

Knowledge, beliefs, mental health, substance use, and behaviors related to the COVID-19 pandemic among U.S. adults: A national online survey

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Abstract

Background: Given the urgent need for data to inform public health messaging to mitigate the spread of the COVID-19 pandemic, this national survey sought to assess the state of COVID-19-related knowledge, beliefs, mental health, substance use changes, and behaviors among a sample of U.S. adults.

Methods: A survey of U.S. adults was administered online from March 20-30, 2020. The survey collected data on socio-demographic characteristics; COVID-19-related knowledge, awareness and adoption of preventive practices; depression and anxiety (assessed by the Patient Health Questionnaire-4); stress (adapted Impact of Event Scale-6); pessimism; and changes in tobacco and alcohol use. Differences between age groups (18-39 years, 40-59 years and ≥ 60 years) were tested using Pearson's chi-squared tests or ANOVAs; associations between drinking and smoking and depression, anxiety and stress were tested using adjusted logistic regression models.

Results: Approximately, half of the sample ($N_{\text{Total}}=6,391$) were 50-69 years old and 58% were female. COVID-19 knowledge (Mean=12.0; SD=1.2; Range=0-13) and protective practice awareness (Mean=9.1; SD=0.8; Range 0-10) were high. However, only 84% of respondents were aware of the protective value of alcohol-based hand sanitizers and 19% had purchased facemasks. Among respondents, 44% had a score consistent with depression and anxiety (PHQ-4 score ≥ 6); and 52% reported high stress scores (\geq median of 1.33). COVID-19-related anxiety and depression were associated with increased drinking (AOR=1.79; 95% CI=1.49, 2.15, $p<0.001$) and smoking (AOR=2.17; 95% CI=1.64, 2.88, $p<0.001$). High stress scores were also associated with increased drinking (AOR=1.80; 95% CI=1.49, 2.17, $p<0.001$) and smoking (AOR=1.75; 95% CI=1.31, 2.33, $p<0.001$) among respondents.

Conclusions: In spite of high knowledge about COVID-19 and protective practices, important gaps were identified. High prevalence of poor mental health outcomes and associated increases in drinking and smoking warrant ongoing risk communications tailoring to effectively disseminate information and expanding psychosocial and substance use treatment services, particularly online telehealth services, to mitigate the negative mental health impact of the COVID-19 pandemic.

Background

The novel coronavirus disease (COVID-19) has rapidly emerged as a pandemic, precipitating the largest global health and economic crisis in recent history.¹ Highly transmissible, with relatively high morbidity and mortality rates,² particularly among older adults,³⁻⁵ COVID-19 has already inflicted myriad adverse

health, social, and economic consequences, and exacerbated existing health inequities. While many states have enacted social distancing measures to slow viral transmission, there is limited empirical research regarding people's knowledge, beliefs, and perceptions related to COVID-19 that may affect compliance with recommended mitigation measures. Given the disproportionate burden of COVID-19 morbidity and mortality among older adults, age-specific data are also of great importance.⁶ Equally lacking are data on COVID-19-related anxiety, depression and substance use, which may adversely affect adoption and sustainment of mitigation behaviors.⁷ Social separation, particularly for prolonged periods, can promote poor mental health outcomes.⁸⁻¹⁰ Given the absence of a vaccine, preventing COVID-19's more dire outcomes largely depends on compliance with preventive behaviors, modulated by the public's perceptions of the pandemic.¹¹⁻¹⁵ The development and widespread dissemination of effective risk communication strategies are critical for containment. To optimize the development of effective public health messaging, it is critical to identify gaps in COVID-19-related knowledge, beliefs, and mitigation behaviors.

To address this gap, we implemented an internet-based, nationwide survey of knowledge, beliefs, mental health and behaviors related to the COVID-19 pandemic among U.S. adults.

Methods

Participant recruitment

The sample was a self-selected non-probability sample of social media users aged ≥ 18 years and residing in the U.S. who responded to an anonymous web-based survey administered via Qualtrics (Provo, UT).¹⁶ To minimize redundant reporting, participants could only complete the survey once (based on IP address). Eligibility was confirmed through two screening questions (age and residence in the U.S.) at the start of the survey. Survey reporting followed the American Association for Public Opinion Research guidelines.¹⁷ The New York University Institutional Review Board reviewed and exempted the study procedures.

Recruitment was facilitated via a social media advertisement campaign through Facebook and its affiliated platforms. Used by 69% of U.S. adults, Facebook was chosen because it is the most popular social media platform among adults ≥ 65 years.^{18,19} A growing body of evidence suggests that Facebook is a valid and effective recruitment tool in health research, resulting in lower costs and shorter recruitment periods than other methods.²⁰ The advertisements ran for eleven consecutive days, from March 20-30, 2020.

Survey

The survey questionnaire was developed for this study (See Supplementary File S1 Questionnaire). The survey was informed by the Health Belief Model (HBM), which is a widely used model to explain preventive health behaviors based on knowledge, attitudes, and cues to action.^{21,22} HBM has been

previously utilized to guide surveys for other viral outbreaks, such as H1N1 and Middle East Respiratory Syndrome (MERS),²³⁻²⁷ and for Ebola in the U.S.^{28,29} The survey was also informed by the World Health Organization (WHO) Tool for behavioral insights on COVID-19.³⁰ The survey included questions on COVID-19 knowledge, risk perceptions, and preventive behaviors, and psychometrically validated mental health scales adapted for this pandemic.

Knowledge of COVID-19 was measured by 13 binary response format (True/False) items, such as “Coronavirus is a contagious disease.” Responses consistent with information provided by the CDC as of March 11, 2020, were summed to create a composite knowledge score

Awareness of COVID-19 Protective Practices was assessed by 10 binary response format (True/False) items, that respondents may have considered preventive of COVID-19 infection, such as “Getting a flu shot.” Items were selected from previous surveys^{28,31,32} and updated to reflect behaviors relevant to the current pandemic. Responses consistent with CDC recommendations as of March 11, 2020, were summed to create a composite COVID-19 prevention score.

Adoption of COVID-19 Protective Practices was assessed by 12 binary response format (Yes/No) items about specific evidence- and non-evidence-based behaviors that respondents may have considered preventive of COVID-19 infection, such as “Started wearing rubber gloves in public.”

COVID-19-related changes in tobacco and alcohol use were assessed by the question “Since hearing about the Coronavirus outbreak, has your smoking (tobacco products) and alcohol use behaviors changed?” Response options ranged from “Much more” to “Much less” and included “Not applicable.” The variables were re-coded as “more,” “less,” or “no change.”

Anxiety and depression related to COVID-19 were assessed with an adapted version of the 4-item Patient Health Questionnaire (PHQ-4).^{31,33} The stem question was, “Over the last 7 days, how often have you been bothered by any of the following problems because of the Coronavirus outbreak?” Response options were rated on a 4-point Likert scale ranging from “Not at all” to “Nearly every day.” Total scores ranged from 0-12; with higher scores indicative of greater anxiety and depression symptoms. The score was dichotomized based on the clinical cutoff for possible depression and anxiety (<6 and ≥6).³³ The scale demonstrated internal reliability (alpha=0.89).

Impact of Event Scale (IES) and its abbreviated 6-item version (IES-6) are widely validated scales to measure subjective stress.^{27,34,35} We adapted the IES-6 scale to measure stress associated with the COVID-19 pandemic. An item example was, “I thought about Coronavirus when I didn’t mean to,” with 4 response options ranging from “Not at all” to “Nearly every day.” The mean item response was calculated (possible range from 0 to 3), with higher mean scores indicative of more subjective stress. The sample was dichotomized at the median into high and low stress scores. The scale’s internal consistency was 0.86.

Pessimism was assessed by the question: “I am optimistic that the Coronavirus outbreak will be controlled in the next 3 months.” Response options on the 4-point Likert scale ranged from “Strongly agree” to “Strongly disagree.” The variable was reverse coded and dichotomized into a Pessimism variable (Disagree/Strongly Disagree=0; Strongly Agree/Agree=1).

Demographics assessed included sex, race, age category (by decade), employment status, educational attainment, living with children <18 years of age, state of residence (re-coded by U.S. Census region³⁶), urban/rural residence, and political party affiliation.

Statistical analysis

Given the potential importance of age as a demographic risk factor for mortality among people with COVID-19 infection, the sample was categorized into three age groups: (1) 18-39 years, (2) 40-59 years, and (3) ≥ 60 years. Descriptive statistics characterized respondents’ demographics and COVID-19-related knowledge, behaviors, substance use, and mental health for the total sample and the three age categories. Pearson’s chi-squared tests for categorical variables, and ANOVA tests for continuous variables, were used to examine differences by age categories. Post hoc pairwise comparisons were also tested. All tests were two-sided with significance level of $p < 0.05$. Logistic regression analyses assessed changes in alcohol consumption and smoking associated with anxiety, depression, and stress, controlling for age and race. All analyses were complete case analyses. Statistical analyses were performed using Stata version 15.1 (StataCorp, College Station, TX).

Results

Sample Characteristics

The sample was comprised of 6,391 respondents; 4,998 respondents (78%) completed 100% of the survey, 1,393 (22%) were partial completers (906 completed <33% and 487 completed 50%-79% of the items). Respondents took a median of 10.9 minutes [interquartile range (IQR)=9.0, 13.4] to complete the full survey.

Sociodemographic Characteristics of the Sample

Sociodemographic characteristics of respondents are presented for the entire sample and by age group in Table 1. Approximately, half of the respondents were 50-69 years old and 58% were female. The majority self-identified as non-Hispanic White. Participants were almost uniformly distributed between three of the four major geographic regions in the U.S. (26-30% in each), with fewer respondents residing in the West (15%). Almost half lived in suburban areas. Approximately, three-fourths of adults under 60 years were employed, compared to a third of those aged 60 years and over.

Knowledge of COVID-19

Respondents had high COVID-19 knowledge scores [Mean=12.0; Standard Deviation (SD)=1.2; Range=0-13] (Table 2). Most were aware that people infected with Coronavirus could be asymptomatic (89%), and that a vaccine was unavailable (97%). One item assessing knowledge of the protective value of alcohol-based hand sanitizers, while high (84%), was lower relative to other knowledge items. Only 81% of respondents aged ≥ 60 years were aware of the protective value of alcohol-based hand sanitizers; lower than respondents aged 40-59 years (81% $_{\geq 60}$ vs. 86% $_{40-59}$ years, $p < 0.001$).

Awareness of COVID-19 Protective Practices

Respondents, on average, correctly identified 90% (Mean=9.1; SD=0.8; Range 0-10) of protective practices (Table 2). However, some gaps were observed: only 84% and 51% of respondents, respectively, were aware that receiving an influenza vaccine did not confer protection against the novel Coronavirus, and that wearing a facemask was protective. Few differences were observed across age groups; with one exception: fewer respondents 60 years and older were aware that the influenza vaccine was not protective against the novel Coronavirus compared to 18-39 year-olds (82% $_{\geq 60}$ years vs. 86% $_{18-39}$ years, $p = 0.005$).

Adoption of COVID-19 Protective Practices

Most respondents reported avoiding crowded places and using alcohol-based hand-sanitizers (Table 3). Only 19% of respondents reported purchasing facemasks. Overall, significant differences were observed across age groups; although the magnitude of differences was relatively modest. Differences across age groups were more pronounced with regards to non-evidence-based protective practices (e.g., taking hot baths and dietary supplements) than to evidence-based practices.

COVID-19-Related Changes in Tobacco and Alcohol Use

Among self-identified smokers ($n = 1,359$), about half indicated no change in their smoking behavior as a result of COVID-19, while 22% reported smoking more (Table 3). With respect to alcohol consumption, 53% reported no change in drinking behavior, while 25% reported drinking more. There was an observed age gradient in those reporting increased drinking: 34% of respondents aged 18-39 years reported increased drinking compared to 25% of those aged 40-59 years and 15% of those aged 60 years or more (all differences $p < 0.001$).

Mental Health Indicators: Anxiety, Depression, Stress, and Pessimism

COVID-19-related anxiety and depression symptoms experienced within the week prior to survey participation were high; 44% of respondents had a score consistent with depression and anxiety (PHQ-4 score of ≥ 6) (Table 4). Notably, 85% of respondents reported "feeling nervous, anxious, or on edge." Stress levels were also high, with 52% reporting high scores (at or above the median of 1.33). Similarly, 47% of respondents reported "pessimism" about the COVID-19 pandemic being resolved in the next 3 months. Differences were observed between age groups for both anxiety/depression and stress: older age was associated with lower proportion of identified symptoms of anxiety, depression, and stress.

Among 18-39-year-olds, 57% had PHQ-4 scores ≥ 6 compared to 33% of ≥ 60 year-olds ($p < 0.001$). Respondents aged 18-39 years were more likely to report high stress scores than adults aged ≥ 60 (67%_{18-39-year-olds} versus 39% _{≥ 60 years}, $p < 0.001$).

Associations Between Mental Health, Stress, and Substance Use

Adjusted analyses, controlling for age and race, showed that respondents reporting symptoms of anxiety and depression (PHQ-4 score ≥ 6) were 79% more likely than those below the clinical cutoff to report drinking more [adjusted odds ratio (AOR)=1.79; 95% confidence interval (CI)=1.49, 2.15, $p < 0.001$] and more than twice as likely to report smoking more (AOR=2.17; 95% CI=1.64, 2.88, $p < 0.001$) in response to the COVID-19 pandemic (Table 5). A similar pattern was observed with stress symptoms, whereby respondents with high stress levels were 80% more likely to report increased drinking (AOR=1.80; 95% CI=1.49, 2.17, $p < 0.001$), and 75% more likely to report increased smoking (AOR=1.75; 95% CI=1.31, 2.33, $p < 0.001$) relative to those with low stress levels.

Discussion

Overall, respondents had high levels of COVID-19 knowledge and awareness of protective practices. Most were aware that a vaccine was unavailable and to avoid congregating in crowded places, a key COVID-19 mitigation strategy.^{37,38} However, purchase of facemasks was low. This may be attributable to mixed public health messaging at the time of the survey (March 2020) about the effectiveness of facemasks as a personal protective practice, and the limited availability of masks to the public.³⁹ Another gap was the relatively low awareness about alcohol-based hand sanitizers as a protective practice. These findings suggest that while adults are largely cognizant of accurate information about COVID-19 and preventive practices, some gaps remain to be addressed.

As our scientific understanding of COVID-19 improves continuously with respect to transmission, treatment, and prevention, public attitudes towards COVID-19 will also likely evolve. Public health messaging will need to rapidly respond and adapt to both. Furthermore, COVID-19 is likely to require sustained public health action in the foreseeable future. Research on recent global emerging disease outbreaks, such as SARS and H1N1, has shown that public perceptions and behaviors can change significantly during the course of outbreaks, and several studies have highlighted the importance of understanding the public's response.^{15,40-42} Therefore, monitoring perceptions and behaviors over time in response to changes in the COVID-19 pandemic, and its containment strategies, is warranted, and can provide policymakers with useful information to ensure continued compliance with key recommended mitigation behaviors.⁴³

Of particular concern is the high prevalence of COVID-19-related depression, anxiety, stress and pessimism, and increases in alcohol and tobacco use. While the impact of the COVID-19 pandemic has been predominantly measured in terms of morbidity and mortality,⁴⁴ the myriad adverse societal consequences may be precipitating a "hidden epidemic" of mental illness that is not receiving adequate

attention.⁷ Indeed, the American Psychological Association has predicted the need for a scaled-up response to traumatic stress resulting from the pandemic.^{45,46} Outbreaks such as H1N1 negatively impacted the mental health not only of survivors⁴⁷ and healthcare workers,⁴⁸ but also of communities.⁴⁹⁻⁵¹ Furthermore, suicide rates increased by up to 6.4% following the 2008 financial crisis.⁴⁶ Given that the COVID-19 pandemic is driving a global economic recession, similar trends may emerge.

Depression and anxiety already constitute the leading cause of disability worldwide.⁵² Exacerbation of their burden in the U.S., may produce unforeseen public health and economic consequences long after the COVID-19 pandemic is controlled. Therefore, policymakers should allocate resources for psychosocial support to alleviate both the personal and societal burden of a mental health crisis. The observed associations between stress, substance use, and depression and anxiety suggest that these factors may be interrelated adverse consequences of the COVID-19 pandemic. Although there is limited research on substance use following viral outbreaks, increases in problem alcohol use were observed among hospital employees in China during the 2003 SARS outbreak.⁵³ Thus, confronting these challenges may necessitate enhancing access to substance use treatment and mental health services. Given the scope and disruptive effect of COVID-19 relative to other outbreaks,⁵⁴ mental health and substance use interventions utilized after natural disasters^{55,56} can provide valuable guidance. Resiliency from the short term mental, social, and economic impacts of COVID-19 will require intense study.⁵⁷

Even though many states have instated social distancing measures, which may preclude face-to-face counseling with healthcare providers, opportunities remain to utilize online and telehealth counseling services. These services are compliant with social distancing policies and can play a critical role in coping with the adverse consequences of COVID-19, such as loneliness, income loss, and pessimism. One technological strategy to enhance self-care may include the use of smartphone applications to monitor and link users to services.^{58,59} Distance telehealth counseling strategies are not only valuable, but may be essential to confront the mental health and substance use threats posed by the COVID-19 pandemic.

During a pandemic, accurate and verifiable information is essential to dispel misconceptions and mitigate fears and ambiguity that could result in the adoption of non-evidence-based practices, maladaptive coping strategies, or use of unproven therapeutics. Non-evidence-based treatments are not solely ineffectual; they are dangerous. Complex medical information, such as COVID-19 virology, immunology, medical treatments, and epidemiology, needs to be clear, consistent and understandable. Thus, there is a need to improve risk communications and increase the message dissemination channels. Risk and health communication theories and techniques can be utilized to enhance message clarity and impact.⁶⁰ For instance, the use of dynamic visual depictions may enhance effective communication and facilitate accurate information transfer. The visual depiction of “flattening the curve” has been used to convey social distancing recommendations based on complex epidemiological modeling.⁶¹ A dynamic depiction of the virus’ spread could show the increasing prevalence of COVID-19 across the U.S. over time. Diverse communication channels, strategies, and techniques are needed to facilitate message

reach. News media outlets, predominantly those on television, are a major source of COVID-19 information. Other media, such as social media, blogs, and text messaging, can complement accurate news and may be harnessed to disseminate important information.

Strengths and limitations

Strengths of this study included a large sample size, the wide geographic distribution of participants, the use of theory-driven, validated scales and items, and the fact that data were collected during the peak of the pandemic, thus providing a snapshot of the perceptions and behaviors of the U.S. population during a critical time of the crisis. However, the findings should be considered in the context several limitations. First, given that the survey was opt-in, there is likely a bias towards respondents with greater interest in the subject. These respondents may differ in unmeasured, systematic ways from those uninterested in COVID-19. Second, the population from which the sample was drawn included only Facebook users. Although almost 70% of Americans use Facebook (of whom 74% use it daily), certain demographic groups, such as men and racial/ethnic minorities, are under-represented.⁶² The demographic distribution of our respondents mirrors this disparity, with an over-representation of Non-Hispanic Whites and females. Consequently, this survey may not be generalizable to the U.S. population and may not adequately reflect the perceptions and behaviors of other groups.

Conclusion

As the toll from COVID-19 continues to rise, there is a need to address both the community transmission and the concomitant mental health and substance use consequences of the crisis. This requires a well-articulated, coordinated, and systematic pandemic control strategy; one based on science and effective behavior change and risk communication strategies. This study contributes to the vital evidence base needed to inform targeted public health interventions on disparities in knowledge, beliefs, and behaviors (including substance use) occurring during the COVID-19 pandemic. To increase the uptake and sustained practice of COVID-19 preventive behaviors requires utilizing theory- and empirically-based strategies with demonstrable evidence of effectiveness in other health threats. Ultimately, reducing the transmission of COVID-19 will require the public health equivalent of a full-court press, with prevention messages aimed at addressing knowledge gaps, misconceptions, and practices, using the most effective social and behavioral science communications strategies.

Abbreviations

ANOVA: analysis of variance

AOR: adjusted odds ratio

CI: confidence interval

COVID-19: novel coronavirus disease

HBM: Health Belief Model

IES: Impact of Event Scales

IQR: interquartile range

MERS: Middle East Respiratory Syndrome

OR: odds ratio

PHQ-4: Patient Health Questionnaire

SARS: Severe Acute Respiratory Syndrome

SD: standard deviation

WHO: World Health Organization

Declarations

Ethics and consent to participate: The New York University Institutional Review Board reviewed and exempted the study procedures, included the need for consent to participate, ruling that no formal ethics approval was required to conduct this survey.

Availability of data and materials: The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

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Authors' contributions: All authors have read and approved the manuscript. RJD: Conceptualization, Methodology, Writing – review & editing, Supervision; AC: Data curation, Formal analysis, Methodology, Writing, original draft; SHA: Data curation, Methodology, Writing – review & editing; AMJ: Data curation, Methodology, Writing – review & editing; JF: Methodology, Writing, original draft; YT: Writing – review & editing.

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Tables

Table 1. Characteristics of adult Facebook Users in the U.S. During the COVID-19 Outbreak, March 20-30, 2020

	Total (n = 4998)	Ages			p-value*
		18-39 (n = 1231)	40-59 (n = 2314)	60+ (n = 1453)	
		Female sex, %**	58	59	
Non-Hispanic White race, %	92	89	92	96	<0.001
Geographic Region, %***					
Northeast	26	26	26	24	
Midwest	30	33	29	28	
South	30	26	30	32	
West	15	15	15	16	0.029
Residence type, %					
Rural	34	28	35	37	
Suburban	49	51	48	47	
Urban	17	20	16	16	<0.001
Employment status, %					
Employed	63	72	77	33	
Not employed	11	12	13	8	
Unpaid labor/student	7	16	5	2	
Retired	19	0	5	58	<0.001
Educational attainment, %					
High School or below	16	16	16	15	
Some college	34	33	35	34	
Bachelor's degree	28	30	27	26	
Master's degree or higher	23	21	22	25	0.138
Political affiliation, %					
Democrat	34	39	30	35	
Republican	26	19	27	29	
Other	19	22	19	15	
Prefer not to disclose	22	20	23	21	<0.001

Notes: * Pearson's chi-squared test ** n=6391 *** n=4997

Table 2. Accurate Knowledge of COVID-19 Facts and Protective Practices Among 5960 Facebook Users in the U.S., March 20-30, 2020

	% Correct Total Sample	% Correct by Age Group			p-value*
		18-39	40-59	60+	
		(n = 1512)	(n = 2744)	(n = 1704)	
Coronavirus is a contagious disease (T), %	99	99	99	99	0.655
A person infected with Coronavirus is not contagious until after symptoms appear (F), %	96	96	96	96	0.855
Coronavirus cannot be spread through sneezing and coughing (F), %	93	91	93	93	0.151
Currently, there is an FDA approved drug for treating individuals with Coronavirus (F), %	90	90	90	91	0.433
Coronavirus can live on surfaces outside of the body for a few hours or several days (T), %	98	99	98	98	0.085
There is no vaccine currently available to prevent infection with Coronavirus (T), %	97	97	97	97	0.761
Children are at high risk for complications from Coronavirus (F), %	79	81	80	77	0.003
Older people with other health conditions are more likely to die from Coronavirus (T), %	98	99	98	98	0.075
People with Coronavirus can have no symptoms at all (T), %	89	91	90	88	0.020
Most people with Coronavirus will have severe or critical symptoms (F), %	89	89	89	88	0.665
Alcohol-based hand sanitizers cannot protect you from Coronavirus (F), %	84	84	86	81	<0.001
Coronavirus may be transmitted by mosquito bites (F), %	95	95	95	96	0.360
Coronavirus originated from animals (T), %	90	92	91	88	<0.001
COVID-19 knowledge score (range 0-13), mean (SD)	12.0 (1.2)	12.0 (1.2)	12.0 (1.2)	11.9 (1.2)	<0.001
	% Correct Total Sample	% Correct by Age Group			p-value*
		18-39	40-59	60+	
Washing your hands frequently with soap and water (T), %	99	99	100	99	0.099
Getting a flu shot (F), %	84	86	83	82	0.014
Wearing a face mask (T), %	51	50	52	51	0.383
Stop going to school/work (T), %	94	94	93	94	0.373
Wiping potentially contaminated surfaces with a disinfectant (T), %	99	99	99	99	0.532
Staying away from Asian people (F), %	96	95	96	96	0.414
Staying away from people who sneeze and cough (T), %	97	97	97	97	0.537
Avoiding touching your eyes, nose and mouth (T), %	99	99	99	99	0.264
Taking antibiotics (F), %	96	95	96	97	0.056
Stop eating Chinese food (F), %	99	98	99	99	0.003
COVID-19 protective practices awareness score (range 0-10), mean	9.1	9.1	9.1	9.1	0.638

(SD)	(0.8)	(0.8)	(0.8)	(0.8)
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Notes: SD=standard deviation * Pearson's chi-squared test for categorical variables and ANOVA for continuous variables

Table 3. Adoption of COVID-19 Protective Practices Among a Sample of U.S. Adult Facebook Users (N=5486), March 20-30, 2020

	Total	Age Groups			p-value*
	Sample	18-39	40-59	60+	
	(n = 5486)	(n = 1364)	(n = 2541)	(n = 1581)	
% endorsing each behavior					
To protect myself from COVID-19, I...					
Got a flu shot (or had my children get a flu shot) after hearing about Coronavirus, %	8	7	8	10	0.025
Purchased a face mask, %	19	17	20	20	0.065
Started working from home, %	63	64	63	64	0.738
Started using hand-sanitizer and/or washing my hands more often, %	96	97	96	97	0.532
Started drinking more fluids and/or getting more rest, %	77	74	75	81	<0.001
Started taking antiviral and/or antibiotics, %	2	4	2	2	0.001
Started taking dietary supplements (e.g., vitamins, probiotics), %	37	39	37	34	0.008
Avoided using public transportation, %	88	90	86	88	0.001
Kept away from crowded places, %	97	97	97	98	0.099
Started cleaning and/or disinfecting things that I might touch (e.g., doorknobs, phone), %	90	89	91	89	0.081
Started wearing rubber gloves in public, %	25	22	25	29	<0.001
Started taking more hot baths, %	11	15	11	9	<0.001
COVID-19-Related Changes in Tobacco and Alcohol Use					
Smoking (tobacco products)^a					
Smoking less	26	31	23	27	
Did not change	51	45	55	49	
Smoking more	22	24	21	23	0.015
Drinking (alcohol)^b					
Drinking less	22	26	21	20	
Did not change	53	40	54	64	
Drinking more	25	34	25	15	<0.001

Notes: * Pearson's chi-squared test ^aAmong 1359 smokers (24.8% of respondents)

^bAmong 2864 people who drink (52.2% of respondents)

Table 4. Mental Health Related to the COVID-19 Outbreak Among a Sample of U.S. Adults (N=5044), March 20-30, 2020

	Total	Age Groups			p-value*
	Sample	18-39	40-59	60+	
	(n = 5044)	(n = 1242)	(n = 2336)	(n = 1466)	
	% endorsing each symptom or mean (SD)				
PHQ-4 scale (Past 7-day anxiety and depression symptoms)					
Feeling nervous, anxious, or on edge?, %	85	92	86	77	<0.001
Not being able to stop or control worrying?, %	69	82	70	57	<0.001
Feeling down, depressed, or hopeless?, %	64	75	65	53	<0.001
Little interest or pleasure in doing things (that I used to enjoy)?, %	56	63	57	48	<0.001
PHQ-4 score of =>6 is the cutoff^a	44	57	45	33	<0.001
IES-6 (% respondents with median+ scores)	52	67	52	39	<0.001
Pessimism about COVID-19^{cd}	47	49	46	45	0.079

Notes: SD=standard deviation PHQ-4=The Patient Health Questionnaire-4 IES-6=Impact of Event Scale-6 * Pearson's chi-squared tests for categorical variables and ANOVA for continuous variables ^aScores ≥6 on the PHQ-4 may be indicative of anxiety and depression ^bMean IES-6 score ^cResponded disagree or strongly disagree to "...being optimistic about COVID-19 being under control within 3 months" ^dDenominator n=5167

Table 5. Substance Use Associated With Depression, Anxiety and Stress During the COVID-19 Outbreak

	Adjusted Odds Ratio (95% Confidence Interval)*	p-value
PHQ-4 score at or above depression and anxiety cutoff		
Drinking more (compared to drinking same/less)	1.79 (1.49, 2.15)	<0.001
Smoking more (compared to smoking same/less)	2.17 (1.64, 2.88)	<0.001
Scores at median or above on the Impact of Event Scale-6		
Drinking more (compared to drinking same/less)	1.80 (1.49, 2.17)	<0.001
Smoking more (compared to smoking same/less)	1.75 (1.31, 2.33)	<0.001

Notes: PHQ-4=The Patient Health Questionnaire-4 *Logistic regressions adjusted for age and race. The PHQ-4 score was evaluated above the clinical cutoff score for depression and anxiety (PHQ-4 score ≥6); IES-6 was evaluated as high and low values based on a median split (Median=1.33)

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [S1Questionnaire.pdf](#)