

EXAMINING PREDICTORS OF VACCINE UPTAKE AND HESITANCY

**IN THREE RURAL SUB-MUNICIPALITIES IN
NKWANTA SOUTH, OTI REGION, GHANA**

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CONTENTS

BACKGROUND	Page 04
KEY FINDINGS	Page 05
POLICY RECOMMENDATIONS	Page 07
METHODS	Page 08
FINDINGS AND DISCUSSION	Page 09
PREDICTORS OF HESITANCY AMONGST UNVACCINATED RESPONDENTS	Page 10
REFERENCES	Page 12

BACKGROUND

THIS POLICY BRIEF REPORTS SURVEY DATA COLLECTED IN ALOKPATSA (N = 338), BREWANIASE (N = 359), AND TUTUKPENE (N = 753) – THREE SUB-MUNICIPALITIES IN NKWANTA SOUTH, A MUNICIPAL IN THE OTI REGION OF GHANA – IN JANUARY 2022. DATA WAS COLLECTED IN-PERSON VIA COMMUNITY VOLUNTEERS, WHO WERE TRAINED BY THE MUNICIPAL HEALTH DIRECTORATE ON GOOD RESEARCH PRACTICE AND HOW TO USE THE ELECTRONIC DEVICES TO COLLECT HEALTH DATA. ANALYSES WERE CONDUCTED ON A RELATIVELY LARGE SAMPLE OF RURAL RESPONDENTS (N = 1500). WE COMPARE SOCIO-DEMOGRAPHICS OF VACCINATED VS. UNVACCINATED PARTICIPANTS, AND EXAMINE KEY GROUPS MOST ASSOCIATED WITH VACCINE HESITANCY.

While high-income settings have achieved relatively high coverage with their COVID-19 vaccination campaigns, as of 21 March 2022 under 40% of the world's population are yet to receive a single dose of any COVID-19 vaccine [1]. The vast majority of unvaccinated people reside in low- and lower-middle income countries in sub-Saharan Africa (SSA). This includes Ghana, where only 14.4% of the country is considered fully vaccinated [2]. With the recent emergence of the highly transmissible Omicron variant [3], large-scale vaccination coverage is fundamental to the national and global pandemic response. Government, healthcare, and policy groups in Ghana will require timely data to guide their immunisation strategies. Thus, it is fundamental that we continue to develop a rich understanding of the factors that influence people's willingness to be vaccinated – especially in “hard to reach” rural communities where people may be more cut off from credible information sources.

Significant obstacles stand in the way of ensuring global access to the vaccines – including vaccine hesitancy. According to the World Health Organization (WHO), vaccine hesitancy is defined as the delay in the acceptance or blunt refusal of vaccines, which has been identified as a growing trend in global health and Africa [4]. Previously, many experiences and rumours have challenged the success and effectiveness of vaccination programs in African countries. For example, the polio vaccine boycott in Northern Nigeria in 2003-2004 was prompted by distrust and misconceptions of their

religious leaders [5]. This is often driven, in part, by vaccine misinformation, which is an ongoing problem in West African countries [6].

We hope that our findings provide additional insights into the socioeconomic and psychological predictors associated with COVID-19 vaccine hesitancy in “hard to reach” rural community cohorts in Ghana.

KEY FINDINGS

- Across three sub-municipal communities containing 1500 participants, **700 (46.7%)** reported having received at least one COVID-19 vaccine dose, whereas **800 (53.3%)** reported not having received any doses of the vaccine.
- **387 (55.7%)** of the 700 vaccinated participants received one dose, whereas **308 (44.3%)** received two doses.
- The vaccines most commonly received were **Oxford AZ (51.9%)** and **Moderna (13.4%)**. One third of participants reported not knowing which vaccine they received (**33.6%**).
- Analyses comparing participants who received at least one dose vs. unvaccinated participants showed significant differences between sub-municipalities. Specifically, the proportion of participants who reported having received at least one dose was highest in **Alokpatsa (61.1%)**, followed by **Brewaniase (46.0%)**, and **Tutukpene (39.6%)**. To corroborate these findings, supplementary analyses showed that unvaccinated participants in the Tutukpene sub-municipality were also 2.51 times more likely to report hesitancy compared to those in the Alokpatsa sub-municipality.
- Among our sample of 800 unvaccinated participants, **556 (69.4%)** reported that they would be willing to receive the vaccine once available, **190 (23.7%)** said they would not, and **55 (6.9%)** said they were still unsure. Overall, this represents 30.6% hesitancy within the currently-unvaccinated group.
- Among the 30.6% of hesitant participants, the most common reasons included believing that they **did not need the vaccine (33.8%)**, **believing the vaccine to be dangerous (30.6%)**, **concerns about side effects (25.3%)**, and **not having enough information about the vaccine (20.1%)**.
- **High vaccine-related mistrust** predicted greater vaccine hesitancy. The odds of expressing vaccine hesitancy were 13.52 times higher for participants who indicated high (vs. low) vaccine-related mistrust.
- **Difficulties in obtaining the vaccine** (e.g., getting to the vaccination site) was the next strongest predictor of hesitancy in our model. The odds of hesitancy were 5.21 times higher for participants who indicated high (vs. low) difficulties in obtaining the vaccine.
- Replicating results from previous surveys, **years of education received** was a key predictor of vaccine hesitancy. The odds of expressing vaccine hesitancy were 2.21 times higher for formally-educated participants (i.e., those who attended primary school and above) compared to participants who received no formal education at all.
- **Muslims** were marginally less likely to report vaccine hesitancy than Christians. The odds of expressing vaccine hesitancy were 3.05 times lower for Muslims compared to Christians.
- Participants who indicated agreement with at least one **vaccine-related misinformation beliefs** were 1.82 times more likely to report hesitancy compared to those who did not. However, **uncertainty about vaccine-related misinformation belief** (i.e., being “on the fence” about their beliefs) was the strongest predictor of hesitancy. These participants were 2.36 times more likely to report hesitancy.
- Replicating results from previous surveys, **gender** is a significant predictor for hesitancy. The odds of expressing vaccine hesitancy were 1.61 times higher for females compared to males.



POLICY RECOMMENDATIONS

The levels of vaccine hesitancy reported here (30.6%) are similar to those reported in our most recent electronic nationwide survey in June 2021 (28.6% [7]). However, compared to this survey, a greater proportion of hesitant participants in the Nkwanta South sub-municipality believed that they did not need the vaccine [33.8%]. It is clear that the vaccine is a low priority for many people in these municipality. Thus, it is critical that health promotion campaigns focus on providing general information about the continuing dangers of COVID-19 to reiterate why the COVID-19 vaccine will be important to take for the future (e.g., the dangers of long COVID).

Further, many participants expressed that concerns about side effects were the main reasons for hesitancy [25.3%]. The odds of expressing vaccine hesitancy were also 13.52 times higher for participants who indicated high (vs. low) vaccine-related mistrust. Health promotion campaigns should also focus on distributing accessible information about the safety of vaccine to increase trust.

While some measures will involve governmental strategies (e.g., municipal, regional, or national), others will require

multi-stakeholder collaboration and solutions, and our findings demonstrate the importance of tailored health promotion messages. As highlighted by a WHO review [8], this is more likely to have a positive impact upon people with specific religious beliefs, or with who are mistrustful toward vaccine safety. These results lend evidence to the implementation of health service programs that take healthcare (for example, COVID-19 vaccines) into the communities, therefore reducing obstacles around access to healthcare.

Short-term measures

- Promote measures within specific districts (i.e., with low vaccine uptake) that increase the share of accurate and reliable medical and scientific information available about the pandemic and the safety and efficacy of vaccines to build trust. For example, information that is released by official sources, such as the Ghana Health Service, should be promoted via appropriate methods for local communication, which may include word of mouth dissemination via trusted individuals or groups.
- Develop targeted programs via multiple channels in Ghana, such as community outreach and media campaigns, in order to educate unvaccinated populations, such as women or people with specific religious beliefs, with the goal to increase knowledge and trust in vaccines. We must engage with trusted local leaders in each of those regions to support the delivery of good public health messaging.
- Boost efforts via multiple channels, such as mass media outlets and official government and health outlets, to reach a broader range of people with clear information about vaccine safety. Case studies using photos of real people and other trusted “voices” who are associated with the hesitant cohorts (e.g., women, religious communities) may be effective in inducing confidence in the COVID-19 vaccines.
- Recruit more female community champions for health promotion campaigns to empower vaccine-hesitant females to receive their doses.

- Develop regular doorstop campaigns at national/district, community, and neighbourhood levels to target hard-to-reach individuals with potential difficulties in obtaining vaccinations. Funding should be provided for these campaigns.
- Researchers should begin urgent exploration of the role of good and bad vaccine-related information, including tailored health promotion campaigns aimed at diverse Ghanaian demographics, such as people with different levels of education.

Medium-term measures

- Facilitate initiatives among traditional media and online information providers to develop measures to assist consumers in discerning the quality of sources and of information content.
- Promote information and scientific literacy. It would be beneficial for Ghanaian citizens to learn more about scientific methods, such as measures of risk and probability, and how scientific breakthroughs such as vaccines are created and tested. Furthermore, many respondents have previously reported reservations about the vaccine being developed in Western countries such as the US and the UK. Thus, there could be approaches to show how international research can be adapted and adopted for local populations.
- Advocate for continued investment in primary healthcare infrastructure in community settings – human and equipment.

METHODS

Participants in this cross-sectional survey were 1500 citizens residing in the Alokpatsha (388), Brewaniase (359), and Tutukpene (753) sub-municipalities in Nkwanta South, a municipal in the Oti region of Ghana (53.1% male; Age Range = 18–100, Mage = 40.65, SD = 14.98). Data collection took place for 2 weeks from January 10–21 2022 by a group of community volunteers, who collected responses in-person using survey software installed on electronic devices.

First, we asked participants basic demographic (age, gender, relationship status, religion) and socioeconomic (employment status, education) questions, and the extent in which they trusted the municipal health team's response to the pandemic and the safety of the vaccine. We also assessed perceptions on how difficult it would be to obtain the vaccine (e.g., travelling to a vaccination site), and whether they knew anybody who had received the vaccine. Finally, participants indicated the extent to which they agreed with two vaccine-related misinformation beliefs (e.g., "The COVID-19 vaccine is a weapon designed to reduce or control the population").

Next, participants indicated whether they were vaccinated – that is, whether they had previously received one or more doses of the COVID-19 vaccine. Those who indicated 'yes' disclosed what vaccine they received and how many doses. Those who indicated 'no' disclosed their willingness to receive the COVID-19 vaccine in the future. To do this, participants indicated their response to the statement: "When the vaccine for COVID-19 becomes available to you, I will take it." (yes, no, I don't know). Participants who ticked 'no' or 'I don't know' – which we operationalised as vaccine hesitancy – subsequently specified reasons for their hesitancy. A list of ten reasons was consequently presented and participants selected the reasons they agreed with.



FINDINGS

AND DISCUSSION

Among the participants, the largest ethnic groups were Konkomba (33.2%) and Ewe (29.0%). While 32.1% of all participants reported receiving no formal education, most participants were educated up to primary (17.1%) or junior high (31.0%). Almost 70.0% were married (vs. single; 25.2%), 80.7% were employed to some degree (vs. unemployed; 19.3%), and 74.7% reported having Christian beliefs (vs. 18.6% who had traditional beliefs, and 6.7% who were Muslim).

From our total sample, 800 (53.3%) had not yet received a single dose of the COVID-19 vaccine, whereas 700 (46.7%) received at least one dose of the vaccine. Of the 700 vaccinated participants, 387 (55.7%) received one dose, and 308 (44.3%) received two doses. The vaccines most commonly received were Oxford AZ (51.9%) and Moderna (13.4%). However, one third of participants reported not knowing which vaccine they received (33.6%).

Analyses comparing vaccinated vs. unvaccinated participants showed significant associations with sub-municipalities. Specifically, the proportion of participants who received at least one dose was highest in Alokpatasa (61.1%), followed by Brewaniase (46.0%),

and Tutukpene (39.6%). Supplementary analyses showed that participants in the Tutukpene sub-municipality were also 2.51 times more likely to report hesitancy compared to those in the Alokpatasa sub-municipality.

The proportion of participants who received at least one dose was also higher among single (56.1%) compared to non-single participants (43.9%), those who completed senior/higher (56.5%) compared to primary/junior (44.2%) or no education (44.3%), and Christian (48.4%) or Muslim (46.9%) participants compared to those with traditional religious beliefs (39.9%). There were no differences between gender, age, and occupational status on doses received.

Variables	Categories	Vaccinated	Unvaccinated	p-Value
Sub-municipality	Alokpatasa Brewaniase Tutukpene	237 (61.1) 165 (46.0) 298 (39.6)	151 (38.9) 194 (54.0) 455 (60.4)	< 0.001
Age in category	18-24 25-34 35-44 45-54 55+	88 (41.3) 178 (47.0) 154 (44.5) 141 (50.5) 139 (49.1)	125 (58.7) 201 (53.0) 192 (55.5) 138 (49.5) 144 (50.9)	0.242
Gender	Female Male	332 (47.3) 367 (46.0)	370 (52.7) 430 (54.0)	0.333
Marital status	Single Not single	192 (56.1) 508 (43.9)	150 (43.9) 649 (56.1)	< 0.001
Education	None Primary or junior Senior or higher	213 (44.3) 318 (44.2) 166 (56.5)	268 (55.7) 402 (55.8) 128 (43.5)	< 0.001
Occupational status	Unemployed Employed	133 (47.5) 544 (46.3)	147 (52.5) 630 (53.4)	0.388
Religion	Christianity Islam Traditional	517 (48.4) 45 (46.9) 106 (39.9)	552 (51.6) 51 (53.1) 160 (60.1)	< 0.05
Total		700 (46.7)	800 (53.3)	

PREDICTORS OF HESITANCY AMONGST UNVACCINATED RESPONDENTS ⁽¹⁾

Among unvaccinated participants, 69.4% selected that they would be willing to be vaccinated against COVID-19 when it became available to them, 6.9% were unsure, and 23.7% selected ‘no’ (30.6% overall hesitancy). These results are similar to our most recent nationwide electronic survey conducted in Ghana in June 2021, where 71.4% of Ghanaian respondents agreed that they would be willing to be vaccinated against COVID-19 when offered the opportunity (28.6% overall hesitancy [7]). The most common reasons for hesitancy in the current sample included believing that they did not need the vaccine (33.8%), believing the vaccine to be dangerous (30.6%), concerns about side effects (25.3%), and not having enough information about the vaccine (20.1%).

We next assessed predictors of populations more likely to be vaccine-hesitant. Participants who indicated high vaccine-related mistrust predicted greater vaccine hesitancy. Specifically, the odds of expressing vaccine hesitancy were 13.52 times higher for participants who indicated high (vs. low) vaccine-related mistrust. Further, access to the vaccine (e.g., getting to the vaccination site) was the next strongest predictor of hesitancy in our model, where the odds of expressing vaccine hesitancy were 5.21 times higher for participants who indicated high (vs. low) difficulties in obtaining the vaccine. These highlight the importance of health promotion campaigns in distributing accessible information about the safety of vaccine to increase trust, as well as creating vaccination sites that are more accessible for communities.

Replicating results from previous electronic nationwide surveys, years of education was a key predictor of vaccine hesitancy. Specifically here, the odds of expressing vaccine hesitancy were 2.21 times higher for formally-educated participants (i.e., those who attended at least primary school) compared to participants who received no formal education at all. This finding has been mixed in previous surveys. However, it may reflect more consistent access among educated populations to a wider variety of sources that includes good and bad information (i.e., misinformation). It is worth acknowledging that this contradicts our vaccine uptake findings above, in which those with more years of education had the highest uptake. More research should be conducted to explore the role of education in vaccine uptake and hesitancy, and how this may be confounded by other factors.



Muslim participants were marginally significantly less likely to report vaccine hesitancy than Christians. The odds of expressing vaccine hesitancy were 3.05 times higher for Christians compared to Muslims. These findings suggestively replicate results from our previous survey in June [7]. Thus, there is a continual need for policymakers to develop targeted programs aimed at providing religious communities in Ghana with high quality information on the safety and efficacy of the COVID-19 vaccine.

Participants who indicated agreement with at least one vaccine-related misinformation belief (e.g., “The COVID-19 vaccine is a weapon designed to reduce or control the population”) were 1.82 times more likely to report hesitancy compared to those who indicated disagreement. However, uncertainty about vaccine-related misinformation beliefs (i.e., those who indicated neither agreement nor disagreement) was the strongest predictor of hesitancy. These participants were 2.36 times more likely to report hesitancy. We also found these results in our previous Ghana surveys [7]. Previous research has shown that the relationship between conspiracy theory beliefs and vaccine acceptance is highly complex [9], and thus, these findings should be interpreted cautiously.

Finally, replicating results from our previous Ghana surveys [7], gender is also a significant predictor for hesitancy. The odds of expressing vaccine hesitancy were 1.61 times higher for females compared to males. This has been found in other studies, for example in Nigeria [10]. Differences in age, relationship status, employment status, sources of COVID-19 vaccine-related information, and governmental mistrust were not associated with vaccine hesitancy.

Whilst only 55.7% of the 700 vaccinated participants received only their first dose, we did not assess when these doses were given, nor did we assess whether participants who received their first dose may be hesitant to receive their second. It is possible that these participants received their first doses recently and were still waiting to receive their second dose. Secondary data also showed that 43.1% of respondents who received their first dose experienced side effects. Thus, it is possible that adverse events from the first dose may have caused participants to be hesitant to receiving the second vaccine. Further research is needed to understand why people may be hesitant to the second dose of the COVID-19 vaccine, including subsequent booster jabs.



PREDICTORS OF HESITANCY

AMONGST UNVACCINATED RESPONDENTS (2)

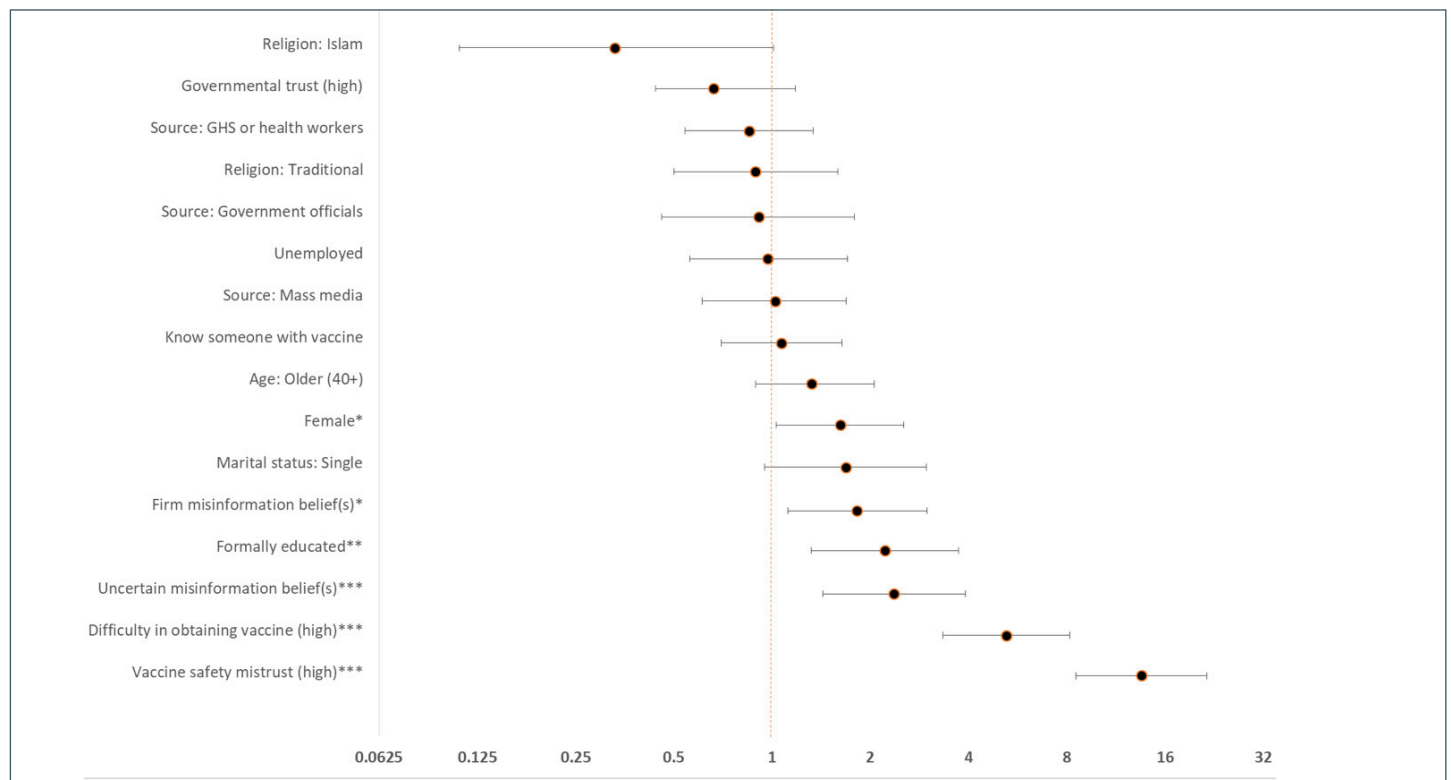


Figure 1. Expressed hesitancy to the COVID-19 vaccine.

Table 2. Expressed hesitancy to the COVID-19 vaccine				
		OR	p-value	95% CI
1. Age (Older: 40+)		1.321	.219	0.848 – 2.058
2. Female		1.618	.035	1.034 – 2.532
3. Marital status: Single		1.676	.078	0.945 – 2.973
4. Formally educated		2.22	.003	0.128 – 0.3551
5. Unemployed		0.974	.925	0.558 – 1.699
6. Religion	Mustlim	0.327	.052	0.106 – 1.009
	Traditional	0.891	.698	0.498 – 1.593
7. Firm beliefs in vaccine misinformation		1.820	.018	1.107 – 2.993
8. Uncertainty about beliefs in vaccine misinformation		2.368	.000	1.432 – 3.916
9. Personally know somebody who received vaccine (Y)		1.070	.756	0.698 – 1.641
10. Channels of COVID-19 information	Mass media (e.g., radio, newspapers, TV)	1.017	.947	0.612 – 1.690
	Ghana Health Service or health workers	0.854	.493	0.544 – 1.341
	Government officials	0.911	.788	0.463 – 1.794
11. Governmental mistrust (high)		0.656	.158	0.366 – 1.177
12. Vaccine safety mistrust (high)		13.542	.000	8.537 – 21.483
13. Difficulty in obtaining vaccine (high)		5.215	.000	3.336 – 8.150
Number of participants				696
R²				0.498

Notes: Predictors of vaccine hesitancy were examined using a binary regression model. The column labelled OR are the odd ratios for each variable. Dummy variables were used to estimate the effect of categorical variables. Reference categories are (1) younger (18-39), (2) male, (3) married/in a relationship, (4) primary education and above, (5) employed to some degree, (6) Christian religion, (7) did not express firm beliefs in vaccine misinformation, (8) did not express uncertainty in vaccine misinformation, (9) do not know somebody personally who received vaccine, (10a) does not consult mass media, (10b) does not consult GHS, (10c) does not consult government officials, (11) low governmental trust, (12) low vaccine safety mistrust, and (13) low difficult in obtaining vaccine. p-values indicate the level of significance. p-values below 0.05 indicate significance at the 95% confidence level; p-values below 0.01 indicate significance at the 99% confidence level; p-values below 0.001 indicate significance at the 99.9% CLs



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Ethics

The study was reviewed and approved by the Psychology Ethics Committee, University of Southampton, UK (ref: 57267) and the Institutional Review Board, Ghana Health Service (ID: NHRCIRB440).

Peer Review

The findings reported in this policy brief have not been subjected to a formal peer review. A manuscript is currently being prepared for pre-print.

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In collaboration with





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