Microbes and Infectious Diseases 2024; 5(4): 1273-1284

Microbes and Infectious Diseases

Journal homepage: https://mid.journals.ekb.eg/

Original article

Knowledge and attitude towards Mpox among healthcare workers: an Intervention study

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ARTICLE INFO

Article history:
Received 11 June 2024
Received in revised form 24 July 2024
Accepted 28 July 2024

Keywords:
Mpox
Health care workers
Knowledge
Attitude
Training program

ABSTRACT

Background: Health care workers lack knowledge about human Mpox, and most are not confident in their abilities to identify and manage cases. The study's objectives are to improve healthcare workers ' knowledge and attitudes regarding Mpox infections and to help them become confident in diagnosis and management. **Methods:** This study was carried out in two stages. The first phase involved a cross-sectional survey of 206 healthcare workers, utilizing the snowball sampling approach, to evaluate their knowledge and attitudes regarding Mpox using a self-administered questionnaire. The second phase was a pre-posttest study with stratified random sampling method to improve the participants' knowledge and attitude towards Mpox among health care workers. **Results:** In phase one, 7.3% of the 206 participants had good knowledge with a mean knowledge score of 14.2 ± 6.1, and 89.3% had a positive attitude. In phase two, there was significant improvement in the score of knowledge post intervention immediately [28.6 ± 1.7] and after one month [28.5 ± 1.4] compared with before (6.2 ± 8.3). The improvement in knowledge level was from 5.7% before to 100% after the intervention. The positive attitude frequency also increased from 42.9% to 100% [$p < 0.001$]. **Conclusion:** In conclusion the knowledge and attitude level towards human Mpox infection in our study were considered low. After giving the educational training program, the participants' knowledge and attitude towards Mpox among health care workers was improved.

Introduction

Mpox is a viral zoonotic disease. Its symptoms are strikingly like those of smallpox in the past, while clinically less severe. It is brought on by the Mpox virus. The Congo Basin [Central African] clade and the West African clade are the two clades of Mpox virus. When the virus was first identified in 1958 in monkeys, it was given the name Mpox. The first human case was discovered in a young child in the Democratic Republic of the Congo, 1970 [1].

Close contact with lesions, body fluids, respiratory droplets, and contaminated items like bedding can all spread the Mpox virus from one person to another. Typically, Mpox is a self-limiting illness with symptoms that last between two and

DOI: 10.21608/MID.2024.297060.1991

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four weeks. The case fatality ratio has been around 3-6% recently. The most reliable clinical symptom for distinguishing Mpox from smallpox and chickenpox is enlargement of the lymph nodes, particularly those in the sub-mental, submandibular, cervical, and inguinal regions [2].

Starting from May 2022, three WHO regions which are Western Pacific region, region of the Americas and European region, 12 Member States that are not endemic for the Mpox virus have reported 92 laboratory confirmed cases of the disease and 28 suspected cases with ongoing investigations. No related fatalities have been noted yet [1]. In May 2024, a total of 646 new laboratory-confirmed cases of Mpox and 15 deaths were reported to WHO from 26 countries, illustrating continuing transmission of Mpox across the world [3].

According to a recent systematic review, contacts who have not received vaccinations may experience secondary attacks at a rate of up to 10% [4]. This suggests that there is a chance of human-to-human transmission of the Mpox virus in hospitals between cases and either other patients or HCWs. Healthcare-related transmission has been documented in several nations, including the Democratic Republic of the Congo [5,6], Nigeria [7], and the Central African Republic [8].

For every 100 cases of human Mpox, one percent of HCWs have been infected [4,6]. According to a study conducted in Indonesia, only 10% of general practitioners [GPs] had a good understanding of human Mpox and the majority of them appear to be less confident in their ability to diagnose and treat patients using their current knowledge, skills, and workplace resources [9,10].

The rise in human Mpox cases highlights the significance of healthcare professionals in preventing, early identifying, and promptly treating Mpox. But according to a WHO report, one of the difficulties in stopping the disease from reemerging was the lack of awareness, especially among medical professionals. Studies evaluating knowledge, attitude, and practice in the general public and healthcare workers have been conducted on multiple occasions. Healthcare professionals must be informed about and ready for Mpox cases in various regions especially in the middle east [11].

In addition to a prevention strategy, the current resurgence of human Mpox necessitates early detection, a prompt response, and appropriate management from frontline HCWs in the region. HCWs need to be familiar with the clinical signs and symptoms of human Mpox to quickly spot, report, and handle any new cases in order to stop an outbreak. So, this study aims to assess and improve the knowledge and attitude of Egyptian HCWs towards Mpox after giving an educational training program on Mpox infection through their assessment; before-immediately after and one month later post program conduction among a group of healthcare workers.

Subject and Methods

Ethical approval: The study was approved by the Research Ethics Committee, Faculty of Medicine, Suez Canal University [Research#4987#] on 27/ 9/ 2022. Informed consent was obtained from all subjects and/or their legal guardian [s]. The title, aim and objectives of the study were clarified in the beginning of the questionnaire form. A clear statement was included in the beginning of the questionnaire form that completion of it indicates participant's consent to participate in the study. The data of the participants was anonymous to the authors. We have activated the option limit to one response for online questionnaire to avoid more than one response from the same participant. The study was in accordance with Helsiniki declaration for human experimentation World Medical Association, 2001. World Medical Association Declaration of Helsinki [12].

Study design: The study was conducted on 2 phases:

•**Phase one:** cross sectional study design to assess knowledge and attitude towards Mpox among HCWs in Egypt

•**Phase two**: pre-post-test study design to evaluate the effectiveness of a designed training program on improvement of knowledge and attitude towards Mpox among a selected group from healthcare workers recruited in phase one.

Study setting:

•Phase one was conducted among HCWs all over Egypt through both an online form and printed copies of the questionnaire and they were tested by a pilot study.

•Phase two was conducted in Ismailia city, Egypt.

Study participants: the study included different HCWs categories including physicians, pharmacists, dentists, nurses and technicians from Egypt. Participants were recruited to study during the period between October 2022 and April 2023.

Sampling:

Sample size estimation:

The sample size was estimated for each phase.

Phase one: the following equation was used:

n= sample size

Zα/2= 1.96 [The critical value that divides the central 95% of the Z distribution from the 5% in the tail]

p= the prevalence of good knowledge among HCWs [≥80% correct answers] = 10 % [9]

E = the margin of error [width of confidence interval] = 5%

After calculation we got a minimum required sample of 139 HCWs then 50% were added to substitute for incomplete questionnaires or non-response, so a total of 209 participants were studied. Three questionnaires were excluded after data collection due to missing data to give a total sample of 206.

Phase two: objective was to double the frequency of moderate and good knowledge from 35% as detected by our pilot study to 70% of HCWs. So, we used the following equation:

Where n is required sample size.

Z α/2 = 1.96 [The critical value that divides the central 95% of the Z distribution from the 5% in the tail].

Zβ = 0.84 [The critical value that separates the lower 20% of the Z distribution from the upper 80%]

p1 [prevalence of moderate and good knowledge among healthcare workers pre intervention [35%] from our pilot study data.

p2 prevalence of moderate and good knowledge among healthcare workers post intervention [70%].

q1 [1-p1]; q2 [1-p2]

After calculation required sample size was 28 participants. The sample was then increased by 25% to compensate for dropouts during follow up visits, so 35 healthcare workers were recruited in the program.

Sampling method:

For phase one, [assessment of knowledge and attitude]: snow-ball sampling method was used to recruit HCWs from different health facilities during October and November 2022. We first collected five healthcare workers from each governorate and asked them to recruit other healthcare workers to fill the questionnaire until completion of the required sample size.

Phase two, [intervention program application and post testing]: stratified random sampling method was used as follows: a full list all participants in phase one from Suez Canal university specialized hospital constituted our sampling frame. The list was stratified into five strata [physicians in the 1st stratum, pharmacists in the 2nd stratum, nurses in the 3rd stratum, technicians in the 4th stratum and assisting personnel in the 5th stratum]. Seven participants were selected from each stratum by a simple random method. Randomization was carried out using Microsoft excel. Phase two was carried out during the period from December 2022 till May 2023.

Data collection tools:

1.Questionnaire development: to assess the level of knowledge and attitude towards human Mpox among health care workers, the questionnaire was adopted from a previous study, revised and modified by a panel of three infection prevention and control experts [9].

The questionnaire included questions about:

•Socio-demographic characteristics [name, age, gender, occupation, marital status, education level].

•Whether the participant had any prior knowledge on Mpox [two questions].

•Knowledge questions [30 questions] with options including [yes, no, do not know] each correct answer is given one point and either a wrong answer or do not know were given score zero with a total score of 30. Participants scores was calculated and more than [75%] correct answers were considered good knowledge from 50 to 75% was considered moderate knowledge and < 50% was considered poor knowledge. The knowledge section covered questions about the origin of Mpox, mode of transmission, symptoms, methods of prevention and the availability of vaccine.

•Attitude questions [six questions] as follows:

Two questions about risk of getting infected and severity of infection with four options on Likert scale ranging from very low to very high.

Four questions about effectiveness of precautionary measures with four options Likert scale ranging from not effective to very effective

where not effective at all and not effective take scores of zero and somewhat effective takes score 1 and very effective takes score 2. Participants scores was calculated and a score < four was considered negative attitude and score four and above were considered positive attitude.

A pilot study was conducted on 20 HCWs to test questionnaire reliability by using Cronbach's alpha of the questionnaire items and it was found to be 0.907 [excellent internal consistency] for knowledge questions and 0.704 [acceptable internal consistency] for attitude questions.

A final copy in Arabic language was created in two formats following the confirmation of the questionnaire reliability, an online Google form and a printed form. Both forms were used in phase one to recruit HCWs from different health facilities in Egypt.

2.Training program preparation: the program was designed based on information from Egyptian ministry of health guide for dealing with Mpox [13] and WHO interim rapid response guidance [1]. The program was conducted by zoom video conferencing in the form of

•Audiovisual lectures on methods of transmission, symptoms and prevention of infection,

•Training on precautionary measures related to Mpox prevention.

All participants in phase two were asked to:

•Attend the whole training program on Mpox.

Refill the same questionnaire post-intervention at two points [immediately after the program and one month later].

The study steps are clarified in Figure 1.

Data availability:

All data generated or analyzed during this study are included in this published article.

Data management:

Data were entered and analyzed using the statistical package for social science (SPSS) software version 25. The Kolmogorov-Smirnov test was used to assess the normality of the distribution of the studied variables. Quantitative data such as age and score of knowledge were presented in mean and standard deviation. Qualitative data such as gender were presented as frequency and percentages. Cronbach's alpha was used to test questionnaire validity and reliability. For statistical analysis, the knowledge and attitude scores were compared pre and post intervention by using Friedman's test. Frequency of good knowledge was compared pre and post intervention at 2 points using Cochran Q test. The chi square or t test was used, as applicable, to evaluate the relationships between sociodemographic characteristics and the dependent variables (knowledge level, good, moderate, or poor), or attitude level, positive or negative, prior to the intervention.

RESULTS

Phase one:

Two hundred and six participants were enrolled in the study from nineteen Egyptian governorates with the most representation from Ismailia 85 participants [41.3%] followed by Assiut 68 participants [33 %]. Above quarter of study participant [35%] belonged to age group [36 – 45]. Females represent 82.5% of the sample. Most of the participants are residents in urban areas. About 70.9% of participants are married. Only 2% of study participants belong to paramedical field. Above half of participants [61.7 %] have less than five years of experience "Table1".

Though the majority of participants heard about Mpox before, they didn't receive any information regarding Mpox during their study [83 %, 88.3% respectively]. The mean score of 30 knowledge questions among participants regarding Mpox was 14.2 ± 6.1. Only 7.3 % of participants have a good knowledge level while 44.7 % of participants have poor knowledge level "Table 2".

Regarding participants' attitude towards the probability of getting infected, 73.3% of participants thought that the risk of infection is very low or low, 24.8% thought the risk is moderate and 1.9% thought it is high.

Regarding the severity of infection if affected, half of participants thought that the disease will be of very low or low severity if they caught the Mpox infection, 39.3% thought it might be of moderate severity and 10.7% thought it might be severe or profound.

Concerning attitude towards precautionary measures towards Mpox; about 10.7% had negative attitude and 89.3% had positive attitude towards precautionary measures of Mpox infection.

Different socio-demographic characteristics were compared with the grade of knowledge, either poor, moderate, or good or

attitude level, positive or negative, but none showed a significant association.

Phase two:

A total of thirty-five participants were included in the analysis. Most of participants [86.1%] were in the age group 20-30 years old. The mean age of the participants was 31 ± 6.7. Near two third [65.7 %] of participants were females. Above two thirds [77.1 %] of participants were resident in urban areas. Above half [57.1 %] of participants were married. Most of participants [80%] were from a medical background. Less than one third of participants [28.6 %] were classified in their early career ≤5 years of experience "Table 3".

Above half of participants [51.5 %] didn't hear about moneybox before. All participants confirmed that they didn't receive any information regarding Mpox during their academic study "Table 4".

The improvement of knowledge and attitude after the intervention program is shown in "Table 5". Before the intervention program the mean knowledge score was 6.2 ± 8.3. There was significant improvement in the score of knowledge post intervention immediately [28.6 ± 1.7] and after one month [28.5 ± 1.4] compared with before [p=< 0.001]. Also, the frequency of good knowledge [>75% correct answers] increased from 5.7% pre intervention to 100% at the 2 points post intervention [$p < 0.001$].

Regarding the probability of catching infection, before the intervention, 62.9% thought it was very low or low. This was increased to 97% post intervention. About 57% of participants thought that the severity of infection would be negligible or low if occurred. This was also increased to 97% post intervention. Both changes were statistically significant [$p< 0.001$].

More than 42% of participants had positive attitude toward precautionary measures of Mpox before the intervention program, this increased to 100% immediately post intervention and 1 month post intervention.

Table 1. Socio-demographic characteristics of study participants [n = 206]

Characteristic	Frequency	Percent
Age in years		
< 25	15	7.3
25 – 35	69	33.5
36 – 45	72	35
46 – 55	24	11.7
> 55	26	12.6
Gender		
Male	36	17.5
Female	170	82.5
Residence		
Urban	189	91.7
Rural	17	8.3
Marital status		
Single	52	25.2
Married	146	70.9
Divorced/ widow	8	3.9
Occupation		
Medical	202	98
Para medical	4	2
Years of experience		
< 5 years	127	61.7
5 – 10 years	44	21.3
> 10 years	35	17

Table 2. Knowledge on human Mpox [n = 206] of study participants in phase I:

	Frequency	**Percent**
Do you hear about Mpox before?		
Yes	171	83
No	35	17
Have you received any information regarding Mpox during your study?		
Yes	24	11.7
No	182	88.3
Knowledge score interpretation		
Poor knowledge [< 50 correct answers]	92	44.7
Moderate knowledge [50 – 75 correct answers]	99	48.1
Good knowledge [> 75 correct answers]	15	7.3
The mean score of 30 knowledge questions	14.2 ± 6.1	

Table 3. Socio-demographic characteristics of study participants in phase II [n = 35]

Characteristic	**Frequency**	**Percent**
Age in years		
20 – 30	22	62.9
30 – 40	10	28.6
> 40	3	8.6
Mean ± SD	31 ± 6.7	
Gender		
Male	12	34.3
Female	23	65.7
Residence		
Urban	27	77.1
Rural	8	22.9
Marital status		
Single	9	25.7
Married	20	57.1
Divorced/ widow	6	17.2
Occupation		
Medical	28	80
Para medical	7	20
Years of experience		
< 5 years	10	28.6
5 – 10 years	12	34.3
> 10 years	13	37.1

Table 4. Previous knowledge on Mpox pre intervention

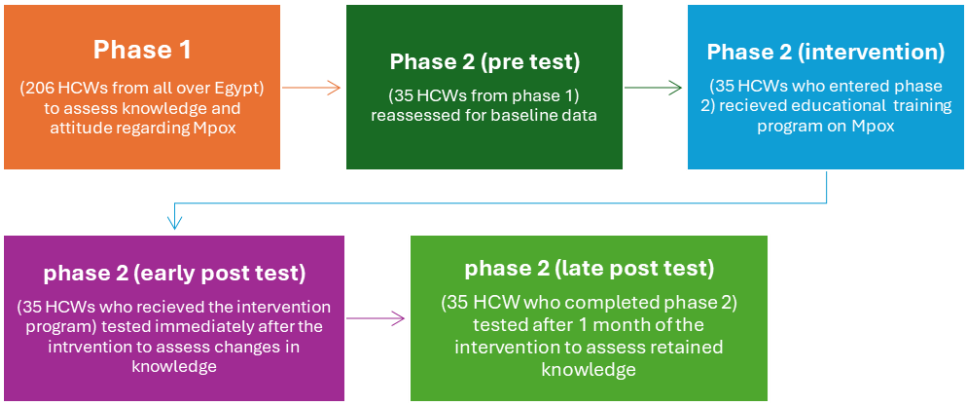
	Frequency	Percent
Have you heard about Mpox before?		
Yes	17	48.6 %
No	18	51.5 %
Have you received any information regarding Mpox during your study?		
Yes	0	0 %
No	35	100 %

Table 5. Changes in knowledge score after the intervention [n = 35].

Knowledge score	Pre intervention	Immediately post intervention	1 month post intervention	*p*-value
Score of correct answers [total 30]				
Mean ±SD	6.2 ± 8.3	28.6 ± 1.7	28.5 ± 1.4	**< 0.001**[1*]
Median [IQR]	2 [14]	29 [2][#]	29 [3][#]	
Knowledge score interpretation (30 questions) %				
Poor knowledge [< 50 %]	28 [80%]	0 [0%]	0 [0%]	**< 0.001**[1*]
Moderate knowledge [50 % – 75%]	5 [14.3%]	0 [0%]	0 [0%]	
Good knowledge [>75 %]	2 [5.7%]	100 [100%] [#]	100 [100%] [#]	

1. Friedman's test; * Statistically significant at $p < 0.05$;
Statistically significant when compared to pre intervention level.

Figure 1: Flow diagram showing phases of the study



Discussion

Mpox presents a new challenge for medical professionals particularly in nations where cases have not yet been reported. For the control of diseases, early detection and quick action are essential. The ability of a clinician to recognize and treat Mpox depends on having sufficient knowledge about the disease [11].

This study was conducted during the early Mpox global outbreak. It was conducted on 2 phases; Phase one was carried out to assess the knowledge and attitude towards Mpox among healthcare workers in Egypt. Phase two a training

program was done to a selected group of participants with pre and post assessment of knowledge and attitude.

In phase 1, although 98% of the participants were medical staff, only 7% of them had good knowledge about Mpox which is a very low percentage. This inadequate knowledge among participants in this study may be due to their little work experience as more than 60% of the participants have less than 5 years of experience in their work. In addition, over 88% didn't receive any information about Mpox during their study. Moreover, this study was conducted early during the Mpox outbreak and Egypt is not an endemic area of Mpox so it was out of the interest of the medical staff.

The majority of participants were ignorant of the transmission, signs and symptoms, differences between Mpox and smallpox, treatment, and vaccination. The knowledge gap among medical professionals will result in a lower level of knowledge among the public, which continues to be the biggest obstacle to preventing the surge of human Mpox.

A previous study among clinicians in USA reported similar findings suggesting also a relatively poor level of knowledge related to Mpox[14]. Moreover, insufficient level of knowledge about Mpox among the general population was found in previous studies among Nigerian[15], Philippines [16] and Jordanian university students[17]. On the other hand, a study was conducted in Saudi Arabia showed that approximately 55% of physicians had a "good knowledge" score about human Mpox[11]. In contrast to our findings, a different survey of Saudi Arabian resident physicians in the Asir region found that 67.3% of them had a solid understanding of Mpox. The fact that doctors were provided with a copy of the Saudi MOH Mpox management protocol may account for their high level of knowledge [18]. In May 2022, the Egyptian Ministry of Health and Population launched the first Egyptian Mpox guide protocol to support and urge hospitals affiliated with the Ministry of Health to train their healthcare workers on the signs, symptoms, prevention, surveillance, and treatment of Mpox [13]. However, not all HCWs in different sectors received and trained on it.

The present study found no significant differences in level of knowledge among different demographic groups. In contrast, a previous study found that younger GPs, who were working in community health centers had better knowledge about Mpox [9]. Contrarily, Alshahrani et al. [2022] reported that the only factors associated with a high level of knowledge about human Mpox were being a female physician, working in the private sector, and having information on the disease at time of medical school or residency years [11]. Another study conducted in Lebanon among HCWs reported that being Physicians, had post postgraduate education, and older age were significantly associated with better level of knowledge and attitude compared to others [19]. Contrary to our findings, another study, which used a bivariate analysis, showed that participants' age ($p = 0.01$), level of work ($p < 0.01$), and identification as dentists were indicative of significantly lower knowledge compared to those who identified as specialists in preventive medicine ($p = 0.001$), routine work ($p = 0.01$), experience in medical practice ($p = 0.01$), possession of a copy of the Saudi MOH Protocol ($p < 0.01$), earlier information receipt ($p < 0.01$), and conference attendance ($p = 0.01$) were significantly associated with having a good knowledge score for Mpox [18].

In this study, only 38% of the participants were aware about human Mpox vaccine availability. Worldwide, previous studies reported variable levels of knowledge about human Mpox vaccine [20-23].

This study found that nearly half of participants think that the risk of infection is very low and only 39% of participants think that the disease will be of moderate severity if they caught the Mpox infection. This was consistent with a previous study reported that Participants neither agreed nor disagreed that Mpox was a substantial risk [14].

This study also reveals that HCWs have a favorable attitude toward Mpox and its prevention. The HCWs' upbeat outlook is caused by the fact that they are already depleted from their experiences with COVID-19 and are cognizant of the effects of a pandemic. They showed a positive attitude toward learning about the virus as a result, and they are eager to take the necessary precautions to stop the virus from spreading and to adhere to the recommended treatment plan. Most of the participants [84.83%] in a prior study conducted in Bangladesh by Hasan et al. in 2023 demonstrated a favorable attitude [23].

In our study, none of the demographic characteristics showed statistically significant difference in attitude. On the contrary, only age of a participant demonstrated a statistically significant correlation with a positive attitude in the logistics regression model, according to a univariate regression analysis conducted by Hasan et al., 2023 [OR=2.31, 95% CI=1.29, 4.27] [23].

In phase 2, we selected 35 participants randomly from phase 1 who were working in Suez Canal university specialized hospital to apply our designed educational training program. Most of the participants [80%] had poor knowledge, 14.3% had moderate knowledge and 5.7% had good knowledge regarding human Mpox before the health education intervention with mean score 6.2 ± 8.3. Such high frequency of poor knowledge was influenced by lack of previous medical training as all participants confirmed that they didn't receive any information regarding Mpox during their study and above half of participants [51.5 %] didn't hear about moneybox before. There was significant improvement in the score of knowledge post intervention immediately [28.6 ± 1.7] and after one month [28.5 ± 1.4] compared with before [$p < 0.0001$]. There was significant change in their perception regarding the probability of catching the infection and the severity of the infection after the health education compared with pre-intervention.

Our study also found that 42% had positive attitude toward precautionary measures of Mpox before the intervention program, this increased to 100% immediately post intervention and one month post intervention [$p < 0.001$]. Our results align with those of another study among nurses carried out in Egypt. They discovered that there was a statistically significant difference ($P < 0.001$) between the mean total knowledge and attitude scores before and after the application of the education program. The training sessions enhanced the nurses' understanding of Mpox and their perspective on it [24].

Strength and limitation:

To the best of our knowledge, this is one of the first studies in the middle east region to assess the knowledge and attitude toward Mpox before and after giving a health education training that lead to improvement of the knowledge and attitude of the health care workers. The findings of our study will provide a baseline data about knowledge and attitude toward Mpox among HCWs in Egypt. The study included HCWs from different occupational categories. There are two limitations in the study. Sample was drawn in the first phase by using a snowball sample which may limit the generalizability of data. Although the questionnaire was adopted from a previous study, the validity and reliable was tested by conducting a pilot study and calculating Cronbach's alpha. The questionnaire was self-reported and subjected to recall bias. Moreover, we cannot confirm it is filled by the participant or someone else. Even though a stratified random sampling technique was employed in the study's second phase to enroll participants, the sample was still small and limited to a specific location within Suez Canal University Specialized Hospital. The Suez Canal University Specialized Hospital was the venue for our face-to-face interactive lectures and workshops during the intervention program, which is why we chose them for feasibility issues.

Conclusion and recommendations:

In our study, knowledge about human Mpox infection was rated as being uniformly low across various sociodemographic factors among HCWs. A significant improvement in knowledge and attitude was noticed among them after the designed educational training program, which reflects the importance of continuous training and education. So, the government and health authorities should provide continuous Mpox training to HCWs. The Mpox content in medical curricula has to be revised by the ministry of higher education and health authorities. The Egyptian Mpox guideline protocol should be distributed to all HCWs in different sectors to assist in the diagnosis and management of new cases.

Conflict of interest: The authors declare that there is no conflict of interest.

Competing Interests: The authors have no relevant financial or non-financial interests to disclose.

Funding: The authors declare that no funds, grants, or other support were received during the preparation of this manuscript.

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