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Assessment of COVID-19 vaccine hesitancy among Zimbabweans: A rapid national survey

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Abstract

Background

As a way of minimising the devastating effects of the coronavirus disease 2019 (COVID-19) pandemic, scientists hastily developed a vaccine. However, the scale-up of the vaccine is likely to be hindered by the widespread social media misinformation. We therefore conducted a study to assess the COVID-19 vaccine hesitancy among Zimbabweans.

Methods

We conducted a descriptive online cross-sectional survey using a self-administered questionnaire among adults. The questionnaire assessed willingness to be vaccinated; socio-demographic characteristics, individual attitudes and perceptions, effectiveness and safety of the vaccine. Multivariable logistic regression analysis was utilized to examine the independent factors associated with vaccine uptake.

Results

We analysed data for 1168 participants, age range of 19–89 years with the majority being females (57.5%). Half (49.9%) of the participants reported that they would accept the COVID-19 vaccine. Majority were uncertain about the effectiveness of the vaccine (76.0%) and its safety (55.0%). About half lacked trust in the government's ability to ensure availability of an effective vaccine and 61.0% mentioned that they would seek advice from a healthcare worker to vaccinate. Chronic disease [vs no chronic disease—Adjusted Odds Ratio (AOR): 1.50, 95% Confidence Interval (CI)I: 1.10–2.03], males [vs females—AOR: 1.83, 95%CI: 1.37–2.44] and being a healthcare worker [vs not being a health worker—AOR: 1.59, 95%CI: 1.18–2.14] were associated with increased likelihood to vaccinate.

Conclusion

We found half of the participants willing to vaccinate against COVID-19. The majority lacked trust in the government and were uncertain about vaccine effectiveness and safety. The policy makers should consider targeting geographical and demographic groups which were unlikely to vaccinate with vaccine information, education and communication to improve uptake.

Introduction

Since the first case of the coronavirus disease (COVID-19) caused by the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was reported in 2019, more than three million fatalities and 1.55 billion cases have been recorded globally [1] The healthcare systems have been strained and the adverse socio-economic and psychological impacts are overwhelming [2–4]. Fortunately, more than 100 vaccines have gone beyond the pre-clinical development phase with more than half of these reaching the clinical development phase [5]. The herd immunity for SARS-CoV-19 can be reached by vaccinating about 60–72% of the population [6], thus, vaccine acceptance rates will play a major role in combating the pandemic. However, vaccine hesitancy has been recognized as a major threat to the control of vaccine preventable diseases [7]. The recent COVID-19 pandemic has caused an outbreak of "infodemics" which has led to rapid and far-reaching spread of inaccurate information on the COVID-19 vaccine [8]. This deluge of unreliable information can contribute to COVID-19 vaccine hesitancy despite the availability of safe and effective vaccines [9]. Like many other developing countries, Zimbabwe has started the process of securing COVID-19 vaccine. A COVID-19 national deployment and vaccination strategy [10] has been developed and plans for national deployment and training of healthcare workers are underway. In this barrage of infodemics, Zimbabweans have not been spared as conspiracy beliefs filtered through the population, particularly through the different social media platforms. The best way to fight misinformation is through aggressive dissemination of accurate information about the truths of the risks and benefits of COVID-19 vaccine.

Evidence on the population's intention to be vaccinated for COVID-19 is limited and public health authorities are confronted with a challenge of objectively discerning the truth from the circulating information blast. Understanding the factors influencing vaccine hesitancy is pertinent in crafting targeted communication and interventions to sell the idea of vaccination to specific groups of people. We therefore conducted a national survey to assess COVID-19 vaccine hesitancy among Zimbabweans. We assessed socio-demographic characteristics, individual attitudes and perceptions, Covid-19 vaccine effectiveness and safety, and risks of contracting the COVID-19 in relation to the uptake of the COVID-19 vaccine.

Methods

Study design

We conducted an online descriptive cross-sectional survey in February 2021.

Study setting

The study was conducted in Zimbabwe. By the end of 2020, the country had an estimated population of 15.1 million [11]. Approximately 99.6% of the population is of African origin and

the median age is 18.7 years [12]. Geographically, the country is divided into 10 provinces and 63 districts. The first COVID-19 case was recorded on the 20th of March 2020 and according to the Zimbabwean Ministry of Health and Child Care Daily COVID-19 Update Report of the 11th of May 2021, the country had recorded a cumulative of 38 466 cases, 36 277 recoveries, and 1579 deaths [13].

Study participants

All Zimbabwean residents were eligible to participate in the survey. Considering the online nature of the survey and the easy sharing via social networks, we allowed Zimbabweans out of the country to participate but were excluded from the analysis because (information to inform local context) their COVID-19 vaccine uptake was more likely to be influenced by their current context. We included adults aged 18 years and above and those who had participated but below 18 years were excluded. The survey was disseminated mainly via social media networks (WhatsApp and Facebook) hence those registered in those platforms were likely to participate. Mobile internet takes up 98% of all internet use in Zimbabwe with WhatsApp accounting for up to 44% of all mobile internet usage [14] while Facebook takes up 9% of the usage [15].

Sample size

The minimum sample size was estimated at 423, based on the following assumptions; 95% confidence interval, 5% margin of error, the expected proportion of vaccine uptake estimated as 52% [16] in the adult population in Zimbabwe and the attrition rate of 10%.

Data collection tools and procedures

A multi-item survey questionnaire was developed based on literature review [17, 18]. These were validated and published COVID-19 vaccine hesitancy questions which were adopted and adapted to the context of this study. The online questionnaire was designed using Google Forms and a link was provided to participants. To prevent participants from responding to the survey multiple times, the resubmission link was turned off soon after the participant had submitted their completed survey. The survey questionnaire was developed in English and later translated into the two main local languages in Zimbabwe, Shona, and Ndebele. The survey questionnaire comprised of five sections with the first section collecting participant's demographic data (age, sex, residence, educational level, employment status, medical aid status). The second section consisted of questions soliciting information and knowledge on COVID-19 vaccine. The third section sought to assess vaccine uptake, effectiveness, and safety. The fourth section assessed the risk of contracting COVID-19. We also collected qualitative information through open-ended questions and will be reported separately.

Study variables

Our dependent variable was vaccine acceptance in the event that a COVID-19 vaccine becomes available and it had three responses, "Would Accept", "Unsure" and "Would reject". However, for our analysis we combined our responses into binary those that will be vaccinated "Yes" (Would Accept) and those that would not be vaccinated, "No" (Unsure/Would reject). The independent variables were the socio-demographic characteristics such as age, sex, occupation, chronic conditions, residence etc. Perceived COVID-19 vaccine efficacy and safety as well as the perceived risk of contracting the disease were treated as categorical variables and were scaled as 'very', 'somewhat', 'not so', and 'not at all'.

Potential study participants were recruited using random sampling via social media mainly WhatsApp and Facebook through the network and contacts of the researchers. The researchers encouraged participants to share the online survey with others in their networks as well. The survey was also shared in social media groups for academic and community organizations. Measures were put in place to ensure that the questionnaire was taken only once. Data were collected over a period of 15 days from the 3rd of February 2021 to the 17th of February 2021.

Statistical analysis

A database was created in Microsoft Excel using the data extracted from the online server. Responses from the Shona and Ndebele questionnaires were coded into English and then merged into one English database. Data cleaning was done in Excel before exporting it to SPSS for analyses. Statistical analysis was performed using SPSS (V.26.0). Descriptive statistics were used to describe demographic characteristics of the participants. Vaccine uptake proportions were computed and compared across groups using chi-square tests. Multivariable logistic regression analyses were conducted with vaccine uptake as the outcome and socio-demographic characteristics and attitudes and perceptions on vaccine effectiveness and safety as predictor variables. Adjusted odds ratios (AOR) and unadjusted odds ratios (UOR) with 95% confidence intervals were reported. Statistical significance was set at an alpha of $p < 0.05$.

Ethical considerations

Ethical clearance to carry out this study was obtained from the Medical Research Council of Zimbabwe (MRCZ/A/2714). Informed consent was provided online, and all participants were asked to accept or reject participation in the online survey. Participation in this study was voluntary and was not incentivized. All the responses provided during this survey were anonymous.

Results

Study participants

We received 1290 responses during the survey period. In terms of language, the distribution of responses was as follows: 1196 English, 71 Shona and 23 Ndebele. Of the 1290 participants who completed the survey, 122 were excluded from analysis for the following reasons (89 were based outside Zimbabwe, 4 were under the age of 18 years, 26 were duplicate responses, and in 3 age was missing). Duplication (where all fields were exact replica of the subsequent response in the downloaded dataset) was noted during data cleaning and the auto-duplicates may have been a result of unstable internet connection during the submission of the completed survey form. We finally analysed 1168 participants. The study participants were from all the 10 provinces of Zimbabwe and half (50.5%) were from Harare province which houses the capital city of the country.

Socio-demographic characteristics of the study participants

A total of 1168 participants were included in the study with a median age of 39 years (interquartile range; IQR: 32–49) and an age range of 19–89 years. Table 1 shows a summary of the socio-demographic characteristics of the participants and their likelihood of getting vaccinated. The majority of the study participants were in the 36–45 years age group. Females constituted (57.5%) while 36% were health care workers. A significantly higher proportion (92.6%) of participants was residing in an urban setting. About 41.2% of the participants reported having at least one chronic condition. More than 90% reported having a good health

Table 1. Socio-demographic characteristics and vaccine hesitancy.

Characteristic	Total Sample n (%)	Vaccine uptake		
		Yes (n = 579)	No (n = 589)	p-value
Age group (years)				0.06
18–25	125 (10.7)	53 (42.4)	72 (57.6)	
26–35	308 (26.4)	141 (45.8)	167 (54.2)	
36–45	365 (31.3)	186 (51.0)	179 (49.0)	
46–55	214 (18.3)	109 (50.9)	105 (49.1)	
>55	156 (13.4)	90 (57.7)	66 (42.3)	
Sex				<0.001
Male	496 (42.5)	280 (56.5)	216 (43.5)	
Female	672 (57.5)	299 (44.5)	373 (55.5)	
Health care worker				0.002
Yes	420 (36.0)	234 (55.7)	186 (44.3)	
No	748 (64.0)	345 (46.1)	403 (53.9)	
Chronic conditions				<0.001
Yes	481 (41.2)	276 (57.4)	205 (42.6)	
No	687 (58.8)	303 (44.1)	384 (55.9)	
Health status*				0.62
Good	1054 (90.2)	520 (49.3)	534 (50.7)	
Not so good	114 (9.8)	59 (51.8)	55 (48.2)	
Tertiary education				0.86
Yes	1102 (94.3)	547 (49.6)	555 (50.4)	
No	66 (5.7)	32 (48.5)	34 (51.5)	
Residence				0.07
Urban	1081 (92.6)	544 (50.3)	537 (49.7)	
Rural	87 (7.4)	35 (40.2)	52 (59.8)	
Employment status				0.33
Employed	955 (81.8)	465 (48.7)	490 (51.3)	
Not employed	103 (8.8)	58 (56.3)	45 (43.7)	
Student	110 (9.4)	56 (50.9)	54 (49.1)	
Medical Aid				0.67
Yes	922 (78.9)	460 (49.9)	462 (50.1)	
No	246 (21.1)	119 (48.4)	127 (51.6)	
Medical Home				0.05
Yes	895 (76.6)	458 (51.2)	437 (48.8)	
No	273 (23.4)	121 (44.3)	152 (57.7)	
Telehealth access				0.18
Yes	665 (56.9)	341 (51.3)	324 (48.7)	
No	503 (43.1)	238 (47.3)	265 (52.7)	
Got COVID-19[#]				0.01
Yes	57 (4.9)	19 (33.9)	38 (66.7)	
No	1111 (95.1)	560 (50.4)	551 (49.6)	
Confident in vaccine safety				<0.001
Extremely confident	407 (34.8)	235 (57.7)	172 (42.3)	
Very confident	271 (23.2)	212 (78.2)	59 (21.8)	
Somewhat confident	250 (21.4)	115 (46.0)	135 (54.0)	
Not so confident	93 (8.0)	7 (7.5)	86 (92.5)	
Not at all confident	147 (12.6)	10 (6.8)	137 (93.2)	

(Continued)

Table 1. (Continued)

Characteristic	Total Sample n (%)	Vaccine uptake		
		Yes (n = 579)	No (n = 589)	p-value
Confident in vaccine effectiveness				<0.001
Extremely confident	381 (32.6)	225 (59.1)	156 (40.9)	
Very confident	287 (24.6)	222 (77.4)	65 (22.6)	
Somewhat confident	269 (23.0)	117 (43.5)	152 (56.5)	
Not so confident	98 (8.4)	5 (5.1)	93 (94.9)	
Not at all confident	133 (11.4)	10 (7.5)	123 (92.5)	

*Health status: 'Good'- self reported state of complete physical, mental, and social well-being and absence of a chronic disease. 'Not so good'-self-reported physical and mental ailment of an acute or chronic nature.

#Got COVID-19: 'Yes'- tested COVID-19 positive after a Rapid Diagnostic Test or DNA-PCR test or both. 'No': Tested COVID-19 negative after a Rapid Diagnostic Test or DNA-PCR test and asymptomatic patients.

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status and a similar proportion had tertiary education as the highest level of education achieved. About 5% reported having tested positive for COVID-19 at some point prior to the survey.

Among health care workers, only 6% of them reported having been diagnosed of COVID-19 prior to the survey. Additionally, about 37.9% of health care workers reported having at least one chronic condition (results not shown in the table). Using Chi-square tests, statistically significant differences in vaccine hesitancy were found based on socio-demographic characteristics and the highest prevalence of vaccine uptake was found in females, non-healthcare workers, individuals with no chronic conditions, individuals who had previously tested positive for COVID-19 and individuals who were not so confident or not at all confident in vaccine safety and vaccine effectiveness. Table 1 shows a summary of the socio-demographic characteristics of the participants.

Uptake of the vaccine

Half (49.9%) of the participants indicated that they would accept the COVID-19 vaccine if they are offered when it becomes available, about 31.1% were unsure of whether they would take the vaccine or not and the other 19% indicated that they would reject the vaccine outright. The proportion of vaccine uptake across the different age groups differed. Among adults aged 55 years and older, about 57.9% were willing to get vaccinated compared to only 43.9% in the 18–25 years age group. Among health care workers, 56.3% reported having an intention to get vaccinated. Additionally, 57.9% of those who reported having at least one chronic condition expressed willingness to get vaccinated once the vaccine was available. Participants with a tertiary education were indifferent about vaccination with 50% expressing interest. After combining responses on our outcome variable, half (49.9%) of the study participants would accept the vaccine, "Yes" (Would Accept) and the other half (50.1%) would not be vaccinated, "No" (Unsure/Would reject).

Risk of contracting the COVID-19 infection

Among those who had been previously diagnosed of COVID-19, about 37% indicated that their infection was not so severe, while the other 14% did not experience any severe symptoms due to the infection. Additionally, about 37% indicated that they were not worried of the possibility of re-infection by the virus. Approximately 77% of the participants were worried about
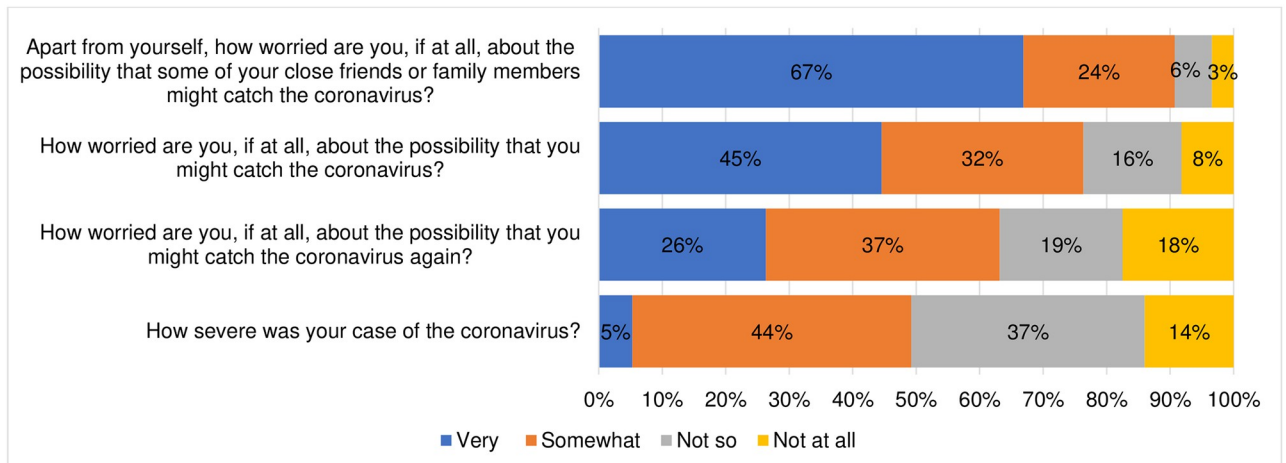
Fig 1. Risk of contracting COVID-19.

the possibility that they might contract the virus, while 91% were worried about the possibility that a friend or a relative might catch the virus. Fig 1 shows the perceived risk of contracting COVID-19.

Perceived vaccine effectiveness and safety of the COVID-19 vaccine. Approximately 76% of the participants did not think that the vaccine will be effective in reducing symptoms of the virus and another 72% indicated that they did not think that the vaccine will be effective in preventing infection. Slightly more than half (51%) of the participants indicated that they did not trust the government and other relevant authorities in ensuring that the vaccine is effective and safe. Fig 2 shows the perceived effectiveness and safety of the COVID-19 vaccine.

Decision to be vaccinated with the COVID-19 vaccine. Among factors considered by participants in deciding to get vaccinated or not, we looked at convenience, availability,
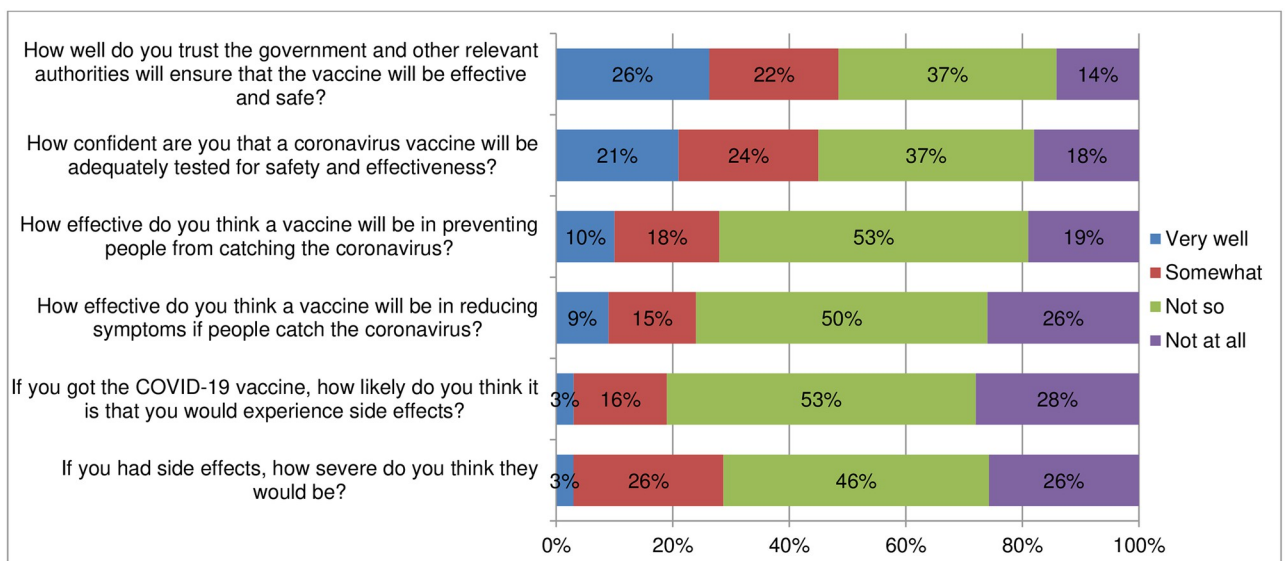
Fig 2. Perceived vaccine effectiveness and safety of the COVID-19 vaccine.

Fig 3. Decision to be vaccinated with the COVID-19 vaccine.

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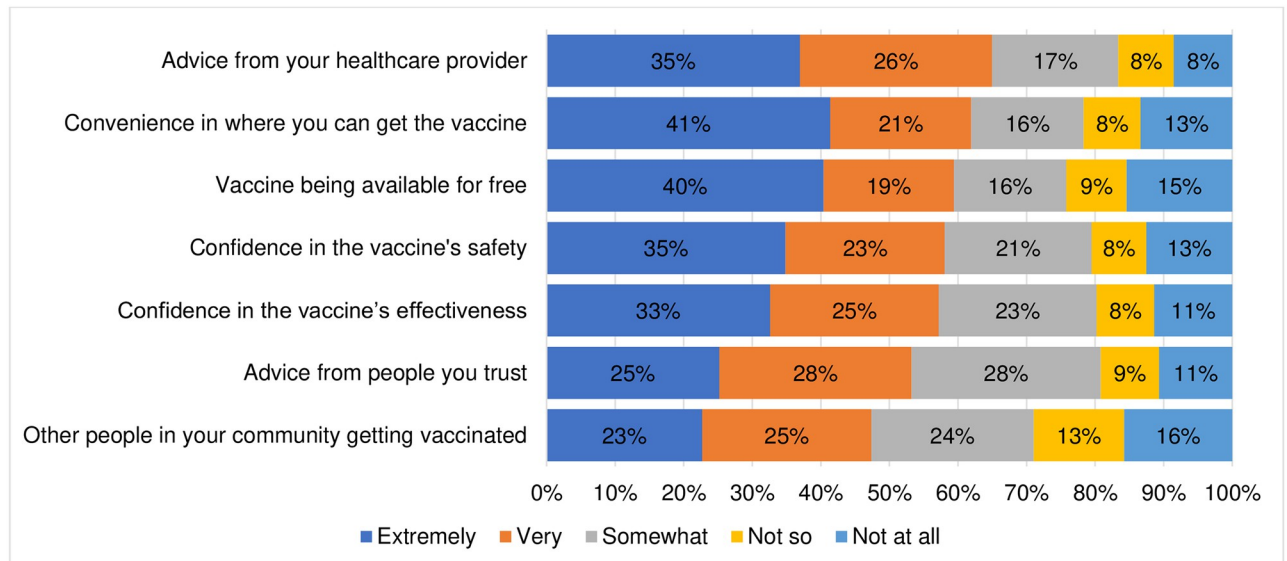
confidence in vaccine efficacy, vaccine effectiveness, and potential sources of advice. About 58% of the adults indicated that they would strongly consider vaccine effectiveness in their decision-making process. A similar proportion also identified free vaccine access and vaccine safety as important factors in deciding whether to get vaccinated for COVID-19 or not. Fig 3 shows the preferences of the adults on the different factors assessed.

Factors associated with intention to be vaccinated with the COVID-19 vaccine

Different covariates were assessed on their association with intention to vaccinate using logistic regression analysis (Table 2). After adjusting for all covariates of interest, health care workers were 1.59 times more likely to get vaccinated when compared to non-health care workers [AOR: 1.59, 95% CI: (1.18–2.14)]. Being male [vs female AOR: 1.83, 95% CI: (1.37–2.44)] and having at least one chronic condition [vs no chronic condition AOR: 1.50, 95% CI: (1.10–2.03)] were significantly associated with intention to vaccinate.

Compared to those who were extremely confident in vaccine's safety, those who were not at all confident (AOR = 0.47), not so confident (AOR = 0.11), somewhat confident (AOR = 0.11) and very confident (AOR = 0.53) had significantly lower odds of vaccine uptake. Similarly, compared to those who were extremely confident in vaccine's effectiveness, those who were not so confident (AOR = 0.15), somewhat confident (AOR = 0.06) and very confident (AOR = 0.40) had significantly lower odds of vaccine uptake. Not so good health status, tertiary education, and medical home (having a primary health care doctor) were associated with borderline likelihood of getting vaccinated. We assessed the same covariates among the health care workers sub-group, and being male [vs females, AOR: 1.74 95% CI: (1.02–2.94)] was associated the likelihood of getting vaccinated. Also being somewhat confident in vaccine's safety (AOR = 0.07), not so confident in vaccine's effectiveness (AOR = 0.03), and somewhat confident in vaccine's effectiveness (AOR = 0.07) were significantly associated with lower odds of getting vaccinated among health care workers.

Table 2. Bivariate and multivariable logistic regression analysis—Predictors of vaccine uptake in study participants.

Variable	UOR	95% CI	AOR	95% CI
Age group (years)				
18–25	Ref		Ref	
26–35	1.15	0.75–1.75	1.28	0.66–2.50
36–45	1.41	0.94–2.13	1.50	0.76–2.98
46–55	1.41	0.90–2.20	1.37	0.66–2.83
>55	**1.85**	**1.15–2.98**	1.66	0.77–3.58
Sex				
Female	Ref		Ref	
Male	**1.62**	**1.28–2.04**	**1.83**	**1.37–2.44**
Health care worker				
No	Ref		Ref	
Yes	**1.47**	**1.16–1.87**	**1.59**	**1.18–2.14**
Chronic conditions				
No	Ref		Ref	
Yes	**1.71**	**1.35–2.16**	**1.50**	**1.10–2.03**
Health status				
Good	Ref		Ref	
Not so good	0.91	0.62–1.34	1.03	0.64–1.66
Tertiary education				
No	Ref		Ref	
Yes	1.05	0.64–1.72	0.66	0.35–1.26
Residence				
Urban	Ref		Ref	
Rural	0.66	0.43–1.04	0.79	0.46–1.35
Employment status				
Not employed	Ref		Ref	
Student	0.81	0.47–1.38	1.41	0.61–3.21
Employed	0.74	0.49–1.11	**0.57**	**0.32–0.99**
Medical Aid				
No	Ref		Ref	
Yes	1.06	0.80–1.41	0.76	0.52–1.11
Medical Home				
No	Ref		Ref	
Yes	**1.32**	**1.00–1.73**	1.27	0.88–1.83
Telehealth access				
No	Ref		Ref	
Yes	1.17	0.93–1.48	1.10	0.83–1.47
Got COVID19				
No	Ref		Ref	
Yes	**0.49**	**0.28–0.86**	0.56	0.28–1.12
Confident in vaccine safety				
Extremely confident	Ref		Ref	
Very confident	**0.24**	**0.16–0.35**	**0.53**	**0.29–0.97**
Somewhat confident	**0.02**	**0.01–0.05**	**0.11**	**0.04–0.31**
Not so confident	**0.02**	**0.01–0.04**	**0.11**	**0.03–0.34**
Not at all confident	**0.38**	**0.27–0.54**	**0.47**	**0.28–0.79**

(*Continued*)

Table 2. (Continued)

Variable	UOR	95% CI	AOR	95% CI
Confident in vaccine effectiveness				
Extremely confident	Ref		Ref	
Very confident	**0.23**	**0.16–0.33**	**0.40**	**0.22–0.73**
Somewhat confident	**0.02**	**0.01–0.04**	**0.06**	**0.02–0.19**
Not so confident	**0.02**	**0.01–0.05**	**0.15**	**0.05–0.48**
Not at all confident	**0.42**	**0.30–0.60**	0.78	0.46–1.30

Statistical significance at 5% alpha and bold indicates statistically significant odds of vaccine uptake, CI: confidence interval, Ref: reference category, UOR: Unadjusted Odds Ratio, AOR: Adjusted Odds Ratio.

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Discussion

Our study was the first to assess the COVID-19 vaccine hesitancy and uptake at national level in Zimbabwe. The study findings showed that half of the study participants reported that they would accept the COVID-19 vaccine if it becomes available. The majority of the survey participants were uncertain about the effectiveness of the vaccine and lacked confidence on the safety of the vaccine. About half lacked trust in the government's ability to ensure that the vaccine will be effective and most participants would seek the advice of a healthcare worker first before getting vaccinated. Presence of chronic disease/condition, male gender and being a healthcare worker were associated with increased likelihood of vaccine acceptance while confidence in vaccine's safety and vaccine's effectiveness were associated with reduced likelihood of vaccine acceptance.

Our study findings showed that half of the participants (50%) were willing to take the COVID-19 vaccine while the other half were either unsure or would reject taking the vaccine. These findings are consistent with other African studies from the Democratic Republic of Congo (DRC) (56%) [19], and Nigeria (50%) [20]. The similarities in findings may be due to resemblances in the methodology used, as well as socio-economic and political settings in DRC, Nigeria, and Zimbabwe. However, a South African survey showed that about 71% were willing to get vaccinated against COVID-19 [21]. Based on the significant difference in vaccine acceptance for this study and the South African study, one might hypothesize that South Africans were more likely to accept the vaccine given the high numbers of reported COVID-19 cases and fatalities as compared to the other countries (DRC, Nigeria, and Zimbabwe).

Moreover, the surveys from DRC, Nigeria and this study were conducted before the vaccine was rolled out and conspiracy theories on the COVID-19 vaccine were at their peak thus, the researchers predict an increase in vaccine acceptance as more accurate information penetrates the population, more people getting vaccinated and vaccine effectiveness being witnessed in those who would have been vaccinated. The level of vaccine hesitancy found in our study was low when compared to the required COVID-19 herd immunity i.e. 60–70% [22]. A COVID-19 vaccine uptake of 50% may not be adequate based on Zimbabwean government's plans to vaccinate 60% of the population as a way of reaching the herd immunity threshold [23]. Therefore, there is a need to come up with strategies to increase the proportion of citizens willing to get the COVID-19 vaccine. Strategies that have been shown to increase COVID-19 vaccine uptake include engagement of community leaders, social mobilization tactics, mass media campaigns, the use of reminder and follow-up systems, training and education of health care professionals, incentives, vaccine mandates, efforts to make vaccine more accessible, and efforts to increase general knowledge and awareness [24, 25].

Healthcare workers who took part in this study were more likely to accept the COVID-19 vaccine and this finding corroborated with a study in the U.S [26]. It can be hypothesised that healthcare workers perceived their susceptibility to contract COVID-19 as high as evidenced by a study which reported that healthcare workers had a more than seven-fold higher risk of severe COVID-19 across all occupational groups [27]. Since health providers have the moral obligation not to harm their patient [28], they may feel compelled to protect the sick and vulnerable patients by getting vaccinated themselves. This is a decisive finding since healthcare workers' vaccine acceptance can easily untangle vaccine hesitancy when recommending the vaccine to their clients. The health providers can also serve as role models of vaccine acceptance for the general population. Efforts to combat COVID-19 vaccine hesitancy among the general population can utilize the increased intention to vaccinate among health workers by making them community outreach vaccine advocates. Most of the study participants doubted the effectiveness of the COVID-19 vaccine. This was consistent with findings from an African study where despite the respondents' agreement with the importance of vaccinating the population against SARS-CoV-2, many had reservations about the effectiveness and safety of the vaccine [29]. The doubting of the effectiveness could be attributed to several reasons. Firstly, this could be attributed to the lack of information on how the vaccine was developed and tested. There has been concern on how some vaccines were developed with people preferring those thought to have been developed transparently in comparison to those whose development was shrouded with secrecy [30, 31]. Secondly, there were concerns on whether trials were not rushed and regulatory standards relaxed considering the unprecedented speed at which the COVID-19 vaccines were developed [32]. The lack of lucid information on vaccine development exacerbates the vaccine hesitancy problem and it is essential for health authorities to be equipped with authentic information on how the COVID vaccines were developed; thus, enabling them to disseminate factual information and allay the vaccine effectiveness related anxieties. The perceived lack of acceptance of the COVID-19 vaccine in Zimbabwe can partly be attributed to earlier reports on safety of the COVID-19 vaccines with respect to possible side- and adverse effects [33]. Some Zimbabweans became sceptical and reserved towards the vaccine especially after experts questioned the effectiveness of the vaccines developed before the 501. V2 coronavirus variant which originated from South Africa and appeared to be a more contagious strain infiltrating the country [23]. The widespread dissemination of vaccine safety information should be done before rolling out the vaccine to ensure that people make an informed decision based on scientifically proven information instead of rumours and conspiracy theories. The health authorities should continue to update citizens about vaccine side-effects and institute strong pharmacovigilant systems as well as, compensation schemes for severe adverse events as this might boost public confidence in vaccine safety [34, 35]. About half of the participants in this study lacked trust on whether the government and relevant authorities would be able to provide a safe vaccine that would protect them from COVID-19. Such public insecurities were also observed in other studies on vaccine hesitancy [36, 37]. These public insecurities may be caused by unsubstantiated political statements, incapacities of the health system and centralisation of health services. Unscientific claims on COVID-19 by individuals in positions of authority can introduce uncertainties within the population and lower their trust in how the government is handling the pandemic. The Zimbabwean healthcare system is facing serious challenges including shortage of essential drugs, lack of equipment to carry out basic procedures, and skills migration thus, citizens may lack trust in the system's ability to contain the pandemic. Despite the proposed free COVID-19 vaccination, there are other indirect costs that could be incurred by citizens to get to the vaccination sites which are currently centralised at secondary and tertiary health facilities. Travelling costs and loss of productive time could be potential barriers to COVID-19 vaccination in low-

income settings like Zimbabwe. Thus, the government should work towards increasing the national health budget to cater for the excess service demand caused by the pandemic. It is also critical to decentralize vaccination sites and to use influential community leaders for community outreach activities.

Living with a chronic disease was associated with a high likelihood of vaccine acceptance. This finding corroborated with a similar study in Mozambique where participants who had pre-existing chronic conditions were more likely to accept the vaccine [38]. Multiple chronic conditions complicate the progression of COVID-19 [39]. Thus, the elderly and those with chronic conditions may have increased perceived vulnerability to the disease and are more likely to take steps towards protecting themselves from coronavirus.

We noted that males were more likely to accept the vaccine. Several other studies also revealed similar results [29, 30, 40–42]. This was an unexpected finding given the poor health seeking behaviour among men [43]. However, men constitute the highest proportion of the Zimbabwean workforce and the speculations that some organisations might prioritise or mandate vaccination among their employees to continue productivity in wake of anticipated lockdowns might have influenced men's decision. The reduced vaccine acceptance among women can be attributed to a lack of information of the safety of the vaccine especially with regards to conception related matters; however experts believe that the vaccines were unlikely to pose a risk to pregnant and lactating woman [44]. The finding that among the health care worker subgroup, males were also likely to be vaccinated than females can be explained by some of the reasons discussed above. Health authorities have the responsibility to give women updated information on the safety of the vaccine during the community outreach activities. It was surprising to note that 39% of those who reported previous COVID-19 infection in this study were less likely to be vaccinated. This is despite the fact that those with a history of prior infection could be reinfected by SARS-CoV-2 even after recovering from the initial infection [45]. Studies have shown that primary infection only provides short term protective immunity against SARS-CoV-2 [46–48]. Individuals who would have recovered from coronavirus infection may perceive their susceptibility as low assuming that they would have garnered natural immunity. Although those who have been previously infected by SARS-CoV-2 are less likely to have a repeat infection when compared to those without evidence of previous infection, they are still susceptible to reinfection [49], hence, the need to be vaccinated as well. The present study noted that rural residents were less likely to pursue COVID-19 vaccination when compared to those residing in urban areas. This finding corroborates with findings from other similar studies [30, 36, 50]. This could be attributed to poor information penetration and reduced perceived susceptibility risk among the rural folks. The finding can also be explained by the fact that rural residents have reduced health literacy and awareness, reduced trust and interaction with healthcare workers, and presumed cost-based concerns [36, 51, 52]. Information travels faster in urban areas where mass media and internet connection are readily available thus, it can be easier for those residing in urban areas to access authentic information about the vaccine when compared to most remote rural areas in Zimbabwe. This shows the importance of tailoring vaccine awareness strategies relative to populations residing in varying geographical regions. The authors recommend that policy makers consider geographical- and socio-cultural-specific information for education and communication when approaching the diverse residential settings.

Strengths and limitations

Our study assessed a broad range of factors that have been known to influence vaccine acceptance. The findings can be used to guide future health activities with an aim of improving

COVID-19 vaccine uptake or uptake of other vaccines. All the ten Zimbabwean provinces were represented although some were more represented than others. The data collection tools were distributed in all the three common languages used in Zimbabwe to accommodate the majority of citizens. The study received a fairly good response rate, which was unexpected by the researchers given that no incentives were given to cover internet connection fees. The increased use of internet services during the COVID-19 era enabled swift and cost-effective online data collection on the part of the researchers.

Despite the relatively large sample size, the generalizability of our findings can be hampered by our sampling method. The researchers used mainly their social media networks as proxies for distributing the data collection tool and this carries a possibility of bias in responding to the questionnaire. The study was also limited to those who had access to mobile phones, tablets, or computers, thus introducing a selection bias. We may have excluded the poor and the old who in fact are vulnerable to COVID-19. Besides, the data were collected before the vaccine was rolled out in the country and vaccine hesitancy may have waned as more authentic information became available to the population. The participants were mostly urban dwellers with easy access to internet connection and this could have potentially resulted in a selection bias leaving the rural population. The fact that this study utilized self-reported data makes it vulnerable to reporting bias.

There is a need for further studies to understand how COVID-19 vaccine hesitancy will evolve with time. With the COVID-19 vaccine now available in the country and already being given, studies should be conducted periodically to assess the time-sensitive aspect of the vaccine hesitancy among those who rejected the vaccine or were unsure of it. Our study reported the quantitative findings associated with COVID-19 vaccine; there is therefore a need for qualitative studies to explore contextual and other individual factors that lead to vaccine hesitancy. Since in our study we were unable to report vaccine hesitancy among targeted sectors of the populations e.g., education, commerce, tourism among others, studies are required to assess how vaccine hesitancy will vary across these sectors. These will enable targeted messaging to improve the vaccine uptake. Though we assessed vaccine hesitancy among health care workers, we were unable to disentangle our data to find out hesitancy among various groups of healthcare workers. Future studies looking into vaccine hesitancy among health care workers should be in position to assess vaccine hesitancy among doctors, nurses, pharmacists, and many other healthcare worker professionals. To try and be more representative, especially inclusion of the rural communities, future studies should be conducted physically so that the barrier of access to internet and electronic gadgets can be bridged. However, strategies to mitigate against COVID-19 infection and spread should be observed.

Conclusions

In our study, we found half of the participants were willing to get vaccinated against COVID-19 with the majority lacking trust in the government and being uncertain about vaccine effectiveness and safety. The high vaccine acceptance among health workers and the finding that the majority will consult health care workers before deciding to vaccinate, can be a good foundation to launch a successful COVID-19 vaccine awareness campaign in the country. However, the level of vaccination uptake is way below the expected herd immunity hence the government and other relevant authorities should provide timely and accurate information through community-wide campaigns. Strategies should also be put in place to target and prioritise groups likely not to vaccinate such as females and those without chronic conditions. The government and other relevant authorities should aim for a more transparent strategy since it will contribute to public trust and increased acceptability of the vaccine.

Supporting information

S1 File. This is the dataset that was used in data analysis.
(XLSX)

Acknowledgments

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