

Re-Emerging Viral Infections: An Appraisal of Monkeypox Knowledge and Perception Among Staff of a Tertiary Hospital in Central, Nigeria

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ABSTRACT

Background

Monkeypox is one of the re-emerging viral diseases caused by the monkeypox virus and global outbreaks have occurred recently. The awareness of monkeypox and its prevention is important. The aim was to elucidate the awareness about transmission, prevention, symptoms and perceptions of the participants about monkeypox disease at the Federal Medical Centre, Makurdi, Nigeria.

Methods: The study was a descriptive cross-sectional study of hospital staff. The sample size was 386 at 50% prevalence and a random sampling technique was employed. A self-administered questionnaire was used. All statistical analysis was done using SPSS version 20 and were significant at $p < 0.05$ and a 95% confidence interval.

Result: The mean age of the participants was 41.1 ± 13.0 years, females 215(56.6%) and graduates 202(53.2%). Health workers were 177(46.6%), their mean work experience was 12.1 ± 10.1 years. Those who had heard about monkeypox disease were 283(74.5%), and of these 176 were health workers. Participants who thought that monkeypox disease was caused by a virus or a public deception were 175(61.6%) and 8(2.8%) respectively. Those who knew the mode of transmission were 298(78.4%). Those who were aware of the monkeypox vaccine and were willing to take the vaccine if available were 73(19.2%) and 271(71.3%) respectively. Some responses to prevention were avoiding close contact with infected persons (51.3%) and vaccination (36.3%). Few health workers had training on monkeypox (22, 12.4%) and knew salient information such as the incubation period (32,8.4%)

Conclusion: Monkeypox awareness was not satisfactory and few healthcare workers knew salient information about the virus.

Keywords: Knowledge, monkeypox, monkeypox vaccine, perception, re-emerging viral diseases.

INTRODUCTION

Monkeypox is a zoonotic disease caused by the monkeypox virus which is of the orthopoxvirus genus (WHO, 2023a; Alakunle *et al.*, 2020). The first case of monkeypox was recorded in 1970 and since then cases have been reported in several central and western African countries. Following eradication of smallpox in 1980 and

the end of smallpox vaccination worldwide, monkeypox steadily emerged in Central, East and West Africa (CDC, 2023). In 2022, there was an outbreak of monkeypox in countries without a prior history of the disease (CDC, 2023). The World Health Organization on July 23, 2022, declared the global outbreak of monkeypox to be a public health emergency of international concern and reiterated same on August 14, 2024 (Dong, 2023; WHO, 2024).

The animal reservoir is unknown, small mammals such as rope and sun squirrels, giant-pouched rats and African dormice are thought to harbour the virus in the environments of West and Central Africa (CDC, 2024). Monkeypox can be transmitted by direct contact with infected monkeypox rash, scab or body fluids (CDC, 2022; CDC, 2023). Other transmission routes are contact with infected materials, such as contaminated sheets, clothes or needles, contact with infected respiratory secretions, sexual contact and in-utero transmissions (CDC, 2022; Dasraath *et al.*, 2023). In a Nigerian study, some of the known transmission routes were via contact with contaminated surfaces (32.83%), close contact with infected people (42.68%), through sexual intercourse (24.48%) and 24.48% knew that hunting and contact with wildlife could transmit the disease to humans (Awoyomi *et al.*, 2023).⁸

The incubation period of monkeypox is usually from 6 to 13 days but can range from 5 to 21 days (WHO, 2022a). The symptoms of monkeypox include rash, fever, sore throat, headache, muscle aches and swollen lymph nodes. Detection of viral DNA by polymerase chain reaction (PCR) is the preferred laboratory test for monkeypox (WHO, 2023a).

Awareness, knowledge and perception of monkeypox can impact the spread of the disease. An online cross-sectional survey of monkeypox among 822 Nigerians showed that 89% of the participants were aware of the 2022 monkeypox outbreak and obtained information mostly from internet sources (33.4%), social media platforms (28.6%) and television (25.6%) (Al-Mustapha *et al.*, 2023). In a study among medical and health sciences students across the media space in Nigeria, 94.1% had heard about monkeypox before, 59.1% believed that monkeypox could be treated, 80.8% believed that monkeypox is zoonotic but can be transmitted from human to human, and the majority (60.1%) were aware of the symptoms of monkeypox (Ugwu *et al.*, 2022). A web-based assessment of the perception and knowledge of monkeypox among Nigerian healthcare workers, academics and tertiary students reported that 33.9% knew the incubation period of monkeypox disease (Awoyomi *et al.*, 2023). They were aware of prodromal symptoms such as high fever (51.7%), and fatigue (26%) (Awoyomi *et al.*, 2023).

Avoiding contact with infected animals and persons, infected material and monkeypox vaccine are used to prevent monkeypox infection. Monkeypox vaccine is recommended for people at high risk of getting infected such as health workers at risk of exposure, men who have sex with men, people with multiple sex partners and sex workers. Two types of vaccines are used. These are the replication-deficient modified vaccinia Ankara (MVA) vaccine and the replication-competent vaccinia virus vaccine (CDC, 2023). Vaccine hesitancy has been observed in recent times, especially following the COVID-19 outbreak. Vaccine hesitancy can hinder efforts aimed at prevention, especially during an outbreak of a vaccine-preventable disease like monkeypox. In an online study in Indonesia among Internal Medicine residents, 77.3% were willing to be vaccinated against monkeypox (Salim *et al.*, 2022). This was higher than that obtained among Algerian health workers, where 38.7% of the respondents indicated willingness to receive human monkeypox vaccination if given for free with COVID-19 vaccine uptake as a determinant factor of acceptance (Lounis *et al.*, 2023). In a multinational survey of 11 countries, 77.3% were willing to be vaccinated against monkeypox (Swed *et al.*, 2023).

There is paucity of data on monkeypox research in Benue State, Nigeria. Therefore, the aim of this study was to raise awareness about transmission, prevention, symptoms and perceptions of the participants about monkeypox disease and to enable them to prepare if the disease occurs.

METHODOLOGY

The study was conducted at the Federal Medical Centre, Makurdi, Benue State, North Central Nigeria. It is a tertiary hospital. This was a cross-sectional study, carried out from January to May 2023.

The participants included health and non-health staff of the hospital. The health staff were Community Health Extension Workers, doctors, laboratory scientists, nurses and pharmacists. The non-health staff were administrative staff, messengers, cleaners, drivers and maintenance officers. Every consenting adult aged 18 years and above among them were included in the study.

Single proportion population formula was used to determine the minimum sample size for the study (Araoye, 2004).

$$N = Z^2pq/\delta^2 \text{ where,}$$

N = Minimum sample size, Z = constant at 95% confidence level =1.96,

p = Proportion in the target population estimated to have a particular characteristic (awareness of monkeypox) of interest where 50% was used.

50 % was used because the prevalence of awareness of monkeypox in the area of study was not found on literature search. This also gave a good sample size.

$$q = 1-p \text{ (i.e. } 1 - 0.5) = 0.5$$

δ = desired precision at 5%=0.05

$$N = (1.96)^2 \times (0.5 \times 0.5) / (0.05)^2$$

$$N = 384.$$

Random sampling technique was used. A pretested, self-administered closed ended, structured questionnaire was employed. The response rate was 98% (380). The questionnaire had two parts. The first part was answered by all the participants and enquired about the details found on tables 1, 2 and figures 1, 2, 3, 4. The second part was answered by only the health workers and contained the questions found in tables 3 and 4. Data analysis was done using SPSS version 20. All statistical analysis were significant at $p < 0.05$ and a 95% confidence interval.

RESULTS

Table 1: Sociodemographic characteristics of the respondents.

Variable	Health-workers n(%) n=177	Non health workers n(%) n= 203	Total
Age, mean=41.1 ± 13.0 years			
≤ 20	1(0.6)	15(6.8)	16(4.2)
21 - 40	78(48.4)	88(40.2)	166(43.7)
41 - 60	81(50.3)	92(42.0)	173(45.5)
61 – 80	1(0.6)	23(10.5)	24(6.3)
≥ 81	0(0.0)	1(0.5)	1(0.3)
Gender			

Male	79(49.1)	86(39.3)	165(43.4)
Female	82(50.9)	133(60.7)	215(56.6)
Marital status			
Single	50(31.1)	53(24.2)	103(27.1)
Married	89(55.3)	160(73.1)	249(65.5)
Divorce/separated	6(3.7)	5(2.3)	11(2.9)
Widow/widower	16(9.9)	1(0.5)	17(4.5)
Ethnic group			
Tiv	101(62.7)	158(72.1)	259(68.2)
Idoma	23(14.3)	29(13.2)	52(13.7)
Igede	11(6.8)	1(0.5)	12(3.1)
Others	26(16.1)	31(14.2)	57(15.0)
Religion			
Christianity	153(95.0)	212(96.8)	365(96.1)
Islam	7(4.4)	6(2.7)	13(3.4)
Others	1(0.6)	1(0.5)	2(0.5)
Level of education			
Informal	0(0.0)	5(2.3)	5(51.3)
Primary	0(0.0)	9(4.1)	9(2.4)
Secondary	11(6.8)	77(34.8)	86(22.6)
Graduate/Diploma	85(52.8)	117(52.9)	202(53.2)
Postgraduate	65(40.4)	13(5.9)	78(20.5)
Years of practice of health worker			
≤10 years			
11 - 20	106(65.8)	115(52.5)	221(58.2)
21 – 30	40(24.8)	52(23.7)	92(24.2)
31- 40	12(7.5)	24(11.0)	36(9.5)
≥41 years	3(1.9)	26(11.9)	29(7.6)
	0(0.0)	2(0.9)	2(0.5)

Average monthly income			
<30,000	14(8.7)	113(51.6)	127(33.4)
30,000 to 99,000	31(19.3)	73(33.3)	104(27.4)
>100,000	116(72.0)	33(15.1)	149(39.2)

The mean age of the participants was 41.1 ± 13.0 years. Those aged 21-40 years (n=166, 43.7%) and 41-60 years (n=173, 45.5%) made up over four-fifths of the respondents. Females were slightly more (n=215, 56.6%). Nearly two-thirds were married (n=249, 65.5%) and 103 (27.1%) were single. Slightly above half were graduates (n=202, 53.2%). The health workers were 177(46.6%), their work experience was 12.1 ± 10.1 years and 221(58.2%) had worked for less than 10 years (Table 1).

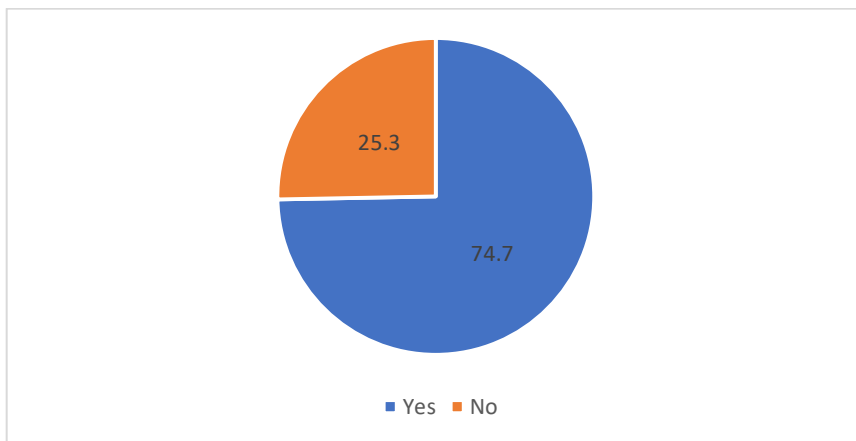


Figure 1: Prevalence of respondents who had heard about monkeypox.

Those who had heard about monkeypox disease were 284(74.7%), and out of these 177 (ie 46.57%) were health workers (Figure 1).

Table 2: Responses to awareness about monkeypox causes, symptoms, transmission, prevention and willingness to receive monkeypox vaccine.

Variable	Frequency	Percent
Cause of monkeypox (mpox) disease (n=284)*		
Caused by virus	175	61.6
Caused by a bacteria	24	8.5
Not a real disease, but a public deception	8	2.8
I don't know	77	27.1
Time of first information about mpox disease (n=284)*		
Within the year	122	43.0
earlier than this year	162	57.0

First source of information (n=284)*		
Social media/television/radio	225	79.2
Family/friend	45	15.8
Market/schools/church	14	4.9
Contact with monkeypox patient (n=280)*		
Yes	40	10.5
No	240	63.2
Knowledge of symptoms of monkeypox (n=380)		
Yes	208	54.7
No	172	45.3
Symptoms mentioned (multiple responses, n=380)		
Body rash	187	49.2
Fever	153	40.3
Headache	118	31.1
Lymph node swelling	102	26.8
Muscle pain	78	20.5
Respiratory symptom	55	14.5
Knowledge of transmission (multiple responses, n=380)		
Contact with infected monkeys and rats	116	30.5
Contact with infected rashes	350	92.1
Contact with infected respiratory droplets	149	39.2
Contact with infected materials	257	67.6
Contact with infected body fluids	302	79.5
Mother to unborn child	69	18.2
I don't know	30	7.8
Knowledge of prevention (n=380)		
Not sure	6	1.6

Protecting food from contact with infected rats and monkey	162	42.6
Avoiding close contact with infected surface/materials	292	76.8
Vaccination	276	72.6
Avoiding close with infected person	374	98.4
Perception of being at risk of mpox infection (n=380)		
Yes	163	42.9
No	217	57.1
Awareness of monkeypox vaccine(n=380)		
Yes	73	19.2
No	307	80.8
Willingness to take vaccination for monkeypox (n=380)		
Yes	271	71.3
No	109	28.7

n= number of responses, *not all participants responded to this question

Table2 shows that one hundred and seventy-five (61.6%) knew that monkeypox was caused by a virus, while some did not know the cause (n=77, 27.1) and few thought that it was not a real disease but a public deception (n=8, 2.8%). The first source of information of the disease was via media (n=225, 79.2%) and fourteen (n=14, 4.9%) obtained their information from market/schools/church. The most known symptoms of monkeypox were body rash, fever and headache, while the least known was respiratory symptoms. Few respondents knew transmission via respiratory droplets and from mother to unborn child. Preventive measures known by the respondents included avoiding contact with infected person and avoiding contact with infected surfaces/materials. Willingness to receive monkeypox vaccine was reported by 271 (71.3%).

Table 3: Knowledge and perception of health-workers about monkeypox

Variable	Frequency (n=177)	Percent
I was taught monkeypox in school.		
Yes	64	36.2
No	113	63.8

As medical personnel, I have you had training on monkeypox		
Yes	22	12.4
No	155	87.6
Knowledge of the incubation period of monkeypox		
1-10 days	32	18.0
6-13 days	60	33.7
>30 days	20	11.2
Don't know	65	36.7
Knowledge of prodromal symptoms (multiple response, n=435)		
Fever	110	75.3
Lymphadenopathy	86	58.9
Malaise	91	62.3
Myalgia	61	41.8
Headache	69	47.3
Not sure	18	12.3
Monkeypox is prevalent in West and Central Africa		
Yes	122	68.9
No	42	23.7
Not sure	13	7.3
Monkeypox is transmitted from human to human		
Yes	132	74.6
No	33	18.6
Not sure	12	6.8
Monkeypox and smallpox have similar signs and symptoms		
Yes	123	69.5
No	54	30.5
Diagnosis of monkeypox can be confirmed by		
Serology	50	28.2

ELISA#	24	13.6
Real-time PCR*	36	20.3
Immunohistochemistry	9	5.1
Not sure	58	32.8
Lymphadenopathy is used to differentiate between monkeypox and smallpox		
Yes	102	57.6
No	53	29.9
Don't know	22	12.4
An antiviral used in the management of monkey pox is		
Sotrivimat	18	10.2
Tecoviramat	33	18.6
Molnupiravir	9	5.1
Don't know	117	66.1
Skin lesion of monkeypox include (multiple response, n=256)		
Macules	59	47.6
Papules	72	58.1
Vesicle	53	42.7
Pustule	67	54.0
Don't know	5	4.0
The case fatality had been around 3-6%		
Yes	79	44.6
No	25	14.1
Don't know	73	41.2
I think there are currently enough preventive measures for monkey pox		
Yes	74	41.8
No	103	58.2

I am worried monkeypox may become a world pandemic.		
Yes	115	65.0
No	62	35.0
I think regular protocol for handling pandemic like monkeypox should be made routine		
Yes	161	91.0
No	16	9.0
Judging from COVID-19 pandemic, I am prepared to handle monkeypox pandemic		
Yes	91	51.4
No	86	48.6
I think the government is responding swiftly and adequately to curb the spread of monkeypox		
Yes	83	46.9
No	94	53.1

Only 64 (36.2%) of the health-workers had been taught about monkeypox while at school and 22 (12.4%) had received training on monkeypox during their working experience. Fever was the most known prodromal symptom (75.3%). Only 36 (20.3%) knew that PCR was the confirmatory test. Over two-fifths knew all the range of exanthems of monkeypox disease, however few did not know any of them (n=5, 4%). Only 18 (10.2%) knew an antiviral (sotrivimat) used for the treatment. Most of the health-workers were worried that monkeypox could become a world pandemic (n=115, 65%) and thought that regular protocol for handling pandemics should be made routine for monkeypox (n=161, 91.0%). Over half of the respondents thought that currently the preventive measures were not enough (n=103, 58.2%) and that the government response was not adequate (n=94, 53.1%). Ninety-one (51.4%) felt they were prepared to handle the monkeypox pandemic.

Table 4: Association between sociodemographic characteristics and awareness of monkeypox disease

Variables	Have you heard about monkeypox		p value
	Yes	No	
Age in years			0.000*
≤ 20	7(43.8)	9(56.3)	
21 - 40	129(77.7)	37 (22.3)	
41 - 60	135 (78.0)	38 (22.0)	

61 – 80	11 (45.8)	13 (54.2)	
≥ 81	1 (100.0)	0 (0.0)	
Gender			0.016*
Male	133 (80.6)	32 (19.4)	
Female	150 (69.8)	65 (30.2)	
Marital status			0.243
Single	74 (71.8)	29 (28.2)	
Married	184 (73.9)	65 (26.1)	
Divorced/separated	9 (81.8)	2 (18.2)	
Widower/widower	16 (94.1)	1 (5.9)	
Tribe			0.063
Tiv	182 (70.3)	77 (29.7)	
Idoma	42 (80.8)	10 (19.2)	
Igede	12 (100.0)	0 (0.0)	
Others	47 (82.5)	10 (17.5)	
Religion			0.226
Christianity	269 (73.7)	96 (26.3)	
Islam	12 (92.3)	1 (7.7)	
Others	2 (100.0)	0 (0.0)	
Level of education			0.000*
Informal	3 (60.0)	2 (40.0)	
Primary	1 (11.1)	8 (88.9)	
Secondary	34 (39.5)	52 (60.5)	
Graduate/Diploma	168 (83.2)	34 (16.8)	
Postgraduate	77 (98.7)	1 (1.3)	
Average monthly income			0.000*
≤29,999	60 (47.2)	67 (52.8)	
30,000 to 99,000	78 (75.0)	26 (25.0)	
≥100,000	145 (97.3)	4 (2.7)	

Type of job			0.000*
Health worker	176 (99.4)	1 (0.6)	
Non health worker	107 (52.7)	96 (47.3)	

***Statistically significant**

There was statistically significant relationship between age ($p < 0.05$), gender ($p = 0.016$), level of education ($p < 0.05$), average monthly income ($p < 0.05$) and type of job ($p < 0.05$) and awareness of monkeypox disease (Table 4).

Table 5: Association between willingness to take monkeypox vaccine and other variables

Variables	Willingness to take monkeypox vaccine		p Value
	Yes	No	
Age			0.070
≤ 20	11 (68.8)	5 (31.3)	
21 - 40	122 (73.5)	44 (26.5)	
41 - 60	126 (72.8)	47 (27.2)	
61 – 80	11 (45.8)	13 (54.2)	
≥ 81	1 (100.0)	0 (0.0)	
Gender			0.761
Male	119 (72.1)	46 (27.9)	
Female	152 (70.7)	63 (29.3)	
Marital status			0.953
Single	74 (71.8)	29 (28.2)	
Married	178 (71.5)	71 (28.5)	
Divorced/separated	7 (63.6)	4 (36.4)	
Widow/widower	12 (70.6)	5 (29.4)	
Ethnic group			0.129
Tiv	181 (69.9)	78 (30.1)	
Idoma	39 (75.0)	13 (25.0)	
Igede	12 (100.0)	0 (0.0)	
Others	39 (68.4)	18 (31.6)	

Religion			0.659
Christianity	260 (71.2)	105 (28.8)	
Islam	9 (69.2)	4 (30.8)	
Others	2 (100.0)	0 (0.0)	
Level of education			0.001*
Informal	3 (60.0)	2 (40.0)	
Primary	3 (33.3)	6 (66.7)	
Secondary	50 (58.1)	36 (41.9)	
Graduate/Diploma	156 (77.2)	46 (22.8)	
Postgraduate	59 (75.6)	19 (24.4)	
Type of job			0.000*
Healthworker	142 (80.2)	35 (19.8)	
Non-health worker	129 (63.5)	74 (36.5)	
Average monthly income			0.020*
<30,000	79 (62.2)	48 (37.8)	
30,000 to 99,000	78 (75.0)	26 (25.0)	
>100,000	114 (76.5)	35 (23.5)	
Have you heard of monkeypox?			0.000*
Yes	220 (77.7)	63 (22.3)	
No	51 (52.6)	46 (47.4)	
What do you think causes monkeypox?			0.172
Caused by virus	135 (77.1)	40 (22.9)	
Caused by bacteria	18 (75.0)	6 (25.0)	
It is not a real disease, but a public deception	4 (50.0)	4 (50.0)	
Not sure	64 (83.1)	13 (16.9)	
Do you know symptoms of monkeypox?			0.000*
Yes			

No	165 (79.3)	43 (11.3)	
	106 (61.6)	66 (38.4)	
Do you think you are at risk of having monkeypox?			0.003*
Yes	129 (79.1)	34 (20.9)	
No	142 (65.4)	75 (34.6)	
Are you aware of monkeypox vaccine?			0.000*
Yes	65 (89.0)	8 (11.0)	
No	206 (67.1)	101 (32.9)	

***Statistically significant**

Having heard about monkeypox, education, type of job, monthly income, knowing the symptoms, being aware of the vaccine and feeling at risk of the disease had statistically significant ($p < 0.05$) relationship with willingness to take monkeypox vaccine (Table 5).

DISCUSSION

A new incidence of monkeypox is continually being recorded. As at the 11th of September 2023, the WHO received a report of 1131 newly diagnosed cases and five deaths in the preceding 21 days (WHO, 2022b). This an increase compared to 1020 cases and three deaths over the preceding days as at 9th August, 2023 (WHO, 2023b). Nigeria recently reported a surge in cases this year. More studies can help in instituting preventive measures.

In this study, the mean age of the participants was 41.1 ± 13.0 years. Those aged 21-40 years ($n=166$, 43.7%) and 41 - 60 years ($n=173$, 45.5%) made up over four-fifths of the respondents. In a Nigerian online national survey on monkeypox the mean age of the respondents was 35.2 ± 10.9 years, 43.6% were aged between 30 – 44 years (Awoyomi *et al.*, 2023). The present study shows that, those within the ages of 41 – 60 had the highest proportion of awareness of monkeypox disease compared to all other age groups. In addition, younger age groups (≤ 20 , 21 – 40 years) had higher proportion of awareness compared to older age groups. Age showed a statistically significant relationship with awareness of monkeypox. This finding may be because younger persons may have more interest with electronic media and hence more contact with information compared to older age groups. Therefore, health education should be channelled through means that target both the younger and older individuals.

Females were slightly more ($n=215$, 56.6%) unlike in another study where males were more (Awoyomi *et al.*, 2023). Although the females were more than the males, the proportion of awareness of monkeypox disease was higher among the males and was statistically significant. The reason for this is unclear since they were all working in the same environment, but may be attributed to women being more involved in domestic chores after work and may not keep abreast with information on trending issues. Most of the participants were married ($n=249$, 65.5%) and more than half were graduates ($n=202$, 53.2%) while five (1.3%) had no formal education. There was a statistically significant relationship between the level of education and awareness of monkeypox. The awareness increased as the educational level progressed with those having postgraduate education (98.7%) being the highest. Similarly, Awoyomi *et al.*, found that students and academics were quite aware of monkeypox disease. Non health-workers were 203 (53.4%). Healthcare workers were 177(46.6%), their work experience was 12.1 ± 10.1 years and 221(58.2%) had worked for less than 10 years. The type of job (health related/not health related). Health workers were also found to be more aware of monkeypox disease

in another study (Awoyomi *et al.*, 2023). The average monthly income showed a statistically significant relationship with awareness of monkeypox with people who had high income (> 100,000 naira) having the highest proportion of awareness. Interventions to increase awareness may be effective if people of lower educational and socio-economic status are being targeted with educational aids such as pictures, jingles in local dialects on radio and television, community awareness programmes and school talk shows to enable them get a good grasp of information on monkeypox.

Those who had heard about monkeypox disease were 284 (74.7%), and out of these 177 (46.57%) were health workers. This present finding aligns with observations reported by Al-Mustapha and colleagues in an online cross-sectional survey where majority of the study participants (89%) were aware of monkeypox outbreak (Al-Mustapha *et al.*, 2023). Though majority in these studies knew about the disease, it is still obvious that awareness strategies still need to be intensified. This may be achieved by health education at schools, markets and hospitals.

Most of the participants, (61.6%) knew that monkeypox was caused by a virus, some did not know the cause (27.1%) and few thought that it was not a real disease but a public deception (n=8, 2.8%). Participants obtained information of monkeypox from media (59.2%) and fourteen (n=14, 4.9%) obtained their information from market/schools/church. In another study, information about the monkeypox were obtained from internet sources (33.4%), social media platforms (28.6%) and television (25.6%) (Al-Mustapha *et al.*, 2023). The notable point of this finding is that media, social and educational institutions are very relevant mediums in passing information to people in a bid to curbing monkeypox. Misinformation and spread of myths during disease outbreaks can render preventive measures ineffective. Therefore, interaction with the public should address such misinformation.

The most known symptoms of monkeypox were body rash (89.9), fever (73.6%) and headache (56.3%) while the least known was respiratory symptoms (26.4%). In another study, the participants were mostly aware of the prodromal symptoms such as high fever (51.7%), and fatigue (26%), while for the more specific symptoms, rashes (52%) and swollen lymph nodes (33.1%) were most known symptoms (Al-Mustapha *et al.*, 2023).

Majority (68.9%) of the health workers knew that monkeypox was prevalent in West and Central Africa. Only about one-third of the healthcare workers (33.7%) knew the incubation period of monkeypox. For each of the exanthems which included macules, papules, vesicles, and pustules the healthcare workers knew at least two-fifths for each of the exanthems, however few did not know any of them (4%). These skin lesions are one of the most recognizable symptoms of monkeypox and health workers are supposed to know them to enable them have high index of suspicion whenever such presents. This can help in identifying the patients early for treatment and may prompt the health worker pay more attention to preventive measures that can mitigate transmission of the disease to themselves or others.

Contact with infected rashes (49.4%) and infected body fluids (42.7%) were the commonest responses to modes of transmission and is consistent with other studies (Al-Mustapha *et al.*, 2023). Few respondents knew transmission via respiratory droplets (21.0%) and from mother to unborn child (9.8%). Toeing a similar line, Al-Mustapha and colleagues found that less than half were aware of the less known sexual route of transmission (Al-Mustapha *et al.*, 2023). Preventive measures known by the respondents included avoiding contact with infected persons, and avoiding contact with infected surfaces/materials while responses to 'not sure' were 37.3%. Proper hygiene and vaccination are also top on preventive measures in another study (Silas & Ikechukwu, 2019; Al-Mustapha *et al.*, 2023; Awoyomi *et al.*, 2023). During outbreaks, it is important to tackle all possible routes of transmission and if some of the less reported routes are not known, this may hinder preventive measures. The knowledge of preventive measures is important in mitigating the spread.

Prevention of monkeypox is also achieved by use of vaccination against the disease (Salim *et al.*, 2022; CDC, 2023). In this study few respondents (n=73, 19.2%) were aware of this. One hundred and sixty-three respondents (42.9%) felt they were at risk of the disease. A remarkable proportion (n=271, 71.3%) expressed willingness to take vaccination against monkeypox. This is close to observation in Indonesia among Internal Medicine residents where 77.3% were willing to be vaccinated against monkeypox (Salim *et al.*, 2022), but higher than that obtained among Algerian health-workers, where 38.7% of the respondents indicated

willingness to receive human monkeypox vaccination if given for free with COVID-19 vaccine uptake as a determinant factor of acceptance (Lounis *et al.*, 2023). There was statistically significant relationship between level of education ($p=0.001$), occupation (0.002), type of job ($p<0.05$) and average monthly income ($p=0.02$) and willingness to receive monkeypox vaccine. Those who had heard about monkeypox and knew the symptoms had the highest proportion of willingness to receive monkeypox vaccine and it was statistically significant ($p<0.05$). In addition, there was also statistically significant relationship between feeling at risk of contracting monkeypox ($p=0.003$) and being aware of the monkeypox vaccine ($p<0.05$). In an online Nigerian study among health care workers, the determinants of monkeypox vaccine confidence were being single, having a higher education level and absence of chronic disease (Ghazy *et al.*, 2022). In a Bangladeshi study, there was statistically significant association between monkeypox knowledge score with gender, age group, educational qualification, monthly family income, job position at the hospital, total length of service, duration of service at the current place of posting and attendance of any monkeypox seminar/symposium/workshop in last 6 months (Nurul *et al.*, 2022).

Few of the health-workers had been taught about monkeypox while at school ($n=64$, 36.1%) and 22 (12.4%) had received training on monkeypox during their working experience. This low proportion is comparable to 40.6% who had learnt about monkeypox during schooling in a study among health care professionals in Bangladesh (Nurul *et al.*, 2022). About one-third knew the incubation period of monkeypox ($n=60$, 33.7%) and 79 (44.6%) knew the case fatality rate. This concurs with low awareness of monkeypox of less than 10% reported among general practitioners in Indonesia (Harapan *et al.*, 2020). These findings are quite low as it would have been expected that healthcare workers are supposed to be conversant with details of an outbreak such as monkeypox. Fever was the most known prodromal symptom among the healthcare workers (75.3%). Majority knew that monkeypox could be transmitted from human to human ($n=132$, 74.6%), had similar signs and symptoms with small pox ($n=123$, 69.5%) but could be differentiated from smallpox by presence of lymphadenopathy ($n=102$, 57.6%). Only 36 (20.3%) knew that PCR was the confirmatory test. Over two-fifths knew all the range of exanthems of monkeypox disease, however few did not know any of them ($n=5$, 4%). Only 18 (10.2%) knew an antiviral (tecoviramat) used for the treatment though it is still under trial (Harapan *et al.*, 2020) and is quite close to 13.3% among Internal Medicine residents in Indonesia who knew the medication used for treatment (Salim *et al.*, 2022). Among doctors in Calabar, Nigeria, 72% were confident to clinically diagnose monkeypox in their clinics (Iwuafor *et al.*, 2022). These specific knowledge of information about monkeypox disease among the healthcare workers is insufficient. It is essential for national health agencies in Nigeria to expeditiously train and retrain health-workers immediately an outbreak of any disease occurs. Health care workers can then have vast information to disseminate to the populace.

Most of the health-workers were worried that monkeypox could become a world pandemic ($n=115$, 65%) and thought that regular protocol for handling pandemics should be made routine for monkeypox ($n=161$, 91.0%). A multinational survey done among healthcare workers in Egypt, Saudi Arabia, Yemen, Syria, Libya, Algeria, Tunisia, Iraq, Palestine, Jordan, and Sudan. reported that 8.8% of participants were concerned that monkeypox might generate an epidemic like COVID-19 (Swed *et al.*, 2023). In agreement with the current findings, 79.6% also felt that healthcare workers should apply more infection control measures (Swed *et al.*, 2023). Over half of the respondents thought that currently the preventive measures were not enough ($n=103$, 58.2%) and that the government response was not adequate ($n=94$, 53.1%). Ninety-one (51.4%) felt they were prepared to handle monkeypox pandemic. It is crucial that government should support training of health staff, institute and monitor protocols for universal precautions including provision of personal protective equipment. This can boost the confidence of health care workers in handling monkeypox when patients present.

In conclusion, awareness of monkeypox was not satisfactory and few healthcare workers knew salient information about the disease, hence more needs to be done on the aspects of health education and staff training on monkeypox. Our findings buttress the need for policymakers to institute health education on monkeypox, especially for the elderly and those of lower educational and economic status and ensure that personal protective equipment is provided for health workers at risk and train health workers on how to identify and manage cases. Clinicians should be able to identify cases of monkeypox, provide information on prevention to patients, relatives and their communities and have the necessary knowledge to treat monkeypox disease.

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