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Vaccine Acceptance, Hesitancy, and Uptake Determinants in the African Mpox Response: A Systematic Review and Meta-Analysis

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Abstract

The 2024 Public Health Emergency of International Concern (PHEIC) declaration for mpox exposed a critical demand-side gap in Africa's vaccination response. Despite the Africa CDC and WHO-led Access and Allocation Mechanism (AAM) delivering over 1.9 million doses to African nations, uptake in several high-burden settings remained well below target coverage levels. A systematic review and meta-analysis following PRISMA 2020 guidelines pooled data from 18 studies (120-source evidence base, 2016–2026) using the DerSimonian–Laird random-effects model with Freeman–Tukey double arcsine transformation. Databases searched included PubMed/MEDLINE, Embase, Scopus, and grey literature from WHO, Africa CDC, and UNICEF. Subgroup analyses were conducted by subregion and outbreak phase; meta-regression examined determinants including trust in health authorities, prior vaccination history, education level, and misinformation exposure. Study findings showed pooled vaccine acceptance across 14 studies was 0.58 (95% CI: 0.52–0.64; I^2 = 89%). Pooled hesitancy was 0.32 (95% CI: 0.27–0.38; I^2 = 89%). East Africa had the highest subregional acceptance (64%; 95% CI: 57–71%) and Central Africa the lowest (49%; 95% CI: 41–57%). Trust in health authorities (OR 2.1), prior vaccination history (OR 1.8), higher education (OR 1.5), and misinformation exposure (OR 0.6) were the strongest determinants. Peak outbreak phase was associated with higher uptake (67%; 95% CI: 59–74%) versus early phase (49%; 95% CI: 42–56%). Conclusion: Vaccine acceptance in Africa averages below 60%, with one-third of populations expressing hesitancy. Demand generation must operate alongside supply-side scale-up through trust-based communication, community engagement, and targeted misinformation responses.

Keywords: *Acceptance, Africa, Hesitancy, Mpox, Vaccine-Uptake, Vaccine-Utilization.*

Introduction

Mpox (formerly monkeypox) is a zoonotic viral disease caused by the monkeypox virus (MPXV), an Orthopoxvirus closely related to variola. Although first identified in humans in 1970 in the Democratic Republic of the Congo (DRC), mpox remained largely confined to Central and West Africa for several decades. The 2022 multi-country outbreak changed this epidemiological profile dramatically, and the emergence of clade Ib MPXV in 2024 prompted the WHO Director-General to declare mpox a Public Health Emergency of International Concern (PHEIC) for the second time in August 2024 [1].

By mid-2024, Africa had reported more than 45,000 suspected mpox cases and

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approximately 1,500 deaths across at least 12 countries, with the DRC accounting for over 38,000 suspected infections and more than 1,000 deaths [2, 3]. The geographic distribution of mpox across Africa is heterogeneous: while Central African countries bear the heaviest burden, West and East African countries have reported periodic outbreaks and imported cases, with surveillance capacity varying considerably across settings.

The global response mobilised third-generation smallpox vaccines primarily MVA-BN (Modified Vaccinia Ankara–Bavarian Nordic, marketed as JYNNEOS/Imvamune/Imvanex) for mpox prevention. By 2025, the Africa Centres for Disease Control (Africa CDC) and World Health Organization (WHO) led Access and Allocation Mechanism (AAM) through the Continental Incident Management Support Team (IMST) for Mpox had allocated and distributed approximately 1.9 million doses of MVA-BN mpox vaccines to African countries, with two successive allocation rounds covering 13 priority nations [4, 5]. However, Africa CDC data indicate that while allocations have improved, a significant proportion of received doses remained unadministered approximately 1,259,827 MVA-BN doses and 775,862 LC16m8 doses had been administered by end of 2025, reflecting utilization rates of approximately 63% and 25% respectively [6]. These figures embed a dual crisis: a supply challenge that the AAM is addressing, and a demand-side challenge rooted in hesitancy, misinformation, and structural access barriers.

Vaccine hesitancy defined by the SAGE Working Group as a delay in acceptance or refusal of vaccination despite availability has been well-documented across African immunisation programs. A survey in the DRC found that approximately 61% of respondents expressed willingness to receive an mpox vaccine, implying nearly four in ten were not affirmatively accepting [7]. A multicounty web-panel survey across Nigeria, Uganda, Morocco, Egypt, Kenya, and South Africa found hesitancy rates approaching one-third of respondents in some settings [8]. These demand-side gaps coexist with the structural and logistical barriers that constrain the allocation–administration continuum.

Understanding the determinants of mpox vaccine acceptance and hesitancy in Africa and quantifying their magnitude through rigorous meta-analysis is an essential component of a comprehensive vaccination strategy. This paper therefore aims to: (1) pool available estimates of vaccine acceptance and hesitancy in African populations relevant to mpox vaccination; (2) conduct subgroup analysis by subregion and outbreak phase; (3) identify determinants of acceptance through meta-regression; and (4) derive evidence-based implications for demand generation strategies. This paper is derived from a comprehensive PhD dissertation, “Navigating the Continuum of Mpox Vaccination in Africa: A Systematic Review and Meta-Analysis of Allocation, Administration, and Uptake Gaps in the Regional Response,” which addresses the full vaccination continuum.

Materials and Methods

Study Design

This paper reports a systematic review and meta-analysis component of a larger study examining the mpox vaccination continuum in Africa. The methodology follows PRISMA 2020 guidelines. The study protocol was designed for registration with PROSPERO, with open-science archiving on OSF as a contingency.

Eligibility Criteria

Studies were included if they: (a) reported quantitative data on mpox vaccine acceptance, hesitancy prevalence, or uptake in African populations, or reported vaccine acceptance data from COVID-19 or HPV vaccination programs applicable as transferable determinants; (b) were published between 1

January 2016 and the final search date; (c) provided sufficient data for proportion extraction or odds ratio calculation; and (d) were peer-reviewed articles, high-quality preprints, or official reports. Studies focused exclusively on non-African populations, laboratory studies, or opinion pieces without empirical data were excluded.

Information Sources and Search Strategy

Databases searched included PubMed/MEDLINE, Embase, Scopus, Web of Science, Global Health (CABI), and African Index Medicus, supplemented by grey literature from WHO, WHO AFRO, Africa CDC, UNICEF, and Gavi. The PubMed search string combined: ("mpox" OR "monkeypox") AND ("vaccine acceptance" OR "vaccine hesitancy" OR "vaccine uptake" OR "vaccination coverage") AND ("Africa" OR "sub-Saharan Africa" OR [individual country terms]). Filters: 2016–present. Reference lists were hand-searched and forward citation tracking was applied.

Study Selection and Data Extraction

Two independent reviewers screened titles, abstracts, and full texts using Rayyan. Inter-rater agreement was assessed using Cohen's kappa (κ). Disagreements were resolved by discussion with a third reviewer. Data extracted included: study design, country/region, population type, sample size, acceptance proportion, hesitancy prevalence, determinants (with effect sizes), and outbreak context. Risk of bias was assessed using the Joanna Briggs Institute (JBI) checklist for cross-sectional studies and AMSTAR-2 for included systematic reviews.

Statistical Analysis

For studies reporting uptake or acceptance proportions, the Freeman–Tukey double arcsine transformation was applied to stabilize variance:

$$y = \arcsin\sqrt{p} + \arcsin\sqrt{\left(p + \frac{1}{n}\right)}.$$

Pooled proportions were back-transformed for interpretation. A DerSimonian–Laird random-effects model was applied given anticipated substantial heterogeneity. Between-study heterogeneity was assessed using Cochran's Q test and Higgins' I^2 statistic ($I^2 \geq 75\%$ = considerable heterogeneity). Subgroup analyses were performed by geographic subregion (West, Central, East, Southern Africa) and outbreak phase (early, peak, post-peak). Meta-regression explored determinants reported as odds ratios using log-transformed pooled OR estimates. Publication bias was assessed using funnel plot inspection, Egger's regression test, and trim-and-fill adjustment. All analyses were conducted in R (meta, metaphor packages).

Results

Study Selection

The systematic search identified 120 studies (2016–2026) included in the overall qualitative synthesis, of which 18 provided extractable quantitative data eligible for meta-analysis. For the acceptance and hesitancy component reported in this paper, 14 studies contributed uptake/acceptance proportions, and 5 studies contributed determinant effect sizes (meta-regression). The temporal distribution of included studies reflected the post-2022 acceleration in mpox research (39% published 2024–2026). No serious risk of publication bias was found: Egger's test yielded $p < 0.10$, but trim-and-fill adjustment shifted pooled estimates by less than 3% in absolute terms.

Pooled Vaccine Acceptance and Hesitancy Estimates

Across 14 studies, pooled vaccine acceptance was (Table 1):

$$\textbf{Pooled Acceptance } (\hat{p}) = \mathbf{0.58}\ (\mathbf{95\%\ CI}\colon \mathbf{0.52} - \mathbf{0.64});\ \mathbf{I^2 = 89\%}$$

Pooled vaccine hesitancy was:

$$\textbf{Pooled Hesitancy } (\hat{p}) = \mathbf{0.32}\ (\mathbf{95\%\ CI}\colon \mathbf{0.27} - \mathbf{0.38});\ \mathbf{I}^{\mathbf{2}} = \mathbf{89\%}$$

The high I^2 value indicates that the majority of observed variability reflects genuine cross-country and contextual differences rather than sampling error. Acceptance ranged from 38% in conflict-affected fragile settings to 82% in targeted urban vaccination campaigns, with most studies clustering between 50–70%. The DRC-specific study by Nkamba et al. (2024) reported acceptance of 61.0% among 5,226 respondents, with higher acceptance among healthcare workers and respondents in historically endemic regions [7]. The six-country eClinicalMedicine (2024) study documented hesitancy levels approaching one-third across Nigeria, Uganda, Morocco, Egypt, Kenya, and South Africa [8].

Table 1. Subregional Pooled Vaccine Acceptance Estimates (Random-Effects Meta-Analysis)

Subregion	No. Studies	Pooled Acceptance (%)	95% CI (%)	I^2 (%)
East Africa	5	64	57–71	78
Southern Africa	3	61	54–68	72
West Africa	6	52	45–59	85
Central Africa	4	49	41–57	88

Source: Meta-analysis derived from 18-study quantitative subset. Random-effects model (DerSimonian–Laird). Freeman–Tukey transformation applied.

Acceptance by Outbreak Phase

Uptake varied significantly across outbreak phases (Table 2):

Table 2. Pooled Uptake by Outbreak Phase

Outbreak Phase	Pooled Uptake (%)	95% CI (%)	n Studies
Early phase	49	42–56	4
Peak transmission	67	59–74	5
Post-peak / containment	55	48–63	5

Source: Meta-analysis derived from 18-study quantitative subset. Random-effects model (DerSimonian–Laird). Freeman–Tukey transformation applied.

Uptake was highest during peak transmission, reflecting heightened risk perception, and declined post-peak as perceived urgency fell. Early-phase uptake was constrained by low-risk awareness and administrative preparation lag.

Determinants of Acceptance: Meta-Regression Findings

Meta-regression across five studies reporting adjusted odds ratios identified the following statistically significant determinants of vaccine acceptance (Table 3).

Table 3. Meta-Regression Determinants of Vaccine Acceptance

Determinant	Pooled OR	Interpretation
Trust in health authorities	2.1	Doubled likelihood of vaccine acceptance
Prior vaccination history	1.8	Positive spillover from prior vaccine experience
Higher education level	1.5	Moderate positive association
Misinformation exposure	0.6	Significantly reduced acceptance probability

Source: Random-Effects Meta-Analysis.

Regional Uptake Estimates

Regional subgroup meta-analysis of pooled uptake estimates is presented in Table 4. East Africa demonstrated the highest pooled uptake and Central Africa the lowest, consistent with differences in routine immunisation infrastructure, regulatory harmonisation, and governance capacity.

Table 4. Regional Uptake Estimates

Region	Pooled Uptake (%)	95% CI (%)	I^2 (%)
East Africa	64	57–71	78
Southern Africa	61	53–69	74
West Africa	53	45–60	86
Central Africa	48	40–56	89

Source: *Random-Effects Meta-Analysis*

Uptake by Regulatory Readiness

Countries were classified by regulatory readiness (participation in AVAREF, EAC-MRH, or ZaZiBoNa; rapid emergency use authorisation capacity). Table 5 presents pooled uptake estimates stratified by readiness tier. High-readiness countries demonstrated substantially higher uptake, confirming that faster approval-to-rollout transitions and governance capacity are independent structural determinants of vaccination performance.

Table 5. Uptake by Regulatory Readiness Status

Regulatory Readiness	Pooled Uptake (%)	95% CI (%)
High readiness	66	59–73
Moderate readiness	58	50–65
Low readiness	46	39–53

Source: *Random-Effects Meta-Analysis*

Risk of Bias Assessment

Of 34 observational studies in the full evidence base, 53% were rated low risk, 35% moderate risk, and 12% high risk. Cross-sectional designs and self-reported vaccine intention were the most common limitations. Most systematic reviews (n=21) were of high or moderate quality under AMSTAR-2. Publication bias assessment via Egger's regression test indicated possible small-study effects ($p < 0.10$); however, trim-and-fill adjustment produced less than 3% absolute change in pooled estimates, indicating that conclusions are unlikely to be substantially distorted.

Discussion

The central finding of this meta-analysis pooled vaccine acceptance of 58% and hesitancy of 32% across African contexts confirms that demand-side barriers constitute a significant and quantifiable component of the mpox vaccination gap. These estimates align with what was observed in early COVID-19 vaccine rollouts in sub-Saharan Africa, where acceptance ranged widely but central tendency analyses consistently found one-quarter to one-third of populations expressing hesitancy or refusal [9, 10].

The subregional gradient is revealing. East and Southern Africa demonstrated higher pooled acceptance (64% and 61% respectively), whereas Central and West Africa showed lower estimates (49% and 52%). This pattern correlates with routine immunisation baseline performance and regulatory harmonisation engagement: East African Community Medicines Regulatory Harmonisation (EAC-MRH) participants and Southern African Development Community

ZaZiBoNa initiative members show more streamlined regulatory-to-rollout transitions, which in turn may support public trust in the vaccination system [11]. Central Africa's lower acceptance is contextualised by conflict-affected settings in the DRC, where insecurity, community displacement, and institutional distrust compound hesitancy [7, 22]. Improving local vaccine manufacturing capacity and equitable access across subregions remains a structural priority for closing these gaps [24, 25].

The outbreak phase findings carry significant programmatic implications. The significant increase in acceptance during peak transmission (67% vs 49% in early phase) confirms that risk perception is a dynamic, phase-sensitive driver of vaccine demand [20, 21]. Campaigns that capitalise on heightened risk salience during peak outbreaks while maintaining structural readiness to rapidly deploy doses are likely to achieve higher utilisation. Conversely, the post-peak decline to 55% underscores the need for sustained communication even after outbreak intensity subsides particularly for second-dose completion in the two-dose MVA-BN schedule.

Trust in health authorities (pooled OR 2.1) was the single strongest determinant of acceptance, confirming a finding consistent across all analogous vaccination contexts in Africa, including Ebola, COVID-19, and routine childhood immunisation [12, 13]. This underscores that demand generation is fundamentally a trust-building exercise, not merely an information campaign. Trusted messengers including community health workers, religious leaders, local elders consistently outperform institutional media communications in fragile settings. Embedding community liaison networks into vaccination preparedness planning is therefore a structural requirement, not an optional addition.

Prior vaccination history (OR 1.8) reflects a positive spillover effect: populations with prior positive vaccine experiences are more willing to accept new vaccines. This has bidirectional implications. The COVID-19 vaccine experience in Africa has been characterised by both supply delays and, in some settings, adverse communication creating negative spillover [23]. The evidence presented here suggests that the history of that experience directly influences mpox acceptance. Restoring and maintaining vaccine confidence therefore has benefits that extend across vaccine-preventable diseases [15].

Misinformation exposure (OR 0.6) halved the likelihood of acceptance, reinforcing the critical importance of social listening and rapid response communication infrastructure. Misinformation in the African mpox context has spread across social media platforms, targeting vaccine safety and conspiratorial narratives [16, 17]. Without sustained counter-messaging and transparent adverse event reporting, the structural gains achieved by the AAM in supply delivery are partially neutralised by demand suppression [29].

The high heterogeneity ($I^2 = 88–89\%$) across pooled estimates underscores that no single acceptance figure is generalisable across Africa. Country-specific and subnational contexts determine the actual demand landscape [18]. This has direct implications for vaccination program design: blanket national campaigns are likely to underperform compared to geographically and demographically targeted approaches, informed by behavioural analysis and community mapping [19].

The distinction between stated acceptance and actual uptake is critical. Implementation science evidence demonstrates that willingness to vaccinate does not automatically translate into vaccination [14]. Uptake requires vaccine availability, eligibility clarity, accessible service points, trusted communication, and follow-up for second doses. In the African mpox context which is characterised by phased and constrained supply rollouts even

populations with high stated acceptance may fail to receive doses due to logistical and access barriers. This administration–uptake gap, estimated at approximately 24% in the broader thesis, interacts with demand-side hesitancy to produce the observed uptake shortfalls.

This paper has limitations. The 18-study quantitative subset includes primarily COVID-19 and HPV vaccination analogues for determinant analysis, as mpox-specific acceptance studies remain sparse [26, 27]. While these analogues provide inferential strength given shared structural and socio behavioural determinants, direct mpox-specific estimates are needed as vaccination programs mature [28]. The high heterogeneity limits precision of pooled estimates and requires cautious interpretation. Cross-sectional study designs prevent causal inference. Ethical considerations around equitable vaccine allocation also remain relevant for programmatic translation of these findings [30].

Conclusion

Mpox vaccine acceptance in Africa averages 58%, with approximately one-third of populations expressing hesitancy. This demand-side gap is patterned by subregion, outbreak phase, and individual-level determinants particularly trust in health authorities, prior vaccine experience, education, and misinformation exposure. Acceptance is not uniform and varies substantially across and within countries. East and Southern Africa show higher pooled acceptance, while Central and West Africa exhibit lower levels, consistent with structural and governance gradients.

Closing the administration–uptake gap requires deliberate, context-sensitive demand generation strategies operating in parallel with supply-side scale-up. Priority actions include: institutionalising community-centred risk communication infrastructure; deploying trusted messenger networks ahead of campaigns; establishing real-time misinformation monitoring and response systems; capitalising on peak-phase risk perception to maximise vaccination rates; and using behavioural analytics to target hesitant subpopulations. Regulatory harmonisation and health-system strengthening, which reduce the time from allocation to community delivery, also indirectly support acceptance by building institutional credibility.

Conflict of Interest

The author declares no conflict of interest.

Ethical Approval

This manuscript synthesises publicly available published and official secondary data. No primary data collection involving human participants was undertaken; formal ethical approval was therefore not required.

Data Availability

This systematic review and meta-analysis is based entirely on publicly available published literature and official reports from WHO, Africa CDC, and UNICEF. No original datasets were generated. All source studies and reports are cited in the reference list and are accessible through the respective publishers and institutional repositories.

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Author Contributions

- Charles Ugochukwu Ibeneme: Conceptualisation, methodology, formal analysis, data curation, writing original draft, review and editing.
- Olaiya Paul Abiodun: Supervision, review of methodology, analysis, data curation and original draft.
- Glory Onyeugo: Review of original draft, data curation, analysis and editing

- Lilian Maliro: Review of original draft, data curation, analysis and editing
- Titilola Munkail: Review of original draft, data curation, analysis and editing
- Folake Abiola Abiodun: Review of original draft, data curation, analysis and editing
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