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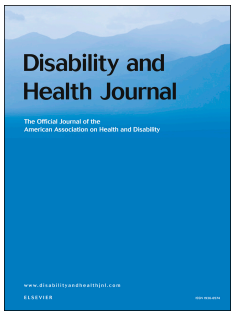

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Post-COVID Conditions and Healthcare Utilization Among Adults With and Without Disabilities—2021 Porter Novelli FallStyles Survey

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ABSTRACT

Background: Adults with disabilities are at increased risk for SARS-CoV-2 infection and severe disease; whether adults with disabilities are at an increased risk for ongoing symptoms after acute SARS-CoV-2 infection is unknown.

Objectives: To estimate the frequency and duration of long-term symptoms (> 4 weeks) and health care utilization among adults with and without disabilities who self-report positive or negative SARS-CoV-2 test results.

Methods: Data from a nationwide survey of 4,510 U.S. adults administered from September 24, 2021 – October 7, 2021, were analyzed for 3,251 (79%) participants who self-reported disability status, symptom(s), and SARS-CoV-2 test results (a positive test or only negative tests). Multivariable models were used to estimate the odds of having ≥1 COVID-19–like symptom(s) lasting >4 weeks by test result and disability status, weighted and adjusted for socio-demographics.

Results: Respondents who tested positive for SARS-CoV-2 had higher odds of reporting ≥ 1 long-term symptom (with disability: aOR=4.50 [95% CI: 2.37, 8.54] and without disability: aOR=9.88 [95% CI: 7.13, 13.71]) compared to respondents testing negative. Among respondents who tested positive, those with disabilities were not significantly more likely to experience long-term symptoms compared to respondents without disabilities (aOR=1.65 [95% CI: 0.78, 3.50]). Healthcare utilization for reported symptoms was higher among respondents with disabilities who tested positive (40%) than among respondents without disabilities who tested positive (18%).

Conclusions: Ongoing symptoms among adults with and without disabilities who also test positive for SARS-CoV-2 are common; however, frequency of healthcare utilization for ongoing symptoms is two-fold among adults with disabilities.

Keywords (5): COVID-19, disabilities, post-COVID conditions, long COVID, post-acute sequelae of SARS-CoV-2 infection

INTRODUCTION

Infection with the coronavirus (SARS-CoV-2) is associated with a wide range of acute and long-term symptoms and conditions. Long-term symptoms experienced 4 or more weeks after SARS-CoV-2 infection are collectively called post-COVID conditions (PCC)[1] (also known as long COVID or post-acute sequelae of SARS-CoV-2 (PASC)) and can include activity-limiting symptoms associated with long-term disability.[2] Adults with disabilities, defined as serious difficulties with vision, hearing, mobility, cognition, self-care, or independent living, have higher prevalence of underlying chronic health conditions than adults without disabilities. They are also at higher risk of SARS-CoV-2 infection and severe COVID-19 illness than adults without disabilities[3,4] and may have increased occurrence of PCC.

The estimated 61 million adults in the United States with disabilities[5] who experienced challenges to accessing health care and social services before the pandemic[6] remain medically underserved during the pandemic.[7] They report disparities in access to health care, testing, and vaccines[8], among other psychosocial stressors[9], and may require additional resources, technical assistance, and disability accommodations if they develop PCC. Many long-term symptoms reported by people with disabilities, such as fatigue or shortness of breath, are similar to those reported from PCC, but distinguishing symptoms resulting from underlying disabilities from PCC symptoms is important.[10-14] Understanding the prevalence and duration of PCC in people with disabilities can help clinicians and public health practitioners identify long-term symptoms associated with SARS-CoV-2 infection and treat them more effectively.

We analyzed cross-sectional survey data collected by Porter Novelli (PN) Public Services[15] to 1) estimate the frequency of PCC and health care utilization among adults with and without disabilities after self-report of SARS-CoV-2 testing, and 2) identify whether PCC were more common among adults with disabilities who self-reported a positive SARS-CoV-2 test.

METHODS

Survey design and study sample

We performed analyses using cross-sectional survey data collected by Porter Novelli (PN) Public Services[15] in PN FallStyles 2021, a nationwide survey of U.S. adults administered from September 24, 2021 – October 7, 2021. PN FallStyles participants were chosen from a sample of 4,510 panel members aged 18 years or older who also answered an earlier survey of panelists in March–April 2021, called PN SpringStyles 2021. The survey was conducted by the market research firm Ipsos via their KnowledgePanel©, a continuously replenished panel consisting of approximately 60,000 panelists representative of the non-institutionalized U.S. population.[16] Panel members were randomly recruited by mail using probability-based sampling by address to reach respondents regardless of whether they have landline phones or Internet access. If needed, households were provided with a laptop or tablet and access to the Internet. Respondents received cash-equivalent reward points for their participation. Respondents could refuse to answer questions or leave the survey or panel at any time. We analyzed complete responses (which included answers for at least half of the questions in the survey) with self-reported socio-demographic information, underlying chronic conditions, disability status, SARS-CoV-2 test history, symptom(s), vaccination status, and healthcare utilization**.** Statistical weighting was used to align the sample with the noninstitutionalized U.S. population distributions, accounting for gender, age, household income, race/ethnicity, household size, education, census region, and metropolitan status (i.e., urban/rural differences). For this analysis we used the recommended weights provided by Porter Novelli Public Services. For data currency, we used the most recent weighting from U.S. Census' American Community Survey (ACS) data.[17] Weights were designed to match the ACS proportions for these variables.[17] For precision, we supplemented these data with metropolitan status, which is not available from the one-year ACS and was obtained from the 2020 March Supplement of the Current Population Survey (CPS).[18]

Variable Definitions

Socio-demographics. Participants reported their age, sex, race/ethnicity, marital status, highest level of education completed, employment status, household income in 2021, and U.S. Census region.

Pre-existing conditions. Respondents self-reported health conditions they experienced currently, in the past year, or reported no health problems. They self-reported symptoms since January 2020 separately. (See "Symptoms.")

Disability status. Respondents answered a series of questions asking whether or not they had serious difficulty with vision, hearing, mobility, cognition, self-care, or independent living, according to the six-item set often referred to as the American Community Survey – 6 (ACS-6).[19,20] Respondents who answered 'yes' to at least one question were categorized as having a disability. Those who answered 'no' to all questions were categorized as not having a disability.

SARS-CoV-2 test history. Respondents self-reported ever having received a positive SARS-CoV-2 test result ("reported a positive test"), always receiving a negative SARS-CoV-2 test result ("reported only negative tests"), or never having been tested for SARS-CoV-2 ("never been tested"). Respondents who reported having received a positive or negative test result were included in the analysis.

Symptoms. Respondents who reported a positive SARS-CoV-2 test were asked if they experienced ≥1 of 17 symptoms following their first positive test that lasted >4 weeks since they first experienced the symptom(s).[21] (See Appendix A.) PCC was defined as having one or more of these symptoms. Respondents who reported only negative tests were also asked to report whether they experienced any of the same symptoms for >4 weeks since January 2020. Respondents reported duration of symptoms as lasting one to three months; three to six months; six to nine months; nine to twelve months; and twelve months or more. Throughout the results section, we use "long-term symptoms" to refer to respondents who reported these symptoms for >4 weeks, versus other underlying symptoms.

Vaccination status. Respondents were asked about receipt of ≥1 doses of a COVID-19 vaccine. Responses were categorized as fully vaccinated (reported receiving one dose of Johnson & Johnson or two or more doses of Pfizer or Moderna, and considered fully vaccinated ≥2 weeks after receipt of that series); partially vaccinated (reported receiving only one dose of Pfizer or Moderna); and unvaccinated (reported not having received any doses of a COVID-19 vaccine).[22] The survey was conducted prior to the recommendations of boosters.[23] We define up-to-date vaccination as up-to-date during the survey time period (see Appendix A).[24]

Health care utilization. A smaller number of respondents self-reported their health care utilization related to long-term symptoms that lasted longer than 4 weeks since they first experienced the symptoms: seeing a doctor, nurse, or other health professional once or more than once; going to urgent or emergency care; hospitalization; or "none of these."

Statistical analyses

We used chi-squared tests to examine differences in the frequency of demographics, underlying conditions, and long-term symptoms among participants by disability status or SARS-CoV-2 test status. Using multivariable logistic regression analyses, we estimated the odds of having ≥1 COVID-like symptoms lasting >4 weeks following a positive SARS-CoV-2 test and their duration: 1) among individuals who reported testing positive for SARS-CoV-2, comparing adults with and without disabilities; 2) among adults with disabilities, comparing those with a positive test to those with a negative test; and 3) among adults without disabilities, comparing those with a positive test to those with a negative test. We described symptom clusters observed >4 weeks after infection in these respondents that were associated with not returning to pre-COVID physical and mental health in another survey of U.S. adults from this time period (see Appendix B).[25] (Certain analyses did not compare respondents

with and without disabilities due to small sample size of subgroups.) All odds ratios in the multivariable logistic regression model were adjusted for categorical age, sex, race/ethnicity, highest level of education completed, employment status, and U.S. census region. All analyses accounted for sampling weights and were completed in STATA 17. Statistical significance was defined as $p < 0.05$.

Human subjects protection

This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy. (See e.g., 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §551a; 44 U.S.C. §3501 et seq.) We performed secondary data analysis on de-identified survey responses. Survey responses were confidential. Participants' personally identifiable information was protected. The survey was conducted by IPSOS via their KnowledgePanel©[16], which maintains a confidentiality agreement with participants to protect their personally identifiable information and does not require a survey-specific consent for KnowledgePanel members who agreed to join the panel and receive survey invitations. Participation was voluntary.

RESULTS

Analytic sample. PN FallStyles 2021 invited 4,510 noninstitutionalized U.S. adults aged ≥18 years to participate; 3,584 adults responded (79% response rate). Among these respondents, 31 who did not complete the survey or who completed the survey in 10 minutes or less (indicating incomplete responses) were excluded. Respondents with unknown disability status (n=36) were also excluded from the analysis. Of the remaining 3,517 respondents, 3,251 (92%) reported being tested for SARS-CoV-2 and disability status. Thus, 3,251 respondents were included in our analyses.

Characteristics of respondents. Among the 3,251 total respondents in the analytic sample, there were 653 (20%) respondents with disabilities and 2,598 (80%) respondents without disabilities (Table 1). Overall, 63% of respondents were non-Hispanic White. Respondents with disabilities were generally older, not working, not married, and had lower educational attainment and household income than adults without disabilities ($p<0.001$). A greater proportion (95%) of respondents with disabilities had ≥1 chronic conditions than respondents without disabilities (66%) (Table 1). Among respondents with disabilities, the most commonly reported conditions were anxiety (48%), depression (41%), and high blood pressure (41%). The most common conditions among respondents without disabilities were seasonal allergies (22%) and high blood pressure (22%). Seventy-two percent (72%) of respondents with disabilities were fully vaccinated, versus 79% of respondents without disabilities ($p<0.004$) (Table 1). Among the 653 respondents with disabilities, 82 (13%) reported a positive test and 571 (87%) reported only negative tests. Among the 2,598 respondents without disabilities, 302 (12%) reported a positive test and 2,296 (88%) reported only negative tests (Supplemental Table).

The following three sub-sections present results of this analysis for 1) all respondents (with or without disabilities); 2) respondents with disabilities, and 3) respondents without disabilities. The results under each subheading include results stratified by SARS-CoV-2 test history.

All respondents (with or without disabilities)

Many (n=2,330; 72%) respondents reported ≥1 symptoms lasting >4 weeks. Symptoms were most frequently reported among respondents with disabilities who reported a positive test (72%) (Figure 1). The most common long-term symptoms reported were fatigue/tired/weakness, which were also most common among respondents with disabilities (50%) and without disabilities (28%) who reported a positive SARS-CoV-2 test. Change in smell or taste was also common among respondents with disabilities (36%) and without disabilities (29%) who reported a positive test.

Among respondents who reported a positive test, we found no statistical evidence that those with disabilities were more likely than those without disabilities to have ≥1 long-term symptoms (aOR=1.65, 95% CI 0.78–3.50, p=0.188) (Table 3). However, respondents with disabilities who reported a positive test were significantly more likely to report myalgic encephalomyelitis/chronic fatigue syndrome (ME/CFS)-like symptoms, digestive symptoms, and symptoms lasting three to six months compared to respondents without disabilities who reported a positive test (Table 2).

Respondents with disabilities

Of the 82 respondents with disabilities who reported a positive test, 44% reported ≥1 long-term symptoms lasting one to three months following their first positive test and 20% reported ≥1 symptoms lasting three to six months following their first positive test (Supplemental Figure). Among respondents with disabilities who reported only negative tests, 15% reported ≥1 symptom lasting one to three months and 3% at three to six months after the most recent test date; similar results were reported at six to nine and nine to twelve months after the most recent test date. Respondents with disabilities who reported only negative tests had the highest percentage of reported symptoms twelve months or more after the most recent test date (14%; see Supplemental Figure).

The odds of having ≥1 long-term symptoms were higher among those who reported a positive SARS-CoV-2 test than among those who reported only negative tests (aOR 4.50, 95% CI 2.37–8.54)

(Table 3). Respondents with disabilities who reported a positive test were more likely to have symptoms up to three to six months after the test date than those who always reported negative tests (aOR=9.73, 95% CI 3.09–30.62), but this association was not statistically different six to nine months after the test date.

Respondents without disabilities

Of 302 respondents without disabilities who reported a positive SARS-CoV-2 test, 42% reported ≥1 symptom one to three months post-infection; 6% reported ≥1 symptom three to six months post-infection (See supplemental figure). In comparison, 7% of the 2,296 respondents without disabilities with a negative test reported ≥1 symptom one to three months after the test result and 1% reported ≥1 symptom three to six months after their test result.

Similar to respondents with disabilities, respondents without disabilities were more likely to report long-term symptoms if also reporting a positive test rather than only negative tests (aOR=9.88, 95% CI 7.13–13.71, p<0.001) (Table 3). Respondents without disabilities who reported a positive test were more likely to have symptoms lasting three to six months than those who always reported negative tests (aOR=11.16, 95% CI 5.19–24.00, p<0.001). However, this association was not statistically significant more than twelve months after the test date (Table 3).

Health care utilization

Healthcare utilization for reported symptoms was higher among respondents with disabilities who tested positive than among respondents without disabilities who tested positive. Among respondents with disabilities, the proportion who saw a doctor, nurse, or other health professional for long-term symptoms was similar: 40% of those who reported testing SARS-CoV-2 positive and 39% who reported only negative tests. Among respondents without disabilities, 18% of those who reported a positive test sought health care for long-term symptoms compared to 29% of those who always reported negative tests (p=0.03) (Figure 2).

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DISCUSSION

In this nationwide survey of U.S. adults, more than half of all respondents who self-reported a positive SARS-CoV-2 test result also reported ≥1 symptoms lasting >4 weeks after the date of their first positive test result. This proportion did not differ significantly between respondents with or without a disability. Among respondents with disabilities, one in five (20%) reported symptoms still present three to six months after SARS-CoV-2 infection. Healthcare utilization for reported long-term symptoms was more common among respondents with disabilities, and higher among respondents with disabilities who tested positive (40%) than among respondents without disabilities who tested positive (18%), with the caveat that only a subgroup responded to these questions.

Our finding that long-term symptoms following SARS-CoV-2 infection were common among respondents is consistent with the literature. A systematic review by Groff et al. estimated that over half of adults who have an acute SARS-CoV-2 infection may develop PCC.[26] Many of these adults had underlying chronic conditions[26,27] before they developed PCC. Consistent with other studies, we found a strong positive association between reporting a positive test and long-term symptoms, regardless of disability status.[2,21] An analysis of PCC-like symptoms versus underlying symptoms associated with disability more generally is out of the scope of this study.

This is one of the first studies to estimate and compare ongoing long-term symptoms following SARS-CoV-2 infection among adults with and without disabilities.[13,28] Tartof *et al.* found COVID-19-associated excess health care utilization in the six months following SARS-CoV-2 infection, but their study did not look at utilization by disability status.[29] Adults with disabilities have more underlying chronic conditions, social vulnerability factors[6], and pandemic-related behavioral or mental health changes[12,7] than adults without disabilities, and associated increased care needs and expenditures for social services.[9] They experience greater challenges than adults without disabilities in accessing health care services[30] (e.g., testing, vaccination, nonpharmaceutical interventions, clinic visits) and might be at

higher risk for undiagnosed SARS-CoV-2, leading to missed cases, [13] e.g., PCC in adults with intellectual disabilities.[31] Adults with disabilities have been shown to have a lower likelihood of having received COVID-19 vaccination, attributed to difficulties obtaining a COVID-19 vaccine or (less likely) vaccine hesitancy.[8] This information might help centers for independent living and other disability organizations anticipate how many new consumers with long COVID they may receive, and how demand for these services could increase as more people with PCC gain eligibility for disability accommodations.

Though we hypothesized that adults with disabilities with SARS-CoV-2 infection are more likely to have PCC than infected adults without disabilities, we did not find a statistically significant association between presence of ≥1 symptoms in adults who self-reported a positive SARS-CoV-2 test and disability status. This might be because it can be difficult to distinguish symptoms related to underlying chronic conditions from symptoms of PCC. Many people with disabilities report underlying symptoms similar to long COVID, even prior to infection. Similar differences were observed in this survey, with 5% of adults with disabilities reporting no underlying chronic conditions, compared to 34% of adults without disabilities. Persistent long-term symptoms were observed in respondents with disabilities who always reported negative tests for SARS-CoV-2, but these symptoms may reflect underlying chronic conditions which may overlap with PCC. A higher proportion of respondents without disabilities who reported a positive test reported underlying chronic conditions (70%) than respondents without disabilities who reported only negative tests (65%).

This cross-sectional study had several limitations. The survey did not capture when disabilities occurred relative to the presentation of symptoms, associated chronic conditions, or a positive SARS-CoV-2 test or receipt of COVID-19 vaccination[32], complicating the analysis of a direct connection between long COVID and healthcare utilization. The analysis adjusted for age in multivariate models but did not compare respondents with and without disabilities directly or test for interaction between

disability status and symptoms. These results cannot be used to estimate risk of PCC attributable to SARS-CoV-2 infection. The respondents who agreed to join a survey panel might not be representative of the general population of U.S. adults. These data are subject to recall bias because respondents may have recalled symptoms differently depending upon their test status, frequency of testing, timing of when the illness occurred, or chronic conditions (e.g., intellectual and developmental disabilities). Respondents who self-reported a positive test might have been more likely to recall their symptoms. Also, respondents with disabilities were older than those without disabilities, potentially affecting reporting of underlying chronic conditions and severity of COVID-19 illness. Long-term symptoms in respondents with disabilities may have been missed as well, potentially affecting adjusted odds ratios estimates of PCC by self-reported disability and SARS-CoV-2 test status. The SARS-CoV-2 test histories were based on respondents' self-report and subject to misclassification (e.g., false negative). Frequency of testing may have had an impact on the likelihood of identifying a positive test; there was no clear way to evaluate how long symptoms lasted. Respondents who always received a negative test result might have had a longer period in which to report symptoms, potentially inflating prevalence of long-term symptoms and healthcare utilization. The survey measured prevalence and duration of symptoms (based on survey respondents' self report of how long symptoms have lasted), but not intensity or severity. In addition, the survey did not ask about the date of infection or date of vaccination, so we could not determine precisely when a respondent tested positive for SARS-CoV-2, nor whether vaccination played a role in the burden of PCC. Results should be interpreted with caution, given the small sample size of people with disabilities who tested positive for SARS-CoV-2.

Conclusion

PCC is common among SARS-CoV-2-infected adults with or without disabilities. Longer duration of ongoing symptoms after infection and seeking health care for symptoms are more common among adults testing positive for SARS-CoV-2 with disabilities. Although adults with disabilities do not appear to have an increased occurrence of PCC compared to those without disabilities, any increase in their healthcare needs and utilization is important to address. Many adults with disabilities already experience challenges in accessing health services, and they may need different clinical management of their symptoms after SARS-CoV-2 infection, especially if their long-term symptoms are difficult to distinguish from their underlying chronic conditions. Our findings raise awareness of PCC among adults with disabilities and their health care providers and caregivers. Continued monitoring and clinical care for long-term symptoms and reducing disparities in access to SARS-CoV-2 infection prevention and control measures are important. Reducing infection and transmission of SARS-CoV-2 with up-to-date vaccination (including booster administration) and nonpharmaceutical interventions can reduce risk of COVID-19 illness and PCC.

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(Redacted to maintain author anonymity in peer review. See title page.)

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Figure Legends

Figure 1

Caption: Frequencies of symptoms lasting longer than 4 weeks among individuals with and without disabilities, stratified by self-reported SARS-CoV-2 test result* (N=3,251)

Legend:

(blue box) With disability tested positive, N=82

(gray box) Without disability tested positive, N=302

(orange box) With disability tested negative, N=571

(yellow box) Without disability tested negative, N=2,296

Footnote:

*Statistical weighting was used to align the sample with U.S. population distributions, adjusting for gender, age, household income, race/ethnicity, household size, education, census region, and metropolitan status. Weights were designed to match the U.S. Census' American Community Survey (ACS) proportions for these variables. Metropolitan status, which is not available from the 1-year ACS, were obtained from the 2020 March Supplement of the Current Population Survey (CPS).

Figure 2

Caption: Health utilization among individuals with and without disabilities who reported at least one symptom lasting for >4 weeks, stratified by self-reported SARS-CoV-2 test result, weighted

Legend:

(blue box) With disability tested positive, N=59

(orange box) Without disability tested positive, N=212

(gray box) With disability tested negative, N=174

(yellow box) Without disability tested negative, N=300

Table 1. Comparison of the frequencies of demographics and other characteristics among survey participants with and without disabilities* (N=3,251)

	With disabilities[†] (N=653) unweighted n (weighted %)	Without disabilities (N=2,598) unweighted n (weighted %)	p-value[#]
Age groups, years			
18-29	104 (16)	547 (21)	<0.001
30-39	89 (14)	444 (17)	
40-49	83 (13)	419 (16)	
50-59	118 (18)	472 (18)	
60-69	117 (18)	414 (16)	
≥70	142 (22)	302 (12)	
Sex			
Male	310 (47)	1,250 (48)	0.816
Female	343 (53)	1,348 (52)	
Race/Ethnicity			
White, non-Hispanic	427 (65)	1,610 (62)	0.179
Black or African American, non-Hispanic	80 (12)	298 (11)	
Other, non-Hispanic[‡]	41 (6)	254 (10)	
Hispanic	105 (16)	436 (17)	
Marital status			
Married	306 (47)	1,533 (59)	<0.001
Widowed	33 (5)	78 (3)	
Divorced/Separated	119 (18)	217 (8)	
Never married	195 (30)	770 (30)	
Highest-level of education completed			
Some high school or less	138 (21)	211 (8)	<0.001
High school graduate/some college	398 (61)	1,479 (57)	
4-year college/some postgraduate education	73 (11)	512 (20)	
Postgraduate degree	44 (7)	396 (15)	
Employment status			
Employed full-time	153 (23)	1,309 (50)	<0.001
Employed part-time	75 (24)	368 (14)	
Not working	424 (65)	921 (35)	
Household income 2021, USD			
<25,000	180 (28)	231 (9)	<0.001
25,000-49,999	153 (24)	407 (16)	
50,000-74,999	107 (16)	449 (17)	
75,000-99,999	73 (11)	391 (15)	
100,000-149,999	69 (11)	540 (21)	
≥150,000	71 (11)	580 (22)	
U.S. Census Region[§]			
Northeast	111 (17)	471 (18)	0.176
Midwest	139 (21)	512 (20)	
South	266 (41)	962 (37)	
West	137 (21)	653 (25)	
Past-year or current self-reported health conditions			
One or more health conditions	619 (95)	1,711 (66)	
--Anxiety	312 (48)	484 (19)	<0.001
--Arthritis	236 (36)	284 (11)	<0.001

--Asthma	78 (12)	155 (6)	<0.001
--Chronic Pain	250 (38)	193 (7)	<0.001
--Depression	267 (41)	285 (11)	<0.001
--Diabetes	141 (22)	221 (9)	<0.001
--Emphysema/COPD	41 (6)	26 (1)	<0.001
--Flu	23 (4)	19 (1)	<0.001
--High cholesterol	212 (32)	425 (16)	<0.001
--Migraine headaches	115 (18)	213 (8)	<0.001
--Seasonal Allergies	212 (32)	576 (22)	<0.001
--High blood pressure	270 (41)	570 (22)	<0.001
--Heart condition (atrial fibrillation, congestive heart failure, angina, heart attack or other heart condition)	53 (8)	70 (3)	<0.001
--Stroke	13 (2)	5 (0.2)	<0.001
--Cancer (including skin cancer)	46 (7)	76 (3)	<0.001
--Other mental health condition	106 (16)	35 (1)	<0.001
--Other physical health condition	147 (23)	198 (8)	<0.001
No health problems	34 (6)	887 (34)	<0.001
SARS-CoV-2 positive test (self-report)[‖]			
Yes	82 (13)	302 (12)	0.630
No	571 (87)	2,296 (88)	
Receipt of COVID-19 vaccination (self-report) [¶]			
Full vaccination	471 (72)	2,053 (79)	0.004
Partial vaccination	19 (3)	31 (1)	
Unvaccinated	161 (25)	499 (19)	

[*]This count includes only those survey respondents who had a recorded disability and SARS-CoV-2 status (N=3,251). Statistical weighting was used to align the sample with U.S. population distributions, adjusting for gender, age, household income, race/ethnicity, household size, education, census region, and metropolitan status. Weights were designed to match the U.S. Census' American Community Survey (ACS) proportions for these variables. Metropolitan status, which is not available from the 1-year ACS, were obtained from the 2020 March Supplement of the Current Population Survey (CPS).
[†]With disabilities includes persons aged ≥18 years who reported having serious difficulty with vision, hearing, mobility, cognition, self-care, or independent living. Excludes respondents whose disability status was unknown.
[‡]Participants who reported a race other than non-Hispanic White or Black, including Asian, American Indian, Alaskan Native, and Hawaiian/Pacific Islander or reported 2 or more non-Hispanic races.

[§]States included in census regions: Northeast: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont, New Jersey, New York, Pennsylvania; Midwest: Indiana, Illinois, Michigan, Ohio, Wisconsin, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota; South: Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia, Alabama, Kentucky, Mississippi, Tennessee, Arkansas, Louisiana, Oklahoma, Texas; West: Arizona, Colorado, Idaho, New Mexico, Montana, Utah, Nevada, Wyoming, Alaska, California, Hawaii, Oregon, Washington.

[‖] The exposure of interest was SARS-CoV-2 infection, measured by one or more positive SARS-CoV-2 test results since January 2020. Respondents self-reported ever having received a positive test result, always receiving a negative test result, or never having been tested for SARS-CoV-2. Respondents who reported having received a positive ("reported a positive test") or only negative test results ("reported only negative tests") were included in the analysis.

[¶]Vaccination status was defined as follows: Full vaccination: reported receiving one dose of Johnson & Johnson and two or more doses of Pfizer or Moderna; partial vaccination: reported receiving one dose of Pfizer or Moderna; and unvaccinated: did not report receiving any doses of a COVID-19 vaccine. At the time of the survey, up-to-date vaccination was defined as receiving one dose of Johnson & Johnson or two or more doses of Pfizer or Moderna.[1] The survey was conducted prior to the recommendations of boosters[2], though 194 respondents received more than two vaccine doses.

[#]Characteristics were compared among groups using a chi-square test, with p-values <0.05 indicating significant differences between respondents with and without disabilities.

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Table 2. Results of multivariable analyses estimating the odds of having symptoms lasting longer than 4 weeks and the odds of select duration of symptoms* among participants with disabilities who reported testing positive for SARS-CoV-2 compared to participants without disabilities who tested SARS-CoV-2-positive[†]

	Odds Ratio (95% Confidence Interval) *(ref: adults without disabilities)*	P-value
Symptoms for >4 weeks		
One or more symptom	1.65 (0.78, 3.50)	0.188
Two or more symptoms	1.91 (0.86, 4.21)	0.110
Myalgic encephalomyelitis/chronic fatigue syndrome-like (ME/CFS-like) symptoms[‡]	2.60 (1.29, 5.24)	0.008
Digestive symptoms[§]	3.07 (1.36, 6.91)	0.007
Change in taste or smell[‖]	1.68 (0.76, 0.37)	0.197
Upper respiratory symptoms[¶]	1.95 (0.90, 4.24)	0.090
One or more symptoms by different duration		
1-3 months*	1.31 (0.57, 3.02)	0.527
3-6 months*	3.38 (1.19, 9.59)	0.022
6-9 months*	0.58 (0.06, 5.33)	0.630
9-12 months*	2.00 (0.38, 10.57)	0.415

* Duration of symptoms were mutually exclusive categories in the survey question but may overlap depending on how the respondent interpreted the survey question. For example, an individual who experienced three months of symptoms may have responded "1-3 months" or "3-6 months."

[†]Statistical weighting was used to align the sample with U.S. population distributions, adjusting for gender, age, household income, race/ethnicity, household size, education, census region, and metropolitan status. Weights were designed to match the U.S. Census' American Community Survey (ACS) proportions for these variables. Metropolitan status, which is not available from the 1-year ACS, were obtained from the 2020 March Supplement of the Current Population Survey (CPS). Odds ratios were adjusted for age category, sex, race/ethnicity, highest level of education completed, employment status, and census region.

[‡]Myalgic encephalomyelitis/chronic fatigue syndrome-like (ME/CFS-like) symptoms include change in mood, "brain fog," fatigue/tired/weakness, joint/muscle pain, palpitations (heart racing or pounding), post-exertional malaise, problems sleeping, and shortness of breath/breathlessness. (See Appendix B.)
[§]Digestive symptoms include diarrhea, nausea/vomiting, and stomach pain. (See Appendix B.)
[‖]Change in taste or smell, a specific symptom for COVID infection[1], was asked as one question, rather than as two separate symptoms, as on other surveys of patients with PCC. (See Appendix B.)
[¶]Upper respiratory symptoms include cough and sore throat. (See Appendix B.)

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Table 3. Among individuals with and without disabilities, multivariable analyses estimating the odds of having long-term symptoms* and select duration of symptoms† by self-reported SARS-CoV-2 test status‡

With disabilities		
	Odds Ratio (95% confidence interval) *(ref: adults with disability with a negative test history)*	P-value
One or more symptom	4.50 (2.37, 8.54)	<0.001
Two or more symptoms	6.12 (3.10, 12.10)	<0.001
Myalgic encephalomyelitis/chronic fatigue syndrome-like (ME/CFS-like) symptoms§	3.78 (2.05, 6.99)	<0.001
Digestive symptoms‖	3.12 (1.51, 6.48)	0.002
Change in taste or smell¶	52.62 (19.11, 144.92)	<0.001
Upper respiratory symptoms#	9.46 (4.24, 21.11)	<0.001
One or more symptom for 1-3 months*	8.19 (3.97, 16.90)	<0.001
One or more symptom for 3-6 months*	9.73 (3.09, 30.62)	<0.001
One or more symptom for 6-9 months*	1.38 (0.21, 9.31)	0.738
One or more symptom for 9-12 months*	4.36 (0.86, 22.21)	0.076
One or more symptom for more than 12 months*	0.38 (0.08, 1.94)	0.246
Without disabilities		
	Odds Ratio (95% confidence interval) *(ref: adults without disability with a negative test history)*	P-value
One or more symptom	9.88 (7.13, 13.71)	<0.001
Two or more symptoms	15.07 (10.27, 22.13)	<0.001
Myalgic encephalomyelitis/chronic fatigue syndrome-like (ME/CFS-like) symptoms§	9.88 (7.12, 13.71)	<0.001
Digestive symptoms‖	9.19 (4.48, 14.96)	<0.001
Change in taste or smell¶	222.24 (76.57, 645.05)	<0.001
Upper respiratory symptoms#	18.00 (11.30, 28.69)	<0.001
One or more symptom for 1-3 months†	12.61 (8.61, 18.46)	<0.001
One or more symptom for 3-6 months†	11.16 (5.19, 24.00)	<0.001
One or more symptom for 6-9 months†	38.43 (15.82, 93.36)	<0.001
One or more symptom for 9-12 months†	19.55 (4.84, 79.03)	<0.001
One or more symptom for more than 12 months†	1.22 (0.48, 3.12)	0.676

*Long-term symptoms were defined as symptoms lasting longer than 4 weeks since the respondent first experienced symptoms believed to be related to acute SARS-CoV-2 infection, and excluding symptoms that could be a side effect of getting a COVID-19 vaccine (within 7 days of vaccination). For those who never had documented infection.

[†]Duration of symptoms were mutually exclusive categories in the survey question but may overlap depending on how the respondent interpreted the survey question. For example, an individual who experienced three months of symptoms may have responded “1-3 months” or “3-6 months.”

[‡]Statistical weighting was used to align the sample with U.S. population distributions, adjusting for gender, age, household income, race/ethnicity, household size, education, census region, and metropolitan status. Weights were designed to match the U.S. Census’ American Community Survey (ACS) proportions for these variables. Metropolitan status, which is not available from the 1-year ACS, were obtained from the 2020 March Supplement of the Current Population Survey (CPS).

[§]Myalgic encephalomyelitis/chronic fatigue syndrome-like (ME/CFS-like) symptoms include change in mood, "brain fog," fatigue/tired/weakness, joint/muscle pain, palpitations (heart racing or pounding), post-exertional malaise, problems sleeping, and shortness of breath/breathlessness. (See Appendix B.)
[‖]Digestive symptoms include diarrhea, nausea/vomiting, and stomach pain. (See Appendix B.)
[¶]Change in taste or smell, a specific symptom for COVID infection[1], was asked as one question, rather than as two separate symptoms, as on other surveys of patients with PCC. (See Appendix B.)
[#] Upper respiratory symptoms include cough and sore throat. (See Appendix B.)

References

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