

Myths, misinformation, and perception of COVID-19 vaccine hesitancy among market women in Ghana

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Abstract

Scepticism of the COVID-19 vaccine is a chronic issue influenced by myths, misinformation, and attitudes. Market women, a critical part of the informal sector in Ghana, may have special barriers to vaccination. Understanding their behaviour regarding vaccines is important for creating suitable health promotion strategies. A mixed-methods approach, including quantitative and qualitative methods, was used in the study. A cross-sectional survey of 324 market women, including 35.5% from the New Market and 64.5% from the Old Market, was conducted in the Nsawam Adoagyiri Municipality. Statistical tests, including chi-square tests, binary logistic regression, and thematic approaches, were used to examine the sociodemographic risk factors, perceptions, and social media's role in vaccine demand in a climate of vaccine hesitancy. Vaccine hesitancy is influenced by demographic factors such as low education, marital status, and social media misinformation. Additionally, women with low perceived risk of contracting COVID-19 and concerned about vaccine side effects were more likely to be hesitant. Logistic regression analysis showed that women who believed in myths and misinformation about COVID-19 vaccination were four times more likely to be hesitant. Developing effective strategies to reduce vaccine hesitancy should prioritise addressing women's misconceptions.

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Introduction

For centuries, marketplace systems have been central to the urban economies of West Africa (Asante & Helbrecht, 2018; Clark, 1994), serving as hubs of economic activity and community interaction. With 85% of workers, sub-Saharan Africa leads the world in informal sector employment (Moyo, 2022), with women comprising most workers. According to (Asante & Helbrecht, 2018; Moyo, 2022), in developing economies, the informal sector employs approximately 61% of the urbanised workforce, particularly women, who comprise the bulk of workers (Akintoye, 2006). Among all traders in Anglophone West Africa, women make up between 70% and 89% (Asante & Helbrecht, 2018; Awuah, 1997).

In Ghana, over 90% of women are engaged in the informal sector (Bonnet et al., 2019), which helps to improve their financial independence, socioeconomic status, and standard of living (Wrigley-Asante, 2013). Additionally, the income generated by these women constitutes the largest portion of local government revenue, a share that continues to grow as taxes and fees increase (Owusu & Lund, 2004). However, the exchange of goods between sellers and customers in densely populated markets creates a conducive environment for the rapid spread of infectious diseases (Neiderud, 2015). Despite understanding COVID-19, market participants resist safety protocols, exacerbating their vulnerability (Quashie et al., 2021). These traders are, however, less likely to qualify for government programmes to help them through the crisis. Since markets provide essential daily services such as food and clothing, it is challenging to close them to prevent the spread of disease (Asante & Helbrecht, 2018).

The pandemic has also magnified existing gender disparities, increasing the susceptibility of women to widespread economic hardship (Nordhues et al., 2021). Women also experience aggression, exploitation, abuse, and exclusion (Al-Ali, 2020; Peterman et al., 2020). Notwithstanding, women's voices are underrepresented in the media, leading to the neglect of their knowledge and viewpoints in crisis policy formulation. It is important to ensure that women are well-informed and actively involved in the decision-making processes where solutions are developed.

Although some authorities have asserted the imminent end of the pandemic because the global surge of new COVID-19 cases driven by the omicron variant (B.1.1.529) appears to be subsiding, COVID-19 is expected to persist as an endemic disease (Torjesen, 2021). The spread of inaccurate health information on COVID-19, particularly regarding vaccines, further complicates public health efforts. One of the most effective and affordable strategies for disease prevention and public health improvement is vaccination (Kantarcioglu et al., 2022). Community-wide immunity to infectious diseases reduces the likelihood of disease transmission. This can be attained through immunisation or naturally acquired immunity through earlier infection. The WHO recommends

vaccination to increase herd immunity (Nguyen et al., 2022). Vaccine hesitancy, which is influenced by misinformation, perceived risk, and sociocultural factors, has emerged as a significant barrier to achieving herd immunity. Past pandemics, such as HIV and Ebola, have always included myths and false information (Afolabi et al., 2021), and COVID-19 has given rise to several intriguing conspiracy theories, including the development of the COVID-19 vaccine to introduce microchips into people to control them and reduce women's fertility to control the population. Additionally, the advent of a postmodern medical services framework and the extraordinary growth of the internet cast doubts on the validity of science and the concept of knowledge, opening a gap in the debate (Kwok et al., 2021). COVID-19 and similar pandemics can be controlled by addressing low vaccine uptake and identifying signs of vaccine hesitancy in marginalised demographic groups such as market women, whose experiences remain underrepresented in research.

Research on COVID-19 vaccine hesitancy among market women is limited. Few studies in Ghana investigated the socioeconomic effects of COVID-19 in Ghanaian urban markets (Asante & Mills, 2020) and COVID-19's impact on women's socioeconomic standing in informal trade and their coping strategies (Wrigley-Asante & Frimpong, 2023). Similarly, Frimpong et al. (2022) explored market women's perspectives on COVID-19 in Ghana and South Africa, whereas Lenshie et al. (2021) investigated the COVID-19 experiences of undocumented women workers in peri-urban areas of Nigeria.

While there is scholarship on COVID-19 and women (socioeconomic impacts and perspectives) in the informal sector (Asante & Mills, 2020; Wrigley-Asante & Frimpong, 2023; Frimpong et al., 2022), there is a paucity of research on COVID-19 vaccine hesitancy among Ghanaian market women. Little research has examined myths, misinformation, and perceptions of COVID-19 vaccine hesitancy among Ghanaian market women. This study addresses the gap in understanding COVID-19 vaccine hesitancy among market women in the Nsawam Adoagyiri Municipality in Ghana. Specifically, we investigate the effects of some sociodemographic predictors on COVID-19 vaccine hesitancy among market women, examine the role of social media in COVID-19 vaccine hesitancy among market women, and assess market women's perceptions of the vaccine and its impact on COVID-19 vaccine hesitancy, to shed light on the unique challenges of vaccine uptake. We offer insights to guide targeted interventions to improve vaccine confidence in similar communities.

Vaccine hesitancy fueled by misinformation and conspiracy theories poses a significant barrier to the success of COVID-19 vaccination campaigns. A high vaccination refusal rate jeopardises herd immunity, with minor decreases in vaccination uptake potentially leading to severe epidemiological consequences (Dror et al., 2020).

Theoretical perspective

This study draws on the social amplification of risk framework (SARF), which holds that psychosocial, institutional, and cultural processes transmit and transform risk signals, either heightening or dampening how individuals and groups perceive and act on risk (Kasperson & Kasperson, 1996). Risk information travels through amplification stations – mass media, social media, and face-to-face conversation – and each recipient reinterprets it according to their attention, circumstances and social position (Wachinger et al., 2012). The framework suits vaccine hesitancy because it treats risk as socially produced rather than objectively given. Unverified claims about vaccine side effects acquire emotional charge and volume as they circulate, inflating perceived risk even where the claims have been scientifically discredited (Skafle et al., 2022). For market women, the relevant amplification stations are largely informal. Limited schooling and precarious incomes restrict access to authoritative health information (Dubé et al., 2018), and traders rely heavily on word of mouth within dense, trust-based networks (Ikoja-Odongo, 2013). Where influential figures such as market queens voice doubt, that doubt is amplified across the network; where they endorse vaccination, the same channels can normalise it.

Attenuation is the converse process. Consistent, credible communication from trusted institutions can dampen exaggerated signals and lower perceived risk. Because market women receive information through the same channels that amplify it, attenuation depends less on the volume of official messaging than on whether it enters these networks through trusted intermediaries.

SARF therefore structures the analysis in two directions: identifying which channels amplify hesitancy among market women, and where attenuation could realistically be introduced.

Methods

Study design

This study employed a sequential explanatory mixed-methods design, in which quantitative data are collected and analysed first, followed by the collection of qualitative data to explain and elaborate on the statistical findings (Creswell & Plano Clark, 2018; Teye, 2012). The design was selected because vaccine hesitancy is a multifaceted social phenomenon that neither strand alone can capture. Survey data establish the distribution of hesitancy and identify its sociodemographic and attitudinal correlates but cannot recover the reasoning behind those associations or the social processes through which beliefs about vaccines circulate and gain credibility. The qualitative phase was therefore designed to interrogate patterns produced by the survey rather than to run alongside it.

Priority was given to the quantitative strand, with the qualitative strand serving an explanatory function. Integration occurred at two points. First, during the design stage

of the interview guide, it was refined following preliminary analysis of the survey, so that the questioning focused on the associations identified therein had survey, particularly those between exposure to social media content, perceived susceptibility, and hesitancy. Second, at the interpretation stage, where qualitative accounts were used to explain quantitative results and, where accounts diverged from the survey pattern, that divergence was treated as a finding in its own right rather than as an inconsistency.

Research settings

This study was conducted in two major market centres within the Nsawam-Adoagyiri Municipality: The Old Market (Main Market) and the New Market (Prison Market) (see Fig.1).

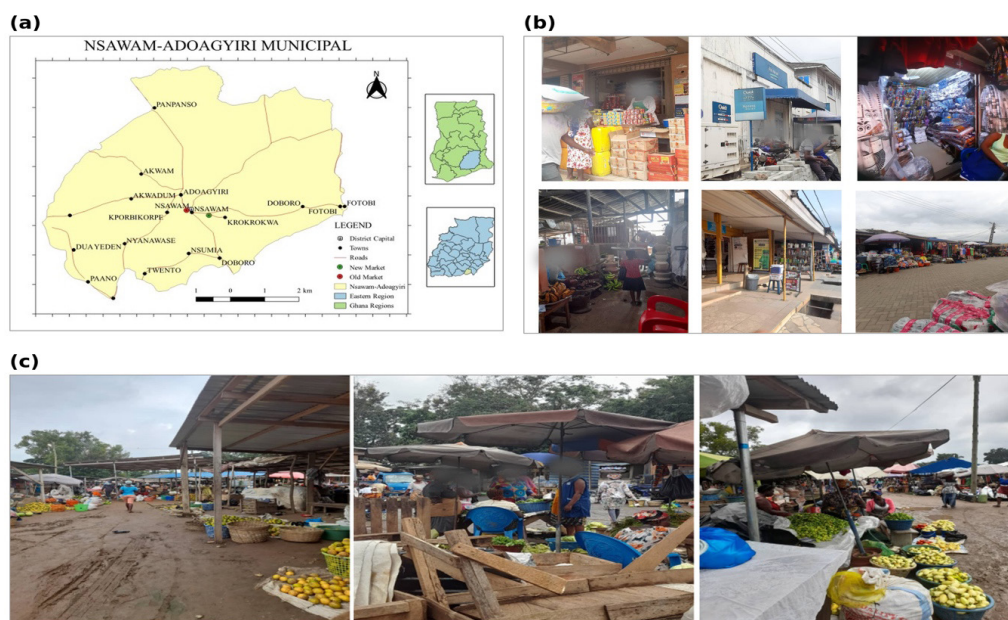


Figure 1: Study area and market conditions: (a) map of Nsawam-Adoagyiri Municipality showing the two market centres; (b) the New Market; (c) the Old Market.

In 2020, the outbreak of COVID-19 prompted the New Market to be carved out of the Old Market near the Nsawam Medium Security Prison to reduce congestion. There are 2,250 female traders in the Old Market and 1,180 in the New Market. Traders in the Old Market sell fruits, vegetables, meat, clothing, toiletries, processed foods, rice, and oil. The market also accommodates salons, sewing shops, pharmacies and rural banks. The new market, which sells affordable fruits and vegetables, relies on temporary structures with some goods sold directly on the ground. Prices are generally lower in the New Market, but muddy conditions during the rainy season make it inaccessible. Poor sanitation,

traffic congestion and security issues are common challenges in both markets. However, compared with the Old Market, which has one restroom and an infrequent water flow, the New/Prison Market has no restrooms, exacerbating unsanitary conditions. The Old Market and New Market conditions are depicted in Plates 1 and 2, respectively.

Consistent with the structured organisation of Ghanaian markets, where commodity-specific sections serve as landmarks and reflect the cultural and economic underpinnings of market activities, goods in the two markets are categorised by type, with specific sections dedicated to commodities reflecting the vendor's specialisation or ethnic background (Asante & Helbrecht, 2018). For example, the sale of fish items by vendors from coastal locations is well known.

Market Queens manage daily market operations, playing pivotal roles in dispute resolution, price negotiation with suppliers, and the general administration of the markets. Additionally, the district assembly oversees the organisation and management of the markets, including decisions on relocations and licensing. However, tensions between the district assembly and market vendors are common, especially during relocation efforts, which result in unauthorised hawking outside the market (Asiedu & Agyei-Mensah, 2008). These tensions, coupled with disputes over land use and profiteering, highlight the complex dynamics of market governance in many Ghanaian markets (Clark, 1994).

Sample and sampling strategy

A multistage sampling strategy was used. In the first stage, the two most patronised markets in the municipality were purposively selected, on the grounds that they concentrate the municipality's trading activity and most of its female traders and therefore offer the widest variation in the characteristics of interest. At the second stage, the study population was stratified by market, so that each market formed a separate stratum and both were represented proportionally. At the third stage, respondents were selected within each stratum by simple random sampling.

A sampling frame of 3,430 registered market women across the two markets was obtained from the Nsawam Adoagyiri Municipal Assembly. Sample size was determined using Yamane's (1967) formula, $n = N / (1 + Ne^2)$, where N is the population and e is the margin of error. With $N = 3,430$ and $e = 0.05$ at the 95 per cent confidence level, the required sample was 358 respondents. Allocation was proportional to stratum size, giving 209 respondents in the Old Market and 115 in the New Market.

Within each stratum, trading stalls were assigned sequential numbers, and random numbers were generated using Microsoft Excel (Office® 2018). Women occupying the corresponding stalls were approached. Of the 358 women sampled, 324 consented and completed the questionnaire, giving a response rate of 90.5 per cent, which exceeds the

threshold conventionally regarded as adequate for survey research of this kind. Non-response arose from outright refusal and from women who could not be reached after return visits. Eligible participants were women aged 18 years and above who traded in either market and were present during the data collection period. Participation was voluntary and contingent on written informed consent; women who declined and those under 18 were excluded.

Measures for data collection

Primary data were collected using a structured questionnaire and a semi-structured interview guide. Both instruments were developed from the published literature on COVID-19 vaccine hesitancy and adapted to the linguistic and occupational context of market trading in Ghana. The questionnaire comprised four sections. The first captured sociodemographic characteristics, including age, marital status, level of formal education, religious affiliation, number of dependants and years in trading. The second measured perceived knowledge of COVID-19 and vaccines using a five-point Likert scale from strongly agree to strongly disagree. The third measured risk perception, covering perceived susceptibility to infection, perceived severity of illness, and perceived risk of vaccine side effects. The fourth addressed the role of social media, recording platforms used, the frequency of exposure to COVID-19 vaccine content, and the endorsement of specific myths and misinformation circulating at the time of fieldwork.

Outcome measure: Vaccine hesitancy, the dependent variable, was operationalised as self-reported unwillingness to accept a COVID-19 vaccine when offered, coded 1 = hesitant (Yes), 0 = not hesitant (No).

Translation: The questionnaire was developed in English and translated into Akuapem Twi, the dominant language of the study area. The translation involved forward translation by a bilingual translator, independent back-translation into English by a second translator, and reconciliation of discrepancies by the research team to secure conceptual rather than literal equivalence. Five trained research assistants administered the instrument in the respondent's preferred language.

Pre-testing and reliability: The instrument was pre-tested with 20 market women in the Madina market, after which items were reworded, ambiguous response categories were collapsed, and the ordering was changed.

Data collection procedures

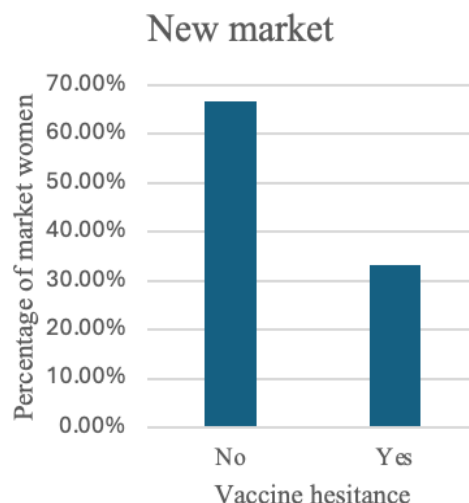
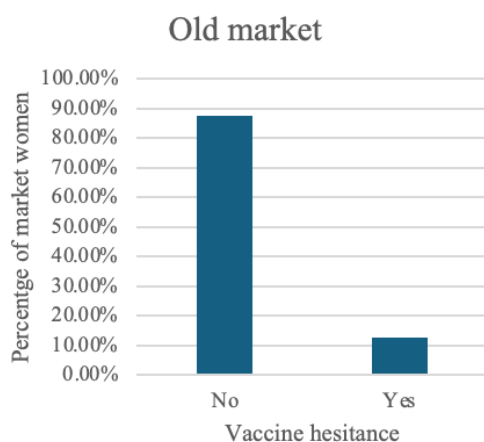
Data for the quantitative phase were collected between January and March 2022 by five trained research assistants fluent in Akuapem Twi. Training covered the instrument, informed consent procedures, and adherence to COVID-19 protocols. Questionnaires were self-administered in the Old Market and interviewer-administered in the New

Market, reflecting the difference in educational attainment between traders in the two markets and ensuring that limited literacy did not exclude eligible women from participating. Because the mode of administration was not randomised and coincided with the market, differences observed between the two markets may partly reflect mode effects rather than genuine differences between populations. Interviewer administration can encourage socially desirable responding on sensitive items, including vaccination status and endorsement of misinformation. We mitigated this by using neutral question wording, assuring anonymity, and drawing interviewers from outside the market community. This constraint is acknowledged in interpreting market-level differences.

The qualitative phase adopted an interpretive approach concerned with how participants understand their circumstances and construct meaning around risk, and with the social settings in which those understandings are formed and shared. Ten participants were interviewed: nine market women and one market queen. Participants were purposively sampled to maximise variation in vaccination status, age, market, and years in trading, and in willingness to discuss their experiences, knowledge, and perceptions of COVID-19 vaccination and of reducing social interaction to limit transmission. The inclusion of a market queen was deliberate: market queens exercise considerable influence within trading networks, and their position makes them a significant node in the circulation of information about vaccination.

The interview guide covered three domains: experiences of COVID-19 and of the vaccine; perceived risk associated with the vaccine; and the role of social media in vaccine decision-making. Interviews were conducted by telephone, a decision driven by prevailing COVID-19 restrictions and by the difficulty of securing uninterrupted face-to-face time with women during trading hours. Interviews lasted between 30 and 45 minutes and were conducted in the participant's preferred language. Where in-person follow-up contact was necessary, COVID-19 protocols were observed to minimise risk to participants and interviewers.

Telephone interviewing carries acknowledged limitations: it precludes observation of non-verbal cues, can shorten responses, and excludes women without reliable telephone access, who may differ systematically from those included.



Data analyses approach

Key sociodemographic variables, such as age, religion, education, and marital status, were categorised for analysis. Age was categorised into young adults (18–39 years), middle-aged adults (40–59 years), and older adults (60 years and above). Marital status was classified as married, single, divorced/separated, or widowed. Education was classified as primary level, junior high school, senior high school, tertiary, or no formal education. Religion was classified as Christian, Muslim, traditionalist, or other. Household income was excluded, as most respondents were unwilling to disclose their monthly income. The quantitative data were coded and analysed via SPSS. Vaccine hesitancy, the outcome variable, was categorised as “vaccine hesitant” (yes) if the respondent had not been vaccinated and “not vaccine hesitant” (no) if the respondent had been vaccinated. A Likert-scale perception measure was computed into composite variables, including myths and misinformation, perceived knowledge of COVID-19 and vaccines, and risk perceptions. The Likert scale items, coded as strongly agree = 1, agree = 2, undecided = 3, disagree = 4, and strongly disagree = 5, were computed as the mean scores of the perceptions. Point-biserial correlation analysis was used to test for relationships between vaccine hesitancy and myths and between vaccine hesitancy and misinformation, risk perception, and knowledge of the COVID-19 vaccine. The chi-square test was used to determine the relationships between vaccine hesitancy (dependent variable) and sociodemographic factors (independent variables). Variables significantly associated with vaccine hesitancy were entered into a binary logistic model to estimate the odds of vaccine hesitancy.

The qualitative data from the interviews were analysed thematically using content analysis and integrated with the quantitative findings. The thematic and statistical analyses enabled the effective examination of the study objectives.

Ethical consideration

All key ethical principles of informed consent, voluntary participation, anonymity and confidentiality were adhered to. All study participants were informed about the purpose, procedures, potential risks, and benefits. Participation was voluntary, and participants could withdraw at any time without penalty. All participants gave verbal informed consent, which was recorded. Throughout the study, confidentiality and anonymity of participant data and responses were ensured. Informed consent to publish was also obtained from all participants.

Results

Sociodemographic predictors associated with COVID-19 vaccine hesitancy

The sociodemographic characteristics of the 324 respondents analysed in this study included a sample of 35.5% from the Nsawam New Market and 64.5% from the Nsawam Old Market, as shown in Table 1. The age of respondents ranges from 18 to 69 years, with a mean age of 42.99 ± 0.83 years. Most of the respondents (44.1%) were young adults (18–39 years), and older adults (60 years and above), with 17.3% being the least represented. Regarding ethnicity, Akans were the most represented (44.1%), with 11.1% belonging to the northern extraction, the least represented in the sample. Moreover, 32.7% had completed primary education, while 0.6% had no formal education. The marital status shows that 49.0% of the respondents were married, and 6.4% were widowed. Most respondents were Ghanaians (94.1%), whereas 5.9% were foreigners.

Sociodemographic predictors of COVID-19 vaccine hesitancy

A chi-square test of the association of sociodemographic predictors with COVID-19 vaccine hesitancy (Table 1) showed a statistically significant association between marital status ($p = 0.004$) and COVID-19 vaccine hesitancy. However, age ($p = 0.739$), ethnicity ($p = 0.621$), education ($p = 0.314$), and nationality ($p = 0.182$) were not significantly associated with COVID-19 vaccine hesitancy.

Table 1: Association between sociodemographic and behavioural characteristics and COVID-19 vaccine hesitancy (N = 324)

	Number of respondents		Total	Vaccine hesitancy		
Variable	New Mkt (n = 115)	Old Mkt (n = 209)	N (%)	Not hesitant n (%)	Hesitant n (%)	χ ² (df), p
Age (in years)						0.606 (2), .739
Young adults (18–39)	52	91	143 (44.1)	112 (34.6)	31 (9.6)	
Middle-aged adults (40–59)	48	77	125 (38.6)	102(31.5)	23(7.1)	
Older adults (≥60)	15	41	56 (17.3)	46 (14.2)	10 (3.1)	
Ethnicity						2.631 (4), .621
Akan	45	98	143 (44.1)	114 (35.2)	29 (8.9)	
Ewe	30	47	77 (23.8)	62 (19.1)	15 (4.6)	
Ga/Dangme	15	34	49 (15.1)	42 (12.9)	7 (2.2)	
Northerner	10	26	36 (11.1)	29 (8.9)	7 (2.2)	
Other	15	4	19 (5.9)	13 (4.0)	6 (1.9)	
Education						4.751 (4), .314
Primary level	65	41	106 (32.7)	79 (24.4)	27 (8.3)	
Junior High School	32	70	102 (31.5)	87 (26.9)	15 (4.6)	
Senior High School	16	68	84 (25.9)	69 (21.3)	15 (4.6)	
Tertiary level	0	30	30 (9.3)	23 (7.1)	7 (2.2)	
No formal education	2	0	2 (0.6)	2 (0.6)	0 (0.0)	
Marital status						13.398 (3), .004
Married	48	111	159 (49.1)	137 (42.3)	22 (6.8)	
Single	47	65	112 (34.6)	80 (24.7)	32 (9.9)	
Divorced/Separated	14	18	32 (9.9)	23 (7.1)	9 (2.8)	
Widowed	6	15	21 (6.5)	20 (6.2)	1 (0.3)	
Nationality						1.781 (1), .182
Ghanaian	99	206	305 (94.1)	247 (76.2)	58 (17.9)	
Foreigner	16	3	19 (5.9)	13 (4.0)	6 (1.9)	
Market						19.867 (1), < .001
Old Market	—	—	209 (64.5)	183 (56.5)	26 (8.0)	
New Market	—	—	115 (35.5)	77 (23.8)	38 (11.7)	
Social media use ^a						66.969 (1), < .001
Yes	—	—	63 (19.8)	27 (8.5)	36 (11.3)	
No	—	—	255 (80.2)	227 (71.4)	28 (8.8)	

Note. Percentages are of the total sample (N = 324) unless otherwise indicated. Chi-square statistics test the association between each characteristic and vaccine hesitancy. A Social media use was not recorded for six respondents; percentages for this variable are of the 318 valid cases. Bold p values are statistically significant at $p < .05$. Hesitancy includes those who responded, “I have not taken the COVID-19 vaccine”

Table 2: Binary logistic regression analysis of several factors associated with COVID-19 vaccine hesitancy

Variable	B	Wald	df	p value	Odds ratio	95% CI
Market						
Old market	-0.907	4.639	1	0.031	0.404	0.177–0.922
New market					1 (Ref)	
Nationality						
Ghanaian	0.975	1.434	1	0.231	2.651	0.538–13.078
Foreigner					1 (Ref)	
Education						
Primary	0.490	0.610	1	0.296	1.633	0.651–4.096
Junior High	0.079	0.637	1	0.880	1.082	0.388–3.020
Senior High	-0.985	0.023	1	0.373	1.141	0.101–1.384
Tertiary					1 (Ref)	
Social media usage						
Yes	-2.750	45.029	1	<0.001	0.064	0.029–0.143
No					1 (Ref)	
Age	0.018	2.006	1	0.157	1.018	0.993–1.043
Marital status						
Married	-1.110	6.977	1	0.008	0.330	0.145–0.751
Single	-1.342	5.076	1	0.024	0.261	0.081–0.840
Divorced	2.130	3.544	1	0.060	8.412	0.916–77.249
Widowed					1 (Ref)	

Note. Hosmer and Lemeshow test $p = .300$. Ref = reference category. Bold p values are statistically significant at $p < .05$. CI = confidence interval.

Spatial variation in vaccine hesitancy between the two marketplaces

The results indicate that while 87.6% of the respondents from the Old Market had received the COVID-19 vaccine, 12.4% had not. In contrast, 66.9% of the respondents from the new market were vaccinated, whereas 33% were not vaccinated. The association between the market and vaccine hesitancy was statistically significant ($\chi^2=19.8666$, $p < 0.001$), as shown in Table 1.

The role of social media in COVID-19 vaccine hesitancy

The results indicated that 19.8% of respondents used social media, while 70.8% did not. Among social media users, 57.1% had received the COVID-19 vaccine, while 42.9% had not. Furthermore, Table 1 shows that the association between social media usage

and vaccine hesitancy among market women is statistically significant ($\chi^2 = 66.969$, $p < 0.001$).

A binary logistic regression of sociodemographic predictors and COVID-19 vaccine hesitancy shows that market women from the Old Market are significantly less likely to be COVID-19 vaccine-hesitant than those from the New Market ($p = 0.031$, OR: 0.404, CI: 0.177–0.922) (Table 2). Although education was not a predictor of vaccine hesitancy in this study, educational attainment was lower among the market women in the New Market than those in the Old Market because they were mostly farmers. However, married market women were significantly more likely to be COVID-19 vaccine hesitant than single and widowed women ($p = 0.008$, OR: 0.330, CI: 0.145–0.751).

Reasons for vaccine hesitancy

Most respondents (67.7%) were worried about the vaccine's side effects, 17.6% preferred treatment to vaccination, and 8.8% believed faith would protect them from contracting COVID-19. Only 5.9% of the participants indicated that there were still thinking about vaccination.

Effect of perception on COVID-19 vaccine hesitancy

A point-biserial correlation analysis between vaccine hesitancy and misinformation revealed a weak positive correlation of 0.417 ($p < 0.001$). A scatterplot of the correlation between vaccine hesitancy and the mean misinformation score is shown in Fig. 2a. Risk perception showed a negative correlation of -0.799 with vaccine hesitancy ($p < 0.001$). A scatterplot of the correlation between vaccine hesitancy and the mean risk-perception score is shown in Fig. 2b.

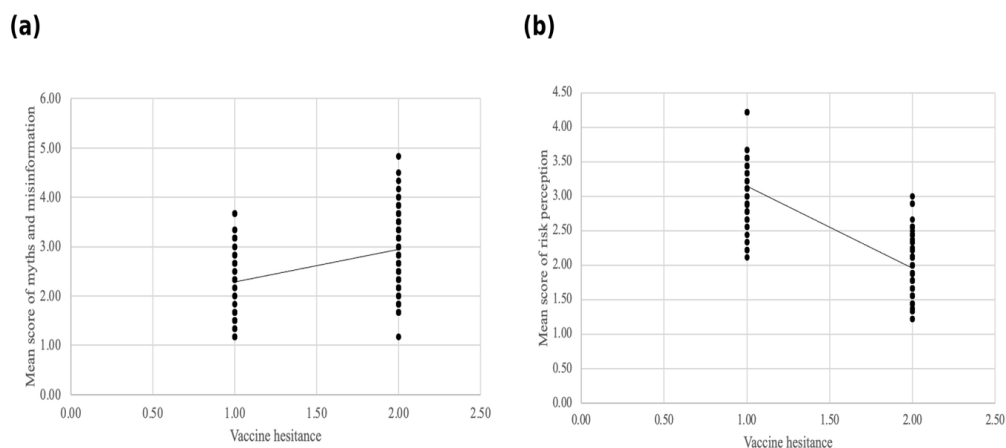


Figure 2: Scatterplots of the correlation between vaccine hesitancy and (a) mean score for myths and misinformation, and (b) mean score for risk perception of COVID-19.

Knowledge and Experiences of COVID-19

Respondents indicated awareness of the COVID-19 vaccine and associated side effects:

"I know they have produced vaccines for protection against COVID-19. My husband told me that the vaccines have lots of side effects. We will vaccinate but not now. Maybe they will change those vaccines". (39-year-old fish seller, New Market).

The possible vaccine side effect was the main reason for vaccine hesitancy among married women in the study. This is seen in the interview responses of a 27-year-old trader at the New Market:

I have heard that the COVID-19 vaccine can make you barren. I have advised my husband against it because I know men are also affected. It can also interfere with the menstrual cycle. I don't intend to take the shot. I have resorted to herbs to protect myself against COVID-19 (27-year-old trader, New Market).

Along with being exposed to potential vaccine side effects, others talked about struggling to get vaccinated. One market woman recounted during the interview.

I went to join the queue as early as 1:00 am. When I got there, people were already in the queue. Some people brought mattresses from their homes to sleep over. I spent the whole day trying to get the shot. I was almost close to getting vaccinated, but we were told to come back the next due to a shortage of vaccines. I did not return because I couldn't afford to close my shop for two days. I don't go out without my nose mask and hand sanitiser, so I believe I won't be infected. (37-year-old jewellery seller, Old Market).

The role of social media

We observed that women who accessed media-based education on the vaccine were more receptive to it. When people understand the value of the vaccine, their anxiety concerning vaccination decreases. This is seen in the interview response below:

"I took my second dose a few weeks ago. I am waiting for the booster. My daughter is a nurse. She shares information and videos regarding the vaccine. It encouraged me to vaccinate". (56-year-old Cloth seller, Old Market).

Misinformation and infodemic on social media platforms had serious repercussions. This information fed into preconceived notions, sowing doubt and distrust about novel vaccines, and posing a risk to the public's ability to receive COVID-19 vaccinations. A 25-year-old trader at the Old Market stated the following.

Before the vaccine was rolled out, I found on Facebook that it was meant to track us. They (manufacturers) will track our activities. If they decide to kill us, finding us will not be a problem. I will not vaccinate. Unlike Ebola, the symptoms of COVID-19 are not new. It can be managed. (25-year-old trader, Old Market)

False internet assertions that the vaccine can harm you prevented some women from vaccinating. This is depicted in the following responses from the market women.

The COVID-19 vaccine can paralyse you. I have watched videos of victims narrating their stories on YouTube. I am a mother of four. Who will take care of my kids? I will not subject myself to this (39-year-old fruit seller, New Market).

Perceived risk of the vaccine

Our findings also showed that those who perceived a high risk of the COVID-19 vaccine portrayed scepticism concerning vaccination:

I heard the vaccine has severe side effects. I heard you can get very sick after vaccination. When I took the H1N1 vaccine, it took me one week to recover from the side effects. I don't know about this one (COVID-19 vaccine). I will vaccinate, but I want to wait for others. If there are no side effects, then I will vaccinate. (36-year-old tomato seller, New Market)

Respondents also perceived high vaccine risk mainly fuelled by misinformation:

I believe the vaccine is 666 (contains a microchip). I heard that buying or selling would soon be impossible without the vaccination card. The world will soon end, but as a trader, I will need the card. I will vaccinate eventually. If the government changes its decision about the vaccination card, then it won't be necessary for me to be vaccinated. (50-year-old Onion Queen, New Market).

Discussion

Sociodemographic characteristics as predictors of COVID-19 vaccine

Several studies in Ghana and Saudi Arabia reveal notable differences in vaccine trust and reluctance to receive the COVID-19 vaccine among different sociodemographic groups (Sampene et al., 2023; Brackstone et al., 2022). Sociodemographic predictors of COVID-19 vaccine hesitancy in this study show that the association of marital status with COVID-19 vaccine hesitancy was statistically significant. The binary logistic regression shows that market women from the Old Market were significantly less likely to be COVID-19 vaccine-hesitant than those from the New Market. Although education was not a predictor of vaccine hesitancy in this study, educational attainment was lower among the market women in the New Market than those in the Old Market because

they were mostly farmers from the surrounding villages. This result contrasts with other research in Ghana that indicates more COVID-19 hesitancy in less educated populations (Sampene et al., 2023; Alhassan et al., 2021). Married market women were, however, significantly more likely to be COVID-19 vaccine-hesitant than single women and widowed women. This finding is consistent with previous studies in Ghana and the United States (Brackstone et al., 2022; Liu et al., 2023) that show married women with lower education levels were less likely to receive vaccinations than less educated unmarried women. Safety concerns during pregnancy and adverse effects of some vaccines on babies may be related to vaccine hesitancy among married women (Bhattacharya et al., 2022).

However, other studies in Ghana and Japan have established that single women are more likely to be vaccinated (Sampene et al., 2023; Kuroda et al., 2022). One of the reasons is that unmarried women are more involved in community activities, which raises vaccine awareness. The main reason for vaccine hesitancy among married women in this study was possible side effects. The qualitative response suggested that some married women resorted to local remedies to protect themselves against COVID-19 to avoid complications associated with the vaccine. They believed that the vaccine could render them infertile. COVID-19 vaccines are provided at no cost to all Ghanaians; however, market women may be reluctant to accept the offer due to perceived severity and convenience barriers caused by insufficient health literacy. The side effects and the low perceived severity of COVID-19 may prevent women from receiving the vaccine. This is evident in prior studies in the United Kingdom and the United States (Venema & Pfattheicher, 2021; Scarinci et al., 2021) and highlights the need for health officials to intensify public education about the effectiveness of vaccines. More empirical studies on COVID-19 in market communities can determine who is hesitant and why, and how to target education and awareness-raising efforts to overcome hesitancy. This study is an anchor for focused interventions because it identifies demographic groups reluctant to receive the COVID-19 vaccine.

Social media and vaccine hesitancy

The results revealed a statistically significant association between social media and vaccine hesitancy among market women. This is quite surprising because women in the informal sector spend insufficient time on social media due to household responsibilities, caregiving duties, and the nature of their work (Owoo & Lambon-Quayefio, 2021). Additionally, accessing the internet can be costly, especially among informal traders. This study found that market women who used social media were significantly less likely to be vaccine-hesitant than those who did not. This is consistent with several studies in China, the European Union, Vietnam, and the United Kingdom (Wang et al., 2022; Mascherini & Nivakoski, 2022; Jennings et al., 2021).

However, social media is used by 98% of adults, and it requires just a moment of interacting with false information to cause a person to become reluctant to get vaccinated (Dubé et al., 2018). Vaccine reluctance is associated with individuals who use social media as a source of vaccination information without verification from reliable sources, but not with those who use social media as a source of news (Al-Uqdah et al., 2022). Misinformation has been able to proliferate thanks in large part to social media. The misinformation that circulated has had serious repercussions. Infodemic feeds into preconceived notions, sowing doubt and distrust about novel vaccines and posing a risk to the public's ability to receive COVID-19 vaccinations (Islam et al., 2020).

The quantitative results of the study revealed a weak positive correlation between misinformation and vaccine hesitancy. However, in the qualitative responses, one market woman recounted that she found out on Facebook about the tracking devices in the COVID-19 vaccine. She claims she will not get vaccinated because COVID-19 symptoms are manageable. According to Hildreth & Alcendor (2021), anti-vaxxers have led to many shocking claims (vaccines containing microchips) concerning the safety of the vaccine. They seek false information about the safety of vaccines and offer their opinions in irrational ways that foster public mistrust. Exposure to false information decreases the desire to protect others and take up vaccines (Loomba et al., 2021). There are also claims that the COVID-19 vaccine contains the genes of animals. The rumours that the COVID-19 vaccine contains genes of pigs made it difficult to roll out the vaccine in Muslim and Jewish communities unless a halal certificate was given under Islamic laws (Leader et al., 2022). Based on the qualitative response, misinformation contributed to vaccination resistance. The need for a vaccination card was the only motivation for some market women to vaccinate. Vaccine hesitance is, however, less likely among individuals who use trusted sources like the CDC and WHO. The interview responses show that market women find information promoted by experts and officials quite reliable. Accordingly, one respondent shared that her daughter, who educates the public on COVID-19 on YouTube, often sends her video links to watch. This encouraged her to vaccinate.

Thus, our study reveals a dual effect of social media on vaccine hesitancy. On the one hand, social media use was significantly associated with lower vaccine hesitancy, implying that credible online platforms may facilitate access to credible information that encourages vaccination. On the other hand, qualitative responses from market women highlight the spread of misinformation, like the belief that COVID-19 vaccines contain tracking devices or cause infertility, which fuelled distrust and reluctance to vaccinate. These apparent contradictions necessitate a more nuanced understanding of how social media facilitates the simultaneous spread of accurate information and misinformation. A plausible explanation could be that higher digital literacy affords individuals access to reliable sources, while those engaging with unverified content encounter fear-inducing

narratives. Enhancing the digital literacy of market women may be crucial for accessing credible vaccine information during pandemics to reduce their anxiety and encourage vaccination uptake.

The Risk Attenuation Model supports the findings of this study. The main drivers of risk attenuation are the media (Kasperson & Kasperson, 1996). Market women who come across credible information talk about it and spread it, which reduces their perception of vaccine risk. Emotions and values, among other things, also attenuate this process. Assuring information can offset false information. Attenuation is influenced by expert views, good experiences with risk-reducing initiatives, and productive dissemination of risk information (Kasperson & Kasperson, 1996). By tackling false information in social settings, intended channels of communication can be created to highlight the benefits of the COVID-19 vaccination and reduce fears.

Vaccination risk perception and COVID-19 vaccine hesitancy

A point biserial correlation analysis of vaccination risk perception also revealed a strong negative correlation with vaccine hesitancy. High perceived vaccine risk amplifies vaccine scepticism (Pennycook et al., 2020). According to the results, possible side effects were the main reason for refusing vaccination. The literature demonstrates how beliefs about vaccines influenced hesitancy. The perceived threat and barriers lead to an increase in perceived risk. Although most market women perceived COVID-19 risk and took preventive measures like wearing nose masks, the vaccine risk outweighed the potential benefit. Market women with a high-risk perception of the vaccine's safety were more vaccine-hesitant. Owing to adverse reactions or a wish to hold on and observe how other people react to the vaccination, reluctance was frequently mentioned in the interview responses. This finding is consistent with other studies in countries such as China, Egypt, Norway, Italy, and the United States Wang et al., 2022; Ebrahimi et al., 2021; Patterson et al., 2022) reporting a loss of trust in vaccine safety. Vaccine hesitancy occurs when people believe they are not highly susceptible, overlook the severity of the illness, question the vaccine's efficacy, and believe that there are substantial obstacles to vaccination. The study indicates that views regarding the severity and susceptibility of COVID-19 and vaccines, and vaccination obstacles, were determining factors for the vaccination. Investigating reasons for vaccine refusal helps to control perceived barriers and make appropriate recommendations.

Limitations of the study

The following are the study's limitations that require consideration. First, its cross-sectional design precludes the establishment of a causal relationship between vaccine hesitancy and predictors. Second, the analysis may not be subject to confounding factors

that were not accounted for, potentially affecting the associations observed. Third, despite the guarantee of anonymity, participants may have provided socially desirable responses, which may have introduced bias into the findings. Additionally, the study depended on self-reported data rather than observed behaviour. Thus, the degree of alignment between participants' stated intentions to get vaccinated and their actual behaviours remains uncertain. Future research should address these limitations to provide a more comprehensive understanding of vaccine hesitancy and its determinants.

Implications for policy and practice

Addressing vaccination hesitancy requires communication strategies targeted to specific groups, given the complexities of these issues and the limited research on effective interventions. Engaging women's groups and facilitating community involvement through social learning could help increase the acceptability of vaccinations among women. This is crucial for overcoming communication disparities and fostering trust within vulnerable communities. It is important to develop culturally, linguistically and literately suitable materials to promote immunisation, particularly in groups at greater risk of contracting COVID-19 and suffering serious consequences. Messages that speak to the causes of vaccine hesitancy must be used in campaigns to combat the triggers of vaccine hesitancy.

Social media is not simply a channel for sharing information but can also be used to encourage vaccination. The government and public health professionals should use social media to distribute health information and increase public awareness of COVID-19 vaccines. Additionally, relevant authorities such as the National Communications Authority and National Media Commission and social media platforms must regulate social media content by removing misinformation and directing users to verify sources of information.

Health Authorities such as the Ministry of Health and Ghana Health Service should prioritise countering misinformation about COVID-19 vaccines by implementing more preventative measures through immunisation campaigns in markets where misconception may be prevalent. These campaigns must highlight medical consensus on the safety of vaccines and expose the deceptive tactics that undermine public trust. This can combat vaccine hesitancy and improve vaccination rates among vulnerable populations.

Conclusion

The introduction of vaccines amid the pandemic was intended to signal widespread acceptance. However, there has been anxiety and scepticism about the vaccination, and digital channels have only amplified these feelings. Additionally, information from

scientific platforms was not always clear-cut because the evidence was changing and updating. This was met with impatience, which bred mistrust. Hesitancy resulted from the rapid spread of false information about the vaccine. The reluctance to receive vaccines is intricate and varied. Vaccine decisions were influenced by reservations regarding vaccine safety, individual or group-specific factors, political beliefs, societal and peer pressure, and cultural standards. Concerns regarding vaccine safety accounted for most vaccine hesitancy in this study. The attitudes toward vaccinations with different plans have been investigated via social risk attenuation and amplification. Human papillomavirus and childhood vaccination schedules are two examples of vaccines evaluated via this model [99]. The theory of social risk attenuation and amplification was used in this study to understand how perceptions, myths, and misinformation affect the decision to receive vaccinations. Health regulators may use the study's findings to understand vaccine uptake and the efficacy of future mass immunisation programs among vulnerable groups. Furthermore, how the public shares risk and how risk may be amplified or attenuated will significantly impact subsequent COVID-19 modifications.

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