

Americans' COVID-19 preventive practices in April and May 2020: Are they good enough?

Jade Lamb¹, Kerry Bruce^{1*}, Natalie Fahsen Paetau², Sarah Alummoatil², Christian Marin¹

¹ Clear Outcomes, Boise, ID, United States of America

² Department of International Health, Georgetown University, Washington DC, United States of America

*Corresponding Author

Email: kbruce@clearoutcomes.net (KB)

Abstract

Our research team conducted three cross-sectional, nationally representative, online surveys of the U.S. population over a period of six weeks, starting in early April and ending in mid-May 2020. The surveys provided a snapshot of the self-reported social distancing compliance, handwashing and mask wearing behavior, proportion of population receiving COVID-19 tests, and Americans' sentiments about the pandemic during this period. We found that people having contact with others zero times in a four day period ranged from 17%–28% during the three surveys, people wearing masks rose from 23%–49% over the three surveys, and that people washing their hands three or more times a day remained high at 83%–88% through all three surveys. The results provide evidence for state and national level policy makers on which segments of the population may need more attention with messaging to ensure compliance with staged re-opening of the economies. They also point researchers to areas for more research, especially related to mental health and testing coverage.

Introduction

SARS-CoV-2, the virus that causes COVID-19, originated in Wuhan in the Hubei province of China and has since spread globally since its genesis in December of 2019 [1]. On January 14th, 2020, the first case of COVID-19 was reported in the US [3], and on March 11th, 2020, the World Health Organization declared the COVID-19 outbreak to be a pandemic [4]. Two days later, the United States declared it a National Emergency, leading to a series of government decisions aimed at minimizing transmission in order to flatten the epidemic curve (The White House, 2020). As of July 23, 2020, there were 15,265,081 Coronavirus cases worldwide [2]. On the same date, the United States had the most cases of COVID-19 globally with a total of 3,987,584 cases and 143,224 deaths due to the virus [2].

Because a vaccine is not yet available, preventive behaviors are key to minimizing the impact on healthcare systems by keeping individuals from contracting and spreading the virus [5]. In order to achieve this goal, health organizations recommend minimizing physical contact between individuals through social distancing measures like restricting the size of gatherings, maintaining six feet of physical distance from those outside the household, closing non-essential businesses, promoting measures for sheltering in place and adopting sanitation and personal hygiene behaviors [6]. By April 17th, 2020, 45 U.S. states had implemented stay at home orders [7]. In addition, the CDC provided recommendations regarding protective behaviors such as hand washing, social distancing, and mask-wearing [8].

The daily case-rate of the pandemic in America has neither flattened nor decreased and is still rising [2], especially as states ease restrictions [10], and experts expect COVID-19 cases to continue rising if current control measures are not properly executed [7]. However, the success of these measures relies on the ability of the population to adopt protective behaviors and their willingness to adhere to them [9].

Evidence from the 2002 SARS outbreak and the 2009 H1N1 swine flu outbreak showed that the adoption of preventive behaviors was dependent on demographic characteristics, attitudes, and structural factors [11]. Knowledge of American's behavioral response to the COVID-19 pandemic is crucial for evidence-based policymaking and, ultimately, for limiting the spread of this virus. Due to the novelty of this pandemic, additional research on preventive behaviors remains limited. We aim to contribute to the closure of this knowledge gap by providing evidence of American's early self-reported behaviors in response to the pandemic. Specifically, we aim to contribute to the literature on risk perception, risk tolerance, and actual self-reported behaviors of Americans in April and May 2020 at the height of the state stay at home orders and discuss Americans' practices during this period of time.

Literature review

There is an emerging body of work on COVID-19 preventive behaviors to which this study hopes to contribute. Existing studies on COVID-19 preventive behaviors demonstrate an association between risk perception and people's willingness to adopt health-protective behaviors. Dryhurst et al. (2020), studied the public risk perception of a sample of 6,991 people from 10 countries in relation to COVID-19 and found a correlation between the adoption of protective behaviors and risk perception [9]. More specifically, the study provides evidence that people that have been personally affected by the virus or have a more liberal standpoint, have a higher risk perception of COVID-19 [9]. However, through an online survey of 1591 individuals living in the United States, Wise et al (2020), found that people's ability to estimate their likelihood of being affected by COVID-19 is poor, leading to an underestimation of the risk of contagion [10].

In another study, researchers examined what other factors play a role in the adoption of preventive behaviors related to COVID-19. They conducted two online surveys on a sample of 338 Americans to study the influence of preexisting health factors, risk tolerance, and altruism on compliance with social distancing measures. They found that one-quarter of the participants did not comply with preventive recommendations despite having pre-existing conditions, regardless of risk or altruism preferences. The policy implications of their findings suggest that weak enforcement policies might not be enough to promote the adoption of preventive behaviors like social distancing [11]. State, government, and imposed rules around protective behaviors resulted in higher levels of social distancing [12].

In March and early April 2020, Nelson et al. did a cross-sectional analysis of 2,065 survey participants from the United States, Canada, and several countries in Europe on the impact of the COVID-19 pandemic on mental health, financial security, COVID-19 concern, and self-quarantine behavior [13]. They found that concern about the pandemic was associated with increased anxiety and depressive symptoms [13]. They also found that unemployment was associated with COVID-19 concern and depressive symptoms, which in turn were associated with more rigid protective behavior [13].

Other research has documented that Americans are handwashing more and avoiding social gatherings while either self-isolating all the time, or most of the time [14]. One survey found that 92.6% of respondents (n= 3000) believed that handwashing, social distancing, and avoiding contact of unwashed hands with the eyes, nose, and mouth were effective preventive measures for COVID-19 [15]. One study tested reactions to others wearing masks and found that individuals would maintain a shorter distance socially to those that were masked and a further distance to those that were not wearing a face mask [16].

Methodology

Our research team conducted three nationally representative surveys using a SurveyMonkey panel, which is based on the European Society for Opinion and Market Research (ESOMAR) standard questions for determining target samples. We targeted a sample size of 1,200 based on the SurveyMonkey calculations that, using their panel, this sample would result in a margin of error less than or equal to 3%. SurveyMonkey recruits its panels through SurveyMonkey Contribute, which donates \$0.50 to charity in exchange for each completed survey, and through SurveyMonkey Rewards, which allows respondents to earn \$0.25 in credits towards gift cards or donations. This process of automated recruitment enabled us to exceed the target sample size in two of the surveys (April 6 and May 4) The target panels for these surveys were balanced by gender, age, and region. The survey dates, sample sizes, and margins of error are below in Table 1.

Table 1. Survey dates, sample size and margin of error.

Survey Date	Sample Size	Margin of Error
April 6, 2020	1,332	+/- 2.74%
April 20, 2020	1,200	+/- 2.88%
May 4, 2020	1,284	+/- 2.78%

The surveys consisted of 11–16 questions (depending on survey date) on behaviors thought to prevent COVID-19 transmission, including number of times respondents were within six feet with people outside their household, mask-wearing practices, and handwashing practices. These three questions and demographic variables were included in all three surveys. The team made slight variations to some questions between surveys. These changes were made based on participant feedback and to elicit more accurate responses; they are described in more detail below. The research team analyzed data in Stata 16, looking at the difference in the distribution of responses between the three cross-sectional surveys using a chi-square test to test for statistical significance. Additional analysis to explain select trends used multivariate regression analysis to control for covariates.

In addition, each survey included a final open-ended question for respondents to leave comments. Responses to this question contributed to a qualitative dataset (n=96, n=151, and n=111 codable segments for the three surveys, respectively). The team used Dedoose 8.3.17, a qualitative software analysis tool, to code and analyze the responses from each survey. In the initial phase, the team coded each comment as positive, negative, or neutral. Subsequent focused coding categorized key topical themes found in the survey comments.

The research team had no access to personal identifying information for this study. SurveyMonkey’s panel was told the purpose of participating in the panel, told responses would be confidential, had the opportunity to decline to participate, and were sent a link to SurveyMonkey’s full privacy policy describing how data are used and disclosed.

Our data and relevant code are available through the Open Inter-University Consortium for Political and Social Research repository (available at <https://doi.org/10.3886/E120312V1>).

Findings

Demographic coverage

Table 2 presents the demographic breakdown of the sample for each survey. The sample demographics are slightly more female than the national average [17], but the age (of adults over 18 years of age) and income distributions of the sample are reflective of national distribution [18, 19].

Table 2. Demographics (sex, age, and income) of survey respondents.

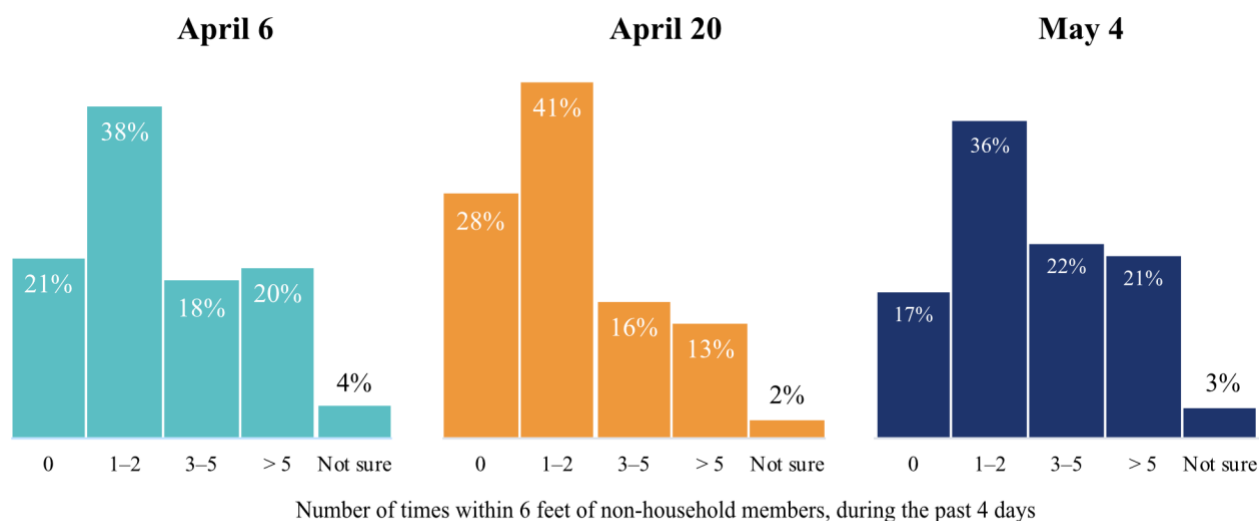
Characteristic	Survey 1 April 6	Survey 2 April 20	Survey 3 May 4
Sex			
Male	46%	44%	46%
Female	54%	56%	54%
Age			
18–29	26%	27%	24%
30–44	24%	22%	23%
45–60	32%	35%	31%
>60	18%	16%	22%
Income			
\$0–\$9,999	6%	6%	7%
\$10,000–\$24,999	11%	12%	10%
\$25,000–\$49,999	20%	22%	19%

Characteristic	Survey 1 April 6	Survey 2 April 20	Survey 3 May 4
\$50,000–\$74,999	19%	20%	20%
\$75,000–\$99,999	13%	12%	13%
\$100,000–\$124,999	9%	8%	9%
\$125,000–\$149,999	5%	4%	4%
\$150,000–\$174,999	2%	3%	3%
\$175,000–\$199,999	1%	2%	2%
\$200,000+	4%	3%	3%

Social distancing

Respondents in the April 20 survey reported social distancing the most compared to the other survey periods, with 28% reporting being with six feet of people outside the household zero times, compared with 21% in the April 6 survey and 17% in the May 4 survey (chi-squared=84.45, $p < .001$) (Fig 1). Similarly, people doing so 1–2 times peaked in the April 20 survey.

Fig 1. American’s self-reported physical distancing practices in April and May 2020.



Social distancing with others correlated with income. The second and third surveys showed differences in distribution of how often people reported being near others by income, though the patterns were not always clear. In a regression that controls for survey date and income group, being in a higher income group corresponded to a decline in number of times

reported being within six feet of others (our survey captured this on a four point scale of zero times, 1–2 times, 3–5 times, and more than 5 times) (Table 3).

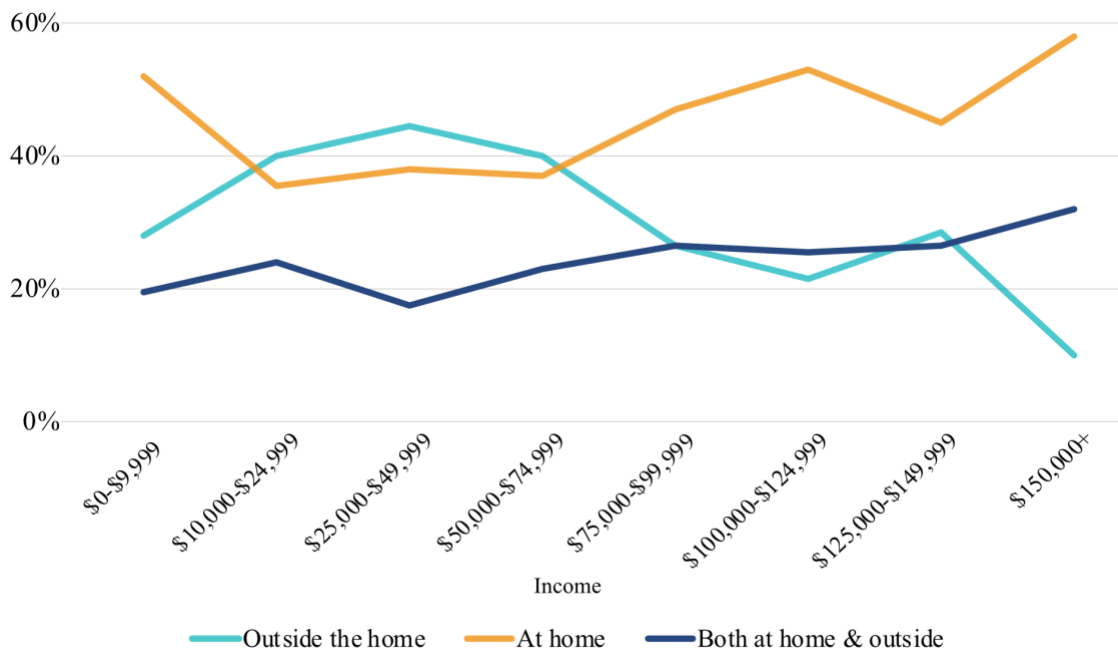
Table 3. Regression analysis of number of times people were within six feet of people outside their household in the last four days.

Number of contacts outside household	Coef.	P> t	Std. Err.	[95% Conf. Interval]
Household Income	-0.021	0.009*	0.02	-0.039 to -0.003
April 20 Survey	-0.237	0.043**	0.00	-0.320 to -0.154
May 4 Survey	0.115	0.042**	0.01	0.032 to 0.198
Constant	2.475	0.048**	0.00	2.380 to 2.570

* $p < 0.05$; ** $p < 0.01$

This finding corresponds with data collected in the April 6 survey, which showed that those with incomes between \$10,000 to \$75,000 were most likely to be working or going to school outside the home (Fig 2). Of those who were going outside their homes, those with income between \$10,000 and \$75,000 were more likely than those in other income groups to be doing so for work; above \$75,000, exercise was the second most common reasons for going outside the home (essential shopping was the most common reason for leaving the home for all income groups).

Fig 2. Those working or going to school outside the home by income level (April 6, 2020).



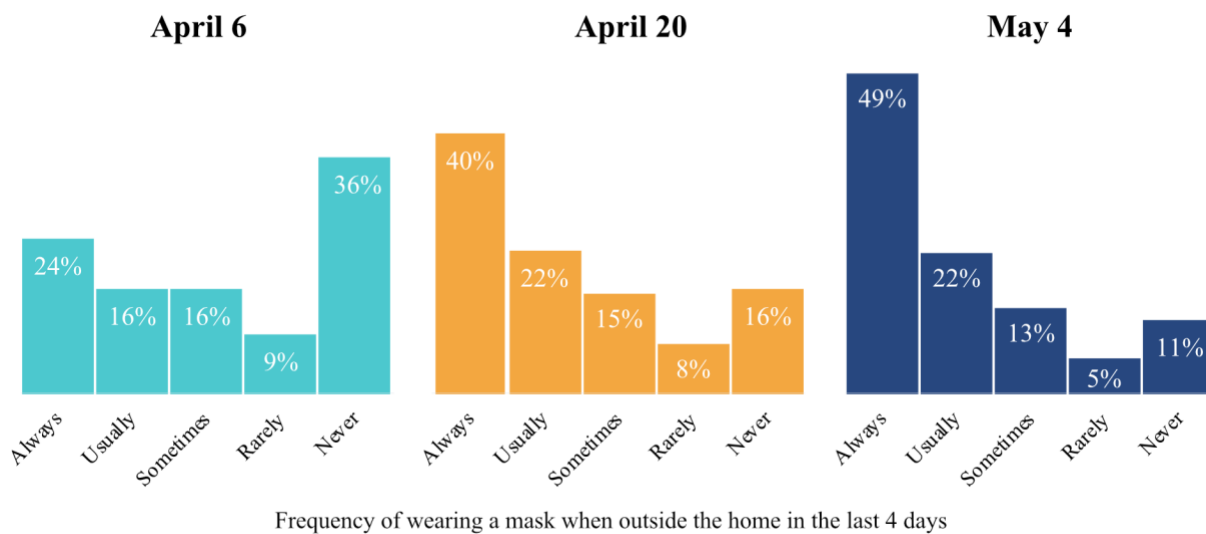
Social distancing was correlated with age. On average across the three surveys, 32% of respondents over 60 reported contact with others 0 times, compared to 17%–23% of other age groups, while 14% reported contact with others more than 5 times compared to 17%–22% of other age groups (chi-squared=82.66, p=0.000).

Social distancing also correlated with sex in the April 20 survey, where women reported having less contact outside their households than men; 30% reported going out 0 times and 42% reported going out 1–2 times, compared to 25% and 29% of men respectively (chi-squared=9.60, p=0.048). The differences were not statistically significant in the April 6 (chi-squared=3.15, p=0.532) or May 4 (chi-squared=4.37, p=0.358) surveys.

Wearing masks

Mask wearing frequency rose steadily during the course of the three surveys, from 40% of respondents saying they “Always” or “Usually” wore a mask in the April 6 survey to 62% in the April 20 survey, rising again to 71% in the May 4 survey (Fig 3) (chi-squared=357.76, p=0.000). The CDC first officially recommended that Americans wear cloth masks on April 3, three days before the first survey.

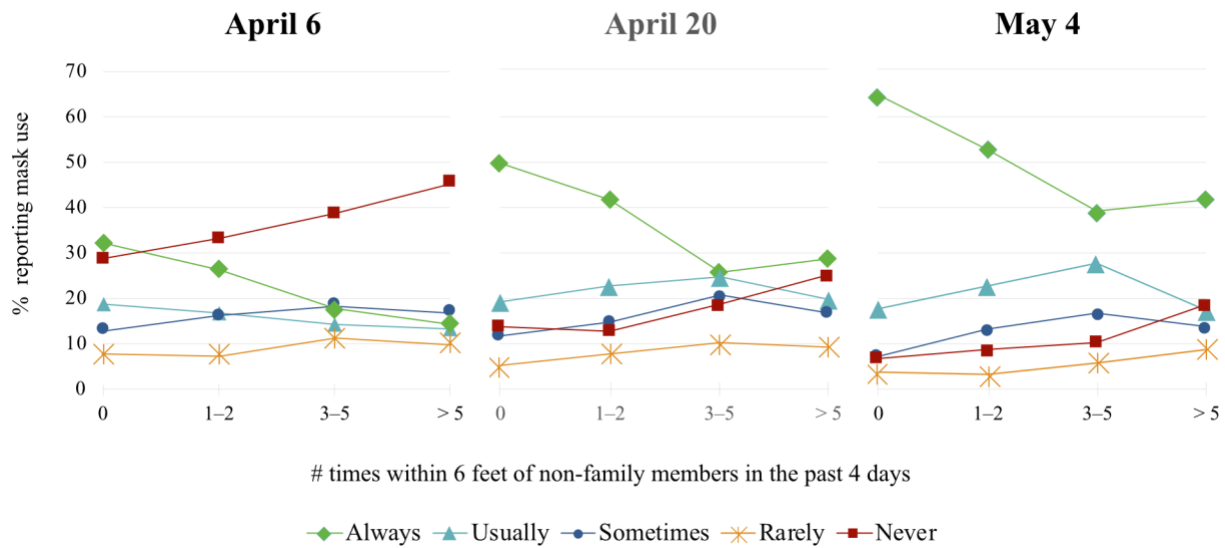
Fig 3. Frequency of self-reported mask wearing in public places April-May 2020.



Those that were having the most outside contact—more than five times in the last four days—increased their mask wearing on the whole, but during all survey periods were both among the least likely to be always wearing a mask, and more likely than other groups to never be wearing a mask (Fig 4). In the April 6 survey, 45% of those going out five or more times in the last four days reported never wearing a mask and 14% reported always wearing a mask, compared to 29–38% of other groups never wearing masks and 18–32% always wearing masks (chi-

squared=47.12, $p=0.000$). In the April 20 survey, 25% of those going out five or more times in the last four days reported never wearing a mask and 29% reported always wearing a mask, compared with 13%–19% of other groups never wearing masks and 26%–50% always wearing masks ($\text{chi-squared}=49.71$, $p=0.000$). In the May 4 survey, 19% of those going out five or more times in the last four days reported never wearing a mask and 42% reported always wearing a mask, compared with 7%–10% of other groups never wearing masks and 39%–64% always wearing masks ($\text{chi-squared}=73.89$, $p=0.000$)

Fig 4. Mask use by frequency of going out.



In a regression model controlling for the number of times a respondent reported contact with others, different reasons for going out, and survey date (combining data from the April 6 and April 20 surveys), we found that:

- A higher frequency of going out was associated with a lower frequency of mask wearing when controlling for purpose (coefficient=0.22, $p=0.000$).
- A lower frequency of mask wearing was associated with exercising (coefficient=.187, $p=0.01$), picking up items for takeaway (coefficient=.440, $p=0.000$), visiting family (coefficient=.373, $p=0.011$), and other (uncategorized) reasons (coefficient=.522, $p=.022$).
- When controlling for purpose and frequency of going out, getting healthcare was associated with wearing masks more often (coefficient=-.306, $p=0.040$), as was essential shopping (coefficient=-.228, $p=.013$).

Mask wearing was coded on a scale of 1–5, with 1= “Always” and 5= “Never.” Negative coefficients indicate more frequent than average mask wearing. As with the cross-tabulation above, the later (April 20) survey is still associated with more frequent mask wearing than the April 6 survey.

Table 4. Regression analysis of Mask Wearing, controlling for reasons going out.

Mask Wearing Frequency	Coef.	Std. Err.	P> t	[95% Conf. Interval]
Number of times with contact outside household	0.219	0.046	0.000**	0.129 – 0.308
Dropping off children at care	-0.081	0.254	0.75	-0.996
Eating at restaurant	0.027	0.313	0.932	-1.23
Essential Shopping	-0.228	0.092	0.013*	-0.36
Exercising	0.187	0.093	0.044*	0.005 - 0.370
Getting Healthcare	-0.306	0.149	0.040*	-0.584
Non-Essential Shopping	0.07	0.183	0.701	-0.718
Picking up takeaway items	0.44	0.099	0.000**	0.247 – 0.633
Visiting Family	0.373	0.147	0.011*	0.084 – 0.661
Visiting Friends	0.276	0.215	0.2	-0.843
Working	0.042	0.095	0.66	-0.374
Other	0.522	0.228	0.022*	0.074 – 0.969
April 20 Survey	-0.131	0.292	0.654	-1.148
Constant	1.991	0.323	0.000**	1.358 – 2.625

* $p < 0.05$; ** $p < 0.01$

Mask wearing was also correlated with gender. Women were more likely than men to always be wearing a mask when they went outside during all three survey periods: 26% compared to 20% in the April 6 survey (chi-squared=9.36, $p=0.053$); 44% compared to 35% in the April 20 survey (chi-squared=21.11; $p=0.000$) and 54% compared to 44% in the May 4 survey (chi-squared=13.57, $p=0.009$).

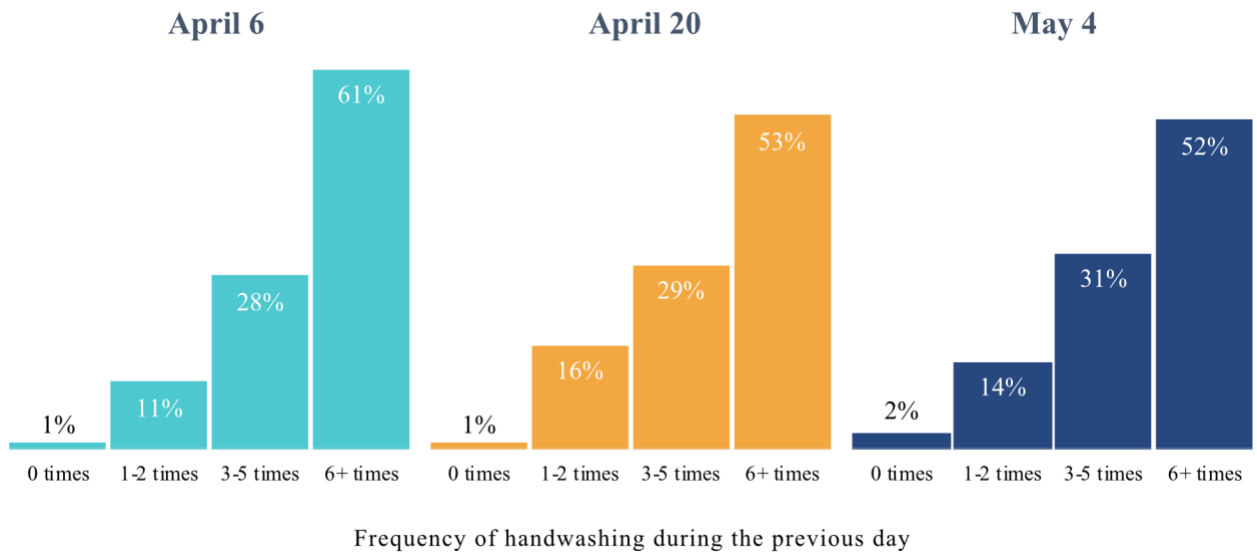
Mask wearing also correlated with region: In the May 4 survey, the Mid-Atlantic (68%), New England (59%), and Pacific Coast (55%) were most likely to always be wearing a mask when they went outside compared to other regions, where percent always wearing a mask ranged

from 31% to 50% (chi-squared=88.53, p=0.000). The pattern was similar for the earlier surveys as well.

Handwashing

Self-reported frequency of handwashing was highest during the April 6 survey, where 61% of respondents reported washing their hands more than five times the previous day. Self-reported handwashing more than five times per day decreased to 53% and 52% in the subsequent two surveys (Fig 5) (chi-squared=38.93, p=0.000). This decline happened despite an edit to the question broadening the behavior being asked about to include disinfecting hands with hand sanitizer.

Fig 5. Self-reported handwashing behavior in April and May 2020.



Those with the most outside contact—more than 5 times over the last 4 days—were more likely to be washing their hands more than five times the previous day than other groups in the April 6 survey (67% compared with 51%–61%, chi-squared=24.60, p=0.017). In the April 20 survey, those going out more than five times in the past four days reported washing their hands five or more times about as often as those who reported not going out at all, 57% compared to 60%; this was more than those going out between 1–5 times in the past four days (44%–51%, chi-squared=23.41, p=0.024). Differences in the May 4 survey were not statistically significant.

Handwashing correlated with gender in all three surveys, with women reporting washing their hands more frequently than men. In the April 6 survey, 68% of women reported washing their hands five or more times in a day compared with 52% of men (chi-squared=39.70; p=0.000); in the April 20 survey, 62% of women reported doing so compared to 42% of men

(chi-squared=48.17; $p=0.000$); and in the May 4 survey, 62% of women reported doing so compared to 41% of men (chi-squared=57.82, $p=0.000$).

Handwashing also correlated with age. Handwashing five or more times a day was highest among those aged 45–60, and lowest among those aged 18–29. In the April 6 survey, 69% of those aged 45–60 washed their hands five or more times a day, compared to 50% aged 18–29 (chi-squared=38.97, $p=0.000$); in the April 20 survey, 61% of those aged 45–60 did so, compared to 43% aged 18–29 (chi-squared=29.34, $p=0.001$); and in the May 4 survey, 62% of those aged 45–60 did so, compared to 42% aged 18–29 (chi-squared=32.39, $p=0.000$).

Testing for COVID-19

In the May 4 version of the survey, our research team added a question on testing for COVID-19. Seven percent of respondents reported having received either a COVID-19 diagnostic or antibody test, and 3% reported that they tried to get a test, but one was not available. Those over 60 were least likely to have been tested, at 2% compared to 10% of those 18–29, 9% of those 30–44, and 7% of those 45–60 (chi-squared=22.47, $p=0.001$). A total of 53% of the 91 respondents tested reported receiving only a diagnostic test, 34% reported receiving only an antibody test, and 13% reported receiving both.

Sentiment of Americans during April and May 2020

In an open-ended space for comments at the end of the surveys, the majority of respondents from all surveys who opted to answer expressed negative reactions towards the pandemic, and the comments became increasingly negative over time. Americans expressed great concern, worry, and fear over the illness's spread and anger towards political leaders and the public for not complying with regulations. Neutral responses, representing a large portion of the respondents, were typically statements around simple beliefs and new protective behavior such as social distancing, mask and glove wearing and how the government and other people should react to the pandemic. These statements had no particular indication of positive or negative sentiment. A few respondents offered positive messages of hope, inspiration, and trust within the local and state governments (Table 5).

Table 5. American’s sentiments positive, neutral, and negative by survey period

Item	Survey 1 April 6, 2020	Survey 2 April 20, 20020	Survey 3 May 4, 2020
Positive	7 (7.3%)	12 (7.9%)	6 (5.4%)
Neutral	38 (39.6%)	66 (41.5%)	31 (27.9%)
Negative	51 (53.1%)	73 (45.9%)	74 (66.7%)
Total	96	151	111

Those who expressed concern conveyed anxiety or stress, such as, “I’m concerned about my family’s well-being and financial situation.” Others expressed “fear of getting sick,” and worry for essential workers. Adapting to new protective behaviors was also frequently mentioned, such as, “I am doing my best to [maintain] social distancing guidelines and using hand sanitizer after going out as well as wearing gloves.” By the second survey, many respondents reported, “I want this to be over with and people get better soon.” With comments such as, “I hope this pandemic ends as soon as possible,” individuals showed that they are waiting and hoping for the situation to pass.

Respondents communicated anger about political leadership (at both local and federal levels) during the first survey, such as, “I wish the governor would enforce her emergency orders more.” Respondents in this category held a range of views, including those wanting guidance to be firmer and others wanting restrictions to end. By the second survey, people expressed concern about others not adhering to the safety recommendations for COVID-19. People made statements such as, “This is so stupid. If people were doing what [they] should have done to begin with this virus would not be a problem.”

There was a consensus that people were not taking the pandemic seriously by ignoring social distancing and mask wearing guidelines, thereby putting themselves and others in danger. In all of the surveys, respondents expressed concern about others not abiding by social distancing protocols, such as, “I went grocery shopping yesterday and was appalled at the number of people who are not wearing masks [...] or gloves” and, “When I did go out to pick up essential items, others around me refused to [physically] distance [themselves] despite signs at the store asking people to. People around me were coughing without covering it with no regard to those around them. Store employees didn't enforce guidelines. For this reason, I will likely not leave my house again for quite some time, even for essential supplies. We will have to make do with the supplies we have for now, since people in this area are not taking it seriously.”

In the May 4, 2020 survey, respondents left comments related to the re-opening of the

economy. The number of comments in support of State reopening exceeded the number of statements against reopening. One respondent said, "Open everything back up. My civil liberties are being eroded and the numbers of casualties has been grossly over predicted. We are causing more harm through loss [of] income, increased personal crimes, and depression/stress/suicide etc." Some responses related to the potential negative impact of this pandemic in the economy. One person said that, "the damage it's caused to the US, and world economies may be irreparable". Some comments suggested that individuals should adopt behaviors based on their own vulnerability rather than widespread regulations: "If an individual is in poor health with comorbidity factors, they should isolate themselves, not the entire population".

Discussion

This study examined US residents' protective behaviors during the early days of the COVID-19 pandemic in the US. In general, we found that the majority of the population went out rarely—0–2 times in four days—and washed their hands frequently throughout the three survey periods, while mask wearing grew over time.

The following sections examine these results in more detail. We used a Health Belief Model (HBM) to aid in examining our results. The HBM suggests that the adoption of health preventive behaviors depends on whether the individual: 1) feels susceptible to the diseases, 2) believes it might have a negative impact in their life; 3) understands that adopting protective behaviors reduces their susceptibility to contracting the disease or its severity in case they already have it, and 4) feels capable of overcoming the perceived obstacles and performing those health actions [20,21,22].

Social distancing behavior

Our research found a relationship between income, sex, and age with self-reported social distancing behaviors. Our data suggest that the relationship with income may be related to type of work rather than individual beliefs of susceptibility; those with annual household income between \$10,000–\$74,999 were more likely to report leaving the home for work those with higher or lower incomes (those with incomes lower than \$10,000 likely include the unemployed, retired people, or students). This may indicate that these individuals had jobs which they could not perform remotely.

On the other hand, findings related to age and gender can be interpreted through the HBM. The survey found that those over 60 were going out the least; this is also the age demographic most severely affected by COVID-19. This likely corresponds with a feeling of higher susceptibility to COVID-19 and belief that it may have a negative impact. Men were more likely than women to be going out; other studies related to protective behaviors during the pandemic have found the same tendency in women to adhere more compliantly with protective behavior. In the meta-analysis that Moran and Del Valle conducted, a majority of studies

highlighted that women had a higher adoption rate of health protective behaviors during respiratory pandemics such as Middle Eastern Respiratory Syndrome, Severe Acute Respiratory Syndrome, and avian influenza [23]. The meta-analysis concluded that women are 49.5% more likely to practice non-pharmaceutical protective measures than men [23].

The peak in staying at home, which our study observed the week of April 20, is slightly different from the Washington Post's analysis of SafeGraph cell phone data which showed the week prior to April 7 as the peak [24], and a Gallup poll conducted the week of April 20 found less social distancing that week than the week of April 6 [25] (Fig 1). The change between April 6 and April 20 may have been influenced in part by a change in the number of days under consideration in the question, which were the past 5 days for the April 6 survey and the past 4 days for the April 20 and May 4 surveys. The April 6 survey asked respondents, "In the past five days, how many times were you, or people you live with, within six feet of people outside your household?", which the research team changed to "In the past four days" in subsequent surveys to align with CDC guidance for such questions. Both survey periods covered weekends, when people were most likely to be going out. This difference in questions between surveys may explain differences between our data and other data sources which show an earlier peak in staying in.

Hand washing and mask wearing

Our data do not explain the correlation between high levels of going out and not wearing a mask, but two possible explanations include:

- **Constraints:** Those having the most contact may have done so for low-paid work, as discussed above, and may have had associated constraints at their jobs (such as not permitted to wear a mask at work) or lack of access to masks. However, regression modeling demonstrated that going outside the home for work was not correlated with frequency of mask wearing when controlling for other reasons for going out and frequency of contact with others.
- **Perception of risk:** Having more outside contact and declining to wear masks may correlate because individuals were not inclined to take protective measures at all. This corresponds to the HBM's tenets of feeling susceptible to disease and believing the disease may have a negative impact on one's life. This group did not, however, wash their hands less than other groups.

The regions where people wore masks more frequently covered the states (California, New York, Massachusetts) where COVID-19 cases grew the earliest and most rapidly; these populations likely both felt more susceptible to COVID-19 and saw the negative effects of the virus on their communities [3]. In addition, these regions generally are more Democratic, which other literature linked to higher compliance with social distancing orders [26], and higher degree of concern about the pandemic [27][28]. Polling also linked differences in attitudes towards how

soon it is safe to end social distancing measures to political affiliation [29] or to mask wearing [30]. Political leaders in these states also promoted mask wearing as a protective behavior [7], adding to the likelihood that individuals in these regions saw it as a means to reduce susceptibility.

While our research does not in itself explain why certain groups have been resistant to mask wearing, the results suggest that particular groups, including men and those in the central and mountain regions, may need additional messaging and guidance on mask wearing to increase uptake enough to have a public health benefit. Such messaging should include both the risks of not taking protective behaviors, such as mask wearing and handwashing, as well as the benefits of these protective behaviors.

COVID-19 testing

By early May, almost two months into the national emergency, our research found that only 7% of respondents received a test of any kind, either diagnostic or antibody. According to the CDC, during the week ending on June 13, 2020, a total of 14,566,119 diagnostic tests were reported [31]. This equates to roughly 4.4% of the U.S population, not accounting for re-tests; this is in keeping with our data. If testing and contact tracing are going to be the cornerstones of re-opening our economies, the percentage of the U.S. population tested for COVID-19 needs to increase dramatically.

Sentiment in the population towards COVID-19

Our research found that the majority of comments about COVID-19 had a negative sentiment and there was substantial worry, concern, and anxiety about the pandemic expressed in our nationally representative sample. This may point to a need for more research on the mental health effects of the pandemic on the population.

As stated previously, preventive behaviors are critical to minimizing the spread of COVID-19 [5]. The ability of individuals to engage in the recommended behaviors depends on many factors, including the perceived severity of the disease and susceptibility to infection as well as confidence in the efficacy of the recommended behaviors [19]. Given the comments provided in the survey, there were considerable differences of perception on these factors among this sample. As the timeline of the pandemic impact continues these differences in perception may increase.

Limitations

Edits to the survey questions: As described above, the study team made several edits to the survey questions between survey waves. This likely affected the results we observed in

people's self-reported number of contacts with people outside their household, though it does not seem to have affected the other trends observed.

Sample: The sample was more female than the US as a whole. In addition, participation in the required internet access and required participants be involved in SurveyMonkey's Contribute or Rewards program, which may make for a more internet-literate sample than the population as a whole. When triangulating results with other polls and data sources, we found results that were largely consistent with other literature.

Response bias: All data are self-reported. While the study team sought to use best practices for question phrasing and the surveys were taken anonymously, data may be influenced by recall bias (where individuals do not accurately remember what they did) or social desirability bias (where individuals describe themselves as behaving in a more socially desirable way than they actually did). Consequently, we triangulate our data with non-self-reported sources (such as for social distancing and testing) where possible to confirm the validity of our findings.

Limited qualitative sample size: The qualitative responses analyzed were in response to a request for any further comments, an optional question, which only 10–15% of respondents chose to answer. Therefore, qualitative data should be taken as illustrative of trends rather than representative of the overall population.

Conclusion

This research involving three cross-sectional, nationally representative surveys of the U.S. population, gives us a snapshot of the self-reported social distancing compliance, handwashing behavior, mask wearing behavior, and popular sentiment towards COVID-19 over a six-week period covering early April and early May 2020. The results provide evidence for state and national level policy makers on the need for targeted messaging for men, those under 45 years of age, and those living in the central and mountain regions—to ensure their compliance with health and safety measures as part of the staged economic re-opening. They also point researchers to areas for additional research, especially related to mental health and testing coverage.

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