Original Article

Associations between COVID-19 Death Exposure and COVID-19 Vaccine Hesitancy and Vaccine Uptake

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Objectives: The aim of the study was to determine the relation between coronavirus disease 2019 (COVID-19) death exposure and COVID-19 vaccine hesitancy and vaccine uptake among Arkansans, controlling for sociodemographic factors.

Methods: Data were collected from a telephone survey administered in Arkansas between July 12 and July 30, 2021 (N = 1500) via random digit dialing of telephone landlines and cellular telephones. Weighted data were used to estimate regressions.

Results: Controlling for sociodemographic variables, COVID-19 death exposure was not a significant predictor of COVID-19 vaccine hesitancy ($P = 0.423$) or COVID-19 vaccine uptake ($P = 0.318$). Younger individuals, those with lower levels of education, and those who live in rural counties were more likely to be COVID-19 vaccine hesitant. Older individuals, Hispanic/Latinx individuals, those who reported higher levels of education, and those who reported living in urban counties were more likely to have reported receiving the COVID-19 vaccine.

Conclusions: Many efforts to promote COVID-19 vaccines have focused on prosocial norms, including encouraging vaccination to protect the community from COVID-19 infection and death; however, COVID-19 death exposure was not related to COVID-19 vaccine hesitancy or uptake in the present study. Future research should examine whether prosocial messaging is effective in decreasing hesitancy or motivating some individuals to receive the vaccine among those who have been exposed to COVID-19 deaths.

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The coronavirus disease 2019 (COVID-19) pandemic created an urgent need for vaccination development and deployment; however, COVID-19 vaccine hesitancy and the slow uptake of the vaccines have limited their efficacy in slowing and/or ending the pandemic. As of August 2022, only 67.2% of the US population were fully vaccinated, and only 48.2% of the population have received a booster dose.[1] Vaccine uptake has been slower in some states, especially in the southern United States. For example, in Arkansas, only 58.1% of the population are fully vaccinated, and among those who are fully vaccinated, only 49% have received a booster dose.[2]

Many of the efforts in promoting COVID-19 vaccinations have focused on prosocial norms, including encouraging vaccination to protect the community at large from COVID-19 infection. Prior research has shown that people with an increased awareness of the importance of population immunity and higher levels of empathy for those especially vulnerable to COVID-19 are more likely to be motivated to be vaccinated against COVID-19.[3–5] Vaccine hesitancy also has been shown to be related to complacency or lower levels of fear of COVID-19 infection,[6] which may be dependent on experiences such as death exposure (ie, knowing someone who died of COVID-19). Given these findings, the expectation would be that the estimated 40% of people living in the United States who have been exposed to COVID-19

Key Points

- Overall, the models showed that coronavirus disease 2019 (COVID-19) death exposure was not a significant predictor of COVID-19 vaccine hesitancy or uptake.
- Age, education, and location were significant predictors of vaccine hesitancy. Age, race, education, and location were significant predictors of vaccine uptake.
- Because prosocial messaging focuses on protecting others from COVID-19 infection, more research is needed to determine whether prosocial messaging may decrease hesitancy or motivate individuals exposed to COVID-19 deaths to receive the vaccine.

deaths[7] would be less hesitant about receiving the COVID-19 vaccine and would be more likely to report being vaccinated.

Results have been mixed, however, on the effect of COVID-19 death exposure on COVID-19 vaccine hesitancy and uptake. Some studies among adults have shown lower odds of uptake of the COVID-19 vaccination among those who did not know someone in their social network who had been infected, had been hospitalized with, or had died of COVID-19.[8,9] Other studies, however, found no effect or a negative relation between COVID-19 exposure and COVID-19 vaccine hesitancy and uptake.[10] A study among parents found that exposure to COVID-19 deaths increased parents' intentions to vaccinate their children,[11] although similar studies found no effect.[12,13] Another study focused on vaccine hesitancy among Black adults in Arkansas found increased odds of COVID-19 vaccine hesitancy among those who had lost a close friend or family member as a result of COVID-19.[10]

Given the low rates of vaccination in Arkansas,[2] it is especially important to understand what factors may decrease hesitancy and increase vaccine uptake. As such, the goal of our study was to examine the relation between COVID-19 death exposure and COVID-19 vaccine hesitancy and vaccine uptake among Arkansans, controlling for sociodemographic factors shown to be important in other studies focused on vaccine hesitancy and uptake.

Methods

Procedures

From July 12 to July 30, 2021, 1500 Arkansas adults were surveyed using random digit dialing of telephone landlines and cellular telephones. Surveys were conducted by a national polling company using computer-assisted telephone interviewing techniques. Black and Hispanic/Latinx residents were oversampled. Spanish-speaking respondents were surveyed using a Spanish translation of the survey. The completion rate of the interviews was 20.4%.

Inclusion criteria required participants to be 18 years of age or older and a current resident of Arkansas. The study was explained to potential participants, and verbal consent was obtained before survey administration. Participants could refuse to answer any question or state that they did not know. All of the study procedures were reviewed and approved by the institutional review board at the University of Arkansas for Medical Sciences.

Measures

Vaccine Hesitancy

The first dependent variable was an ordinal measure of COVID-19 vaccine hesitancy. Vaccinated participants were asked, "Thinking specifically about the COVID-19 vaccines, how hesitant were you about getting vaccinated?" Response options included "not at all hesitant," "a little hesitant," "somewhat hesitant," and "very hesitant."

Vaccine Uptake

The second dependent variable was a dichotomous measure of COVID-19 vaccination. Participants were asked, "Have you received a COVID-19 vaccine?" Response options included "yes" and "no."

Sociodemographic Characteristics

Age was calculated from participants' reported year of birth. Sex was reported as either male or female. Although third and fourth options of nonbinary and self-defined were available, too few participants selected these options (n = 3) to be included in the analysis. Participants reported their highest level of education completed. Responses were grouped into high school diploma/General Educational Development test (GED) or lower, some college/associate degree, and bachelor's degree or higher. Participants also reported their relationship status. Responses were grouped into married/coupled and unmarried/not coupled. Location was designated as rural or urban based on the county where the participant resided. The determination of location status was based on the US Department of Agriculture Rural-Urban Continuum Codes.[14]

COVID-19 Death Exposure

The independent variable of interest was a dichotomous measure of COVID-19 death exposure. Participants were asked, "Has a close friend or relative died of COVID-19?" Response options included "yes" and "no."

Statistical Analyses

Data were managed, cleaned, and analyzed using SAS version 9.4 (SAS Institute, Cary, NC). No duplicate records were detected. Participants with incomplete responses (n = 91; 6.1%) were omitted from the analyses. The most frequent pattern was missing only date of birth (n = 38). Weights were generated using ranking ratio estimation to ensure the sample was representative of the Arkansas 2019 census estimates for age (18–29, 30–39, 40–49, 50–59, 60–69, 70–79, ≥80), sex (male, female), and race/ethnicity (non-Hispanic White, non-Hispanic Black, non-Hispanic other or multiracial, and Hispanic or Latino any race). We present results of weighted descriptive statistics and of the ordinal and logistic regressions. Regarding the ordinal regression, the Brant test indicated the assumption of proportional odds was met ($P = 0.1295$). All of the predictors were set to use a reference group that produced odds ratios above 1.00 for the purposes of interpretation.

Results

Descriptive statistics of the variables used are shown in Table 1. The sample was nearly evenly split by sex, with women making up a slightly greater proportion (51.2%). The two largest racial/ethnic groups, White (72.3%) and Black/African American (15.1%), made up nearly 90% of the respondents. A majority (56.3%) were married or cohabitating, and more than two-thirds of participants (68.6%) resided in urban areas. Half of the sample were

Table 1. Sociodemographic and COVID-19 vaccine-related experiences and behaviors (N = 1409)

Measures	Weighted % or weighted mean (SD)	Unweighted N	% ACS 2019 estimates
Age, y	48.4 (19.1)		Median age (in years) 38.1
Sex			
Male	48.8	562	48.9
Female	51.2	847	51.1
Race/ethnicity			
White	72.3	718	72.0
Black/African American	15.1	341	15.4
Hispanic/Latinx	7.4	227	7.7
Multiracial	2.0	51	2.4
Other	3.2	72	2.5
Relationship status			
Married/coupled	56.3	726	—
Unmarried/not coupled	43.7	683	—
Education			—
HS diploma/GED or lower	30.7	455	—
Some college/ associate degree	32.7	464	—
Bachelor's degree or higher	36.6	490	—
Location			—
Urban	68.6	963	—
Rural	31.4	446	—
COVID-19 death exposure			—
Yes	24.0	380	—
No	76.0	1029	—
COVID-19 vaccine hesitancy			—
Not hesitant at all	51.1	753	—
A little hesitant	15.3	218	—
Somewhat hesitant	10.7	154	—
Very hesitant	22.9	284	—
COVID-19 vaccine uptake			—
Yes	70.4	1069	—
No	29.4	340	—

Percentages may not total 100 due to rounding. ACS, American Community Survey; COVID-19, coronavirus disease 2019; GED, General Educational Development test; HS, high school; SD, standard deviation.

not hesitant at all with regard to the COVID-19 vaccine (51.1%), whereas nearly one-fourth reported being very hesitant (22.9%). Out of every 10 participants, seven reported they had received the COVID-19 vaccine (70.4%), and just under one-fourth of participants had been exposed to a COVID-19–related death (24.0%).

Ordinal Regression: COVID-19 Vaccine Hesitancy

Controlling for sociodemographic variables, COVID-19 death exposure was not a significant predictor of COVID-19 vaccine hesitancy (P = 0.423). Age, education, and location were significant predictors of vaccine hesitancy. For every 1-year increase in age, there was a 2.5% decrease in odds of being more vaccine hesitant. Participants with lower levels of education (high school diploma/GED or less, some college/associate degree) had increased odds of being more vaccine hesitant compared with participants with a bachelor's degree or higher, (odds ratio [OR] 2.50 and 1.87, respectively). Finally, participants living in rural counties had nearly 1.5 times greater odds of being more vaccine hesitant than those living in urban counties (OR 1.44). Race/ethnicity, sex, and relationship status were not associated with vaccine hesitancy (Table 2).

Logistic Regression: COVID-19 Vaccine Uptake

Accounting for sociodemographic factors, exposure to COVID-19 death was not a significant predictor of COVID-19 vaccine uptake (P = 0.318). Age, race, education, and location were significant predictors of vaccine uptake. For every 1-year increase in age, there was a 4% increase in odds of being vaccinated (OR 1.04). Although all other races did not significantly predict vaccine uptake, Hispanic participants had twice the odds of White participants (OR 2.01) of being vaccinated. Those with higher levels of education (some college/associate degree, bachelor's degree or higher) had 1.5 times (OR 1.60) and > 5 times (OR 5.18) greater odds of being vaccinated than participants with lower levels of education (high school diploma/GED or lower). Finally, participants living in urban counties had nearly 1.4 times greater odds of being vaccinated than those living in rural counties (OR 1.38) (Table 2).

Discussion

The goal of our study was to determine whether there was a relation between COVID-19 death exposure and COVID-19 vaccine hesitancy and uptake among Arkansans. Overall, the models showed that COVID-19 death exposure was not a significant predictor of COVID-19 vaccine hesitancy or uptake. These results support some previous studies that indicate that exposure to the worst outcomes of COVID-19 does not influence COVID-19 vaccine hesitancy or uptake.[12,15,16] For example, our prior work demonstrated no effect of prior COVID-19 infections or the death of close family or friends resulting from COVID-19 on parents' decisions to vaccinate their children.[12] Other studies examining influenza vaccination uptake have shown that lower risk perception hinders vaccine uptake[16]; however, these results run counter to some research demonstrating a positive association between COVID-19 death exposure and vaccine hesitancy. Our prior work has shown that for Black individuals, exposure to COVID-related deaths increases vaccine hesitancy.[10] The explanation for a lack of an effect of COVID-19 death exposure on vaccine uptake and hesitancy is complicated. Prior work

Table 2. Ordinal and logistic regression: effects of COVID-19 death exposure on COVID-19 vaccine hesitancy and vaccine uptake (N = 1409)

	COVID-19 vaccine hesitancy			COVID-19 vaccine uptake	
	OR (95% CI)	*P*		OR (95% CI)	*P*
Age, y	0.975 (0.97–0.98)	<0.001		1.04 (1.03–1.05)	<0.001
Sex					
Male	—	—	—	—	—
Female	1.20 (0.98–1.47)	0.078		1.13 (0.87–1.45)	0.362
Race/ethnicity					
White	—	—	—	—	—
Black/African American	1.16 (0.86–1.40)	0.303		1.43 (0.99–2.08)	0.058
Hispanic/Latinx	0.83 (0.57–1.24)	0.374		2.01 (1.25–3.24)	0.004
Multiracial	1.41 (0.71–2.81)	0.330		0.57 (0.25–1.30)	0.183
Other	1.34 (0.77–2.34)	0.294		0.71 (0.37–1.38)	0.312
Relationship status					
Married/coupled	1.02 (0.83–1.25)	0.845		1.15 (0.90–1.49)	0.271
Unmarried/not coupled	—	—	—	—	—
Education					
HS diploma/GED or lower	2.50 (1.95–3.21)	<0.001		—	—
Some college/associate degree	1.87 (1.47–2.39)	<0.001		1.60 (1.20–2.13)	0.001
Bachelor's degree or higher	—	—		5.18 (3.72–7.22)	<0.001
Location					
Rural	1.44 (1.16–1.78)	<0.001		—	—
Urban	—	—		1.38 (1.06–1.80)	0.018
COVID-19 death exposure					
Yes	—	—		—	—
No	1.10 (0.87–1.40)	0.423		1.17 (0.86–1.58)	0.318

CI, confidence intervals; COVID-19, coronavirus disease 2019; GED, General Educational Development test; HS, high school; OR, odds ratio.

provided evidence of increased hesitancy and reduced uptake because of personal beliefs about the vaccine and risks of COVID-19 infection, a lack of trust in health authorities and scientists, and beliefs in conspiracy theories.[16–19] These beliefs and concerns may override the prosocial norms around vaccines, even when someone has personally experienced the loss of a loved one from COVID-19 infection.

There are limitations to consider when interpreting these results. The study used cross-sectional data, which do not allow for causal analysis or clear temporal order. For example, although we have posited a relation wherein COVID-19 death exposure then influences COVID-19 vaccine hesitancy and uptake, any relations that we could have found may plausibly operate in the reverse direction. The study was conducted only in Arkansas, and thus, the results may not be generalizable to the US population. Despite the low vaccination rate in Arkansas, approximately 70% of the participants in our sample had received at least one dose of the vaccine before the survey, which may bias the results of the study by decreasing the size of the unvaccinated group. In addition, it may be that unvaccinated individuals are reluctant to participate in a telephone survey regarding COVID-19 vaccinations; therefore, unvaccinated individuals may be underrepresented in the survey sample. Twenty-four percent of the participants had been exposed to the COVID-19–related death of a friend or family member, which is lower than the estimated 40% in the United States.[7] Telephone surveys do carry some risk of bias,[20] as a small percentage of individuals in the United States do not have access to either landline or cellular telephone service, and the majority of households no longer have landline service. We have attempted to mitigate the potential of bias by conducting a random digit dialing survey using both landline and cellular telephone numbers to minimize the risk of nonresponse to questions important to the research team, an issue that has been noted in larger surveys that have transitioned from telephone to paper administration.[21] The study, however, is strengthened by the use of a large, diverse, random sample with data collection in both English and Spanish. Despite limitations, this study makes a significant contribution to the literature as one of the first population-based studies to examine the relation between COVID-19 death exposure and both COVID-19 vaccine hesitancy and uptake.

Conclusions

Throughout the United States and in Arkansas, many of the efforts to promote the uptake of the COVID-19 vaccine have focused on prosocial norms such as encouraging COVID-19 vaccination

to protect the community at large from COVID-19 infection or to protect at-risk family members from harm. Future research should examine whether prosocial messaging is effective in decreasing hesitancy or motivating some individuals to receive the COVID-19 vaccine among those who have been exposed to COVID-19 deaths.

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