

Willingness to receive monkeypox vaccine and associated factors among the Ghanaian population: Findings from a nationwide survey

Edem Kojo Dzantor

edzantor@our.ecu.edu.au

Edith Cowan University

Peter Mensah

Yangtze University

Shamsu-Deen Ziblim

University for Development Studies

Stephen Owusu

Asankrangwa Nurses and Midwifery Training College

Samuel Obeng

Yangtze University

Edmore Masaka

Edith Cowan University

Research Article

Keywords: Monkeypox, Mpox vaccine, 5C Vaccine acceptance, Ghana

Posted Date: September 10th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-10694398/v1>

License:   This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Additional Declarations: No competing interests reported.

Abstract

Background

The World Health Organization recommends vaccination as an important public health intervention for controlling mpox outbreaks globally. The willingness to receive mpox vaccine and associated determinants is not fully understood in Ghana. The study therefore assessed Ghanaians' willingness to receive mpox vaccine and the associated factors using the 5 C vaccine uptake model.

Methods

This was a nationwide cross-sectional online survey conducted between July and October 2025 in Ghana. The study was conducted and reported in line with the STROBE Checklist for cross-sectional studies. The questionnaire was adopted and modified based on the five psychological antecedents of vaccination (confidence, complacency, constraints, calculation, and collective responsibility) and the WHO frequently asked questions on mpox. Descriptive statistics, chi-square test, and multivariate analysis were performed using Stata version 17.

Results

The study involved 1670 respondents, with most of them in the 18–22 years age category (761, 45.61%) and predominantly females (1296, 77.60%). Most of the respondents indicated their willingness to take the vaccine (1006, 60.24%). Vaccine confidence ($p \leq 0.001$), complacency ($p \leq 0.001$), and calculation ($p = 0.003$) were significantly associated with the willingness to receive mpox vaccine. Age 23–27 years was significantly associated with higher odds of receiving the mpox vaccine (aOR = 1.41; 95% CI: 1.11–1.80; $p = 0.005$). Respondents in the Bono (aOR = 2.67; 95% CI: 1.32–5.42; $p = 0.007$), North-East (aOR = 2.29; 95% CI: 1.11–4.76; $p = 0.026$), and Savannah (aOR = 1.91; 95% CI: 1.01–3.28; $p = 0.048$) regions were significantly associated with higher odds of receiving the mpox vaccine. High vaccine confidence (aOR = 1.75; 95% CI: 1.40–2.20; $p = p \leq 0.001$) and calculation (aOR = 1.73; 95% CI: 1.35–2.06; $p = p \leq 0.001$) were also associated with higher odds of willingness to receive the mpox vaccine.

Conclusion

Willingness to receive the mpox vaccine was high among the respondents. Tailored interventions aimed at improving vaccine confidence, complacency, and calculation are recommended. Such interventions should be age-appropriate and consider regions with low vaccine willingness rates.

Strength and limitations

Strengths

- The study was conducted at a time when Ghana was recording higher mpox cases, allowing assessing the population's vaccine readiness in real-time.
- The study has a higher national representation compared to the previous mpox vaccine in Ghana.
- The use of the 5C's scale questions, complemented by the WHO frequently asked questions on mpox, enhances the study's reliability for informed public health decision making.

Limitations

- The study only captures a snapshot of the population's vaccine acceptance at one point in time.
- The study considered persons who had access to and were users of smart devices and social media platforms. This limits the population generalizability of the study, particularly for those who may not have access to smart devices and social media platforms, who may be at risk of mpox.

Introduction

Monkeypox (mpox) remains a major threat to global health ¹. Mpox was originally endemic to some parts of Central and West Africa ^{2,3}. However, the current epidemiological profile of the infection shows a significant shift between 2022 and 2025. Mpox has transitioned from sporadic and localized outbreaks to a widespread multi-regional epidemic, with the Americas, Europe, and Africa accounting for 54.9%, 23.4%, and 15.8%, respectively ⁴. Mpox is a zoonotic viral disease that belongs to the *Orthopoxvirus* genus and *Poxviridae* family ^{5,6}. Historically, mpox was initially identified in 1958, with the first human case reported in 1970 in the Democratic Republic of Congo (DRC) ^{2,7,8}. Geographically, mpox has been classified into two clades: Clade I and Clade II. Clade I is further divided into subclades Ia and Ib, and predominantly circulates in parts of Central and East Africa. Clade II, with sub-clades IIa and IIb, is common to parts of the West African region ^{9,10}. Available evidence indicates that Clade I is commonly associated with severe illness and case fatality as compared to Clade II ¹¹. In Africa, mpox is an endemic disease, even in countries where no cases have been historically documented ². According to the World Health Organization (WHO) African Region, more than 21 member states have recorded mpox cases since January 1, 2022. Most of these cases were reported from the DRC (11,984 cases), Burundi (2,523 cases), and Uganda (925 cases) as of December 2024 ¹². Ghana reported a human mpox case in June 2022, followed by a sharp increase in cases beginning in 2024. As of October 14, 2025, Ghana has confirmed 735 mpox cases, 2 hospital admissions, and 3 deaths ^{13,14}.

The clinical presentation of mpox varies and is characterized by fever, rash, lymphadenopathy, pneumonia, encephalitis, and death ^{1,2}. Mpox is transmitted through direct contact with infected persons and indirect contact with contaminated surfaces ^{15,16}. Previous studies have reported animal-to-human transmission ^{17,18}. Globally, mpox response strategies and public health measures vary markedly across developed and developing countries due to differences in health-system capacity, public health infrastructure, and resource availability ². In developed countries, mpox prevention is characterized by robust health-system surveillance, rapid diagnostic capacity, effective vaccination, and risk-

communication measures that promote early disease detection and containment. These countries also have advanced public health reference laboratories and universal access to personal protective equipment². In contrast, some developing countries face significant challenges in their healthcare systems, including limited access to vaccines and diagnostic facilities, as well as weak surveillance systems². Ghana's response to the mpox outbreak has focused on case identification, treatment of infected persons, contact tracing, quarantine, and public health education. Subsequently, the Ghana Ministry of Health and allied agencies announced the introduction of mpox vaccination and commenced vaccination on 5th October 2025¹⁹.

However, the biggest threat to achieving mpox vaccine herd immunity is vaccine hesitancy. Vaccine hesitancy refers to the delay or refusal to be vaccinated in spite of the availability of a safe and effective vaccine^{20,21}. As described by Taylor-Abdulai et al.²², vaccine hesitancy could be the next "plague" the world would be grappling with, particularly among countries in Lower and Middle Income Countries (LMICs)²². According to the WHO, vaccine hesitancy is 7th among the top 10 threats to global public health and a hindrance to vaccine-preventable diseases in Africa²³. According to the Strategic Advisory Group of Experts (SAGE) on Immunization, three matrices determine vaccine hesitancy and they include the contextual influence, individual and group, and vaccine/vaccination specific influences²¹. In 2022, a Ghanaian study involving 605 respondents found that more than half (326, 53.9%) did not have the intention to take mpox vaccine²⁰. Since that study, there have been no major mpox vaccine hesitancy in Ghana. Ghana's plans to implement mass mpox vaccination¹⁹ require an understanding of current vaccine hesitancy to achieve adequate vaccination coverage. Therefore, this study adopted the 5C scale framework (confidence, complacency, constraints, calculation, and collective responsibility) to assess the population's willingness to be vaccinated against mpox²⁴.

Methods

Study design and area

This was a nationwide cross-sectional online survey conducted in Ghana between July and October 2025. The study was conducted and reported the study in line with the STROBE Checklist for cross-sectional studies²⁵ (**Research checklist**). In addition, the study design was guided by the "guide to the design and application of online questionnaire surveys"²⁶, with particular emphasis on methodological, planning, management, and ethical considerations related to online surveys. The use of the online survey approach provided timely population-level data by reaching out to geographically dispersed populations while reducing logistical and financial limitations.

Ghana is a West African country bordered by Côte d'Ivoire to the west, Burkina Faso to the north, and Togo to the east, with the Atlantic Ocean forming its southern boundary. The country has a population of approximately 35 million and is administratively divided into sixteen (16) regions. Ghana is recognized for its relative political stability, strong democratic institutions, and growing economy, driven by sectors such

as agriculture, services, mining, and oil production. The capital city, Accra, serves as the economic and administrative hub of the country. Ghana operates a decentralized health system and continues to implement public health initiatives aimed at improving population health outcomes, including emerging infectious disease preparedness.

Study population, inclusion, and exclusion criteria

The study recruited respondents who were 18 years and above and had resided in Ghana for at least 1 year. Eligible respondents were individuals who owned or had regular access to a smartphone or other digital device with active access to at least one social media platform. This population was selected to facilitate efficient online data collection, engage a digitally connected and information-rich population, and assess preparedness among individuals in settings with a potentially higher risk of mpox transmission. Respondents without access to the internet, smartphones/devices, and non-users of major social media platforms were excluded from the study.

Sample size determination

The sample size for the study was determined at a 95% confidence level ($Z = 1.96$), 5% margin of error, and an estimated mpox vaccine uptake of 46.1% among Ghanaians. A 5% non-response rate was determined to adjust for the online survey as suggested elsewhere^{27,27,28}.

The sample size was determined as;

$$n = Z^2 \times p (1 - p) / d^2$$

Where $Z = 1.96$ at 95% CI, $p = 0.461$ (that is, 46.1/100 based on the estimated prevalence of mpox-related knowledge and preparedness study), and $d = 0.05$ (margin of error).

$$n = (1.96)^2 \times 0.461 \times (1 - 0.461) / (0.05)^2 = 382$$

Now, to adjust for a 5% non-response rate, the estimated sample size = 402.1 respondents.

Sampling procedure

Convenience and snowballing sampling approach was employed to recruit participants nationwide through major online platforms such as social media networks, including Facebook, WhatsApp, LinkedIn, and X. The questionnaire was shared with to groups, professional networks, tertiary students, civil servants and individuals (family and friends). These accessible populations were equally encouraged to share the questionnaire with other potential participants in their contacts and others groups. This approach facilitated widely distribution of the questionnaire to many potential participants. Data safeguard guidelines as one submission per device was activated to eliminate double entries. The data collection procedure adopted have been employed in previous Ghanaian studies on mpox and COVID-19

vaccine uptake ^{20,29,30}, providing the best approach to reduce cost, infection risk and reach a large number of the population within the shortest possible time.

Data collection tool

The questionnaire was adopted and modified based on the 5 psychological antecedents of vaccination (confidence, complacency, constraints, calculation, and collective responsibility) from previous mpox vaccine uptake studies in Ghana ^{20,24} and the WHO frequently asked questions on mpox vaccine uptake ³¹. The questionnaire collected data on: 1) demographic characteristics of respondents; 2) vaccination history, awareness, and willingness to receive mpox vaccine; and 3) the 5C's of mpox vaccine uptake (**Supplementary material**).

Study variables

The study variables are given in (Table 1).

Table 1
Description of study variables

Dependent variables	Definitions
Willingness to take mpox vaccine	The self-reported affirmative intention to receive the mpox vaccine if it is made available to respondents
Unwilling to take mpox vaccine	The self-reported refusal and or lack of intention to receive mpox vaccine if it is made available to respondents
Independent variables	
Demographic characteristics	The sociodemographic attributes of respondents, such as age, sex, educational background, occupation etc
The 5C's of mpox vaccine uptake	As defined in the protocol published by Betsch et al. ²⁴

Data management and analysis

Statistical analyses were performed using Stata version 17, including descriptive statistics, chi-square tests, and multivariate logistic regression. The treatment of the variables and subsequent data analysis were informed by previous mpox studies in Ghana and elsewhere ²⁰. First, all the variables were descriptively analysed and presented in frequencies and percentages. The outcome/dependent variable was treated as a binary variable as “yes or no”. Respondents were asked about their “willingness to receive mpox vaccine” if it were made available to them. Respondents who indicated “yes” were considered “willing” to be vaccinated, and those who indicated “no” were considered “not or “unwilling” to receive the mpox vaccine.

A composite score was determined for the 5C's of mpox vaccine uptake and categorized as "high and low". Respondents with scores < 50% were considered to have "low 5C," and those with scores $\geq$ 50% were considered to have "high 5C" for mpox vaccine uptake. The internal consistency of the 5C scale was assessed using Cronbach's alpha coefficient, with a value of $\alpha = 0.82$ considered acceptable for reliability.

To perform the multivariate logistic regression analysis, first, a chi-square test was conducted between the dependent and independent variables. The statistically significant variables were included in the multivariate logistic regression model to identify independent predictors while controlling for potential confounders (Table 4). The chi-square and multivariate logistic regression analysis were tested at a p-value of < 0.05 and a 95%CI.

The data summary was presented in frequencies, percentages, charts and tables for clarity.

Results

Socio-demographic characteristics

The study involved 1670 respondents, with most in the 18–22 age category (761, 45.61%) and the majority being female (1296, 77.60%). With regard to educational background, more than half of the respondents had a tertiary level of education (1010, 60.48%), and with health profession education description (974, 58.32%). Most of the respondents had health-related occupations (671, 40.18%), and resided in the Greater Accra Region (244, 14.61%) (Table 2).

With the distribution of the willingness to take the mpox vaccine, most of the participants were in the 18–22 age category [unwilling (320, 48.19%) vs. willing (353, 35.09%)]; female [unwilling (518, 78.01%) vs. willing (778, 77.34%)]; tertiary education [unwilling (390, 58.73%) vs. willing (620, 61.63%)]; Health profession education oriented [unwilling (384, 57.83%) vs. willing (590, 58.65%)]; health related occupation [unwilling (252, 37.95%) vs. willing (419, 41.65%)] and Greater Accra Region [unwilling (117, 17.62%) vs. willing (127, 12.62%)] (Table 2).

With regards to the vaccine history, most of the respondents (991, 59.34%) [unwilling (380, 57.23%) vs. willing (611, 60.74%)] have received vaccine over last 5 years and majority have heard about mpox vaccine (1116, 66.83%) [unwilling (376, 56.63%) vs. willing (740, 73.56%)] (Table 2).

Table 2
Sociodemographic characteristics and mpox vaccine willingness distribution

Variable	Unwilling n (%)	Willing n (%)	Total N (%)	p-value
Age				0.001
18–22 years	320(48.19)	441(43.84)	761(45.61)	
23–27 years	178(26.81)	353(35.09)	531(31.80)	
28–32 years	62(9.34)	66(6.56)	128(7.66)	
33–37 years	48(7.23)	59(5.86)	107(6.41)	
38–42 years	25(3.77)	55(5.47)	80(4.79)	
43 years and above	31(4.67)	32(3.18)	63(3.77)	
Sex				0.746
Female	518(78.01)	778(77.34)	1296(77.60)	
Male	146(21.99)	228(22.66)	374(22.40)	
Educational level				0.171
No formal education	32(4.82)	31(3.08)	63(3.77)	
Primary	132(19.88)	209(20.78)	341(20.42)	
Secondary	110(16.57)	146(14.51)	256(15.33)	
Tertiary	390(58.73)	620(61.63)	1010(60.48)	
Educational description				0.740
Health profession education	384(57.83)	590(58.65)	974(58.32)	
Non-health profession education	280(42.17)	416(41.35)	696(41.68)	
Occupation				0.159
Unemployed	251(37.80)	379(37.67)	630(37.72)	
Health related occupation	252(37.95)	419(41.65)	671(40.18)	
Non health related occupation	161(24.25)	208(20.68)	369(22.10)	
Region				p ≤ 0.001
Ahafo Region	37(5.57)	44(4.37)	81(4.85)	
Ashanti Region	59(8.89)	52(5.17)	111(6.65)	
Bono East Region	37(5.57)	39(3.88)	76(4.55)	

Variable	Unwilling n (%)	Willing n (%)	Total N (%)	p-value
Age				0.001
Bono Region	18(2.71)	57(5.67)	75(4.49)	
Central Region	45(6.78)	51(5.07)	96(5.75)	
Eastern Region	33(4.97)	36(3.58)	69(4.13)	
Greater Accra Region	117(17.62)	127(12.62)	244(14.61)	
North East Region	17(2.56)	44(4.37)	61(3.65)	
Northern Region	73(10.99)	130(12.92)	203(12.16)	
Oti Region	33(4.97)	56(5.57)	89(5.33)	
Savannah Region	29(4.37)	61(6.06)	90(5.39)	
Upper East Region	52(7.83)	97(9.64)	149(8.92)	
Upper West Region	28(4.22)	64(6.36)	92(5.51)	
Volta Region	37(5.57)	45(4.47)	82(4.91)	
Western North Region	21(3.16)	51(5.07)	72(4.31)	
Western Region	28(4.22)	52(5.17)	80(4.79)	
Vaccine history				
Received any vaccine in the last 5 years				0.153
No	284(42.77)	395(39.26)	679 (40.66)	
Yes	380(57.23)	611(60.74)	991(59.34)	
Heard about mpox vaccine				0.243
No	288(43.37)	266(26.44)	554 (33.17)	
Yes	376(56.63)	740(73.56)	1116 (66.83)	

With regards to the willingness to take the vaccine, majority of the respondents indicated their willingness to take the vaccine (1006, 60.24%), and less than half were not willing to receive the vaccine (664, 39.76%) (Fig. 1).

The 5C's model constructs on mpox vaccine

Respondents were assessed on the 5C model of mpox vaccine. From the results, majority of the respondents showed positive confidence towards mpox vaccine. More than half of the respondents (917,

54.91%) agreed that mpox vaccine was safe. More than half of the respondents (956, 57.25%) agreed that they had trust in health authorities concerning mpox vaccine. About 940 (56.29%) of the respondents agreed that mpox vaccine will protect them.

Regarding vaccine complacency, most of the respondents (773, 58.14%) disagreed that mpox was not serious. Almost half of the respondents (833, 49.88%) disagreed that they were unlikely to get on contract with the mpox infection. Approximately half of the respondents (846, 50.66%) disagreed that vaccination was unnecessary when healthy.

Regarding vaccine constraints, approximately half of the respondents (878, 52.57%) agreed that access to the vaccine becomes difficult if it far to get the vaccine. Most of the respondents (648, 38.80%) agreed that the time spent getting or being vaccinated against mpox was a constraint. About half of the respondents (842, 50.42%) agreed that they would take the mpox vaccine if it were made free and close to them.

With regards to the vaccine calculation, more than half of the respondents (922, 55.21%) agreed that they will weigh the risk and benefits of mpox and the associated vaccine. Most of the respondents (951, 56.95%) indicated that they will actively seek scientific information before taking mpox vaccine.

On the issue of collective responsibility against mpox, most of the respondents 744(44.55%) agreed that they will get the vaccine to protect persons who cannot be vaccinated. Half of the respondents 835(50.00%) agreed that prevention of community spread of mpox was a collective responsibility (Table 3).

Table 3
Responses to 5C model constructs on mpox vaccine

5C Construct	Item statement	Strongly agree n (%)	Agree n (%)	Neutral n (%)	Strongly disagree n (%)	Disagree n (%)
Confidence	Mpox vaccine is safe	306(18.32)	917(54.91)	169(10.12)	154(9.22)	124(7.43)
	Trust health authorities	366(21.21)	956(57.25)	148(8.86)	72(4.31)	128(7.66)
	The vaccine will protect me	357(21.38)	940(56.29)	119(7.13)	108(6.47)	146(8.74)
Complacency	Mpox not serious	65(3.89)	198(11.86)	158(9.46)	476(28.50)	773(58.14)
	Unlikely to get Mpox	52(3.11)	160(9.58)	204(12.22)	421(25.21)	833(49.88)
	Vaccination unnecessary if healthy	56(3.35)	159(9.52)	121(7.25)	488(29.22)	846(50.66)
Constraints	Access difficult if far	234(14.01)	878(52.57)	175(10.48)	69(4.13)	314(18.80)
	Time spent barrier	193(11.56)	648(38.80)	163(9.76)	127(7.60)	539(32.28)
	Cost: Will take the vaccine if free and nearby	543(32.51)	842(50.42)	131(7.84)	36(2.16)	118(7.07)
Calculation	Weigh risks and benefits	531(31.80)	922(55.21)	84(5.03)	27(1.62)	106(6.35)
	Seek scientific information before accepting the vaccine	543(32.51)	951(56.95)	72(4.31)	21(1.26)	83(4.97)
Collective Responsibility	Get vaccinated to protect those who can't vaccinate	181(10.84)	744(44.55)	181(10.84)	255(15.27)	309(18.50)
	Prevent community spread	117(7.01)	835(50.00)	112(6.71)	298(17.84)	117(7.01)

Association between respondent characteristics and willingness to receive mpox vaccine

The 5C's were categorized into low and high and associated with respondents' willingness to be vaccinated against mpox in a chi-square analysis. The results showed that vaccine confidence ($p \leq 0.001$), complacency ($p \leq 0.001$), and calculation ($p = 0.003$) were significantly associated with willingness to receive mpox vaccine (Table 4).

Table 4
Bivariate association between respondent characteristics and willingness to receive mpox vaccine

Variable	Unwilling n (%)	Willing n (%)	χ^2	p-value
Confidence			19.14	$p \leq 0.001$
Low	315(47.44)	369(36.68)		
High	349(52.56)	637(63.32)		
Complacency			20.22	$p \leq 0.001$
Low	257(38.70)	502(49.90)		
High	407(61.30)	504(50.10)		
Constraints				
Low	268(40.36)	431(42.84)	1.01	0.314
High	396(59.64)	575(57.16)		
Calculation				
Low	325(48.95)	417(41.45)	9.09	0.003
High	339(51.05)	589(58.55)		
Collective responsibility				
Low	279(42.02)	492(48.91)	7.63	0.006
High	385(57.98)	514(51.09)		

Factors associated with willingness to receive mpox vaccine

The multivariable logistic regression analysis identified significant predictors of willingness to receive mpox vaccine. Respondents in the 23–27 years age category were significantly associated with higher odds of receiving the mpox vaccine (aOR = 1.41; 95% CI: 1.11–1.80; $p = 0.005$) as compared to persons aged 18–22 years. Respondents in non-health-related occupations had less likelihood of receiving the mpox vaccine (aOR = 0.79; 95% CI: 0.60–1.21; $p = 0.043$) as compared to unemployed respondents. With

regard to the region, respondents in the Bono (aOR = 2.67; 95% CI: 1.32–5.42; $p = 0.007$), North East (aOR = 2.29; 95% CI: 1.11–4.76; $p = 0.026$), and Savannah (aOR = 1.91; 95% CI: 1.01–3.28; $p = 0.048$) regions were significantly associated with higher odds of receiving the mpox vaccine as compared to the Ahafo region.

Having high vaccine confidence (aOR = 1.75; 95% CI: 1.40–2.20; $p = p \leq 0.001$) and calculation (aOR = 1.73; 95% CI: 1.35–2.06; $p = p \leq 0.001$) had higher odds of receiving the mpox vaccine as compared to lower confidence and calculation, respectively. Higher vaccine complacency (aOR = 0.59; 95% CI: 0.47–0.74; $p = p \leq 0.001$) and collective responsibility (aOR = 0.68; 95% CI: 0.69–1.94; $p = p \leq 0.002$) were all associated with reduced odds of receiving mpox vaccine as compared to lower complacency and collective responsibility, respectively (Table 5).

Table 5
Multivariable logistic regression analysis of factors associated with willingness to receive mpox vaccine

Variable	cOR(95%CI)	p-value	aOR (95% CI)	p-value
Respondent age				
18–22 years	Ref		Ref	
23–27 years	1.44(1.14–2.81)	0.002	1.41(1.11–1.80)	0.005
28–32 years	0.77(0.53–1.12)	0.178	0.77(0.51–1.15)	0.209
33–37 years	0.89(0.59–1.34)	0.582	0.78(0.49–1.21)	0.268
38–42 years	1.59(0.97–2.62)	0.064	1.31(0.77–2.25)	0.308
43 years and above	0.74(0.44–1.25)	0.271	0.75(0.43–1.31)	0.313
Occupation				
Unemployed	Ref		Ref	
Health related occupation	1.10(0.88–1.38)	0.398	1.23(0.97–1.43)	0.357
Non health related occupation	0.77(0.60–1.01)	0.056	0.79(0.60–1.21)	0.043
Region				
Ahafo Region	Ref		Ref	
Ashanti Region	0.74(0.41–1.32)	0.307	0.71(0.38–1.28)	0.255
Bono East Region	0.88(0.47–1.66)	0.706	0.91(0.48–1.74)	0.782
Bono Region	2.66(1.33–5.29)	0.005	2.67(1.32–5.42)	0.007
Central Region	0.95(0.53–1.72)	0.874	0.99(0.53–1.83)	0.985
Eastern Region	0.92(0.48–1.75)	0.793	0.89(0.45–1.73)	0.734
Greater Accra Region	0.91(0.55–1.51)	0.723	1.03(0.59–1.69)	0.990
North East Region	2.18(1.06–4.42)	0.032	2.29(1.11–4.76)	0.026
Northern Region	1.49(0.88–2.52)	0.130	1.51(0.88–2.61)	0.133
Oti Region	1.42(0.77–2.63)	0.256	1.38(0.73–2.61)	0.317
Savannah Region	1.77(0.95–3.29)	0.072	1.91(1.01–3.28)	0.048
Upper East Region	1.57(0.90–2.72)	0.110	1.56(0.88–2.77)	0.126
Upper West Region	1.92(1.03–3.58)	0.040	1.72(0.89–3.28)	0.102
Volta Region	1.02(0.55–1.89)	0.943	1.17(0.62–2.23)	0.619

Variable	cOR(95%CI)	p-value	aOR (95% CI)	p-value
Respondent age				
Western North Region	2.04(1.04–3.99)	0.037	1.99(0.99–3.97)	0.051
Western Region	1.56(0.82–2.94)	0.168	1.69(0.88–3.26)	0.112
Confidence				
Low	Ref		Ref	
High	1.55(1.27–1.90)	p ≤ 0.001	1.75(1.40–2.20)	p ≤ 0.001
Complacency				
Low	Ref		Ref	
High	0.63(0.52–0.77)	p ≤ 0.001	0.59(0.47–0.74)	p ≤ 0.001
Constraints				
Low	Ref		Ref	
High	0.90(0.73–1.10)	0.314	0.84(0.66–1.08)	0.173
Calculation				
Low	Ref		Ref	
High	1.35(1.11–1.64)	0.003	1.73(1.35–2.06)	p ≤ 0.001
Collective responsibility				
Low	Ref		Ref	
High	0.76(0.62–0.92)	0.006	0.68(0.69–1.94)	0.002

Discussion

The study assessed the willingness to receive the mpox vaccine and its associated factors in a nationwide study. The study found that more than half of the respondents were willing to be vaccinated against mpox infection when the vaccine was made available. This has important implications for controlling the current outbreak of mpox in Ghana. The results offer the opportunity to protect individuals, increase community immunity, and control the local transmission of mpox. The high willingness to be vaccinated equally has the potential to strengthen Ghana's healthcare system with reduced hospitalizations that may be associated with mpox infection ³². However, the current study's vaccine willingness was higher than previous Ghanaian cross-sectional studies that reported low vaccine acceptance intention between 32-46.1% ^{20,33}. Situating the current study's findings within the context of global health, the prevalence of mpox vaccine acceptance was within the range of 58.50-75.22%, as highlighted in some systematic reviews ^{34–36}. Nonetheless, the observed differences in Ghana's context may be a result of the time

variation and the contexts within which the studies were conducted. The increased willingness to receive the mpox vaccine in the current study may be partly attributed to the increase in disease burden and risk perception among the population. For example, the current mpox cases, according to the Ghana Health Service, stand at 1062 with 8 case fatalities as of 11th April 2026³⁵ as compared to 116 mpox cases as of 10th January 2022²⁰. This observation is equally grounded in the health belief model (HBM), where an increase in the population's perceived susceptibility and severity influences their uptake of available public health interventions such as the mpox vaccine^{37,38}. Other factors, including the sampling approaches and improved public awareness, may equally contribute to the increased willingness to receive the mpox vaccine^{39–42}.

Ghana introduced and launched the mpox vaccine campaign on 5th October, 2025, with the intention to reduce the spread, particularly in the most affected regions and communities¹⁹. However, post the launch of the vaccine campaign, mpox cases have significantly increased. Therefore, understanding the factors that could influence vaccine acceptance is important to achieve community immunity. From the predictors of the willingness to receive mpox vaccine in this study, age, region, vaccine confidence, and calculation were significantly associated with vaccine acceptance among respondents. These findings have been reported in other mpox vaccine-related studies elsewhere^{43,44}. An appreciation of how these factors may influence willingness to receive mpox vaccine by healthcare providers is essential to increase the overall vaccine uptake. For instance, previous studies reported varied findings on age and vaccine acceptance. While some studies reported that old age was associated with increased intention to accept mpox vaccine^{45–47}, other studies have reported higher vaccine hesitancy^{17,48,49} and higher vaccine uptake among the younger population^{34,50,51}. Again, the variations in the geographical or regional distribution of mpox acceptance should be taken into consideration³⁴. Regions with higher mpox cases could be targeted for early vaccine initiation, while others who may be at risk should be monitored. Targeting the population should be done in consideration of the 5C's of vaccine acceptance. In this study, vaccine confidence and calculation were found to have higher odds with the willingness to be vaccinated against mpox. This may suggest that improving the public's trust, safety, and effectiveness of mpox vaccine is highly recommended^{52,53}. Similarly, providing important and factual information about the population's risk will enhance the comparison of personal mpox health risks versus taking the vaccine⁵³. This may partly explain why there was an increase in the willingness to be vaccinated in the current study as compared to the other Ghanaian studies^{20,33}. While complacency and collective responsibility were found to have lower odds of receiving mpox vaccine, Oeser et al.⁵² study reported that collective responsibility was positively associated with the intention to receive the vaccine, and complacency was negatively correlated with the intention to receive mpox vaccine. Both complacency and collective responsibility are important constructs in vaccine campaigns globally. Whereas vaccine complacency deals with low perceived risk of an infectious disease and reduced preventive action, such as vaccine uptake, collective responsibility is concerned with the protection of others through one's own vaccine uptake^{44,53}. Even though the multivariate logistic analysis found that complacency and collective responsibility were associated with a reduced likelihood of receiving mpox vaccine, the descriptive analysis showed that most of the respondents showed positive attitudes towards these concepts. For example, a significant proportion of

the participants were of the view that mpox was serious and were likely to contract the infection. Similarly, some respondents equally noted that protecting and curbing the community spread of mpox was a collective responsibility. These views from respondents provide opportunities for healthcare providers to leverage to maximise vaccine health promotional activities.

Study strength and limitations

The study was conducted at a time when Ghana was recording higher mpox cases, allowing assessing the population's vaccine readiness. The findings from this study could provide health authorities with opportunities to leverage on respondents' positive attitudes to promote mpox vaccine campaigns in Ghana, while taking the needed steps to address perceived barriers. The study has a higher national representation compared to the previous mpox vaccine in Ghana. The use of the 5C's scale questions, complemented by the WHO frequently asked questions on mpox, enhances the study's reliability for informed public health decision making. Nonetheless, the study has other limitations, and the use of the findings should be done within a context and with caution. This is a cross-sectional design and only captures a snapshot of the population's vaccine acceptance at one point in time. The use of a non-probability sampling approach to reach and select respondents may increase selection bias. Similarly, the study only considered persons who had access to and were users of smart devices and social media platforms. This limits the population generalizability of the study, particularly for those who may not have access to smart devices and social media platforms, who may be at risk of mpox. Majority of the respondents were females, resulting in gender imbalance. The gender imbalance may limit the generalizability of the results to males. As such, it is important to interpret the findings with caution when extending the conclusions beyond the study sample.

Suggestion for future research

The study did not include questions on mpox history and infected persons. Future studies should consider persons who have been infected with mpox and assess their vaccine history, risk perception, and gender differences in mpox infection and vaccine uptake. Additionally, future mpox studies should aim to recruit a more balanced sample to enhance the gender representation.

Conclusion

The study found that willingness to receive mpox vaccine was high among the respondents. Tailored interventions that seek to promote vaccine confidence, complacency, and calculation are recommended. Such interventions should be age-appropriate and with a consideration for the region with low vaccine willingness rates.

Declarations

Ethical approval and consent to participate

This study was approved by the research ethics committee of the College of Nursing and Midwifery, Nalerigu (ERC: U0107/24). The study was conducted in accordance with the Helsinki Declaration for Ethical Principles for Medical Research involving Human Subjects⁵⁴. Informed consent was obtained from all respondents via electronic consent. Detailed information on the study aims/objectives, potential benefits, harm, and compensation was explained to respondents. No direct identifier was collected and used in this study. The study was purely voluntary and with no monetary compensation; however, a word of “thank you” was used to appreciate respondents.

Consent for publication

Not applicable

Clinical trial number

Not applicable

Data collection tool and data availability

The data collection tool is attached as a supplementary file. The data can be accessed through the corresponding author via email.

Competing interest

None declared

Source of funding

None

Author's contribution

EKD; Conceptualization, Project administration, Methodology, Investigation, Data curation, Validation, Writing– original draft, Writing– review & editing

PM; Methodology, Investigation, Data curation, Formal analysis, Validation, Writing– original draft, Writing– review & editing

SO; Methodology, Investigation, Writing– review & editing

SZ; Methodology, Investigation, Validation, Writing– original draft, Writing– review & editing

EM; Methodology, Validation, Writing– original draft, Writing– review & editing

SO; Investigation, Validation, Writing– original draft, Writing– review & editing

Acknowledgments

Authors acknowledge respondents for taking time to complete the survey. We also extend our gratitude to all persons who shared the survey questionnaire and assisted with the data collection.

References

1. Wu S, Deng J, Du M, Liu M, Liu J. Global transmission characteristics of mpox outbreaks: a systematic review and meta-analysis. *eClinicalMedicine*. 2025;89(38):103526. 10.1016/j.eclinm.2025.103526.
2. Kangbai JB, Sesay U, Vickos U, Kagbanda F. Mpox in Africa: What we know and what is still lacking. Published online 2025:1–7. 10.1371/journal.pntd.0013148
3. Akingbola A, Adegbesan CA, Adewole O, et al. Understanding the resurgence of mpox: key drivers and lessons from recent outbreaks in Africa. *Trop Med Health*. 2025;1:1–12. 10.1186/s41182-024-00678-1.
4. Situation Report_ Mpox Multi-Country. Outbreak - Region of the Americas – 28 February 2025 - PAHO_WHO _ Pan American Health Organization.
5. Tiecco G, Degli Antoni M, Storti S, Tomasoni LR, Castelli F, Quiros-Roldan E. Monkeypox, a Literature Review: What Is New and Where Does This concerning Virus Come From? *Viruses*. 2022;14(9). 10.3390/v14091894.
6. Emilia D, Fern D, Casillas-muñoz FAG, et al. Human Monkeypox: A Comprehensive Overview of Prevention Strategies. *Pathogens*. 2023;12(947):1–23. <https://www.mdpi.com/journal/pathogens>.
7. [bullwho00076-0026.pdf](#).
8. Ladnyj D, Ziegler P, Kima E. A human infection caused by monkeypox virus in Basankusu Territory, Democratic Republic of the Congo *. Published online 1972:593–7.
9. Vakaniaki EH, Kacita C, Kinganda-Lusamaki E, et al. Sustained human outbreak of a new MPXV clade I lineage in eastern Democratic Republic of the Congo. *Nat Med*. 2024;30(10):2791–5. 10.1038/s41591-024-03130-3.
10. Mpox.
11. Srivastava S, Sharma D, Sridhar SB, et al. Comparative analysis of Mpox clades: epidemiology, transmission dynamics, and detection strategies. *BMC Infect Dis*. 2025;25(1):1290. 10.1186/s12879-025-11784-8.
12. Mpox in the WHO African region Weekly Regional Situation Report # 16 | 8 December 2024 Mpox in the WHO African region Weekly Regional Situation Report # 16 | 8 December 2024 Table 1. 2024 Mpox Cases, Testing Coverage among Suspected Cases and Test Posit. 2024;(December):0–15.
13. GHS confirms seven. new Mpox cases, total rises to 170 - Graphic Online.
14. Mpox cases surge. to 85 - Public health measures prevent deaths - Graphic Online.
15. Pinto P, Costa MA, Gonçalves MFM, Rodrigues AG, Lisboa C. Mpox Person-to-Person Transmission—Where Have We Got So Far? A Systematic Review. *Viruses*. 2023;15(5):1–20. 10.3390/v15051074.
16. Taha AM, Katamesh BE, Hassan AR, et al. Environmental detection and spreading of mpox in healthcare settings: a narrative review. *Front Microbiol*. 2023;14(December):1–11.

- 10.3389/fmicb.2023.1272498.
17. Temsah Mhani, Aljamaan F, Alenezi S, Alhasan K. Monkeypox caused less worry than COVID-19 among the general population during the first month of the WHO Monkeypox alert: Experience from Saudi Arabia. *Travel Med Infect Dis*. 2022. <https://doi.org/10.1016/j.tmaid.2022.102426>.
 18. Seang S, Burrell S, Todesco E, et al. Evidence of human-to-dog transmission of monkeypox virus. *Lancet (London England)*. 2022;400(10353):658–9. 10.1016/S0140-6736(22)01487-8.
 19. Ghana Health Service. Launches Mpox Vaccination Campaign in Takoradi _ Ghana Health Service.
 20. Ghazy RM, Yazbek S, Gebreal A, et al. Monkeypox Vaccine Acceptance among Ghanaians: A Call for Action. *Vaccines*. 2023;11(2):1–13. 10.3390/vaccines11020240.
 21. Macdonald NE, Group W. Vaccine hesitancy: Definition, scope and determinants. 2015;33:4161–4. 10.1016/j.vaccine.2015.04.036
 22. Taylor-Abdulai HB, Dzantor EK, Mensah NK, et al. Coronavirus disease 2019 (COVID-19) vaccine acceptability in Ghana: An urban-based population study. *PLoS ONE*. 2025;20(3 March):1–16. 10.1371/journal.pone.0319798.
 23. Njoga EO, Awoyomi OJ, Onwumere-idolor OS, Awoyomi PO, Ugochukwu ICI, Ozioko SN. Persisting Vaccine Hesitancy in Africa: The Whys, Global Public Health Consequences and Ways-Out – COVID-19 Vaccination Acceptance Rates as Case-in-Point. Published online 2022:1–23.
 24. Betsch C, Habersaat KB, Deshevoi S et al. Sample study protocol for adapting and translating the 5C scale to assess the psychological antecedents of vaccination. Published online 2020:1–11. 10.1136/bmjopen-2019-034869
 25. Von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: Guidelines for reporting observational studies. *Bull World Health Organ*. 2007;85(11):867–72. 10.2471/BLT.07.045120.
 26. Communication S, Access O. Guide to the design and application of online questionnaire surveys Abstract: 2016;6(December):640–644.
 27. Qi J, Zhao X, Zhuang Y, Li B. Non-sampling errors in questionnaire surveys: findings from a National Fertility Survey. *China Popul Dev Stud*. 2022;6(1):34–54. 10.1007/s42379-022-00102-3.
 28. Wilks R, Younger N, Mullings J, et al. Factors affecting study efficiency and item non-response in health surveys in developing countries: The Jamaica national healthy lifestyle survey. *BMC Med Res Methodol*. 2007;7:1–14. 10.1186/1471-2288-7-13.
 29. Dzantor EK, Asumah MN, Inusah W, et al. Adverse events reported after first dose of SARS- vaccine in the Northern Region of Ghana. 2023;(October. 2022;1785–93. 10.1002/nop2.1438.
 30. Serwaa D, Lamptey E, Appiah AB, Senkyire EK, Ameyaw JK. Knowledge, risk perception and preparedness towards coronavirus disease-2019 (Covid-19) outbreak among ghanaians: A quick online cross-sectional survey. *Pan Afr Med J*. 2020;35(2):1–7. 10.11604/pamj.2020.35.2.22630.
 31. WHO Mpox. <https://www.who.int/news-room/fact-sheets/detail/mpox>
 32. Lancet T, Diseases I. Mpox vaccines attenuate disease — but evidence and equity gaps remain Unified global action needed to tackle bedaquiline-resistant tuberculosis. 2025;3099(25):1059–60.

10.1016/S1473-3099(25)00282-8

33. Braimah JA, Achore M, Dery F, Ayanore MA, Bisung E, Kuuire V. Do self-rated health and previous vaccine uptake influence the willingness to accept MPOX vaccine during a public health emergency of concern? A cross-sectional study. *PLOS Glob Public Heal*. 2024;4(8 August):1–11. 10.1371/journal.pgph.0003564.
34. Makama BT, Sulaiman AK, Abdulaziz TB. Global prevalence and correlates of mpox vaccine acceptance and uptake: a systematic review and meta-analysis. *Commun Med* Published online 2024:1–14. 10.1038/s43856-024-00564-1
35. Mektebi A, Elsaid M, Yadav T, Abdalh F, Assker M. Mpox vaccine acceptance among healthcare workers: a systematic review and meta – analysis. *BMC Public Health* Published online 2024:1–12. 10.1186/s12889-023-17186-2
36. Yeshiwas AG, Tsega TD, Denku CY, et al. Mpox vaccine acceptance and its predictors among people who have risky sexual practices: A systematic review and meta-analysis. *Hum Vaccin Immunother*. 2025;21(1). 10.1080/21645515.2025.2461806.
37. Subedi S, Leal W, Adekunle F. An assessment of the health belief model (HBM) properties as predictors of COVID – 19 preventive behaviour. *J Public Health (Bangkok)*. 2025;33(6):1329–39. 10.1007/s10389-023-02109-7.
38. Haller DM, Ph D, Sanci LA, et al. Do Young People ' s Illness Beliefs Affect Healthcare ? *Syst Rev*. 2008;42:436–49. 10.1016/j.jadohealth.2007.09.013.
39. Guo X, Xue F. Textbook of Medical Statistics. For Medical Students.2024. <https://doi.org/10.1007/978-981-99-7390-3>
40. Ranganathan P. Understanding Research Study Designs. Published online 2019.
41. Isonne C, Marzuillo C, Villari P, et al. The role of vaccine literacy and health literacy in the health prevention decision-making process decision-making process. *Hum Vaccin Immunother*. 2024;20(1). 10.1080/21645515.2024.2321675.
42. Gao S, Li Y, Wang X, Li S, Chen M, Yue B. Vaccine literacy, vaccination intention, and their correlation among adults in Mainland China : a cross-sectional study. 2024;7.
43. Cheng LN, Kong J, Xie XF, Zhang FY. What factors affect acceptance attitudes towards vaccination amidst a major public health crisis ? A national cross- sectional study. Published online 2024:1–9. 10.1136/bmjopen-2024-088245
44. Oeser P, Grune J, Dedow J, Herrmann WJ. The 5 C model and Mpox vaccination behavior in Germany: a cross-sectional survey. Published online 2024:1–7.
45. Chen Y, Li Y, Fu L et al. Knowledge of Human Mpox (Monkeypox) and Attitude towards Mpox Vaccination among Male Sex Workers in China: A Cross-Sectional Study. Published online 2023:1–11.
46. Alibrahim H, Bohsas H, Jawish N et al. A multinational cross-sectional study on the awareness and concerns of healthcare providers toward monkeypox and the promotion of the monkeypox vaccination.

47. Smith LE, Potts HWW, Brainard J et al. Did mpox knowledge, attitudes and beliefs affect intended behaviour in the general population and men who are gay, bisexual and who have sex with men ? An online cross- sectional survey in the UK. 2023;(August). 10.1136/bmjopen-2022-070882
48. Zheng M, Du M, Yang G et al. Mpox Vaccination Hesitancy and Its Associated Factors among Men Who Have Sex with Men in China: A National Observational Study. Published online 2023:1–12.
49. Bingyi W, Xin P, Yuwei L et al. Perceptions, precautions, and vaccine acceptance related to monkeypox in the public in China. A cross-sectional survey. 2022. <https://doi.org/10.1016/j.jiph.2022.12.010>
50. Andersen EW, Kulie P, Castel AD, Lucar J, Benator D, Greenberg AE. Mpox Awareness, Risk Reduction, and Vaccine Acceptance among People with HIV in Washington, DC. Published online 2024.
51. Abara WE, Sullivan P, Carpino T et al. Characteristics of mpox vaccine recipients among a sample of men who have sex with men with presumed exposure to mpox. 2023;50(7):458–61. 10.1097/OLQ.0000000000001800.Characteristics
52. Carolina S, Rancher C, Moreland AD et al. Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID- 19. The COVID-19 resource centre is hosted on Elsevier Connect, the company ' s public news and information. 2020;(January).
53. Betsch C, Schmid P, Heinemeier D, Korn L, Holtmann C, Böhm R. Beyond Confidence: Development of a Measure Assessing the 5C Psychological Antecedents of Vaccination. 13.; 2018. 10.1371/journal.pone.0208601
54. Kong HWS, ETHICAL PRINCIPLES FOR Scientific Requirements and Research Protocols. Wma 2013; (October 1975):29–32. <https://www.wma.net/policies-post/wma-declaration-of-helsinki-ethical-principles-for-medical-research-involving-human-subjects/>

Figures

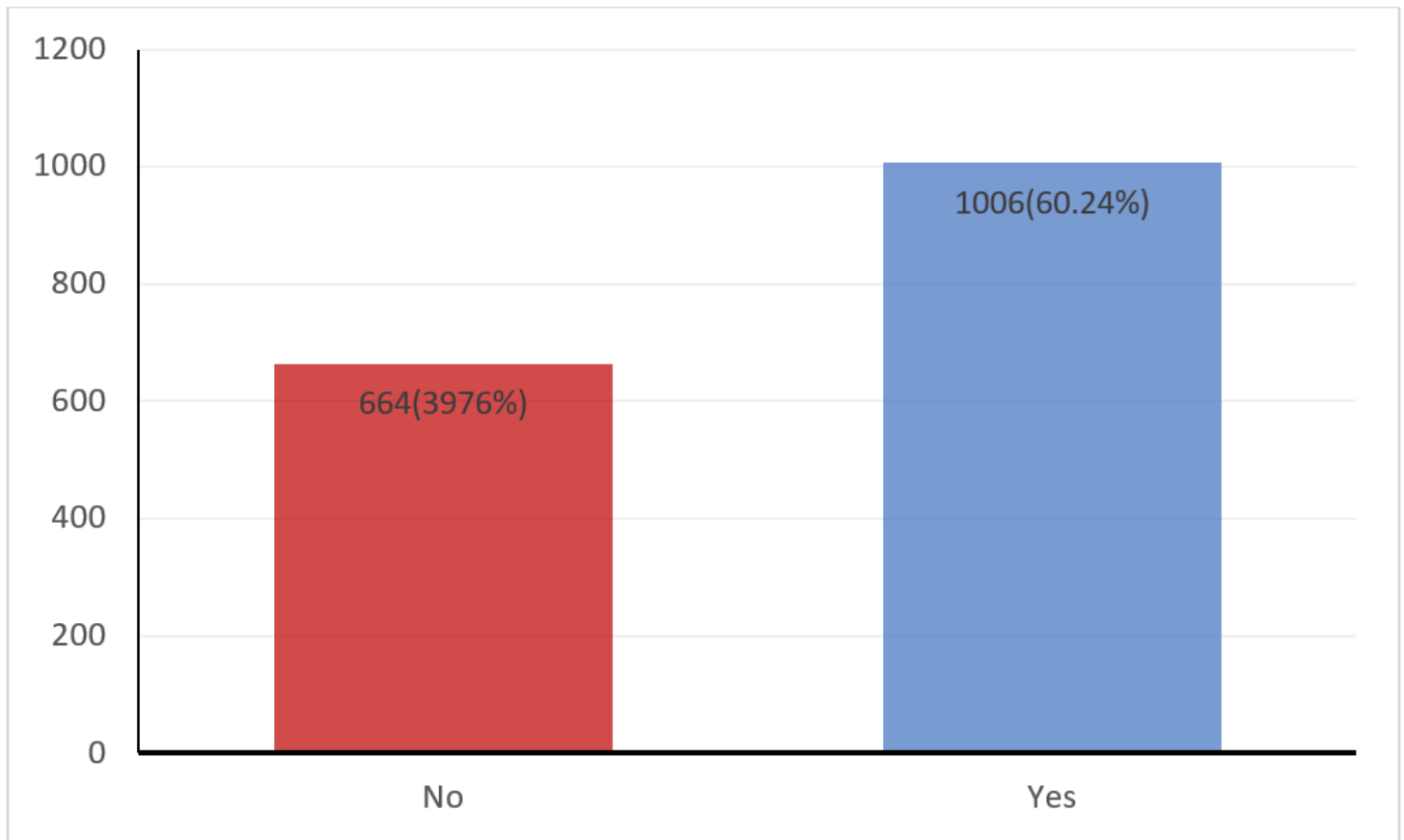


Figure 1

Willingness to receive the mpox vaccine

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Mpoxquestionnaire.pdf](#)
- [STROBEchecklistcrosssectional3.docx](#)