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A cross-sectional survey of COVID-19 testing status among vaccine recipients in Gombe State, North-Eastern Nigeria

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Abstract

The COVID-19 testing status and vaccine acceptance are two key components of any COVID-19 control program as they are important in evaluating the prevalence of the disease as well as curbing the spread of the SARS-CoV-2, the causative agent of COVID-19. Hence, the aim of this study was to conduct a non-probability cross-sectional survey of COVID-19 vaccine recipients in Gombe State to determine their testing status and socio-demographic profiles. A total of 872 vaccine recipients were included in this study. The descriptive analysis revealed that the median age group was 30–39 years. More than half (57.7%, $n=503$) of the study participants earned 50,000 Naira or less and approximately 51% of the vaccine recipients ($n=444$) had tertiary education. Approximately one-third (35.1%, $n=306/872$) of the study participants have been previously screened for SARS-CoV-2 and the COVID-19 positivity rate among them was 6.9% ($n=21/306$). Some 108 (18.2%) persons reported Adverse Event Following Immunization (AEFI). The multivariable logistic regression analysis revealed that the age [30–39 years, (OR: 1.76; 95% CI: 1.13, 2.74; $p=0.041$)], monthly income [150,000 naira and above (OR: 10.43; 95% CI: 2.22, 21.88; $p<0.001$)], and background [health-related, (OR: 6.30; 95% CI: 4.35, 9.13; $p=0.01$)] of the vaccine recipients was significantly associated with the COVID-19 testing status. The COVID-19 testing status of vaccine recipients is low. Hence, mass COVID-19 screening strategies should be implemented together with improved vaccine advocacy to focus on vaccine safety and efficacy.

Keywords COVID-19, Socio- demographic, Vaccine acceptance, COVID-19 testing, Nigeria

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Introduction

The 2019 coronavirus disease (COVID-19) pandemic has caused a serious global public health crisis with severe socio-economic implications, especially in low-and middle-income countries (LMICs) [1, 2]. As of 25th May 2023, more than 689 million confirmed COVID-19 cases and over 6.88 million deaths have been recorded in over 200 countries and some 13.4 billion doses of the COVID-19 vaccine have been administered [3]. The burden of COVID-19 in Nigeria has been average as the country has detected 266,675 confirmed COVID-19 cases and 3,155 COVID-19-associated deaths [4]. Since its index case on the 20th of April 2020, Gombe state has recorded 3,313 confirmed COVID-19 cases and 66 COVID-19-related deaths as of 25th May 2023 [4].

The epidemiology of COVID-19 in Nigeria was complicated as the pandemic exposed the most critical loopholes in Nigeria's public health sector, especially in its poor diagnostic and genomic surveillance capacities [5]. Furthermore, Nigeria's poor adherence to the laid down non-pharmaceutical interventions meant the country needed more effective ways to curb the spread of SARS-CoV-2 [6–8]. Hence, pharmaceutical interventions such as COVID-19 vaccines were needed. Several COVID-19 vaccines were granted emergency use authorization to protect lives [9]. Then came the global challenge of vaccine inequity, which resulted in huge disparities in vaccination rates between high-income countries (with an average of 75–80%) and low and middle-income countries (< 10%) [10].

Despite these obvious inequalities, multinational pharmaceutical companies did not release the patent to allow for the local production of COVID-19 vaccines [11]. Hence, most LMICs including Nigeria depended on vaccine donations from regional bodies such as Africa Center for Disease Control and Prevention (Africa CDC) or multinational organizations and donor countries [12, 13]. Slightly over two years since its index vaccination (5th of March 2021), Nigeria has administered over 112 million doses of the COVID-19 vaccine across the country [14] and has cumulatively vaccinated 53.36 per 100 persons across the country [15]. With varying vaccination rates across the country, Northeastern states ($n = 6$) have the highest population of fully vaccinated citizens [15].

In contrast to the increasing cumulative COVID-19 vaccination rates, Nigeria's COVID-19 testing system is sub-optimal [5] and the country has only screened 5.7 million samples as of 20 April 2023 [4]. In addition to its use in disease control, COVID-19 testing was shown to be positively associated with increased vaccination acceptance as participants tested for COVID-19 were 4.71 times more likely to accept the COVID vaccines [16]. Also, evaluating the COVID-19 testing status and profiles of vaccine recipients would provide information on effective health communication strategies necessary to increase the public acceptance of COVID-19 vaccines [17]. Hence, the aim of this study was to assess the COVID-19 testing status as well as the socio-demographic profiles of the COVID-19 vaccine recipients in Gombe State, North-Eastern Nigeria.

Methods

Survey methodology

The study was administered as one-on-one interviews with vaccine recipients from four selected COVID-19 vaccination centers. These centers were selected due to the high turnout of vaccine recipients and their strategic locations. The study was purposively done in three adjourning LGAs (Akko, Billiri, and Gombe) from which a vaccination center was selected in each LGA by simple random sampling technique. Finally, we selected the University Hospital Vaccination Center which serves all the neighboring communities of the federal university in Gombe state. These vaccination centers were selected due to the higher volume of recipients, their location, and the ease of access. Data collectors were trained, supervised, and randomly distributed to the vaccination centers. We avoided clustering responses by interviewing each respondent independently. The questionnaire was designed in English but was verbally translated into the respondents' languages where necessary (Hausa language). The survey instrument was administered to the intending vaccine recipients during the registration phase before their vaccination or in a few cases after the inoculation of the vaccine. Study participants were selected using the simple random sampling technique. The required sample size was computed using an online sample size calculator, Raosoft Inc [18]. At a 96% confidence interval and a 4% margin of error, assuming a 50% vaccine acceptance rate, the required sample size was 659 vaccine recipients [19]. Hence, a target of 165 vaccine recipients was targeted in each of the four vaccination centers. A total of 872 study participants were eventually included in this study as more voluntary vaccine recipients were recruited from the University Clinic Vaccination Center.

Study design, study participants, and sampling

This study was designed as a cross-sectional survey of adult COVID-19 vaccine recipients (18 years and above) from the three neighboring Local Government Areas (LGAs) of Gombe State. The state has a population of approximately 3.25 million people. The survey started on the 28th of December 2021 to the 31st of January 2022. The study was conducted as a one-on-one interview at the four adjourning COVID-19 vaccination centers in the state. In Gombe State, each LGA has at least one vaccination center. Recently, several strategies to increase

vaccination coverage and uptake have resulted in new vaccination points including several mobile vaccination teams that conduct COVID-19 vaccination outreach programs.

Questionnaire design

To obtain information on the COVID-19 testing status and the socio-demographic parameters of vaccine recipients, we adapted a semi-structured questionnaire from a previous study that evaluated the socio-demographic characteristics of COVID-19 vaccine recipients in Kwara State [17] and administered it as one-on-one interviews using paper questionnaires in Gombe State. The survey instrument was first conducted as a pre-test on 20 vaccine recipients in Gombe Metropolis to estimate the time required to fill out the survey, the need for translation, and other technical and contextual evaluations. Responses obtained from the pre-test were not incorporated in the final analysis of the dataset. The survey instrument was sub-categorized into two sections: A and B. Section A assessed the socio-demographic characteristics of the respondents (age, gender, level of education, monthly income, occupation, background, and marital status) while Section B focused on the COVID-19 vaccine (Supplementary file 1).

Table 1 Socio-demographic characteristics of COVID-19 vaccine recipients in Gombe state ($n=872$)

Variable	Frequency (%)
Age (Years)	
18–29	219 (25.1)
30–39	384 (44)
40–49	190 (21.8)
50–59	68 (7.8)
> 60	11 (1.3)
Gender	
Female	408 (46.8)
Male	464 (53.2)
Monthly income (Nigerian Naira)	
50,000 or less	503 (57.7)
51,000–100,000	273 (31.3)
101,000–150,000	74 (8.5)
151,000–200,000	18 (2.06)
> 200,000	4 (0.46)
Level of Education	
No formal education	30 (3.44)
Primary education	28 (3.21)
Secondary education	370 (42.43)
Tertiary education	444 (50.92)
Occupation	
Government employee	205 (23.51)
Private company or self-employed	552 (63.3)
Student	115 (13.19)
Background	
Working in a health-related field	404 (46.33)
Working in a non-health-related field	468 (53.67)
Marital Status	
Single	196 (22.48)
Married	612 (70.18)
Divorced/Widowed	64 (7.34)

Data analysis

The data were summarized using SPSS v. 28. We presented descriptive data as frequencies and proportions. Because only vaccine recipients were included in this study, we could not test for an association between the socio-demographic variables and vaccine acceptance. However, we conducted univariable and multivariable logistic regression analysis to test for the association between the socio-demographic variables (age, gender, level of education, monthly income, marital status, background, and occupation) and the COVID-19 testing status (tested and untested) of the study participants. All inferences were made based on the odd's ratio generated from the multivariable logistic regression model at $p<0.05$.

Ethical approval

The ethical clearance of this study was obtained from the Ministry of Health, Gombe State of Nigeria (Reference number: MOH/ADM/621/S/456). A personalized written informed consent was obtained from each respondent after brief information on the purpose of the study was provided to them in groups. The respondents signed the paper questionnaire when the survey instrument was administered to the participants. Participation in this survey was voluntary and without prejudice as specified in the World Medical Association Declaration of Helsinki Ethical principles as participants were free to withdraw from the survey at any time [20].

Results

Structure of COVID-19 vaccine recipients in Gombe state

A total of 872 vaccine recipients were included in this study. They were very diverse as vaccine recipients consisted of all age groups, gender, and level of education, as well as from varying social classes. The majority of the study participants were aged between 30 and 39 years old. More than half (57.7%, $n=503$) of the study participants were low-income earners and earned 50,000 Naira or less (~ 2 USD per day). Similarly, approximately 51% of the vaccine recipients ($n=444$) had tertiary education in universities, colleges of education, or polytechnics. Only very few vaccine recipients had no formal or basic education (Table 1). The occupation of our study participants was widely distributed between self-employed or workers in private companies (63.3%, $n=552$), government employees (23.51%, $n=205$), and students (13.19%, $n=115$). The background of the vaccine recipients was

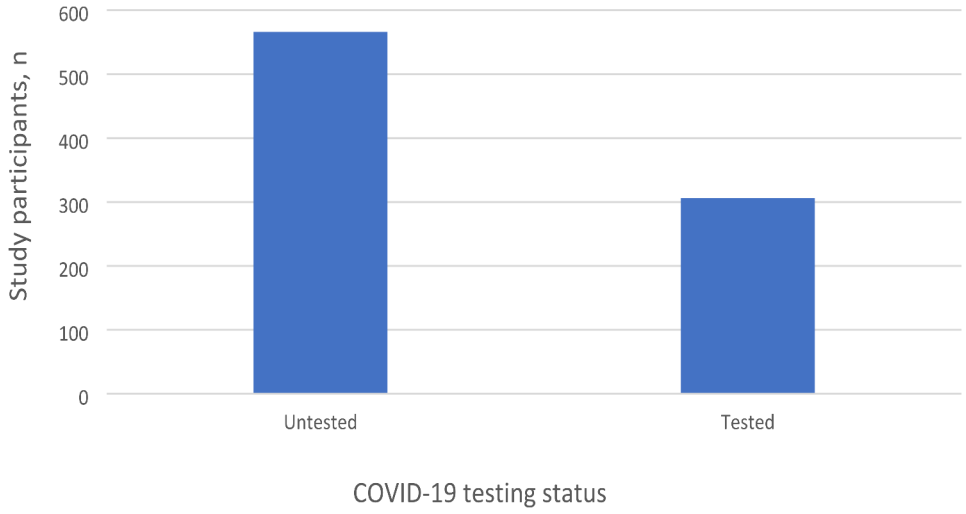

Fig. 1 The testing status of COVID-19 vaccine recipients in Gombe State ($n=872$)

Table 2 Responses related to COVID-19 vaccine in Gombe state ($n=872$)

Variable	Frequency (%)
Have you been screened for SARS-CoV-2?	
No	566 (64.9)
Yes	306 (35.1)
Result of SARS-CoV-2 screening test*	
Negative	285 (93.1)
Positive	21 (6.9)
Dose of vaccine	
1st dose	239 (27.4)
2nd dose	633 (72.6)
Known underlying condition	
No	474 (54.4)
Yes	398 (45.6)
Adverse events following inoculation with the first dose of the COVID-19 vaccine ($n=592$)	
No	484 (81.8%)
Yes	108 (18.2%)
Most common adverse effect after COVID-19 vaccination?	
Fever	69 (63.9)
Headache	53 (49)
Dizziness	51 (47.2)
Pain at injection site	31 (28.7)
Pruritis	3 (2.8)
Chest pain	2 (1.86)
Vomiting	1 (0.93)

*- self-reported

broadly divided into health-related (46.33%, $n=404$) and non-health-related (53.67%, $n=468$).

The analysis of our dataset revealed that two-thirds of the 872 vaccine recipients included in this study have never been screened for SARS-CoV-2 as only 35.1% ($n=306$) had been tested (Fig. 1).

Of the 306 tested, 21 (6.9%) of them tested positive for SARS-CoV-2 (Table 2). Approximately one-third of the study participants (27.4%, $n=239$) presented themselves to be inoculated with the first dose of the vaccine whereas 72.6% ($n=633$) were at the vaccination center to obtain their second dose of the Pfizer vaccine and are therefore fully vaccinated. There was a significant difference in the testing status between those receiving the first dose (previously unvaccinated individuals) and those receiving the second dose ($p<0.05$).

Most of the second-dose vaccine recipients (81.2%, $n=484/592$) had not experienced any adverse event following immunization (AEFI) with their first dose of the COVID-19 vaccine. However, 108 (18.2%) persons reported AEFI that ranged from fever, pain at the injection site, headache, and body weakness or several combinations of these symptoms (Table 2). Most of the vaccine recipients voluntarily accepted the vaccine because of the need to protect themselves and their families from SARS-CoV-2 whereas only 3.2% ($n=28$) were forced to take the vaccine by their employers. Approximately 45.6% ($n=398$) of the vaccine recipients have underlying disease conditions. The most reported diseases were asthma (10.44%, $n=91$), diabetes (16.17%, $n=141$), and hypertension (18.81%, $n=164$).

Association of socio-demographic variables on the COVID-19 testing among vaccine recipients in Gombe state

The results of the multivariable logistic regression analysis revealed that only the age, monthly income, vaccination dose, and background of the vaccine recipients significantly impacted the COVID-19 testing status. Study participants who were aged between 30 and 39 years were more likely (OR: 1.76; 95% CI: 1.13, 2.74; $p=0.041$) to have been screened for SARS-CoV-2. Participants who were of health-related background (OR: 6.30; 95% CI: 4.35, 9.13; $p=0.01$) were more likely to get tested than those with non-health-related backgrounds.

Table 3 Logistic regression analysis of the impact of socio-demographic characteristics on the COVID-19 testing status of COVID-19 vaccine recipients in Gombe state

				Univariable analysis		Multivariable analysis	
Variables		**Tested**	**Untested**	**OR (95% CI)**	**P-value**	**Adjusted OR (95% CI)**	**P-value**
Age (years)	18–29	104 (47.5)	115 (52.5)	1.00	-	1.00	-
	30–39	127 (33)	257 (67)	2.24 (1.59–3.14)	< 0.01	1.76 (1.13–2.74)	0.041
	40–49	42 (22.1)	148 (77.9)	3.9 (2.52–6.1)		1.63 (0.93–2.87)	0.001
	50–59	22 (27.8)	57 (72.2)	2.86 (1.64–5.01)		0.99 (0.48–2.05)	0.001
Gender	Male	270 (58.2)	194 (41.8)	1.00	-	1.00	-
	Female	296 (72.5)	112 (27.5)	1.89 (1.43–2.52)	< 0.01	1.53 (0.86–2.19)	0.023
Level of Education	No formal education	19 (63.3)	11 (36.7)	1.00	-	1.00	-
	Primary school	17 (60.7)	11 (29.3)	0.89 (0.31–2.58)	< 0.01	0.95 (0.26–3.35)	0.154
	High School	186 (50.3)	184 (49.7)	0.58 (0.27–1.26)		0.62 (0.25–1.53)	0.065
	Bachelor (or higher)	344 (77.5)	100 (22.5)	1.99 (0.92–4.32)		0.94 (0.37–2.39)	0.027
Vaccination dose	1st dose	122 (51.1)	117 (48.9)	1.00		1.00	
	2nd dose	184 (29.1)	449 (70.9)	2.54 (1.87–3.45)	< 0.01	2.04 (1.40–2.95)	< 0.01
Monthly income (Naira)	< 50 – 000	241 (48)	262 (52)	1.00	-	1.00	-
	51,000–100,000	241 (88.3)	32 (11.7)	7.85 (3.82–16.11)	< 0.01	5.60 (0.49–8.87)	0.002
	101,000–150,000	65 (87.8)	9 (12.2)	8.18 (5.44–12.31)		4.47(2.01–8.97)	0.368
	> 150,000	16 (88.9)	2 (11.1)	8.69 (1.97–12.21)		10.43 (2.22–21.88)	0.001
Marital status	Single	110 (56.1)	86 (43.9)	1.00	-	1.00	-
	Married	402 (65.9)	210 (34.1)	3.80 (2.35–6.15)	< 0.01	1.18 (0.47–2.95)	0.021
	Divorced/Widowed	54 (84.4)	10	3.12 (2.06–4.72)		0.58 (0.36–0.94)	0.693
Background	Non-health related	165 (40.8)	239 (51.2)	1.00	-	1.00	-
	Health-related	401 (85.7)	67 (14.3)	8.66 (6.25–12.01)	< 0.01	6.30 (4.35–9.13)	< 0.01
Occupation	Student	46 (40)	69 (60)	1.00	-	1.00	-
	Self-employed / Private Company	373 (67.6)	179 (32.4)	3.13 (2.06–4.73)	< 0.01	1.44 (0.84–2.46)	0.412
	Government worker	147 (71.7)	58 (28.3)	3.80 (2.35–6.15)		1.38 (0.74–2.58)	< 0.001

OR - odds ratio; CI: confidence interval

Finally, there was an association between higher monthly earnings and the likelihood of being tested as study participants who earned 150,000 and above (OR: 10.43; 95% CI: 2.22, 21.88; $p < 0.001$) were more likely to have been screened for SARS-CoV-2 than other income groups (Table 3).

Discussion

To effectively curb the spread of SARS-CoV-2, a combination of non-pharmaceutical- and pharmaceutical interventions are needed to protect lives, prevent deaths, and reduce the burden of the COVID-19 pandemic [17, 21]. Generally, COVID-19 testing status is very important to determine the true disease burden at the population level [22]. This study contributes to the evolving picture of Nigeria's COVID-19 testing status by focusing on information generated from a cross-sectional survey of 872 vaccine recipients in Gombe State.

The effectiveness of Nigeria's COVID-19 testing system as well as the acceptance of the COVID-19 vaccines depends on several factors which included the willingness of citizens to be tested, proximity to the testing center, the individual's level of education, preexisting health conditions, knowledge of COVID-19 symptoms, and previous healthcare experience [5, 22–25]. In addition, risk communication and community engagement strategies have influenced healthcare seeking behavior of Nigerians, specifically during the COVID-19 pandemic [26]. Despite these factors, COVID-19 testing behaviours and vaccine acceptance could vary based on the environment as well as the socio-cultural practices and beliefs of a geographical region of Nigeria [22].

Our findings showed that only 35.1% of the 872 vaccine recipients were previously screened for SARS-CoV-2. This testing rates could be attributed to the socio-demographic profiles of the vaccine receipt and the intensified awareness campaign. This COVID-19 testing rate in Gombe state was higher than the 6.8% reported in Ondo State as well as the 15.6% testing rate reported in Lagos State respectively [22]. These differences could be due to the heterogenous sampling population as well as differences in time and study design (vaccine recipient versus general population). The low national testing rate (5.7 million cumulative tests) could be attributed to several socio-demographic factors listed above as well as to the poor COVID-19 testing mechanism across Nigeria [5]. In addition, the poor testing rate could be due to the stigma associated with COVID-19, especially at the rural level [17]. This has made people shy away from testing. However, there was better mass advocacy on vaccine

acceptance than in testing, especially with the arrival of the COVID-19 vaccines which made people voluntarily present themselves for inoculation even at the grassroot level [17, 21]. Hence, to determine the true burden of COVID-19 in Nigeria, there is a need for robust improvement in the national COVID-19 testing capacity including genomic surveillance [22, 27, 28]. Furthermore, innovative pandemic control strategies such as the COVID-19 host-spot strategy could help increase testing in Nigeria [29].

The COVID-19 positivity rate among the 852 study participants in Gombe state was 6.9%. While this might not be representative for the whole state, it is higher than the 3.6% reported among vaccine recipients in Kwara State [17]. Hence, to curb the spread of the disease, health authorities must intensify COVID-19 screening tests by funding the designated sample collection points that were established in every local government of the state and ensure that at least a COVID-19 screening facility is cited in each region of the state. Increasing screening tests will help identify positive predictors, predisposing factors, and clusters of infections across Nigeria [17]. Previously, Ditekemena et al., reported that there was an association between increased Covid 19 screening and acceptance of the COVID-19 vaccine as the study found that previously tested participants were 4.71 times more likely to accept COVID vaccines [16].

Our research findings that age, monthly income, and background were associated with the testing status were corroborated by previous studies across Nigeria. For instance, Amoo et al. reported that the testing behavior of their study participants (from Lagos and Ondo States) was associated with socio-demographic variables such as awareness of nearby COVID-19 testing centers, internet access, knowledge of preexisting conditions, and having another member of the family testing positive [22]. Other studies have evaluated the utility and acceptability of COVID-19 self-tests as complementary to the current national COVID-19 testing strategy. However, concerns remain about its value for case detection, correct usage, and reporting system, amongst other concerns that could affect its wide acceptance [30, 31].

In Gombe state, a total of 126,519 tests have been done since the index case on 20 April 2020 [32]. From our analysis, the age, occupational background, and monthly income of the study participants were significantly associated with the COVID-19 testing status of the respondents. Previously Akinyemi et al., [33] had reported that age significantly influenced COVID testing in rural settlements of Southwestern Nigeria. The significant differences based on the occupational background could be due to the increased likelihood of healthcare workers (medical-related fields) being tested more than the general population [34]. Similar to our findings, Paul et al., [35] previously showed that persons with higher monthly income were associated with increased willingness to accept the vaccine which has now been shown to be associated with COVID testing. Our analysis revealed no gender differences in the testing status. This is contrary to reports by Scully et al., [34] and Ballering et al., [36] who both reported that there was gender-based differences in the COVID-19 testing status with the female gender being more tested. On a general note, it is encouraging to know all these strata voluntarily presented themselves for COVID-19 inoculation. So, we advocate for a more effective, engaging mass COVID-19 advocacy campaign with special emphasis on COVID-19 testing and vaccine acceptance. Hence, a positive behavioural change toward COVID-19 testing and acceptance of its vaccine could be achieved through enhanced community engagement and risk communication [26, 37].

The self-reported AEFI recorded in the 592 vaccine recipients was consistent with several reports that COVID-19 vaccines were safe and produced only mild and transient AEFI if any [38]. This shows that the vaccine is safe and effective to reduce hospitalizations and the tendency of spreading the disease [39, 40]. The prevalence of AEFI in vaccine recipients in Gombe state (18.2%) was however lower than the 50.5% reported among vaccine recipients in Rivers State or the 90.9% reported in Ibadan, Oyo State respectively [38, 41]. This difference could be attributed to the variations in study settings as our study was in municipal vaccination centers whereas these studies were conducted in health facilities, hence, the possibility of selection bias.

Our data revealed that the need to protect themselves and their families from the deadly disease and prevent complications of underlying disease conditions (co-morbidities) were the most prominent reasons for accepting the COVID-19 vaccine amongst our study participants. However, some of the vaccine recipients (3.2%) were forced to take the vaccine by their employers to curb the spread of the disease in their workplaces.

To further boost the COVID-19 vaccination acceptance among Nigerians, health agencies should adopt the WHO's Behavioural and Social Drivers of Vaccination model (BESD) which suggests that countries should reduce access barriers to COVID vaccinations [42]. Dependent on the availability of vaccines, health authorities should make vaccines closer to the populace by increasing vaccination centers across the nation, reducing the time lag in the online registration of recipients, and designing integrated health programs that will leverage the vaccination centers' workforce and facilities. In Nigeria, an increased vaccine acceptance rate can be achieved by persuading the populace through community engagement activities and employing Social and Behavior Change Communication (SBCC) strategies [26, 40]. We

advocate that vaccine messaging should focus on vaccine safety, efficacy, and the lack of side effects even in persons with co-morbidities. In addition, the full implementation of projects such as SCALES 3.0 (integrated COVID services with routine primary health care services such as routine vaccinations) could significantly help Nigeria defeat the pandemic.

On a positive note, there was more positive behavior towards vaccine acceptance among all socio-demographic strata including those with no formal education, low monthly income, and even in the untested population than initially anticipated. The main strength of this study is its novelty in the study area. The main limitations of the study are the possibility of proportionality bias and the non-randomness of the study participants, which makes the *p*-value not very reliable. Hence, the findings of this survey might not be representative of all COVID-19 vaccine recipients in the state and cannot be used for making causality inferences. There is also the possibility that some of the intending vaccine recipients did not receive the vaccine.

Conclusion

This study assessed the COVID-19 testing status of COVID-19 vaccine recipients in Gombe State. Approximately one-third of vaccine recipients have been previously screened for SARS-CoV-2. This low testing rate could create an undercount of true COVID-19 cases. The multivariable logistic regression analysis revealed that three of the socio-demographic variables (the age, monthly income, and background) significantly impacted the COVID-19 testing status among vaccine recipients in Gombe state.

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Author contributions
Author Contributions: N.A.S.: Conceptualization, writing, original draft preparation, and editing. A.I.A: formal writing, data curation, writing, original draft preparation, and editing. M.O: visualization, writing, reviewing and editing. B.S.S: data curation, writing, reviewing and editing. A.H: data curation, writing, reviewing and editing. M. M. A: data curation, writing, reviewing and editing. N.E: data curation, writing, reviewing and editing.

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Data availability
Raw data can be found in online data repository using the link below https://doi.org/10.5281/zenodo.10065511.

Declarations

Ethics approval and consent to participate
we got ethical approval from Gombe State of Nigeria, Ministry of Health Headquarters with reference MOH/ADM/621/S/456.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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