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Assessing healthcare workers' confidence level in diagnosing and managing emerging infectious virus of human mpox in hospitals in Amhara Region, Northwest Ethiopia: multicentre institution-based cross-sectional study

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ABSTRACT

Objective To assess healthcare workers' (HCWs) confidence level in diagnosing and managing mpox disease and its associated factors in hospitals in the Amhara Region.

Design Institution-based cross-sectional study.

Setting Hospitals in the Amhara Region, Northwest Ethiopia.

Participants A total of 640 HCWs, with a response rate of 96.9%, participated from 1 October to 30 December 2022. A multistage stratified random sampling technique with proportional allocation was used to recruit study participants. Data were collected using the KoboCollect toolbox and exported to STATA V.17 for analysis. Descriptive statistics were used to describe data. Ordinal logistic regression analysis was used to identify predictors of confidence level to diagnose and manage mpox at $p<0.05$.

Primary outcome HCWs' confidence level in diagnosing and managing mpox disease and its associated factors.

Results The overall proportion of HCWs who had high confidence level in diagnosing and managing mpox disease was found to be 31.5% (95% CI: 27.9%, 35.2%). Similarly, 26.8% (95% CI: 23.2%, 30.3%) and 41.8% (95% CI: 38.1%, 45.4%) of HCWs expressed medium and low confidence level to diagnose and manage the disease, respectively. The odds of higher confidence versus lower or medium confidence level in diagnosing and managing mpox were greater for HCWs who regularly visit amenable websites (adjusted OR (AOR)=1.59, 95% CI: 1.16, 2.2), were physicians (AOR=1.9, 95% CI: 1.32, 2.73), were aged 30–35 years old (AOR=1.64, 95% CI: 1.12, 2.39), had got public health emergency epidemic disease management training (AOR=2.8, 95% CI: 1.94, 4.04) and had positive attitudes (AOR=1.72, 95% CI: 1.26, 2.36) compared with their counterparts.

Conclusion The overall confidence level of HCWs in diagnosing and managing mpox disease in the study area was low. Therefore, the HCWs should be regularly updated about mpox disease through morning sessions and training in the diagnosis and clinical management of mpox disease including infection prevention and control.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This study has used a relatively larger sample size, which increases the study's power and generalisability of its findings.
⇒ The study has also employed multivariate ordinal logistic regression analysis to control the effect of confounders.
⇒ The possibility of social desirability bias, as some respondents, that is, physicians, might give positive responses that were not actually true, and recall bias such as remembering frequency of handwashing, were the limitations of this study.

INTRODUCTION

Mpox is an illness caused by the mpox virus, a double-stranded DNA virus belonging to the genus *Orthopoxvirus* within the Poxviridae family, almost similar to variola virus responsible for smallpox.[1 2] The mpox disease is originally a viral zoonotic infection that spreads from animals to humans. However, human-to-human and environment-to-human transmissions were also evident recently.[3 4] The genetic changes of the virus over time enhanced its ability to infect different species and adapt to new environments. Furthermore, the zoonotic spillover of mpox has also provided the virus to jump from animals to humans and raised concerns about the potential for increased virulence or the emergence of more transmissible strains in the future.[5]

The mpox virus was first isolated from monkeys in laboratories in Copenhagen, Denmark in 1958[6 7] and the first human case, a 9-month-old patient, was identified in Democratic Republic of Congo (DRC) in 1970.[8] The first mpox outbreak outside Africa was documented in the USA in 2003, which originated from an infected rodent species imported from West Africa.[9] Since then, there was sporadic occurrence of mpox outbreaks in endemic regions in Africa. The problem is particularly severe in the DRC, the country where a survey research revealed that of 77 suspected cases that spread across 138 homes, 27.3% of PCR tests were positive for mpox, with the largest recorded number of cases (882) and deaths (2) documented.[10] Moreover, the Nigerian mpox outbreak in 2017 leads to the spread of the disease to the UK and elsewhere in Europe, followed by a dramatic increase in the number of mpox infections. Consequently, we now face a period of multiple outbreaks in countries without clear epidemiological links to endemic countries.[11 12]

As of 30 December 2023, approximately 92 783 confirmed cases and 660 probable cases, including 171 deaths, have been reported across 116 countries since 1 January 2022. Notably, nearly 98% of cases and 88% of deaths were reported from countries that have not historically reported mpox.[13 14] The case fatality ratio of mpox is lower than that of smallpox,[15] as its case fatality reaches 17%, which is well below that of smallpox (25–40%).[16]

The mpox disease is primarily a cutaneous illness with lymphadenopathy. It is transmitted through direct or indirect close contact with droplets, fomites, skin lesions or contaminated body fluids.[17–22] Additionally, it can be transmitted through sexual intercourse and mother-to-fetus transmission.[23 24] The mpox disease is also self-limiting, with symptoms ranging from mild to severe. These symptoms include itchy to painful skin lesions, fever, generalised headache, fatigue, lymphadenopathy, back pain and myalgia.[22–24] The symptoms of mpox normally disappear after 14–21 days, following an incubation period of 5–21 days.[22 25] The most prominent clinical symptom of mpox is a skin rash that typically appears up to 3 days after fever. However, in more severe cases, this rash can be observed throughout the body.[26 27] Patients admitted to the hospital show clinical manifestations of complications such as bacterial superinfection, dehydration and respiratory distress.[19 28]

Several risk factors are linked to an increase in mpox outbreaks, including the interruption of smallpox vaccination, which leads to increased susceptibility to mpox infection; the extensive consumption of animals as a protein source, which are potential mpox virus reservoirs; increased population density; ease of travel; and ecological and environmental factors, such as clearing of tropical rainforests with an increased risk of exposure to reservoir animals.[29–33]

Enhancing case definition, epidemiological, clinical, genomic and molecular surveillance alone is not enough to prevent the mpox epidemic. Instead, it requires integrated health promotion or education, as well as announcement or implementation of prevention mechanisms. These measures are critical for disease control.[34]

Based on these global efforts, effective and safe vaccines are ongoing, with licenses being used in countries such as the UK, Canada and the USA for high-risk populations. Moreover, basic public health interventions, such as the use of personal protective equipment (PPE), practising good hand hygiene, immediate case isolation, contact tracing, and avoiding contact with infected animals or materials, are effective means of controlling the spread of human mpox.[35 36] Similar to communities, healthcare workers (HCWs) should practise strict use of PPE such as wearing well-fitted N95 masks, gloves and other pieces of PPE before any contact with a suspected case.[37]

The HCWs' confidence level in diagnosing and managing mpox disease is challenging due to inadequate capacity to diagnose and clinically manage patients and to identify exposure accurately.[38] Moreover, the *Orthopoxvirus* testing capacity in endemic areas in Africa is reported to be very low.[38] Therefore, the rapid increase in mpox cases calls for investigations on HCWs' knowledge, confidence and attitude towards their ability to diagnose and manage patients with mpox,[12 35] which is the primary role of healthcare professionals in responding to the ongoing mpox epidemic.[39–41]

Ethiopia, as the third most populous country in Africa, is at risk of the mpox virus, along with other countries in the Horn of Africa. Sudan, which shares its border with the Amhara Region in Northwest Ethiopia, has reported 19 mpox cases and 1 death since August 2022.[13 14]

The continued political instabilities and unrest in Sudan forced civilians to migrate to Ethiopia through the border of Metema, West Amhara Region. Moreover, the current political instability in the Amhara Region also deteriorates the capacity of healthcare facilities, which makes testing of *Orthopoxvirus* very difficult. Considering such scenarios, assessing the HCWs' confidence level in diagnosing and managing mpox at the Amhara Region will have paramount importance. Therefore, the aim of this study is to assess HCWs' confidence level in diagnosing and managing emerging infectious mpox viruses in hospitals in the Amhara Region, Northwest Ethiopia.

METHODS

Study design, setting and period

An institution-based cross-sectional study was conducted in hospitals found in the Amhara Region, Northwest Ethiopia from 1 October to 30 December 2022. Bahir Dar City is the capital city of Amhara Region, which is located at 575 km in the northwest direction of Addis Ababa, the capital city of Ethiopia. It is also located at 340 km from Metema, which is a border route to Sudan. The region has 15 zones and 98 public hospitals (8 comprehensively specialised, 20 general and 70 primary) (figure 1).

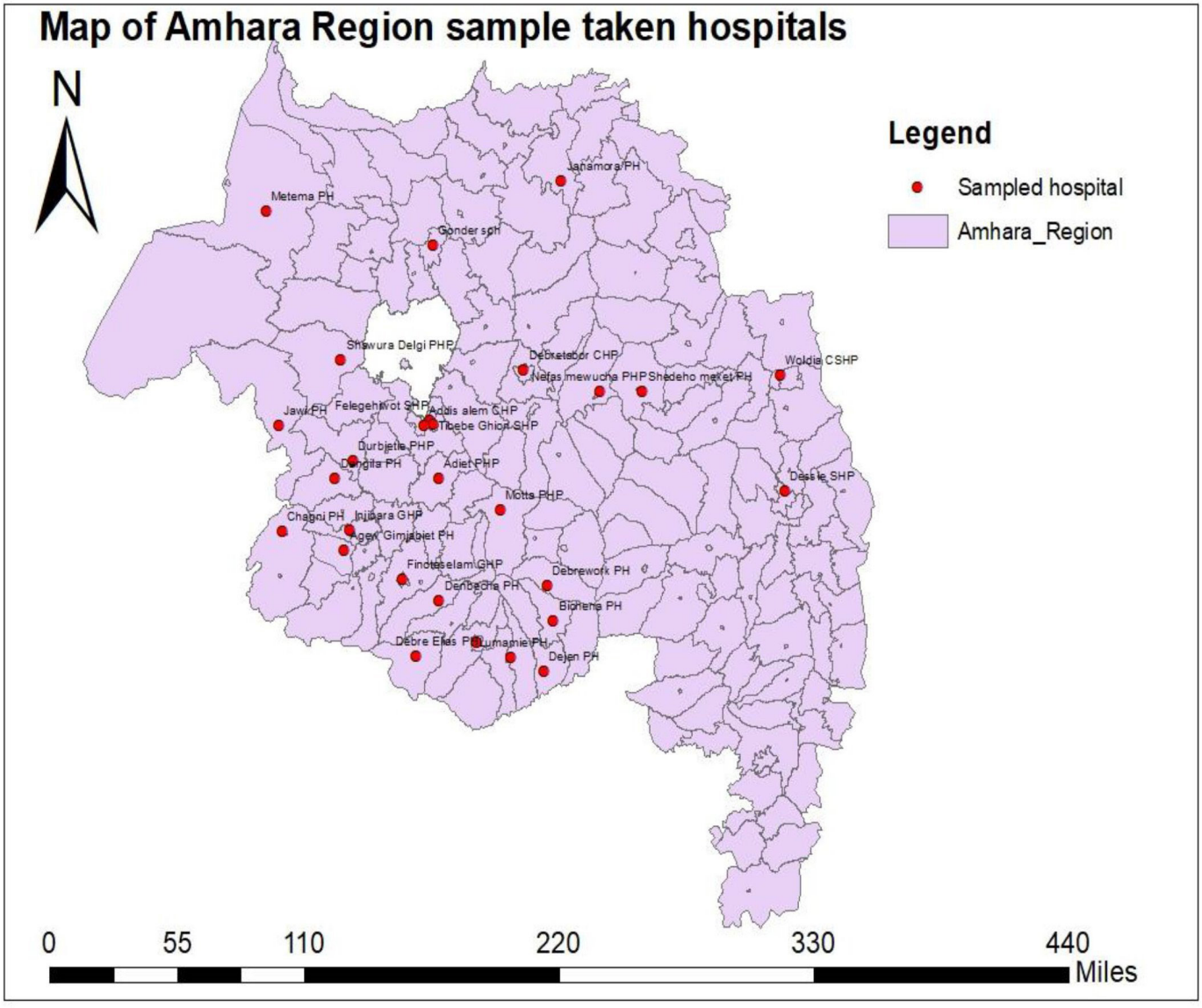

Figure 1 Map of the Amhara Region where hospitals of the healthcare workers included were located. The healthcare workers were selected to assess their confidence level of the mpox disease (Northwest Ethiopia, 2022).

Source and study population

All HCWs working in public hospitals in the Amhara Region were taken as the source population, and those HCWs working in randomly selected public hospitals were considered as the study population.

Inclusion and exclusion criteria

All HCWs working in public hospitals in the Amhara Region were included in this study; however, those HCWs who are not available during data collection and who are on annual/maternal leave were excluded from the study.

Patient and public involvement

There is no involvement of patients and/or the HCWs in the design, or conduct, or reporting or dissemination plans of this research.

Sample size determination

The minimum sample size that represents the source population was estimated considering the single population proportion formula with the following assumptions: 95% CI, power (β=80%), proportion of HCWs assessed for their confidence level in diagnosing and managing patients with mpox (p=50%), considering no previous study in Ethiopia,[42] standard normal distribution ($Z_{a/2}$=1.96), margin of error (d=5%) and design effect (1.5). Therefore, the final adequate sample size including 10% non-response rate was 640 HCWs.

Sampling procedure and technique

A multistage stratified random sampling was employed to select HCWs working in hospitals in the Amhara Region. 28 hospitals (9 from general and comprehensive specialised hospitals and 19 from primary hospitals),

representing 28.6% of the total hospitals in the region, were selected randomly. The sample size was proportionally allocated to each selected hospital and similarly to each professional stratification. Finally, the HCWs who provided their responses in the data collection were selected using simple random sampling.

Variables

The dependent variable was HCWs' confidence level in diagnosing and managing mpox disease (categorised as poor, medium or high confidence). The independent variables included the sociodemographic characteristics such as age, residence, marital status and level of education; professional category and years of experience. The independent variables also included some personal behaviours such as the knowledge and attitude towards mpox disease, previous training exposure on public health emergency epidemic disease management (PHEM), habit of regular participation in the morning session and the habit of visiting websites of the WHO, Center for Disease Control and Prevention (CDC) and other websites.

Operational definitions

HCWs' confidence level

A total of 44 questions (9 related to preparedness, 28 related to diagnoses, 7 related to management of mpox disease) were used to measure HCWs' confidence level. Each question had three responses: 'yes' coded as +1, 'no' coded as 0 and 'I do not know' coded as −1. The responses from each respondent were summed and the percentage score of ≥80% was labelled as higher confidence, 50–79% labelled as medium confidence and <50% labelled as poor confidence level.[43 44]

Knowledge

The knowledge score was calculated from 35 questions (28 related to diagnosis and 7 related to management of mpox disease) with three responses: 'yes' coded as +1, 'no' coded as 0 and 'I do not know' coded as −1. The percentage of knowledge score for each respondent was categorised into three labels: <50% was labelled as less knowledgeable, 50–79% was labelled as moderately knowledgeable and ≥80% was labelled as knowledgeable.[18 44]

Attitude

The HCWs' attitude was assessed using a 7-point Likert scale with 14 questions (strongly disagree (1), disagree (2), somewhat disagree (3), neutral/no opinion (4), somewhat agree (5), agree (6) and strongly agree (7)). The sum of their responses was calculated as attitude score between 14 and 98. Those HCWs who scored less than 70% were considered to have negative attitude and those who scored ≥70% were considered to have positive attitude.[43]

Validity and reliability of the questionnaire

The tool's validity and reliability were also assessed. The degree to which all items in the questionnaire reflect the contents to which the instrument will be generalised was assessed using reliability and validity tests. Five general practitioners (GPs) reviewed the questionnaires. The content validity ratio (CVR) formula, CVR=(Ne−n/2)/(n/2), was used to determine whether the questionnaires were relevant, needed revision or should be removed.[45] The CVR scores of diagnosis, management and preparedness questionnaires were 0.952, 1.00 and 0.963, respectively. On the other hand, the CVR scores for knowledge, attitude and confidence level were 0.9619, 0.8815 and 0.9619, respectively (online supplemental files 1 and 2). The instrument has an overall Cronbach's alpha coefficient value of 0.846, which is used to evaluate the questionnaire's consistency across all items.

Data collection tools and procedure

Data were collected using a structured questionnaire, which was prepared after reviewing previous studies conducted for similar purposes.[46–50] The questionnaire was developed in English, then translated into Amharic (local language), then back to English to ensure its consistency. The questionnaire contained sociodemographic characteristics and habit-related factors of the HCWs. Data collection was conducted using KoboCollect (V.2022.4.4). 29 GPs and 5 master's holder health professionals were recruited to manage the data collection process.

Data quality assurance

Data quality was assured using a properly designed questionnaire adapted from literature. Two-day training was provided for both data collectors and supervisors in the purpose of the study, data collection techniques and tools conducted by the principal investigators. The data collectors pretested the questionnaires, on 5% of the sample size at Injibara Health Center where the study was not undertaken, and necessary amendments were taken based on the findings of the pretest. Every day after data collection, the principal investigator reviewed the questionnaires to ensure the completeness of each response. The principal investigator and supervisor closely monitored the data collection process.

Data management and analysis

Data were exported to STATA V.17 from the KoboCollect data collection toolbox. Data were cleaned (categorisation for continuous variables and recategorisation for categorical variables) and descriptive statistics such as frequency distribution tables, means and SDs were computed to describe the data. Bivariate and multivariable ordinal logistic regression analyses were used to identify predictors of HCWs' confidence level in diagnosing and managing mpox disease. The proportional odds assumption was checked (X^2 p value=0.054) to evaluate whether the distance between each category of the outcome was equivalent or not. The two cut-off points, cut1=0.8603 and cut2=2.083, were estimated to see the inherently ordered distances

between low, medium and high confidence level in diagnosing and managing mpox disease. A p value of <0.25 was used as a criterion during bivariate analysis to retain variables for the multivariable ordinal logistic regression model. Crude and adjusted ORs (AORs) with 95% CI were calculated to measure the degree of association between independent variables and HCWs' confidence level in diagnosing and managing mpox disease. A p value of <0.05 was considered as a level of statistical significance in multivariable ordinal logistic regression analysis.

RESULTS

Sociodemographic characteristics of HCWs

620 HCWs (with a response rate of 96.9%) gave a complete response. The majority (312 (50.3%)) of HCWs were Orthodox Christian followers. Similarly, 63.9% of the HCWs had more than 5 years of experience. The mean (±SD) age of the HCWs was 31.67 (±5.355) years old and 432 (69.7%) of them were male. Only 153 (24.7%) HCWs had gotten PHEM from governmental and non-governmental organisations (table 1).

HCWs' confidence level in diagnosing and managing mpox

The overall proportion of HCWs who had high confidence level in diagnosing and managing mpox disease was found to be 31.5% (95% CI: 27.9%, 35.2%). Similarly, 26.8% (95% CI: 23.2%, 30.3%) and 41.8% (95% CI: 38.1%, 45.4%) of HCWs expressed medium and low confidence level in their ability to diagnose and manage mpox disease, respectively. Aside from that, 22.1% (95% CI: 19.0%, 25.5%) of HCWs had higher confidence level in diagnosing and 20.2% (95% CI: 17.2%, 23.4%) of them had higher confidence level in managing mpox disease (figure 2).

HCWs' knowledge and attitude towards mpox

Although about 41.7% (95% CI: 37.9%, 45.8%) of HCWs were less knowledgeable, more than half (361 (58.2%)) of them responded that the mpox virus is prevented by frequent handwashing for at least 20 s with soap and water or alcohol. Similarly, more than half (328 (52.9%)) of them responded that antibiotics can be used to treat mpox disease. However, only 36.9% of HCWs had knowledge on contaminated environment-to-person transmissions of mpox and 34.3% of them responded that mpox is a bacterial disease. About 44.4% of physicians and only 27.6% of nurses and other professionals had higher knowledge about mpox (figure 3).

Regarding HCWs' attitude towards mpox, only 35.8% (95% CI: 32.3%, 39.6%) of them had positive attitude, leaving the majority (64.2% (95% CI: 60.4%, 67.7%)) of the HCWs with negative attitude. A higher percentage (42.3%) of physicians had positive attitude towards mpox virus compared with nurses and other professionals (33.9%) (figure 3).

Factors associated with HCWs' confidence level in diagnosing and managing mpox disease

In binary ordinal logistic regression analysis, variables such as working hospital standards, sex, work experience, occupational category, regular participation in morning sessions, exposure to PHEM training, attitude, visiting WHO, CDC and other websites, and age group were selected as candidates for multivariable ordinal logistic regression analysis. During the multivariable ordinal logistic regression analysis, variables such as positive attitude, aged 30–35 years old, professional category and habit of visiting the WHO, CDC and other amenable websites were found to be significantly associated with the outcome variable.

The HCWs with a cut-off point value of ≤13.97% were classified as having a low confidence level, given that they were working in a primary hospital, female, have <5 years of work experience, a nurse and other health professionals, not participating in a morning session, not receiving PHEM training, having a negative attitude, not visiting the WHO, CDC and other websites, and aged <30 years old as opposed to between 30 and 35 years. Similarly, the HCWs with a cut-off point value of ≥2.083 were classified as having a higher confidence level, given that the above variables were kept similar with their reference. Additionally, participants with a cut-off point value between 0.8603 and 2.083 were considered to have medium confidence level where the independent variables were kept similar with their reference.

The odds of higher confidence level versus lower or medium confidence level in diagnosing and managing mpox disease were 1.59 times (AOR=1.596, 95% CI: 1.158, 2.198) higher for the HCWs who regularly visit the WHO, CDC and other potential websites than those who do not visit the websites when other variables were kept constant. The odds of higher confidence versus lower or medium confidence level were 1.9 times (AOR=1.899, 95% CI: 1.318, 2.734) higher for physicians in comparison with nurses and other professionals when the other variables are kept constant. Similarly, the odds of higher versus lower or medium confidence level in managing and diagnosing mpox disease were 1.6 (AOR=1.637, 95% CI: 1.118, 2.397) times greater for HCWs if their age is 30–35 years compared with less than 30 years old when the other variables were kept constant.

Moreover, the odds of higher versus lower or medium confidence level in managing and diagnosing mpox disease were 2.8 times (AOR=2.799, 95% CI: 1.942, 4.035) greater for HCWs who had exposure to PHEM training than their counterparts. Lastly, the odds of higher confidence level versus lower or medium confidence level in managing and diagnosing mpox disease were 1.72 times (AOR=1.724, 95% CI: 1.258, 2.362) greater for HCWs who had positive attitudes than their counterparts when the other variables were kept constant (table 2).

Table 1 The characteristics of HCWs assessed for their confidence in diagnosing and managing mpox disease in hospitals in Amhara Region, Northwest Ethiopia, 2022

Characteristics	Confidence level of HCWs				
	Low confidence	Medium confidence	High confidence	X^2	P value
Religion of HCW					
Orthodox	136	79	97	4.047	0.670
Muslim	70	49	52		
Protestant	36	30	29		
Others*	17	8	17		
Visits WHO, CDC and other amenable websites					
No	189	104	121	7.718	0.021
Yes	70	62	74		
Occupational category					
Physician	50	29	63	14.442	0.001
Nurse and others†	209	137	132		
Year of experience					
<5	100	57	67	1.187	0.553
>5	159	109	128		
Hospital where HCW works					
CSPH	177	108	132	0.518	0.772
Primary hospital	82	58	63		
Sex					
Male	179	118	140	0.424	0.809
Female	80	48	55		
Participates in morning sessions					
No	142	74	96	4.385	0.112
Yes	117	92	99		
PHEM training					
No	215	135	117	36.086	0.001
Yes	44	31	78		
Age of HCW					
<30 years	142	86	83	9.691	0.046
30–35 years	49	38	59		
>35 years	68	42	53		
Highest level of formal education					
Diploma	22	20	21	5.923	0.432
Degree	184	119	126		
Master (MPH/MSC)	30	13	24		
Specialist	23	14	24		
HCW's profession					
Pharmacist	26	12	12	40.79	0.197
Nurse	86	66	55		
Health officer	20	16	11		
Midwife	40	22	26		
General practitioner	23	19	29		
Laboratory professional	15	11	7		

Continued

Table 1 Continued

Characteristics	Confidence level of HCWs				
	Low confidence	Medium confidence	High confidence	X^2	P value
Anaesthetist	7	6	10		
Environmental health professional	7	2	4		
Gynaecologist	4	3	4		
Internist	7	5	11		
IESPS	5	0	6		
Surgeon	5	2	10		
Neurologist	1	0	1		
Ophthalmologist	1	0	1		
Dentist	2	0	0		
Radiologist	2	0	1		
Ophthalmic nurse	1	0	3		
Others‡	7	2	4		
Attitude					
Negative	239	113	46	11.37	0.003
Positive	122	72	28		

Specialist=gynaecologist, internist, surgeon, neurologist, ophthalmologist, dentist, radiologist. Physician=general practitioner and any specialist doctors.
*Catholic, Jobha, etc.
†Health officer, midwife, laboratory professional, environmental health professional, pharmacist and dentist.
‡Biomedical Engineering, Emergency medicine, Nephrology , Cardiology and ENT specialists.
CDC, Center for Disease Control and Prevention; CSPH, comprehensive specialised hospital; HCWs, healthcare workers; IESPS, integrated emergency surgery professional specialty; PHEM, public health emergency epidemic disease management.

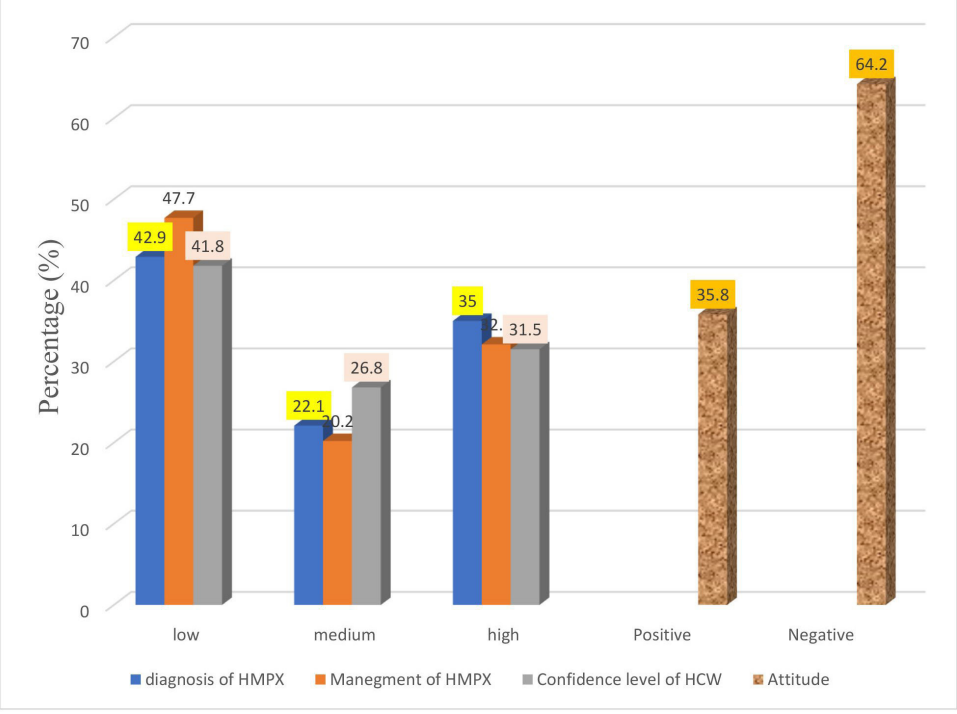

Figure 2 HCWs' confidence level in diagnosing and managing mpox disease in hospitals in Amhara Region, Northwest Ethiopia, 2022. HCWs, healthcare workers; HMPX, human mpox.

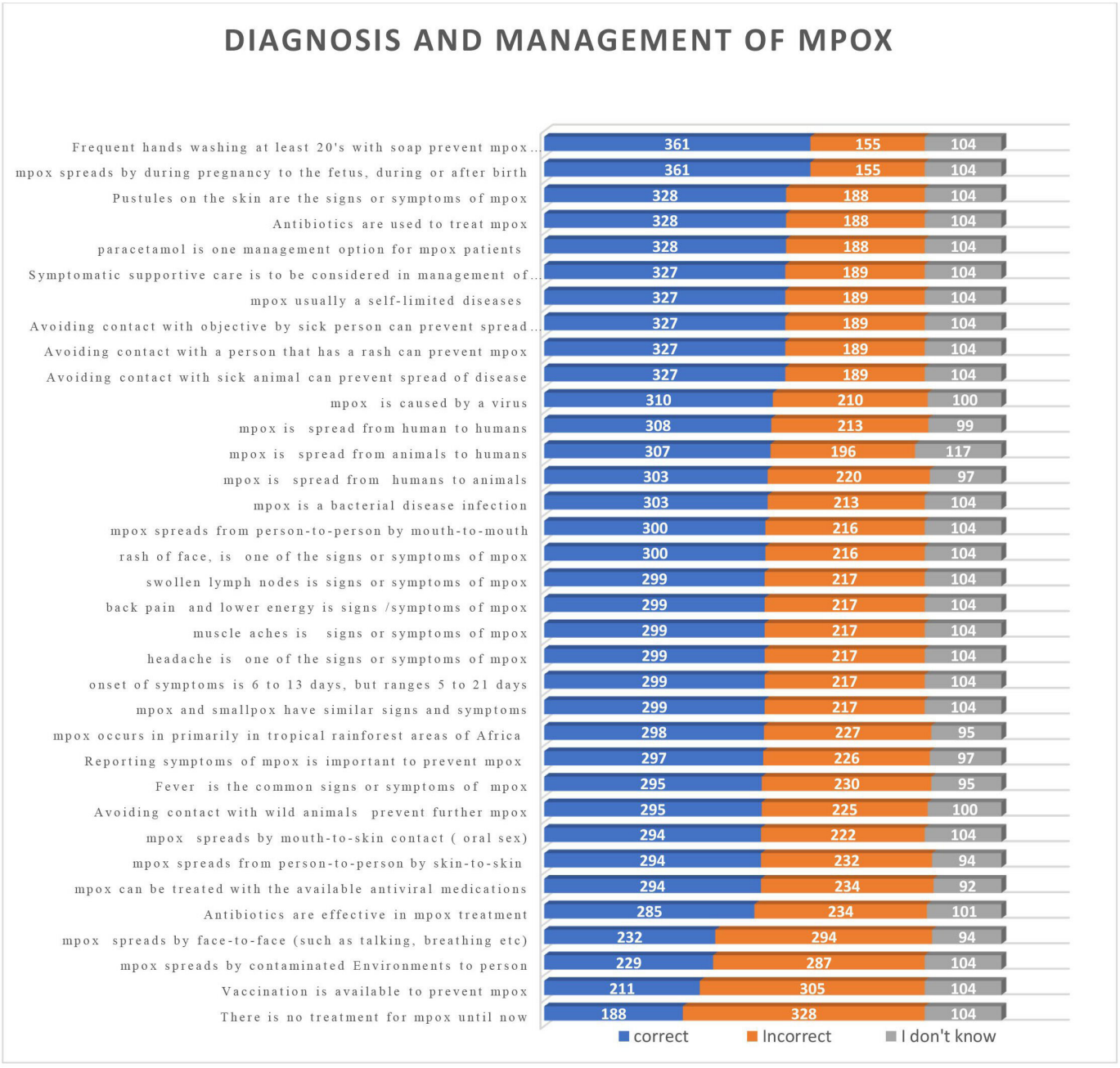

Figure 3 Healthcare workers' knowledge on questions related to the diagnosis, management, prevention and control of mpox disease in hospitals in Amhara Region, Northwest Ethiopia, 2022.

DISCUSSIONS

HCWs should be equipped with the required knowledge and confidence in clinically diagnosing and managing mpox disease in areas where there are scarce resources to install testing laboratories. However, this is a predominant challenge that the HCWs faced in the current mpox outbreak, which requires not only an intensive prevention strategy including vaccination but also early detection, quick response and proper management of affected patients. This study was designed to assess the HCWs' confidence level in diagnosing and managing mpox disease in hospitals in the Amhara Region. The findings of this study are important to design interventions that strengthen HCWs' preparedness for mitigation and responses towards the outbreak.[51]

The overall proportion of HCWs who had high confidence level in managing and diagnosing mpox disease was 31.5% (95% CI: 27.7%, 35.2%). Even though there were differences in the cut-off points in determining the outcome and the study participants, similar proportion (34.9%) was reported by a study conducted in Indonesia.[52]

Similarly, the proportion of HCWs who had higher confidence level in managing the mpox disease was found to be 32.1% (95% CI: 28.2%, 35.7%). However, higher proportions (p=47.5%[46] and p=38.9%[18]) were reported in studies conducted in Kuwait and Jordan, respectively.

Table 2 Multivariable ordinal logistic regression of factors associated with HCWs' confidence level in diagnosing and managing mpox disease in hospitals in Amhara Region, Northwest Ethiopia, 2022

Characteristics	Confidence level of HCWs			SE	AOR (95% CI)	P value
	Low	Medium	High			
Visits WHO, CDC and other websites						
No	189	104	121	1	1	
Yes	70	62	74	261	1.596 (1.158, 2.198)	0.004
Occupational category						
Nurse and others*	209	137	132	1	1	
Physician	50	29	63	1.353	1.899 (1.318, 2.734)	0.001
Years of experience						
<5	100	57	67	1	1	
>5	159	109	128	0.212	1.297 (0.94, 1.789)	0.113
Hospital where HCW works						
Primary	82	58	63	1	1	
CSPH	177	108	132	0.165	0.989 (0.714, 1.372)	0.950
Sex						
Female	80	48	55	1	1	
Male	179	118	140	0.187	1.096 (0.783, 1.532)	0.594
Participates in morning sessions						
No	142	74	96	1	1	
Yes	117	92	99	0.194	1.253 (0.925, 1.699)	0.145
PHEM training						
No	215	135	117	1	1	
Yes	44	31	78	0.522	2.799 (1.942, 4.035)	0.001
Age of HCW						
<30 years	142	86	83	0.318	1	
30–35 years	49	38	59	0.221	1.637 (1.118, 2.397)	0.011
>35 years	68	42	53	1	1.202 (0.834, 1.731)	0.322
Attitude						
Negative	239	113	46	1	1	
Positive	122	72	28	0.277	1.724 (1.258, 2.362)	0.001
Cut1				0.274	0.860 (0.324, 1.396)	
Cut2				0.284	2.084 (1.527, 2.641)	

*Health officer, midwife, laboratory professional, environmental health professional, pharmacist and dentist.
AOR, adjusted OR; CDC, Center for Disease Control and Prevention; CSPH, comprehensive specialised hospital; HCWs, healthcare workers; PHEM, public health emergency epidemic disease management.

Likewise, the proportion of HCWs who had higher confidence levels to diagnose the disease was also determined to be 35.0% (95% CI: 31.3%, 38.7%). Similar proportions were reported by studies conducted in Kuwait (32.3%) and Jordan (38.0%).[18 46]

In this study, HCWs aged 30–35 years old had higher confidence level in diagnosing and managing mpox disease compared with HCWs aged less than 30 years old. This finding may be due to the fact that HCWs in this age range capitalised on their knowledge and prior clinical experiences such as with the COVID-19 pandemic to better manage the mpox outbreak. In addition, HCWs in this age category may have a habit of searching new facts and updates about emerging and re-emerging epidemics. This study also found that those HCWs with positive attitude had higher confidence in diagnosing and managing mpox disease compared with those HCWs with negative attitude. This may be because having a positive attitude towards understanding mpox helps HCWs thrive in searching for new information regarding the diagnosis and management of the disease. The information-seeking behaviour might help the HCWs to develop a higher level

of confidence towards the management and diagnosis of the disease. This finding was also supported by the current study, which revealed that HCWs who had visited different websites such as the WHO and CDC websites had higher odds of having a high level of confidence in diagnosing and managing mpox disease compared with those who had not. The mere reason behind this might be due to the fact that the WHO and other partners like CDC might release accurate and updated information on a daily basis regarding the signs and symptoms, transmission, prevention and treatment of the virus and the global strategies for the prevention and control of mpox outbreaks.[53] The importance of prior information about the mpox virus was mentioned to be an independent predictor of a higher level of confidence among GPs as those GPs who had received information on mpox virus during their medical education had higher confidence than those who had never received such information.[54] Therefore, visiting different websites could improve HCWs' knowledge and attitude about mpox, leading to a high level of confidence in the diagnosis and management of re-emerging viruses.

Like another study conducted in Jordan,[18] this study identified that physicians (GPs and specialists) had a higher confidence level in diagnosing and managing mpox disease compared with nurses and other professionals. The possible explanation might be due to the fact that physicians have higher and intensive educational exposure during their medical education, which might help them understand the fundamental sciences of communicable diseases like mpox virus. In addition, the physicians might have an opportunity to attend regional and international conferences during such type of pandemics, which update them of the current worldwide understanding about the diseases. This was explained by a study conducted in Indonesia, which suggested that attending national conferences (at least one) equips GPs with better confidence.[52] Another possible reason might be because physicians such as specialists have practical experiences in the management and diagnosis of similar pandemics such as COVID-19, which help them to be sensitive to potentially threatening mpox virus epidemics across the globe. In contrast to our finding and this justification, a study conducted in Kuwait[46] reported that nurses displayed higher self-reported confidence levels to diagnose and manage the disease. The possible reason might be the differences in the variable categorisation: this study categorised the variable into dichotomous variable (GPs and specialists vs nurse and other professionals); however, the latter study categorised the variable into four categories.

Those HCWs who had received training in public health epidemic-prone diseases had higher confidence levels in diagnosing and managing mpox disease. Previous studies conducted in Indonesia,[52] Australia[55] and Italy[56] agreed with our findings that receiving information during medical training was significantly associated with having good knowledge about mpox, which increases HCWs' confidence level. HCWs' confidence level increased with prolonged education and training in healthcare centres,[55] as adequate training and continuing medical education are important to ensure the build-up of confidence in diagnosing and managing infectious diseases.[57]

Conclusions

The overall HCWs' confidence level in diagnosing and managing mpox disease in the Amhara Region was low compared with what was recommended by the WHO. The modifiable variables such as positive attitude, professional category (being a GP and specialist doctor), age, and visiting the WHO, CDC and other amenable websites were found to be significantly associated with HCWs' higher confidence level in diagnosing and managing mpox disease. Raising awareness and confidence levels of HCWs in diagnosing and managing mpox disease can strengthen their preparedness for the mitigation and response for the emerging threat of mpox. For instance, training in the WHO's rapid interim guideline for the clinical management and infection prevention and control of mpox should be given for all HCWs in the study area.[58] Additionally, those physicians with higher confidence levels in diagnosing and managing diseases should share their knowledge and skills with nurses and other health professionals.

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Ethics approval This study involves human participants and ethical approval was obtained from the Institutional Review Board (IRB) (no. /RCS/70024/26) of the Debre Tabor University, College of Medicine and Health Sciences. Before data collection,

formal permission letters were obtained from each hospital. Similarly, facility heads were communicated through supporting letters and informed about the purpose of the study before actual data collection. Informed verbal consent was obtained from the HCWs. The respondents were also informed that they have the full right to withdraw or refuse at any time during interviews. Data confidentiality was maintained by avoiding possible identifiers, such as changing the names of study participants into ID numbers.

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