


Evaluation of Level of Knowledge among Healthcare Workers in Ebonyi State Regarding MPOX Infection, Including Its Prevention and Control Measures

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Abstract

Background: Monkeypox (MPOX) is a zoonotic viral infection from the *Poxviridae* family that is endemic to West Africa. In recent times, outbreaks have also been reported in countries outside the African continent. This study aimed to evaluate the level of knowledge among healthcare workers in Ebonyi State regarding MPOX infection, including its prevention and control measures. **Methods:** This was a cross-sectional study conducted among healthcare workers in Ebonyi State, located in southeastern Nigeria. Data on MPOX infection were collected using a self-administered questionnaire completed by the participants. **Result:** A total of 251 healthcare workers participated in the study. There were more male participants (56.6%) than females, and doctors constituted the majority of respondents. Overall, the level of knowledge regarding MPOX and its control measures was low (58.7%). Only a small proportion of participants (30.7%) were aware that MPOX could be transmitted through

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sexual contact. More concerning was the poor knowledge of MPOX infection prevention and control measures, reported by only 11.2% of respondents. However, the majority of healthcare workers (91.2%) demonstrated adequate knowledge of the causative agent and clinical features (74.1%) of MPOX infection. **Conclusion:** The findings of poor knowledge in this study underscore the urgent need for retraining and awareness campaigns on MPOX and infection prevention and control (IPC) measures among healthcare workers in Ebonyi State.

Keywords

Monkeypox, MPOX, Knowledge, Prevention, Control, Healthcare, Workers

1. Introduction

Monkeypox is a viral zoonotic disease caused by Monkeypox virus, which is a double-stranded DNA virus and a member of Poxviridae family in the genus of Orthopoxvirus [1]. It was first discovered in 1958 at the State Serum Institute (SSI) in Copenhagen, among monkeys kept for laboratory experiment, but its human infection was identified first in 1970 in the Democratic Republic of the Congo [2] [3]. The spread of MPXV beyond endemic regions (Central and West African Countries) has posed a global threat, with recent reports in several countries in Europe and America. Over 120 countries have reported mpx between 2022-2024, with over 100,000 laboratory-confirmed cases reported and over 220 deaths among confirmed cases [2].

In Africa, 1536 cases have been reported and 72 deaths reported [2]. Locally in Nigeria, 124 confirmed MPX cases with one death were reported in 2024 [4].

Although natural reservoir of MPXV has not been discovered, zoonotic transmission occurs from direct human contact with bodily fluids of infected squirrels, rodents, dormice and monkeys [2]. This mode of zoonotic transmission puts those living in forest areas or consuming poorly cooked meats at risk of contacting the infection [2] [5] [6]. Human-to-human transmission is possible through contact with bodily fluids and respiratory droplets of infected individuals [5] [6]. Those at risk of being infected are people with prolonged face-to-face contact with the patients or handling the bodily fluid, such as healthcare workers, laboratory workers and household members [2]. Previous studies have also reported transmission among family members and nosocomial transmission [7] [8]. Patients with MPX present with prodromal symptoms such as fever, severe headache, lymphadenopathy, back pain, and muscle pain [2] [6]. Following a few 2 to 3 days of the initial fever, there is an eruption of maculopapular rash that is predominantly on the face and extremities. The skin lesion is characterized by initial macular lesions followed by papular lesions, then pustular, vesicular, and crust lesions [6] [9]. Encephalitis, bronchopneumonia, and gastrointestinal upsets are the major compli-

cations, and lymphadenopathy appears to be the main distinguishing sign of MPX from small pox [9].

There is no definitive treatment for MPX, but tecovirimat and brincidofovir are the leading experimental drugs for MPX management [10]. The main stay of MPX management is infection prevention and control. According to World Health Organization (WHO), people with prior smallpox immunization show mild MPX manifestation and complications [2]. Increase in health education and awareness campaign focused on risk factors, mode of transmission, early case recognition and isolation, and appropriate respiratory precaution are the main prevention strategies for MPX [2] [11].

Adequate knowledge, early detection and quick response to human MPX by healthcare worker becomes very important with the recent outbreaks in several states and countries. Nonetheless, lack of knowledge of MPXV has been identified by WHO as the major problem to mitigating MPX outbreak, especially among healthcare workers [2] [12]. Therefore, this study intends to assess the knowledge of MPXV and infection prevention practices among healthcare worker in order to improve the preparedness to combat a possible outbreak in the state since cases have been reported in neighboring states. This study aimed to evaluate the level of knowledge among healthcare workers in Ebonyi State regarding MPOX infection, including its prevention and control measures.

2. Materials and Methods

2.1. Study Area

The study was conducted in Ebonyi, a state in southeast geopolitical zones of Nigeria. It shares boundary in the North with Enugu and Benue States and in the Southern part with Cross River as well as Abia States. It involved health care professionals working in various hospitals in Ebonyi State. These hospitals included Alex-Ekwueme Federal University Hospital Abakaliki (AEFUTHA), National Obstetric Fistula Centre (NOFIC), and Mile 4 Maternity Hospital (MMH).

2.2. Study Design

The study was a cross-sectional descriptive study on knowledge of health workers towards monkeypox and its infection prevention and control measures. It involved the use of self-administered pretested questionnaire to collect data with a target population of health worker in Ebonyi State. The questionnaire required approximately 10 - 15 minutes to be completed. Personal identities of the participants were guaranteed confidentiality and anonymity. The data was analyzed using Statistical Package of Social Sciences (SPSS) version 25.

2.3. Study Population

The target population included different cadre of healthcare professionals working in Ebonyi State.

2.4. Inclusion Criteria

All consenting healthcare professional working in Ebonyi State that completed the questionnaire before close of work on the day of survey were recruited for the study.

2.5. Exclusion Criteria

Any healthcare worker who was not working in Ebonyi State or those who were not ready to submit the filled questionnaire before the close of work were exempted from the study.

2.6. Selection Technique

About 70% of the healthcare professionals work in Alex-Ekwueme Federal University Teaching Hospital, followed by 20% HCW in National Obstetrics Fistula Centre (NOFIC) and 10% from Mile 4 Maternity Hospital (MMH). Systematic random sampling technique was used to select one in every four-healthcare worker with specific consideration on the population size of the hospitals. Two hundred, one hundred and fifty-one HCWs were recruited from AEFUTHA, NOFIC, and MMH, respectively. However, the enrolled participants were not up to the calculated sample size of 356 because some HCW either did not return the forms, refused to participate or did not complete the questionnaire properly.

2.7. Sample Size

The sample size was determined using the Cochran formula for cross-sectional studies, where minimum sample size (N) was equivalent to the following:

$$N = Z^2 \frac{pq}{d^2}$$

N = the desired sample size.

Z = the standard normal deviation, usually set at 1.96, corresponding to 95% confidence interval.

P = the prevalence.

$q = 1 - p$.

d = the standard error (margin of error) set at 0.05.

Where prevalence (p) is 36.5%, the prevalence of good knowledge of Monkey-pox in a similar study [12].

The sample size was calculated using the formula above where: $z = 1.96$; $p = 0.365$; $q = 1 - p = 0.635$; and $d = 0.05$.

$$\begin{aligned} N &= (1.96)^2 \times 0.365 \times 0.635 / (0.05)^2 \\ &= 3.8416 \times \frac{0.231775}{0.0025} \\ &=> 356.1549 \\ &= 356 \end{aligned}$$

2.8. Survey Tools

The data was collected using a semi-structured questionnaire and consisted of two sections (A and B). Section A comprised questions on socio-demographic characteristics of the healthcare professionals, level of health institution, health professional cadre, and years of experience in healthcare profession. The second section (section B) consisted of 20 multiple-choice questions related to knowledge of MPX symptoms, transmission, infection prevention and control measures. The questionnaire was developed based on existing facts from the World Health Organization (WHO) factsheet on MPX [2] and modifying previously used questionnaire on available literature in similar study [12]. The validity and reliability of the questions were tested among 20 healthcare workers in a pilot study.

2.9. Data Collection and Analysis

Participants were recruited based on systematic consecutive sampling techniques. The pretested questionnaire was administered to the participants after obtaining an informed consent. Data generated were entered on excel sheet version 2010 and analyzed using SPSS version 25.

2.10. Level Knowledge Score

A correct response to an item was assigned one point, while an incorrect or not sure was assigned zero point. The level of knowledge was assessed and grouped into: high level of knowledge (80% - 100%), moderate level of knowledge (60% - 79%) and low level of knowledge (<60%). Based on Modified Bloom's cutoff point (80% of the total score) [12] [13]. A correct response to an item was assigned one point, while an incorrect or not sure response was assigned zero point.

2.11. Ethical Consideration

Ethical clearance was obtained from Alex-Ekwueme Ethical Committee and informed consent was obtained from the participants before data collection. Ethical approval number: NHREC/16/05/413. Informed consent was obtained from all participants before specimen collection.

3. Result

3.1. Demographic Characteristics

A total of 251 healthcare workers (HCWs) participated in the study and response rate was (70.5%, 251/356). More males (56.6%, 142/251) participated in the study than females (43.4%, 109/251). Majority of the respondents (46.2%, 116/251) were between the age group of 30 to 39 years and the least (6%, 15/251) was between age range of 50 and above. A higher proportion of the respondents (70%, 176/251) were HCWs working in Alex-Ekwueme Federal University Teaching Hospital Abakaliki while a proportion (20%, 50/251) and (10%, 25/251) were working in National Obstetric Fistula Centre (NOFIC) and Mile 4 Maternity Hospital (CMH)

respectively. Most HCWs (86.5%, 217/251) were working in tertiary hospitals and doctors accounted for higher proportion of participants (70.9%, 178/251). Ward assistants and pharmacists were the least respondents with percentages of (3.6%, 9/251) and (1.2%, 3/251) respectively. There were most participants (46.2%, 116/251) that had at least 10 years of working experience that were enrolled in the study (Table 1).

3.2. Knowledge of MPXV Aetiology, Clinical Features, Treatment and Its Prevention and Control Measures among HCWs

Overall mean knowledge score of MPXV infection, management and its prevention and control measures was (58.7%). Over 90% of the respondents had good knowledge of the causative agent while about 50% was aware of the mode of transmission. Only a few of the health workers (30.7%) were aware that MPXV can be transmitted through sexual intercourse. The mean score of the knowledge of aetiological agent and mode of transmission (63.4%) was marginally below 80% Modified Bloom's cut off point (Table 2). Most HCWs (91.2%) had high level of knowledge of the symptoms of MPX infection but very level of knowledge (33.9%) of drug used in treating MPOX. The average score of knowledge of clinical features of MPOX was 74.1% which is moderate level of knowledge (Table 3).

Majority of the HCWs (38.5%) do not know proper infection prevention and measures of MPOX infection. In fact, high proportion (40.2%) still did not know the proper PPE to use when managing MPOX patients. There was also poor knowledge (11.2%) among the participants on appropriate way of wearing PPE in MPX case management. There was generally poor knowledge of infection prevention and control measures of MPX infection among HCWs ranging from minimal knowledge of proper hand hygiene on contact with MPX patients (27.5%) to low knowledge of proper waste management (44.2%) (Table 4).

The mean score knowledge of aetiology and mode of transmission; symptoms and treatment; and prevention and control measures were 63.4%, 74.1% and 38.5% respectively (Table 5). All components of the knowledge assessment scored below the 80% Bloom's cut-off point, with the lowest performance observed in the area of infection prevention and control measures among healthcare workers.

Table 1. Demographic profiles of participants.

Characteristics	Frequency	Percentage
Sex		
Female	109	43.4
Male	142	56.6
Age		
18 - 29	45	17.9
30 - 39	116	46.2
40 - 49	75	29.9
≥50	15	6.0

Continued

Healthcare facilities		
AEFUTHA	176	70
NOFIC	50	20
MMH	25	10
Hospital level		
Primary	21	8.4
Secondary	13	5.2
Tertiary	217	86.5
CADRE		
Chew/J. chew	16	6.4
Doctor	178	70.9
Lab Sci/Tech	26	10.4
Nurse/Matron	19	7.6
Pharmacist	3	1.2
Ward assistant	9	3.6
Years of work		
<5 yrs	76	30.3
5 - 10 yrs	59	23.5
>10 yrs	116	46.2

Table 2. Aetiology and transmission.

Items	Correct options	Correct answers n (%)	Incorrect answers n (%)	Unsure answers n (%)	Mean Knowledge score n (%)
1. MPX is caused by: a. Bacteria b. Fungi c. Virus d. Protozoa e. Not sure	C	231 (92.0)	10 (4.0)	10 (4.0)	231 (92.0)
2. MPX is transmitted by: a. Flies b. Mosquitoes c. Rodents d. Not sure	C	128 (51.0)	19 (7.6)	104 (41.4)	128 (51.0)
3. Can MPX be transmitted from one person to another? a. Yes b. No c. Not sure	A	239 (95.3)	1 (0.4)	11 (4.4)	239 (95.3)
4. MPX CANNOT be transmitted when the patient is NOT having symptoms a. Yes b. No c. Not sure	B	115 (45.8)	55 (21.9)	81 (32.3)	115 (45.8)
5. Can MPX be transmitted through sexual intercourse? a. Yes b. No c. Not sure	A	77 (30.7)	58 (23.1)	116 (46.2)	77 (30.7)

Continued

6. Is the corpse of an MPX patient infectious?	A	182 (72.5)	35 (13.9)	34 (13.5)	182 (72.5)
a. Yes					
b. No c. Not sure					
7. MPX patients, their visitors, their healthcare workers, medical equipment and the hospital environment are the sources of MPX transmission	A	142 (56.6)	28 (11.2)	81 (32.3)	142 (56.6)
a. Yes					
b. No c. Not sure					
TOTAL					1114 (63.4)

Table 3. Symptoms and treatment.

Items	Correct options	Correct answers n (%)	Incorrect answers n (%)	Unsure answers n (%)	Mean Knowledge score n (%)
In which of the following situations would you suspect MPOX as been responsible for the symptoms the patient is experiencing:					
1. A patient presented with flu-like symptoms and generalized skin rashes	A	229 (91.2)	5 (2.0)	17 (6.8)	229 (91.2)
a. Yes					
b. No c. Not sure					
2. A patient presented with similar symptoms like small pox	A	210 (83.7)	8 (3.2)	33 (13.1)	210 (83.7)
a. Yes					
b. No c. Not sure					
3. A patient present same symptoms as small pox	B	150 (59.8)	37 (14.7)	64 (25.5)	150 (59.8)
a. Yes					
b. No c. Not sure					
4. The skin lesion comprises of macular, popular, pustular, vesicular rashes and crust	A	221 (88.0)	8 (3.2)	22 (8.8)	221 (88.0)
a. Yes					
b. No c. Not sure					
5. A pregnant woman, children and immunocompromised individuals are among the risk group that develop severe infection	A	221 (88.0)	4 (1.6)	26 (10.4)	221 (88.0)
a. Yes					
b. No c. Not sure					

Continued

6. Tecovirmat can be effective in the treatment and control of MPX.	A	85 (33.9)	6 (2.4)	160 (63.7)	85 (33.9)
a. Yes					
b. No c. Not sure					
TOTAL					1116 (74.1)

Table 4. Infection prevention and control measures.

Items	Correct options	Correct answers n (%)	Incorrect answers n (%)	Unsure answers n (%)	Mean Knowledge score n (%)
1. Which of the following statements about IPC on MPX is NOT true?	A	94 (37.5)	139 (55.4)	18 (7.2)	94 (37.5)
a. IPC increases the prevalence of Monkeypox Virus					
b. IPC reduces the number of Monkeypox Virus-related deaths					
c. IPC leads to safer wards and healthcare facilities					
d. IPC prevents antimicrobial resistance					
e. Not sure					
2. Which of the following is NOT a PPE?	D	150 (59.8)	50 (19.9)	51 (20.3)	150 (59.8)
a. Apron b. Boot c. Respirator					
d. Ventilator e. Not sure					
3. Which of the following is NOT a best practice of wearing of a PPE?	A	28 (11.2)	214 (85.3)	9 (3.6)	28 (11.2)
a. Wearing a gown outside the environment of one's duty post					
b. Performing hand hygiene before glove use					
c. Performing hand hygiene after glove use					
d. Wearing goggle for high-risk procedure on an MPX patient					
e. Not sure					
4. Which of the following is NOT a best practice in performing a hand hygiene?	D	69 (27.5)	169 (67.3)	13 (5.2)	69 (27.5)
a. Each time before touching an MPX patient					
b. After contact with an MPX patient					
c. After contact with blood and body fluid of an MPX patient					
d. Use of hand sanitizer when hands have been visibly soiled					
e. Not sure					

Continued

5. Which of these is not a good infection prevention and control practice?	C	111 (44.2)	137 (54.6)	3 (1.2)	111 (44.2)
a. Regular handwashing with soap and water before and after all procedures					
b. Regular use of gowns and boots in procedures that generates splashes					
c. Nursing confirmed cases in a general ward					
d. Ensuring proper isolation of mpox patient					
e. Not sure					
6. Proper management of waste and IPC in MPXV patient include the following except	C	111 (44.2)	136 (54.2)	4 (1.6)	111 (44.2)
a. Regular disposal of sharps in sharp box					
b. Sorting and separating waste at the point of general					
c. Recycling medical devices such as needles					
d. Ensure regular disinfection of waste					
e. Not sure					
7. Vaccines can protect one from contracting MPX.	A	118 (47.0)	12 (4.8)	121 (48.2)	118 (47.0)
a. Yes					
b. No c. Not sure					
TOTAL					563 (38.5%)

Table 5. Mean score of knowledge of aetiology, transmission, clinical features, treatment, infection prevention and control measures.

Serial Number	Items	Proportion	Percentage mean Score
1	Aetiology and transmission	1114	63.4
2	Clinical features and treatment	1116	74.1
3	Infection prevention and control measures	563	38.5
4	Mean knowledge score	2793	58.7

4. Discussion

The majority of healthcare workers who participated in this study were medical doctors employed in government tertiary hospital (AEFUTHA and NOFICs), compared to those working in private healthcare facility (MMH). As frontline personnel, medical doctors play a critical role in the identification and management of Monkeypox cases. To effectively carry out this responsibility, it is essential for healthcare workers especially physicians to possess adequate knowledge of Monkeypox disease.

Our findings revealed that the overall knowledge level regarding Monkeypox infection, including its prevention and control, was 58.7%. This indicates a significant knowledge gap when evaluated against an 80% benchmark [12]. Similar findings have been reported in other studies, such as that of Harapan *et al.* (2020) in Indonesia [12], as well as in other countries [14] [15]. This knowledge deficit is not entirely unexpected, given that Monkeypox is a re-emerging infectious disease that typically appears in outbreaks. Consequently, many healthcare workers may have limited or no prior experience managing such cases [12].

The relatively low knowledge level observed in this study contrasts with the high level of awareness and understanding reported among healthcare workers regarding other viral infections, such as Lassa fever, which has become endemic in regions like Abakaliki [16].

In this study, healthcare workers exhibited a high level of knowledge regarding the aetiology, clinical symptoms, and modes of transmission of the Monkeypox virus, despite the overall low knowledge score. This finding is consistent with results from previous studies [15] [17].

The moderate level of knowledge regarding the basic mechanisms of Monkeypox aetiology and transmission may be attributed to formal medical education or increased awareness through social media platforms [17]. Notably, 95% of participants demonstrated awareness of human-to-human transmission, although this contrasts with the findings reported by Alkalash and colleagues [15]. However, there was a general lack of adequate knowledge concerning the availability of vaccines and antiviral treatments for Monkeypox, with only 47% and 33.9% of participants, respectively, being aware of these options. This is a concerning finding, given that healthcare workers are directly responsible for both the administration of treatment and vaccination.

Only a small proportion of participants (30.7%) were aware that Monkeypox can be transmitted through sexual contact. This gap in knowledge has significant implications for the effectiveness of infection control strategies, especially considering that, according to the World Health Organization's 2022 report, same sexual relationships constitute a high-risk group for Monkeypox infection [18].

This study also highlighted a low level of knowledge regarding infection prevention and control (IPC) measures for Monkeypox. Only a small proportion of healthcare workers demonstrated adequate understanding of proper hand hygiene (27.5%), use of personal protective equipment (PPE) (11.2%), and appropriate waste management (44.2%). These findings are consistent with previous reports on Monkeypox prevention and control [19]. This is particularly significant, as effective protection of healthcare workers is crucial for interrupting the transmission chain of the virus. It is essential to emphasize that hand hygiene, correct use of PPE, and safe waste disposal are fundamental components of Monkeypox prevention and control strategies [19] [20]. The overall poor knowledge and limited awareness of IPC measures among key healthcare providers is a serious concern, given their critical roles in both managing confirmed cases and im-

plementing measures to prevent further spread of the infection. The One Health approach have also been highlighted as very important in breaking the chain of transmission from animal to human and human to human transmission [21].

5. Conclusion

The overall knowledge of Monkeypox infection and its prevention measures among healthcare workers remains inadequate. While there is sufficient understanding of the causative agent and clinical symptoms, significant gaps persist regarding proper infection prevention and control practices. Therefore, ongoing training focused on the identification, management, and prevention of Monkeypox is essential for healthcare professionals. Additionally, the continuous sharing of best practices and sustained surveillance efforts are critical to effectively control the spread of the disease.

6. Limitation

It is important to note that conducting additional studies with larger sample sizes would yield more comprehensive data to guide policy formulation. A challenge encountered in this study was the failure of some participants to return their completed questionnaires, which resulted in not reaching the initially calculated sample size. However, this limitation did not compromise the validity of the study's findings.

Conflicts of Interest

The authors have no conflict of interest.

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