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Predictors of intention to vaccinate against COVID-19: Results of a nationwide survey

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ABSTRACT

Background: Public polling indicates that vaccine uptake will be suboptimal when COVID-19 vaccines become available. Formative research seeking an understanding of weak vaccination intentions is urgently needed.

Methods: Nationwide online survey of 804 U.S. English-speaking adults. Compensated participants were recruited from the U.S. through an internet survey panel of 2.5 million residents developed by a commercial survey firm. Recruitment was based on quota sampling to produce a U.S. Census-matched sample representative of the nation with regard to region of residence, sex, and age.

Results: COVID-19 vaccination intentions were weak, with 14.8% of respondents being unlikely to get vaccinated and another 23.0% unsure. Intent to vaccinate was highest for men, older people, individuals who identified as white and non-Hispanic, the affluent and college-educated, Democrats, those who were married or partnered, people with pre-existing medical conditions, and those vaccinated against influenza during the 2019–2020 flu season.

In a multiple linear regression, significant predictors of vaccination intent were general vaccine knowledge (β = 0.311, p < .001), rejection of vaccine conspiracies (β = −0.117, p = .003), perceived severity of COVID-19 (β = 0.273, p < .001), influenza vaccine uptake (β = 0.178, p < .001), having $\geq$ 5 pre-existing conditions (β = 0.098, p = .003), being male (β = 0.119, p < .001), household income of $\geq$ $120,000 ($\beta$ = 0.110, p = .004), identifying as a Democrat (β = 0.075, p < .029), and not relying upon social media for virus information (β = -0.090, p ⟨002). Intent to vaccinate was lower for Fox News (57.3%) than CNN/MSNBC viewers (76.4%) (χ2 (1) = 12.68, p < .001). Political party differences in threat appraisals and vaccine conspiracy beliefs are described.

Conclusions: Demographic characteristics, vaccine knowledge, perceived vulnerability to COVID-19, risk factors for COVID-19, and politics likely contribute to vaccination hesitancy.

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1. Introduction

An epidemic of severe acute respiratory disease linked to a new strain of coronavirus (COVID-19) emerged in late December 2019 in Wuhan, China [1]. By mid-October 2020, the number of documented cases and deaths reported globally exceeded 38 million and 1.08 million, respectively [2]. Within the U.S., there have been more than 7.8 million cases, resulting in over 216,000 deaths at the time of this writing [2]. The COVID-19 illness spectrum is broad, ranging from asymptomatic infection to acute respiratory distress syndrome, culminating in death [3].

Dozens of vaccine development programs have been initiated in response to the pandemic [4]. Once a vaccine is approved, high rates of vaccine uptake will be required to protect human health [1]. If seasonal influenza vaccination rates are any indication, acceptance of a COVID-19 vaccine in the U.S. will be suboptimal [5]. The lethality of COVID-19 should encourage high rates of immunization when a vaccine becomes available. Unfortunately, recent public opinion polls in the U.S. suggest otherwise, with 20–27% of the public reporting that they will decline to get vaccinated against the virus [6–8].

An understanding of the factors that foster COVID-19 vaccination hesitancy is critically important. To overcome people's doubts about such vaccines, robust public health campaigns must be developed and sustained. Effective public communication requires formative research that explicates the knowledge deficits, attitudes, beliefs, health perceptions and demographic characteristics that give rise to anticipated COVID-19 vaccine hesitancy.

This study had four objectives. First, we measured intention to vaccinate against COVID-19 if and when a vaccine becomes available. Vaccine safety concerns, in particular, have been shown to adversely affect vaccination decisions. Such concerns may be amplified by efforts to expedite COVID-19 vaccine development [9]. Other potential reasons assessed include worries about vaccine effectiveness, assumptions about one's personal susceptibility to and severity of COVID-19, the possibility of being immune from a past COVID-19 infection, to name a few.

Second, we sought a demographic and health status profile of individuals least likely to vaccinate. Given the extensive media coverage of the pandemic, we predicted that most individuals are aware of the risk factors associated with COVID-19 and thus expected intent to vaccinate to be strongest for respondents with these factors [10]. These groups include men, people aged 65 and over, individuals with pre-existing conditions, and minorities [11,12]. While we know of no research on the matter, a potential geographic predictor of intent to vaccinate is living in the Northeast part of the country, the first epicenter of the pandemic in the U.S. Regarding health predictors, we predicted that intentions would be strongest for those with more of the pre-existing health conditions that make one susceptible to COVID-19. It was also our expectation that being vaccinated against influenza in the current flu season would serve as a marker for strong COVID-19 vaccination intentions.

Third, we investigated the role played by general vaccine knowledge, vaccine conspiracy beliefs, and perceived susceptibility to and severity of COVID-19 in people's intentions to get a COVID-19 vaccine [13–15]. Previous studies found that people who are educated about the benefits of vaccination and the significance of herd immunity are more accepting of vaccines [16]. We thus expected that those with lower vaccine knowledge would be less likely to report a willingness to vaccinate against COVID-19. Similarly, conspiracy beliefs about vaccinations can exacerbate vaccination hesitancy [17], and we expected this to be no different for any COVID-19 vaccine that comes to market. Perception of one's personal vulnerability to serious harm from COVID-19 were also hypothesized to enhance vaccination intentions [18]. This approach is supported by the Health Belief Model tenet that people will take action if they regard themselves as susceptible to COVID-19 and if they believe COVID-19 poses a serious threat [13–15].

Fourth, we sought to cast light on the role of media and partisan politics in resistance to vaccination. Vaccine conspiracy beliefs are often spread through conservative media sources, so those who consume conservative media are expected to have weaker intentions to vaccinate against COVID-19 [8,19]. The possibility of a COVID-19 vaccine, in particular, has often been framed in partisan terms by the media [8]. Thus, a concern of this study was to assess the impact of people's main media source of COVID-19 information on vaccine hesitancy. Although our analyses were exploratory, we did predict that a preference for Fox News and social media to be associated with weaker intentions to vaccinate against COVID-19.

2. Materials and Methods

2.1. Survey sample

The sample consisted of 804 compensated English-speaking adults residing in the U.S. Respondents were recruited through the Dynata Samplify platform (www.dynata.com) from this survey firm's panel of 2.5 million U.S. residents. A nationwide nonprobability quota sampling design was employed to create a sample representative of the nation with regard to region of residence, gender, and age. The questionnaire was hosted on the Qualtrics survey platform (www.qualtrics.com). Data were collected over two days

(June 15–16, 2020). Study procedures and consent protocols for this online survey were approved by the IRB at the authors' institution.

2.2. Measures

Scale items and other measures are reported in supplementary table S1. The primary outcome measure was intention to get vaccinated against COVID-19 when a vaccine becomes available. This was a single-item, 5-point measure to allow for direct comparisons with recent poll data (*All things considered, how likely are you to get a coronavirus vaccine when one becomes available?*). In some analyses responses were dichotomized by classifying respondents as being likely to vaccinate if they responded with a "somewhat likely" or "extremely likely" to the intention question. This group was compared to the remaining survey participants who responded with "unsure," "somewhat unlikely" or "extremely unlikely."

General knowledge about vaccines was assessed with an established instrument [20]. The Vaccine Conspiracy Beliefs Scale was used to measure conspiratorial thinking about immunizations [21]. Threat appraisal was assessed with three Likert-type items modeled after Witte's conceptualization of health threat appraisal (e.g., *I am at high risk of becoming seriously ill from COVID-19*) [22]. This model assumes that perceived threat is a function of the severity and one's perceived susceptibility to a disease. The medical pre-existing conditions that make one more vulnerable to serious COVID-19 disease are well covered by the media. We thus asked respondents to check any of eight such conditions listed on the Centers for Disease Control and Prevention (CDC) site at the time the study was carried out. We acknowledge that understanding of this novel virus continues to evolve and the list of pre-existing conditions used for this assessment may be incomplete. The sum of the number of conditions checked served as an index of pre-existing vulnerabilities.

Preferred source of news about COVID-19 was measured based on a Pew Research Center (PRC) question developed to solicit preferred media for election news [23]. Specifically, respondents were asked which media outlet they most often turn to for news about COVID-19. Response options were limited to sources nominated by at least 2% of respondents in PRC polling. These included the three broadcast networks (ABC, CBS, NBC), three cable networks (CNN, FOX News, MSNBC), NPR, "social media sites," and the *New York Times*. Respondents could provide their preferred source if not listed. The questionnaire ended with standard demographic questions.

2.3. Data analysis

Basic descriptive statistics were used to characterize the sample and study variables. Associations between demographic variables and vaccination intent were initially assessed with cross-tabulations, followed by multiple linear regression to determine significant independent predictors.

3. Results

3.1. Preliminary analyses

The sample is described in Table 1. By design, the quota sample was representative of the U.S. population in terms of region of residence, sex, and age, but also diverse with regard to all demographic variables assessed. Means, standard deviations, and reliabilities for the primary study variables are reported in Table 2. The composite variables reported in the table were based on an averaging of items. Scale reliabilities were high. The mean vaccina-

Table 1
Sample characteristics (*N* = 804).

Characteristic	*n*	%
Female	431	53.6
Hispanic/Latino Cultural Identity	74	9.3
Race		
American Indian/Alaskan Native	5	0.6
Asian	85	10.6
Black	87	10.8
Native Hawaiian/Pacific Islander	5	0.6
White Race	525	65.3
Multi-racial/other	97	12.1
Age		
18–24	118	14.7
25–34	146	18.2
35–44	150	18.7
45–54	135	16.8
55–64	114	14.2
≥65	141	17.5
US Region		
West	188	23.4
Midwest	171	21.3
Northeast	149	18.5
South	296	36.8
Married/living as married	455	56.6
Education		
HS or less	160	19.9
Some college / Associates Degree	221	27.5
4-Year College Degree	236	29.4
Post-graduate Degree	187	23.3
Total Household Income		
Under $19,999	85	10.6
$20,000–$39,999	123	15.3
$40,000–$59,999	103	12.8
$60,000–$79,999	89	11.1
$80,000–$99,999	96	11.9
$100,000–$119,999	84	10.5
≥$120,000	161	20.0
Declined to answer	63	7.8
Political Party Affiliation		
Republican	238	29.6
Democrat	250	31.1
Independent	227	28.2
Something Else	9	1.1
No Preference	80	10.0
Preferred Media for Coronavirus News		
ABC	113	14.1
CBS	71	8.8
CNN	141	17.5
Fox News	131	16.3
MSNBC	33	4.1
NBC News	64	8.0
NPR	24	3.0
Social Media Sites	64	8.0
New York Times	59	7.3
Other Source	104	12.9

tion knowledge score was only slightly above what a respondent would be expected to earn by chance alone (4.5 out of 9), suggesting poor understanding of how vaccines work. Average conspiracy

acceptance scores and COVID-19 threat appraisals were near the midpoint of their respective scales. Respondents had an average of 1.2 pre-existing conditions; 56.1% reported no pre-existing condition. Because this variable was highly skewed, it was recoded as a categorical variable, as described below. Respondents were also asked if they have, or thought they might have been infected with COVID-19. Approximately 19.8% answered affirmatively but only 6.8% reported that their answer was based on actual testing (results not tabled).

3.2. Vaccination intentions

Regarding our first objective, the distribution of responses on the intent to vaccinate question was as follows: *extremely or somewhat unlikely* to get vaccinated (14.8%), *unsure* (23.0%), and *extremely or somewhat likely* (62.2%). A follow up question was asked of respondents who were unlikely or unsure about getting a vaccine about the reasons for their doubts. Nine possible reasons for why they felt that the vaccine might not be right for them were presented. Selection of multiple reasons was allowed. Stronger opposition to vaccination corresponded with the endorsement of more reasons to decline, which is to be expected (Table 3). The top four reasons given for vaccination hesitancy were as follows: concerns about vaccine side effects, worries about allergic responses to the vaccine, doubts about vaccine effectiveness, and a preference for developing immunity through infection. Other reasons were less frequently endorsed, including being healthy, fear of needles, being immune from past infection, being young, and lack of concern about developing a serious illness. Clearly, vaccine safety and effectiveness assessments were the primary basis for hesitancy.

3.3. Demographic and health status profile of vaccination-hesitant individuals

Our second goal was to explicate the demographic and health status characteristics associated with intentions to vaccinate against COVID-19 when that opportunity presents itself (Table 4). Males were more likely than females to express an intention to get a COVID-19 vaccine once one is available. Older age (≥65), white race, high household income, and being college educated were all associated with stronger vaccination intentions. It is noteworthy that a majority of the least educated respondents did not expect to get vaccinated against COVID-19. Democrats were most likely to express an intent to vaccinate while only one fourth of the politically indifferent expected to do so. Having a spouse or partner was associated with higher anticipated likelihood of vaccination. A potent predictor of intent to obtain a COVID-19 vaccine when one is developed was having been vaccinated against influenza in the current flu season. Counter to expectations, region of residences was not significantly related to intent to vaccinate against COVID-19.

Table 2
Descriptive statistics for study variables (*N* = 804).

Variable	*M*	SD	Possible Range	Items	Alpha[a]
General vaccine knowledge test	5.03	2.78	1-9[b]	9	0.83
Acceptance of vaccine conspiracies	2.65	1.07	1-5[c]	7	0.95
Threat Appraisal	3.13	1.11	1-5[c]	3	0.85
Pre-existing conditions index	1.15	1.96	1-8[d]	8	0.85

[a] Cronbach's alpha.
[b] Range reflects the number of correct answers given across 9 test questions.
[c] Item responses for the multi-item belief measures were averaged for each respondent to create composite scores reflecting the 5-point response scales used.
[d] Range reflects how many of the 8 pre-existing conditions the respondent reported having.

Table 3
Analysis of reasons for anticipated coronavirus vaccine rejection for vaccination hesitant respondents, sorted by frequency of reason endorsement.

Reason Endorsed	Likelihood of Getting a COVID-19 Vaccination			
	Extremely Unlikely (*n* = 73)	Somewhat Unlikely (*n* = 46)	Unsure (*n* = 185)	Combined (*n* = 304)
The vaccine might have dangerous side effects.	57.5%	47.8%	37.3%	43.8%
I might be allergic to the vaccine.	34.2%	30.4%	25.9%	28.6%
The vaccine probably would not work.	27.4%	17.4%	17.8%	20.1%
I prefer developing immunity from infection than immunity through vaccination.	23.3%	19.6%	15.1%	17.8%
I am healthy and at low risk for infection.	19.2%	15.2%	11.4%	13.8%
I hate needles and injections.	8.2%	17.4%	11.9%	11.8%
I am already immune from a past COVID-19 infection.	2.7%	4.7%	11.4%	8.2%
I am young and at low risk for infection.	5.5%	2.2%	8.1%	6.6%
If I got infected, I would not become seriously ill.	5.5%	10.9%	5.4%	6.3%

Note: Percentages sum to > 100% because respondents were able to check all reasons that applied to them, personally.

3.4. Knowledge and vaccine-related beliefs

Third, we examined the impact of general vaccination knowledge, vaccine conspiracy beliefs, and personal COVID-19 threat appraisals on COVID-19 vaccine intentions. This was accomplished via a multiple regression analysis that included these variables along with the demographic and health variables described in Table 4. The dependent variable in this analysis was the 5-point likelihood of vaccination rating (Table 5). The model was statistically significant ($F(30, 773) = 21.06$, $p < .001$, Adj. $R^2 = 0.43$).

Greater likelihood of COVID-19 vaccine acceptance was associated with more knowledge about vaccines, less acceptance of vaccine conspiracies, elevated COVID-19 threat appraisals, and being current with influenza immunization. With regard to risk factors, having five or more pre-existing conditions and being male predicted greater likelihood of vaccination. Being aged 65 or older, white, or Hispanic were not significant predictors. The other demographic predictors of likelihood of being vaccinated against COVID-19 were having an income of $120,000 or higher and being a Democrat (in comparison to the reference category Republican). Only one preferred media outlet proved to be a significant predictor of vaccination likelihood. Respondents relying on social media for information about COVID-19 anticipated a lower likelihood of COVID-19 vaccine acceptance.

3.5. Media, politics and vaccination intentions

Our final objective was to explore the relationship of reliance on traditional and social media to COVID-19 vaccine intentions. Recall that in the regression analysis just reported, no significant effect was found on likelihood of vaccination for any traditional television news network. We suspected that any effect might have been diminished by the inclusion of political party and other predictors in the model. Thus a direct comparison of respondents was made between those who rely on conservative Fox News (*n* = 131) for their virus information with those who rely on the liberal cable networks CNN and MSNBC (*n* = 174) [23]. We did so after first determining that there were no significant differences among these three groups in their comorbidities. Intent to vaccinate was lower for respondents relying upon Fox News (57.3%) than CNN and MSNBC (76.4%) ($\chi2(1) = 12.68$, $p < .001$). Fox News viewers also perceived COVID-19 to be a lesser personal threat ($M = 3.04$, $SD = 1.20$) than CNN and MSNBC viewers ($M = 3.34$, $SD = 0.94$) ($t(303) = -2.38$, $p = .018$). However, these two audiences did not differ in their vaccine knowledge (Fox News: $M = 5.02$, $SD = 2.72$; CNN/MSNBC: $M = 5.06$, $SD = 2.54$; $t(303) = -0.16$, $p = .87$). There was also no significant difference in acceptance of vaccine conspir-

acy beliefs between Fox News ($M = 2.78$, $SD = 1.05$) and CNN/MSNBC viewers ($M = 2.72$, $SD = 1.07$) ($t(303) = 0.49$, $p = .62$).

Having found earlier that Democrats reported a greater likelihood of COVID-19 vaccine uptake than Republicans in the linear regression analysis, we followed up with a comparison of those who identify with these two parties or as Independents on the main study measures using one-way ANOVAs and the Bonferroni paired comparisons test (Table 6). The members of these three political groups did not differ in their general vaccine knowledge, but Democrats were more likely than both Independents and Republicans to state that they will get a COVID-19 vaccine. Republicans were significantly more likely to accept vaccine conspiracies than Independents. Democrats perceived COVID-19 to be a more significant personal threat than Independents.

4. Discussion

Vaccination remains the most effective public health approach to disease prevention, but is undermined by vaccine refusal [24]. Results of this national survey support four broad conclusions. First, the survey confirms previous polling that suggests hesitancy will be a challenge when novel COVID-19 vaccines become available. More than one third of our respondents were either not likely to get a COVID-19 vaccine or unsure about doing so. Those respondents with a disinclination to be vaccinated against COVID-19 when vaccines come to market cited vaccine safety and effectiveness as their primary reasons. These safety concerns may be exacerbated by the attempts to rush a COVID-19 vaccine to market [25].

Second, this study provides a demographic and health profile of the individuals most hesitant about being immunized. The demographic and health risk factors associated with serious COVID-19 disease parallel several of the individual characteristics associated with vaccine acceptance. Media reports have regularly noted that men, older adults age 65 and over, and individuals with pre-existing conditions are most vulnerable to COVID-19 [10,12,26]. Respondents from these groups were more likely to accept a future vaccine in this survey. This suggests that the public is generally aware of medicine's emerging understanding of who is most vulnerable to the virus.

Unfortunately, the health disparities present in the spread and treatment of COVID-19 were reflected in survey participants' vaccination hesitancy estimations. The pandemic has especially burdened the African American, Latino, and Native American communities, who account for a disproportionate number of COVID-19 cases and deaths [11]. Respondents from these subpopulations reported less interest in getting vaccinated against COVID-19 in the future. Beyond worries about vaccine safety and effec-

Table 4
Demographic and health predictors of coronavirus vaccine uptake intention, N = 804.

Variable	N	Likely to Get Vaccine[a]	p[b]
Sex			.001
Female	431	53.8%	
Male	373	71.9%	
Age			.005
18–24 years	118	52.5%	
25–34 years	146	61.0%	
35–44 years	150	64.0%	
45–54 years	135	55.6%	
55–64 years	114	64.0%	
≥65 years	141	74.5%	
Racial Identity			.001
White	525	67.2%	
Asian	85	56.5%	
Black/African American	87	59.8%	
Multicultural/Other race[c]	107	43.9%	
Hispanic/Latino Cultural Identity			.001
No	730	63.7%	
Yes	74	47.3%	
Total household income			.001
<$40,000	208	54.3%	
$40,000–$79,999	192	61.5%	
$80,000–$119,999	180	72.8%	
$120,000 and higher	161	73.3%	
Declined to answer	63	31.8%	
Education			.001
High school or less	160	47.5%	
Some college/associate's degree	221	60.6%	
Bachelor's degree	236	71.2%	
Graduate degree	187	65.2%	
Political party identity			.001
Republican	238	62.6%	
Democrat	250	73.2%	
Independent	227	63.0%	
Other party	9	55.6%	
No preference	80	25.0%	
Region of residence			.834
West	188	63.8%	
Midwest	171	63.2%	
Northeast	149	63.1%	
South	296	60.1%	
Marital Status			.001
Married/Living as Such	455	69.0%	
Not Married	349	53.3%	
Number of pre-existing conditions			.001
No conditions	451	57.7%	
1-2 conditions	231	64.1%	
3-4 conditions	63	66.7%	
5 or more conditions	59	84.8%	
Influenza vaccination status (2019-2020)			.001
Not Vaccinated/Unsure	427	45.2%	
Vaccinated	377	81.4%	

[a] Responses to the vaccination intention question was dichotomized as likely/very likely to get vaccinated (n = 500) versus unsure/unlikely/very unlikely (n = 304).
[b] Test of significance based on the χ^2 test for the contingency table.
[c] "Other race" includes races with too few cases to allow for meaningful analysis, including American Indians, Alaskan Natives, Native Hawaiians, Pacific Islanders, and others.

tiveness, a better understanding of the unique concerns of these groups is needed. One possibility is that mistrust in medicine, science and public health, which has been shown to be high in these groups [27,28], provides the foundation for safety and effectiveness concerns. Another issue are the existing health care disparities that arise from adverse social and economic conditions [29]. Similarly, improvements in health have not been distributed equally across racial, ethnic, and economic groups, negatively impacting the social determinants of health for minority populations in the U.S. [30].

We were surprised to find no regional differences in COVID-19 vaccination intentions. The survey was carried out when the Northeastern region – the first epicenter of the U.S. pandemic – had made significant strides in bringing the virus under control and just before the infection rates began to skyrocket in other regions following their relaxation of restrictions on movement and business operations. We predicted that vaccination intentions would be greatest in the Northeast owing to its direct experience with the devastation wrought by the virus. Perhaps the extensive media coverage of the pandemic brought the experiences of the hardest hit areas into the living rooms of all Americans, minimizing regional differences.

Third, the study reinforces previous research on the importance of being knowledgeable about the immunization process, rejecting conspiratorial disinformation about vaccines, and personal assessments of risk in the development of vaccination intentions. Although public health outreach cannot change a vaccine-hesitant person's demographics, outreach has the potential to educate the uninformed; challenge disinformation about future COVID-19 vaccines, as well as vaccines in general; and help those most at risk for serious illness from COVID-19 infection to appraise accurately their personal risk. The study also provides healthcare providers with a simple method for identifying patients who are least likely to avail themselves of a future COVID-19 vaccine – their current influenza vaccine status. Flu vaccination promotion efforts may offer valuable lessons to inform a COVID-19 mass vaccination program.

Fourth, the study suggests that traditional media and social media may both play a role in the development of COVID-19 vaccine hesitancy. It has been observed that the nation's response to the pandemic has been hindered by the politicization of public policy and discourse about the origins, spread and containment of COVID-19 [31]. This article is being written at a sad point in time when mask-wearing is seen as the (weak) behavior of Democrats in some conservative parts of the country. Survey results provide insight into the matter. Political party identity was unrelated to knowledge about vaccinations, but was nevertheless associated with people's appraisal of the seriousness of COVID-19 and anticipated COVID-19 vaccine uptake. Respondents who relied on the two primary liberal cable news sources were more likely than conservative Fox News viewers to say they would get vaccinated. It should be noted, however, that a majority of respondents from both groups reported an inclination toward vaccination. Furthermore, the cross-sectional nature of these data do not provide a basis for causal explication. It could be that individuals gravitate toward the cable news networks that present a view on the pandemic that is aligned with their opinions.

People are increasingly turning to social media for information expanding the potential for disseminating harmful health-related information [32]. The impact of social media on vaccine decisions likely varies with quality of information to which people are exposed [33]. We found that individuals who turn to social media for pandemic news were less likely to anticipate getting vaccinated. However, we believe that social media have more nuanced effects than what our survey was capable of assessing. Future research should be carried out to measure more precisely the social media, traditional media, and political news sites people use, and then link their use patterns to their politics and COVID-19-related attitudes, beliefs and behaviors.

This study is not without limitations. First, nonprobability quota sampling can produce a Census-matched sample with regard to the quotas used in recruitment, it does not offer the same level of population representation provided by probability sampling. Second, the survey was administered in English, leading to an underrepresentation of non-English speaking residents, most notably Hispanics. Third, the survey was administered online, which limits coverage of individuals lacking internet access. Fourth, surveys of this kind must rely upon abbreviated measures of con-

Table 5
Multiple regression analysis of predictors of novel coronavirus vaccination intention.

Variables	B	SE	Beta	t	p-value
Beliefs and Health Practices					
Vaccine knowledge	0.137	.016	.311	8.43	.001
Belief in vaccine conspiracies	−0.134	.044	−.117	−3.03	.003
COVID-19 threat appraisal	0.302	.035	.273	8.59	.001
Influenza vaccine (2019-2020)	0.438	.073	.178	5.99	.001
Risk Factors					
Pre-existing conditions index					
No conditions	—[a]				
1-2 conditions	−0.064	.080	−.024	−0.80	.426
3-4 conditions	−0.040	.136	−.009	−0.29	.771
5 or more conditions	0.461	.157	.098	2.95	.003
65 years or older	−0.130	.095	−042	−1.45	.148
Male	0.291	.070	.119	4.17	.001
White race	.073	.083	.028	0.88	.377
Hispanic cultural identity	−0.162	.129	−.039	−1.27	.204
Other Demographic Variables					
Total household income					
<$40,000	—[a]				
$40,000–$79,999	0.070	.100	.024	0.70	.484
$80,000–$119,999	0.198	.109	.067	1.82	.070
$120,000 and higher	0.338	.118	.110	2.86	.004
Declined to answer	0.219	.145	.048	1.51	.132
Education					
High school or less	—[a]				
Some college/associate's degree	0.140	.101	.051	1.38	.168
Bachelor's degree	0.134	.106	.050	1.27	.205
Graduate degree	0.009	.114	.003	0.08	.938
Political party identity					
Republican	—[a]				
Democrat	0.199	.091	.075	2.18	.029
Independent	0.076	.091	.028	0.83	.408
Other party	−0.078	.321	−.007	−0.24	.807
No preference	0.109	.137	.027	0.80	.426
Married/Living as Such	−0.091	.074	−.037	−1.21	.225
Preferred Media for Virus News					
Broadcast news	—[a]				
CNN/MSNBC	0.060	.094	.020	.0.64	.525
Fox News	−0.120	.103	−.036	−1.17	.243
Social Media	−0.427	.134	−.090	−3.18	.002
New York Times	−0.143	.140	−.030	−1.02	.308
Other Source	−0.249	.107	−.074	-2.34	.020

[a]Reference Category

Table 6
Mean differences (standard deviations) in the likelihood of coronavirus vaccine uptake, general vaccine knowledge, acceptance of vaccine conspiracies and threat appraisal among Democrats, Independents and Republicans.

Variable	Democrats (n = 250)	Independents (n = 227)	Republicans (n = 238)	F	P
Likelihood of Vaccine Uptake[a]	3.98[ab] (1.07)	3.67[a] (1.29)	3.68[b] (1.23)	5.28	0.006
General Vaccine Knowledge	5.45 (2.52)	5.22 (2.71)	5.10 (2.79)	1.11	0.33
Acceptance of Vaccine Conspiracies	2.60 (1.11)	2.51[a] (0.97)	2.82[a] (1.16)	5.23	0.006
COVID-19 Threat Appraisal	3.35[a] (0.99)	3.00[a] (1.09)	3.15 (1.19)	6.07	0.003

Note. For all analyses, *df* = 2, 712. For each row, cell means with the same superscript are significantly different at *p* < .05 based on the Bonferroni test.
  [a] Likelihood rating made on a 5-point scale, ranging from 1 = *Extremely Unlikely* to 5 = *Extremely Likely*.

structs to avoid respondent fatigue. Our measure of preferred media outlet, for example, did not fully capture the behavior of respondents who rely upon multiple news channels. Nor did it measure the extent of use for, or trust in, their preferred outlet. Additional studies are needed that focus on broadcast and cable media, politics, and vaccination intentions.

As we await the successful development of COVID-19 vaccines, public health experts need to develop sustained strategies for encouraging uptake. Formative research that can guide such inter-ventions is urgently needed. The present study makes a small contribution toward this end.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary material

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