

Examining knowledge of Mpox among primary care physicians in north-western Nigeria: an online cross-sectional study

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Abstract

Background: Mpox is a rare but re-emerging zoonotic disease that causes significant morbidity and mortality. As primary care physicians serve as gatekeepers in the healthcare system, it is essential that they be proficient at identifying and coordinating care for suspected mpox patients. However, there is a scarcity of studies on the knowledge of mpox among primary care doctors in the northwestern geopolitical zone of Nigeria.

Objectives: This study assessed the knowledge of mpox and its associated sociodemographic factors among primary care physicians in northwestern Nigeria.

Methods: This online survey involved 155 primary care physicians practicing in seven northwestern states of Nigeria.

Results: The questionnaire completion rate was 91.2% (155/170). The mean age of participants was 38.8 ± 7.4 years, with male preponderance (60.7%). Most were general outpatient clinic doctors (77.4%), with ≥ 10 years of practice experience (63.2%), and senior registrars (36.1%). Only 18.9% had prior experience in diagnosing or managing mpox. Nine (5.8%) had good knowledge of mpox, with a mean overall knowledge score of $61.7 \pm 12.5\%$. Participants with ≥ 10 years of practice experience ($p=0.049$), senior professional cadres ($p=0.031$), and involvement in diagnosing or managing mpox ($p=0.021$) were associated with higher mean knowledge scores.

Conclusions: The overall knowledge rate was notably low, indicating significant gaps in participants' knowledge of the various aspects of the disease. Senior professional cadres, long practice years, and experience in the diagnosis and management of mpox were associated with higher yet suboptimal knowledge scores. Hence, targeted educational interventions are needed to enhance their preparedness to identify and coordinate mpox cases in primary care settings.

Introduction

Monkeypox (mpox) is a zoonotic viral disease caused by the monkeypox virus, a member of the Orthopoxvirus genus within the Poxviridae family.¹ Its aetiology involves transmission from animal reservoirs, primarily rodents and primates, to humans, often through direct contact with infected animals or contaminated materials; human-to-human transmission is also well documented.¹ First identified in 1958 during outbreaks in research monkeys in Denmark, the first human case was documented in 1970 in an infant in the Democratic Republic of Congo (DRC). Since then, mpox has been endemic in Central and West Africa, with distinct viral clades identified, notably the Central African (Congo Basin) and West African clades, which differ in transmissibility and severity.^{1,2}

In recent years, mpox has re-emerged as a significant public health concern, notably in Nigeria (2017), where sporadic cases and outbreaks have been documented. The re-emergence in Nigeria has been characterised by an increased incidence (e.g., 276 suspected cases, including 118 confirmed and seven

deaths in 2018), prompting concerns about its potential to spread beyond endemic regions.³ Outbreaks have also been reported in other parts of Africa and internationally, including the United Kingdom, highlighting the global health implications of mpox.^{4,5} These outbreaks led to the World Health Organization declaring mpox a public health emergency of international concern on July 23 2022, emphasizing the need for enhanced surveillance, preparedness, and response strategies.⁶ Although mpox was predominantly reported in southern Nigeria, cases have spread across Nigeria, with 30 out of 36 states, including both southern and northern regions, now reporting at least one confirmed case.⁷

The clinical course of mpox typically involves an incubation period of 1 to 21 days, followed by prodromal symptoms such as fever, headache, lymphadenopathy, and myalgia.^{1,8} This is succeeded by a characteristic painful rash that usually begins on the face and spreads to other parts of the body, although this order may vary,⁹ and then progresses through macular, papular, vesicular, pustular, and scabbing stages. Mpox typically resolves within four weeks but can be severe or fatal in immunocompromised individuals.^{8,11} The case fatality rate varies depending on the clade, with the Central African clade associated with higher mortality rates, reaching up to 10%, whereas the West African clade has a lower fatality rate.¹²

The differential diagnoses include varicella, smallpox, and other exanthematous illnesses, necessitating accurate clinical and laboratory assessment.^{1,8,11} Current management of mpox involves supportive care, with no universally approved specific antiviral. However, antivirals such as tecovirimat, brincidofovir, and cidofovir, used for other orthopoxviruses, have shown promise in clinical trials, and compassionate use in severe cases.¹¹ Vaccination strategies, including the smallpox vaccine (e.g., JYNNEOS/Imvamune), have demonstrated efficacy in preventing mpox infection, especially among high-risk populations.¹¹ The deployment of these vaccines has been crucial in controlling outbreaks and reducing disease burden.

Globally, evidence indicates variable levels of knowledge about mpox among the general population and healthcare workers, with gaps in understanding of transmission, clinical features, and management.¹³⁻¹⁷ In Nigeria, studies among primary care physicians are scarce. However, a study in Calabar, southern Nigeria, found that only 23.2% of physicians demonstrated good knowledge of mpox, and physicians were more confident in identifying mpox than surgeons.¹⁵ In contrast, a 2023 study among Turkish family physicians reported a much lower good knowledge rate of just 8.8%.¹⁷ A study in the general population identified male gender, higher education levels, and being homosexual as factors associated with better mpox knowledge.¹⁶

Our study, therefore, aims to assess mpox knowledge and its sociodemographic associations among primary care physicians in northwestern Nigeria with the hope that findings would help in articulating strategies for enhancing primary care physicians' knowledge through targeted education and training for timely diagnosis, appropriate referral, effective patient counselling leading to containment of mpox outbreaks, ultimately improving patient outcomes and public health responses.¹⁸

Materials and methods

Study design and setting

This study, which used a descriptive, cross-sectional, online design, was conducted between December 26, 2024, and February 25, 2025. It involved first-contact (primary care) physicians working in family medicine/general outpatient and pediatric outpatient clinics at seven tertiary hospitals in northwestern Nigeria. The physicians, who were approached electronically, worked in hospitals located in Kano, Jigawa, Kaduna, Katsina, Sokoto, Kebbi, and Zamfara states of Nigeria. Tertiary hospitals were selected because they also serve as training centres for primary care physicians, who are likely to encounter mpox, necessitating accurate evaluation and diagnosis for timely management (including referrals).

Participants

The study population comprised medical practitioners and staff of family medicine-affiliated general outpatient clinics and pediatric outpatient clinics in Nigeria's northwestern geopolitical zone. Participants included medical officers, resident doctors, and consultants actively working in the selected hospitals during the study period. Medical interns (under supervision) and practitioners who declined consent to participate were excluded.

Sampling technique

To obtain a representative sample, we used a multi-stage sampling technique. First, we targeted primary care physicians across the seven states of the Northwest geopolitical zone: Kano, Jigawa, Kaduna, Katsina, Sokoto, Kebbi, and Zamfara. Second, in each state, we identified a tertiary hospital with both family medicine/general outpatient and pediatric outpatient clinics, using balloting to select one hospital in states with more than one tertiary hospital. Finally, we approached the primary care doctors with an online questionnaire for voluntary enrollment.

Sample size calculation

During the study period, a total of 255 medical practitioners were estimated to be available for selection across family medicine and pediatric outpatient clinics in various states: Kano (55), Kaduna (30), Kebbi (30), Sokoto (50), Jigawa (30), Katsina (30), and Zamfara (25). Using Epi StatCal version 7.4.6, we calculated the sample size for a finite population of 255, an assumed knowledge rate of 50%, a 95% confidence interval, and a 5% margin of error. This resulted in a minimum required sample size of 153, to which we added a 10% buffer for non-responders, yielding a total sample size of 170.

Study procedure

The principal investigator initiated the study by distributing a questionnaire via WhatsApp or email (Google Form link) to seven study coordinators (primarily primary care physicians) at selected hospitals. Subsequently, these coordinators shared the form through departmental WhatsApp groups for doctors.

The first page of the online questionnaire outlined the study's objectives, procedure and participants' information before seeking consent to participate. Reminders were posted fortnightly to encourage potential participants to complete the forms and to advise them to submit their responses only once to prevent duplicate entries.

Data collection

Data were collected through a self-administered semi-structured online questionnaire (Google Forms). The questionnaire was developed by adapting questions from previous studies and reviewing literature,^{13-15,17} and had two main sections: (1) a demographic section assessing participants' age, sex, practice location, department, clinic, years of experience, professional status (e.g., registrar, consultant, medical officer), additional education, attendance at Mpox workshops or conferences, in-house Mpox training, and information received during undergraduate medical education, along with the timing of their first awareness of Mpox. (2) The knowledge section explored understanding of the aetiological agent of Mpox, confirmed cases in Nigeria, transmission methods, symptoms, diagnosis, antiviral treatments, and vaccine availability. Epidemiology experts reviewed the questionnaire's face and content validity, and reliability was established through pretesting with 17 practitioners from a different geopolitical zone, yielding a Cronbach's alpha of 0.75.

Definition and measurement of variables

The primary outcome variable was participants' overall knowledge of mpox, assessed using 18 knowledge questions. Each correct answer was awarded 1 point, while incorrect or unanswered questions scored zero, yielding a total possible score range of 0 (0%) to 18 (100%). Utilizing the modified Bloom's cut-off points from previous knowledge assessment researches,^{19,20} knowledge scores were categorized into three groups: poor (<50.0%), fair (50.0%–79.9%), and good (80.0%–100.0%). Subsequently, participants with good knowledge were deemed to have adequate knowledge, whereas those with poor or fair knowledge were classified as having inadequate knowledge of mpox disease.²¹ Participants' sociodemographic characteristics were the independent variables.

Ethical considerations

Ethical approval (NHREC/28/01/2020/AKTH/EC/3919) for the study was obtained from the Research Ethics Committee of Aminu Kano Teaching Hospital, Kano. The first page of the online questionnaire outlined the study's objectives, potential risks and benefits, and participants' right to withdraw at any time before providing their consent to participate. Submission of the completed questionnaire was regarded as implied informed consent. All other principles of the Helsinki Declaration were respected.

Data analysis

Data from the online Google Form entries were exported to an Excel spreadsheet and subsequently analyzed using Epi Info version 7.2.6 (CDC, Atlanta, GA). Frequency tables were used to present

categorical data. Continuous variables were presented as mean and standard deviation or median and interquartile range, depending on data distribution. The student's t-test or one-way analysis of variance (ANOVA) was used to establish an association between participants' characteristics and their mean percentage knowledge score, as appropriate. A p-value of < 0.05 was considered statistically significant.

Results

A total of 155 participants (out of a sample of 170 physicians) completed the questionnaire, representing a completion rate of 91.2%, and were analyzed.

Sociodemographic characteristics of participants

The mean age of participants was 38.9 (± 7.4) years. **Table 1** shows that most participants were males (60.7%), from family medicine departments (91.6%), worked in the general outpatient clinics (77.4%), situated in urban settings (87.7%), with practice experience of at least ten years (63.2%) and of the senior registrar professional cadre (36.1%). Similarly, most did not have additional educational qualifications (59.3%), and did not attend any workshop/conference (94.2%), or receive in-house training on mpox (80.6%). Only 29 (18.7%) had been involved in the diagnosis/management of an mpox disease patient.

<<Insert **Table 1**>>

Mpox knowledge among the participants

As shown in **Table 2**, all the participants had heard of mpox disease before the study. Nearly a quarter of participants (23.8%) reported hearing about mpox disease during medical school lectures, while another 23.8% reported hearing about it through social media. However, nearly half (49%) did not know that mpox could be transmitted sexually; two-thirds (66.4%) did not know that the case fatality rate of mpox varied but was not as high as 80%; and over half (56.1%) did not know that vesicles were a typical feature of mpox disease. Similarly, 92.9% did not know that the rash of mpox evolves from maculopapular to vesicular to pustular to crusty/scabbed. Also, most participants did not know that antivirals were not required by most mpox patients (91%); that antiviral therapy could be given in the outpatient setting (51.6%), and that there was an FDA-approved vaccine for mpox prevention (79.3%).

<<Insert **Table 2**>>

Overall, the majority had inadequate knowledge of the disease (n=146, 94.2%), with only 9 (5.8%) participants having good knowledge (**Table 3**).

<<Insert **Table 3**>>

Comparing participants' mean percentage knowledge score by sociodemographic characteristics

Table 4 shows that years of practice (≥ 10 years), employment cadre, and involvement in the diagnosis or management of mpox were significantly associated with higher mean percentage knowledge scores ($p < 0.05$).

<<Insert Table 4>>

Discussion

This online survey among primary care physicians in northwestern Nigeria reported a remarkable 100% awareness rate regarding mpox disease among participants, surpassing the 99.4% awareness found among healthcare professionals in Ekiti State, Nigeria, in 2022,²⁰ and the 95.1% reported among family physicians in Turkey in 2023.¹⁷ This rate stands in stark contrast to the 73.6% awareness among general practitioners in Indonesia in 2019.²² These findings highlight a growing awareness of this previously rare disease among healthcare providers with time. Notably, social media and medical education emerged as the primary sources of information reported by participants, aligning with previous local and international studies, and could be leveraged as effective channels for disseminating information.^{20,22}

Consistent with other studies, most participants provided correct answers to questions on mpox aetiological agent,^{17,20} and awareness of confirmed cases in Nigeria, transmission through person-to-person contact,^{17,20} influenza-like symptoms manifesting in the first week of the disease,¹⁷ lymphadenopathy being a distinguishing feature between mpox and smallpox,²⁰ importance of patient isolation in mpox cases,²⁰ polymerase chain reaction for confirming a diagnosis,²⁰ and the role of symptomatic treatment in managing mpox.²⁰ Despite the above-average scores in these aspects of mpox, the overall knowledge score was inadequate.

Furthermore, only 5.8% of participants demonstrated adequate overall knowledge of mpox, a finding consistent with the 9% and 8.8% reported in Indonesia and Turkey, respectively.^{17,22} In contrast, a 23.2% knowledge rate was noted among physicians and surgeons in Calabar, South-South Nigeria, and a meta-analysis revealed a combined good knowledge prevalence of 34.8% among health workers.^{14,15} The differences in the good knowledge rate may arise from differing cut-off scores (60% versus 80%), study populations (health workers or all doctors versus primary care doctors), and study location (southern Nigeria with more reported cases versus northern Nigeria with fewer reported cases).^{7,20}

Furthermore, the proportion of participants with adequate mpox knowledge in this study may indicate significant gaps in knowledge of other aspects of mpox. For instance, whereas current evidence suggests that human-to-human transmission primarily occurs through direct close contact with an infected individual, which includes touching,¹ sexual activity,^{1,23} kissing,¹ talking,¹ or breathing in close proximity,^{1,24} all of which can generate infectious particles, only about half (49%) of our study participants were unaware that mpox could be transmitted sexually. Also, although cases of animal-to-human transmission have been documented, which can occur through bites or scratches from infected

animals, as well as activities such as hunting, skinning, trapping, cooking, handling carcasses, or consuming animals,^{1,25} 43.9% of our study participants were ignorant of mpox transmission via the bite of an infected rodent. This finding was lower than the 67% found among Peruvian physicians.²⁶ In addition, most participants demonstrated inadequate knowledge of mpox symptoms and signs. For instance, while skin vesicles are a typical presentation of the disease,^{1,2,8,11} more than half (56.1%) of participants were unaware of this fact. Also, the typical sequence of mpox rash progression, from macules to papules to vesicles to pustules to crusting/scabbing, was unknown to 92.9% of participants. Moreover, the mortality rate of mpox has remained at about 10% (e.g., 0.2% in the US during the 2022 global outbreak; 4.6% in a previous outbreak in Africa; and 8.7% in a meta-analysis), while the number of cases globally has increased.^{12,27,28} Interestingly, two-thirds (66.4%) of our study participants incorrectly reported that mpox was a public concern because of its 80% mortality rate. Furthermore, the Nigerian Centre for Disease Control and Prevention (NCDC) management guidelines recommend that the key principles of human mpox management should be protection of compromised skin and/or mucous membranes, rehydration therapy, alleviation of distressful symptoms, provision of nutritional support, treatment of complications, psychosocial support, and treatment of comorbidities, with no clear recommendation on the use of antivirals.⁸ However, where available, antivirals are reserved for patients with severe disease or those at risk of severe disease.¹¹ However, 91% of our study participants erroneously reported that antivirals are used in most cases of mpox, suggesting that most participants may wrongly recommend the use of antivirals in the treatment of all mpox cases. Similarly, over three-quarters of participants (79.3%) were unaware of FDA-approved smallpox vaccines to prevent mpox.²⁹ This finding contrasts with the 39.3% found among Peruvian physicians, likely due to vaccine availability and greater publicity in Peru.²⁶

Interestingly, we observed that participants with 10 or more years of practice experience had higher mean knowledge scores than their counterparts. This finding contrasts with findings from south-western Nigeria,²⁰ and Turkey,¹⁷ where participants with less than five years of experience had higher knowledge scores. This could be because most participants in our study with 10 years of practice experience were either consultants, senior registrars, or chief medical officers (with mean scores of $\geq 63\%$) and were more likely to have had access to some mpox information over the years, even though their knowledge remained suboptimal. This finding corroborates the significant association demonstrated between the senior professional cadre and higher mean knowledge scores in this study. In contrast, a study in Egypt among health workers found higher knowledge scores among physicians than other health workers,³⁰ while another Turkish study found more internal medicine physicians with higher knowledge than other disciplines.³¹

Furthermore, the observed link between prior involvement in the diagnosis and/or management of mpox and higher mean knowledge scores was a key finding in our study. This aligns with the findings of a Peruvian study,²⁶ which suggests that prior engagement with an mpox patient provides physicians with valuable learning experiences and encourages them to research this rare disease further when

challenged. Additionally, exposure to mpox information during medical school or residency programs has been associated with higher knowledge scores in some studies.³¹ Our participants who had prior exposure to mpox medical education similarly demonstrated higher knowledge scores; however, this difference did not reach statistical significance ($p=0.057$).

Although consistent with one study, practice location was not significantly associated with participants' mean knowledge score.²² In contrast, studies in Ekiti, southwestern Nigeria, and Peru showed that the mpox knowledge significantly differed by practice location/area.^{20,26} This could be due to differences in access to mpox information and the study populations (health workers, different medical specialists versus primary care doctors). Furthermore, our study found no link between participants' age and the mean knowledge score. In contrast, some Indonesian and Egyptian studies found a higher proportion of participants with adequate knowledge among those under the age of 30 years,^{22,30} while a higher proportion of Turkish physicians with good knowledge was found in the 30- to 49-year age group.³¹ This suggests an inconsistent relationship between the age of doctors and mpox knowledge levels.

Finally, consistent with many other studies, sex,^{17,20,22,26,30} setting of practice,²⁶ involvement in residency program,²⁶ additional educational qualification,^{20,26,30} attending local or international workshops/conferences,²² and length of time since first hearing about mpox,²² were not significantly associated with the participants' mean knowledge score.

Policy implications

The low proportion of primary care physicians with adequate knowledge of mpox underscores the urgent need to invest in targeted training and retraining initiatives to enhance the competence of all primary care physicians in identifying and coordinating the care of mpox cases in the region's primary care settings.

Study weaknesses and strengths

The study was conducted among tertiary hospital doctors, suggesting caution in generalizing the findings to primary care physicians at other levels of care. Given that most questions were structured, answer guessing could not be eliminated. Selection bias could not be eliminated, as those who volunteered to complete the questionnaire online may differ significantly from those who did not. Despite these limitations, this baseline study clearly shows that mpox knowledge among these gatekeepers at tertiary hospitals was low and that they require training and retraining in mpox detection and management. Future research should involve primary care physicians in public and private primary and secondary healthcare facilities.

Conclusions

The overall knowledge rate of mpox in this study was notably low, revealing significant gaps in participants' understanding of the disease. Senior primary care physicians with many years of practice and prior experience in the diagnosis and management of mpox had higher, yet suboptimal, knowledge scores. These findings clearly indicate a pressing need for targeted educational interventions to improve their preparedness for the identification and management of mpox in primary care settings within the region.

Declarations

Authors' contribution

GCM was involved in the study design, implementation, analysis, and interpretation of data, initial draft manuscript writing, revised the draft and approved the final version.

BAG was involved in the study implementation, major contribution to writing, read and approved the final version.

HYM was involved in the study implementation, major contribution to writing, read and approved the final version.

CN was involved in the study implementation, major contribution to writing, read and approved the final version.

TOL was involved in the study implementation, major contribution to writing, read and approved the final version.

MBU was involved in the study implementation, interpretation of data, major contribution to writing, read and approved the final version.

RA was involved in the study implementation, interpretation of data, major contribution to writing, read and approved the final version.

FAF was involved in the study implementation, interpretation of data, major contribution to writing, read and approved the final version.

MM was involved in the study implementation, interpretation of data, major contribution to writing, read and approved the final version.

ZA was involved in the study implementation, interpretation of data, major contribution to writing, read and approved the final version.

ALO was involved in the study implementation, interpretation of data, major contribution to writing, read and approved the final version.

ZUA was involved in the study implementation, interpretation of data, major contribution to writing, read and approved the final version.

MBM was involved in the study implementation, interpretation of data, major contribution to writing, read and approved the final version.

AKB was involved in the study implementation, interpretation of data, major contribution to writing, read and approved the final version.

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Ethical approval: Ethical approval (NHREC/28/01/2020/AKTH/EC/3919) for the study was obtained from the Research Ethics Committee of Aminu Kano Teaching Hospital, Kano. The first page of the online questionnaire outlined the study's objectives, potential risks and benefits, and participants' right to withdraw at any time before providing their consent to participate. Submission of the completed questionnaire was regarded as implied informed consent. All other principles of the Helsinki Declaration were respected.

Data Availability: Data will be made available upon reasonable request from the corresponding author.

References

1. World Health Organization (WHO). Mpox Fact Sheet. WHO, 26 August 2024. Available at <https://www.who.int/news-room/fact-sheets/detail/mpox> (accessed 25 May 2025)
2. Africa Centres for Disease Control and Prevention (Africa CDC). Monkeypox Technical Factsheet. Africa CDC, Addis Ababa. Available at <https://africacdc.org/disease/monkeypox/> (accessed 8 September 2025)
3. Yinka-Ogunleye A, Aruna O, Dalhat M, Ogoina D, McCollum A, Disu Y, et al. CDC Monkeypox Outbreak Team. Outbreak of human monkeypox in Nigeria in 2017-18: a clinical and epidemiological report. *Lancet Infect Dis.* 2019 Aug;19(8):872-879. doi: 10.1016/S1473-3099(19)30294-4.
4. UK Health Security Agency. Monkeypox cases confirmed in England – latest updates. See www.gov.uk/government/news/monkeypox-cases-confirmed-in-england-latest-updates (last checked 10 September 2022)
5. Mahase E. Seven monkeypox cases are confirmed in England. *BMJ.* 2022 May 17;377:o1239. doi: 10.1136/bmj.o1239.
6. World Health Organization. WHO Director-General's statement at the press conference following IHR Emergency Committee regarding the multi-country outbreak of monkeypox – 23 July 2022. See www.who.int/director-general/speeches/detail/who-director-general-s-statement-on-the-press-

- conference-following IHR-emergency-committee-regarding-the-multi-country-outbreak-of-monkeypox-23-july-2022 (last checked 5 September 2022).
7. Cadmus S, Akinseye V, Besong M, Olanipekun T, Fadele J, Cadmus E, et al. Dynamics of Mpox infection in Nigeria: a systematic review and meta-analysis. *Sci Rep*. 2024 Mar 28;14(1):7368. doi: 10.1038/s41598-024-58147-y.
 8. Nigerian Centre for Disease Control and Prevention (NCDC). National Monkeypox Public Health Response Guidelines 2019. Available at https://ncdc.gov.ng/themes/common/docs/protocols/96_1577798337.pdf
 9. Patel A, Bilinska J, Tam JCH, Da Silva Fontoura D, Mason CY, Daunt A, et al. Clinical features and novel presentations of human monkeypox in a central London centre during the 2022 outbreak: descriptive case series. *BMJ*. 2022 Jul 28;378:e072410. doi: 10.1136/bmj-2022-072410.
 10. Brown K, Leggat PA. Human Monkeypox: Current State of Knowledge and Implications for the Future. *Trop Med Infect Dis*. 2016 Dec 20;1(1):8. doi: 10.3390/tropicalmed1010008.
 11. Titanji BK, Hazra A, Zucker J. Mpox Clinical Presentation, Diagnostic Approaches, and Treatment Strategies: A Review. *JAMA*. 2024;332(19):1652–1662. doi:10.1001/jama.2024.21091
 12. Bunge EM, Hoet B, Chen L, Lienert F, Weidenthaler H, Baer LR, Steffen R. The changing epidemiology of human monkeypox-A potential threat? A systematic review. *PLoS Negl Trop Dis*. 2022 Feb 11;16(2):e0010141. doi: 10.1371/journal.pntd.0010141.
 13. León-Figueroa DA, Barboza JJ, Siddiq A, Sah R, Valladares-Garrido MJ, Rodriguez-Morales AJ. Knowledge and attitude towards mpox: Systematic review and meta-analysis. *PLoS One*. 2024 Aug 9;19(8):e0308478. doi: 10.1371/journal.pone.0308478.
 14. Jahromi AS, Jokar M, Sharifi N, Kashkooli S, Rahmanian K, Rahmanian V. Global knowledge and attitudes towards mpox (monkeypox) among healthcare workers: a systematic review and meta-analysis. *Int Health*. 2023 Oct 20;ihad094. doi: 10.1093/inthealth/ihad094. Epub ahead of print.
 15. Iwuafor AA, Ogban GI, Owai PA, Udoh UA, Ita OI, Elem DE. Assessing Medical Doctors' Knowledge and their Confidence in Spot Diagnosing Monkeypox in South-South Nigeria. *CJHL [Internet]*. 2023 Jun. 29 [cited 2024 Aug. 15];1(1). Available from: <https://journals.covenantuniversity.edu.ng/index.php/cjhl/article/view/3630>
 16. Al-Mustapha AI, Ogundijo OA, Sikiru NA, Kolawole B, Oyewo M, El-Nadi H, et al. A cross-sectional survey of public knowledge of the monkeypox disease in Nigeria. *BMC Public Health* 2023; 23:591. <https://doi.org/10.1186/s12889-023-15398-0>
 17. Atadağ YB, Keten HS, Şahin A. How Ready is Primary Care for Mpox (Monkeypox)? Mpox Knowledge Level Among Family Physicians: A Prospective Cross-sectional Study. *Istanbul Med J*. 2024;25(3):250-254. doi:10.4274/imj.galenos.2024.17802
 18. Bass J, Tack DM, McCollum AM, Kabamba J, Pakuta E, Malekani J, et al. Enhancing health care worker ability to detect and care for patients with monkeypox in the Democratic Republic of the Congo. *Int Health*. 2013 Dec;5(4):237-43. doi: 10.1093/inthealth/iht029. Epub 2013 Nov 17.

19. Chand D, Mohammadnezhad M, Khan S. Levels and Predictors of Knowledge, Attitude, and Practice Regarding the Health Hazards Associated With Barber's Profession in Fiji. *Inquiry*. 2022 Jan-Dec;59:469580221100148. doi: 10.1177/00469580221100148.
20. Ajayi PO, Esan DT, Ipinnimo TM, Olanrewaju MT, Solomon OO, Atanda-Owoeye OO. Knowledge and awareness of human mpox infection among healthcare workers: A cross-sectional study in southwestern Nigeria. *Asian Pac J Trop Med* 2023; 16(6): 245-252.
21. Michael GC, Aliyu I, Grema BA, Ashimi AO. Knowledge of Zika virus disease among reproductive-age women attending a general outpatient clinic in Northern Nigeria, *South African Family Practice* 2017; 59:4, 148-153
22. Harapan H, Setiawan AM, Yufika A, Anwar S, Wahyuni S, Asrizal FW, et al. Knowledge of human monkeypox viral infection among general practitioners: a cross-sectional study in Indonesia. *Pathog Glob Health*. 2020 Mar;114(2):68-75. doi: 10.1080/20477724.2020.1743037. Epub 2020 Mar 23.
23. Allan-Blitz LT, Gandhi M, Adamson P, Park I, Bolan G, Klausner JD. A Position Statement on Mpox as a Sexually Transmitted Disease. *Clin Infect Dis*. 2023 Apr 17;76(8):1508-1512. doi: 10.1093/cid/ciac960.
24. Beeson A, Styczynski A, Hutson CL, Whitehill F, Angelo KM, Minhaj FS, et al. Mpox respiratory transmission: the state of the evidence. *Lancet Microbe*. 2023 Apr;4(4):e277-e283. doi: 10.1016/S2666-5247(23)00034-4. Epub 2023 Mar 7.
25. Falendysz EA, Lopera JG, Rocke TE, Osorio JE. Monkeypox Virus in Animals: Current Knowledge of Viral Transmission and Pathogenesis in Wild Animal Reservoirs and Captive Animal Models. *Viruses*. 2023 Mar 31;15(4):905. doi: 10.3390/v15040905.
26. Gonzales-Zamora JA, Soriano-Moreno DR, Soriano-Moreno AN, Ponce-Rosas L, Sangster-Carrasco L, De-Los-Rios-Pinto A, et al. Level of Knowledge Regarding Mpox among Peruvian Physicians during the 2022 Outbreak: A Cross-Sectional Study. *Vaccines (Basel)*. 2023 Jan 12;11(1):167. doi: 10.3390/vaccines11010167.
27. Centers for Disease Control and Prevention. Mpox: Ongoing 2022 global outbreak cases and Data. Accessed May 1, 2024. Available at <https://archive.cdc.gov/#/details?q=https://www.cdc.gov/poxvirus/mpox/response/2022/index.html>
28. Li P, Li J, Ayada I, Avan A, Zheng Q, Peppelenbosch MP, et al. Clinical Features, Antiviral Treatment, and Patient Outcomes: A Systematic Review and Comparative Analysis of the Previous and the 2022 Mpox Outbreaks. *J Infect Dis*. 2023 Aug 16;228(4):391-401. doi: 10.1093/infdis/jiad034.
29. Rao AK, Petersen BW, Whitehill F, Razeq JH, Isaacs SN, Merchlinsky MJ, et al. Use of JYNNEOS (Smallpox and Monkeypox Vaccine, Live, Nonreplicating) for Preexposure Vaccination of Persons at Risk for Occupational Exposure to Orthopoxviruses: Recommendations of the Advisory Committee on Immunization Practices - United States, 2022. *MMWR Morb Mortal Wkly Rep*. 2022 Jun 3;71(22):734-742. doi: 10.15585/mmwr.mm7122e1. Erratum in: *MMWR Morb Mortal Wkly Rep*. 2022 Jul 08;71(27):886. doi: 10.15585/mmwr.mm7127a5.

30. Alkalash SH, Marzouk MM, Farag NA, Elesrigy FA, Barakat AM, Ahmed FA, Mohamed RA, Almowafy AA. Evaluation of human monkeypox knowledge and beliefs regarding emerging viral infections among healthcare workers. *Int J Emerg Med*. 2023 Oct 18;16(1):75. doi: 10.1186/s12245-023-00547-4.
31. Sahin TK, Erul E, Aksun MS, Sonmezer MC, Unal S, Akova M. Knowledge and Attitudes of Turkish Physicians towards Human Monkeypox Disease and Related Vaccination: A Cross-Sectional Study. *Vaccines (Basel)*. 2022 Dec 21;11(1):19. doi: 10.3390/vaccines11010019.

Tables

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Supplementary Files

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