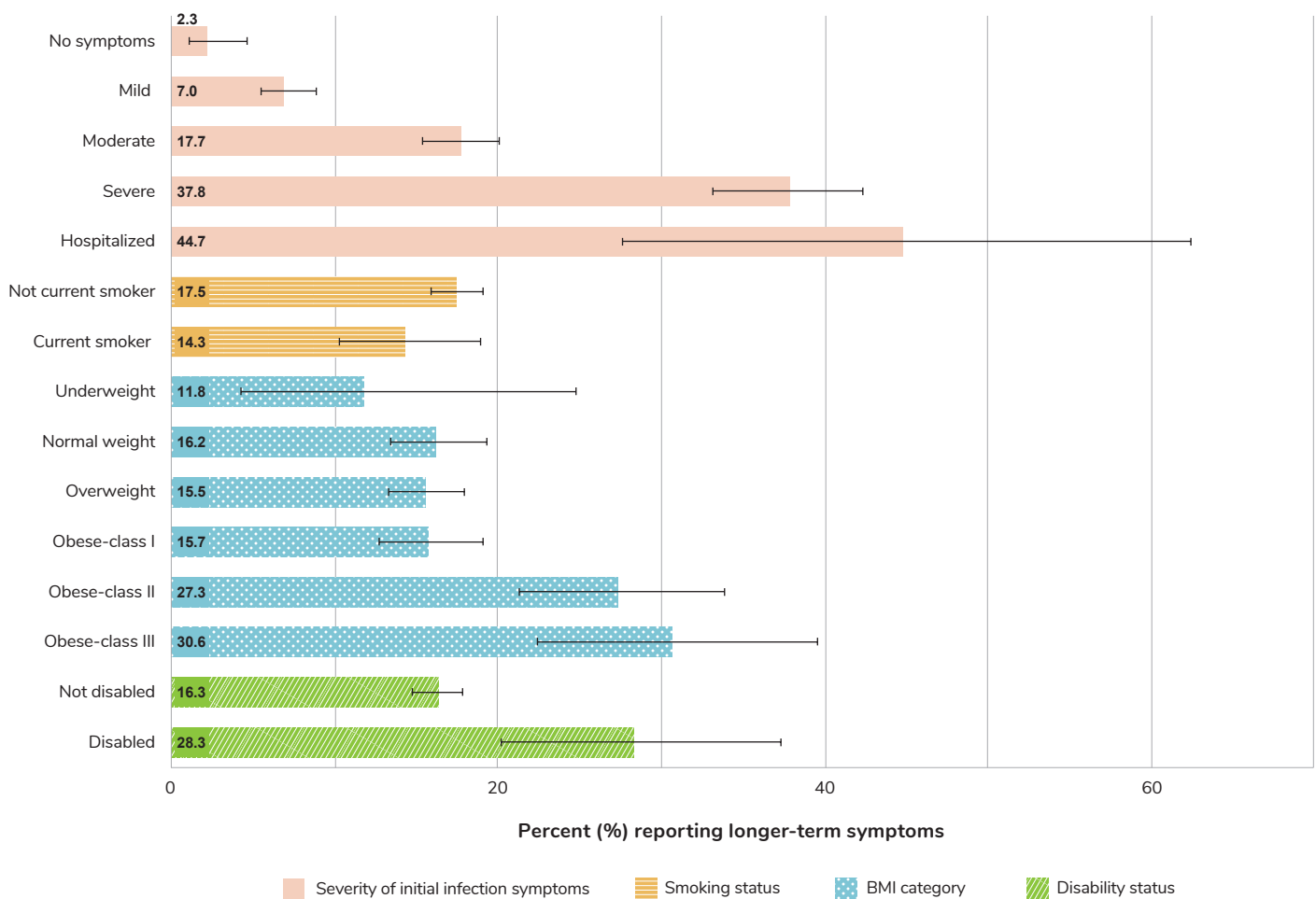
The relationship between vaccine doses received prior to infection and longer-term symptoms should not be assumed to continue into the future because of the

potential for waning immunity and changes in vaccine effectiveness against additional emerging variants of concern.

Associations between Longer-term Symptoms and Self-rated Health

Adults who continued to experience longer-term symptoms at the time of questionnaire completion were 4 times more likely to report fair or poor overall health and almost 3 times more likely to report fair or poor mental health compared to those never experiencing longer-term symptoms (Figure 9). Adults whose longer-term symptoms had resolved at the time of questionnaire completion had health ratings comparable to adults never experiencing longer-term symptoms.

Figure 6: Percent of Adults (Aged 18+) Self-reporting Longer-term Symptoms after a positive COVID-19 Test or Suspected Infection by Selected Risk Factors, Canada, January 2020 to August 2022



Source: Canadian COVID-19 Antibody and Health Survey—Cycle 2.

Note: Longer-term symptoms are defined as self-reported persistent, recurring, or new symptoms 3 or more months after a positive COVID-19 test or suspected infection. Estimates exclude the territories. BMI = body mass index, COVID-19 = Coronavirus Disease 2019.

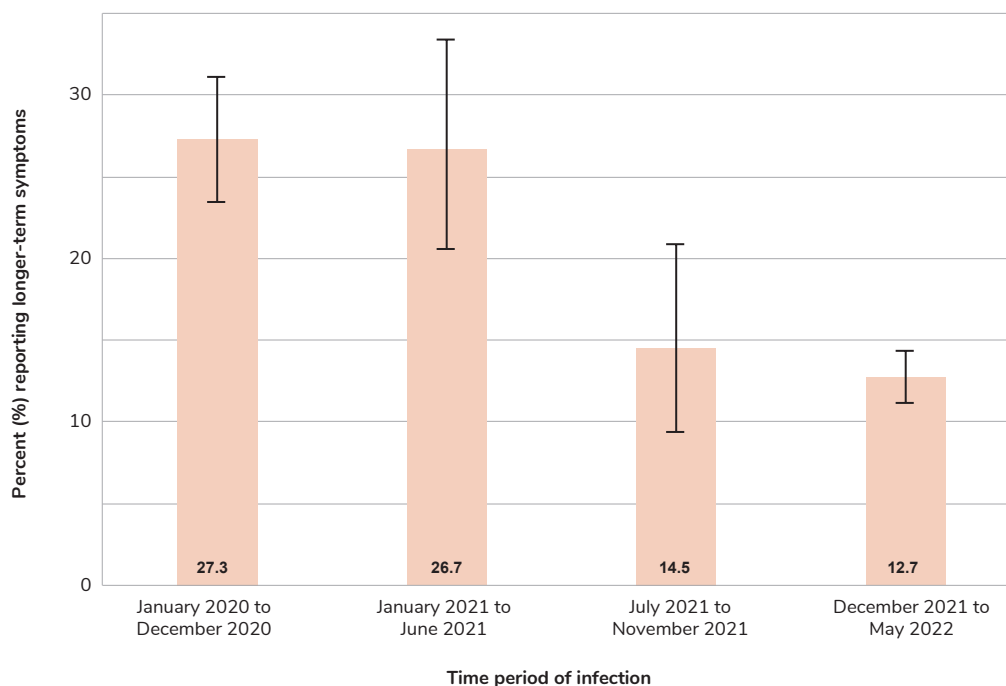
- › 20.8% (95% CI: 16.5%, 25.6%) of adults who continued to experience longer-term symptoms rated their overall health as fair or poor relative to 5.2% (95% CI: 4.3%, 6.1%) of adults never reporting longer-term symptoms.
- › 26.0% (95% CI: 20.6%, 32.1%) of adults who continued to experience longer-term symptoms rated their mental health as fair or poor relative to 9.6% (95% CI: 8.3%, 11.0%) of adults never reporting longer-term symptoms.

Measures of overall health and mental health prior to infection were not captured in the questionnaire. Thus, caution is warranted when interpreting these results as health status prior to infection may influence the risk of longer-term symptoms.

Summary and Future Work

Provisional results showed that female sex, pre-existing comorbidities, more severe initial SARS-CoV-2 infection symptoms, obesity, identifying as a person with a disability, and being infected earlier in the COVID-19 pandemic were all associated with an increased risk of reporting longer-term symptoms, while having received more vaccine doses prior to infection was associated with a reduced risk of longer-term symptoms. The lower risk of longer-term symptoms among adults infected in the later half of 2021, prior to the less virulent Omicron wave, suggests that vaccinations were protective and contributed to the observed associations between time period of infection and longer-term symptoms. In addition, the percentage of adults reporting longer-term symptoms varied by province of residence, perhaps related to differences in underlying risk and protective factors associated with longer-term symptoms. The presented results are consistent with the current state of

Figure 7: Percent of Adults (Aged 18+) Self-reporting Longer-term Symptoms after a Positive COVID-19 Test or Suspected Infection by Time Period of Infection, Canada, January 2020 to August 2022



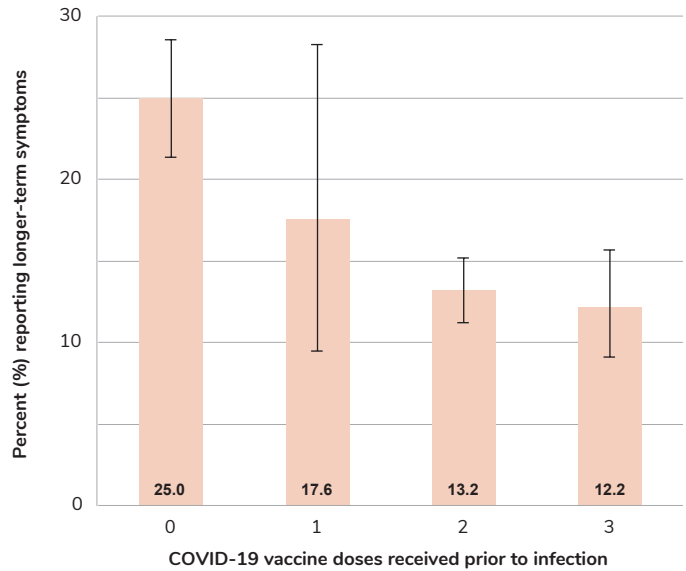
Source: Canadian COVID-19 Antibody and Health Survey—Cycle 2.

Note: Longer-term symptoms are defined as self-reported persistent, recurring, or new symptoms 3 or more months after a positive COVID-19 test or suspected infection. Infections occurring within 3 months of August 31, 2022 are excluded because of an insufficient post-infection period to assess longer-term symptoms. Estimates exclude the territories. COVID-19 = Coronavirus Disease 2019.

knowledge on longer-term symptoms following SARS-CoV-2 infections. Others have found that being female, having a more severe SARS-CoV-2 infection, **being obese, and having respiratory comorbidities** are associated with an increased risk of longer-term symptoms, while receiving two or more COVID-19 vaccine doses prior to infection and being infected with the Omicron variant are associated with a lower risk of developing longer-term symptoms.

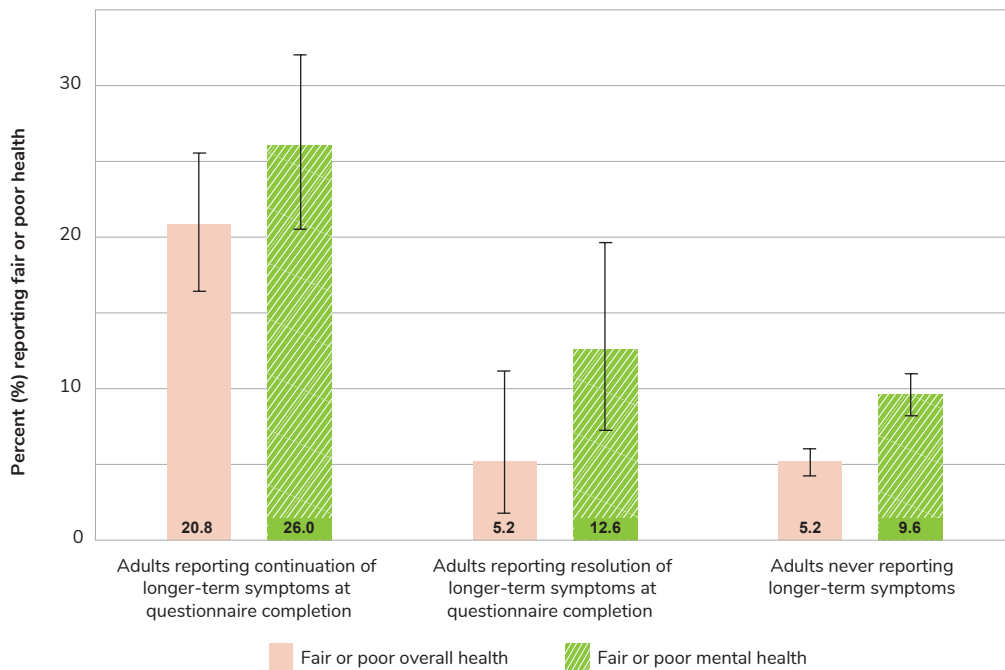
This publication is one of a series of products related to this survey to be released by PHAC, Statistics Canada, Canada’s COVID-19 Immunity Task Force, and the larger research community to further our knowledge about COVID-19. Intended for a range of audiences, these products may include technical reports, journal articles and infographics. Forthcoming releases by PHAC will provide a more detailed portrait of the prevalence of longer-term symptoms in population subgroups defined by economic status and ethnicity, as well as provide information on factors associated with the severity and duration of longer-term symptoms.

Figure 8: Percent of Adults (Aged 18+) Self-reporting Longer-term Symptoms after a Positive COVID-19 Test or Suspected Infection by Number of COVID-19 Vaccine Doses Received Prior to Infection, Canada, January 2020 to August 2022



Source: Canadian COVID-19 Antibody and Health Survey—Cycle 2.
Note: Longer-term symptoms are defined as self-reported persistent, recurring, or new symptoms 3 or more months after a positive COVID-19 test or suspected infection. Estimates exclude the territories. COVID-19 = Coronavirus Disease 2019.

Figure 9: Percent of Adults (Aged 18+) Self-reporting Fair or Poor Health after a Positive COVID-19 Test or Suspected Infection by Self-reported Longer-term Symptoms, Canada, April to August 2022



Source: Canadian COVID-19 Antibody and Health Survey—Cycle 2.
Note: Longer-term symptoms are defined as self-reported persistent, recurring, or new symptoms 3 or more months after a positive COVID-19 test or suspected infection. Overall health measures physical, mental, and social well being. Overall health and mental health were self-reported at the time of questionnaire completion between April and August of 2022. Estimates exclude the territories. COVID-19 = Coronavirus Disease 2019.

Technical Notes

All results presented here are based on self-report. CCAHS-2 data about SARS-CoV-2 infections relate to the first infection with a positive test result or, in the absence of a positive test result, the first suspected infection. The survey does not account for multiple infections in the same person. Further, the results may not reflect the experiences of all infected Canadians — not everyone who acquired COVID-19 may have been aware or tested.

Although questionnaire data were collected between April 1, 2022 and August 31, 2022, information about COVID-19 infections and vaccinations relate to the period since the start of the pandemic to questionnaire completion. Consequently, the time period for which infection and vaccination status is reported differs across respondents.

Populations excluded from the survey are persons living in the three territories, persons under 18 years of age, persons living on reserves and other Indigenous settlements in the provinces, full-time members of the Canadian Forces, persons living in institutions, and residents of certain remote regions.

To ensure estimates pertaining to longer-term symptoms were accurate, all respondents who self-reported infections less than 90 days prior to questionnaire completion were excluded. Respondents who self-reported their date of infection as early, middle, or late in the month were assumed to be infected on the 5th, 15th, and 25th of the month, respectively.

When examining the association between severity of initial SARS-CoV-2 infection symptoms and longer-term symptoms, adults reporting being hospitalized due to COVID-19 were categorized as having the highest severity while all other adults were categorized based on self-reported initial symptom severity: no symptoms; mild symptoms — didn't affect my daily life; moderate symptoms — some effect on my daily life; and severe symptoms — significant effect on my daily life.

Body mass index (BMI) is defined as a person's weight in kilograms divided by the square of the person's height in metres. People who were pregnant were excluded from BMI calculations, which were [corrected for known biases in self-reported height and weight](#) by Statistics Canada. [BMI categories](#) are defined as follows: underweight is less

than 18.5 kg/m², normal weight is 18.5 kg/m² to 24.9 kg/m², overweight is 25.0 kg/m² to 29.9 kg/m², obesity class I is 30.0 kg/m² to 34.9 kg/m², obesity class II is 35.0 kg/m² to 39.9 kg/m², and obesity class III is 40 kg/m² or greater.

Because the CCAHS-2 collection and reference periods span a long time period, readers are advised caution when comparing results with other research based on an overlapping but shorter time period, as the COVID-19 landscape across Canada changed drastically over the time span covered by CCAHS-2.

Results presented in this publication are based on a share file compiled from the 3rd provisional release of data from CCAHS-2. Provisional releases include a subset of all data collected in the survey, which are considered provisional and subject to change upon the final release of the survey data by Statistics Canada.

Imputations and Sensitivity Analyses

Diagnosed Chronic Conditions

Adults were asked whether a health professional had diagnosed them with any of the following 21 chronic conditions: chronic lung condition, asthma, sleep apnea, diabetes, high blood pressure, chronic heart disease, the effects of a stroke, chronic neurological disorder, Alzheimer's disease or other dementia, mental health condition, chronic blood disorder, weakened immune system, chronic kidney disease, liver disease, chronic fatigue syndrome or fibromyalgia, osteoporosis, arthritis, back problems, urinary incontinence, bowel disorder, and other long-term health condition. The year of diagnosis was collected and, for those diagnosed in 2020 to 2022, the month of diagnosis was also captured. Chronic conditions diagnosed up to and including the month of self-reported SARS-CoV-2 infection were defined as existing prior to infection. Adults not completing the chronic condition section were assumed to have none of the conditions. When the date of diagnosis of a self-reported chronic condition was completely missing, the chronic condition was assumed to have been diagnosed prior to the date of self-reported SARS-CoV-2 infection. Partial dates were used, when possible, to establish the temporality of chronic condition diagnosis and infection. A sensitivity analysis that excluded adults not completing the chronic condition section or date of diagnosis, did not substantially alter the conclusions presented above.

Vaccination

Approximately 3.7% of respondents reported receiving vaccine doses prior to the first vaccine dose administered in Canada on Dec 14, 2020. Although possible, this percentage is too high to be explained by participation in vaccination trials. An examination of the data suggested that participants may have misreported the year as 2020 rather than 2021. An imputation process was used to correct for this issue. Specifically, when the first two or three vaccine dose dates were complete and occurred in 2020 and the first vaccine dose was received prior to Dec 2020, all vaccine doses received in 2020 were shifted forward by one year. If shifting doses received in 2020 resulted in dose 2 being received after dose 3, dose 3 was imputed as being received 6 months after the imputed second dose date. A 6 month interval was assumed between dose 2 and 3 because this was the most common and median interval between dose 2 and 3 in the survey data. For all other respondents, if the first vaccine dose was received prior to Dec 2020 or in 2020 without a specified month, the first vaccine date was set to Dec 2020 and subsequent dates were imputed, as necessary, to maintain the appropriate sequencing of vaccine dose dates. When such imputations were performed, the second vaccine dose was assumed to occur 2 months after the first and the third vaccine dose was assumed to occur 6 months after the second. A two month interval was assumed between dose 1 and 2 because this was the most common and median interval between dose 1 and 2 in the survey data. In total, 3.7% of respondents had 1 or more vaccine dose dates imputed. A sensitivity analysis which excluded all adults with imputed vaccine dates did not impact examined associations between vaccination status and longer-term symptoms.

Analytical Methods

Provisional survey weights were used to create a representative sample and to minimize any potential bias that could arise from survey non-response and respondents not consenting to sharing their data with the Public Health Agency of Canada. Adjustments for non-response and respondents declining to share data, and calibration using available auxiliary information were applied to the survey weights. Despite adjustments and calibrations reflected in the provisional survey weights, a high degree of non-response to the survey combined with the exclusion of respondents who decline to share their data increases the risk of remaining bias. This

remaining bias may impact estimates produced using the survey data. Further, since the share file contains a subset of all respondents, estimates based on the share file may differ somewhat from those produced using all respondents contained in the masterfile.

The estimates in this release are based on a multi-stage sample from the Canadian adult population eligible to participate. Repeated samples would provide different estimates. The 95% confidence interval (CI) is a range of values that we can be 95% confident contains the true value of interest in the absence of bias. The width of the 95% CI conveys the degree of precision of the estimate: the narrower the confidence interval the greater the precision. Wide confidence intervals should be interpreted cautiously because of the wide range of values within which the true value of interest may lie.

All analyses were conducted using SAS Enterprise Guide 7.1 Software with a two-tailed alpha level of 0.05. SAS survey procedures and bootstrap weights provided by Statistics Canada were used to produce estimates, 95% CIs, and tests of association that acknowledge the complex survey design through the bootstrap method. CIs for weighted means use the t-distribution while CIs for weighted proportions were calculated using the Clopper-Pearson (exact) method. The design-based first-order Rao-Scott test was used to test for associations.

Additional Resources

- › [Deaths, 2020](#)
- › [COVID-19's impact on hospital services](#)
- › [COVID-19 in Canada](#)
- › [Post COVID-19 condition \(long COVID\)](#)
- › [COVID-19 for health professionals: Post COVID-19 condition \(long COVID\)](#)
- › [Chief Science Advisor of Canada's Task Force on Post COVID-19 Condition](#)
- › [Frequency and impact of longer-term symptoms following COVID-19 in Canadian adults](#)
- › [Self-reported COVID-19 test results in Canada, January 2020 to March 2022](#)
- › [Long-term symptoms in Canadian adults who tested positive for COVID-19 or suspected an infection, January 2020 to August 2022](#)

- › Canadians' awareness of when they have COVID-19, May to August 2022
- › Prevalence of long-term effects in individuals diagnosed with COVID-19: a living systematic review
- › Canadian Institutes of Health Research
- › Canadian COVID-19 Antibody and Health Survey (CCAHS)
- › Risk factors and preventive interventions for post Covid-19 condition: systematic review
- › A clinical case definition of post COVID-19 condition by a Delphi consensus
- › COVID-19 vaccination in Canada
- › One-Year Temporal Changes in Long COVID Prevalence and Characteristics: A Systematic Review and Meta-Analysis
- › Bias in self-reported estimates of obesity in Canadian health surveys
- › Body Mass Index (BMI)

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