Original Research Article

A survey on factors influencing COVID-19 Vaccine Hesitancy in the Bamenda-Cameroon

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 individual's 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 was analyzed using SPSS version 23.

Results: A total of 2531 participants of both sexes were included in the study with a mean age of 23.63±7.52years. Vaccine hesitancy was 97.6% (2,161). The main reason for vaccine hesitancy was safety concerns 72.3% (1786). Univariate analysis showed significant differences among the age groups, towns, marital status, monthly income, and religion. 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 FFCFA (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 was misinformation and lack of trust. Therefore a reduction in the COVID-19 vaccine hesitancy rate mandates a 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

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 189.92 million cases and 4.1 million deaths as of 16 July 2021[7]. Despite the successful response strategies made by many countries, the disease has spread across the globe and has threatened the healthcare system with appalling medical, economic, education, and social repercussions [1,2,6,8,9] 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].

WHO has approved different COVID-19 vaccines most of which have shown >95% 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) and Janssen or Johnson and Johnson (USA) [1,11]. Of these, Sinopharm, AstraZeneca, Janssen, 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 estimates 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 70% to 90% of the population needs to be vaccinated[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]. The effectiveness of these COVID-19 immunization programs depends on the population's willingness to be vaccinated however, vaccine hesitancy and refusal are significant concerns globally [2]. 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 [20,21].

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 and is growing worldwide. 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, vaccine safety, and efficacy, religious reasons, and personal beliefs wide-spread [8,21]. 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 1313 deaths ranking Cameroon among the first eleventh countries in Africa [22]. 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. By the 19th July 2021, a total of 48,971 vaccine doses have been administered given an acceptance rate of 8.28% despite the efforts made by the government in assuring the population of the safety of the vaccine [23]. 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.

METHODS, DESIGN, SETTING

A cross-sectional survey based on the administration of questionnaires was conducted among the inhabitants of the Bamenda from April 20th to May 20th, 2021 after approval from the university of Bamenda 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 [24]. The minimum number of participants to obtain statistically significant data was calculated to be 2401 [25].
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. The questionnaire was pre-tested and data collectors were trained to conduct the face-to-face interview while respecting the measures of infection prevention. The questionnaire was written in English language, approved, and pre-tested to minimize data errors. 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. Chi-square tests was used for socio-demographic and categorical data. The variables associated with COVID-19 vaccine hesitancy was 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 $p < 0.05$.

RESULTS

A total of 2531 participants were recruited for the study. Table 1 provides a synopsis of their socio-demographic features. A total of 55.8 % (1412) came from a rural town and 51.5% (1303) 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% (1779), whereas the elderly aged >39 years were the minority 5.5% (139). More than half of the participants were single 87.3 % (2210), unemployed 71.0 % (1797), and Christians 96.1 % (2432). The majority of them belong to a household number range of 2 to 4 persons ,39.4% (997), had attained tertiary education 47.6% (1204), with a monthly income <50,000 FFCFA, 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).

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 (FFCFA)	<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 Conditions	Medical	**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

Participants' Information regarding vaccines

Before the coming of the COVID-19 vaccine, a total of 85.4% (2,161) 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 haven taken between 5 or 6 of the 13(14 for females) available vaccines in the enlarge 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%(1578) followed by television/Radio 58.9%, (1491). The greater number of the respondents 63% (1595) 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 % (1775) respondents (48.2% (1220) 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% (2442) or example of any COVID-19 vaccine being administered 96.9% (2453). 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 a concern, the name of vaccine currently being used, 12.9% (328) respondents knew one or more vaccines. Of these (328 respondents), 48.5 %(159) most of them knew Sinopharm vaccine, followed by AstraZeneca 31.7%(104) and least by Sputnik V 1.5%(5).

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

Perception towards the COVID-19 vaccine hesitancy

As regards participant's willingness to receive the COVID-19 vaccine when it is available, only 2.4% (60) of the respondents answered 'Yes' while 60.4% (1529) answered 'No' (Figure 1). Those who said 'no', as well as those who were 'uncertain', were considered as vaccine hesitant. Of the 2471 respondents that were hesitant, 82.2% (2033) were willing to take the vaccine if recommended to them by different persons or organizations. More than half of the participants 50.17% (1451) will likely take the vaccine if recommended by a family member followed by a friend/Colleague 45.60% (927) (Figure 2). The main reason for vaccine hesitancy (Figure 3) was that of safety 72.3% (1786) while 68.88% (1702) said they did not trust the intention of the vaccine. Of the 82.86% (2093) persons who accepted to take the vaccine (those who said yes (60) and those who will take the vaccine is recommended to (2033)) more than half of the 66.70 % (1396) are willing to take the vaccine if only is mandatory while 35.64%(746) will take the vaccine for self-protection (Figure 4).

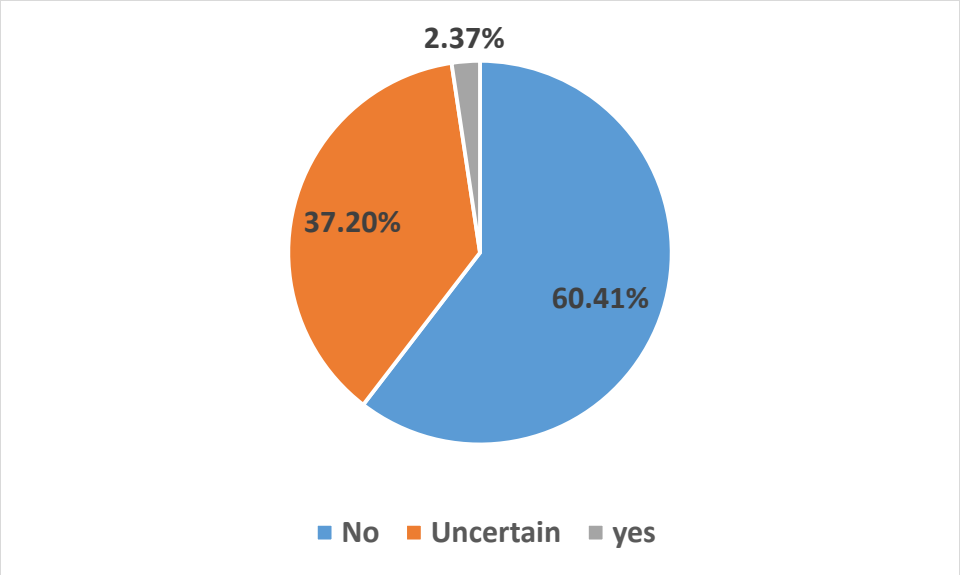

Figure 1: Willingness to take the COVID-19 vaccine

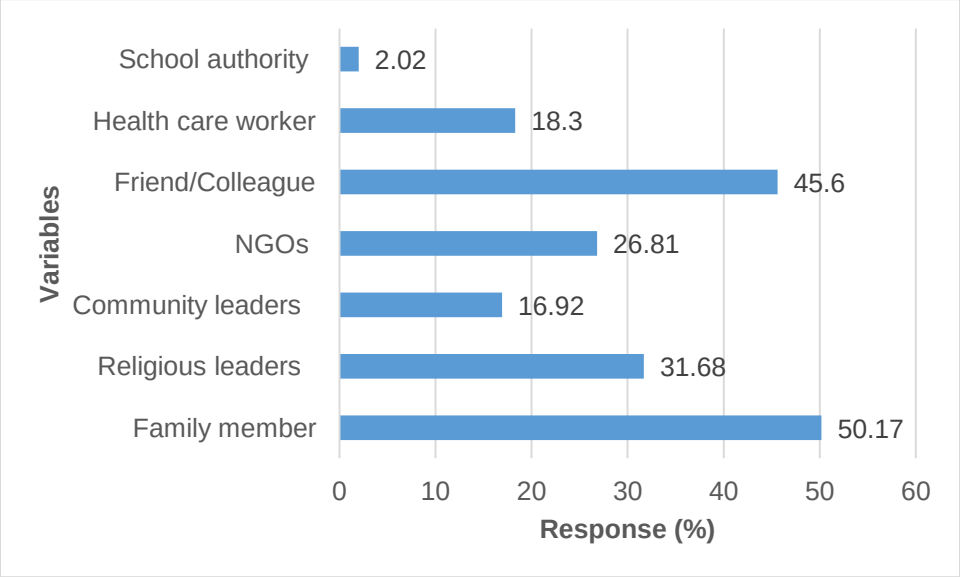

Figure 2: Persons or institutions to recommend the vaccine

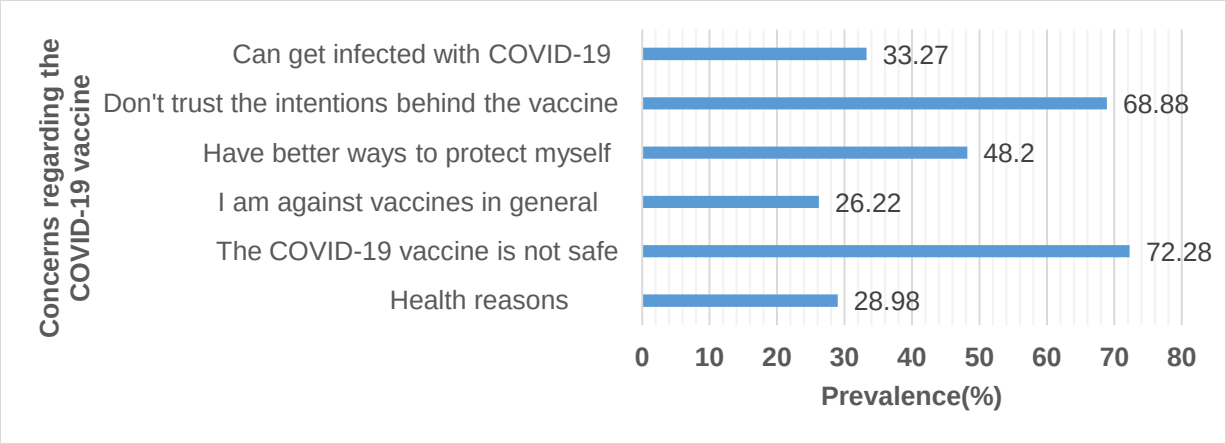

Figure 3: Reasons for vaccine hesitancy

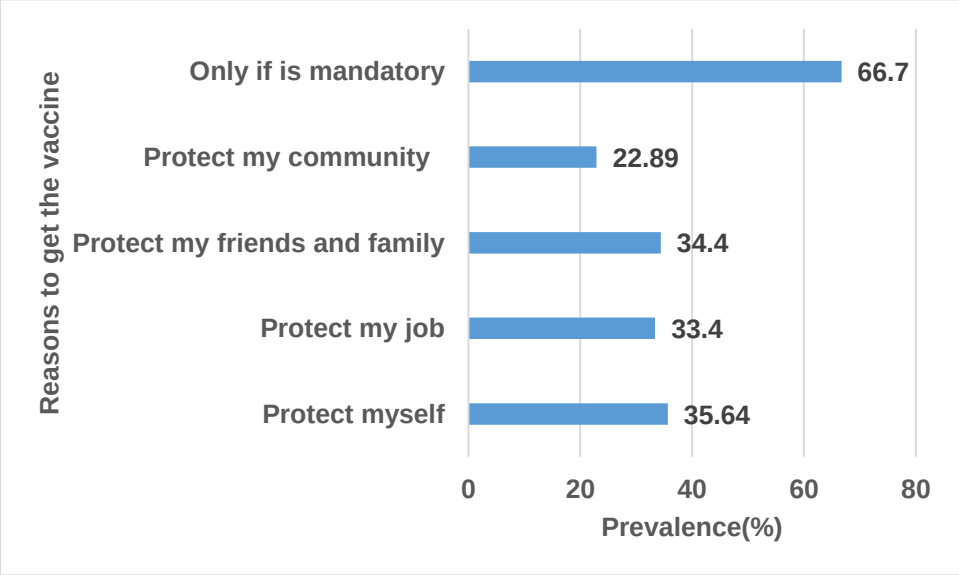

Figure 4: Reasons to get the vaccine

Our study reveal significant (p<0.05) high hesitancy in the age group between 20-29years (98.8%; 1755), resident in rural towns (98.5%; 1391), 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%; 2379). On the other hand, although hesitancy was high among males (98.1%, 1205), tertiary education (98. 3%, 1184), single (97.8%, 2161), and self-employed (97.8%, 1757) as seen in Table 3, these differences were not significant (p=<0.05).

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	1779	24 (1.3)	1755 (98.7)	
30-39	171	4(2.3)	167 (97.7)	
>39	139	10(7.2)	129 (92.8)	

Gender				
Female	1303	37 (2.8)	1266 (97.2)	0.11
Male	1228	23 (1.9)	1205 (98.1)	
Town				
Rural	1412	21 (1.5)	1391(98.5)	0.001
Urban	1119	39 (3.5)	1080(96.5)	
Marital Status				
Married	301	9 (3.0)	292 (97.0)	0.056
Single	2210	49 (2.2)	2161 (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	1768	41 (2.3)	1727 (97.7)	
Religion				
Christian	2432	53 (2.2)	2379 (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	1043	29 (2.8)	1014 (97.2)	0.050
Tertiary	1204	20 (1.7)	1184 (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	1797	40 (2.2)	1757 (97.8)	

FCFA Central African Franc 1USD ~ 565 FCFA

In this study, the socio-demographic variables that shows 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 include 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 4: Factors associated with vaccine hesitancy

Characteristic	**Crude Odds Ratio (OR)**			**Adjusted Odds Ratio (aOR)**		
	OR	**95% CI**	**P value**	**aOR**	**(95% CI)**	**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	
Religion						
Christian	16.562	0.01-0.20	0.0001	21.61	4.92-94.94	0.001
Muslim	5.488	0.02-0.70	0.019	8.67	1.42-52.82	0.02
None*			1		1	
House hold 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	
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**

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 [2,26]. In contrast, other studies reported an overall low vaccine hesitancy in the range of 3% to 35%. [2,3,8,20,27,28]. 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 actually reflect what prevail in the field as only 2.7% person of the entire population of the Northwest region have received that vaccine as of 23rd of September 2021(Regional Delegation of public health for the Northwest region [005/COM/NWR/RDPH], unpublished)

The highest source of information in this area was social media (62.3%) followed by family/friends [58.9%]. High use of social media as the main source of information about COVID-19 has also been reported by [8] and has contributed to the dissemination of false information since this information is not controlled and 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 result [2,9,28]. 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[26]. 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 [2,3,8,20,27,28].

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. 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-political situations in Bamenda that has 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. 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 2). Similar findings have been reported with another vaccine such as Human Papilloma Virus vaccine [29,30]. 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 reunion. 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 (3), 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 [2,8,20]. 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 [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 [31]. The 33.3% 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 [3,8,9,26–28]. The reasons are numerous and include; vaccine safety and effectiveness, fear of long term side effects, rational about the vaccine in Africa and distrust in government information. Secondly**, t**his can be attributed to the fact that COVID-19 severity and high death rates are associated with older age [28].

Our data, reveals that, locality significantly affects the willingness to be vaccinated. This indicates that people from the rural area 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 via useful messages through social media to help reduce the vaccine hesitancy rate.

We also observed in this study that higher income has a positive attitude toward receiving the vaccination as reported by [3,8,9,27]. 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.

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 [2] and with other vaccines like human papillomavirus vaccine [32]**.** However, it was contrary to reports by [26,27] 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 such as [27]. 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 suggesting that the coronavirus vaccine is the groundwork for the coming of the Antichrist. Other respondents believe that if the survival rate is above 98%, there is no need for a vaccine [33]. This account 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 [8] which identify gender as a significant factor, we observed that women had a lower acceptance rate as reported in other studies [9,20,26–28], contrary to [9,20] 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% 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 [9,26] 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. 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 [21]. Therefore a careful balance is required between educating the public about the necessity for universal vaccine coverage and avoiding any form of coercion.

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 on 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.

ABBREVIATIONS

COVID-19: Coronavirus disease 2019, SARS-CoV-2: severe acute respiratory syndrome coronavirus-2, WHO: World Health Organization

ETHICS STATEMENT

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

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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