A Survey on Factors Influencing COVID-19 Vaccine Hesitancy in Bamenda-Cameroon

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Authors’ contributions

This work was carried out in collaboration among all authors. Author LEA conceptualized the study. Authors NNM, MSN, MNN and MNM collected data under the supervision of LEA and LS. Authors LEA NHN, and NNM performed data management, analysis, and interpretation. Author LEA wrote the initial draft of the manuscript. All authors read and approved the final manuscript.

ABSTRACT

Aims: Vaccine hesitancy has been a longstanding and complex public health attitude amongst the population. Despite the numerous benefits of the COVID-19 vaccine, COVID-19 vaccine hesitancy remains a major problem. While the importance of vaccine hesitancy is widely acknowledged, comparatively little is known about vaccine hesitancy in Bamenda. We, therefore, sought to examine individuals’ willingness to accept the COVID-19 vaccines in order to understand and address the community-specific concerns and misconceptions.

Study Methodology: This was a community-based cross-sectional study carried out in Bamenda-Cameroon from April to May 2021. Paper-based, pre-tested open-close questionnaires were administered to consented participants. Data were analyzed using SPSS version 23.

Results: A total of 2,531 participants of both sexes were included in the study with a mean age of 23.63±7.52 years. Vaccine hesitancy was 97.6% (2,161). The main reason for vaccine hesitancy was safety concerns 72.3% (1,786). Univariate analysis showed significant differences among the age groups, towns, marital status, monthly income, and religion. The multivariate model identified...
age group 20-29 years (OR 4.8, CI 1.82-12.53), Christians (OR 21.61, CI 4.92-94.94), Muslims (OR 8.67, CI 1.42-52.82), rural area (OR 2.9, CI 1.58-5.38), monthly income >100,000 FCFA (OR 0.28, CI 0.09-0.87) and those who attained primary education (OR 0.36, CI 0.14-0.92) as predictors of vaccine hesitancy (p<0.05).

**Conclusion:** The major reasons for vaccine hesitancy were misinformation and lack of trust. Therefore a reduction in the COVID-19 vaccine hesitancy rate mandates collaborative efforts of governments, health policymakers, and media sources to provide useful information that will address the people’s concerns and misconceptions.

**Keywords:** COVID-19; vaccine; vaccine hesitancy; Bamenda.

**ABBREVIATIONS**

COVID-19 : Coronavirus Disease 2019
FCFA : Central African franc
SARS-CoV-2 : Severe Acute Respiratory Syndrome Coronavirus-2
WHO : World Health Organization

**1. INTRODUCTION**

The Coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) is a major threat to public health and was declared a pandemic by the World Health Organization (WHO) in March 2020 [1–6].

The COVID-19 pandemic has quickly spread globally with over 318.65 million cases and 5.5 million deaths as of 14th January 2022 [7]. Despite the successful response strategies made by many countries, the disease has spread across the globe and has endangered the healthcare system with appalling medical, economic, societal, and education consequences [2,4,6,8,9]. These negative impacts have encouraged pharmaceutical companies to develop the COVID-19 vaccine urgently since there is no curative or standardized treatment [2,4,10]. As of 14th January 2022, WHO has approved different COVID-19 vaccines most of which have shown >90% protection rate and these include AstraZeneca (Oxford), Astrazeneca-SK Bio (Republic of Korea), Pfizer-BioNTech, German, Sinopharm (China), Moderna (USA), Sputnik V (Argentina), Sinovac (China and Brazil), Sinovac-CoronaVac (China), Covaxin (India) and Janssen or Johnson and Johnson (USA) [1,11]. Of these, Sinopharm, AstraZeneca, Johnson and Johnson, and Sputnik V are the four vaccines approved by Cameroon’s Scientific Council [12].

Vaccinations are among the most important public health tools for reducing the spread and harm caused by dangerous diseases (measles, polio, hepatitis B, influenza, etc) for decades [2,8,13]. Reports from WHO estimate that vaccines prevented at least 10 million deaths between 2010–2015 worldwide [14]. This has given prevue hope in preventing person-to-person transmission in the community. Vaccination of the community will lead to herd immunity such as in the case of infectious diseases such as measles, mumps, polio, and chickenpox [15].

To achieve herd immunity in the era of COVID-19 at least 66.7% to 90% of the population needs to be vaccinated [4,15–17]. As of 16th July 2021, 26.3% of the world population has received at least one dose of a COVID-19 vaccine, and of this, only 1% is from low-income countries [18,19]. To attain this goal, economists have proposed monetary or employment compensation to those taking the vaccine [20]. The effectiveness of these COVID-19 immunization programs depends on the population’s willingness to be vaccinated [5]. However, vaccine hesitancy and refusal are significant concerns globally [2,4]. Vaccine hesitancy is the refusal or denial in accepting safe and recommended available vaccines despite the availability of the vaccine services while vaccine acceptance is the willingness to receive the vaccine [4,21,22]. The act of vaccine hesitancy has been a growing concern long before the COVID-19 pandemic [22]. Previous studies have shown that vaccine acceptance rates vary between countries as a prevalence of <30% was recorded in Kuwait and Jordan, 50 - 60% in Italy, Russia, Poland, and France, and > 90% in Ecuador, Malaysia, Indonesia, and China [23,21].

Although organizations and governments worldwide have spent billions of dollars in preparing to immunize the population [8], COVID-19 vaccine hesitancy occurs in many countries worldwide and has been on a steady
rise[13,23]. This is a major call for concern as it presents substantial obstacles in obtaining herd immunity against COVID-19. Previous studies elsewhere have identified many factors that influence the acceptance of the COVID-19 vaccine. These include Socio-demographic characteristics, political beliefs, vaccine safety, and efficacy, religious reasons, and the widespread of personal beliefs [5,8,23]. Thus to obtain herd immunity with COVID-19 the Government and related associations must determine vaccine hesitancy to build up the acceptance rate.

In Cameroon, the first COVID-19 case was confirmed in March 2020 [6] and as of 20th June 2021, they are over 80,328 confirmed cases and 1,313 deaths ranking Cameroon among the first eleven countries in Africa [24]. Cameroon received 591,200 doses of COVID-19 vaccine (Sinopharm, AstraZeneca, Sputnik V, and Johnson and Johnson) in April 2021 intending to vaccinate 20% of her population by the end of 2021. Despite the efforts made by the government in assuring the population of the safety of the vaccine, by the 19th of July 2021, a total of 48,971 vaccine doses have been administered giving an acceptance rate of 8.28% in the entire country and a 2.7% rate in Bamenda [25]. This low rate of vaccine acceptance represents a major problem in the global efforts to control the current COVID-19 pandemic.

For herd immunity to be successful, there should be high rates of vaccine acceptance and coverage which can be accomplished by understanding the perceptions about the COVID-19 vaccine acceptance. This study, therefore, sought to assess the COVID-19 vaccine acceptance rate using demographic information with aims to develop evidence-based interventions for public health officials. The findings of this study will therefore provide useful information to policymakers to formulate the best approach to implement the COVID-19 vaccination program, at this critical time where vaccine hesitancy around the world is very low.

2. METHODS, DESIGN, SETTING

A cross-sectional survey based on the administration of questionnaires was conducted among the inhabitants of Bamenda from April 20th to May 20th, 2021 after approval from the University of Bamenda’s ethical review committee.

Sample Size: The estimation of the sample size was done using the Raosoft sample size online calculator with a margin error of 2%, confidence interval of 95%, response distribution of 50%, and population size of 27,224,262 [26]. The minimum number of participants to obtain statistically significant data was calculated to be 2,401 [27].

Study population: Bamenda residents, aged 15 years or more and who agreed to participate in the study by completing the questionnaire.

Data collection tool: The survey questions were adapted and modified from previously published literature [8,9,22,27]. Third Year University students were recruited as data collectors. The data collectors were trained to conduct face-to-face interviews while respecting the measures of infection prevention. The questionnaire was written in English language, pre-tested in a subpopulation of different educational backgrounds by the data collectors and validated to minimize data errors. For participants who could not read or write, the questionnaires were translated into Pidgin English and the form completed by the data collectors. Questions were answered on a Yes/No basis with an additional “I don’t know” option as well as some open-ended questions. The questionnaire consisted of 3 parts: the socio-demographic variables, concerns regarding the vaccines as a whole, and knowledge, attitude, and practice on the COVID-19 vaccine.

Data Analysis: The questionnaires were entered into Microsoft Excel 2019 and imported to SPSS v. 23.0 (Chicago, Illinois, USA) for analysis. The Chi-square test was used for socio-demographic and categorical data. The variables associated with COVID-19 vaccine hesitancy were analyzed using bivariate analysis. Binary logistic regression was performed with a 95% confidence interval to determine significant associations between categorical dependent and independent variables. Multivariable logistic regression was conducted to identify predictors of COVID-19 vaccine hesitancy. The statistical significance level was set at \( p < 0.05 \).

3. RESULTS

A total of 2,676 respondents were recruited into the study. However, 2,531 (94.88%) participants completely filled the questionnaire and were considered for the analysis. Table 1 provides a synopsis of their socio-demographic features. A total of 55.8 % (1,412) participants came from a
rural town and 51.5% (1,303) were female. The age ranged from 15 to 71 years with a mean (±SD) of 23.63(±7.52) years. Participants in the age range of 20-29 years constituted the highest population 70.3% (1,779), whereas the elderly aged >39 years were the minority 5.5% (139).

Table 1. Characteristics among respondents (N = 2531)

| Parameter                  | Characteristics | Frequency | Percentage |
|----------------------------|-----------------|-----------|------------|
| Residence                  | Rural           | 1,412     | 55.8       |
|                            | Urban           | 1,119     | 44.2       |
| Gender                     | Female          | 1,303     | 51.5       |
|                            | Male            | 1,228     | 48.5       |
| Age in years               | <20             | 442       | 17.5       |
|                            | 20-29           | 1,779     | 70.3       |
|                            | 30-39           | 171       | 6.8        |
|                            | >39             | 139       | 5.5        |
| Marital Status             | Married         | 301       | 11.9       |
|                            | Single          | 2,210     | 87.3       |
|                            | Widow/widower   | 20        | 0.8        |
| Household number (in persons) | 1               | 728       | 28.8       |
|                            | >5              | 806       | 31.8       |
|                            | 2 to 4          | 997       | 39.4       |
| Educational Level          | None            | 46        | 1.8        |
|                            | Primary         | 238       | 9.4        |
|                            | Secondary       | 1,043     | 41.2       |
|                            | Tertiary        | 1,204     | 47.6       |
| Occupation                 | Civil Servant   | 140       | 5.5        |
|                            | Self Employed   | 594       | 23.5       |
|                            | Un-employed     | 1,797     | 71.0       |
| Monthly Income (FCFA)      | <50,000         | 526       | 20.8       |
|                            | 50,000 to 100,000 | 68 | 2.7 |
|                            | >100,000        | 169       | 6.7        |
|                            | NA              | 1,768     | 69.9       |
| Religion                   | Christian       | 2,432     | 96.1       |
|                            | Muslim          | 84        | 3.3        |
|                            | None            | 15        | .6         |
| Type of Religion           | Baptist         | 680       | 26.9       |
|                            | Catholic        | 898       | 35.5       |
|                            | Muslim          | 84        | 3.3        |
|                            | Pentecostal     | 252       | 10.0       |
|                            | Presbyterian    | 510       | 20.2       |
|                            | None            | 107       | 4.2        |
| Underlying Medical Conditions | No              | 2,460     | 97.2       |
|                            | Asthma          | 15        | 0.6        |
|                            | Cancer          | 8         | 0.3        |
|                            | Confidential    | 18        | 0.7        |
|                            | Diabetes        | 13        | 0.5        |
|                            | Eye defect      | 2         | 0.1        |
|                            | High blood pressure | 11 | 0.4 |
|                            | Tuberculosis    | 4         | 0.2        |

NB: NA; non-applicable, FCFA; Central African franc
More than half of the participants were single (87.3% (2,210), unemployed 71.0% (1,797), and Christians 96.1% (2,432). The majority of them belong to a household number range of 2 to 4 persons, 39.4% (997), had attained tertiary education 47.6% (1,204), with a monthly income <50,000 FCFA, 20.8% (526). Among Christians, those who fellowshipped in the catholic church constituted the highest number of participants 35.5% (898), while among the 2.8% (71) participants with underlining medical conditions, the majority of the 0.7% (18) were not willing to disclose their health disease status (Table 1).

3.1 Participants’ Information Regarding Vaccines

Before the coming of the COVID-19 vaccine, a total of 85.4% (2,161) participants had a positive view about vaccines while 1.5% (37) were not certain about the outcome of taking any vaccine. More than three-quarters of the respondents 89.0% (2,253) have been previously vaccinated and only 26.2% (662) of them could remember taken between 5 or 6 of the 13 (14 for females) available vaccines in the enlarged vaccination program in Cameroon. The data from this study showed that all participants have heard about the COVID-19 vaccine. Most respondents acquired information regarding the COVID-19 vaccine from social media 62.3% (1,578) followed by television/Radio 58.9% (1,491). The greater number of the respondents 63% (1,595) graded the information gotten about the COVID-19 vaccine to be false. As regards the COVID-19 vaccine information given by the government; 27.6% (698) respondents (25.1% (637) for agree and 2.4% (61) for strongly agree) agreed that the information was correct while 70.1% (1,775) respondents (48.2% (1,220) for disagree and 21.9% (555) for strongly disagree) disagreed with the information given by the government. More than 95% of the participants did not know how the vaccine protects the body 96.5% (2,442) or example of any COVID-19 vaccine being administered 96.9% (2,453). However, of the 3.5% (89) participants who knew the mechanism of action, the majority 68.5% (64/89) said the vaccine will elicit an immune response (Table 2). As concern the name of vaccine currently being used, 12.9% (328) respondents knew one or more vaccines. Of these (328 respondents), 48.5% (159) of them knew Sinopharm vaccine, followed by AstraZeneca 31.7% (104) and least by Sputnik V 1.5% (5).

3.2 Perception Towards the COVID-19 Vaccine Hesitancy

As regards participants’ willingness to receive the COVID-19 vaccine when it is available, only 2.4% (60) of the respondents answered ‘Yes’ while 60.4% (1,529) said ‘No’ and 37.2% (942) were uncertain about taking the vaccine. Those who said ‘no’, as well as those who were ‘uncertain’, were considered as vaccine-hesitant. Of the 2,471 respondents that were hesitant, 82.2% (2,033) were willing to take the vaccine if recommended to them by different persons or organizations. More than half of the participants 50.17% (1,451) will likely take the vaccine if recommended by a family member followed by a friend/Colleague 45.60% (927) (Fig. 1). The main reason for vaccine hesitancy (Fig. 2) was that of safety 72.3% (1,786) while 68.88% (1,702) said they did not trust the intention of the vaccine. Of the 82.86% (2,093) persons who accepted to take the vaccine [those who said yes (60) and those who will take the vaccine is recommended to (2,033)], more than half of the 66.70% (1,396) are willing to take the vaccine if only is mandatory while 35.64% (746) will take the vaccine for self-protection (Fig. 3).

Our study made known significant (p<0.05) high hesitancy in the age group between 20-29 years (98.8%; 1,755). resident in rural towns (98.5%; 1,391), living in a household of >5 persons (98.6%; 795), having a monthly income of <50,000 FCFA (98.5%, 518) and being a Christians (97.8%; 2,379). On the other hand, although hesitancy was high among males (98.1%; 1,205), tertiary education (98.3%; 1,184), single (97.8%; 2,161), and self-employed (97.8%, 1,757) as seen in Table 3, these differences were not significant (p=0.05).

In this study, the socio-demographic variables that showed significance p<0.05 or a trend p= 0.05 in the Bivariate analysis were used for the logistic regression analysis. Our data revealed that variables significantly associated with hesitancy (at p<0.05) in the univariate analysis included respondents who were Christian or Muslim, those living in a rural area, individuals with monthly income >100,000 FCFA, and those who had attained primary education. After adjusting for the rest of the variables in the multivariate model, the odds for vaccine hesitance was 4.78 higher for respondents between 20-29 years. Similarly, odds were also elevated 21.61 times for Christians, 8.67 times for Muslims, and 2.9 times higher for...
respondents from rural areas. Nevertheless, we also found out that monthly income >100,000 FCFA and those who attained primary education were associated with a lower risk of 0.5 in multivariate analysis (Table 4).

Table 2. Responses to vaccines and COVID-19 vaccine information

| Variables                                                                 | Frequency | Percentage |
|---------------------------------------------------------------------------|-----------|------------|
| Before COVID-19 vaccines what is your general view about vaccines?        |           |            |
| Negative                                                                  | 333       | 13.1       |
| Not certain                                                               | 37        | 1.5        |
| Positive                                                                  | 2161      | 85.4       |
| Have you ever been vaccinated?                                            |           |            |
| Yes                                                                       | 2253      | 89.0       |
| No                                                                        | 51        | 2.0        |
| Do not know                                                               | 227       | 9.0        |
| If yes, how many vaccines have you received?                               |           |            |
| 0*                                                                        | 278       | 11.0       |
| 1-2                                                                      | 825       | 32.6       |
| 3-4                                                                      | 766       | 30.3       |
| 5-6                                                                      | 662       | 26.2       |
| >6                                                                       | 0         | 0.0        |
| Have you heard about the COVID-19 vaccine?                                 |           |            |
| Yes                                                                       | 2531      | 100.0      |
| Source of COVID-19 vaccine information                                     |           |            |
| TV/ Radio                                                                 | 863       | 34.1       |
| Newspaper                                                                 | 720       | 28.4       |
| Social media                                                              | 1578      | 62.3       |
| Friends/ Family                                                           | 1491      | 58.9       |
| Church                                                                    | 798       | 31.5       |
| School                                                                    | 82        | 3.3        |
| Other sources (Market, Hospital)                                          | 33        | 1.3        |
| How can you grade the COVID-19 vaccine information                        |           |            |
| Positive                                                                  | 640       | 25.3       |
| Negative                                                                  | 1595      | 63.0       |
| Uncertain                                                                 | 19        | 11.7       |
| Do you agree that the information on the vaccine given by our Government has been communicated? | | |
| Agree                                                                     | 637       | 25.2       |
| Disagree                                                                  | 1220      | 48.2       |
| Don't know                                                                | 58        | 2.3        |
| Strongly agree                                                            | 61        | 2.4        |
| Strongly disagree                                                         | 555       | 21.9       |
| How does the vaccine function*                                            |           |            |
| Activate immune response                                                  | 61        | 68.5       |
| Inactivate virus                                                          | 15        | 16.9       |
| Inhibit viral replication                                                 | 13        | 14.6       |
| No idea                                                                   | 2,442     | 96.5       |
| Give example (s) of COVID vaccine that you know **                        |           |            |
| No idea                                                                   | 2,453     | 96.9       |
| AstraZeneca                                                               | 104       | 31.7       |
| Johnson and Johnson                                                       | 28        | 8.54       |
| Moderna                                                                   | 18        | 5.49       |
| EpiVacCorona                                                              | 10        | 3.05       |
| Pfizer                                                                    | 43        | 13.11      |
| Sinopharm                                                                  | 159       | 48.5       |
| Sinovac                                                                   | 48        | 14.63      |
| Sputnik V                                                                 | 5         | 1.52       |

NB * n= 89, ** n=328
Fig. 1. Persons or institutions to recommend the vaccine

![Bar chart showing percentages of recommended persons or institutions for the vaccine.](chart1)

- School authority: 2.02%
- Health care worker: 18.3%
- Friend/Colleague: 45.6%
- NGOs: 26.81%
- Community leaders: 16.92%
- Religious leaders: 31.68%
- Family member: 50.17%

Fig. 2. Reasons for vaccine hesitancy

![Bar chart showing prevalence of various concerns regarding the COVID-19 vaccine.](chart2)

- Can get infected with COVID-19: 33.27%
- Don't trust the intentions behind the vaccine: 68.88%
- Have better ways to protect myself: 48.2%
- I am against vaccines in general: 26.22%
- The COVID-19 vaccine is not safe: 28.98%
- Health reasons: 72.28%

Fig. 3. Reasons to get the vaccine

![Bar chart showing prevalence of reasons for getting the vaccine.](chart3)

- Only if is mandatory: 66.7%
- Protect my community: 22.89%
- Protect my friends and family: 34.4%
- Protect my job: 33.4%
- Protect myself: 35.64%
### Table 3. Bivariate associations between characteristics and outcome respondents (N = 2531)

| Characteristics          | Frequency | Acceptance n(%) | Hesitance n(%) | P-value |
|--------------------------|-----------|-----------------|----------------|---------|
| **Age in years**         |           |                 |                |         |
| <20                      | 442       | 22 (5.0)        | 420 (95.0)     | 0.0001  |
| 20-29                    | 1,779     | 24 (1.3)        | 1,755 (98.7)   |         |
| 30-39                    | 171       | 4 (2.3)         | 167 (97.7)     |         |
| >39                      | 139       | 10 (7.2)        | 129 (92.8)     |         |
| **Gender**               |           |                 |                |         |
| Female                   | 1,303     | 37 (2.8)        | 1,266 (97.2)   | 0.11    |
| Male                     | 1,228     | 23 (1.9)        | 1,205 (98.1)   |         |
| **Town**                 |           |                 |                |         |
| Rural                    | 1,412     | 21 (1.5)        | 1,391 (98.5)   | 0.001   |
| Urban                    | 1,119     | 39 (3.5)        | 1,080 (96.5)   |         |
| **Marital Status**       |           |                 |                |         |
| Married                  | 301       | 9 (3.0)         | 292 (97.0)     | 0.056   |
| Single                   | 2,210     | 49 (2.2)        | 2,161 (97.8)   |         |
| Widow/er                 | 20        | 2 (10.0)        | 18 (90.0)      |         |
| **Household number**     |           |                 |                |         |
| 1                        | 728       | 25 (3.4)        | 703 (96.6)     | 0.029   |
| >5                       | 806       | 11 (1.4)        | 795 (98.6)     |         |
| 2 to 4                   | 997       | 24 (2.4)        | 973 (97.6)     |         |
| Monthly income (FCFA)    |           |                 |                |         |
| <50,000                  | 526       | 8 (1.5)         | 518 (98.5)     | 0.0001  |
| 50,000 to 100,000        | 68        | 4 (2.47)        | 165 (97.6)     |         |
| >100,000                 | 169       | 7 (10.3)        | 61 (89.7)      |         |
| NA                       | 1,768     | 41 (2.3)        | 1,727 (97.7)   |         |
| **Religion**             |           |                 |                |         |
| Christian                | 2,432     | 53 (2.2)        | 2,379 (97.8)   | 0.000   |
| Muslim                   | 84        | 4 (6.7)         | 80 (95.2)      |         |
| None                     | 15        | 3 (20.0)        | 12 (80.0)      |         |
| **Educational Level**    |           |                 |                |         |
| None                     | 46        | 3 (6.5)         | 43 (93.5)      |         |
| Primary                  | 238       | 8 (3.4)         | 230 (96.6)     |         |
| Secondary                | 1,043     | 29 (2.8)        | 1,014 (97.2)   | 0.050   |
| Tertiary                 | 1,204     | 20 (1.7)        | 1,184 (98.3)   |         |
| **Occupation**           |           |                 |                |         |
| Civil Servant            | 140       | 5 (3.6)         | 135 (96.4)     | 0.578   |
| Self Employed            | 594       | 15 (2.5)        | 579 (97.5)     |         |
| Un-employed              | 1,797     | 40 (2.2)        | 1,757 (97.8)   |         |

FCFA Central African Franc 1USD ~ 565 FCFA

### Table 4. Factors associated with vaccine hesitancy

| Characteristic       | Crude Odds Ratio (OR) | 95% CI (OR) | P value | Adjusted Odds Ratio (aOR) | 95% CI (aOR) | P value |
|----------------------|-----------------------|-------------|---------|---------------------------|-------------|---------|
| **Age in years**     |                       |             |         |                           |             |         |
| <20                  | 0.648                 | 0.234-1.79  | 0.404   | 1.543                     | 0.56-4.27   | 0.40    |
| 20-29                | 0.209                 | 0.08-0.55   | 0.001   | 4.778                     | 1.82-12.53  | 0.00    |
| 30-39                | 0.271                 | 0.073       | 0.051   | 3.687                     | 1-13.67     | 0.05    |
| >39*                 | 1                     | 1           | 1       |                           |             |         |
| **Religion**         |                       |             |         |                           |             |         |
| Christian            | 16.562                | 0.01-0.20   | 0.0001  | 21.61                     | 4.92-94.94  | 0.001   |
| Muslim               | 5.486                 | 0.02-0.70   | 0.019   | 8.67                      | 1.42-52.82  | 0.02    |
| None*                | 1                     | 1           | 1       |                           |             |         |
| **Household number** |                       |             |         |                           |             |         |
| 1                    | 1.018                 | 0.56-1.85   | 0.955   | 0.983                     | 0.54-1.79   | 0.96    |
| >5                   | 0.84                  | 0.39-1.79   | 0.651   | 1.191                     | 0.56-2.54   | 0.65    |
| 2 to 4*              | 1                     | 1           | 1       |                           |             |         |
The high use of social media (62.3%) followed by family/friends (58.9%). The high use of social media as the main source of information about COVID-19 has also been reported by Syed Alwi et al., [8] and has contributed to the dissemination of false information since this information is not controlled and is easily spread. Therefore, it is of prime importance to provide means to validate and control the type of information that is being circulated such that only useful information is being dished out on social media. However, effective use of the other source of information (TV/Radio, Church, Newspaper, and School) should not be ignored.

Lessons learned from previous outbreaks such as human immunodeficiency virus (HIV), Influenza A virus (H1N1), Middle East Respiratory Syndrome (MERS) and Ebola showed that trusted sources of information are fundamental to disease control [9]. Our study identifies lack of trust as the best predictor of vaccine hesitancy as only 27.6% believe in the information given by the government. Other studies have experienced similar results [2,9,29]. A high proportion of respondents expressed that they did not trust the information about the COVID-19 vaccine and consider it as a conspiracy model similar to the report by Kreps and Kriner [29]. On a contrary, a review carried out in different countries states that a low level of vaccine hesitancy is due to the strong trust in their governments [2,3,8,23,30,29].

Remarkably, COVID-19 vaccine hesitancy is also strongly related to the fact that the vaccine is being offered free. Considering the importance of the vaccine, some people are very skeptical why it will be offered free as such they doubt the effectiveness of the vaccine. Comparison is made to other vaccines like hepatitis and yellow fever vaccines that are being paid for by the individual concerned. In this study during an interview, most of the participants declared that the government has provided false information in other instances especially issues of the socio-

| Characteristic  | Crude Odds Ratio (OR) | 95% CI  | P value | Adjusted Odds Ratio (aOR) | 95% CI | P value |
|-----------------|-----------------------|---------|---------|---------------------------|-------|---------|
| Residence       |                       |         |         |                           |       |         |
| Rural           | 0.343                 | 0.19-0.64 | 0.001   | 2.912                     | 1.58-5.38 | 0.00   |
| Urban*          | 1                     |         | 1       |                           |       |         |
| Monthly Income (FCFA) |                  |         |         |                           |       |         |
| <50,000         | 0.569                 | 0.24-1.36 | 0.207   | 1.756                     | 0.73-4.21 | 0.21   |
| 50,000-100,000  | 1.034                 | 0.31-3.43 | 0.957   | 0.967                     | 0.29-3.21 | 0.96   |
| >100,000        | 3.507                 | 1.15-10.72 | 0.028   | 0.285                     | 0.09-0.87 | 0.03   |
| NA*             | 1                     |         | 1       |                           |       |         |
| Educational Level |                     |         |         |                           |       |         |
| None            | 1.302                 | 0.31-5.51 | 0.72    | 0.768                     | 0.18-3.25 | 0.72   |
| Primary         | 2.742                 | 1.08-6.93 | 0.033   | 0.365                     | 0.14-0.92 | 0.03   |
| Secondary       | 0.928                 | 0.45-1.93 | 0.841   | 1.078                     | 0.52-2.24 | 0.84   |
| Tertiary*       | 1                     |         | 1       |                           |       |         |

*OR: Crude Ratios; aOR: Adjusted Odds Ratios; FCFA Central African Franc 1USD ~ 565 FCFA, * Reference category

4. DISCUSSION

Vaccine hesitancy is considered by the WHO as one of the top ten threats to global health. The morbidity and mortality rates of COVID-19 can significantly be reduced if vaccine acceptance is high. Therefore, vaccine hesitancy can be the major hindrance to the control efforts to lessen the negative consequences of the COVID-19 pandemic. Despite a large amount of evidence supporting the safety of the COVID-19 vaccine and considering that it is provided free of charge in Cameroon, we recorded a high vaccine hesitancy of 97.6%. High hesitancy values of the range 63.2-83% have been recorded in other studies [2,28]. In contrast, other studies reported an overall low vaccine hesitancy in the range of 3% to 35%. [2,3,8,20,28,29]. These differences in the acceptance rate between countries might pose a serious problem by delaying the global control of the pandemic. The increase in vaccine hesitancy in this study is a result of a lack of knowledge or misinformation about the vaccine as more than 95% of the respondents did not know the mechanism of action of the vaccine. This high rate of vaccine hesitancy in this study reflect what prevails in the field as only 2.7% person of the entire population of the Northwest region had received the vaccine as of 23rd of September 2021(Regional Delegation of public health for the Northwest region [005/COM/NWR/RDPR], unpublished).

The highest source of information in this area was social media (62.3%) followed by family/friends (58.9%). This high use of social media as the main source of information about COVID-19 has also been reported by Syed Alwi et al., [8] and has contributed to the dissemination of false information since this
political situations in Bamenda that have prevailed for over 4 years. Unfortunately, the intricacies of the government systems as regards politics are not well-understood by the inhabitants. Therefore the influence of political thought has led to a lack of trust which has played a great role in vaccine hesitancy not only in Cameroon but in most countries in Africa as a whole [4]. To combat these conspiracy models and improve trust, the government should acknowledge the lower levels of trust and now liaison with other key non-governmental organizations like faith base organizations, Red Cross, community-based groups, and organizations that are considered to be unbiased and respected within the local communities to build on the current public interest and prevent counter misconceptions about the COVID-19 vaccine. This can improve the COVID-19 vaccine uptake by building facilitating environment with skilled strategies to address the people’s beliefs and uncertainty by educating them on the safety and efficacy of the vaccine and the importance of attaining herd immunity in a community.

Family hesitancy (50.17%) was one of the strongest reasons behind the high hesitancy rate as most respondents will get the vaccine if recommended only by a family member (Fig. 1). Similar findings have been reported with another vaccine such as the Human Papilloma Virus vaccine [31,32]. As such family members appear to have a stronger influence on vaccine acceptance or refusal. To ensure a high COVID-19 vaccination acceptance rate, effective education should be geared towards family settings like family come together, celebrations or reunions. However, this should not only be limited to this group of persons but other community leaders and organizations.

As concerns the reasons for vaccine hesitancy (Fig. 2), we were also surprised to find that the highest number of participants (72.3%) were concerned about the COVID-19 vaccine safety. Concerns about vaccine safety have been universally reported in various studies [2,8,23]. This emanated from the fact that people are still being asked to respect all the measures of prevention in countries like the USA, Germany, UK, etc where the citizens have been vaccinated. The concerns about the safety of the vaccine may also be because some of the respondents think that the vaccine was produced in a rush and adequate time has not been given to study if they will be any major side effects similar to a study by Syed Alwi et al., [8]. However, the risks of contracting COVID-19 infection, which may lead to severe complications, outweigh the risks of side effects from the vaccine. More than 68.9% of participants said they did not trust the intention of the vaccine. This is most probably the message of the two French doctors who suggested that trials for the COVID-19 Vaccine should be conducted in Africa [33]. The 33.3% of participants who reported that they can get infected with the virus is a clear indication that adequate information on vaccine safety and effectiveness has not reached most of the participants. Thus, there is a need for follow-up on the information being passed out in social media as it was the main source of information (97.4%) for most participants.

In this study, socio-demographic factors were related to vaccine hesitancy. The recognition of these factors can help develop targeted awareness campaigns for the population to increase the vaccination acceptance rate. After adjusting for other demographic characteristics, our study found that members of the age group 20-29 years, Christians as well as Muslims, respondents from rural areas, and primary level of education were more likely to delay or refuse COVID-19 vaccine while those with a higher monthly income of >100,000 FCFA will accept the vaccine.

In this study members of the age group, 20-29 years were associated with high vaccine hesitancy compared to the elderly similar to studies by [3,8,9,30,28,29]. The reasons are numerous and include; vaccine safety and effectiveness, fear of long-term side effects, rationale about the vaccine in Africa, and distrust in government information. Secondly, this can be attributed to the fact that COVID-19 severity and high death rates are associated with older age [29].

Our data, reveals that locality significantly affects the willingness to be vaccinated. This indicates that people from the rural areas have a higher degree of skepticism and concern about the vaccine. High hesitancy in rural areas can first be attributed to misinformation about the vaccine. Most of these persons in these areas get information from social media and unverified sources. As such, the government needs to educate the people with useful messages through social media to help reduce the vaccine hesitancy rate.

We also observed in this study that high-income earners have a positive attitude toward receiving
the vaccination as reported in other studies [3,8,9,30]. Additionally, unemployed participants reported a lower acceptance rate of a COVID-19 vaccine. This low hesitancy among high-income persons is most probably because the vaccine will enable them to maintain their economic status as COVID-19 has shown to have a negative effect by worsening the social, economic, and health impact of the affected people. With the conception that the vaccine should be tested first in Africa, these low-income people believe that the vaccination intends to reduce the population of Africa to improve the economics of the country. These findings demonstrate that low-income communities, which are unduly impacted by COVID-19, might be more susceptible to more outbreaks, even if a vaccine is available. Considering the economic hardship of the most of the participants, huge financial benefit as reported by Serra-Garcia and Szech [20] can be of help.

Strange to the writer was the fact that educated participants recorded the highest number of vaccine hesitance whereas those who accept the vaccination have a lower educational level. This was similar to a study by Al-Qerem and Jarab [2] and with other vaccines like the human papillomavirus vaccine [34]. However, it was contrary to reports from other countries [30,28] where respondents with low education had a lower acceptance rate. One concept behind this observation is that educated participants are often more likely to have access to many different sources of information that have given them the ability to interpret complex scientific and clinical health information before deciding for themselves.

In our analyses, we perceived that religion was negatively correlated with COVID-19 vaccination. This particular aspect has already been described by other authors [4,30]. This is because many Pentecostal preachers purported that the use of the vaccine is a conspiracy theory to prove that we are in the end times of the world. Pointing to verses from the Book of Revelation in the Bible, thus suggesting that the coronavirus vaccine is the groundwork for the coming of the Antichrist. In addition, it has been considered as “a mark of the Beast” as reported by Afolabi [4]. Other respondents believe that if the survival rate is above 98%, there is no need for a vaccine [35]. This accounts for the high hesitancy among Christians and Muslims compared to those who did not believe in any religion.

Although gender was not a factor, contrary to another study by Syed Alwi et al., [8] which identify gender as a significant factor, we observed that women had a lower acceptance rate as reported in other studies [9,23,28-30] contrary to authors [9,23] who state that men were less likely than women to accept vaccines. The most probable motive why most women will not take the vaccine was concerned about the safety of vaccines. It is worth mentioning that social qualms on vaccine infertility among women that have once hit the country years ago can be the main reason.

In our data, although the number of persons in the house was not a predictor of vaccine hesitancy, however, it was significant in the univariate analysis. The higher the number of persons in the house the higher it impacts on a certain decision. This, therefore, support the fact that the family is the basic unit to advocate for vaccine uptake as parental decision remains optimal.

In this study, 66.7% of the respondents say they will only take the vaccine if it is mandatory, contrary to a survey carried out from 19 countries where most of the respondents, reported that they would less likely accept a COVID-19 vaccine if it was made mandatory [9]. However, studies have shown that making the vaccine mandatory may have a second negative consequence that might increase resistance not only to the COVID-19 vaccine but to other childhood vaccines [9,28]. On the other hand, mandatory administration of the vaccine should be avoided since coercion of the population will make more people less motivated to take up any other vaccine or erode their intrinsic motivation to be vaccinated. This can be justified by the fact that during the national immunization days for the vaccination campaign against polio meant for children under 5 years old, a significant proportion of the population refused to take Oral Polio Vaccines thinking it was COVID-19 vaccine [23]. Therefore a careful balance is required between educating the public about the necessity for universal vaccine coverage and avoiding any form of coercion.

5. LIMITATIONS

Most participants were not willing to answer the questionnaire thinking it was a strategic tool to be used for mandatory vaccination. Secondly, we did not use the HBM model to collect data.
However, the data obtained are relevant for a sample with the characteristics described in Table 1.

6. CONCLUSIONS

Our data showed that vaccine hesitancy was high and decisions on vaccine acceptance are multifactorial. Concerns about vaccine safety, side effects, effectiveness, and mistrust of information were the common concerns among hesitant participants. Clear and consistent education should focus not only on vulnerable populations but paying attention to the high-risk groups which include the low age group, Christians and Muslims, individuals with primary education, and rural communities. Clear and consistent communication by government officials is crucial to building public confidence in vaccine programs.

It is recommended that the government should ensure trust in the COVID-19 vaccine by carrying out effective campaigns to carefully explain the vaccine safety and effectiveness, mechanism of protection, and the importance of high vaccine coverage to achieve herd or community immunity through trusted channels like non-governmental organizations and the church. In addition, similar research is carried out in different towns to ascertain whether these deviating results are reflective of the people or the methodological design. This will help to evaluate COVID-19 vaccine hesitancy and its potential consequences on the general public.

DISCLAIMER

The questionnaire used for this research were derived from other studies in other countries. There is no conflict of interest between with the authors because we do intend to use these questionnaires only for the advancement of knowledge. Lastly, the research was funded by the personal efforts of the authors.

CONSENT AND ETHICS STATEMENT

The study was approved by the University of Bamenda ethical committee. The participants provided their informed consent to participate in this study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Polack FP, Thomas SJ, Kitchin N, Absalon J, Gurtman A, Lockhart S, et al. Safety and efficacy of the BNT162b2 mRNA COVID-19 Vaccine. N Engl J Med. 2020; 383(27):2603–15.
2. Al-Qerem WA, Jarab AS. COVID-19 Vaccination Acceptance and Its Associated Factors Among a Middle Eastern Population. Front Public Heal. 2021;9:1–11.
3. Malik AA, McFadden SAM, Elharake J, Omer SB. Determinants of COVID-19 vaccine acceptance in the US. EClinicalMedicine. 2020;26:100495. Available:https://doi.org/10.1016/j.eclinm.2020.100495
4. Afolabi AA, Ilesanmi OS. Dealing with vaccine hesitancy in Africa: The prospective COVID-19 vaccine context. The Pan African medical journal. 2021;38:3.
5. Ferdous MZ, Islam MS, Sikder MT, Mosaddek ASM, Zegarra-Valdivia JA, Gozal D. Knowledge, attitude, and practice regarding COVID-19 outbreak in Bangladesh: An online based cross-sectional study. PLoS One. 2020;15(10):1–29.
6. Ngwewondo A, Nkengazong L, Ambe LA, Ebogo JT, Mba FM, Goni HO, et al. Knowledge, attitudes, practices of/towards COVID 19 preventive measures and symptoms: A cross-sectional study during the exponential rise of the outbreak in Cameroon. PLoS Negl Trop Dis. 2020;14(9):1–15.
7. World Health Organization. WHO COVID-19 dashboard. Available:https://COVID19.who.int/. Accessed 14th January 2022
8. Syed Alwi SAR, Raffidah E, Zurraini A, Juslina O, Brohi IB, Lukas S. A survey on COVID-19 vaccine acceptance and concern among Malaysians. BMC Public Health. 2021;21(1):1–12.
9. Lazarus J V., Ratzan SC, Palayew A, Gostin LO, Larson HJ, Rabin K, et al. A global survey of potential acceptance of a
COVID-19 vaccine. Nat Med [Internet]. 2021;27(2):225–8. Available: http://dx.doi.org/10.1038/s41591-020-1124-9

10. Sarria-Guzmán Y, Fusaro C, Bernal JE, Mosso-González C, González-Jiménez FE, Serrano-Silva N. Knowledge, Attitude and practices (KAP) towards COVID-19 pandemic in America: A preliminary systematic review. J Infect Dev Ctries. 2021;15(1):9–21. Available: https://www.who.int/groups/strategic-advisory-group-of-experts-on-immunization/covid-19-materials

11. Fridman A, Gershon R, Gneezy A. COVID-19 and vaccine hesitancy: A longitudinal study. PLoS One [Internet]. 2021;1:1–12. Available: https://www.who.int/publications/i/item/vaccines/en/

12. Kreps SE, Kriner DL. Factors influencing Covid-19 vaccine acceptance across subgroups in the United States: Evidence from a conjoint experiment. Vaccine. 2021.

13. Abongwa et al. Available: https://covid19.who.int/table

14. Available: https://covid19.who.int/table

15. Available: https://www.mayoclinic.org/diseases-conditions/coronavirus/in-depth/herd-immunity-and-coronavirus/art-20486808

16. Available: https://ccdd.hsp.harvard.edu/2020/12/17/covid-19-vaccines-and-herd-immunity/

17. Available: https://www.populationpyramid.net/covid-immunity/

18. Available: https://ourworldindata.org/covid-vaccinations

19. Available: https://covid19.who.int/

20. Available: https://qz.com/africa/1836272/french-doctors-say-test-covid-19-vaccine-on-africans-spark-fury/

21. Available: https://www.mincom.gov.cm/en/2021/05/31/the-situation-of-covid-19-vaccine-in-cameroon/

22. Available: https://www.populationpyramid.net/covid-immunity/

23. Available: https://www.populationpyramid.net/covid-immunity/

24. Available: https://www.populationpyramid.net/covid-immunity/

25. Available: https://www.populationpyramid.net/covid-immunity/

26. Available: https://www.populationpyramid.net/covid-immunity/

27. Available: https://www.populationpyramid.net/covid-immunity/

28. Available: https://www.populationpyramid.net/covid-immunity/

29. Available: https://www.populationpyramid.net/covid-immunity/

30. Available: https://www.populationpyramid.net/covid-immunity/

31. Available: https://www.populationpyramid.net/covid-immunity/

32. Available: https://www.populationpyramid.net/covid-immunity/

33. Available: https://www.populationpyramid.net/covid-immunity/

34. Available: https://www.populationpyramid.net/covid-immunity/

10. Available: https://www.mincom.gov.cm/en/2020/06.074

11. Available: https://www.mincom.gov.cm/en/2020/06.074

12. Available: https://www.mincom.gov.cm/en/2020/06.074

13. Available: https://www.mincom.gov.cm/en/2020/06.074

14. Available: https://www.mincom.gov.cm/en/2020/06.074

15. Available: https://www.mincom.gov.cm/en/2020/06.074

16. Available: https://www.mincom.gov.cm/en/2020/06.074

17. Available: https://www.mincom.gov.cm/en/2020/06.074

18. Available: https://www.mincom.gov.cm/en/2020/06.074

19. Available: https://www.mincom.gov.cm/en/2020/06.074

20. Available: https://www.mincom.gov.cm/en/2020/06.074

21. Available: https://www.mincom.gov.cm/en/2020/06.074

22. Available: https://www.mincom.gov.cm/en/2020/06.074

23. Available: https://www.mincom.gov.cm/en/2020/06.074

24. Available: https://www.mincom.gov.cm/en/2020/06.074

25. Available: https://www.mincom.gov.cm/en/2020/06.074

26. Available: https://www.mincom.gov.cm/en/2020/06.074

27. Available: https://www.mincom.gov.cm/en/2020/06.074

28. Available: https://www.mincom.gov.cm/en/2020/06.074

29. Available: https://www.mincom.gov.cm/en/2020/06.074

30. Available: https://www.mincom.gov.cm/en/2020/06.074

31. Available: https://www.mincom.gov.cm/en/2020/06.074

32. Available: https://www.mincom.gov.cm/en/2020/06.074

33. Available: https://www.mincom.gov.cm/en/2020/06.074

34. Available: https://www.mincom.gov.cm/en/2020/06.074
35. Available: https://www.huffpost.com/entry/guillermo-maldonado-covid-19-vaccine-evangelicals_n_5fcfef83c5b6787f2a9b8c3. Accessed 10th September, 2021

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