Research Article

Relationship between household member vaccine acceptance and individual vaccine acceptance among women in rural Liberia

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Background

Despite the availability of COVID-19 vaccines, vaccination uptake remains low in Liberia. Social norms, and in particular an individual's family preferences can have a strong normative influence on health behavior. However, few studies across the globe have explored how behavioral intent about COVID-19 vaccination among household members affects individual vaccination acceptance, particularly in rural, resource-limited settings. We respond to this gap in knowledge by analyzing data from a household survey of women in rural Liberia with the goal of understanding how household COVID-19 beliefs and vaccine behavioral intent correlated with those of individual household members.

Methods

Data was analyzed from a household survey of 2,620 women aged 15-49 in 2,201 households in rural Grand Bassa County, Liberia, from March to April 2021. The survey included a COVID-19 module on protective health behaviors and intention to accept a COVID-19 vaccine when available. Each household was defined as being concordantly vaccine-hesitant, concordantly vaccine-accepting, or discordant. A multivariable logistic regression model was fitted to identify correlates of concordant acceptance, adjusting for potential confounders.

Results

The survey found that only approximately one in three households in rural Liberia were fully COVID-19 vaccine accepting. About 42% of households had discordant views on the vaccine, while 33% had concordantly accepting views, and 25% had concordantly hesitant views. The demographic characteristics of households with different vaccine beliefs were similar. Having a household member who accepted the COVID-19 vaccine was associated with an 18.1 percentage point greater likelihood of an individual accepting the vaccine (95% confidence interval, CI=7.3-28.9%, *P*=0.001).

Conclusions

Social norms around vaccine acceptance within households are strongly associated with individual acceptance. Interventions that target hesitant households and individuals could have a significant impact on vaccine acceptance rates.

As of February 2023, Liberia has officially reported over eight thousand cases of COVID-19 and a few hundred COVID-19-related deaths,[1] but modeling estimates suggest the true number of deaths is in the thousands.[2] Although Liberia received its first shipment of vaccinations in April 2021, by the end of 2021 only 15 percent of the population

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had received their first dose[3] even though by the end of 2022 vaccination had increased to 77 percent.[1] While vaccine hesitancy is not known in Liberia, high rates of COVID-19 vaccine hesitancy were found elsewhere in the sub-Saharan African region.[4,5] Studies from several countries in Africa suggest COVID-19 vaccine hesitancy could be due to the spread of misinformation, lack of knowledge on how COVID-19 is transmitted, concerns about side effects, barriers to access, and distrust of government.[6-10]

Familial beliefs and health behaviors can have a strong influence on individual behavior, and the family setting is thought to be one of the most influential on a person's health and social beliefs.[11] That being said, there are few data on how knowledge, beliefs, and behavioral intent about COVID-19 vaccination at the household level affect individual vaccination acceptance of other individuals in the household, and research on the association between beliefs within the household and COVID-19 vaccine hesitancy is lacking, particularly in rural, resource-limited settings. Better understanding how knowledge is shared within households might inform household targeted vaccination program design and interventions focused on addressing vaccine hesitancy. More generally, we aim to understand targets for health promotion initiatives to increase public knowledge about preventive behavior change in rural Liberia.

We respond to this gap in knowledge by analyzing data from a household survey of women in rural Liberia with the goal of understanding how household COVID-19 beliefs and behavioral intent correlated with individual household members' beliefs and behavioral intent. The objectives of this study were to: (1) determine how vaccine acceptance beliefs cluster within households and (2) estimate the association between household vaccine acceptance and individual vaccine acceptance among women in rural Liberia.

METHODS

DATA SOURCE AND STUDY SAMPLE

Data for this study were collected through a population-representative household-based stratified cluster-sample survey in Grand Bassa County, Liberia, from March to April 2021. The survey was part of an ongoing series designed to measure the impact of Liberia's National Community Health Assistant Program (NCHAP) in this county, conducted in four districts that had implemented the intervention and four that had not yet implemented.[12,13] Communities were sampled with probability of selection proportional to size and stratified by NCHAP implementation phase. For each community that was selected, 24 households were selected using a modified random walk procedure. The survey was primarily intended to monitor and evaluate community-based health programs and capture data on maternal health, child health, and health service access. The survey also collected socio-demographic information including age, distance to facility, asset ownership, education, and district. The survey methods have been described fully previously.[12] At the beginning of the COVID-19 pandemic, a module was added to the survey to measure COVID-19 knowledge, perceptions, behavioral intent, and vaccine acceptance (Figure S1 in the **Online Supplementary Document**). Because vaccines were not available in this setting at the time of the survey, the question that asked about vaccine acceptance measured behavioral intent rather than current behavioral practices. All women aged 15-49 in selected households were invited to complete the COVID-19 module of the survey and data were collected for 2,620 women.

The survey was adapted from the Liberia Demographic and Health Survey and was translated to Liberian English. Enumerators were recruited who had prior experience administering surveys in this setting and were bilingual in standard English and Bassa. Enumerators received training on how to administer the questionnaire and research ethics with human subjects. Data were collected from survey respondents on Android mobile phones and uploaded to an Open Data Kit weekly so that the data could undergo quality assurance processes.[14]

VARIABLES

We measured individuals' knowledge and behavioral intention through a survey that included seven questions about COVID-19 vaccine knowledge, attitudes and beliefs (Figure S1 in the **Online Supplementary Document**). COVID-19 knowledge variables included whether the individual had heard of COVID-19, and whether the individual was able to correctly identify routes of COVID-19 transmission and correctly identify practices to avoid COVID-19 infection. The variable for whether the individual had heard of COVID-19 was collected as binary, with respondents answering either yes or no. The twelve responses to routes of COVID-19 transmission were categorized as correct and incorrect routes of COVID-19 transmission (Table S1 in the **Online Supplementary Document**). The variable was dichotomized, and respondents were included as being able to correctly identify all routes of COVID-19 transmission versus one or more incorrect. A similar approach was done for safety measures to avoid COVID-19 (Table S1 **Online Supplementary Document**). Behavioral practice or intention variables included vaccine acceptance, face mask ownership, whether the respondent would seek care if they had COVID-19 symptoms, and whether they would take a COVID-19 test if they were sick. The vaccine acceptance and face mask ownership variables were measured as binary variables. Respondents were asked whether they would take a COVID-19 vaccine if the government said it was safe and available to them. Those that responded that they would definitely take it were categorized as vaccine accepting and all other respondents were categorized as hesitant. The variables that assessed whether the respondent would seek care if they had COVID-19 symptoms and whether they would take a COVID-19 test if they were sick were measured as likert scales and dichotomized as agreeing (really agree/agree) or disagreeing (don't agree/really don't agree).

To enable household level analysis, summary measures were developed for each household. Households were divided into three groups: 1) concordant households in which all respondents were accepting of COVID-19 vaccination;

2) concordant households in which all respondents were not accepting of COVID-19 vaccination; and 3) discordant households whose respondents had discordant COVID-19 vaccination beliefs. If a household only had one respondent to the vaccine acceptance question, it was excluded from analysis of this variable. Household-level variables were also constructed for the age of the eldest respondent in the household and for education by assigning households the highest education level among household respondents. To measure whether anyone else in the household was vaccine accepting, a dichotomous variable was created for whether anyone else in the household (other than the individual respondent) was vaccine accepting, regardless of whether the individual respondent was vaccine accepting or hesitant.

STATISTICAL ANALYSES

Standard descriptive statistics, including frequencies (unweighted) and percentages (weighted) were calculated for each individual-level independent variable for individuals who are vaccine accepting and individuals who are vaccine hesitant, and a pearson's chi-square test was used to determine whether there was a statistically significant difference between the groups.

OBJECTIVE 1: DESCRIBE HOUSEHOLD VACCINE ACCEPTANCE CONCORDANCE AND DISCORDANCE

Standard descriptive statistics were calculated for each household-level independent variable for households that had discordant vaccine acceptance, were concordant vaccine hesitant, and were concordant vaccine accepting, and a pearson's chi-square test was used to determine whether there was a statistically significant difference between the three groups of households.

OBJECTIVE 2: DESCRIBE THE ASSOCIATION BETWEEN HOUSEHOLD VACCINE ACCEPTANCE AND INDIVIDUAL VACCINE ACCEPTANCE

To assess the association between household vaccine acceptance and individual vaccine acceptance, a multivariable logistic regression model was fitted with a dependent variable of individual vaccine acceptance and a primary predictor variable of having anyone else in the household that is vaccine accepting. The model was adjusted for potential confounders, including individual age, wealth (constructed as a household-level wealth index using principal components analysis), education, distance to nearest health facility, and NCHAP implementation status (defined as whether the districts were implementing NCHAP at the time of the study).

The relationship between each dichotomous knowledge or behavioral intent outcome and the socio-demographic predictors was also assessed using multivariable logistic regression models. The models were adjusted for the same potential confounders as in the vaccine acceptance models.

To provide more interpretable estimates from regression models, the ratios produced by regression models were converted to adjusted differences in probabilities using average marginal effects. We present the unadjusted and adjusted regression output in the **Online Supplementary Document** and the adjusted differences in the main text. All models incorporate sampling weights and adjust standard errors for the sampling design. Stata version 17 was used for analyses.

RESULTS

INDIVIDUAL-LEVEL CHARACTERISTICS AND OUTCOMES

Characteristics of the sample disaggregated by vaccine accepting and hesitant are presented in **Table 1**. Among respondents, 47 percent were vaccine accepting (n=1229) and 53 percent were vaccine hesitant (n=1376). There were no significant differences between the two groups for demographic characteristics, except for education level, with the vaccine accepting group having a higher proportion of respondents who had completed primary education or higher (P=0.001). The two groups were significantly different for COVID-19 knowledge and behavioral factors, including having heard of COVID (P<0.001), being able to correctly identify routes of COVID transmission (P=0.001), being able to correctly identify safe COVID practices (P<0.001), owning a face mask (P<0.001), intent to seek care if they had COVID symptoms (P<0.001), and intent to take a COVID test if they were sick (P<0.001).

The results of the multivariable logistic regression models that assessed the association between individual-level predictors and COVID-19 knowledge, vaccine acceptance, and behavioral practices can be found in Tables S3-S5 in the **Online Supplementary Document**. In the adjusted model, participants living in NCHAP implemented districts were 5.9 percentage points more likely to be accepting of a COVID-19 vaccine than participants in districts that have not yet implemented NCHAP (95% confidence interval, CI=0.5-11.3%, P=0.032).

In the adjusted model, the likelihood of having higher COVID-19 knowledge significantly increased as education level increased. Participants with some primary education were 3.7 percentage points more likely (95% CI=1.3-6.1%, P=0.003) and participants who completed primary education or beyond were 4.4 percentage points more likely (95% CI=1.9-6.9%, P=0.001) to have heard of COVID-19 than individuals with no education (n=2589). Participants with some primary education were 5.8 percentage points more likely (95% CI=1.3-10.4%, P=0.013) and participants who completed primary education or beyond were 6.1 percentage points more likely (95% CI=0.1-12.1%, P=0.047) to have correctly identified routes of COVID-19 transmission than participants with no education (n=2597). Participants with some primary education were 5.6 percentage points more likely (95% CI=2.4-8.9%, P=0.001) and participants who completed primary education or beyond were 11.8 percent more likely (95% CI=8.4-15.1%, P<0.001) to correctly identify safe COVID-19 practices than participants with no education (n=2594).

Table 1. Characteristics of individuals who are vaccine hesitant and individuals who are vaccine accepting (compared to total respondents) (n=2620)

Characteristic	Total			Vaccine Hesitant			Vaccine Accepting			p-value (Weighted)
	No. (Unweighted)	n	% (Weighted)	No. (Unweighted)	n	% (Weighted)	No. (Unweighted)	n	% (Weighted)	
Age, years		2620			1229			1376		0.882
15-17	188		7.0	85		6.8	101		7.2	
18-29	1141		43.7	543		44.1	593		43.4	
30-39	785		30.4	370		30.7	411		30.1	
40-49	506		19.0	231		18.5	271		19.4	
Wealth index quintile		2620			1229			1376		0.675
1	431		17.2	203		17.6	223		16.7	
2	479		18.6	227		18.7	248		18.4	
3	547		20.7	254		20.3	289		20.9	
4	577		22.0	281		22.9	295		21.4	
5	586		21.4	264		20.5	321		22.5	
Education level		2616			1226			1375		0.001*
No education	1471		56.8	703		58.6	754		54.7	
Some primary	737		27.9	363		28.8	373		27.4	
Completed primary or beyond	408		15.3	160		12.7	248		17.9	
Distance to nearest health facility, km		2601			1222			1364		0.818
<10	1109		41.2	535		42.1	570		40.5	
10-<20	1099		43.0	511		42.5	578		43.2	
20+	393		15.8	176		15.4	216		16.3	
NCHAP status		2620			1229			1376		0.052
Not yet implemented	935		32.1	481		34.5	450		30.0	
NCHAP implemented	1685		68.0	748		65.5	926		70.1	
Heard of COVID		2612			1221			1376		<0.001*
Yes	2456		93.2	1065		85.6	1376		100.0	
Correctly identified routes of COVID transmission		2620			1229			1376		0.001*
Yes	1396		52.3	621		49.6	774		55.4	

Correctly identified safe COVID practices		2617			1229			1374	<0.001*
Yes	2153		81.6	946		75.9	1201	87.4	
Owns a face mask		2620			1229			1376	<0.001*
Yes	2144		80.7	935		74.5	1203	87.1	
Would seek care if COVID symptomatic		2611			1224			1374	<0.001*
Yes	2117		79.7	848		66.9	1260	91.7	
Would take a COVID test if sick		2616			1226			1376	<0.001*
Yes	1929		71.9	681		52.6	1242	90.2	

*p-value < 0.05

HOUSEHOLD VACCINE ACCEPTANCE

Three hundred fifty-two households were included in the household-level analysis (consort diagram presented in Figure S2 in the **Online Supplementary Document**). Characteristics of households by vaccine acceptance type within the household are presented in Table S6 in the **Online Supplementary Document** (n=352). Among respondents, 42 percent of households had discordant views on the vaccine (average household size = 8.9), 33 percent of households had members that were all vaccine accepting (average household size = 7.5), and 25 percent of households had members that were all vaccine hesitant (average household size = 8.1). There were no significant differences in demographic characteristics between households that have discordant vaccination beliefs, are concordant vaccine accepting, and are concordant vaccine hesitant.

Characteristics of the sample disaggregated by individuals included in the household-level analysis (had more than 1 respondent to the vaccine acceptance question in their household) (n=769) and individuals who were the sole respondent to the vaccine acceptance question in their household (n=1837) are presented in Table S7 in the **Online Supplementary Document**. Individuals with more than 1 respondent to the vaccine acceptance question in their household had a higher proportion of respondents ages 15 to 17 and a lower proportion of respondents ages 30 to 39 (P<0.001), had a higher proportion of respondents who completed primary education or beyond and a lower proportion of respondents who had no education (p=0.008), had a higher proportion of respondents in higher wealth index quintiles (p<0.001), and had a higher proportion of respondents living within 10 km of a health facility and a lower proportion of respondents living 20 km or further from a health facility (P=0.001). Individuals who were the sole respondent to the vaccine acceptance question in their household had a higher proportion of respondents who reported owning a face mask (P=0.025).

HOUSEHOLD AND INDIVIDUAL VACCINE ACCEPTANCE

Seven hundred fifty-six women were included in the individual-level analysis (consort diagram presented in Figure S2 in the **Online Supplementary Document**). The results of the multivariable logistic regression model that assessed the association between household vaccine acceptance and individual vaccine acceptance, adjusting for age, wealth, education level, distance to nearest health facility, and NCHAP implementation status, are shown in **Table 2** (n=756).

Having a household member who is accepting of the COVID-19 vaccine was significantly associated with being accepting of the COVID-19 vaccine at the individual level. In the adjusted model, those with a household member who is vaccine accepting were 18.1 percentage points more likely to be vaccine accepting themselves than those who did not have a household member who is vaccine accepting (95% CI=7.3-28.9%, P=0.001). The only other predictor of vaccine acceptance was living 10 to less than 20 kilometers from the nearest health facility compared to living less than 10 kilometers from the nearest health facility (95% CI=0.2-13.8%, P=0.043). The predictive margins of predictors of individual vaccine acceptance are shown in **Figure 1**.

Characteristics of individuals who are vaccine hesitant and individuals who are vaccine accepting among households that had discordant vaccine beliefs are presented in Table S8 in the **Online Supplementary Document** (n=346). There were no significant differences between the two groups for demographic characteristics. The two groups were significantly different for COVID-19 knowledge and behavioral factors, including having heard of COVID (P<0.001), being able to correctly identify safe COVID practices (P<0.001), owning a face mask (P<0.001), intent to seek care if they had COVID symptoms (P<0.001), and intent to take a COVID test if they were sick (P<0.001).

DISCUSSION

COVID-19 vaccines have been the fastest developed in history,[15] yet hesitancy to vaccinate has posed a challenge to the global effort to combat the pandemic. We examined the effect of concordant and discordant household vaccine acceptance on individual vaccine acceptance in a remote, resource-limited setting. We found that only 33 percent of households where there was more than one survey respondent in rural Grand Bassa were fully COVID-19 vaccine accepting, and the strongest predictor of whether someone was accepting of the COVID-19 vaccine was whether someone else in their household was also vaccine accepting. Our data are consistent with findings from a study in Zambia that assessed the intra-household dynamics and attitudes toward COVID-19 vaccines and found that the likelihood an individual would be willing to get vaccinated was around 62 percentage points higher when other household members were also willing to get vaccinated.[16] This supports the notion that social contagion - that people's decisions are influenced by the behavior of others around them[17] - influences COVID-19 vaccine acceptance and emphasizes the importance of social norms for vaccine acceptance in rural Liberia. It also suggests that a target for vaccine hesitancy interventions may be discordant households where changing the pro-vaccine attitude of one household member could influence other members of their home.

We also found that approximately 25 percent of households had members that were all vaccine hesitant and 53 percent of individuals surveyed were vaccine hesitant, which aligns with documented COVID-19 vaccine resistance across sub-Saharan Africa.[4,5,18] COVID-19 vaccine hesitancy across Liberia and several countries in Africa was found to be associated with misinformation, lack of knowledge on COVID-19 transmission, concerns and fear about side effects, lack of trust in the vaccine, barriers to access and distrust of government.[6-10,16] Forty-two percent of households in this study had discordant views on the vaccine. A study by Schmaling, 2020 found that approximately 16 percent of couples had discordant COVID-19 vaccination status. Among the couples with discordant vaccination status, the vaccine accepting individuals cited concerns about

Table 2. Adjusted differences of individual vaccine acceptance from a multivariable logistic regression model with marginal effects (n=756)

Characteristic	Difference (CI)	p-value
Age, years		
18-29 (ref)	53.44% (base)	ref
15-17	+6.79% (-4.43% - 18.00%)	0.233
30-39	-1.83% (-11.24% - 7.58%)	0.701
40-49	-6.88% (-16.44% - 2.68%)	0.157
Wealth index quintile		
1 (ref)	57.86% (base)	ref
2	-3.61% (-16.68% - 9.47%)	0.586
3	-5.42% (-17.04% - 6.20%)	0.357
4	-9.28% (-20.66% - 2.09%)	0.109
5	-4.43% (-15.54% - 6.67%)	0.431
Education level		
No education (ref)	53.02% (base)	ref
Some primary	-4.11% (-13.08% - 4.87%)	0.367
Completed primary or beyond	+3.40% (-8.09% - 14.89%)	0.559
Distance to nearest health facility, km		
<10 (ref)	49.36% (base)	ref
10-<20	+7.02% (0.23% - 13.81%)	0.043*
20+	+2.57% (-7.39% - 12.53%)	0.61
NCHAP status		
Not yet implemented (ref)	49.54% (base)	ref
NCHAP implemented	+4.56% (-1.92% - 11.05%)	0.166
Anyone else in household vaccine accepting		
No (ref)	41.83% (base)	ref
Yes	+18.08% (7.29% - 28.88%)	0.001*

CI - confidence interval
Reference group values are the rate for that group from which the differences are calculated
*p-value < 0.05

safety of the COVID-19 vaccine as the main reason for their partners' vaccine hesitancy.[19] Many studies have found that concerns about vaccine safety, particularly regarding its fast production, has plagued the COVID-19 vaccine hesitant population.[20-22]

Respondents who completed primary education or higher were significantly more likely to be vaccine accepting. This is consistent with previous studies that demonstrated increased levels of education are positively associated with acceptance of health interventions such as vaccines[23-25] and studies across sub-Saharan Africa that found that children whose mothers had primary and secondary or higher education are more likely to receive measles vaccines.[25] Having greater levels of educational attainment was significantly associated with higher COVID-19 knowledge, particularly in being able to correctly identify routes of transmission and safe COVID practices. These findings suggest that education plays a significant role in women and children's healthcare seeking behavior, utilization, and knowledge.

After the Ebola epidemic, Liberia designed and scaled the National Community Health Assistant (NCHA) program to increase access to primary healthcare for remote communities and improve pandemic response.[26] As part of the NCHA program, all deployed community health workers (CHWs) were trained on COVID-19 prevention practices and surveillance.[27] We found that participants living in NCHAP implementing districts were more likely to be accepting of a COVID-19 vaccine than participants in districts that have not yet implemented NCHAP. One strategy employed by the NCHAP implementation team in Grand Bassa county was to ensure an almost 100 percent COVID-19 vaccine coverage among Community Health Assistants (CHAs). This may imply that fear of COVID-19 vaccination was alleviated when community members saw CHAs - trusted members of their community - accepting the vaccine. Therefore, the NCHA program may promote willingness to receive COVID-19 vaccination among community members. It also aligns with findings from a study conducted in Liberia in 2015 on Ebola knowledge, attitudes, and practices, that showed CHWs' door-to-door sensitization efforts increased Ebola preventive measures in communities.[28]

There are limitations to this study that create an opportunity for further research. Like most survey-based stud-

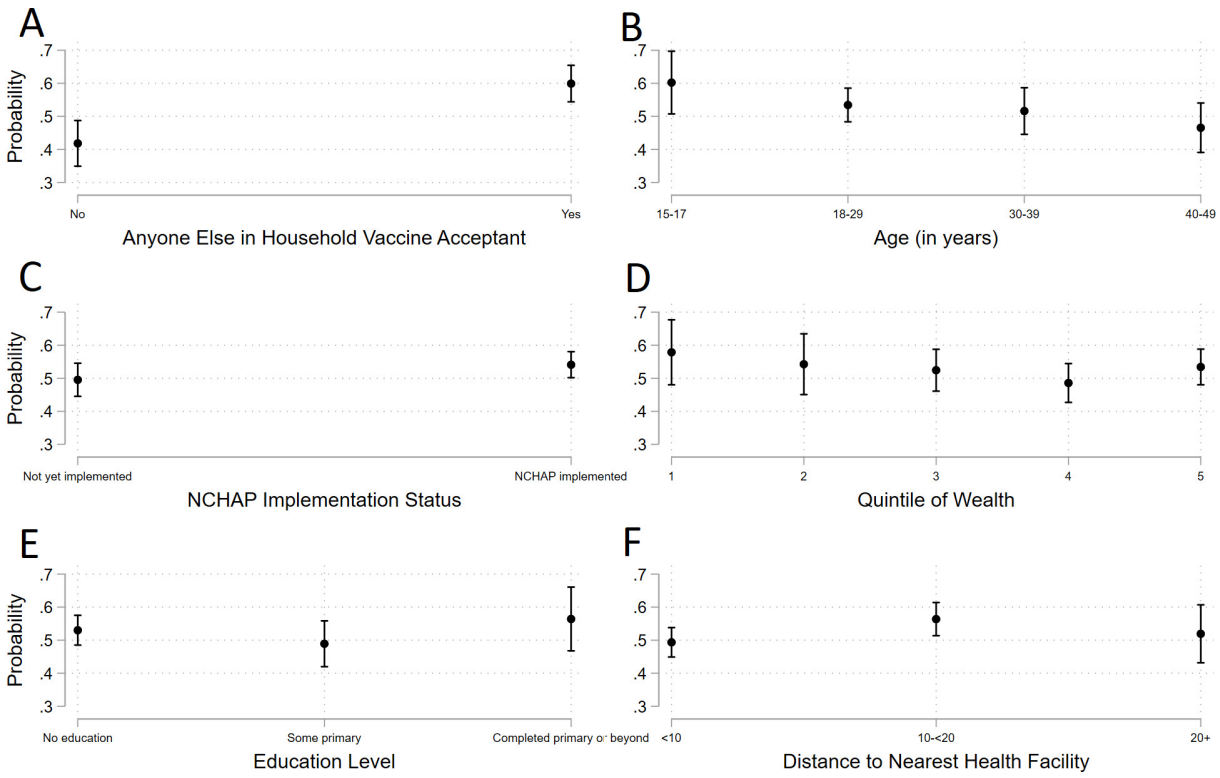

Figure 1. Adjusted probability of vaccine acceptance for predictors, including (A) whether anyone else in household was vaccine acceptant, (B) age, (C) NCHAP implementation status, (D) wealth, (E) education, and (F) distance to nearest health facility.

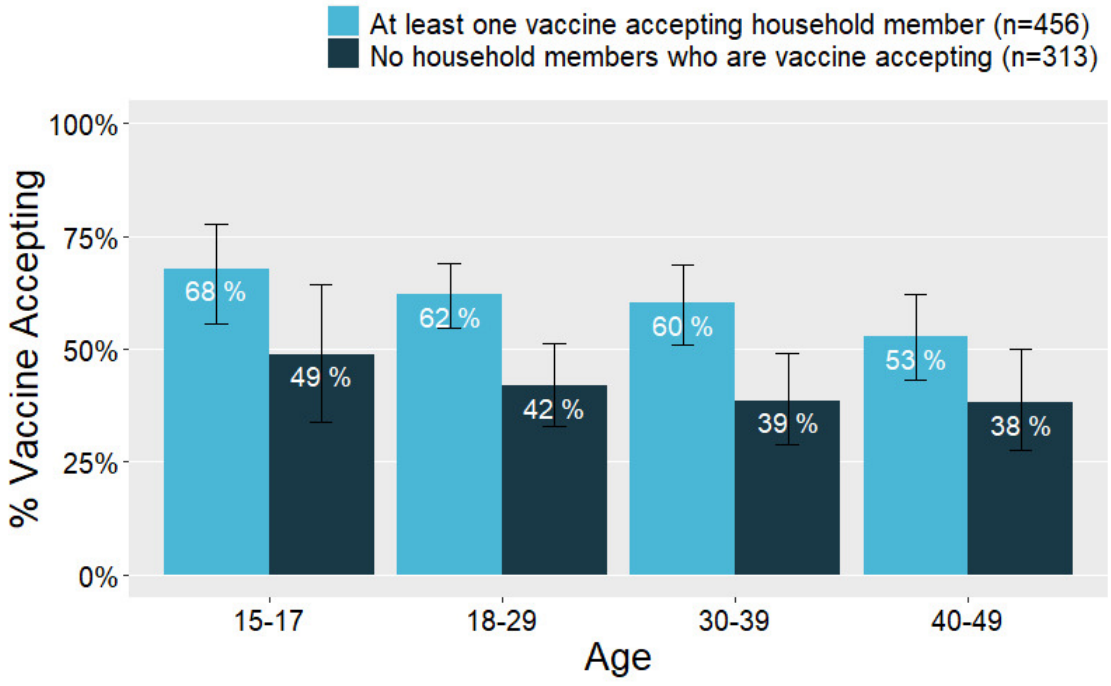

Figure 2. Prevalence of vaccine acceptance, by age and whether anyone else in the household is vaccine accepting (n=769)

ies, respondents self-reported their willingness to be vaccinated so responses may be influenced by social desirability bias. Responses may also be affected by the timing of the survey because the vaccine was not yet available across the country. It could be beneficial for researchers to further investigate vaccine hesitancy in similar populations as vaccines became more widely available. This study was a cross sectional survey and as such its ability to make any causal inference is limited, and although we've controlled for confounders, there is still a potential for residual confounding.

This study also has a narrow focus on women of reproductive age and those who live five kilometers or more away from a health facility. As a result, we are not able to capture all household members' potential vaccine acceptance and hesitancy. Future vaccine hesitancy studies should consider including men and expanding the age range of participants. Furthermore, because this study was conducted among women in rural areas, the results may not be fully generalizable to urban areas, which have different access to information and health services.

CONCLUSIONS

Policy makers, advocates, and programs should promote the implementation of door-to-door vaccination interventions that target vaccine hesitant households as well as individuals, as this may have a significant impact on vaccine acceptance rates in remote settings. Our results suggest that interventions that focus on promoting positive vaccine beliefs among individuals in predominantly vaccine-hesitant households may have an outsized effect. Targeted vaccination programs should leverage community members with higher education, CHWs, and trusted community members to act as role models for health behavior and lead health education and promotion efforts. The positive association between education and vaccine acceptance emphasizes the importance of education programs that target women in improving the health of communities. Vaccination and education programs that leverage the influence of family members and trusted members of the community, such as CHWs, should be implemented to target misinformation and address concerns around the COVID-19 vaccine, and improve vaccination rates, knowledge, and safe practices among community members.

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ETHICS STATEMENT

Approval for the surveys was provided by the institutional review boards at The University of Liberia (#18-11-140) and Advarra Institutional Review Board (25th of January 2021, Pro00048901), United States. All respondents gave informed consent.

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AUTHORSHIP CONTRIBUTIONS

Molly R Mantus helped to conceptualize the study, analyzed the data, drafted the initial manuscript, and reviewed and revised the manuscript. Hawa Iye Obaje helped to conceptualize the study, drafted the initial manuscript and reviewed and revised the manuscript. Rachael Piltch-Loeb helped to conceptualize the study, provided advice, and reviewed and revised the manuscript. Jae Won Chung conducted a literature review and drafted the initial manuscript. Lisa R Hirschhorn helped to conceptualize the study, provided advice, and reviewed and revised the manuscript. Marion Subah provided advice and reviewed the manuscript. Savior Mendin provided advice and reviewed and revised the manuscript. Mark J Siedner helped to conceptualize the study, provided advice, and reviewed and revised the manuscript. John D Kraemer helped to conceptualize the study, supervised the study, and reviewed and revised the manuscript. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

DISCLOSURE OF INTEREST

The authors completed the ICMJE Disclosure of Interest Form (available upon request from the corresponding author) and disclose no relevant interests.

ADDITIONAL MATERIAL

This article contains additional information in an Online Supplementary Document.

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SUPPLEMENTARY MATERIALS

Online Supplementary Document

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