

Healthcare Workers' Preparedness for Monkeypox Pandemic Response in Sub-Saharan Africa: A Rapid Review Investigating the Knowledge Gap

Arole Darwin Touko^{1*}, Ruth Tabi Amin², Gordon Takop Nchanji^{3*}, Fabrice Zobel Lekeumo Cheuyem^{4,5}, Claude Nkfusai Ngwayu^{6,7}, Narcisse Victor Tchamatchoua Gandjui⁸, Abdel Jelil Njouendou^{1,9} and Fanny Nadia Dissak-Delon^{1,10}

¹Data Science Center for the Study of Surgery, Injury, and Equity in Africa

²Department of Public Health and Hygiene, Faculty of Health Sciences, University of Buea, Cameroon

³Tropical Disease Interventions, Diagnostics, Vaccines and Therapeutics (TroDDIVaT) Initiative, Buea, Cameroon

⁴Department of Public Health, Faculty of Medicine and Biomedical Sciences, University of Yaoundé 1, Yaoundé, Cameroon

⁵Regional Delegation of Public Health, West region, Bafoussam, Cameroon

⁶School of Nursing and Public Health, College of Health Sciences, University of KwaZulu-Natal, Durban, South Africa

⁷Clinton Health Access Initiative, Cotonou-Benin

⁸Parasite and Vector Biology Research Unit, University of Buea, Cameroon.

⁹Department of Biomedical Sciences, Faculty of Health Sciences, University of Buea, Cameroon

¹⁰Department of Public Health, Faculty of Health Sciences, University of Bamenda, Cameroon

*Corresponding authors

Arole Darwin Touko, Data Science Center for the Study of Surgery, Injury, and Equity in Africa

Gordon Takop Nchanji, Tropical Disease Interventions, Diagnostics, Vaccines and Therapeutics (TroDDIVaT) Initiative, Buea, Cameroon

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Abstract

Background: Mpox is a zoonotic viral disease caused by an Orthopoxvirus endemic to sub-Saharan Africa (SSA), where its resurgence underscores the urgent need for improved preparedness among health care workers (HCWs). Despite the potential of a One Health approach, current implementations remain fragmented. This rapid review synthesises evidence on HCWs' knowledge, attitudes, information sources, and barriers to preparedness regarding Mpox in SSA to identify training needs and policy implications.

Methods: Following Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, PubMed and ScienceDirect were searched using MeSH terms and Boolean operators for studies published between 2000 and 2024. Studies assessing HCW knowledge, attitudes, or preparedness for Mpox in SSA with full-text availability in English or French were included; those involving non-HCW populations, conducted outside SSA, or lacking primary data were excluded. Two reviewers independently screened and extracted data using a standardised template; quality was assessed using the JBI Critical Appraisal Checklist for Analytical Cross-Sectional Studies.

Results: Five studies from 388 records were included (Cameroon, Ethiopia, Nigeria, DRC; n = 1,672 HCWs). Only 46.8% of HCWs demonstrated adequate Mpox knowledge. Barriers included reliance on social media and limited access to formal training. Positive attitudes towards prevention correlated with higher knowledge levels.

Conclusion: Fewer than half of SSA HCWs demonstrate adequate Mpox knowledge despite a regional case fatality rate nearly ten times the global average; positive attitudes are not translating into clinical preparedness, reflecting a critical intention-action gap; and social media dominates as an information source, underscoring the need for peer-reviewed alternatives within a One Health training framework.

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Abbreviations

LMICs	: Low- and middle-income countries
PRISMA	: Preferred Reporting Items for Systematic Review and Meta-Analysis
PROSPERO	: Prospective Register for Systematic Reviews
SAGE	: Strategic Advisory Group of Experts on Immunization
SSA	: Sub-Saharan Africa
WHO	: World Health Organization

Keywords: Mpox, Monkeypox, Healthcare Workers, Knowledge, Attitudes, Pandemic Preparedness, Sub-Saharan Africa, One Health

Introduction

Human monkeypox (Mpox) is a zoonotic viral disease caused by the Monkeypox virus (MPXV). It is an Ortho poxvirus within the family Poxviridae. Clinically, it presents with fever, lymphadenopathy, and a characteristic vesiculopustular rash, and has historically been endemic to the rodent reservoirs of West and Central Africa. In the human context, the first reported cases outside Africa occurred in the United States in 2003, associated with imported African rodents. Reservoir hosts include squirrels, dormice, Gambian pouched rats, and various primate species [1].

Furthermore, Mpox can be transmitted among humans through direct contact with the body fluids or lesions of infected individuals. This virus can spread via respiratory droplets during prolonged face-to-face interactions. While human-to-human transmission is more common, the infection can also be acquired through handling infected animals or consuming their meat [1].

Mpox presents with clinical symptoms that are similar to those of smallpox but generally less severe. After an incubation period of about 7 to 14 days, patients typically experience fever, chills, headache, and muscle aches, followed by the development of a characteristic rash [2].

If not correctly managed, Mpox infections can lead to encephalitis, sepsis, bronchopneumonia, secondary infections, and corneal infections that result in blindness. The illness can last up to 4 weeks but starts to fade when the skin lesions begin to subside. The virus is known to avoid detection by suppressing T-cell activation and inhibiting the host antiviral immune response, which includes antiviral chemokines, cytokines, and antigen presentation [3].

The 2022 global outbreak and the subsequent declaration of a Public Health Emergency of International Concern (PHEIC) by the World Health Organization (WHO) in 2022 and again in 2024 dramatically increased the urgency of Mpox preparedness. In sub-Saharan Africa (SSA), where the disease burden is disproportionately, the Democratic Republic of Congo (DRC) has reported the largest burden, with over 90% of global confirmed cases and deaths, while the 2024 emergence of Clade Ib in eastern DRC and its rapid spread to neighboring countries including Burundi, Rwanda, Uganda and Kenya signaled a new and more geographically expansive phase of the epidemics [4]. Health

systems across the region remain chronically under-resourced, healthcare workers (HCWs) represent the critical first line of defense. Their capacity to detect, manage, and report Mpox cases is fundamental to containment and outbreak control [5].

Despite the recognized importance of HCW preparedness, evidence from SSA remains fragmented. Studies have reported inconsistent levels of Mpox knowledge among HCWs, and the determinants of preparedness including educational level, training access, and information sources vary considerably across settings. No synthesis of the SSA-specific literature on this topic has yet been conducted. This rapid review therefore aims to synthesize the available evidence on Mpox knowledge, attitudes, information sources, and barriers to preparedness among HCWs in SSA, and to identify implications for policy and workforce training.

Materials and Methods

Study Design

A rapid review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [6]. This review focused on primary studies assessing HCWs’ knowledge, attitudes, information sources and barriers to preparedness regarding Mpox in SSA. The review protocol was not prospectively registered on PROSPERO. The methodological quality of all included studies was assessed using the JBI Critical Appraisal Checklist for Analytical Cross-Sectional Studies, conducted independently by two reviewers (ADT and RTA), with disagreements resolved by consensus.

Search Strategy

A structured search was conducted in PubMed and ScienceDirect (for all years up to December 2024). The following Boolean search string was used in PubMed and: (“Monkeypox” [MeSH Terms] OR “Mpox” OR “Monkeypox virus” [MeSH Terms]) AND (“Health Personnel” [MeSH Terms] OR “Healthcare Workers” OR “Health Workers”) AND (“Knowledge” OR “Attitude” OR “Preparedness” OR “Awareness”) AND (“Sub-Saharan Africa” OR “Africa South of the Sahara” [MeSH Terms]) (Table 1). An equivalent free-text search was used for ScienceDirect. In addition, the reference lists of all included studies were hand-searched to identify further eligible articles. No language restrictions were applied, although only articles published in English or French were ultimately retrieved.

The final search was conducted on 31 December 2024. To supplement database search, the WHO website, Africa CDC publications portals, and Google Scholar were searched for relevant gray literature using the terms “Mpox” OR “monkeypox” AND “healthcare workers” AND “Africa.”

Table 1: Search string by database

Database	Search String
PubMed	("Monkeypox" [MeSH Terms] OR "Mpox" OR "Monkeypox virus" [MeSH Terms]) AND ("Health Personnel" [MeSH Terms] OR "Healthcare Workers" OR "Health Workers") AND ("Knowledge" OR "Attitude" OR "Preparedness" OR "Awareness") AND ("Sub-Saharan Africa" OR "Africa South of the Sahara" [MeSH Terms])

ScienceDirect	("monkeypox" OR "mpox") AND ("healthcare workers" OR "health personnel") AND ("knowledge" OR "attitude" OR "preparedness") AND "Sub-Saharan Africa"
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Eligibility Criteria

Inclusion Criteria : Studies were included if they (1) assessed knowledge, attitudes, awareness, or preparedness regarding Mpox; (2) included HCWs (physicians, nurses, midwives, allied health professionals, or primary healthcare workers) as the study population; (3) were conducted in one or more countries in Sub-Saharan Africa; (4) were published between January 2000 and December 2024; and (5) were available in full text in English or French.

Exclusion Criteria: These included: (1) studies focused on the general public or non-HCW population; (2) studies conducted outside SSA; (3) opinion pieces, editorials, conference abstracts, or case reports without primary data on HCW knowledge or attitudes; (4) duplicate publications; and (5) studies without available full text.

Data Extraction and Analysis

Two reviewers (ADT and RTA) independently screened titles and abstracts against the eligibility criteria, followed by full-text assessment of potentially eligible studies. Disagreements at any stage were resolved through discussion and consensus; a third reviewer (GTN) was available to adjudicate unresolved disagreements. Data were extracted independently by one reviewer (ADT) and verified by a second (GTN) using a pre-piloted standardized extraction template capturing: first author, year, country, study design, sample size and demographics, HCW cadre, data collection method, Mpox knowledge scores, attitude scores, information sources, barriers identified, and key recommendations.

The methodological quality of each included study was independently assessed by two reviewers (ADT and RTA) using the JBI Critical Appraisal Checklist for Analytical Cross-Sectional Studies [Moola S, Munn Z, Tufanaru C, et al. JBI Manual for Evidence Synthesis. JBI; 2024], comprising eight criteria: (1) clearly defined inclusion criteria; (2) detailed description of subjects and setting; (3) valid and reliable exposure measurement; (4) use of objective, standard criteria for measuring the condition; (5) identification of confounding factors; (6) strategies to address confounding; (7) valid and reliable outcome measurement; and (8) appropriate statistical analysis. Each criterion was rated as Yes (Y), No (N), Unclear (U), or Not Applicable (NA). No studies were excluded on the basis of quality score alone; rather, quality where findings are used to contextualise the strength of evidence.

Results

Study Selection

The database search retrieved 388 records (PubMed and ScienceDirect combined). After removal of 25 duplicates, 363 unique records were screened at title and abstract level, of which 290 were excluded as not relevant to the review objectives. Full-text assessment was conducted for 73 records.

Of these, five were excluded due to unavailable full text, 27 because the study population was not restricted to HCWs, 13 because the study was not conducted in SSA, and 23 due to insufficient primary data or a non-healthcare setting. Five studies met all eligibility criteria and were included in the final synthesis (Figure. 1).

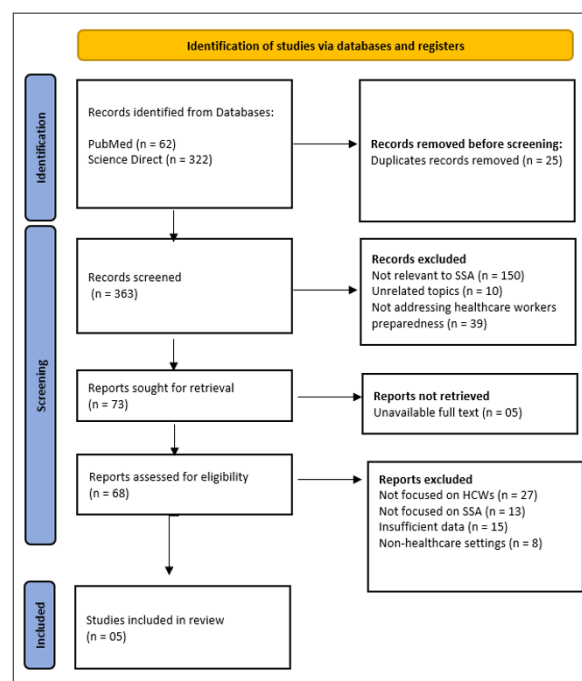


Figure 1: PRISMA flow diagram of study screening and selection [6].

Study characteristics

The total sample size for all five studies was 1,672 HCWs, with a mean age being 30 years, 50.6% were female. Nearly two-thirds (62%) of healthcare workers demonstrated a positive attitude towards Mpox.

Knowledge of Mpox among HCWs was suboptimal across all included studies, with most participants demonstrating only basic or moderate understanding of the disease. The proportion of HCWs with good or adequate knowledge ranged from 12.9% to 42.1% across studies. Factors positively associated with greater knowledge included advanced educational attainment, prior COVID-19 vaccination, and access to credible information sources.

Attitudes toward Mpox were more favourable than knowledge levels, with many HCWs expressing a willingness to learn more about the disease and participate in preventive measures. Barriers to preparedness included reliance on informal or unreliable information sources, limited access to formal training programs, and resource constraints such as insufficient availability of personal protective equipment and diagnostic tools.

Table 2: Basic characteristics of the studies included in the rapid review

Number	First author	Year	Study location	Sample size	M/F ratio (%)	Mean age	Occupation (%)	Type of questionnaire
1	Aynalem et al. [7]	2024	Injibara General Hospital, Northwest Ethiopia	200	N/A	N/A	Medical doctors, nurses, midwives, allied health professionals	Self-administered
2	Nka et al. [8]	2024	Cameroon	342	49.4% M / 50.6% F	30 years (59.6% ≤30 years)	50.3% medical doctors	Online survey
3	Bakare et al. [9]	2024	Jigawa, Oyo, and Lagos states, Nigeria	141	N/A	N/A	Primary health care workers	Self-administered questionnaire
4	Bass et al. [10]	2013	Democratic Republic of the Congo	N/A	N/A	N/A	Healthcare workers	Capacity-building program
5	Temsah et al. [11]	2022	Multinational (Asia, Africa, Europe)	1130	N/A	N/A	Healthcare providers	Online survey

Number	Occupation (%)	Mpox knowledge (%)	Attitude towards Mpox (%)	Summary	Study recommendations
1	Medical doctors, nurses, midwives, allied health professionals	38.5% good knowledge	62% positive attitude	- Good knowledge and positive attitudes were low among HCWs - Factors associated with good knowledge: master's degree, COVID-19 vaccination, access to information	- Conduct educational programs and workshops on Mpox for HCWs (Hospitals and medical institutions)
2	50.3% medical doctors	12.9% excellent, 42.1% good	N/A	- Knowledge of Mpox is substandard across HCWs - A proportion of 92.7% aware of Mpox, with social media as main source - Younger age associated with better knowledge	- Implement capacity-strengthening programs for HCWs to improve knowledge and preparedness (Ministry of Health, healthcare institutions)
3	Primary health care workers	35.5% had good knowledge	N/A	- Mpox knowledge among PHC workers was inadequate - Social media was a major source of Mpox information - Factors associated with adequate knowledge: age ≥30 years, higher education	- Conduct targeted Mpox training for PHC workers - Improve access to credible information resources
4	Healthcare workers	N/A	N/A	- Improved HCW ability to detect and manage Mpox cases after training program - Increased reporting and case detection	- Implement regular training programs to enhance HCW skills in Mpox management (Ministry of Health, healthcare facilities)
5	Healthcare providers	57% recognized Mpox symptoms	N/A	- Poor vaccination knowledge among HCPs	- Enhance awareness campaigns and training on Mpox for HCPs (Public health authorities)

Quality of the included studies and publication bias

Methodological quality was assessed using the JBI Critical Appraisal Checklist for Analytical Cross-Sectional Studies (8 criteria). Results are presented in Table 3. Overall quality was moderate to adequate across the five included studies. All studies clearly

described their study population and setting (criterion 2) and used questionnaire-based outcome measurement (criterion 7), though none employed externally validated Mpox-specific knowledge tools, limiting inter-study comparability (criteria 3 and 7 partially met). No study adequately identified or statistically adjusted for potential confounding variables (criteria 5 and 6 not met in any study), representing the most consistent methodological weakness across the evidence base. Temsah et al. and Nka et al. employed appropriate statistical analysis including logistic regression to identify knowledge determinants (criterion 8: Yes) [8, 11], while Aynalem et al. and Bakare et al. used descriptive statistics only (criterion 8: Unclear) [7, 9]. Bass et al. differed substantially in design assessing post-training outcomes rather than baseline knowledge and could not be scored on several criteria (marked NA) [10]. Regarding publication bias: formal assessment (e.g., funnel plot) was not performed given the small number of included studies (n = 5) and absence of a pooled effect estimate. It is acknowledged that available studies predominantly report knowledge deficits, which may reflect a publication tendency to prioritise studies identifying gaps rather than settings where preparedness is adequate.

Table 3: JBI Critical Appraisal Results – Analytical Cross-Sectional Studies Checklist

Study	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Score
Aynalem et al., 2024 (Ethiopia)	Y	Y	U	U	N	N	Y	U	4/8
Nka et al., 2024 (Cameroon)	Y	Y	Y	Y	N	N	Y	Y	6/8
Bakare et al., 2024 (Nigeria)	Y	Y	U	U	N	N	Y	U	4/8
Bass et al., 2013 (DRC)	Y	Y	NA	NA	N	N	Y	Y	4/6*
Temsah et al., 2022 (Multinational)	Y	Y	Y	Y	U	N	Y	Y	6/8

Q1 = Inclusion criteria defined; Q2 = Subjects/setting described; Q3 = Exposure measured validly/reliably; Q4 = Objective standard criteria for condition; Q5 = Confounders identified; Q6 = Strategies for confounders; Q7 = Outcomes measured validly/reliably; Q8 = Appropriate statistical analysis. Y = yes; N = no; U = unclear; NA = not applicable. *Bass et al. (2013) scored out of 6 applicable criteria (Q3 and Q4 rated NA, training-programme design).

Level of Knowledge and Attitude Toward Mpox

The studies reviewed highlight significant gaps in healthcare workers' (HCWs') knowledge about Mpox, with reported good knowledge levels ranging from 12.9% to 42.1%. Factors influencing knowledge included access to reliable information, higher educational attainment, and prior exposure to public health initiatives such as COVID-19 vaccination campaigns. For instance, Aynalem et al. reported that 38.5% of HCWs in Northwest Ethiopia demonstrated good knowledge, with a positive correlation between knowledge and educational level [7]. Similarly, Nka et al. reported that younger HCWs in Cameroon, who were more engaged with social media, exhibited better awareness but still demonstrated substandard overall knowledge [8]. Despite these gaps, attitudes toward Mpox were generally favorable, with a high interest in learning more about the disease.

Secondary Outcomes

The secondary outcomes focused on systemic barriers, resource availability, and training needs within healthcare systems, addressing Mpox preparedness. Limited access to formal training programs and reliance on informal sources of information, such as social media, emerged as common barriers. Studies such as Bass et al. emphasized the critical role of structured capacity-building programs in improving HCWs' diagnostic and management skills for Mpox [10]. Similarly, Bakare et al. highlighted the absence of structured Mpox training among primary healthcare workers, further underscoring systemic preparedness gaps [9]. Additionally, resource constraints, including insufficient personal protective equipment and diagnostic tools, were identified as limiting factors in HCWs' ability to respond effectively. Secondary outcomes also highlighted the need for improved collaboration between HCWs and public health institutions to address systemic gaps. These findings underscore the importance of sustained investments in training and infrastructure to address not only knowledge deficits but also broader systemic challenges in Mpox management.

Healthcare Workers' Knowledge Toward Mpox

The knowledge levels of healthcare workers (HCWs) regarding Mpox varied significantly across studies, with general awareness being suboptimal. Aynalem et al. reported that only 38.5% of HCWs in Northwest Ethiopia demonstrated good knowledge about Mpox [7], while Nka et al. highlighted that 12.9% of HCWs in Cameroon exhibited excellent knowledge, with 42.1% having good knowledge [8]. Common knowledge gaps included those concerning Mpox transmission, clinical presentation, and preventive measures, suggesting a need for more targeted educational interventions. Bakare et al. reported that only 35.5% of primary healthcare workers in Nigeria demonstrated good Mpox knowledge, indicating inadequate preparedness [9]. Despite these shortcomings, studies have indicated that HCWs generally recognize Mpox as a serious public health concern and express a willingness to enhance their understanding through additional training and information-sharing initiatives.

Factors Associated with HCWs' Knowledge and Preparedness Toward Mpox

Several factors were associated with the levels of knowledge and preparedness of HCWs toward Mpox. Educational attainment emerged as a consistent determinant, with those holding advanced degrees demonstrating significantly better understanding, as noted in previous studies [7, 9]. Age also played a role; younger HCWs, who were more likely to use social media as an information source, showed better awareness but lacked depth of understanding [8]. Additionally, prior exposure to public health campaigns, such as COVID-19 vaccination drives, positively influenced knowledge levels, likely due to increased exposure to health education materials. Access to formal training programs and reliable information sources was highlighted as a critical enabler, whereas reliance on social media for Mpox information often resulted in fragmented or incomplete knowledge. These findings underscore the importance of addressing systemic and individual-level barriers to improve HCWs' preparedness for Mpox outbreaks.

Discussion

The findings of this review reveal a critical preparedness gap among healthcare workers in SSA regarding Mpox. While a mean of 46.8% of HCWs demonstrated adequate knowledge, this proportion remains fundamentally insufficient for a frontline workforce operating in an endemic region, where case fatality rates substantially exceed the global average.

The proportion of SSA HCWs demonstrating good knowledge (46.8%) is broadly comparable to the 46.6% reported in a global Meta-Analysis of mixed populations [12]. However, compared to HCW-specific meta-analyses, the SSA estimate relatively higher, as global HCW-focused reviews have reported good-knowledge proportions as low as 26.0% [13].

One thing is, however, conspicuous in the whole set of analyses that have been carried out so far: that the general public is shown to possess a much higher level of knowledge (ranging between 34% and 58.3%) than the health workers who are actually tackling the pandemic [12, 14].

A comparison of multiple dimensions among determinants reveals a contradiction between both the international and global aspects related to age and experience. The SSA Perspective: In SSA, as well as in Cameroon, the SSA region's younger HCWs (26-30 years old) were more likely to demonstrate "good knowledge", in line with reports from Nka et al. [8]. This is because they are more engaged in electronic health platforms [8]. The Global Perspective: However, globally, the evidence shows that the level of knowledge is greater among people who have more than 5 years of experience (41.6%) and older than 30 years (44.4%) [13].

Moreover, professional background is an important area where results surprised the research team. In SSA, compared with doctors, nurses and medical students revealed higher scores in certain analysis [8, 12, 15]. The results highlighted the possibility that current medical education may fail to adequately address zoonoses in comparison to more updated training in nursing and public health education [8, 15].

An essential commonality among all sources is the heavy use of informal networks. In Cameroon, 92.7% of the HCWs were aware of Mpox, but the main sources were social networks (58.7%) and radio/television (49.2%) instead of scientific publications [8]. This was also reflected in Saudi Arabia, where 68.8% of the health workers reported that the main source was social networks [15]. Although it spreads awareness quickly, a commonality among all sources is the presence of poor clinical knowledge associated with them. For instance, none of the categories described characteristic signs such as vesicles and papules in the Cameroon study [8].

One of the most interesting findings of this literature analysis is the paradox of positive attitudes. HCWs had a positive attitude of 62% to 71.9% toward Mpox control measures [12]. This certainly exceeds the global average positive attitude of 34.6% documented by Jahromi et al. [13]. Nevertheless, this does not necessarily affect actual clinical practices. The knowledge levels of treatment and care practices such as using paracetamol or

antivirals have been documented as poor for all professional groups in Africa as a whole [8], indicating simply "knowing about" Mpox does not necessarily mean "knowing how" either.

The vaccine acceptance for the Mpox vaccine in Africa is perhaps an ultimate example of the intention-action. While vaccine acceptance across the continent is 53.55% [16], actual vaccine uptake is 20.94% [16]. More concerning, it has even collapsed to a paltry 3.4% since 2022 [16]. This gap is largely driven by distrust in health authorities, vaccine safety concerns-especially concerning side effects (like those with ACAM2000)-and supply-related structural barriers [16]. Interestingly, HCWs are willing to vaccinate to a lesser extent (51.63%) usually out of doubt over safety and lack specific training to address vaccination [16].

The need to fill such knowledge gaps is even more aided by the observed high disease burden of Mpox cases in Africa. The common pool severity rate of confirmed cases is put at 43.77%, with a case fatality rate of 3.92%, which is almost ten times higher than the global average of all cases of the disease globally. Clade Ia and Ib infections are associated more severe forms of the disease [17].

Strength and Limitations

This review has several strengths. To our knowledge, the first rapid review to synthesize evidence specifically on Mpox preparedness among HCWs in SSA, addressing a critical evidence gap. A systematic search across two major databases, combined with hand-searching of reference lists and dual-reviewer data extraction and verification, enhances the reliability of our findings. The inclusion of studies from multiple SSA countries (Cameroon, Ethiopia, Nigeria, and the DRC) enhances the regional relevance of the conclusions. However, several limitations should be acknowledged. The small number of included studies ($n = 5$) limits the generalizability of the findings across the full diversity of SSA health systems. All included studies employed cross-sectional designs, which precludes causal inference and may be subject to social desirability bias in self-reported knowledge assessments. Heterogeneity in the knowledge assessment tools used across studies prevented quantitative Meta-Analysis and complicated direct comparisons. The review was not prospectively registered on PROSPERO, which is a recommended standard for systematic and rapid reviews and represents a transparency limitation. The search was restricted to two databases (PubMed and ScienceDirect); a broader search including CINAHL, Embase, or African regional databases (e.g., AJOL, LILACS) would have strengthened comprehensiveness and may have led to the identification of additional eligible studies. Grey literature searching was supplementary and limited in scope. Additionally, the Bass et al. (2013) study assessed post training outcomes rather than baseline knowledge, differing methodologically from the other included studies and introducing heterogeneity in the evidence base. Formal risk-of-bias assessment was conducted using the JBI cross-sectional appraisal tool (Table 3); the consistent absence of confounding control across all studies limits the certainty of individual study findings.

Conclusion

Mpox preparedness among HCWs in Sub-Saharan Africa remains critically insufficient. While the workforce demonstrates

generally positive attitudes toward Mpox prevention and control, knowledge deficits particularly, regarding clinical presentation, transmission routes, and appropriate management remain substantial, and the primary information sources are informal digital networks rather than peer-reviewed clinical guidelines. To address these gaps, Ministries of Health and healthcare institutions across SSA must urgently invest in structured, evidence-based training programs tailored to HCW cadres and integrated into continuing professional development. A One Health approach incorporating coordinated human, animal, and environmental health surveillance should be embedded within these capacity-building initiatives to increase the speed and effectiveness of future outbreak response.

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Author contributions

Conceptualisation: ADT, GTN; Data curation: ADT, RTA, GTN; Investigation: GTN, ADT, RTA; Methodology: ADT, GTN, GRTA; Writing original draft: ADT, RTA, GTN; Review & editing: ADT, RTA, GTN, CNN, NCTG, FZLC, AJD, FNDD

Conflicts of interest

The authors declare that they have no competing interests.

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