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**Exploring COVID-19 vaccination intention:  
A survey of adults in the state of Missouri**

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For:

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and the Missouri Department of Health and Senior Services

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## **Introduction**

### Vaccination acceptance

A milestone of public health, immunization has achieved unprecedented impact in terms of reduced mortality and extension of life-spans over the last century and more. Among a range of life-saving advances, only immunization can claim credit for the eradication of disease, with smallpox eliminated worldwide in the 1970s due to a deliberate global push linking vaccination and surveillance (DeBuono 2006).

Despite this impact, access, acceptance and adoption of vaccines have varied among populations, leading to disparities in infectious disease outcomes globally and domestically (Farmer 1996).

The range of factors contributing to vaccination resistance and disparities historically is broad, including distribution, access, and affordability; distrust of health institutions, science, and the pharmaceutical industry; and (mis)apprehensions about disease severity, vaccine efficacy and side effects (Quinn and Kumar 2014).

In recent years, efforts to promote vaccination have been threatened by uncertainty about vaccination effects and safety, and misinformation amplified by social media. The WHO proclaimed vaccination hesitancy a global threat in 2019, and called on global public health authorities to hasten their efforts to offer and promote safe and effective vaccines (WHO 2019).

Vital to these endeavors is the assessment of factors contributing to vaccination intention to inform public health and health advocacy initiatives that address public concerns, build trust and enhance access about vaccination in communities and populations.

### COVID-19 pandemic

By August 2021, deaths caused by COVID-19 globally surpassed 4 million individuals with more than 200 million cases confirmed. In the US, fatalities exceeded 600,000 and cases approached 36 million. More than 10,000 people had died, and over 700,000 cases confirmed in Missouri. Since the start of the pandemic, African American and lower income communities have been disproportionately affected (JHUM, 2021; Kaiser Family Foundation, 2020).

Vaccination rates across the country have risen dramatically in the first half of 2021. Rates in Missouri lag however, and vaccination hesitancy among African American and low-income groups remains a heightened concern. By summer 2021 a renewed surge of COVID-19 cases and fatalities was linked to the spread of the Delta variant among individuals and regions with lower vaccination rates nationwide; Missouri exemplified this dynamic as a hot spot (CDC 2021).

## Purpose

This study sought to address the question, how do structural, community, social, and behavioral factors and mechanisms contribute to intention to receive the COVID-19 vaccine among a cross section of Missouri residents and among high risk groups?

Our report presents a topline of notable and practical findings from the survey. We offer recommendations to agency and community colleagues to inform design of communications, programs and policies to support and promote COVID-19 vaccination among residents in general, and especially among African American and low-income residents in Missouri.

## **Methods**

### Study design

This study consists of a single cross-sectional online survey conducted among three convenience samples of residents of St. Louis County (N=1117), St. Louis City (N=415), and the rest of Missouri (N=1518) in December 2020 and January 2021. Survey respondents were recruited from a Qualtrics panel; the total sample size is N=3050. The SLU Institutional Review Board approved this project.

### Sampling and recruitment

Qualtrics recruits their online panel from various sources, and invites members to participate in a range of surveys like this one. A recruitment statement at the top of the survey solicits consent. To assure that sample demographics are consistent with the population, Qualtrics first recruited women and African Americans proportional to census reports.

### Measurement

Our conceptual approach draws on a range of social and behavioral theories (Van Bavel et al. 2020), including the Social Determinants of Health framework (Solar and Irwin 2010), the Social Ecological Model (McElroy et al. 1988) and the Integrated Behavior Model (Fishbein and Cappella 2006) (see Appendix 1 for conceptual model). Individual measures assess: demographic characteristics; vaccination intention; disease severity and susceptibility; perceptions about vaccine benefit, efficacy, risk, misinformation and normative processes; and preferences and trust in information sources and media channels. Original questions and scales were created for most variables; others adapt measures drawn from the literature. Spatial metrics addressing community characteristics assess: area deprivation index, rural-urban continuum, life expectancy and health provider shortage (see Appendix 2 for survey items).

## Data analysis

Univariate analysis first assessed frequency and distribution of demographic characteristics, intention and predictors of intention. Bivariate analysis then estimated association of demographic characteristics and other predictors with intention. Finally, a multivariate analysis estimated independent predictors associated with intention, controlling for all other factors for the total sample. Bivariate analyses were conducted for the total sample and African American and lower income participants. Media preferences were also assessed for high risk groups.

## **Results**

### Sample characteristics

The sample is consistent with the census with regard to gender, income and health insurance status (findings not shown). The sample is younger than the census however, with about 60% under 45 years of age, compared to 45% according to 2019 census findings. The sample is also more educated than the population, with 45% holding a Bachelor's degree, compared to 30% in the census. With the oversample of the St. Louis City and County, the sample also has a greater representation of African Americans – about 20% – compared to about 10% for the census.

Our sample is about 60% currently employed. The sample was also about evenly divided regarding political viewpoint, with about a third each leaning liberal, moderate and conservative.

Administration of the survey began just after the Pfizer vaccine was approved for use via Emergency Use Authorization, and by the conclusion of the survey, 11% already reported being vaccinated. Of the remainder, 39% reported intending not to be vaccinated; 50% reported intending to be vaccinated. The findings that follow omit individuals already claiming to have been vaccinated.

### Demographic characteristics are associated with vaccination intention

For all primary demographic characteristics assessed – gender, ethnicity, age, markers of socioeconomic status and political leanings – we find substantial associations with vaccination intention (see Table 1).

Men were more than twice as likely to intend to get vaccinated compared to women in the sample. African Americans were 30% less likely to get vaccinated in our sample compared to whites; Hispanics were 40% more likely to plan to get vaccinated.

**Table 1. Sample characteristics according to intention to receive COVID-19 vaccine<sup>a</sup>**

<b>Categorical Variables</b>	<b>Intends to receive<sup>b</sup></b> <i>n</i> (%)	<b>Does not intend to receive<sup>c</sup></b> <i>n</i> (%)	<b>OR (95% CI)<sup>d</sup></b>
Gender			
Male	774 (66.1)	397 (33.9)	<b>2.03* (1.73, 2.37)</b>
Female	779 (50.9)	750 (49.1)	Ref.
Other	7 (33.3)	14 (66.7)	20.8 (0.83, 5.18)
Age			
18-24	124 (38.4)	199 (61.6)	<b>0.25* (0.18, 0.34)</b>
25-44	696 (56.4)	537 (43.6)	<b>0.51* (0.40, 0.65)</b>
45-64	427 (56.3)	332 (43.7)	<b>0.51* (0.39, 0.66)</b>
65 and older	291 (71.7)	115 (28.3)	Ref.
Ethnicity			
African American/Black	220 (48.7)	232 (51.3)	<b>0.70* (0.57, 0.86)</b>
White	1122 (57.7)	823 (42.3)	Ref.
Hispanic	220 (65.6)	64 (34.4)	<b>1.40* (1.02, 1.92)</b>
Other	138 (53.6)	64 (46.4)	0.85 (0.60, 1.20)
Education level			
High school or less	217 (37.0)	370 (63.0)	<b>0.20* (0.17, 0.25)</b>
Some college, technical or associate degree	450 (46.9)	510 (53.1)	<b>0.31* (0.26, 0.37)</b>
Bachelor's degree or higher	871 (74.2)	303 (25.8)	Ref.
Income level			
< \$25,000	189 (36.1)	335 (63.9)	<b>0.16* (0.12, 0.20)</b>
\$25,000-\$49,999	303 (48.1)	327 (51.9)	<b>0.25* (0.19, 0.32)</b>
\$50,000-\$74,999	296 (57.3)	221 (42.7)	<b>0.36* (0.28, 0.47)</b>
\$75,000-\$99,999	267 (67.6)	128 (32.4)	<b>0.56* (0.42, 0.78)</b>
> \$100,000	429 (78.7)	116 (21.3)	Ref.
Employment status			
Employed	916 (59.6)	622 (40.4)	<b>0.76* (0.65, 0.88)</b>
Other	623 (52.7)	560 (47.3)	Ref.
Health insurance			
Insured	1451 (60.1)	963 (39.9)	<b>3.81* (2.93, 4.95)</b>
Uninsured	87 (28.3)	220 (71.7)	Ref.
Political viewpoint			
Liberal	559 (72.0)	217 (27.2)	<b>2.48* (2.01, 3.06)</b>
Moderate	509 (58.7)	358 (41.3)	<b>1.37* (1.12, 1.66)</b>
Conservative	390 (51.0)	375 (49.0)	Ref.

\*Significance reported at  $\alpha < 0.05$ ; a = excludes participants reporting “already vaccinated”; b = Respondents answered “definitely yes” and “probably yes”; c = Respondents answered “might or might not,” “probably not,” and “definitely not”; d = Odds ratio, 95% confidence interval.

Younger participants were substantially less likely to intend to get vaccinated, with a clear trend toward increased vaccination with older participants. The youngest group (18-24 year-olds) were 75% less likely, while the two middle groups (25-44 years and 45-64 year-olds) were about half as likely to plan to get vaccinated, than the 65 and over group.

Markers of higher socioeconomic status – education, income level and insurance status – also displayed clear and substantial trends towards intention to get vaccinated. Participants with no more than a high school education were 80% less likely, and those with some college about 70% less likely to plan to get vaccinated compared to those with a Bachelor's degree or higher.

Income shows a clear linear trend affecting vaccination intention. Participants in the lowest income group (<\$25,000) were 84% less likely, participants earning between \$25,000 and \$50,000 75% less likely, participants earning between \$50,000 and \$75,000 64% less likely, and participants earning between \$75,000 and \$100,000 44% less likely to intend to get vaccinated, compared to those earning \$100,000 or more. Respondents with insurance indicated they were almost four times more likely to plan to get vaccinated. Employed individuals were 24% less likely to plan to get vaccinated than those not employed.

Political views also had a strong effect on intention. Liberal respondents were two and a half times more likely, and moderate respondents about one third more likely, to plan to get vaccinated compared to conservative respondents.

#### Social and behavioral factors are also associated with vaccination intention

Several social and behavioral factors were assessed using varying numbers of response options and items added together as scales for each factor. Means for each scale and associations with vaccination intention using odds ratios are displayed in Table 2.

First, we report means as indicators of the distribution for each scale. For the total sample, it is worth noting that apart from the scale for preventive actions, the mean for each scale does not approach either the minimum or maximum possible value. This suggests that there is room to move these beliefs, so it may be possible to reinforce and shift them using strategic messaging.

Compared to all other survey respondents, African American respondents reported higher perceptions of severity of COVID, which would be expected to contribute to greater intention to vaccinate. Other beliefs would be expected to reduce vaccination intentions among African Americans compared to others, namely, lower perceptions of vaccine efficacy and trust, greater perceptions of vaccine risk, greater belief in vaccine misinformation, lower normative pressures to vaccinate, and less adherence to enact other COVID prevention behaviors.

**Table 2: Distributions of predictors and associations with intention among the total sample and sub-populations compared with the rest of the sample**

Scale (range)	Full Sample		Black/ African Americans		Lower Income Level	
	Mean (SD)	OR (95% CI)	Mean (SD)	OR (95% CI)	Mean (SD)	OR (95% CI)
Vaccine benefits (12-48)	31.74 (10.18)	<b>2.61 (2.21, 3.08)*</b>	31.91 (9.78)	<b>2.28 (1.44, 3.60)*</b>	<b>29.70 (11.88)-</b>	<b>2.12 (1.23, 3.68)*</b>
Perceived susceptibility (4-20)	14.01 (2.98)	<b>3.90 (3.31, 4.60)*</b>	<b>14.31 (2.98)+</b>	<b>3.08 (1.92, 4.96)*</b>	<b>13.69 (3.18)-</b>	1.00 (0.55, 1.81)
Perceived severity (4-20)	15.52 (3.59)	<b>4.88 (4.13, 5.76)*</b>	15.65 (3.14)	1.64 (0.98, 2.78)	15.43 (4.03)	<b>2.35 (1.21, 4.63)*</b>
Vaccine efficacy and trust (8-40)	29.95 (6.95)	<b>10.1 (8.43, 12.1)*</b>	<b>28.16 (5.45)-</b>	<b>3.00 (1.79, 5.09)*</b>	<b>28.31 (7.01)-</b>	<b>2.34 (1.27, 4.29)*</b>
Vaccine risk (6-30)	20.40 (5.29)	<b>0.25 (0.22, 0.30)*</b>	<b>22.36 (4.12)+</b>	1.04 (0.63, 1.71)	<b>21.22 (5.05)+</b>	<b>0.30 (0.17, 0.52)*</b>
Vaccine misinformation (7-21)	12.52 (3.25)	<b>0.20 (0.17, 0.23)*</b>	<b>14.12 (2.62)+</b>	0.68 (0.42, 1.09)	<b>13.27 (3.03)+</b>	<b>0.30 (0.16, 0.54)*</b>
Normative factors (4-20)	13.97 (2.71)	<b>7.53 (6.35, 8.96)*</b>	<b>13.36 (2.29)-</b>	<b>2.86 (1.79, 4.60)*</b>	<b>13.23 (2.83)-</b>	<b>4.77 (2.73, 8.47)*</b>
Preventive behaviors (3-12)	10.80 (1.64)	<b>2.02 (1.66, 2.46)*</b>	<b>10.53 (1.67)-</b>	<b>0.27 (0.15, 0.47)*</b>	10.88 (1.85)	1.72 (0.70, 4.61)
Racial consciousness (4-20)	9.35 (4.41)	<b>1.70 (1.46, 1.19)*</b>	<b>12.76 (3.92)+</b>	1.62 (0.93, 2.84)	<b>8.26 (3.83)-</b>	<b>1.82 (1.05, 3.22)*</b>

\* Result statistically significant at  $p < .05$ .

+ Result significantly higher than the rest of the sample, at  $p < 0.05$

- Result significantly lower than the rest of the sample, at  $p < 0.05$ .

African American respondents were also more likely to report being treated differently in healthcare settings due to their race.

Compared to all other survey respondents, lower income respondents reported lower perceptions of vaccine benefits, lower perceived susceptibility, lower vaccine efficacy and trust, and lower normative pressures to vaccinate. Lower income respondents reported greater belief in vaccine risk and vaccine misinformation. They were less likely to report being treated differently in healthcare settings due to their race. All but the last of these perceptions would be consistent with reduced intention to vaccinate among this group compared to higher income participants.

Older adults and individuals with pre-existing conditions are at greater personal risk for morbidity and mortality due to COVID-19. It is of interest to note that their perceptions about COVID-19 and the vaccine were generally opposite those of African American and lower income respondents (results not shown).

Next, we look at associations of other predictors with vaccination intention. For this analysis we split the belief scales into dichotomous variables to calculate effect (or odds ratio) of a difference in belief on intention.

For the full sample we can see that all predictors are associated with intention at a statistically significant level, as shown in Table 2. In order of size, the strongest positive results are for perceptions of vaccine efficacy and trust, normative pressures, perceived severity, perceived susceptibility and perceived benefits. We find strong negative results for vaccine risk and misinformation.

The strongest result shows that individuals with a strong belief in vaccine efficacy and trust are 10 times more likely to intend to get vaccinated than those not believing in vaccine efficacy and trust. Normative factors also show a strong influence, with individuals reporting strong normative pressure eight times more likely to intend to receive the vaccine compared to those with weak normative pressure. Respondents with higher perceived severity are about five times, and higher perceived susceptibility about four times, more likely to intend to get vaccinated. Respondents with stronger perceptions of benefits of vaccination were about three times more likely to intend to get vaccinated. Respondents practicing preventative behaviors and who were conscious of their race in healthcare were each about two times more likely to plan to receive a vaccination.

Respondents reporting greater perceptions of risk of vaccination and greater belief in vaccine misinformation also showed a strong negative effect on vaccination intention – 75% and 80%, respectively – less likely to intend to receive the vaccine.



Assessing findings for African American respondents, we see that several factors are associated with vaccine intention, but with smaller odds ratios. In order of strength we find that perceived susceptibility shows the strongest effect with respondents reporting a higher chance of getting COVID more than three times more likely to intend to get vaccinated. Participants reporting greater perceived vaccine efficacy and trust were three times, and participants with stronger normative pressures almost three times more likely to intend to get vaccinated.

African American participants with greater perceptions of vaccine benefits and of severity of COVID-19 were more than two times more likely to intend to receive the vaccine. But participants engaging in other preventative behaviors were about 70% less likely to intend to get vaccinated.

Interestingly, perceptions of vaccine risk, misinformation, and being treated differently in health care settings depending on race were not associated with intention to get vaccinated.

For lower income respondents most factors are associated with vaccine intention. In order of strength we find that normative factors show the strongest effect with respondents reporting stronger normative pressures almost five times more likely to intend to get vaccinated. Participants reporting greater perceived vaccine efficacy and trust, perceived severity of COVID, and perceived benefits of vaccination are more than twice as likely to plan to get vaccinated. Lower income participants reporting being treated differently in health care settings depending on race were almost twice as likely to plan to get vaccinated.

Lower income participants reporting perceptions of vaccine risk and those believing in vaccine misinformation were 70% less likely to intend to receive the vaccine.

Patterns for older adults, respondents reporting pre-existing conditions and frontline workers are similar as those for lower income respondents and the total sample (not shown).

#### Community and regional characteristics are associated with vaccination intention

Three of four spatial measures addressing community and regional characteristics are associated with intention to get a vaccination (see Table 3). Participants living in more disadvantaged communities, as indicated by lower employment, income, housing availability, and educational opportunity, and participants living in more rural communities were less likely to plan to receive a vaccination. Participants living in counties with higher life expectancies were more likely to plan to get vaccinated. Health provider shortage, an indicator of health care access, was not associated with vaccination intention.

**Table 3. Distribution of spatial metrics and association with vaccination intention**

<b>Spatial Variables</b>	<b>Mean (SD)</b>	<b>OR (95% CI)</b>
Average area deprivation index <sup>a</sup>	4.808 (2.467)	<b>0.87 (0.85, 0.90)*</b>
Rural-urban continuum code <sup>b</sup>	1.866 (2.064)	<b>0.87 (0.83, 0.90)*</b>
Life expectancy <sup>c</sup>	76.871 (3.196)	<b>1.08 (1.05, 1.10)*</b>
Entire county health provider shortage, n (%) <sup>d</sup>	18 (0.590 %)	0.46 (0.16, 1.25)
Partial county health provider shortage, n (%)	143 (4.689 %)	1.13 (0.80, 1.61)

\*Significance reported at  $\alpha < 0.05$ ; a. scale from 1 to 10, with higher numbers signifying more disadvantaged zip code; b. scale from 1 to 10, with higher numbers more rural zip code; c. age adjusted county life expectancy; d. HRSA designation of provider shortage

### Structural, social and behavioral factors stand out in multivariate analysis

A multivariate binary logistic regression model (not shown) was calculated to determine probability of vaccine uptake while accounting for a number of respondent characteristics with the total sample. These variables were then included in a stepwise logistic model where the most robust AIC was identified (see Table 4). This model included only normative factors, perceptions of vaccine benefits, perceptions of vaccine efficacy and trust, income and educational attainment (other variables were omitted in the stepwise process because they did not add explanatory power to the overall model).

Next, spatial factors assessing community characteristics were included in the model to better determine the effect of variation among clustered groups according to zip code of residents. To accomplish this, a multi-level model (MLM) with fixed and random effects was applied.

In the final model with location specific covariates, participants with higher perceived vaccine efficacy and trust were seven times more likely, those with higher normative beliefs almost four times more likely, and higher belief in vaccine benefit almost twice as likely to plan to get the vaccine. Participants with higher incomes were 1.4 to three times more likely to report intent of getting the vaccine with a clear upward trend. Those with a college education, compared to those with no high school diploma, were over two and a half times more likely to intend to get the vaccine. Among spatial variables, only urbanicity was identified as statistically significant while controlling for other model variables. As participant residence grew more rural, there was a 7% decrease in likelihood of COVID-19 vaccine intent.

The variables included in the final model were able to explain 33% of the logit variability, as indicated by the McFadden  $R^2$ . No multicollinearity was found and it was determined not to pose an issue. Both the robust and stepwise model were determined to be better fitting than a null intercept model at explaining the variance among dependent variable responses.

**Table 4.**

*Model 1: Multivariate model predicting adjusted odds-ratio of COVID-19 vaccine uptake among Missouri residents*

	AOR (95% CI)	p-value
<b>Higher vaccine normative beliefs</b>	<b>3.55 (2.85, 4.42)</b>	<b>&lt;0.001</b>
<b>Higher belief in vaccine benefit</b>	<b>1.98 (1.60, 2.46)</b>	<b>&lt;0.001</b>
<b>Higher trust in vaccine efficacy</b>	<b>6.42 (5.15, 8.04)</b>	<b>&lt;0.001</b>
Income		
<\$25,000	<i>Reference</i>	
<b>\$25-\$50,000</b>	<b>1.41 (1.02, 1.94)</b>	<b>0.036</b>
<b>\$50-\$75,000</b>	<b>2.13 (1.51, 3.00)</b>	<b>&lt;0.001</b>
<b>\$75-\$100,000</b>	<b>2.51 (1.71, 3.70)</b>	<b>&lt;0.001</b>
<b>&gt;\$100,000</b>	<b>2.97 (2.01, 4.40)</b>	<b>&lt;0.001</b>
Education	<i>Reference</i>	
Less than high school		
High school only	1.09 (0.56, 2.18)	0.800
Some college	1.59 (0.84, 3.11)	0.200
<b>College or more</b>	<b>3.13 (1.62, 6.21)</b>	<b>&lt;0.001</b>

AIC 2138.3. LRT (deviance): p < 0.001; McFadden R2=0.3270

*Model 2: Multivariate model predicting adjusted odds-ratio of COVID-19 vaccine uptake among Missouri residents, adding spatial metrics*

	AOR (95% CI)	P
<b>Higher vaccine normative beliefs</b>	<b>3.61 (2.87, 4.53)</b>	<b>&lt;0.001</b>
<b>Higher belief in vaccine benefit</b>	<b>1.96 (1.57, 2.44)</b>	<b>&lt;0.001</b>
<b>Higher trust in vaccine efficacy</b>	<b>6.84 (5.42, 8.63)</b>	<b>&lt;0.001</b>
Income		
<\$25,000	<i>Reference</i>	
<b>\$25-\$50,000</b>	<b>1.40 (1.01, 1.95)</b>	<b>0.044</b>
<b>\$50-\$75,000</b>	<b>2.04 (1.42, 2.91)</b>	<b>&lt;0.001</b>
<b>\$75-\$100,000</b>	<b>2.12 (1.42, 3.18)</b>	<b>&lt;0.001</b>
<b>&gt;\$100,000</b>	<b>2.73 (1.82, 4.12)</b>	<b>&lt;0.001</b>
Education		
Less than high school	<i>Reference</i>	
High school only	0.95 (0.47, 1.89)	0.900
Some college	1.35 (0.69, 2.64)	0.400
<b>College or more</b>	<b>2.50 (1.25, 4.99)</b>	<b>0.009</b>
Average area deprivation index	0.95 (0.88, 1.02)	0.120
<b>Rural-Urban Code</b>	<b>0.93 (0.86, 0.99)</b>	<b>0.032</b>
Life expectancy	0.98 (0.93, 1.04)	0.600
Entire county health provider shortage	0.48 (0.07, 3.19)	0.400
Partial county health provider shortage	0.89 (0.45, 1.77)	0.700

AIC 2077.7. McFadden R2=0.3329

## Trusted and preferred institutions, sources and media

For the overall sample (see Table 5), trust in institutions was highest for the national and international institutions (CDC, FDA and WHO) and vaccine scientists; pharmaceuticals were less trusted.

Trusted sources for information was highest for health care providers and federal agencies, followed by local and state health departments.

Ratings for preferred media for COVID-related information were highest for healthcare professionals and official health websites, followed by news sources, and family and friends, with social media last.

African American trust in institutions was generally higher than the overall sample, with international and health department agency sources highest, as with the full sample.

African Americans also considered health care providers and professionals and public health agencies as most trusted sources for vaccine information, although scores for providers were less than for the full sample. Scores for remaining sources – professors, clergy, educators, local elected officials and pharmaceutical companies – were higher among African Americans than the rest of the sample.

African Americans preferred television news, newspapers/ online news sites, family/friends, and social media more than the rest of the sample; they trusted health professionals less for vaccine information.

Low-income individuals were more distrustful than the rest of the sample across the board. They were significantly less likely to trust all vaccine-related institutions compared to the rest of the, and trust was significantly lower in learning about the vaccine from all sources compared to the rest of the sample.

Media preferences for lower income individuals were slightly but significantly lower than those for the overall sample.

**Table 5: Institutional trust, media uses and preferences (mean and SD)**

	Full sample	African Americans	Low-income
<i>Trust in vaccine and health related institutions*</i>			
WHO	3.39 (1.34)	3.72 (1.22) <sup>+</sup>	3.09 (1.30) <sup>-</sup>
Pharmaceutical companies	2.88 (1.24)	3.32 (1.32) <sup>+</sup>	2.52 (1.19) <sup>-</sup>
FDA	3.45 (1.17)	3.58 (1.22) <sup>+</sup>	3.22 (1.20) <sup>-</sup>
CDC	3.61 (1.20)	3.68 (1.18)	3.42 (1.26) <sup>-</sup>
Vaccine scientists	3.54 (1.19)	3.49 (1.25)	3.22 (1.24)
<i>Trusted sources for vaccine-related information**</i>			
Local elected officials	1.57 (0.64)	1.70 (0.66) <sup>+</sup>	1.47 (0.62) <sup>-</sup>
Religious leaders	1.55 (0.72)	1.83 (0.81) <sup>+</sup>	1.45 (0.63) <sup>-</sup>
University professors	1.80 (0.72)	1.96 (0.76) <sup>+</sup>	1.69 (0.67) <sup>-</sup>
Principals for grades K-12	1.55 (0.68)	1.71 (0.75) <sup>+</sup>	1.42 (0.61) <sup>-</sup>
Your primary care provider	2.30 (0.71)	2.13 (0.71) <sup>-</sup>	2.27 (0.71)
Other healthcare professionals	2.23 (0.70)	2.11 (0.74) <sup>-</sup>	2.17 (0.69) <sup>-</sup>
Pharmaceutical companies	1.78 (0.71)	1.88 (0.73) <sup>+</sup>	1.63 (0.66) <sup>-</sup>
Local public health dept.	2.08 (0.71)	2.08 (0.72)	1.99 (0.71) <sup>-</sup>
State health department	2.07 (0.71)	2.07 (0.74)	2.01 (0.72) <sup>-</sup>
Federal agencies	2.14 (0.77)	2.10 (0.78)	2.06 (0.78) <sup>-</sup>
<i>Preferred channels for vaccine-related information***</i>			
Television news	2.05 (0.69)	2.21 (0.60) <sup>+</sup>	1.99 (0.71) <sup>-</sup>
Newspapers or news websites	2.02 (0.72)	2.20 (0.75) <sup>+</sup>	1.87 (0.69) <sup>-</sup>
Family and friends	1.98 (0.67)	2.12 (0.72) <sup>+</sup>	1.90 (0.66) <sup>-</sup>
Healthcare professionals	2.34 (0.67)	2.28 (0.69) <sup>-</sup>	2.30 (0.68) <sup>-</sup>
Official health websites	2.21 (0.72)	2.23 (0.71)	2.16 (0.72) <sup>-</sup>
Social media	1.72 (0.75)	2.03 (0.76) <sup>+</sup>	1.66 (0.71) <sup>-</sup>

Green = Sig. Higher (p=0.05) Red= Sig. Lower(p=0.05) \* Trust in Vaccines; 1= Not at all 2=A little 3=Some 4=A lot 5=Complete \*\* Trust to Learn about COVID-19; 1=Not Much 2=Some 3=A lot \*\*\*Prefer to Learn about COVID-19; 1= Not at all 2=Some 3=A lot

## Discussion

Analysis reveals that structural, social and behavioral factors are strongly associated with, and explain a substantial proportion of variance in, intention to receive the COVID-19 vaccine. These findings add to the evidence that factors across social ecological levels influence vaccination intention.

Our bivariate findings show that structural and demographic factors affect intention. At the structural level, community characteristics – overall poverty, urbanicity, and population-level life expectancy – are associated with intention to receive a COVID vaccine. Demographic factors influenced by structural and contextual factors also contribute to a substantially diminished intention to get the vaccine, namely female gender, younger age, African American ethnicity, and lower income and levels of education. Virtually all social and behavioral factors are associated with lack of intention, most notably normative pressures leaning against vaccination, and perceptions that the vaccines were not effective or trustworthy. Perceptions of low severity and susceptibility to COVID also contribute to vaccination hesitation, as do perceptions of riskiness of the vaccine and belief in misinformation. Respondents with moderate and conservative political views are also much less likely to intend to receive the vaccine.

Our multivariate results signal independent and substantial influences on vaccination across the social ecological model and include social determinants of health. Because more rural areas are more likely to be poor, and have a lower life expectancy, the former variable overrides the latter two in our analysis. Urbanicity of residence as well as individual variables assessing level of education and income all remained significant contributors in the multivariate analysis; having both community and individual level variables remain in the final model shows that factors at both individual and community levels affect vaccination behavior independently.

The multivariate analysis also shows that social normative pressures not to vaccinate and individual perceptions about vaccine ineffectiveness and lack of trust and benefits of vaccination are most powerful, accounting for all other factors. These results provide evidence of the explanatory influence of the interpersonal and individual levels of the social ecological model.

Our findings are consistent with the WHO's framework for social determinants of health (Solar and Irwin 2010), showing that both structural features of the environment, and socioeconomic position as marked by level of education and income, affect vaccination intention. Individuals living in more rural areas, as well as those with lower education and income may be at greater risk of exposure and vulnerability to factors leading to disparate health outcomes. But they are also at greater risk of disparities in preventive measures, such as vaccination.

As posited by the WHO framework, and displayed in our conceptual model, intermediary determinants for disparities in vaccination and disease rates include: material circumstances of neighborhoods and workplaces, access and interactions with health care systems, access and use of media, as well as biological, behavioral and social and psychological factors. For example, our findings show that members of disadvantaged groups may distrust health care providers, or their community circumstances may foster normative pressures that reinforce beliefs in riskiness of vaccines and misinformation. Our analysis has only begun to unpack these dynamics.

Taken together, the multivariate analysis shows that individual, social and structural factors affect vaccination intention, and together explain more than 33% of the variance in intention.

Bivariate analyses for sub-populations with low intent to vaccinate – African Americans and lower income individuals – show similar results as the full sample, on the whole. In addition, our results suggest potential institutions and sources more trusted and channels more preferred among the total sample and priority sub-populations.

Limitations to our study stem from the convenience sample that is younger and more educated than the population, according to the census, likely introducing selectivity into our results. Because our sample was younger than the population, our overall results may reflect greater hesitancy than is present in the population. In contrast, our more educated sample was less hesitant; bias introduced by these two characteristics therefore work in opposite directions.

Some of our unexpected findings may be a function of our convenience sample. It is possible that an interaction occurs between income or education and other demographic characteristics, e.g. reduced intent for employed respondents. The greater proportion of younger respondents than the population may have increased the likelihood of vaccine hesitancy in the sample overall.

A similar effect may influence the finding that African American respondents reported greater trust in health care and scientific institutions than the rest of the sample. This result is unexpected, given oft-reported distrust of African American individuals for health care, due to a history of discrimination. It is possible that African American participants have higher levels of education than in the population, and in the full sample, and thereby report greater trust in these institutions.

We acknowledge these limitations as caveats to keep in mind in reviewing our findings. Nonetheless we believe our results provide an important snapshot that contribute to our overall understanding of perceptions about COVID-19 vaccination among Missouri residents. Our analyses combine to provide important insights that can lead to effective programmatic, policy and communication strategies, described next.

## Recommendations

We synthesize here key findings to inform recommendations to support vaccination among Missouri residents in general, and African American and low-income residents specifically.

### What audiences should we prioritize to promote vaccination?

- Total sample results indicate that priority audiences (i.e. those less likely to intend to get vaccinated) are women, individuals of African American ethnicity, younger age, or in low-SES groups, i.e. individuals with lower levels of education and income, as well as individuals who are more moderate and conservative in their politics.
- Results also indicate that more rural areas, and areas with greater poverty and lower life expectancy should receive priority in promoting and providing COVID vaccines.

### What motivating factors can we highlight, reinforce and supplement?

- The total sample and high risk groups have a range of social and behavioral beliefs associated with intention that are held on average in the middle of the range for each belief.
- This suggests that these beliefs may be changeable, and it may be possible to move, reinforce or strengthen them using effective messages and dissemination strategies.
- For the total sample, the social and behavioral factors with the strongest associations with vaccination intention are belief in vaccine efficacy and trust and pro-vaccination social norms. Our evidence indicates that changing these beliefs will increase intention.
- Promotion efforts throughout the state should therefore reinforce and prioritize evidence that vaccines are safe and effective and thereby increase vaccination intention.
- Efforts should also promote perceptions that getting the vaccine is normative and expected.
- Among African Americans, perceived susceptibility was most strongly associated with intention to get a vaccine, and efforts should also offer accurate information about COVID-19 threat to increase these perceptions among these groups.
- For low income audiences, messages should emphasize disease severity and vaccine safety and effectiveness, in addition to norms-based messages.

### What discouraging factors can we counter?

- For the total sample and for low income individuals, concerns about vaccine risk and belief in misinformation both had a strong negative influence on intention.
- In contrast we find that these factors were not associated with intention among African Americans, although they, as well as low income groups, displayed higher concerns about vaccine risks and gave greater credence to vaccine misinformation.
- This suggests the influence arises from low income status, not African American ethnicity.
- For the population overall therefore, and with a specific focus on low income groups and areas, we recommend a heightened emphasis to provide accurate information about vaccine safety and efficacy to these audiences.



#### What sources of information are most trusted?

- Vaccination promotion efforts should refer general audiences to trusted institutions, namely international and federal agencies and scientists.
- State-wide efforts should also prioritize more trusted sources for vaccine-related information, namely health care providers, and local, state or federal health agencies.
- Efforts to encourage vaccination among African American audiences should also capitalize on higher levels of trust in local officials and religious leaders.
- Efforts to encourage vaccination among low income respondents may rely on most trusted sources of information, namely health care providers and health agencies.

#### What information channels are preferred?

- Vaccination promotion efforts should utilize health care providers, official health websites, news sites, and social networks (friends and family) to distribute vaccine-related information.
- Efforts seeking to reach African Americans should use the same channels, as well as greater use of news and social media sources.
- Efforts seeking to reach low income groups should rely more on health care providers, websites, news sites and social groups to release vaccination information.

#### What message strategies show promise?

- Communication best practices suggest that messages addressing priority beliefs noted above have the most promise to move intention to vaccinate among vaccine hesitant individuals.

#### What social processes can we reinforce and highlight?

- Perhaps the most striking finding in this report is the influence of normative processes on vaccination intention.
- Providing data about increasing vaccination rates in the community at large may show county residents that vaccination is common and acceptable.
- Identifying local residents and community leaders who can speak to benefits of vaccination, and vaccine efficacy and safety may also help shift these norms.

#### How can we best address structural and social factors?

- Our findings indicate the fundamental importance of social and structural determinants in affecting vaccination intention. Our study substantiates the influence of economic circumstances for communities in general, as well as social position of disadvantaged groups, but provides limited explanations for why this is so.
- It is of interest that beliefs about the vaccine and normative factors continue to have substantial effects, even when socioeconomic status or regional poverty are accounted for.
- Additional study is needed to better understand how social determinants affect vaccination preferences, e.g. via health care access or social influence.
- Providing added support, incentives and resources for groups and geographic locations with reduced socio-economic position are critical to enhance vaccination rates.

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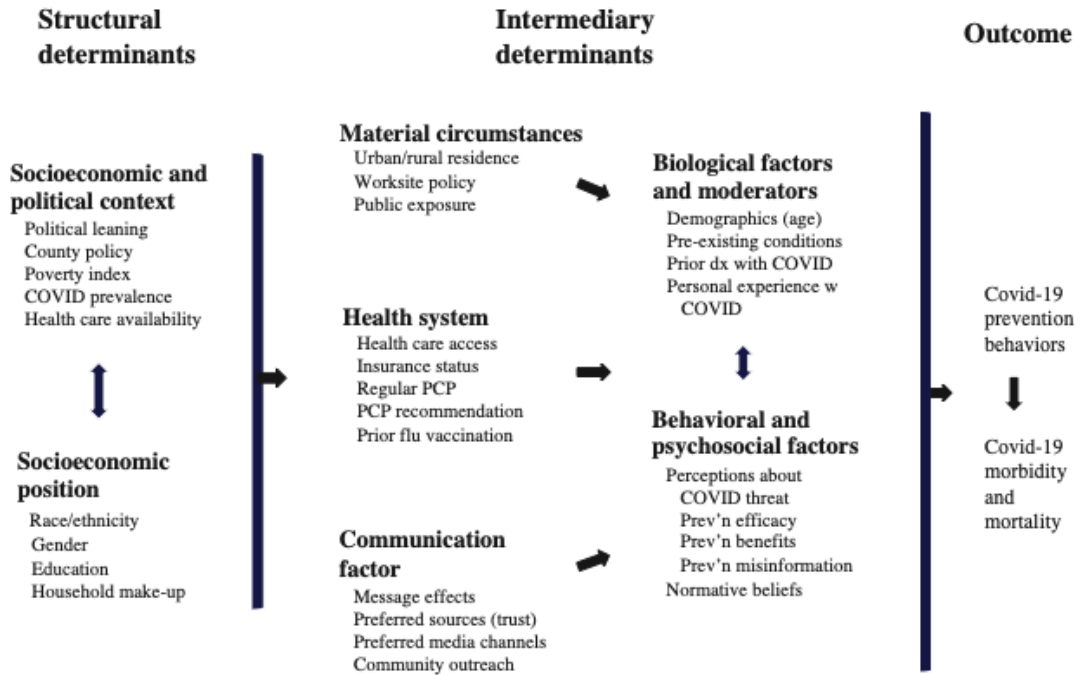
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**Appendix 1: Conceptual Model**  
**Covid-19 prevention model**  
 Adapted from the WHO CSDH framework\*



\*World Health Organization. (2010). A conceptual framework for action on the social determinants of health.

02/05/21

## Appendix 2: Survey Instrument

### SLU Covid Vaccine Survey

#### Start of Block: Screening items



Q99 What is your age?

---



Q100 Race (Check all that apply)

- Black or African American (1)
- Indigenous or Alaska Native (2)
- Asian or Pacific Islander (3)
- White or Caucasian (4)
- Other (5)



Q101 Ethnicity

- Hispanic (1)
- Non-Hispanic (2)



Q102 Gender

- Male (1)
- Female (2)
- Non-Conforming / Non-Binary (3)
- Other (4)

#### End of Block: Screening items

#### Start of Block: Vaccine Intention

Q56 *Have you gotten the COVID vaccine?*

- Yes -- after the FDA approved it (1)

- Maybe -- I'm in a COVID vaccine trial and don't know if I got the vaccine or the placebo (2)
- No (3)

*Skip To: End of Block If Have you gotten the COVID vaccine? = Yes -- after the FDA approved it*



Q2 Do you intend to ever get a COVID-19 vaccination?

- Definitely yes (1)
- Probably yes (2)
- Might or might not (3)
- Probably not (4)
- Definitely not (5)

**Start of Block: Possible benefits of vaccination**



Q6 How important are the following in helping you decide if you would get a COVID?

	Not at all Important (1)	Somewhat Important (2)	Important (3)	Very Important (4)	Not applicable (5)
Getting the COVID-19 vaccine means the chances of me getting severe illness are reduced. (1)	•	•	•	•	•
Getting the COVID-19 vaccine means I no longer have to wear a mask when I go out in public. (2)	•	•	•	•	•
Getting the COVID-19 vaccine means I no longer have to go into quarantine if exposed to COVID-19. (3)	•	•	•	•	•
Getting the COVID-19 vaccine means I can visit loved ones who are at high risk without worrying. (4)	•	•	•	•	•

Getting the COVID-19 vaccine means I can go to work or school in person. (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Getting the COVID-19 vaccine means I can get together with my friends and family without worrying. (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Getting the COVID-19 vaccine means I can comfortably travel on airplanes. (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Getting the COVID-19 vaccine means I can comfortably travel on public transit. (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Getting the COVID-19 vaccine means I can go to religious services and events. (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Getting the COVID-19 vaccine means I can do volunteer work in my community. (10)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Getting the COVID-19 vaccine means I can attend live performances. (11)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Getting the COVID-19 vaccine means I can eat at an indoor restaurant without worrying. (12)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**End of Block: Possible benefits of vaccination**

**Start of Block: Health Beliefs: Perceived Susceptibility**



Q7 For the following statements, please rate how much you agree with them.

	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
Anyone can get COVID-19. (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
COVID-19 is easily spread from person to person. (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

I am likely to get infected by COVID-19 in the next six months. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am more likely to get severe disease or die from COVID-19 than most other people. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**End of Block: Health Beliefs: Perceived Susceptibility**

**Start of Block: Health Beliefs: Perceived severity to self**



Q8 For the following statements, please rate how much you agree with them.

	Strongly Disagree (1)	Disagree (2)	Neither Disagree nor Agree (3)	Agree (4)	Strongly Agree (5)
Overall, I think COVID-19 is more serious than the flu. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am scared about COVID-19. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
COVID-19 can lead to hospitalization or death. (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My health may be severely damaged if I contract COVID-19. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**End of Block: Health Beliefs: Perceived severity to self**

**Start of Block: Health Beliefs: Vaccine Efficacy and Trust (VHS 1)**



Q9 For the following statements, please rate how much you agree with them. These items are about vaccines in general, NOT about COVID-19 vaccines.

	Strongly Disagree (1)	Disagree (2)	Neither Agree nor Disagree (3)	Agree (4)	Strongly Agree (5)
In general, vaccines are important for my health. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Getting vaccines is a good way to protect myself from disease. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vaccines are effective. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Getting vaccinated is important for the health of others in my community. (4)

All vaccines approved by the government are beneficial. (5)

The information I receive about vaccines from the CDC is reliable and trustworthy. (6)

Generally, I do what my doctor or health care provider recommends about vaccines for myself. (7)

I trust alternative/natural medicines more than I would trust a vaccine. (8)

•	•	•	•	•
•	•	•	•	•
•	•	•	•	•
•	•	•	•	•
•	•	•	•	•

**End of Block: Health Beliefs: Vaccine Efficacy and Trust (VHS 1)**

**Start of Block: Health Beliefs: Vaccine Risk and Side Effect (VHS 2)**



Q10 For the following statements, please rate how much you agree with them.

	Strongly Disagree (1)	Disagree (2)	Neither Agree nor Disagree (3)	Agree (4)	Strongly Agree (5)
New vaccines carry more risks than older vaccines. (1)	•	•	•	•	•
I am concerned about serious side effects of vaccines. (2)	•	•	•	•	•
Harmful side effects from vaccines are often covered up. (5)	•	•	•	•	•
A lot of important information about vaccines is not shared with the public. (6)	•	•	•	•	•
The testing of the COVID vaccines has not assessed safety and effectiveness well. (3)	•	•	•	•	•
The testing of the COVID vaccines has not been open and transparent to the public. (4)	•	•	•	•	•



**End of Block: Health Beliefs: Vaccine Risk and Side Effect (VHS 2)**

**Start of Block: Health Beliefs: Vaccine Misinformation**



Q12 For each of the following statements, please indicate how accurate you think they are.

	Inaccurate (1)	Accurate (2)	I don't know (3)
Vaccines cause autism. (1)	•	•	•
Vaccines contain harmful levels of toxins. (2)	•	•	•
Delaying vaccinations and changing the vaccine schedule is harmful. (3)	•	•	•
Developing natural immunity by catching the disease is superior to getting vaccinated. (4)	•	•	•
COVID-19 vaccines use mRNA technology that will change your DNA. (6)	•	•	•
The COVID-19 vaccine caused serious side effects among 75% of clinical trial participants. (7)	•	•	•
Bill Gates wants to use a mass vaccination campaign against COVID-19 to implant microchips in people that would be used to track people with a digital ID. (5)	•	•	•

**End of Block: Health Beliefs: Vaccine Misinformation**

**Start of Block: Normative Factors**



Q38 For the following statements, please rate how much you agree with them.

	Strongly Disagree (1)	Disagree (2)	Neither Agree nor Disagree (3)	Agree (4)	Strongly Agree (5)
I think most people will get the COVID-19 vaccine when it is available. (1)	•	•	•	•	•
Most of my family members will get the COVID-19 vaccine. (2)	•	•	•	•	•
Most of my friends will get the COVID-19 vaccine. (3)	•	•	•	•	•
My opinion about the COVID-19 vaccine has caused conflict	•	•	•	•	•

between me and others who are important to me. (4)



Q82 I would get a COVID-19 vaccine if my doctor or nurse recommended it.

- Definitely yes (1)
- Probably yes (2)
- Might or might not (3)
- Probably not (4)
- Definitely not (5)

**End of Block: Normative Factors**

**Start of Block: Behavior/Biological Factors: COVID-19 Prevention Behaviors**



Q84 For the following statements, please rate how often they are true.

	Never (1)	Not a lot (2)	Sometimes (3)	All the time (4)
In the past month I have worn a mask when I go to places where I am likely to meet people face to face. (1)	•	•	•	•
In the past month I have practiced social distancing when I leave my house. (2)	•	•	•	•
In the past month I have washed my hands with soap and water after visiting public places. (3)	•	•	•	•

**End of Block: Behavior/Biological Factors: COVID-19 Prevention Behaviors**

**Start of Block: Racism: Experience of Discrimination**



Q37 For the following statements, based on your experience, please rate how often they are true.

	Never (1)	Not a lot (2)	Frequently (3)	A lot (4)	Very often (5)
I think about my race when I am in a healthcare setting. (1)	•	•	•	•	•
People of my race have less reason to trust vaccines than other groups. (2)	•	•	•	•	•

Racism makes a difference in getting access to certain medicines or treatments. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The healthcare system favors my race over other groups. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**End of Block: Racism: Experience of Discrimination**

**Start of Block: Trust Scales: Trust in Vaccine Approval Process**



Q52 When it comes to vaccines, please rate how much you trust the following.

	Not at all (1)	A little (2)	Some (3)	A lot (4)	Completely (5)	Don't know (6)
World Health Organization (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pharmaceutical companies (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
U.S. Food and Drug Administration (FDA) (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Centers for Disease Control and Prevention (CDC) (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Scientists who conduct vaccine clinical trials (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**End of Block: Trust Scales: Trust in Vaccine Approval Process**

**Start of Block: Media Use and Trust Scales**



Q53 What sources do you trust to learn about the COVID-19 pandemic?

	Not much (1)	Some (2)	A lot (3)
Local elected officials (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Religious leaders (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
University professors (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Principals for Grades K-12 (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Your primary care provider (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other healthcare professionals (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pharmaceutical companies (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Local public health department (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
State health department (10)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Federal agencies (e.g., CDC) (11) | • • •



Q56 How do you prefer to learn about the COVID-19 pandemic?

	Not at all (1)	Some (2)	A lot (3)
Television news (1)	•	•	•
Newspapers or news websites (2)	•	•	•
Family and friends (3)	•	•	•
Healthcare professionals (4)	•	•	•
Official health websites (e.g., CDC) (5)	•	•	•
Social media (including Facebook, YouTube, etc.) (6)	•	•	•

**End of Block: Media Use and Trust Scales**

**Start of Block: Demographics**



Q61 What is the highest degree or level of school you have completed? If currently enrolled, highest degree received.

- Less than High School (1)
- High School Graduate or GED (2)
- Some College Credit (3)
- Trade/Technical/Vocational Training (4)
- Associates Degree (5)
- Bachelor’s Degree (6)
- Graduate Degree (7)



Q114 Current Employment Status

- Employed/Self-Employed (1)
- Unemployed (2)
- Stay at Home Parent or Guardian (3)
- Student (4)
- Retired (5)
- Unable to Work / Disabled (6)
- Other (7)



Q65 What was your family income last year (in 2019)? Was it:

- Less than \$25,000 (1)
- \$25,000 to \$49,999 (2)
- \$50,000 to \$74,999 (3)
- \$75,00 to \$100,000 (4)
- More than \$100,000 (5)
- I prefer not to answer (6)

Q48 What is the source of your health insurance? (Check all that apply)

- Employment-based Insurance (self/spouse/parent) (1)
- Medicare/Medicaid (2)
- Self-funded (3)
- Other (4)
- Not Insured (5)



Q66 In general, how would you describe your own political viewpoint?

- Very Liberal (1)
- Liberal (2)
- Moderate (3)
- Conservative (4)
- Very Conservative (5)
- Not Sure (6)

### **End of Block: Demographics**

### **Spatial variables**

Area deprivation index is a measure of geographic or neighborhood “disadvantage” calculated by the Department of Medicine and Population Science Lab at University of Wisconsin - <https://www.neighborhoodatlas.medicine.wisc.edu/>. Each neighborhood in the state is ranked on a scale of 1 to 10, 10 being comparatively the most disadvantaged. Factors that contribute to this measure are employment rates, income, housing availability, and educational opportunity.

Rural-Urban Continuum Code is a scale measuring the geographic urbanicity of U.S. zip codes and counties made available by the U.S. Department of Agriculture. These 1 to 10 measures is

given according to proximity to metropolitan centers and their shared transportation routes with surrounding areas. The higher the code, the more ‘rural’ or geographically isolated and population sparse an area is considered (<https://www.ers.usda.gov/data-products/rural-urban-continuum-codes.aspx>).

Life expectancy is a measure calculated by the National Center of Health Statistics using national and mortality surveillance data. This measure is averaged to the county of residence and is age adjusted. This measure is calculated from 2017 to 2019 data (<https://www.countyhealthrankings.org/explore-health-rankings/measures-data-sources/county-health-rankings-model/health-outcomes/length-of-life/life-expectancy>)

Health Provider Shortage is a designation given to an area where the number of primary health care providers is considered comparatively lower. Exact calculation and methodological designations can be found at <http://www.hrsa.gov/about/contact/bhwhelp.aspx>