

**Determinants of MPOX Vaccine dropout in Approved Vaccination Centers in Rivers State, Nigeria**

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Abstract

Background: Mpox, formerly known as monkeypox, has emerged as a significant public health concern in Nigeria, particularly in the south-south region, with Rivers State identified as one of the states with confirmed cases. This study aimed to determine the Mpox vaccine dropout rate between the first and second doses, vaccine completion rate and identify factors associated with vaccine dropout in approved vaccination centers in Rivers State, Nigeria.

Methods: A descriptive cross-sectional study was conducted among 768 eligible individuals aged 18 years and above, comprising first-line health workers, immunocompromised individuals, and all persons who visited three approved vaccination centers between December 2024 and January 2025. Data was collected using a pretested, validated, interviewer-administered questionnaire and analyzed using descriptive and inferential statistics.

Results: Most participants were female (57.3%), within the 36-60 years age group, and 45.2% resided within a 5 km radius of a vaccination center. The study found a dropout rate of 44.3% (340 out of 768), which was statistically significant ($\chi^2 = 121.743$). Factors significantly associated with dropout included older age, female sex, vaccination at the University of Port Harcourt Teaching Hospital (UPTH), and residing more than 5 km from the vaccination center. Multivariate analysis revealed that sex, vaccination site, and proximity to the center were independent predictors of MPOX vaccine dropout.

Conclusion: The high dropout rate emphasizes the need for targeted interventions to improve vaccine completion, such as ensuring consistent vaccine supply, decentralizing vaccination services, providing reminder systems, and offering flexible scheduling to enhance full vaccination coverage and reduce dropouts in future campaigns.

Keywords: MPOX Vaccine, Vaccine dropout Rate, Dropout Determinants, Vaccination Centers, Rivers State (Nigeria), Public Health Intervention

Introduction

Mpox, formerly known as monkeypox, is a contagious zoonotic viral disease endemic to parts of Central and West Africa (including Nigeria). Reports of increasing human-to-human transmission have emerged globally in recent years¹. Over the past decade, the disease has spread beyond traditional endemic regions, marking a notable epidemiological shift. The disease is characterized by flu-like symptoms, lymphadenopathy, and a distinctive rash, which, in severe cases, can lead to complications¹.

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Nigeria has also experienced a resurgence of Mpox cases in recent years, accounting for up to 42% of the global burden², particularly in its south-south region, with Rivers State identified as one of the states in the region with confirmed cases³. The region's unique ecological features and high population mobility may explain this geographical

distribution. The sudden resurgence of MPOX cases across the world poses a major threat to the global health sector and led the WHO to declare it a Public Health Emergency of International Concern (PHEIC)³. Following this declaration, Nigeria became the first African nation to receive a donation of Mpox vaccines from the United States, receiving 10,000 doses in August 2024⁴. Nigeria approached the vaccination campaign, which was launched in November 2024 in a phasic pattern, targeting healthcare workers and immunocompromised individuals in high-burden areas, including Rivers State⁵.

Vaccination against MPOX is a key preventive strategy for curbing the spread of this reemerging infectious disease in Nigeria and globally. According to previous studies, smallpox immunization offers up to 85% protection against MPOX Virus (MPXV) infection^{6-8,9}. The eradication of smallpox and subsequent cessation of routine vaccination against the infection widened immunity gaps, leaving populations vulnerable to outbreaks.

The FDA approved the Modified Vaccinia Ankara (MVA) vaccine, marketed as JYNNEOS¹⁰ in 2019 for the prevention of MPOX disease in adults aged 18 and older⁶. The vaccine is administered subcutaneously as a 2-dose regimen, spaced 28 days apart, to high-risk groups like healthcare workers, close contacts, persons with multiple sexual partners, and commercial sex workers^{6,11}. This study defines Mpox vaccine uptake as individuals receiving at least one dose of the JYNNEOS MPOX vaccine¹²⁻¹⁴.

As with the control of infectious diseases, achieving herd immunity to the MPOX virus depends greatly on the public's willingness to receive the vaccines¹⁵. Despite the availability of the vaccine, its uptake remains suboptimal, with studies revealing varying levels of acceptance and significant barriers to vaccination¹⁴. Additionally, misconceptions about vaccine efficacy and safety pose barriers to acceptance and vaccine completion, especially among marginalized communities¹⁶.

Vaccine dropout rate is the percentage of vaccine recipients who start a vaccination series but do not complete all the required doses and is indicative of good service utilization and quality¹⁶. Vaccine dropout rates are also a measure of the effectiveness of immunization programs and when above 10%, is

considered unacceptable as it indicates underutilization of immunization services¹⁷. Vaccine completion rate on the other hand, is defined as the percentage of vaccine recipients who receive all the recommended doses in a multidose vaccination series¹⁸. Given the resurgence of Mpox, there is an urgent need to assess the vaccine dropout rate and to determine why those who commence vaccination are unable to complete it, as seen in previous vaccination¹⁹.

The exact Mpox vaccine dropout rate, completion rate, and the factors associated with Mpox dropouts in Rivers State is not well-documented, even though preliminary observations suggest that a substantial proportion of vaccine recipients failed to return for their second dose. Vaccination programs cannot be optimally designed or targeted if we lack information on who does not complete vaccinations, the reasons for stopping, and the extent of dropout. This gap may reduce the effectiveness of immunization efforts and allow continued transmission of Mpox in populations thought to be protected.

As a pioneer in the introduction of Mpox vaccines in Africa, Nigeria's experience can serve as a model for other African nations. Challenges such as limited supply, funding gaps, and logistic issues persist in many African countries²⁰. To ensure that immunization efforts reach their full potential in this emerging scenario, understanding and addressing vaccine dropout is essential. Additionally, by focusing on the factors associated with vaccine drop out, this study will provide data to inform the design and implementation of vaccination programs across the continent, enhancing their effectiveness and ensuring higher vaccination coverage rates.

Investigating Mpox vaccine drop out in a diverse adult population, including first-line health workers, immunocompromised individuals and the general population, will offer far-reaching insights into the barriers and facilitators of vaccine completion. These findings will help adapt public health interventions to address specific needs and concerns, ultimately improving overall vaccine completion and reducing the incidence of Mpox.

This research will contribute to the global understanding of Mpox vaccination strategies, providing empirical evidence that can be adapted to similar socio-economic and cultural contexts. There

is also limited published data specific to Rivers State (or similar Nigerian contexts) on Mpox vaccine completion. The local empirical evidence this study provides will be valuable for state and national health authorities, for academic knowledge, and for comparison with other settings. This study will therefore, demonstrate best practices in vaccine distribution and promoting vaccination, strengthening public health in Rivers state and beyond.

Many studies on MPOX vaccination have predominantly focused on men who have sex with men (MSM), a group significantly affected by the disease²¹⁻²⁵. There is a critical need to explore the unique challenges and determinants associated with MPOX vaccine uptake among the broader adult population in Nigeria, which may differ from those observed in MSM-centric studies.

To achieve adequate immunity against MPOX, it is important to complete the full vaccination schedule. Thus, if many people drop out after the first dose, the population remains vulnerable, undermining efforts to control outbreaks. Understanding vaccine completion is thus essential for curbing Mpox spread, reducing morbidity, and protecting health systems.

Additionally, because vaccine vials, health worker time, cold-chain logistics, and other resources are invested with the expectation that recipients complete all necessary doses, vaccine dropouts waste resources and may inflate costs per fully immunized person. Knowing completion and dropout rates helps health managers plan more effectively and allocate resources more efficiently.

Also, vaccine dropouts may disproportionately occur in more disadvantaged groups such as rural areas, low-income, lower literacy, or marginalized populations. Therefore, studying determinants ensures that these disparities are recognized and addressed, aligning with equity goals in public health.

By addressing these important issues, this study will play a key role in supporting Nigeria's ongoing efforts to combat MPOX and offer valuable lessons for other nations pursuing effective vaccination strategies. This study, therefore, aims to assess the determinants of the Mpox vaccine dropout rate in approved centers in Rivers State, Nigeria. Its specific objectives are to determine the vaccine

dropout rate, completion rate, and the determinants of vaccine dropout.

Methods

Study Design and Area

This descriptive cross-sectional study was conducted to assess patients vaccinated during the MPOX vaccination campaign, which was held between 3rd December 2024 and 24th January 2025 in Rivers State, Nigeria. The study was facility-based and took place throughout the campaign in the three designated MPOX vaccination centers in the state: University of Port Harcourt Teaching Hospital (UPTH), Rivers State University Teaching Hospital (RSUTH) and Rivers State Primary Health Care Management Board (RSPHCMB).

The University of Port Harcourt Teaching Hospital (UPTH), a quaternary health facility established in 1980 with over 800 bed spaces, served as one of the vaccination sites. Its immunization clinic operates under the Family Health Unit of the Department of Community Medicine, offering routine immunization and welfare services for both children and adults throughout the week. The Rivers State University Teaching Hospital (RSUTH), formerly the Braithwaite Memorial Specialist Hospital established in 1925, is a 561-bed tertiary hospital located near the Rivers State Government House. In addition to immunization, both tertiary facilities provides outpatient, inpatient, and emergency care across several subspecialties operating on scheduled clinic days. The Rivers State Primary Health Care Management Board (RSPHCMB) functioned as the third vaccination center. Established in 2011, it oversees all primary healthcare programs in Rivers State and houses the state's largest vaccine cold chain store. The facility had previously supported major vaccination campaigns, including COVID-19 and measles, making it strategically suitable for MPOX vaccination. The campaign at this site was supervised by the State Immunization Officer (SIO), with trained personnel ensuring efficient service delivery.

Study Population

The study population comprised all individuals aged 18 years and above who received the MPOX vaccine at any of the three designated centers during

the campaign period. Eligible participants included frontline health workers, immunocompromised individuals (such as persons living with HIV or diabetes), and other adults who presented for vaccination. Pregnant and breastfeeding women, as well as individuals too ill to participate, were excluded.

Sampling Technique

Prior to and during the vaccination campaign, awareness was created through hospital communication channels, traditional and socio media channels. Health workers and clients visiting immunization and outpatient clinics were sensitized about the MPOX outbreak and the benefits of vaccination. Individuals who expressed interest and met eligibility criteria were directed to the vaccination sites. A consecutive sampling technique was employed—every eligible participant who presented for vaccination during the campaign period was recruited into the study.

Study Instrument and Data Collection

Data were collected using a pretested, validated, interviewer-administered questionnaire adapted from previous studies^{16,26,27}. The instrument captured participants' sociodemographic characteristics, vaccination status, and factors associated with MPOX vaccine dropout. Six trained research assistants with prior data collection experience conducted the interviews to ensure the reliability and consistency of responses.

Data Analysis

Completed questionnaires were checked daily for completeness and consistency. Data were double-entered into Microsoft Excel and subsequently exported to IBM SPSS version 25 for analysis. Discrepancies and missing values were resolved through validation checks and cross-referencing with source documents. Descriptive statistics were used to summarize participants' characteristics and vaccination status. Categorical variables such as sex, occupation, and vaccination status were presented as frequencies and percentages, while continuous variables such as age were summarized using means and standard deviations (SD) or medians and interquartile ranges (IQR), depending on normality. Bivariate analysis using Chi-square

(χ^2) or Fisher's exact test examined associations between independent variables (e.g., age, gender, education, occupation) and the dependent variable (vaccine dropout). Binary logistic regression was then applied to identify independent determinants of MPOX vaccine uptake. Adjusted odds ratios (AOR) with 95% confidence intervals (CI) were reported, and statistical significance was set at $p < 0.05$.

Ethical Considerations

Ethical approval was obtained from the Research and Ethics Committee of the University of Port Harcourt Teaching Hospital with ethical approval number NREC/UPTHHREC/03/2023. The study involved no invasive procedures and posed minimal risk to participants. After explaining the study's purpose and procedures, the researchers obtained written informed consent and documented it on an informed consent form. Participation was voluntary, with the option to withdraw at any point without penalty. All collected information was kept confidential, password-protected, and accessible only to the research team.

Results

Table 1: Sociodemographic characteristics of study participants in approved vaccination centers

Variable (N=768)	Frequency	Percent
Age group (years)		
18–35	326	42.4
36–60	394	51.3
>60	48	6.3
Mean age = 39.1 years (SD=12.8)		
Sex		
Male	328	42.7
Female	440	57.3
Center (Site)		
RSPHCMB	179	23.3
RSUTH	221	28.8
UPTH	368	47.9
Distance from center		
5 Km	347	45.2
>5–10 Km	111	14.5
>10–15 Km	64	8.3
>15 Km	246	32

A total of 768 individuals were attended to across the three vaccination centers in the state, with the University of Port Harcourt Teaching Hospital (UPTH) accounting for nearly half of the participants (47.9%, $n = 368$). Females comprised 57.3% ($n = 440$) of the study population, and the

majority were within the 36–60 years age group. The mean age was 39.1 ± 12.8 years. In terms of geographic access, 45.2% ($n = 347$) of participants resided within a 5 km radius of a vaccination center. (See Table 1 above.)

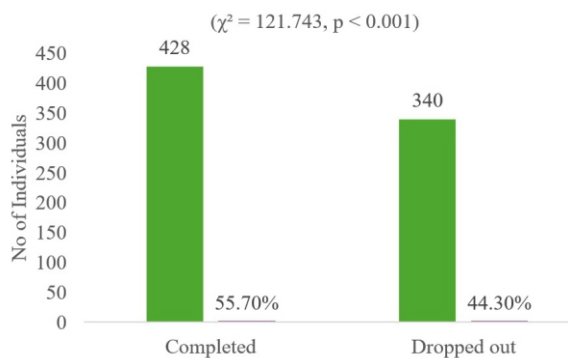


Figure 1: Mpox Vaccination Dropout vs Completion rate in approved vaccination centers

Figure 1 illustrates MPOX vaccination completion and dropout rates in Rivers State. Among the 768 individuals who initiated vaccination, 340 did not complete the full schedule. This dropout rate of 44.3% was found to be statistically significant ($\chi^2 = 121.743, p < 0.001$).

Table 2: Factors associated with Mpox Vaccination Drop Out in approved centers

	1st Dose (n=768)	2nd Dose (n=428)	Drop out (n=340)	%Drop out	df	Chi	p-value
Age group (years)							
18–35	326	196	130	39.9	2	9.335	0.009*
36–60	394	214	180	45.7			
>60	48	18	30	62.5			
Gender							
Male	440	265	175	39.8	1	8.449	0.004*
Female	328	163	165	50.3			
Center (Site)							
RSPHCMB	179	115	64	35.8	2	121.743	<0.001*
RSUTH	221	180	41	18.6			
UPTH	368	133	235	63.9			
Distance from center							
5 Km	347	201	146	42.1	3	10.94	0.012*
>5–10 Km	111	70	41	36.9			
>10–15 Km	64	40	24	37.5			
>15 Km	246	117	129	52.4			

*p-value < 0.05: variable is a significant

Table 2 above shows factors influencing MPOX vaccination. The analysis shows that older adults, females, and individuals living more than 5 km from treatment centers are significantly more likely to drop out of MPOX vaccination ($p < 0.05$). UPTH center accounted for the bulk of the dropout (63.9%,

235) followed by RSPHCMB. The difference in dropout between centers was found to be statistically significant ($p < 0.001$).

Table 3: Multivariate Analysis of Factors associated with MPOX Vaccine Drop out in approved vaccination centers

Factors	Crude		Adjusted	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Age group (years)				
18–35	2.51 (1.35–4.70)	0.004	0.97 (0.48–1.94)	0.920
36–60	1.98 (1.07–3.67)	0.03	1.01 (0.51–2.0)	0.968
>60	1		1	
Gender				
Male	1.53 (1.15–2.05)	0.004	1.51 (1.09–2.09)	0.013*
Female	1		1	
Distance from center				
<5 Km	1.52 (1.09–2.11)	0.013	2.78 (1.86–4.16)	<0.001*
>5 – 10 Km	1.88 (1.19–2.98)	0.007	1.47 (0.87–2.46)	0.147
>10 – 15 Km	1.84 (1.05–3.23)	0.035	1.38 (0.72–2.64)	0.326
>15 Km	1		1	
Center (Site)				
RSPHCMB	3.18 (2.19–4.61)	<0.001	4.22 (2.77–6.42)	<0.001*
RSUTH	7.76 (5.20–11.58)	<0.001	10.44 (6.62–16.45)	<0.001*
UPTH	1		1	

*p-value < 0.05: variable is a significant associated factor of drop out

Of the four factors examined, age was the only variable that did not show a statistically significant association with MPOX vaccination dropout (See Table 3). Gender was significantly associated with vaccination completion, with females having higher odds of dropping out compared to males [AOR = 1.51; 95% CI: 1.09–2.09; $p = 0.013$]. A strong relationship was also observed between the vaccination center and dropout rates. Compared to clients vaccinated at the UPTH center, those vaccinated at RSUTH and RSPHCMB had significantly lower odds of dropping out, with adjusted odds ratios of 10.44 (95% CI: 6.62–16.45; $p < 0.001$) and 4.22 (95% CI: 2.77–6.42; $p < 0.001$), respectively. Regarding access to care, clients residing within a 5 km radius of vaccination centers were significantly more likely to complete their vaccination, with an adjusted odds ratio of 2.78 (95% CI: 1.86–4.16; $p < 0.001$).

Discussion

This study examined Mpox vaccine dropout and completion rates, as well as the determinants of Mpox vaccine dropout at approved vaccination centers in Rivers State, Nigeria.

Regarding completion and dropout rates for Mpox vaccination in this study, the data suggests that while

initial uptake of the Mpox vaccine was encouraging, a substantial proportion of recipients did not complete the full schedule. The difference between completion and non-completion was statistically significant, indicating that nearly half of the vaccine recipients did not receive the second doses. This high dropout rate is consistent with trends observed in other vaccination programs in Nigeria and sub-Saharan Africa, where logistical challenges, limited follow-up, and poor awareness contribute to incomplete immunization^{28,29}. Several contextual factors may explain the high drop-out observed, particularly at UPTH. Distance to the facility also played a role, as clients living farther away faced higher transport costs and logistical challenges. Furthermore, many participants recruited from outpatient clinics preferred to return for vaccination on their routine clinic days to minimize additional travel expenses. These findings highlight the importance of ensuring a consistent vaccine supply, avoiding major travel seasons when planning campaigns, implementing reminder systems, offering flexible scheduling options, and providing decentralized or outreach services to reduce travel barriers, all of which could improve vaccine completion rates.

Bivariate analysis revealed that age was significantly associated with vaccination drop-out with older adults having the highest drop-out rate, a pattern that agrees with previous studies^{28,29}. This may be because older adults are less likely to complete multi-dose vaccine schedules, possibly due to mobility limitations, comorbidities, or lower perceived benefit. Gender was also a significant factor, with females having a higher drop-out rate³⁰, which aligns with a previous study and reflects competing responsibilities, such as caregiving, household duties, or occupational demands, that may hinder follow-up. The vaccination site showed statistical association with dropout, with UPTH having the highest dropout. This high dropout at UPTH may be related to a higher patient load, longer waiting times, or the center serving a wider catchment area with participants traveling long distances, as observed by Mohammed *et al.* in other Nigerian immunization programs³¹.

The distance from the vaccination centre was also statistically significant. Participants living more than 15 km from the vaccination site had the highest

drop-out, highlighting the role of geographic accessibility in vaccine completion. Participants living closer (<5 km) had a lower dropout rate. These findings are consistent with prior studies in Nigeria and sub-Saharan Africa, which emphasize distance and transportation challenges as major barriers to completing vaccination schedules^{31,32}.

Gender remained a significant predictor after adjusting for other factors, with females having higher odds of dropping out compared to males. This aligns with a previous study in Nigeria showing that women, despite higher initial uptake, may be more likely to miss follow-up doses due to competing responsibilities such as childcare, household work, or professional obligations³⁰.

Vaccination site was also a strong determinant of dropout. Participants vaccinated at RSUTH and RSPHCMB had significantly lower odds of dropping out compared to those at UPTH. The UPTH centre, being a tertiary referral hospital with a high volume of specialist cases and patients, may face operational challenges such as long wait times, and increased travel distances for clients, which could reduce adherence. There was also an ongoing major road construction which affected patient access to the facility during the second phase of the campaign. These findings are consistent with previous literature, which indicates that high-volume tertiary centres often face barriers to vaccine completion^{29,31}.

Distance from the vaccination centre was also associated with completion. Participants residing within 5 km of a vaccination centre were more likely to complete the vaccine schedule, confirming the critical role of geographic accessibility in vaccination adherence. Participants living farther away did not show a statistically significant difference after adjustment, suggesting that proximity is particularly important for the most immediate catchment population, as previously reported in Nigeria's immunization programs³².

In summary, the multivariate analysis indicates that gender, vaccination site, and proximity to the centre are determinants of Mpox vaccine dropout in this study. These findings have direct programmatic implications. Strategies such as decentralizing services from high-volume centers like UPTH, targeted health education for women, and improving geographic access through mobile

clinics or outreach programs could improve vaccine completion and reduce drop-out.

Conclusion

This study revealed important insights into Mpox vaccination dropout and completion patterns among adults in Rivers State, Nigeria. Most participants were middle-aged, predominantly female, and received their vaccination at tertiary facilities—mainly UPTH. While initial vaccine uptake was high, completion rates were significantly lower, with nearly half of recipients failing to receive the second dose. Gender, vaccination site, and proximity to the vaccination centre were all determinants of mpox vaccine dropout, with older adults, females, and those living farther away being most affected. These findings call for interventions to improve vaccine completion—such as ensuring consistent vaccine supply, avoiding significant travel periods in scheduling vaccination campaigns, decentralizing vaccination services, providing reminder systems, and offering flexible scheduling—to enhance full vaccination and reduce dropouts in future campaigns.

Conflict of interest

The authors declare no conflict of interest

Authors' Contributions

All authors contributed substantially to this study. The lead author conceptualised the study, drafted the manuscript, and coordinated the research. GOW conducted the data analysis and made significant contributions to refining the study's methodology and key concepts. NO critically reviewed the manuscript for intellectual content, while JIO coordinated data collection. All authors participated in writing, critical revision, and final approval of the manuscript.

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8.0 References

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