



**SAINT LOUIS
UNIVERSITY™**

College for Public Health and Social Justice
3545 Lafayette Ave.
St. Louis, MO 63104-1314
Phone: (314)977-8100
Fax: (314) 977-8150

**Exploring COVID-19 vaccination intention:
A survey of residents in St. Louis County, MO**

August 1, 2021

For:

The St. Louis County Department of Public Health

Prepared by:

Ricardo Wray PhD, Gernysha Little MPH, Steve Scroggins MPH, Will Drexler
and Alexander Nema MPH,
Saint Louis University College for Public Health and Social Justice

Funded by:

Coronavirus Aid, Relief, and Economic Security (CARES) Act to the
St. Louis County Department of Public Health
and the Saint Louis University College for Public Health and Social Justice

Acknowledgements:

For guidance and support in design and conduct of the study, thanks to Lauren Arnold,
Daniel Blash, Tom Burroughs, Jen Jen Chang, Rachel Charney, Daniel Hoft, Steven Rigdon and
Enbal Shacham

Introduction

Vaccination acceptance

Immunization has long been regarded a triumph of public health, credited with substantial contributions to extending lifespan and enhancing global health and well-being over the last century and more. Among the hallmarks is the eradication of smallpox worldwide in the 1970s through a deliberate global push linking vaccination and surveillance (DeBuono 2006).

Despite these successes, access, acceptance and adoption of vaccines have always varied among populations, leading to disparities in infectious disease outcomes internationally and domestically (Farmer 1996).

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

Recently, vaccine efforts and acceptance have been jeopardized by misinformation amplified by social media. In 2019 the World Health Organization (WHO) proclaimed vaccination hesitancy as a global threat, and called on public health authorities worldwide to accelerate their efforts to offer and promote safe and effective vaccines (WHO 2019).

Vital to this effort is the assessment of a range of factors associated with vaccination intention among specific populations and communities to inform public health and community health advocacy efforts to enhance access, build trust, and address public concerns about vaccination.

COVID-19 pandemic

By August 2021, deaths caused by COVID-19 globally surpassed 4 million individuals with more than 198 million cases confirmed. In the US, fatalities exceeded 600,000 and cases approached 35 million. More than 10,000 people had died, and almost 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 ongoing spread of variants among individuals and regions with lower vaccination rates nationwide, and Missouri featured 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 St. Louis County 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 St. Louis County.

Methods

Study design

This study consists of a single cross-sectional online survey conducted among a convenience sample of St. Louis County residents in mid-December 2020 and early January 2021. The sample was recruited from a Qualtrics panel, and the total sample size is N=1117. 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 solicits consent. To assure that sample demographics are consistent with the population of St. Louis County, Qualtrics first recruited women and African Americans proportional to County census reports.

Measurement

Our conceptual approach draws on a range of social and behavioral theories (Van Bavel et al. 2020), including the WHO's 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). Measures assess: demographic characteristics; vaccination intention; disease severity and susceptibility; perceptions about vaccine benefit, efficacy, risk, misinformation and social normative pressures; 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. Our conceptual model is displayed in Appendix 1, and survey items in Appendix 2.

Data analysis

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

Results

Sample characteristics

The sample is approximately consistent with the census with regard to gender, race, income and health insurance status. The sample is younger than the census however, with about 65% under 45 years of age, compared to 43% according to 2019 census findings. The sample is also more educated than the population, with 55% holding a Bachelor's degree, compared to 46% reported in the census.

Our sample is also about 65% currently employed. With regard to political viewpoints, about 40% of the sample leans liberal, 34% moderate and 25% 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, 10% already reported being vaccinated. Of the remainder, 36% reported intending not to be vaccinated; 54% reported intending to be vaccinated. The following findings omit the 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 almost twice as likely to intend to get vaccinated compared to women in the sample. African Americans were only half as likely, compared to whites.

Table 1. Sample characteristics according to intention to receive COVID-19 vaccine^a

Categorical Variables	Intends to receive ^b	Does not intend to receive ^c	OR (95% CI) ^d
	<i>n</i> (%)	<i>n</i> (%)	
Gender			
Male	227 (68.9)	125 (31.1)	1.86* (1.43, 2.43)
Female	321 (54.3)	270 (45.7)	Ref.
Other	7 (87.5)	1 (12.5)	5.89 (0.72, 48.2)
Age			
18-24	69 (48.6)	73 (51.4)	0.32* (0.19, 0.54)
25-44	300 (60.9)	193 (39.1)	0.52* (0.33, 0.82)
45-64	149 (59.6)	101 (40.4)	0.49* (0.30, 0.80)
65 and older	87 (75.0)	29 (25.0)	Ref.
Ethnicity			
African American/Black	100 (47.4)	111 (52.6)	0.47* (0.35, 0.65)
White	422 (65.5)	222 (34.5)	Ref.
Hispanic	48 (61.5)	30 (38.5)	0.84 (0.52, 1.37)
Other	35 (51.5)	33 (48.5)	0.56* (0.34, 0.92)
Education level			
High school or less	52 (35.9)	93 (64.1)	0.20* (0.14, 0.30)
Some college, technical or associate degree	158 (49.7)	160 (50.3)	0.36* (0.27, 0.48)
Bachelor's degree or higher	395 (73.4)	143 (26.6)	Ref.
Income level			
< \$25,000	60 (43.2)	79 (56.8)	0.20* (0.12, 0.31)
\$25,000-\$49,999	92 (49.2)	95 (50.8)	0.25* (0.16, 0.38)
\$50,000-\$74,999	111 (56.1)	87 (43.9)	0.33* (0.22, 0.50)
\$75,000-\$99,999	104 (62.3)	63 (37.7)	0.42* (0.27, 0.65)
> \$100,000	203 (79.6)	52 (20.4)	Ref.
Employment status			
Employed	389 (62.5)	233 (37.5)	0.79 (0.61, 1.03)
Other	216 (57.0)	163 (43.0)	Ref.
Health insurance			
Insured	572 (62.0)	350 (38.0)	2.28* (1.43, 3.63)
Uninsured	33 (41.8)	46 (58.2)	Ref.
Political viewpoint			
Liberal	260 (72.8)	97 (27.2)	1.84* (1.29, 2.62)
Moderate	184 (59.0)	128 (41.0)	0.99 (0.70, 1.40)
Conservative	134 (59.3)	92 (40.7)	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 less likely to intend to get vaccinated, with a clear trend toward increased intention with older participants. The youngest group (18-24 year-olds) were almost 70% less likely, and the two middle groups (25-44 years and 45-64 year-olds) about 50% less likely to get vaccinated than the 65 and over group.

Markers of higher socioeconomic status – education, income level and insurance status – displayed clear trends toward vaccination intention. Participants with no more than a high school education were 80% less likely, and those with some college two-thirds less likely to intend to get vaccinated compared to those with a Bachelor’s degree or higher.

Participants in the lowest income group (<\$25,000) were 80% less likely, with all groups earning less than \$100,000 more than half as likely to intend to get vaccinated compared to those earning \$100,000 or more.

Respondents with insurance indicated they were more than twice as likely to get vaccinated. Employment status did not affect vaccination intention.

Political views also had a strong effect on intention. Liberal respondents were almost twice as likely to get vaccinated compared to moderate and 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 lower perceptions of vaccine efficacy and trust, lower normative pressures to vaccinate, and less adherence to enact other COVID prevention behaviors. African American respondents also reported greater perceptions of risk about the vaccine, and greater belief in vaccine misinformation. African American respondents were also more likely to report being treated differently in healthcare settings due to their race.

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	OR (95% CI)	Mean	OR (95% CI)	Mean	OR (95% CI)
Vaccine benefits (12-48)	32.33	3.04 (2.18, 4.24)*	31.63	4.62 (2.59, 8.40)*	29.88 ⁻	1.44 (0.73, 2.83)
Perceived susceptibility (4-20)	13.87	4.34 (3.27, 5.76)*	14.13	7.43 (3.97, 14.5)*	13.30 ⁻	2.94 (1.47, 6.00)*
Perceived severity (4-20)	15.66	4.77 (3.61, 6.32)*	15.61	4.59 (2.53, 8.58)*	15.89	5.39 (2.48, 12.7)*
Vaccine efficacy and trust (8-40)	30.33	14.19 (10.36, 19.44)*	27.91 ⁻	8.65 (4.58, 17.0)*	29.21	>10 (>10)*
Vaccine risk (6-30)	19.96	0.29 (0.22, 0.38)*	22.31 ⁺	1.46 (0.82, 2.66)	20.30	0.34 (0.17, 0.68)*
Vaccine misinformation (7-21)	5.34	0.18 (0.14, 0.24)*	7.02 ⁺	0.92 (0.48, 1.75)	5.93 ⁺	0.10 (0.04, 0.22)*
Normative factors (4-20)	10.79	12.13 (8.86, 16.61)*	10.38 ⁻	>10 (>10)*†	9.67 ⁻	>10 (>10)*
Preventive behaviors (3-12)	10.99	1.35 (1.00, 1.81)*	10.82 ⁻	0.21 (0.12, 0.37)*	11.33 ⁺	1.47 (0.70, 3.17)
Racial consciousness (4-20)	10.11	1.49 (1.14, 1.93)*	13.69 ⁺	2.96 (1.48, 6.19)*	10.62	1.05 (0.53, 2.05)

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

† OR > 10 indicates a possible singularity or approaching separation warranting caution in interpretation

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

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

Compared to all other survey respondents, lower income respondents reported lower perceptions of vaccine benefits, lower perceived susceptibility, and lower normative pressures to vaccinate. Lower income respondents also reported greater belief in vaccine misinformation, and greater adherence to enact other COVID prevention behaviors.

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. We note the strongest positive results are for perceptions of vaccine efficacy and trust, normative pressures, perceived severity, perceived susceptibility and perceived benefits; the strongest negative results for vaccine risk and misinformation.

The most powerful result shows that individuals with a strong belief in vaccine efficacy and trust are 14 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 12 times more likely to intend to receive the vaccine compared to those with weak normative pressure. Respondents with higher perceived susceptibility were about four times, and those with higher perceived severity about five 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 also showed a smaller but significant effect on intention.

Respondents reporting greater perceptions of risk of vaccination and greater belief in vaccine misinformation also showed a strong negative effect on vaccination intention, 70% and 80%, respectively, less likely to intend to receive the vaccine.

Assessing findings for African American respondents, we see that 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 more than ten times more likely to intend to get vaccinated. Participants reporting greater perceived vaccine efficacy and trust were almost nine times, and participants with greater reported susceptibility more than seven times more likely to intend to get vaccinated. African American participants with greater

perceptions of vaccine benefits and of severity of COVID-19 were five times more likely to intend to receive the vaccine. African American participants reporting being treated differently in health care settings due to race were three times more likely to receive a vaccine. But participants engaging in other preventative behaviors were about 80% less likely to intend to get vaccinated. Those with perceptions of greater vaccine risk and belief in vaccine misinformation were not associated with intention to receive the vaccine.

Findings for lower income respondents were similar to those for African Americans respondents, and again, we see that most factors are associated with vaccine intention. In order of strength we find that normative factors again show the strongest effect with respondents reporting stronger normative pressures more than ten times more likely to intend to get vaccinated. Participants reporting greater perceived vaccine efficacy and trust are also ten times more likely to get vaccinated. Participants with greater reported susceptibility were more than five times more likely, and participants with greater perceptions of severity of COVID-19 were three times more likely to intend to receive the vaccine. Lower income participants reporting perceptions of vaccine risk were almost 70% less likely, and those believing in vaccine misinformation 90% less likely to intend to receive the vaccine.

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

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 3). This model included only vaccine normative factors, vaccine efficacy and trust, educational attainment, and gender (other variables were omitted in the stepwise process because they did not add explanatory power to the overall model). Results were largely similar to the full model, although effect of perceived vaccine efficacy and trust was reduced slightly (from an odds of about ten to one of about nine), and effect of a higher education increased slightly (from an odds of 3.4 to an odds of 3.9).

The variables included in the model were able to explain 40% 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 3. Multivariate analysis for total sample, final step: Probability of COVID-19 vaccine uptake (n=853) Based on Stepwise (AIC)

	AOR (95% CI)	p-value
Higher normative factors	7.98 (5.02, 12.9)	<0.001
Higher vaccine efficacy and trust	8.77 (5.18, 15.30)	<0.001
Higher vaccine misinformation	0.70 (0.42, 1.15)	0.200
Highest education attained		
High School or less	Reference	
Some college (<4 years)	2.00 (0.80, 5.14)	0.140
College (≥ 4 years)	3.94 (1.65, 9.66)	0.002
Males	2.04 (1.26, 3.35)	0.004

AIC 468.45, McFadden R² 0.40, Global chi-square <0.001, Robust vs. Stepwise comparison, p=0.945

Audiences trust and prefer a range of institutions, sources and media

For the overall sample, trust in institutions was highest for the national and international institutions (CDC, WHO and FDA) and vaccine scientists; pharmaceuticals were less trusted (see Table 4). Reported trust in sources of information was highest for health care providers and federal agencies, followed by local and state health departments and academics. Ratings for preferred channels for vaccine-related information were highest for healthcare professionals, official health websites and news sources, followed by family and friends, with social media last.

African American trust in institutions was generally high, consistent with the overall sample, but these respondents were significantly more likely to trust the WHO and pharmaceutical companies. African Americans were also significantly more likely to trust vaccine-related information from university professors, pharmaceuticals, local elected officials, religious leaders and principals for grades K-12 compared to the rest of the sample; they were significantly less likely to trust information from federal agencies, primary care providers, and other healthcare professionals. African Americans preferred television news, newspapers/ online newspapers, family/friends, and social media more than the rest of the sample.

Low-income individuals were particularly distrustful, and they were significantly less likely to trust all vaccine-related institutions compared to the rest of the sample. Furthermore, trust was significantly lower in learning about the vaccine from local elected officials, religious leaders, university professors, principals for grades K-12 and pharmaceuticals. Media preferences for lower income individuals were equivalent to the overall sample, except they were less likely to prefer newspapers/online news sites.

Table 4: Institutional trust, media uses and preferences (mean and SD)

	Full sample	African Americans	Low-income
Trust in vaccine and health related institutions*			
WHO	3.58 (1.33)	3.83 (1.26) ⁺	3.16 (1.34) ⁻
Pharmaceutical companies	2.94 (1.23)	3.83 (1.26) ⁺	2.51 (1.19) ⁻
FDA	3.53 (1.12)	3.58 (1.17)	3.14 (1.18) ⁻
CDC	3.77 (1.13)	3.74 (1.15)	3.48 (1.23) ⁻
Vaccine scientists	3.68 (1.16)	3.58 (1.26)	3.26 (1.16)
Trusted sources for vaccine-related information**			
Local elected officials	1.59 (0.65)	1.72 (0.71) ⁺	1.41 (0.55) ⁻
Religious leaders	1.59 (0.65)	1.81 (0.82) ⁺	1.42 (0.59) ⁻
University professors	1.87 (0.71)	1.98 (0.74) ⁺	1.75 (0.63) ⁻
Principals for grades K-12	1.57 (0.69)	1.70 (0.75) ⁺	1.45 (0.66) ⁻
Your primary care provider	2.27 (0.71)	2.06 (0.71) ⁻	2.22 (0.73)
Other healthcare professionals	2.29 (0.69)	2.15 (0.73) ⁻	2.21 (0.66)
Pharmaceutical companies	1.79 (0.72)	1.89 (0.78) ⁺	1.68 (0.61) ⁻
Local public health dept.	2.12 (0.68)	2.07 (0.72)	2.03 (0.65)
State health department	2.11 (0.69)	2.10 (0.71)	2.03 (0.69)
Federal agencies	2.23 (0.75)	2.13 (0.78) ⁻	2.12 (0.71)
Preferred channels for vaccine-related information***			
Television news	2.11 (0.67)	2.29 (0.60) ⁺	2.17 (0.69)
Newspapers or news websites	2.07 (0.72)	2.21 (0.75) ⁺	1.90 (0.74) ⁻
Family and friends	2.03 (0.68)	2.15 (0.69) ⁺	2.03 (0.69)
Healthcare professionals	2.36 (0.67)	2.28 (0.71)	2.34 (0.68)
Official health websites	2.29 (0.70)	2.26 (0.71)	2.26 (0.65)
Social media	1.77 (0.76)	2.05 (0.75) ⁺	1.77 (0.76)

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.

Our findings show that structural and demographic factors affect intention, as indicated by a substantially diminished intention to get the vaccine among respondents of female gender, African American ethnicity, and lower-income and less 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 hesitation, as do perceptions of riskiness of the vaccine and belief in misinformation. Respondents with moderate and conservative political views were 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. Structural and social factors, indicated by income, education, ethnicity, and gender were all found to be substantially associated with vaccination intention in the bivariate analyses. Level of education and gender remained significant contributors in the multivariate analysis, indicating a critical effect of social determinants and higher levels of the social ecological model to vaccination intention. Consistent with the WHO's framework for social determinants of health (Solar and Irwin 2010), level of education and gender indicate social economic position based on structural and social influences. Individuals in these groups may be at greater risk of exposure and vulnerability to factors leading to disparate health outcome, as well as to disparities in risk factors themselves, such as vaccination.

As posited by the WHO framework, and displayed in our conceptual model in Appendix 1, these intermediary determinants 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, 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 begun to unpack these dynamics.

The multivariate analysis also shows that normative pressures not to vaccinate and perceptions about vaccine ineffectiveness and lack of trust 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.

Taken together, the analysis shows that a range of social ecological factors – individual, social and structural – affect likelihood of getting the vaccine. All told, these factors explain more than 40% of the variance in intention.

Bivariate analyses for sub-populations with low intent to vaccinate – African Americans and lower income individuals – show similar results, on the whole, with some variation. In addition, the 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 largely from the convenience method for recruitment to the sample that likely introduced selectivity and systematic bias into our results. Two aspects of sample characteristics may affect our results: a younger and more educated sample than the population, according to the census. As our findings show, the younger the respondents were the more likely they were to not intend to get vaccinated, whereas the more educated the respondents, the more likely they were to seek vaccination. Because our sample was younger than the population, our overall results may reflect greater hesitancy than is present in the population. In contrast, because our sample was more educated than the population, the overall results may reflect less hesitancy. The bias introduced by these two selectivity characteristics therefore work in opposite directions.

Interestingly, the influence of gender – with women half as likely to intend to get the vaccine as men – remained a significant contributor to intention in the multivariate model. This finding is unexpected and runs counter to vaccination rates nationwide, in which more women than men have received the vaccine (Puzio 2021); other news reporting shows this is also true in Missouri (Ungar 2021). 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. The greater proportion of younger respondents than the population may have increased the likelihood of vaccine hesitancy among the women in the sample.

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. In this case it is possible that the African American participants in the sample have higher levels of education than in the population, and thereby report greater trust in these institutions.

We acknowledge these limitations as caveats to keep in mind in reviewing our results. Nonetheless we believe our results provide an important snapshot that contribute to our overall understanding of perceptions about COVID-19 vaccination among St. Louis County 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 study findings to inform community, promotion and policy recommendations that support vaccination among St. Louis County 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, and individuals who are more moderate and conservative in their politics.

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 mutable, and it may be possible to move, reinforce or strengthen them using effective messages and dissemination strategies.
- For the total sample as well as for both African American and low income groups, 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 county 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.
- A substantial associations was also found for perceived severity and susceptibility among African American and low income participants, therefore efforts should offer accurate information about COVID-19 threat to increase these perceptions among these groups.
- Effort to encourage vaccination among African Americans and low income groups should also provide messages and evidence about benefits of vaccination.

What discouraging factors can we counter?

- For the total sample, concerns about vaccine risk and belief in misinformation both had a strong negative influence on intention.
- African American and low income groups reported higher levels of perceived vaccine risk and misinformation, suggesting 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.
- County-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 respondents 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 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 family and friends 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 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 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 social position, but provides limited explanations for why this is so.
- 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 with reduced socio-economic position are important to approaches to enhance vaccination rates.

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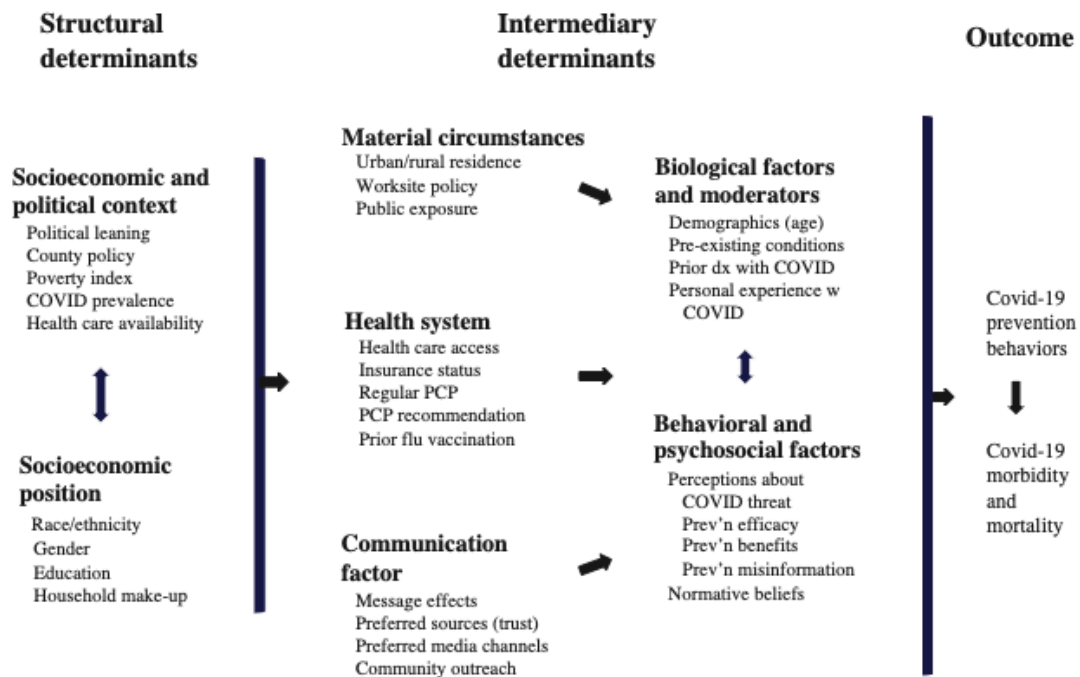
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Appendix 1: Conceptual Model

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 St. Louis County

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