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## Hesitant or not: A cross-sectional study of socio-demographics, conspiracy theories, trust in public health information, social capital and vaccine hesitancy among older adults in Ghana

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### ABSTRACT

Vaccination is an effective strategy to reduce the coronavirus disease 2019 (COVID-19) burden, but its effectiveness hinges on timely vaccine uptake. Addressing concerns among vaccine-hesitant individuals is critical to preventing the immunization program from failing. This study analyzes the determinants of vaccine hesitance among older adults (aged 50 years and older) in Ghana. We adopted a cross-sectional survey with a quantitative approach that accessed data from 400 older adults from the Accra and Kumasi metropolitan areas using purposive and snowball sampling techniques. Multivariate logistic regressions were used to estimate the socio-demographic, social capital, conspiracy theories about COVID-19, and public health information factors associated with vaccine hesitance within the sample. The study found that only minority (5%) of respondents had been vaccinated, with 79% indicating willingness to be vaccinated. The study found that females (AOR: 0.734, CI: 0.019–0.036,  $p = .027$ ) and those who have retired (AOR: 0.861, CI: 0.003–0.028,  $p = .034$ ) were significantly less likely to engage in COVID-19 vaccine hesitance. Furthermore, the study revealed that participants who trust public health information (AOR: 0.065, CI: 0.022–0.049,  $p = .031$ ) and have social capital (AOR: 0.886, CI: 0.017–0.032,  $p = .001$ ) were significantly less likely to present COVID-19 vaccine hesitance. Finally, participants who believe in conspiracy theories about COVID-19 and vaccines (AOR: 3.167, CI: 1.021–2.043,  $p = .004$ ) were significantly more likely to engage in COVID-19 vaccine hesitance. Efforts to convey vaccination benefits and address issues through evidence-based information are needed to strengthen and preserve the public's trust in vaccines in Ghana.

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## Introduction

The coronavirus disease 2019 (COVID-19) pandemic, caused by SARS-CoV-2, has affected over 418 million individuals in over 150 countries. More than 171,172 confirmed cases with 1,462 fatalities have been recorded in Ghana as of February 17, 2023.<sup>1</sup> The pandemic continues to pose a danger to healthcare systems across the globe.<sup>2–5</sup> Several vaccines for emergency immunization have been produced and certified to date.<sup>6–9</sup> At least one dose of the COVID-19 vaccine has been administered to 69.7% of the world's population. Globally, 13.31 billion doses have been given; now, 1.05 million are given per day. People in low-income countries make up 27.7% of the vaccinated population.<sup>10</sup> In Ghana, 22,384,226 vaccine doses have been administered according to the World Health Organisation [WHO].<sup>11</sup> There are still safety concerns, especially in light of potential negative effects, even though the advantages of vaccinations in preventing the spread and COVID-19-induced deaths<sup>12</sup> are documented, notably among vulnerable groups.<sup>13</sup> Although more severe reactions have only sometimes been documented,<sup>14</sup> these reactions are often moderate and transient. There is still a lot of

doubt about the COVID-19 vaccination, despite the successful outcomes of vaccinations and intense public health efforts to implement immunization programs.<sup>15</sup> As a result, it is critical to adopt techniques to foster trust in the general populace<sup>16</sup> by informing people about the advantages of receiving the COVID-19 vaccine and dispelling myths.<sup>17</sup> This will go a long way to address COVID-19 vaccine hesitancy.

Addressing concerns among vaccine-hesitant individuals, on the other hand, is critical to preventing the immunization programme from failing.<sup>18</sup> This provides some promise for reducing the spread of COVID-19 infection. Countries and governments throughout the world have invested billions of dollars to prepare for the immunization of their populations.<sup>18</sup> Vaccination programmes can result in herd immunity without requiring a significant proportion of the population to be infected.<sup>19</sup> However, for such immunity to be achieved, a large enough fraction of the population must be immunized. Immunization programmes are only effective when the vaccine is widely accepted.<sup>20,21</sup> This brings into focus the need to examine the factors that influence vaccine hesitance.

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Studies from around the world have produced mixed results and identified several factors that influence hesitance toward COVID-19 vaccine uptake. These include disease risk perception, vaccine safety and efficacy perception, and general vaccination attitudes.<sup>22</sup> Previous vaccination history, doctor's recommendations, prices of vaccines, vaccination convenience, and sociodemographic features.<sup>23,24</sup> Other reasons include poor trust in the COVID-19 vaccine and the healthcare response during the pandemic, a perception of government initiatives, and a perception of the information presented as inconsistent and contradictory.<sup>25–27</sup> Governments, public health experts, and advocacy groups must be ready to confront skepticism and increase vaccination knowledge so that the public will embrace immunization when necessary.<sup>21</sup> However, to adopt widespread COVID-19 immunization programmes, researchers must continue to explore vaccine hesitance, and health education must be planned ahead of time to address any concerns that may develop during the programme.<sup>18</sup>

Social capital, the quality of connections among community members, as evidenced by trust and reciprocal support that benefits all parties—has been shown to promote vaccination uptake and reduce vaccine hesitance.<sup>29–31</sup> These studies suggest that vaccine resistance decreases with increasing social capital in the form of trust in the healthcare system. According to the findings of a study by Machida et al.<sup>32</sup> in Japan, people with higher levels of social capital on an individual basis are more likely to take up a COVID-19 vaccine than those with lower levels of social capital. It, therefore, suggests that during a pandemic, social capital may help to overcome vaccination hesitance.

Several researchers have conducted studies on COVID-19 vaccination uptake and hesitancy in Ghana. These studies were focused on the general population<sup>33,34</sup> and healthcare workers,<sup>35,36</sup> with no specialized studies conducted on the elderly, who are the demographic group most impacted by the COVID-19 pandemic. Furthermore, rumors and conspiracy theories, which cause distrust and contribute to vaccination hesitance, were not considered a predictor in these studies.<sup>37</sup> To properly track COVID-19 vaccine disinformation in real-time and engage with social media to communicate accurate information, which might help protect the public from misinformation, their effect [misinformation, rumors, and conspiracy theories] must be investigated. Furthermore, social capital, an important component in explaining differences in public behavior during health crises that may help determine policies in local communities,<sup>25</sup> was not included in previous studies that investigated the willingness of the Ghanaian population to accept COVID-19 vaccine.

We examined the socio-demographics, social capital, conspiracy theories, and faith in public health services and information as predictors of COVID-19 vaccination hesitance among older adults in Ghana's Greater Accra and Kumasi Metropolitan Areas. Why older adults? The aged are more vulnerable to severe illness and death from COVID-19 due to age-related declines in the immune system, known as immunosenescence. Additionally, older adults are more likely to have underlying health conditions that increase their risk of severe COVID-19, such as hypertension and chronic

obstructive pulmonary disease. Investigating vaccine hesitancy within older adults can aid in developing policies and measures to promote vaccine uptake and reap its associated benefits. The knowledge gained from such investigations can assist the government of Ghana and other health agencies in targeting their campaigns towards addressing the obstacles to the COVID-19 mass immunization programme's successful implementation, especially for older adults, and ultimately improving vaccination rates among all citizens.

## Materials and methods

### Setting

The study was conducted in the Accra Metropolis and the Kumasi Metropolis, two of Ghana's 261 Metropolitan, Municipal, and District Assemblies (MMDAs). The Accra Metropolis has an estimated population of 2,605,000, while the Kumasi Metropolis has a population of 3,768,000. These two cities also coincide as the most affected by the COVID-19 pandemic in terms of the number of cases recorded. Again, they have the highest population of the country's older adults, perfectly making them ideal study areas.

### Research design

The study was underpinned by the quantitative approach which offers prospects for establishing relationships among variables<sup>38,39</sup> since it comprises the application of rigorous statistical analysis.<sup>40,41</sup> With this approach, it was possible to quantify the responses of the respondents to generalize. To achieve this, the study adopted a cross-sectional survey design that helped collect data on the factors that predict COVID-19 vaccine hesitancy among older persons within the Accra and Kumasi Metropolitan areas of Ghana's Greater Accra and Ashanti Regions respectively. Cross-sectional research provides a picture of the results and the traits associated with it, at a particular period in time.<sup>42–44</sup> It was used to estimate the odd ratios to study the association between exposure and the outcome variables.<sup>43</sup> The exposure variables in this study are socio-demographic characteristics of older adults, belief in conspiracy theories, and trust in public health information in addition to access to social capital whereas the outcome variable is COVID-19 vaccine hesitancy.

### Sources of data and sample size

Primary data was obtained from older adults (50 years and above). The sample size was calculated using the single proportion formula without continuity correction:  $n = Z^2 * P(1-P) / d^2$ .<sup>45</sup> The following assumptions were made: the proportion (P) was assumed to be 0.5 in the absence of past studies, the Z statistic for a 95% confidence level of confidence (Z = 1.96), and the degree of precision (d = 0.05 in a proportion of 1). This yielded a sample of 384. An additional 79 respondents were added to the sample at a 20% non-response rate. At an 86.4% response rate, the 463 people reached filled out 400 questionnaires. Without a sampling frame, the 400 respondents were sampled using the purposive<sup>46,47</sup> and the snowballing<sup>48,49</sup>

approaches. The use of these sampling techniques were premised on the difficulty in locating older adults. Inclusion criteria were that the respondent (i) was 50 years and above; (ii) willing to be interviewed (iii) willing to voluntarily provide informed consent to participate in the study (v) able to communicate in English language, Ga, and Ashanti Twi – the commonly spoken languages in the study areas. Participants excluded were those who were sick at the time of the study and those with communication or speech disabilities.

### **Data collection instrument**

To improve the response rate, a close-ended questionnaire was used to gather the data.<sup>50</sup> Researchers in the social and health sciences, as well as market research, commonly utilize questionnaires. They often use closed-ended questions with a well-designed format because they are easy to comprehend and have quick responses. However, some criticize closed-ended questionnaires for potentially overlooking vital information pertinent to the responses. Despite this, a close-ended questionnaire developed from exhaustive literature is equally good as a partially closed one. To avoid these issues, we adopted a fully closed-ended approach. We structured the questionnaire into six sections. The first covered socio-demographic characteristics;<sup>51,52</sup> the second, vaccine hesitancy;<sup>53,54</sup> and the third, social capital. Believe in conspiracy theories and trust in public health information were captured under sections four and five respectively.

### **Data collection procedure**

Eight research assistants collected the data between June 2021 and August 2021. In most instances, the respondents filled out the questionnaire themselves, while in some instances, the researcher-administered questionnaire approach was used. The self-administered questionnaires were sent to the respondents by mail and text (the WhatsApp messaging application). The respondents filled and Google Forms, which were embedded within e-mails and texts. For the researcher-administered questionnaires, the research assistants interviewed the respondents at predetermined locations, mainly their homes and in a few situations, their workplaces. The research assistants ticked their responses. The researcher-administered approach was used, mainly for persons who had no literacy in English.

### **Data analysis**

The online data in excel format was downloaded, edited and checked for completeness and consistency. It was exported to Statistical Package for the Social Sciences (SPSS) version for analysis. Descriptive statistical tools such as frequencies and percentages were used to summarize the socio-demographic characteristics of the respondents, while the Chi-square analysis was used to establish the association between the socio-demographic characteristics of the respondents and the prevalence of vaccine hesitancy. The binary logistic regression model embedded in the SPSS software was used to establish the factors that predict vaccine hesitancy. The results were

considered significant at an alpha of 0.05 or less. Model 1 = Socio-Demographic variables (gender, age, religion, marital status, level of education and employment); Model 2 = All variables in Model 1 plus Trust in health information and social capital-related variables (gender, age, religion, marital status, level of education and employment, believe in conspiracy theories, trust in public health information and social capital).

### **Ethical consideration**

The study met all ethical requirements. To begin, the concept of voluntary consent<sup>55</sup> as it relates to social science research was followed during the data collection process. The purpose of the study and the usage of the data collected was explained to the respondents. Second, when reporting the findings of the respondents, anonymity and privacy was ensured.

## **Results**

### **Prevalence of vaccine hesitancy**

In Table 1, a disaggregated prevalence of the COVID-19 vaccine hesitance alongside the socio-demographic characteristics of the respondents is presented. Four hundred older adults were involved in this study. Of the 400 participants, 218 (54.5%) reside within the Kumasi Metropolis, 151 (37.8%) of them were males, and 249 (62.3%) were females. Up to 211 (52.8%) of the participants were aged between 50–60 years, 149 (37.2%) were aged between 61–70 years, and 40 (10%) were above 70 years. Among the participants, 331 (82.8%) were Christians, 229 (57.3%) were married, 121 (31%) had primary or basic education, 250 (62.5%) were employed (either by an entity-state or private institution or are self-employed), 157 (39.3%) were quite well off (based on self-reported social status ranking) among others (see Table 1 for further details). There was a significant association between socio-demographic characteristics such as religious affiliation, level of education and employment status on the one hand and vaccine hesitance on the other hand ( $P$ -value  $< .05$ ). However, no association was established between location, gender, age, marital status and socioeconomic status, health insurance enrollment and vaccine hesitance among the respondents ( $P$ -value  $> .05$ ).

### **Associated factors of COVID-19 vaccine hesitancy**

Table 2 presents the associated factors of COVID-19 vaccine hesitancy among older adults in Ghana. Results in model 1 show that female participants (AOR: 0.923, CI: 0.021–0.045,  $p = .072$ ) and those who have retired (AOR: 0.034, CI: 0.024–0.048,  $p = .000$ ) were significantly less likely to engage in COVID-19 vaccine hesitance than their respective counterparts. In the full model, female participants (AOR: 0.734, CI: 0.019–0.036,  $p = .027$ ) and those who have retired (AOR: 0.861, CI: 0.003–0.028,  $p = .034$ ) were significantly less likely to engage in COVID-19 vaccine hesitance. Again, participants who trust public health information (AOR: 0.065, CI: 0.022–0.049,  $p = .031$ ) and have social capital (AOR: 0.886, CI: 0.017–0.032,  $p = .001$ ) were significantly less likely to present

**Table 1.** Vaccine hesitancy according to associated socio-demographics.

| Variables                       | Vaccine Hesitance        |            |            | P-value    |
|---------------------------------|--------------------------|------------|------------|------------|
|                                 | Yes                      | No         | Total (%)  |            |
| Location                        | Greater Accra Metropolis | 105 (45.3) | 77 (45.8)  | 182 (45.5) |
|                                 | Kumasi Metropolis        | 127 (54.7) | 91 (54.2)  | 218 (54.5) |
| Gender                          | Males                    | 82 (35.3)  | 70 (41.7)  | 152 (38.0) |
|                                 | Females                  | 150 (64.7) | 98 (58.3)  | 248 (62.0) |
| Age (years)                     | 50–60 years              | 125 (53.9) | 86 (51.2)  | 211 (52.8) |
|                                 | 61–70 years              | 85 (36.6)  | 64 (38.1)  | 149 (37.2) |
| Religion                        | Above 70 years           | 22 (9.5)   | 18 (10.7)  | 40 (10)    |
|                                 | Christian                | 178 (76.7) | 153 (91.1) | 331 (82.8) |
| Marital Status                  | Non-Christian            | 54 (23.3)  | 15 (8.9)   | 69 (17.2)  |
|                                 | Married                  | 127 (54.7) | 102 (60.7) | 229 (57.2) |
| Level of Education              | Divorced                 | 45 (19.4)  | 34 (20.2)  | 79 (19.8)  |
|                                 | Widowed                  | 60 (25.9)  | 32 (19.0)  | 92 (23.0)  |
| Employment                      | No formal education      | 49 (21.1)  | 21 (12.5)  | 70 (17.5)  |
|                                 | Basic education          | 75 (32.3)  | 49 (29.2)  | 124 (31.0) |
| Perceived socio-economic status | High school education    | 41 (17.7)  | 58 (34.5)  | 99 (24.8)  |
|                                 | Tertiary education       | 67 (28.9)  | 40 (23.8)  | 107 (26.8) |
| Employment                      | Employed                 | 232 (100)  | 18 (10.7)  | 250 (62.5) |
|                                 | Retired                  | 0 (0)      | 150 (89.3) | 150 (37.5) |
| Perceived socio-economic status | Extremely poor           | 41 (17.7)  | 27 (16.1)  | 68 (17.0)  |
|                                 | Quite poor               | 86 (37.1)  | 71 (42.3)  | 157 (39.2) |
| Perceived socio-economic status | Not very well off        | 76 (32.8)  | 45 (26.8)  | 121 (30.2) |
|                                 | Quite well off           | 29 (12.5)  | 25 (14.9)  | 54 (13.5)  |

P-value &lt; .05.

\* = a statistically significant result.

COVID-19 vaccine hesitancy. Finally, participants who believe in the conspiracy theories about the COVID-19 and the vaccines (AOR: 3.167, CI: 1.021–2.043,  $p = .004$ ) were significantly more likely to engage in COVID-19 vaccine hesitancy than those who do not believe in the conspiracy theories about the COVID-19 and the vaccines.

## Discussion

Female older adults demonstrate lower likelihood towards COVID-19 vaccine hesitancy than males. This is contrary to earlier studies in Ghana within the general population more males were ready to participate in the COVID-19 vaccine trial and the uptake of the vaccine than females.<sup>33,56</sup> Similar findings were reported in other countries among the general population,<sup>57</sup> healthcare workers [HCWs]<sup>58</sup> and older adults.<sup>59</sup> The finding of this study significantly support that of Lazarus et al.<sup>21</sup> who found gender differences in their global analysis of COVID-19 vaccine uptake. In their study, males were less likely to accept the COVID-19 vaccine. In Japan, COVID-19 vaccine hesitancy was found to be associated with being a female.<sup>60</sup> Several studies have associated the higher likelihood of COVID-19 vaccine uptake and non-hesitance behavior among males with the higher risks of hospitalization from COVID-19, infection and deaths among males.<sup>61–63</sup> The tendency to escape these ills of the pandemic predisposes males to accept the vaccine at a higher rate than females, hence the lower likelihood of vaccine hesitance. Like the aforementioned studies, there is a higher infection, hospitalization, and death rate among males compared to females in Ghana.<sup>64</sup> Thus, the lower vaccine hesitancy among the females in comparison to the male older adults is rather surprising, within the Ghanaian context. Issues relating to healthy children, particularly for breastfeeding mothers is also a factor for the lower

willingness to accept vaccine among females.<sup>65,66</sup> Such a justification does not hold within our study sample (since female older adults do not reproduce at that age), albeit, it will be interesting for future research to uncover the reasons for this occurrence. Measures to reduce COVID-19 vaccine hesitancy among males are highly recommended, as the gender dimension of vaccine hesitancy, although possibly superficial, warrants attention.

The study again revealed that older adults who have retired were less likely to develop COVID-19 vaccine hesitance than those actively employed. Interestingly, the result affirms evidence from the USA, where unemployed adults [18 years and above] reported higher COVID-19 vaccine hesitance when matched against adults who were employed.<sup>67</sup> In the same study by,<sup>67</sup> retired adults were less likely to accept the vaccine. Our finding confirms that of Alqudeimat et al.<sup>68</sup> on the determinants of COVID-19 vaccine hesitance among the adult population in Kuwait. In that study, retired adults had lower odds of accepting the COVID-19 vaccine compared to other groups.<sup>68</sup> The lower willingness of retired older adults to take the vaccine could be explained by the less obligation placed on them by their employer(s) to take the vaccine, as compared to their counterparts who are in active employment. In Ghana like many other parts of the world, workplaces have opted for compulsory vaccination as a measure to protect their employees and maintain their workforce through these turbulent times.<sup>69</sup> Older adults in active employment are also required to comply with such directives, making them more predisposed to accepting the vaccine, hence less vaccine hesitance than older adults out of active employment [retired]. We recommend that awareness creation and the institution of measures and interventions that promote vaccination among retired older adults are given much premium, since many retired older adults may have comorbid conditions,<sup>70</sup> which

**Table 2.** Determinants of vaccine hesitancy among older adults.

| Variable  | Model 1       |                      | Model 2/Full Model |                      |
|---|---------------|----------------------|--------------------|----------------------|
|   | AOR           | 95% C.I.             | AOR                | 95% C.I.             |
| <b>Socio-Demographic Variables</b>                                      |               |                      |                    |                      |
| <i>Gender<sup>a</sup></i>   |               |                      |                    |                      |
| Female  | <b>0.923*</b> | <b>(0.021–0.045)</b> | <b>0.734</b>       | <b>(0.019–0.036)</b> |
| <i>Age (years)<sup>b</sup></i>  |               |                      |                    |                      |
| 61–70   | 1.452         | (0.023–0.065)        | 0.983              | (0.748–1.673)        |
| Above 70  | 0.963         | (0.998–1.293)        | 1.983              | (0.886–2.963)        |
| <i>Marital Status<sup>c</sup></i>                                       |               |                      |                    |                      |
| Divorced  | 1.082         | (0.043–1.093)        | 1.382              | (0.047–1.053)        |
| Widowed   | 2.253         | (0.672–1.109)        | 1.173              | (0.863–2.220)        |
| <i>Religious group<sup>d</sup></i>                                      |               |                      |                    |                      |
| Non-Christian   | 0.762         | (0.783–1.783)        | 1.753              | (0.783–1.092)        |
| <i>Education<sup>e</sup></i>  |               |                      |                    |                      |
| Basic   | 0.975         | (0.387–1.982)        | 0.382              | (0.983–1.072)        |
| Secondary or high school  | 2.096         | (0.298–1.982)        | 0.653              | (0.054–0.352)        |
| Tertiary  | 0.963         | (0.017–2.256)        | 0.988              | (0.064–0.836)        |
| <i>Employment Status<sup>f</sup></i>                                    |               |                      |                    |                      |
| Retired   | <b>0.034*</b> | <b>(0.024–0.048)</b> | <b>0.861*</b>      | <b>(0.003–0.028)</b> |
| <i>Socio-economic status<sup>g</sup></i>                                |               |                      |                    |                      |
| Quite poor  | 1.823         | (0.398–0.036)        | 0.516              | (0.246–0.083)        |
| Not very well off   | 2.073         | (0.083–0.392)        | 0.440              | (0.159–0.221)        |
| Quite well off  | 0732          | (0.054–0.972)        | 0.805              | (0.124–0.776)        |
| <b>Trust in health information and social capital-related variables</b> |               |                      |                    |                      |
| Believe in conspiracy theories <sup>h</sup>                             |               |                      | <b>3.167*</b>      | <b>(1.021–2.043)</b> |
| Trust in public health information <sup>i</sup>                         |               |                      | <b>0.065*</b>      | <b>(0.022–0.049)</b> |
| Social capital <sup>j</sup>   |               |                      | <b>0.886*</b>      | <b>(0.017–0.032)</b> |
| <b>Model fitting information</b>  |               |                      |                    |                      |
| –2Log Likelihood  |               | 2673.096             |                    | 367.982              |
| Hosmer-Lemeshow $\chi^2$ (significance)                                 |               | 11.23(0.006)         |                    | 7.781(0.025)         |
| Nagelkerke R <sup>2</sup>   |               | 0.253                |                    | 0.063                |

\*  $p < .05$ .<sup>a</sup>Male is the reference category for the gender variable.<sup>b</sup>50–60 years is the reference category for the age variable.<sup>c</sup>Married is the reference category for the marital status variable.<sup>d</sup>Christian is the reference category for religious variables.<sup>e</sup>No formal education is the reference category for the education variable.<sup>f</sup>Employed is the reference group for the employment variable.<sup>g</sup>Extremely poor is the reference category for socio-economic status.<sup>h</sup>Yes is the reference group for the belief in conspiracy theories variable.<sup>i</sup>Yes is the reference group for the trust in health information variable.<sup>j</sup>Yes is the reference group for the social capital variable.

Model 1 = Socio-Demographic variables; Model 2 = All variables in Model 1 plus Trust in health information and social capital-related variables.

CI = Confidence Interval; OR = Odd Ratio = AOR = Adjusted Odd Ratio.

could put them at higher risks of contracting the virus and suffering the worst consequences.

Several conspiracy theories have developed in the public domain to explain the occurrence of COVID-19<sup>71</sup> and to some extent causing fear and preventing people from engaging in certain behaviors [like the uptake of the vaccines developed]. These misconceptions are numerous. They relate to the radiation emitted through the 5 G transmitters,<sup>72</sup> an attempt by influential people to install tracking chips on people through vaccination. Others include injecting people with some harmful coronaviruses created in labs through vaccination programmes,<sup>72</sup> and the prophecy in Chapter 13 of Revelation (19, 20) where the mark of the beast, will be introduced into humans via injections concealed as a cure for COVID-19. However, mobile wireless technology has progressed from 1 G to 4 G, with no solid scientific proof of harmful side effects of radiation on human health. Again, these theories have exposed misconceptions about what vaccines are and how they are licensed for public use. Despite the lack of substance in these misconceptions<sup>71,72</sup> they are continuously shared on various platforms like Facebook, Twitter, and WhatsApp among others.

According to Islam et al.<sup>37</sup> and Hornsey et al.<sup>73</sup> belief in anti-vaccine conspiracy theories reduces vaccination intentions and increases vaccine hesitancy. We found that older adults who believe in conspiracy theories about COVID-19 vaccination were more likely to develop hesitancy toward the COVID-19 vaccination. This implies that belief in conspiracy theory increases COVID-19 vaccine hesitance, thereby, adversely affecting the attitudes, subjective norms, and eventual uptake of the vaccine.<sup>74–77</sup> While recognizing that copious contextual, social and vaccine-related factors can stimulate vaccine hesitance, including the prospect of getting the virus and risk perceptions toward the vaccine,<sup>78</sup> the uncorroborated assertions of morbidity and mortality connected to the COVID-19 vaccine circulating within the public domain may affect COVID-19 vaccine confidence. These rumors could build mistrust and negative attitude toward vaccination efforts, such as vaccine hesitance. Given this, we propose an Integrated Communication and Information Dissemination Strategy (ICIDS) to lessen the undesirable consequence of misconceptions about the COVID-19 vaccine, particularly among older adults. ICIDS should be developed to entail disseminating information via presentations, publications, social media,

a project website, and other channels and through workshops, round tables, and events in a two-way communication method. This should take into account the target audiences and how and where to interact with them to achieve the desired results in terms of clarifying misconceptions about COVID-19 vaccines and future vaccines. As noted by Yang, Luo and Jia,<sup>77</sup> vaccine literacy (people's knowledge of vaccines) plays an important role in the influence of conspiracy theories and vaccine hesitance behaviours. Public health information should also include vaccine education, with the view to increasing vaccine literacy.

We found trust in public health information to be associated with lower vaccine hesitance among older adults in Ghana. In the USA, HPV vaccination hesitance was not predicted by trust in health information from a doctor or other health experts.<sup>79</sup> The association between confidence in government health information and vaccination hesitance was somewhat mediated by perceived vaccine effectiveness, according to mediation studies.<sup>79</sup> This finding supports our results, as the degree to which people trust sources of information may influence how they respond to public health policies.<sup>80,81</sup> Past evidence on trust in public health information and vaccine hesitance for influenza vaccination,<sup>82</sup> hepatitis B vaccination,<sup>83</sup> and H1N1 vaccination<sup>84</sup> reveal that lower trust leads to vaccine hesitancy. Thus, mistrust of public health information leads to lower vaccine hesitance. Since hesitance to vaccinate is associated with a lack of trust in authorities and scientists,<sup>85–87</sup> we recommend that traditional risk communication and community participation techniques be explored. Again, caveats are attached to information about vaccines that are inconclusive, to make amendments easy and less exposed to misinterpretations that breed mistrust. To close this gap, public trust must be developed with all stakeholders to recognize the benefit of vaccinations in their own social, cultural, and political settings. Vaccine information should be transparent in revealing both the threats and benefits of vaccinations, as well as ensuring the public that vaccines are safe and effective. In vaccination communication, people's confidence in the information source, style of communication, and message consistency should be examined. These may hold the key to closing the vaccine confidence gap.

The idea of social capital has been established to include the value of a community structure.<sup>88,89</sup> To better reflect the nature of communities, social capital has been described as the quality of relationships among community members, as indicated by trust and reciprocal help that benefits all parties.<sup>28</sup> Previous research has demonstrated that increased social capital leads to increased vaccine uptake and lower vaccine hesitance.<sup>29–31</sup> According to these researches, the stronger the linking social capital in the form of confidence in the health system, the better the vaccination hesitance. Our finding of lower vaccine hesitance among older people with social support is similar to that of Ferwana and Varshney<sup>25</sup> who found that community vaccination as a dimension of social capital is negatively associated with vaccine hesitancy. Furthermore, among slum residents in Salvador, Brazil, Aguilar Ticona et al.<sup>26</sup> established that COVID-19 vaccine hesitancy was associated with low social capital. Cohesiveness or social capital does not arise in a vacuum. They are created as a result of

social interaction between individuals and have a reciprocal impact on their daily lives. In every environment, there is no one-size-fits-all method for increasing social capital. More research is needed to understand how social capital is formed within the complicated social structure among older adults. Increasing social cohesiveness could have a significant positive impact on COVID-19 vaccine hesitance. In the design of communication efforts to promote COVID-19 vaccination uptake by addressing factors that increase vaccine hesitance among older adults, social capital provides a key opportunity, which must be explored.

### Strengths and limitations

To the best knowledge of the authors, this is the first study that examined the link between social capital and COVID-19 vaccine hesitancy in Ghana, particularly among older adults. Another feature of the study is its timeliness since it documented the social dynamics surrounding the COVID-19 vaccination campaign during and soon after the vaccination campaign. It offers the prospect of integrating results from this study into the vaccine rollout and future vaccination programs in Ghana and beyond. Finally, we integrated personal, social and institutional factors that influence vaccine hesitance among older adults (a group with severe risk factors, relative to COVID-19) to develop a robust decision-making tool to guide institutions and persons in charge of the vaccination program in Ghana.

By way of limitations, our study's cross-sectional methodology is a significant disadvantage, especially given that attitudes toward COVID-19 vaccination are expected to change swiftly. Furthermore, the respondents came from two geographic locations, which may have influenced the generalizability of the survey results. Again, purposive sampling is susceptible to study bias, much like other non-probability sampling methods. Results have a significant risk of bias since the sample units are chosen based on the researcher's subjective evaluation, notably observer bias. As a result, sampling bias results from the fact that not every person in the population has an equal probability of being picked for the sample. Since the respondents were recruited using purposive and snowball sampling techniques, the final sample is not representative of Ghana's population of older adults. Finally, information about available vaccines, as well as other critical factors influencing vaccine hesitance, was not investigated. This might have concealed critical information; consequently, future studies should address these challenges as the pandemic and vaccination programs progress.

### Conclusion

Contributing to the resolution of current and future pandemics, understanding the determinants of COVID-19 vaccine hesitance among older adults is crucial. In this study, we modeled the influence of socio-demographics, trust in public health information, belief in conspiracy theories and social on COVID-19 vaccine hesitance among older adults [50 years and above] in Ghana. Females, retired older adults, those without social capital, and those who do not trust public health information engage in



COVID-19 vaccination hesitance. However, those who do not believe in conspiracies and misconceptions about the vaccine had higher odds of accepting it. In the design of communication efforts to promote COVID-19 vaccination uptake, social capital provides a key opportunity. Future efforts should reach out to older adults through social networks to disseminate trustworthy information about vaccination. Our research provides a snapshot of conspiracy theory trends that have the potential to increase public skepticism about vaccinations. The variety of COVID-19 vaccine misconceptions spreading might jeopardize the deployment of COVID-19 vaccines. We proposed that conventional risk communication and community involvement strategies be employed to track and fact-check misinformation and thereby insulate individuals against potential vaccination program disruptions. Policymakers when developing risk communication and community engagement initiatives to address these concerns with evidence-based information should consider these findings. Above all, greater efforts to convey vaccination benefits and risks, as well as address issues through evidence-based information, can strengthen and preserve the public's trust in vaccines and health systems in Ghana. Measuring and monitoring trust levels, as well as concentrating on efforts to develop trust in vaccinations, are critical steps toward closing vaccine confidence gaps among older adults in Ghana.

## Abbreviations

|       |  |
|-------|--|
| AOR   | Adjusted Odd Ratio                                     |
| CI    | Confidence Interval                                    |
| HPV   | Human Papillomavirus                                   |
| HW    | Healthcare Workers                                     |
| ICID  | Integrated Communication and Information Dissemination |
| MMDAs | Metropolitan, Municipal, and District Assemblies       |
| OR    | Odd Ratio  |
| SPSS  | Statistical Package for the Social Sciences            |
| WHO   | World Health Organisation                              |

## Disclosure statement

The authors declare that they have no competing interests. MAA developed the study design and proofread the final manuscript.

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## Ethics approval and consent to participate

Verbal informed consent was obtained from the participants by agreeing orally to participate in the study, as most could not read or write. As the dignity, safety and well-being of the interviewees were a matter of primary concern to the researchers, participation in the study was strictly voluntary, and no identifying or sensitive information was recorded.

## Author contribution

AKM conceptualized, drafted and prepared the manuscript for submission. MAA contributed to reviewing and editing the manuscript. JC, AAA and SKA were involved in the study design and manuscript drafting. All authors have read and agreed to the published version of the manuscript.

## Data availability statement

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

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