

# Handwashing and disinfection precautions taken by U.S. adults to prevent coronavirus disease 2019, Spring 2020

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## Research note

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# Abstract

**Objectives.** The objectives of this study were to assess self-reported hygiene precautions taken by U.S. adults during spring 2020 to prevent coronavirus disease 2019 (COVID-19) and to identify demographic characteristics associated with these hygiene precautions.

**Results.** We obtained data from Porter Novelli Public Services's national survey, *Spring ConsumerStyles*, conducted March 19 – April 9, 2020 among a nationally representative random sample of 6,463 U.S. adults aged 18 years or older. We present data from the survey question: "What, if any, precautions are you taking to prevent coronavirus?". Respondents replied yes or no to the following precautions: washing hands often with soap and water and disinfecting surfaces at home and work often. Most respondents reported taking hygiene-related precautions to prevent COVID-19; more respondents reported handwashing (93%) than disinfecting surfaces (74%). Men, younger respondents, those with lower income and education levels, and respondents in self-rated poor health had lower reported rates of both handwashing and disinfecting surfaces. Communications about hygiene precautions for COVID-19 prevention may need to target sub-populations with the greatest gaps in hygiene-related practices. Research identifying barriers to these practices and developing effective messaging could inform and improve these communications.

## Introduction

From January through July 2020, 4,225,687 cases of coronavirus disease 2019 (COVID-19), caused by the virus SARS-CoV-2, were reported in the U.S.; these included 146,546 deaths [1]. Although SARS-CoV-2 is thought to [spread mainly from person to person](#), it is possible that people can become infected by touching something with the virus on it and then touching their own mouth, nose, or possibly eyes [2]. CDC has provided guidance to the public to help prevent the spread of COVID-19, including handwashing and cleaning and disinfection guidance [3]. These recommendations include handwashing with soap and water for at least 20 seconds, using hand sanitizer with at least 60% alcohol, and cleaning and disinfecting frequently touched surfaces daily, with products approved by the Environmental Protection Agency. To assess the U.S. public's adherence to these recommendations, we analyzed national survey data on respondents' self-reported hygiene-related precautions (handwashing and surface disinfection) taken to prevent COVID-19. We also examined associations between respondents' demographic characteristics and their self-reported hygiene-related precautions.

## Methods

Porter Novelli Public Services administers a national survey, called *Spring ConsumerStyles*, conducted using Ipsos' KnowledgePanel, which is representative of the non-institutionalized U.S. population [4]. Respondents are randomly recruited by mail through probability-based, stratified sampling to participate in the survey panel. They receive the surveys through email and complete them online; they are provided internet access and a computer, if needed. Respondents receive reward points they can redeem online for gift cards or prizes. The 2020 *Spring ConsumerStyles* survey was conducted from March 19 – April 9, 2020 and was sent via email to 11,097 participants. The final sample included 6,463 adults who completed the survey, yielding a response rate of 58.2%, which was similar to the 2019 *Spring ConsumerStyles* survey [4]. The analyses were

weighted to match the U.S. Census 2019 U.S. Current Population Survey proportions by gender, age, annual household income, race/ethnicity, household size, education, census region, metropolitan status, and parental status. See the Porter Novelli website for more information on *ConsumerStyles* methodology [4].

Coronavirus was defined for respondents as ‘the 2019 novel coronavirus’ as part of the survey. To assess hygiene-related precautions taken in response to COVID-19, respondents were asked, “What, if any, precautions are you taking to prevent coronavirus?”. They then responded yes or no to a series of actions, listed randomly. We present data on the following precautions: washing hands often with soap and water and disinfecting surfaces at home/work often (hereafter, referred to as handwashing and disinfecting surfaces).

We calculated percentages for both precautions, overall and by demographic characteristics (Table 1). The data on demographic characteristics of gender, age, income, education, race/ethnicity, metropolitan status (metropolitan vs. non-metropolitan), and geographic region (based on U.S. Census regions) were collected when respondents agreed to participate in the panel; data on self-rated health were collected in the survey itself. We calculated prevalence ratios for comparisons across demographic categories by calculating the ratio of the prevalence of behavior in one category compared to another (e.g., handwashing prevalence for females vs. males). Prevalence ratios, 95% confidence intervals, and p-values were calculated with Zou’s modified Poisson approach [5] (Table 2). This approach uses generalized estimating equations estimation method fitting a Poisson model to a binary response with a REPEATED statement in SAS (version 9.4 [SAS Institute]) to obtain robust error variances. We discuss below comparisons significant at  $p < .05$ . Multiple comparison adjustments were not made. We weighted the data to adjust for selection and nonresponse.

Table 1  
 Percentages of respondents who reported handwashing and disinfecting surfaces often to prevent coronavirus, by demographic characteristics – *Spring ConsumerStyles 2020*

Characteristic	Categories	Washing hands often n (weighted %)	Disinfecting surfaces often n (weighted %)
All respondents	–	6,013 (93.4%)	4,768 (74.0%)
Gender	Female	3,153 (94.5)	2,624 (78.7)
	Male	2,860 (92.1)	2,145 (69.1)
Age	18–29	1,194 (91.4)	909 (69.6)
	30–44	1,546 (90.1)	1,182 (73.4)
	45–59	1,546 (94.7)	1,261 (77.2)
	≥ 60	1,822 (96.4)	1,417 (74.9)
Income	<\$25 k	745 (86.4)	587 (68.1)
	\$25 k-\$49 k	1,050 (92.9)	850 (75.2)
	\$50 k-\$99 k	1,977 (93.6)	1,560 (73.9)
	≥\$100 k	2,242 (95.9)	1,771 (75.8)
Education	Less than high school	550 (84.7)	463 (71.4)
	High school	1,662 (91.7)	1,324 (73.1)
	Some college	1,713 (95.0)	1,812 (76.6)
	Bachelor’s degree or higher	2,088 (96.0)	1,599 (73.5)
Race/Ethnicity	Non-Hispanic White	3,847 (94.0)	2,982 (72.8)
	Non-Hispanic Black	683 (91.2)	596 (79.6)
	Hispanic	964 (92.0)	816 (77.9)
	Multiracial/Other	91 (96.4)	68 (72.7)
Self-rated health <sup>1</sup>	Excellent	2,333 (95.4)	1,874 (76.6)
	Very good	2,237 (94.1)	1,759 (74.0)
	Good	749 (90.0)	566 (68.0)

<sup>1</sup>Health status assessed by asking “In general, would you say your health is...”

<sup>2</sup>Metropolitan status was defined as a core-based statistical area.

<sup>3</sup> Region categories based on U.S. Census

Characteristic	Categories	Washing hands often n (weighted %)	Disinfecting surfaces often n (weighted %)
	Fair	577 (92.4)	470 (75.3)
	Poor	113 (75.2)	96 (63.4)
Region <sup>3</sup>	Northeast	1,075 (95.4)	865 (76.8)
	Midwest	1,248 (93.8)	994 (74.7)
	South	2,264 (92.8)	1,815 (74.4)
	West	1,427 (92.5)	1,094 (70.9)
Metropolitan status <sup>2</sup>	Metro	5,233 (93.7)	4,169 (74.6)
	Non-metro	780 (91.3)	560 (70.2)
<sup>1</sup> Health status assessed by asking "In general, would you say your health is..."			
<sup>2</sup> Metropolitan status was defined as a core-based statistical area.			
<sup>3</sup> Region categories based on U.S. Census			

Table 2

Prevalence ratios, confidence intervals, and p-values for comparisons of respondents' self-reported handwashing and surface disinfecting, by demographic characteristics – *Spring ConsumerStyles 2020\**

Characteristic	Comparison	Washing hands often				Disinfecting surfaces often			
		% vs. %	PR <sup>1</sup>	(95% CI <sup>2</sup> )	p	% vs. %	PR <sup>1</sup>	(95% CI <sup>2</sup> )	p
Gender	Female vs. Male	<b>94.5 vs. 92.1</b>	<b>1.03</b>	<b>(1.01, 1.04)</b>	<b>.004</b>	78.7 vs. 69.1	<b>1.14</b>	<b>(1.10, 1.18)</b>	<b>.001</b>
Age	≥ 60 vs. 45–59	<b>96.4 vs. 94.7</b>	<b>1.02</b>	<b>(1.00, 1.03)</b>	<b>.037</b>	74.9 vs. 77.2	0.97	(0.933, 1.01)	.125
	≥ 60 vs. 30–44	<b>96.4 vs. 90.1</b>	<b>1.07</b>	<b>(1.05, 1.10)</b>	<b>.001</b>	74.9 vs. 73.4	1.05	(0.99, 1.12)	.121
	≥ 60 vs. 18–29	<b>96.4 vs. 91.4</b>	<b>1.05</b>	<b>(1.02, 1.09)</b>	<b>.001</b>	<b>74.9 vs. 69.6</b>	<b>1.08</b>	<b>(1.01, 1.15)</b>	<b>.026</b>
	45–59 vs. 30–44	<b>94.7 vs. 90.1</b>	<b>1.05</b>	<b>(1.03, 1.08)</b>	<b>.001</b>	<b>77.2 vs. 73.4</b>	<b>1.05</b>	<b>(1.01, 1.10)</b>	<b>.023</b>
	45–59 vs. 18–29	<b>94.7 vs. 91.4</b>	<b>1.04</b>	<b>(1.01, 1.07)</b>	<b>.022</b>	<b>77.2 vs. 69.6</b>	<b>1.09</b>	<b>(1.00, 1.19)</b>	<b>.048</b>
	30–44 vs. 18–29	90.1 vs. 91.4	0.98	(0.95, 1.01)	.392	73.4 vs. 69.6	1.05	(0.98, 1.13)	.132
Income	≥\$100 k vs. \$50 k–\$99 k	<b>95.9 vs. 93.6</b>	<b>1.02</b>	<b>(1.01, 1.04)</b>	<b>.010</b>	75.8 vs. 73.9	1.03	(0.98, 1.07)	.242
	≥\$100 k vs. \$25 k–\$49 k	<b>95.9 vs. 92.9</b>	<b>1.03</b>	<b>(1.00, 1.06)</b>	<b>.005</b>	75.8 vs. 75.2	1.00	(0.93, 1.07)	.984
	≥\$100 k vs. <\$25 k	<b>95.9 vs. 86.4</b>	<b>1.11</b>	<b>(1.07, 1.16)</b>	<b>.001</b>	<b>75.8 vs. 68.1</b>	<b>1.11</b>	<b>(1.04, 1.19)</b>	<b>.002</b>
	\$50 k–\$99 k vs. \$25 k–\$49 k	93.6 vs. 92.9	1.01	(0.98, 1.03)	.520	73.9 vs. 75.2	0.98	(0.93, 1.04)	.508

<sup>1</sup> Prevalence Ratio (PR)

<sup>2</sup> Confidence Interval (CI)

Bold indicates significant comparisons (p < .05).

		Washing hands often				Disinfecting surfaces often			
	\$50 k-\$99 k vs. <\$25 k	<b>93.6</b> vs. <b>86.4</b>	<b>1.08</b>	<b>(1.04, 1.13)</b>	<b>.001</b>	<b>73.9</b> vs. <b>68.1</b>	<b>1.12</b>	<b>(1.01, 1.23)</b>	<b>.026</b>
	\$25 k-\$49 k vs. <\$25 k	<b>92.9</b> vs. <b>86.4</b>	<b>1.08</b>	<b>(1.03, 1.12)</b>	<b>.001</b>	<b>75.2</b> vs. <b>68.1</b>	<b>1.10</b>	<b>(1.02, 1.19)</b>	<b>.010</b>
Education	Bachelor's degree or higher vs. Some college	96.0 vs. 95.0	1.01	(0.99, 1.03)	.210	<b>73.5</b> vs. <b>76.6</b>	<b>0.96</b>	<b>(0.92, 1.00)</b>	<b>.043</b>
	Bachelor's degree or higher vs. High school	<b>96.0</b> vs. <b>91.7</b>	<b>1.04</b>	<b>(1.02, 1.07)</b>	<b>.001</b>	73.5 vs. 73.1	1.02	(0.96, 1.09)	.535
	Bachelor's degree or higher vs. <High school	<b>96.0</b> vs. <b>84.7</b>	<b>1.13</b>	<b>(1.07, 1.20)</b>	<b>.001</b>	73.5 vs. 71.4	1.03	(0.95, 1.12)	.494
	Some college vs. High school	<b>95.0</b> vs. <b>91.7</b>	<b>1.04</b>	<b>(1.01, 1.06)</b>	<b>.002</b>	76.6 vs. 73.1	1.05	(1.00, 1.10)	.054
	Some college vs. <High school	<b>95.0</b> vs. <b>84.7</b>	<b>1.12</b>	<b>(1.06, 1.19)</b>	<b>.001</b>	76.6 vs. 71.4	1.11	(0.99, 1.24)	.074
	High school vs. <High school	<b>91.7</b> vs. <b>84.7</b>	<b>1.08</b>	<b>(1.02, 1.15)</b>	<b>.006</b>	73.1 vs. 71.4	1.02	(0.94, 1.12)	.595
Race/Ethnicity	Non-Hispanic Black vs. Non-Hispanic White	91.2 vs. 94.0	0.97	(0.94, 1.00)	.080	<b>79.6</b> vs. <b>72.8</b>	<b>1.09</b>	<b>(1.04, 1.15)</b>	<b>.001</b>
	Hispanic vs. Non-Hispanic White	92.0 vs. 94.0	0.98	(0.95, 1.01)	.141	<b>77.9</b> vs. <b>72.8</b>	<b>1.07</b>	<b>(1.02, 1.13)</b>	<b>.011</b>

<sup>1</sup> Prevalence Ratio (PR)

<sup>2</sup> Confidence Interval (CI)

Bold indicates significant comparisons (p < .05).

		Washing hands often				Disinfecting surfaces often			
	Hispanic vs. Non-Hispanic Black	92.0 vs. 91.2	1.01	(0.97, 1.05)	.679	77.9 vs. 79.6	0.98	(0.91, 1.05)	.531
	Multiracial/Other vs. Non-Hispanic White	94.5 vs. 94.0	1.01	(0.97, 1.04)	.752	72.7 vs. 72.8	0.94	(0.86, 1.02)	.120
Self-rated health	Fair vs. Poor	<b>92.4 vs. 75.2</b>	<b>1.20</b>	<b>(1.05, 1.36)</b>	<b>.007</b>	75.3 vs. 63.4	1.07	(0.90, 1.27)	.418
	Good vs. Poor	<b>90.0 vs. 75.2</b>	<b>1.25</b>	<b>(1.10, 1.42)</b>	<b>.001</b>	<b>68.0 vs. 63.4</b>	<b>1.35</b>	<b>(1.07, 1.70)</b>	<b>.012</b>
	Very good vs. Poor	<b>94.1 vs. 75.2</b>	<b>1.26</b>	<b>(1.12, 1.44)</b>	<b>.001</b>	<b>74.0 vs. 63.4</b>	<b>1.36</b>	<b>(1.08, 1.71)</b>	<b>.010</b>
	Excellent vs. Poor	<b>95.4 vs. 75.2</b>	<b>1.23</b>	<b>(1.08, 1.40)</b>	<b>.002</b>	<b>76.6 vs. 63.4</b>	<b>1.19</b>	<b>(1.00, 1.41)</b>	<b>.046</b>
	Good vs. Fair	<b>90.0 vs. 92.4</b>	<b>1.05</b>	<b>(1.01, 1.08)</b>	<b>.011</b>	<b>68.0 vs. 75.3</b>	<b>1.09</b>	<b>(1.02, 1.16)</b>	<b>.016</b>
	Very good vs. Fair	<b>94.1 vs. 92.4</b>	<b>1.06</b>	<b>(1.02, 1.10)</b>	<b>.001</b>	74.0 vs. 75.3	1.07	(0.98, 1.16)	.148
	Excellent vs. Fair	95.4 vs. 92.4	1.03	(0.98, 1.07)	.236	76.6 vs. 75.3	1.07	(0.95, 1.19)	.252
	Very good vs. Good	94.1 vs. 90.0	1.01	(1.00, 1.03)	.134	74.0 vs. 68.0	1.04	(1.00, 1.08)	.084
	Excellent vs. Good	95.4 vs. 90.0	0.98	(0.95, 1.01)	.273	76.6 vs. 68.0	1.01	(0.92, 1.10)	.837
	Excellent vs. Very good	<b>95.4 vs. 94.1</b>	<b>0.97</b>	<b>(0.94, 1.00)</b>	<b>.051</b>	76.6 vs. 74.0	0.98	(0.92, 1.05)	.596

<sup>1</sup> Prevalence Ratio (PR)

<sup>2</sup> Confidence Interval (CI)

Bold indicates significant comparisons (p < .05).



		Washing hands often				Disinfecting surfaces often			
Region	Northeast vs. Midwest	95.4 vs. 93.8	1.02	(1.00, 1.04)	.128	76.8 vs. 74.7	1.03	(0.98, 1.08)	.301
	Northeast vs. South	<b>95.4 vs. 92.8</b>	<b>1.03</b>	<b>(1.01, 1.05)</b>	<b>.013</b>	76.8 vs. 74.4	1.03	(0.98, 1.09)	.196
	Northeast vs. West	<b>95.4 vs. 92.5</b>	<b>1.03</b>	<b>(1.01, 1.06)</b>	<b>.012</b>	<b>76.8 vs. 70.9</b>	<b>1.08</b>	<b>(1.02, 1.15)</b>	<b>.005</b>
	West vs. Midwest	92.5 vs. 93.8	0.99	(0.96, 1.01)	.265	70.9 vs. 74.7	0.95	(0.90, 1.00)	.058
	West vs. South	92.5 vs. 92.8	1.00	(0.97, 1.02)	.788	70.9 vs. 74.4	0.95	(0.91, 1.00)	.065
	Midwest vs. South	93.8 vs. 92.8	1.01	(1.00, 1.03)	.350	74.7 vs. 74.4	1.00	(0.96, 1.05)	.843
Metropolitan status	Metro vs. Non-metro	93.7 vs. 91.3	1.03	(1.00, 1.06)	.082	<b>74.6 vs. 70.2</b>	<b>1.06</b>	<b>(1.00, 1.13)</b>	<b>.037</b>
<sup>1</sup> Prevalence Ratio (PR)									
<sup>2</sup> Confidence Interval (CI)									
Bold indicates significant comparisons (p < .05).									

## Results

**Handwashing** (Tables 1 and 2 ). Almost all (93.4%) respondents said they were washing their hands often with soap and water to prevent COVID-19. Women more often reported frequent handwashing than men. Respondents 60 years of age or older more often reported frequent handwashing than respondents in younger age categories (45–59 year-olds, 30–44 year-olds, and 18–29 year-olds); 45–59 year-olds more often reported frequent handwashing than 30–44 and 18–29 year-olds. Respondents in the highest annual income category (\$100 k or more) reported the highest rate of handwashing (95.9%); in general, respondents with higher, compared to lower, incomes more often reported frequent handwashing. Respondents with a

Bachelor's degree or higher reported the highest rate of handwashing (96.0%) compared to other educational levels. Overall, respondents with higher, compared to lower, educational levels more often reported frequent handwashing. Those who rated their health as excellent, compared to those with a lower health self-rating, more often reported frequent handwashing (95.4%). Respondents with self-rated health of fair, good, very good, or excellent more often reported frequent handwashing than those with self-rated poor health. Respondents with good or very good self-rated health more often reported frequent handwashing than those with fair self-rated health, and those with excellent self-rated health more often reported frequent handwashing than those with very good self-rated health. Respondents living in the northeast region of the U.S. reported the highest rate of handwashing (95.4%) and more often reported frequent handwashing than those living in the south and west. No differences by race/ethnicity or metropolitan status were significant.

**Disinfecting** (Tables 1 and 2 ). Nearly three-fourths (74.0%) of respondents said they were disinfecting surfaces at home and work often to prevent COVID-19. Women more often than men (78.7% vs. 69.1%) reported frequent surface disinfection. Respondents aged 45–59 years old reported the highest rate of disinfecting surfaces (77.2%) and more often reported frequent surface disinfection than those aged 30–44 and 18–29 years old. Respondents 60 years of age and older more often reported frequent surface disinfection than those aged 18–29 years old. Respondents in the highest annual income category (\$100 k or more), compared to lower categories, reported the highest rate of disinfecting surfaces (75.8%). Respondents in the highest income categories (\$100 k or more, 50 k–\$99 k, \$25 k–\$49 k) more often reported frequent surface disinfection than those in the lowest category (<\$25 k). Non-Hispanic Blacks reported the highest rate of disinfecting surfaces (79.6%); non-Hispanic Blacks and Hispanics, compared to non-Hispanic Whites, more often reported frequent surface disinfection. Respondents who rated their health as excellent, compared to those with a lower health self-rating, more often reported frequent surface disinfection (75.8%). Respondents with self-rated health of good, very good, and excellent more often reported frequent surface disinfection than respondents with poor self-rated health. Those with good, compared to fair, self-rated health more often reported frequent surface disinfection. Respondents living in metropolitan, compared to non-metropolitan, areas more often reported frequent surface disinfection. Those living in the northeast more often reported disinfecting surfaces than those living in the west. No differences by education were significant.

## Discussion

These data from a nationally representative sample suggest that in the spring of 2020, most U.S. adults were taking hygiene-related precautions to prevent COVID-19. The fact that almost all adults surveyed said that they were washing their hands often with soap and water to prevent COVID-19 is encouraging, as handwashing is an important way to prevent the spread of COVID-19 and other viruses.

Nearly three-quarters of adults said that they were disinfecting surfaces at home and work often to prevent COVID-19. This percentage, although high, is not as high as the percentage for handwashing. Compared to handwashing, disinfecting surfaces often may be a relatively novel behavior (i.e., people may be less familiar with the importance of frequent disinfection than they are with frequent handwashing) potentially making it harder to adopt this practice [6]. Disinfecting surfaces frequently could be more time-consuming and difficult than handwashing; this could contribute to the lower adherence to this practice. Unfamiliarity with how to

disinfect surfaces [7] and, possibly, unavailability and cost of disinfectant, may also contribute to this lower adherence percentage.

This study identified several demographic characteristics associated with hygiene-related practices. Men less often reported both handwashing and disinfecting; this finding is consistent with previous research showing that men engage in protective behaviors (e.g., handwashing) less often than women, even during epidemics [8, 9], and a finding consistent with work conducted during the COVID-19 pandemic [10]. Additionally, those with self-rated poor health were less likely to report handwashing and disinfecting to prevent COVID-19. As evidence indicates that COVID-19 disproportionately affects men and people with underlying health conditions, it may be particularly important for men and people in poor health to take preventive action to protect themselves from COVID-19 [11, 12].

Additional demographic characteristics were associated with a higher prevalence of hygiene-related COVID-19 prevention practices. Generally, frequent handwashing and disinfecting increased with age, although the pattern was stronger for handwashing. Compared to non-Hispanic Whites, non-Hispanic Blacks and Hispanics reported higher disinfecting rates. Current data indicate that COVID-19 causes a disproportionate burden of severe illness and death among older people and among racial and ethnic minority groups [11–13]. It is unclear why these particular groups had higher rates of prevention practices, while other vulnerable groups (i.e., men and people in poor health) did not. More research is needed to clarify these relationships. These data, along with data showing a high rate of cloth face covering use among non-Hispanic Blacks and Hispanics [14], also suggest that individual adherence to CDC guidance is unlikely to explain the racial/ethnic disparity in rates and outcomes of COVID-19; rather, this may be due to systemic racial inequity issues.

Our findings also suggest that people with lower income and education levels are less likely to take these precautions, although these patterns were, again, stronger for handwashing. People with lower income or education levels may face barriers to engaging in these behaviors. For example, they may be more likely to be classified as essential workers and work outside the home during the pandemic [15] and therefore have less time to clean. They may also have less access to water to use for handwashing; recent data indicate that lower income communities disproportionately lack access to clean water and indoor plumbing [16]. More research is needed to better understand the relationship between income, education, and these hygiene practices.

Where people live seems to be related to hygiene-related prevention practices. Those in the south and west regions of the U.S. had lower rates of handwashing compared to those living in the northeast and people living in non-metropolitan areas had lower rates of disinfecting surfaces than those living in metropolitan areas. These findings may be related to the fact that when the survey was conducted, most COVID-19 cases were in more densely populated metropolitan areas and a large COVID-19 outbreak was occurring in the northeast region of the U.S. [17].

## Conclusions

During March 19 – April 9, 2020 most survey respondents reported frequent handwashing and surface disinfection to prevent COVID-19. These practices are important components of a layered approach to COVID-

19 prevention, which also includes wearing masks and physical distancing. We also identified gaps in these self-reported practices; 7% of respondents said they were not handwashing often and 26% said they were not disinfecting surfaces often. We also found that men, younger people, people with lower incomes and lower education levels, and people in self-rated poor health generally reported lower rates of both frequent handwashing and surface disinfection. These practice gaps among sub-populations vulnerable to COVID-19 (men and people in poor health) [11, 12] are of particular concern. Practice gaps for those with low incomes are also concerning, given that underlying health conditions are more prevalent in this group [18]. Communication efforts could be informed and enhanced by research delineating why some sub-populations have lower rates of hygiene-related COVID-19 prevention practices. Additionally, more work is needed to understand how hygiene behaviors fit in with other recommended COVID-19 prevention behaviors, such as wearing masks and physical distancing.

## Limitations

This study has several limitations. First, although the data were weighted to be nationally representative and computers and internet access were provided to respondents who needed them, the results may not be fully representative of the US adult population (e.g., those uncomfortable with the internet may have had lower participation). Second, the data might be affected by social desirability bias, resulting in an overreporting of socially desirable behaviors (e.g., handwashing). Third, these data only measure self-reported practices, not actual practices. Finally, these data do not allow causal inferences about the reasons for differences by demographic characteristics found in self-reported practices.

## Abbreviations

CDC: Centers for Disease Control and Prevention

CI: confidence interval

COVID-19: coronavirus disease 2019

PR: prevalence ratio

## Declarations

### Ethics approval and consent to participate

This analysis was not considered human subjects research (as defined in 45 CFR part 46) and did not require review by Centers for Disease Control and Prevention's (CDC's) institutional review board. CDC licensed these data from Porter Novelli Public Services. While Porter Novelli Public Services and its vendors are not subject to CDC IRB review, they do adhere to all professional standards and codes of conduct set forth by the Council of American Survey Research Organizations (CASRO). Respondents are informed that their answers are being used for market research and they may refuse to answer any question at any time. No personal identifiers are included in the data file that is provided to CDC.

## Consent for publication

Not applicable

## Availability of data and materials

The dataset supporting the conclusions of this article can be licensed from Porter Novelli Public Services by contacting Deanne Weber ([deanne.weber@porternovelli.com](mailto:deanne.weber@porternovelli.com)).

## Competing interests

The authors declare that they have no conflicts of interest.

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The Centers for Disease Control and Prevention purchased the survey data license from Porter Novelli.

## Contributions

LB assisted in data analysis and interpretation and drafted the manuscript. ERH led data analysis. KVE and SC conducted initial data analyses and replication. AGW conceived of the project, interpreted data, and reviewed and edited the manuscript. CB reviewed and edited the manuscript. All authors read and approved the final manuscript.

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