Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Disability and Health Journal 14 (2021) 101096

Contents lists available at ScienceDirect

Disability and Health Journal

journal homepage: www.disabilityandhealthjnl.com

Brief Report

Self-reported handwashing and surface disinfection behaviors by U.S. adults with disabilities to prevent COVID-19, Spring 2020

NaTasha D. Hollis, PhD [a, b, *], JoAnn M. Thierry, PhD [a], Amanda G. Garcia-Williams, PhD [a]

[a] COVID-19 Response, Centers for Disease Control and Prevention, Atlanta, GA, USA
[b] Commissioned Corps, U.S. Public Health Service, Atlanta, GA, USA

ARTICLE INFO

Article history:
Received 21 December 2020
Received in revised form
3 March 2021
Accepted 12 March 2021

Keywords:
Coronavirus
Disability
Hygiene
Handwashing
Disinfection

ABSTRACT

Background: Handwashing and surface cleaning and disinfection are two hygiene behaviors promoted to prevent the spread of COVID-19. Persons with disabilities may be at increased risk for severe COVID-19 illness due to underlying medical conditions that have been associated with COVID-19.
Objective: This study aims to describe self-reported hygiene behaviors among U.S. adults with disabilities to prevent transmission of COVID-19.
Methods: Data were obtained from the March 2020 Porter Novelli *ConsumerStyles* survey. This study includes 6463 U.S. adults (≥18 years) who participated in the survey (58.2% response rate). Participants were asked about frequent handwashing and surface disinfection. Participants were also asked six questions to assess disability status and disability type. Prevalence estimates with 95% confidence intervals were calculated; chi-square tests were conducted.
Results: A total of 1295 (20.3%) of survey participants reported at least one disability and their hygiene-related behavior. Overall, 91.3% of respondents with disabilities reported frequent handwashing; only 72% reported frequent surface disinfection. Those with hearing, vision, cognition, mobility, self-care, and independent living disabilities (range: 77.9%–90.6%) were significantly less likely than those without any disability (94.0%) to report frequent handwashing. People with vision (62.2%) and independent living (66.8%) disabilities were less likely to report frequent surface disinfection than those without any disability (74.6%).
Conclusions: Practices such as handwashing and disinfecting surfaces are effective for reducing and preventing the spread of COVID-19. Promotion of hygiene-related practices among people with disabilities is essential. Tailored communications and implementation of evidence-based strategies are needed to address hygiene-related behaviors among the subgroups of people with disabilities most affected.

Published by Elsevier Inc.

Introduction

SARS-CoV-2, the novel coronavirus which causes coronavirus disease 2019 (COVID-19), spreads from person-to-person through respiratory droplets when in close contact, or less commonly through contact with contaminated surfaces.[1] Frequent handwashing and cleaning and disinfection of surfaces in the home are two hygiene-related preventative behaviors promoted during the COVID-19 pandemic.[1] Evidence suggests that people with certain underlying medical conditions such as cancer, obesity, serious heart conditions and Type 2 diabetes are at increased risk for severe illness from COVID-19.[2,3] Some adults with disabilities may be at increased risk for severe illness because of the presence of serious underlying medical conditions; studies have shown that adults with disabilities are three times more likely to have heart disease, stroke, diabetes, or cancer than adults without disabilities.[4]

Broadly defined, disability is a physical or mental impairment that substantially limits one or more major life activity.[5] Approximately 61 million adults living in the U.S. have a disability, representing ~26% of the adult population.[6] To date, little work has been done examining hygiene-related behaviors among adults with disabilities. The purpose of this study is to describe self-reported

* Corresponding author. Disability and Health Promotion Branch, Division of Human Development and Disability, National Center on Birth Defects and Developmental Disabilities, Centers for Disease Control and Prevention, 4770 Buford Hwy NE, MS S106-4, Atlanta, GA, 30341-3717, USA.
E-mail address: nhollis@cdc.gov (N.D. Hollis).

https://doi.org/10.1016/j.dhjo.2021.101096
1936-6574/Published by Elsevier Inc.

hygiene-related behaviors among U.S. adults with disabilities and compare those to adults without disabilities during the COVID-19 pandemic. Results will be used to inform targeted communication efforts among people with disabilities.

Methods

Data for this study were obtained from Porter Novelli *Spring ConsumerStyles* survey. The internet-panel survey, representative of the noninstitutionalized U.S. population, is conducted using Ipsos' KnowledgePanel®.[7] Participants were randomly selected by mail using probability-based sampling. The *Spring ConsumerStyles* survey, fielded from March 19 – April 9, 2020, was emailed to 11,097 adults, aged 18 and older. The final sample included 6463 panelists (58.2% response rate). Data were weighted to match the U.S. Census 2019 U.S. Current Population Survey proportions based on nine characteristics. More information on weighting and *ConsumerStyles* methodology can be found on the Porter Novelli website.[7]

To assess hygiene-related practices in response to coronavirus, respondents were asked: "What, if any, precautions are you taking to prevent coronavirus; " respondents were also asked to "Select all that apply" by responding 'yes' or 'no' to a series of actions. For the current study, we include responses for "Washing hands often with soap and water," or "Disinfecting surfaces at home/work often," referred to as frequent handwashing and frequent surface disinfection henceforth. Coronavirus was used in the question stem rather than COVID-19 to make the question non-technical and plain language.

To assess disability, respondents were asked six standard disability questions.[8] Respondent were asked to "Please answer yes or no to each of the following questions: Are you deaf or have serious difficulty hearing; Are you blind or have serious difficulty seeing, even when wearing glasses; Because of a physical, mental, or emotional condition, do you have serious difficulty concentrating, remembering, or making decisions; Do you have serious difficulty walking or climbing stairs; Do you have difficulty dressing or bathing; and, Because of a physical, mental, or emotional condition, do you have difficulty doing errands alone such as visiting a doctor's office or shopping?" Disability status is defined as a 'yes' response to any of these questions. Disability type is defined based on the 'yes' response indicative of hearing, vision, cognition, mobility, self-care, and independent living. Disability types are not mutually exclusive. Adults with disability were limited to those who reported information on hygiene-related behaviors (n = 1295). Respondents with missing information were excluded so that our study sample contained only respondents with complete information.

Select demographic variables (gender, age, income, education, race/ethnicity, and U.S. census region) were assessed for hygiene-related behaviors by disability status and disability type. Weighted frequencies were calculated using SAS version 9.4 (SAS Institute). We calculated prevalence estimates with 95% confidence intervals (CI) among adults who reported any disability and by disability type for handwashing and surface disinfecting, overall and by demographic characteristics. We also calculated these measures among people without any disability who reported information on hygiene-related behaviors (n = 5095), and these were compared to people with a disability (n = 1295). Comparisons were made using chi-squared tests and a p-value of <0.05 was considered statistically significant. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.[1]

[1] 45 C.F R. part 46, 21 C.F R. part 56; 42 U S C. Sect. 241(d); 5 U S C. Sect. 552a; 44 U S C. Sect. 3501 et seq.

Results

A total of 20.3% of the U.S. adult population reported at least one disability. Among adults with disabilities, 91.3% (95% CI: 89.2–93.4) reported frequent handwashing which is significantly less than those without a disability (94.0% [95% CI: 93.1–94.9]; p = 0.0091) (Table 1); nonetheless, both groups self-reported a high prevalence of frequent handwashing. Additionally, 72.0% (95% CI: 68.8–75.1) of participants with a disability reported frequent surface disinfection behaviors and no difference in prevalence was identified when compared to people without a disability. Education was associated with handwashing among people with any disability, and gender was associated with frequent surface disinfection.

The prevalence of frequent handwashing varied by disability type, ranging from 77.9% (95% CI: 69.2–86.5) for people with vision disability to 90.6% (95% CI: 87.1–94.0) for those with cognitive disability (Table 2). When compared to people without any disability, those with hearing, vision, cognition, mobility, self-care, and independent living disabilities were all significantly less likely to report frequent handwashing (Table 2). Factors associated with frequent handwashing included gender, age, income, and race/ethnicity among people with hearing disabilities and education level among those with mobility disabilities (Table 2).

Frequent surface disinfection prevalence also varied by disability type, ranging from 62.2% (95% CI: 52.6–71.8) for people with vision impairment to 72.0% (95% CI: 66.6–77.4) for those with cognitive disability (Table 3). When compared to people without any disability, those with vision and independent living disabilities were significantly less likely to report frequent surface disinfection (Table 3). Factors associated with frequent surface disinfection included income among people with cognitive disabilities, gender and education among people with mobility disabilities, and age and income among those with independent living disabilities (Table 3).

Discussion

There are a growing number of peer-reviewed articles addressing COVID-19 and people with disabilities[9–13]; however, they are general and were not focused on hygiene-related preventative behaviors. This study found that self-reported rates of frequent handwashing among people with any disability were lower than those without a disability. The prevalence of frequent surface disinfection was similar between those with and without a disability, however, for both groups this behavior was only reported by <75% of respondents. People with vision disabilities and independent living disabilities reported lower rates of both frequent handwashing and surface disinfection, when compared to people without disabilities. Additionally, people with hearing, cognition, mobility, and self-care disabilities reported lower rates of handwashing compared to people without those disabilities. Few pre-pandemic studies have examined hygiene-related behaviors among people with disability,[14–17] so little information exists to help explain these differences in behavior. Frequent handwashing has been found to be associated with decreased risk of infection with SARS-CoV-2,[18] therefore it is critical to identify strategies to promote this behavior among people with disabilities who, may be at increased risk for severe illness from COVID-19 because of higher prevalence of underlying conditions. Several of the factors associated with hygiene compliance among different demographic groups (gender, age, race/ethnicity, education, and household income) were consistent with work conducted among general populations which have been reported during the COVID-19 pandemic[19–21] and during previous respiratory pandemics.[22] Additional work is needed to further examine demographic factors associated with hygiene-related behavior among different

Table 1
Percentages of respondents with disabilities who reported frequent handwashing and frequent surface disinfection to prevent coronavirus by demographic characteristic, Spring 2020.

Characteristic	Categories	Frequent Handwashing	Frequent Surface Disinfection
		weighted % (95% CI)	weighted % (95% CI)
Overall	Disability (n = 1295)	**91.3 (89.2–93.4)**	72.0 (68.8–75.1)
	No Disability (n = 5095)	**94.0 (93.1–94.9)**	74.6 (73.1–76.1)
Among adults with disabilities (n = 1295)			
Gender	Female	91.4 (88.5–94.3)	**76.4 (72.3–80.5)**
	Male	91.2 (88.2–94.2)	**67.1 (62.3–71.9)**
Age	18–29	90.1 (83.8–96.4)	64.8 (54.8–74.7)
	30–44	88.5 (83.3–93.6)	73.6 (67.0–80.2)
	45–59	90.7 (86.7–94.7)	75.0 (69.4–80.7)
	60+	93.6 (90.9–96.2)	72.9 (68.6–77.3)
Income	<$25k	89.4 (84.6–94.1)	75.7 (69.4–82.1)
	$25k - <$50k	92.2 (88.6–95.8)	70.3 (64.3–76.3)
	$50k - <$75k	91.5 (86.1–97.0)	66.1 (57.3–75.0)
	≥$75k	91.8 (88.4–95.3)	73.4 (68.3–78.4)
Education	Less than high school	**84.0 (76.5–91.6)**	68.7 (59.3–78.1)
	High school	**90.8 (87.6–94.0)**	70.4 (65.1–75.6)
	Some college	**94.5 (91.7–97.4)**	78.0 (73.0–83.1)
	Bachelor's degree or higher	**94.7 (91.9–97.5)**	68.9 (63.0–74.9)
Race/Ethnicity	Non-Hispanic White	93.1 (90.9–95.2)	70.9 (67.2–74.6)
	Non-Hispanic Black	88.5 (81.8–95.1)	77.1 (68.6–85.7)
	Hispanic or Latino	86.4 (82.3–94.7)	74.0 (65.7–82.4)
	Multiracial/Other	89.0 (78.9–98.1)	65.5 (51.9–79.1)
Region	Northeast	93.5 (89.1–97.9)	74.8 (67.1–82.5)
	Midwest	91.1 (86.8–95.3)	70.7 (64.1–77.3)
	South	91.7 (88.4–95.1)	73.3 (68.2–78.3)
	West	89.2 (84.3–94.0)	68.9 (62.3–75.4)

Bolded categories are statistically significant by chi-squared test ($p < 0.05$).

disability types during the COVID-19 pandemic.

Limitations

First, this survey relies on self-reported data and the findings are subject to reporting bias from social desirability. Second, although this survey used probability-based sampling strategies to obtain a nationally representative noninstitutionalized sample, survey participants may be different from the general U.S. population. Due to the large proportion of non-responses, national representation of the U.S., population may have been further impacted. Third, this survey did not ask about use of hand sanitizer which could have displaced handwashing behavior among certain groups with low handwashing compliance. Fourth, stability of data estimates may

Table 2
Percentages of respondents, by disability type, who reported frequent handwashing to prevent coronavirus by demographic characteristic, Spring 2020.

Characteristic	Categories	Hearing	Vision	Cognition	Mobility	Self-Care	Independent Living
		weighted % (95% CI)	weighted % (95% CI)	weighted % (95% CI)	weighted % (95% CI)	weighted % (95% CI)	weighted % (95% CI)
Overall	Disability (by type)	**89.8 (85.3–94.3)**	**77.9 (69.2–86.5)**	**90.6 (87.1–94.0)**	**90.5 (87.3–93.8)**	**86.1 (79.6–92.6)**	**87.5 (82.7–92.4)**
	No Disability	**94.0 (93.1–94.9)**	**94.0 (93.1–94.9)**	**94.0 (93.1–94.9)**	**94.0 (93.1–94.9)**	**94.0 (93.1–94.9)**	**94.0 (93.1–94.9)**
Disability Type		n = 370	n = 189	n = 492	n = 574	n = 190	n = 372
Gender	Female	**83.1 (73.8–92.3)**	74.3 (62.1–86.5)	92.3 (88.4–96.2)	92.3 (88.3–96.3)	81.9 (71.8–91.9)	89.3 (83.1–95.5)
	Male	**94.0 (89.6–98.4)**	83.3 (72.0–94.6)	88.3 (82.3–94.3)	88.3 (82.9–93.6)	92.1 (85.7–98.4)	85.1 (77.2–92.9)
Age	18–29	**66.4 (41.0–91.8)**	68.2 (45.5–91.0)	92.5 (86.0–99.0)	82.6 (63.7–100.0)	81.7 (60.4–100.0)	85.3 (73.8–96.8)
	30–44	**86.0 (68.5–100.0)**	69.9 (52.2–87.5)	94.5 (90.5–98.6)	80.3 (66.6–94.0)	76.1 (58.1–94.2)	90.5 (82.7–98.2)
	45–59	**90.6 (83.3–97.8)**	86.0 (73.1–99.0)	86.3 (78.4–94.3)	91.5 (86.4–96.6)	82.5 (71.1–93.3)	81.5 (70.7–92.4)
	60+	**94.8 (91.2–98.5)**	84.4 (70.0–98.7)	84.0 (73.2–94.7)	93.7 (90.4–97.0)	97.3 (93.2–100.0)	91.9 (85.1–98.8)
Income	<$25k	**80.5 (61.8–99.1)**	82.0 (66.3–97.7)	90.9 (85.7–96.1)	87.1 (79.5–94.8)	85.9 (75.2–96.6)	89.4 (81.7–97.1)
	$25k - <$50k	**86.9 (77.6–96.2)**	81.9 (66.8–97.1)	94.9 (90.6–99.3)	93.5 (88.9–98.0)	86.1 (72.7–99.5)	91.5 (84.4–98.7)
	$50k - <$75k	**90.8 (78.9–100.0)**	74.6 (46.7–100.0)	84.9 (72.3–97.5)	89.8 (80.5–99.1)	82.8 (60.0–100.0)	79.0 (62.4–95.6)
	≥$75k	**93.8 (89.1–98.4)**	71.5 (55.0–88.0)	88.1 (80.2–96.0)	91.2 (85.9–96.5)	88.1 (77.8–98.4)	84.1 (72.5–95.8)
Education	Less than high school	78.3 (59.6–96.9)	63.9 (39.2–88.5)	85.0 (74.8–95.1)	**83.0 (72.3–93.6)**	87.7 (75.1–100.0)	82.5 (71.9–93.1)
	High school	91.7 (85.7–97.7)	82.5 (70.6–94.4)	91.5 (86.7–96.3)	**89.1 (84.0–94.1)**	76.0 (61.2–90.9)	88.8 (81.9–95.6)
	Some college	90.7 (82.5–98.8)	79.9 (63.4–96.3)	93.1 (88.5–97.8)	**95.4 (91.8–98.9)**	92.7 (82.3–100.0)	90.9 (82.1–99.6)
	Bachelor's degree or higher	94.4 (90.0–98.7)	82.9 (68.0–97.8)	93.5 (87.7–99.4)	**94.9 (89.9–99.8)**	83.2 (66.9–99.6)	93.5 (86.2–100.0)
Race/Ethnicity	Non-Hispanic White	**95.5 (91.9–99.1)**	83.0 (71.4–94.5)	92.8 (89.2–96.3)	92.0 (88.5–95.5)	90.1 (83.6–96.5)	89.6 (84.3–94.8)
	Non-Hispanic Black	**61.8 (33.5–90.1)**	62.6 (40.8–84.5)	84.0 (72.0–96.0)	91.6 (83.5–99.7)	79.8 (62.4–97.1)	81.9 (65.6–98.3)
	Hispanic or Latino	**83.2 (69.5–96.8)**	84.7 (66.3–100.0)	88.1 (78.0–98.2)	84.4 (73.7–95.0)	86.0 (70.9–100.0)	82.9 (68.4–97.5)
	Multiracial/Other	**70.9 (38.1–100.0)**	68.1 (38.1–98.0)	92.8 (84.1–100.0)	91.6 (81.1–100.0)	83.1 (57.5–100.0)	90.6 (73.2–100.0)
Region	Northeast	90.4 (77.9–100.0)	74.1 (39.7–100.0)	91.7 (85.6–97.8)	92.8 (86.4–99.3)	77.4 (57.2–97.7)	89.5 (79.5–99.4)
	Midwest	86.8 (76.8–96.9)	78.8 (58.3–99.4)	91.3 (83.4–99.2)	89.6 (82.9–96.2)	87.3 (74.4–100.0)	89.7 (80.7–98.6)
	South	92.8 (86.4–99.3)	74.8 (60.9–88.7)	92.0 (86.9–97.2)	91.1 (86.2–96.1)	88.2 (78.9–97.4)	87.6 (79.1–96.1)
	West	87.0 (76.8–97.3)	83.9 (71.9–96.0)	86.3 (77.3–95.2)	88.6 (80.2–97.0)	88.8 (76.2–100.0)	83.2 (71.3–95.1)

Bolded categories are statistically significant by chi-squared test ($p < 0.05$); Disability types are not mutually exclusive.

Table 3
Percentages of respondents, by disability type, who reported frequent surface disinfection to prevent coronavirus by demographic characteristics, Spring 2020.

Characteristic	Categories	Hearing	Vision	Cognition	Mobility	Self-Care	Independent Living
		weighted % (95% CI)	weighted % (95% CI)	weighted % (95% CI)	weighted % (95% CI)	weighted % (95% CI)	weighted % (95% CI)
Overall	Disability (by type)	68.9 (63.1–74.7)	**62.2 (52.6–71.8)**	72.0 (66.6–77.4)	71.9 (67.4–76.4)	70.7 (61.8–79.6)	**66.8 (60.1–73.6)**
	No Disability	74.6 (73.1–76.0)	**74.6 (73.1–76.0)**	74.6 (73.1–76.0)	74.6 (73.1–76.0)	74.6 (73.1–76.0)	**74.6 (73.1–76.0)**
Disability Type		n = 370	n = 189	n = 492	n = 574	n = 190	n = 372
Gender	Female	68.7 (58.3–79.2)	67.4 (55.0–79.8)	73.9 (67.1–80.7)	**78.4 (72.8–84.0)**	71.1 (58.9–83.3)	72.7 (64.3–81.1)
	Male	69.1 (62.2–75.9)	54.1 (38.3–69.9)	69.6 (60.8–78.4)	**63.6 (56.3–70.9)**	70.1 (56.7–83.5)	58.8 (47.6–70.0)
Age	18–29	59.2 (32.6–85.7)	52.7 (28.3–77.1)	67.0 (55.0–78.9)	61.1 (38.5–83.7)	59.5 (32.6–86.4)	**54.3 (39.1–69.5)**
	30–44	72.6 (53.3–91.9)	70.8 (53.7–87.9)	79.9 (72.8–87.1)	62.0 (47.1–76.9)	68.1 (48.0–88.1)	**77.5 (66.5–88.5)**
	45–59	68.7 (57.6–79.7)	66.7 (50.1–82.9)	72.7 (63.0–82.3)	77.1 (69.5–84.7)	72.2 (58.8–85.5)	**64.7 (51.9–77.5)**
	60+	70.2 (63.4–77.0)	61.2 (44.7–77.7)	65.3 (51.6–79.0)	73.3 (67.7–79.0)	77.6 (62.8–92.5)	**73.1 (61.5–84.7)**
Income	<$25k	64.8 (45.6–84.0)	64.8 (47.4–82.3)	**78.1 (69.6–86.5)**	70.7 (61.4–79.9)	77.9 (64.4–91.3)	**76.6 (66.2–87.0)**
	$25k - <$50k	65.2 (53.6–76.9)	65.6 (46.5–84.8)	**73.1 (63.4–82.9)**	72.8 (64.0–80.5)	71.1 (54.5–87.6)	**70.0 (58.6–81.3)**
	$50k - <$75k	73.6 (59.1–88.0)	47.6 (20.5–74.7)	**54.6 (38.4–70.8)**	63.9 (51.3–76.5)	62.3 (38.3–86.3)	**43.9 (24.8–63.0)**
	≥$75k	70.7 (62.7–78.7)	61.5 (44.5–78.5)	**74.0 (63.8–84.2)**	75.9 (68.0–83.7)	65.6 (45.6–85.6)	**62.6 (47.0–78.3)**
Education	Less than high school	61.8 (41.3–82.2)	58.0 (33.3–82.6)	69.1 (56.0–82.1)	**70.4 (58.0–82.8)**	77.4 (60.3–94.6)	65.0 (51.6–78.4)
	High school	73.8 (65.0–82.6)	57.6 (41.4–73.8)	71.4 (62.3–80.5)	**66.6 (58.8–74.3)**	62.3 (44.5–80.1)	59.5 (47.4–71.4)
	Some college	69.1 (58.4–79.8)	68.7 (51.0–89.5)	76.4 (67.8–84.9)	**82.2 (75.5–88.8)**	71.2 (54.3–88.0)	80.4 (69.2–91.5)
	Bachelor's degree or higher	66.8 (57.2–76.4)	67.3 (48.6–86.0)	70.1 (57.1–83.0)	**65.5 (56.4–74.7)**	67.9 (54.3–88.0)	64.3 (49.4–79.2)
Race/Ethnicity	Non-Hispanic White	73.0 (67.0–78.9)	61.0 (47.5–74.6)	69.1 (62.0–76.3)	71.9 (66.7–77.1)	78.3 (68.1–88.5)	68.1 (60.2–76.0)
	Non-Hispanic Black	53.6 (24.6–82.6)	50.9 (28.4–73.3)	83.4 (71.9–94.8)	75.6 (64.1–87.2)	59.2 (38.1–80.3)	77.3 (60.0–94.5)
	Hispanic or Latino	66.2 (49.1–83.3)	80.6 (61.8–99.3)	77.6 (65.0–90.2)	68.1 (55.0–81.3)	66.4 (38.8–94.0)	61.4 (41.5–81.3)
	Multiracial/Other	40.4 (13.5–67.2)	50.2 (20.2–80.2)	59.0 (38.5–79.5)	71.8 (55.0–88.5)	67.6 (37.5–97.7)	53.7 (28.0–79.4)
Region	Northeast	71.6 (57.3–86.0)	37.8 (8.7–66.8)	76.1 (64.2–88.0)	72.1 (61.0–83.3)	72.8 (52.2–93.5)	70.8 (56.2–85.3)
	Midwest	67.2 (54.6–79.8)	61.4 (39.1–83.8)	65.2 (53.0–77.3)	76.4 (67.7–85.2)	80.0 (63.5–96.6)	64.6 (51.4–77.9)
	South	73.5 (64.1–82.8)	56.6 (41.3–71.8)	77.9 (69.5–86.3)	69.9 (62.3–77.1)	59.4 (44.1–74.6)	67.7 (55.7–79.7)
	West	60.7 (49.0–72.4)	80.6 (68.0–93.0)	64.8 (52.9–76.8)	71.5 (61.7–81.3)	78.1 (59.8–96.3)	64.0 (48.8–79.2)

Bolded categories are statistically significant by chi-squared test ($p < 0.05$); Disability types are not mutually exclusive.

be weakened when stratifying disability types by hygiene-related behavior and demographics due to small sample size.

Conclusions

Additional research to determine potential reasons for variations in hygiene-related practices by disability type may help to better understand the underlying contributing factors to hygiene practices among people with disability. Expansion of hygiene-related practices to prevent COVID-19 among people with disabilities is essential. Tailored communications and implementation of evidence-based strategies are needed to address hygiene-related behaviors among disability subgroups with less adherence. Future health communication efforts should be tailored to specific audiences and produced in accessible formats such as plain language, large print, Braille and American Sign Language.

Disclaimer

The findings and conclusions in this article are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of competing interest

The authors have no conflicts of interest to report for this study.

Acknowledgments

Survey respondents; Fred Fridinger, Office of the Associate Director for Communication, CDC; Deanne Weber, Porter Novelli Public Services.

References

1. CDC. *How to Protect Yourself & Others*; 2020. https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/prevention.html. Accessed December 2, 2020.
2. CDC. *Coronavirus Disease 2019 (COVID-19) Evidence Used to Update the List of Underlying Medical Conditions that Increase a Person's Risk of Severe Illness from COVID-19*; 2020. https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/evidence-table.html. Accessed December 2, 2020.
3. CDC. *Coronavirus Disease 2019 (COVID-19) Guidance for People with Underlying Health Conditions*; 2020. https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html. Accessed December 2, 2020.
4. Carroll D, Courtney-Long E, Stevens A, et al. Disability and physical activity — United States, 2009-2012. *MMWR (Morb Mortal Wkly Rep)*. 2014;63(18):407–413.
5. Civil Rights Unit. *Americans with Disabilities Act*; 1990. https://www.ada.gov/pubs/adastatute08.htm. Accessed August 25, 2020.
6. Okoro C, Hollis N, Cyrus A, Griffin-Blake S. Prevalence of disabilities and health care access by disability status and type among adults-United States, 2016. *MMWR (Morb Mortal Wkly Rep)*. 2018;67(32):882–997.
7. Porter Novelli. *PNStyles*; 2020. http://styles.porternovelli.com/. Accessed October 2, 2020.
8. HHS. *U.S. Department of Health and Human Services Implementation Guidance on Data Collection Standards for Race, Ethnicity, Sex, Primary Language, and Disability*; 2011. https://aspe.hhs.gov/basic-report/hhs-implementation-guidance-data-collection-standards-race-ethnicity-sex-primary-language-and-disability-status#Data. Accessed October 15, 2020.
9. Bernard A, Weiss S, Stein JD, et al. Assessing the impact of COVID-19 on persons with disabilities: development of a novel survey. *Int J Publ Health*. 2020;65(6):755–757.
10. Boyle CA, Fox MH, Havercamp SM, Zubler J. The public health response to the COVID-19 pandemic for people with disabilities. *Disabil Health J*. 2020;13(3):100943.
11. Park J. Unraveling the invisible but harmful impact of COVID-19 on deaf older adults and older adults with hearing loss. *J Gerontol Soc Work*. 2020:1–4.
12. Turk MA, Landes SD, Formica MK, Goss KD. Intellectual and developmental disability and COVID-19 case-fatality trends: TriNetX analysis. *Disabil Health J*. 2020;13(3):100942.
13. Senjam SS. Impact of COVID-19 pandemic on people living with visual disability. *Indian J Ophthalmol*. 2020;68(7):1367–1370.
14. Kang YS, Chang YJ. Using a motion-controlled game to teach four elementary school children with intellectual disabilities to improve hand hygiene. *J Appl*

Res Intellect Disabil. 2019;32(4):942–951.
15. Lee RL, Leung C, Tong WK, Chen H, Lee PH. Comparative efficacy of a simplified handwashing program for improvement in hand hygiene and reduction of school absenteeism among children with intellectual disability. *Am J Infect Contr*. 2015;43(9):907–912.
16. Lee RL, Lee PH. To evaluate the effects of a simplified hand washing improvement program in schoolchildren with mild intellectual disability: a pilot study. *Res Dev Disabil*. 2014;35(11):3014–3025.
17. Choi KS, Wong PK, Chung WY. Using computer-assisted method to teach children with intellectual disabilities handwashing skills. *Disabil Rehabil Assist Technol*. 2012;7(6):507–516.
18. Doung-ngern P, Suphanchaimat R, Panjangampatthana A, et al. Case-Control Study of Use of Personal Protective Measures and Risk for SARS-CoV 2 Infection, Thailand. *Emerging Infectious Diseases*. 2020;26(11):2607–2616. https://doi.org/10.3201/eid2611.203003.
19. Alsan M, Stantcheva S, Yang D, Cutler D. Disparities in coronavirus 2019 reported incidence, knowledge, and behavior among US adults. *JAMA Netw Open*. 2020;3(6), e2012403.
20. Haston JC, Miller GF, Berendes D, et al. Characteristics associated with adults remembering to wash hands in multiple situations before and during the COVID-19 pandemic — United States, October 2019 and June 2020. *MMWR (Morb Mortal Wkly Rep)*. 2020;69:1443–1449.
21. Czeisler ME, Garcia-Williams AG, Molinari N, et al. Demographic characteristics, experiences, and beliefs with hand hygiene among adults during the COVID-19 pandemic — United States, June 24-30 2020. *MMWR (Morb Mortal Wkly Rep)*. 2020;69, 14485–1491.
22. Bish A, Michie S. Demographic and attitudinal determinants of protective behaviours during a pandemic: A review. *Br J Health Psychol*. 2010;15(Pt 4):797–824.