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Knowledge, Attitude, and Practices of Healthcare Workers and Medical Students Toward Monkeypox Virus in Iraq

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Abstract: **Background:** Monkeypox (Mpox) is a re-emerging infectious disease that poses a global public health challenge. Limited awareness among healthcare workers (HCWs) may hinder effective prevention and control measures. **Objectives:** This study aimed to assess the knowledge, attitude, and practices (KAP) of Iraqi healthcare workers and medical students toward Mpox. **Methods:** A cross-sectional study was conducted from 23 October to 23 November 2024 using a structured self-administered questionnaire distributed electronically via social media platforms. A total of 334 participants were included. Data were analyzed using SPSS version 29, with Chi-square and ANOVA tests applied. A p-value <0.05 was considered significant. **Results:** Among 334 participants, 23.7% demonstrated excellent knowledge, while 67% had moderate knowledge. Positive attitudes were observed in 50% of participants. Higher knowledge levels were associated with older age, female gender, rural residence, and dental professionals. A positive attitude was significantly associated with willingness to receive vaccination and adopt preventive measures. **Conclusion:** The KAP of Mpox among Iraqi HCWs and medical students is suboptimal. Targeted educational programs and awareness campaigns are recommended to improve preparedness and response.

Key Words: Monkey Pox Virus, Knowledge, Attitude, Practice, Healthcare Workers,,Medical Students, Iraq, KAP Survey

INTRODUCTION

Monkeypox (Mpox) is a zoonotic disease caused by *Monkeypox virus* (MPXV). It is a double-stranded DNA (dsDNA) virus belonging to the *Orthopoxvirus* (OPXV) genus within the *Poxviridae* family and *Chordopoxvirinae* as the subfamily [1]. MPXV is related to Variola virus, the causative agent of smallpox [2]. Two MPXV clades have been identified through genomic sequencing: Clade I (Congo Basin) and Clade II (West African), with Clade I being more virulent than Clade II, including subclade IIb [3] and less transmissible than clade II [4]. Mpox is mainly transmitted by contact with respiratory secretions, infected skin lesions, or contaminated materials [5], including close physical and sexual contact [6]. The incubation period may be between 5 and 21 days [7]. Symptoms typically include fever, headache, swollen lymph nodes, chills, and fatigue, followed by a rash that spreads from the face to the body [8]. Lymphadenopathy distinguishes mpox from similar diseases like measles, chickenpox, and smallpox [9]. Diagnosing Mpox is challenging due to overlapping symptoms with other orthopoxviruses [10], limited availability of lab tests, and varying accuracy of current diagnostic tests [11].

Monkeypox virus (MPXV) was first reported in 1959 as an outbreak of a pox-like disease in monkeys kept at a research institute in Copenhagen, Denmark. Several years later, in 1970, there was the advent of the first human case of MPXV in medical history in the Democratic Republic of Congo [12]. Since then, there have been multiple outbreaks and sporadic cases, mostly occurring in Central and West Africa [13], while reported cases beyond these regions were detected due to international travel to the endemic regions [14]. Since May 2022, a global outbreak has escalated the situation, leading the World Health Organisation (WHO) to declare Mpox an international public health emergency, urging countries to implement control measures [15]. The WHO reported that, as of May 3, 2023, there have been more than 87,000 laboratory-confirmed cases and 130 deaths identified from 111 countries around the world [16].

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 [17].

The recent increase in the incidence of human Mpox requires prevention, early detection, prompt response, and management by HCWs who are knowledgeable about Mpox. Understanding HCWs' awareness and knowledge of non-epidemic infections and treatment practices could help identify existing gaps and enhance occupational safety and viral surveillance. Adoption of preventive measures, especially in the context of emerging infectious diseases, is largely determined by knowledge about diseases and attitudes toward practice [18,19]. The future HCWs play a crucial role in shaping disease prevention strategies through education and influence. Their knowledge and communication about infectious disease prevention are essential in motivating populations and developing targeted prevention strategies [20].

Therefore, this study was designed to assess the knowledge and attitude of HCWs and medical students towards human Mpox. However, limited data are available regarding the level of awareness and preparedness among Iraqi healthcare workers and medical students toward Mpox, highlighting the need for this study**.**

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METHODS

Study Design, Setting, and Data Collection:

A cross-sectional study was conducted during the period from 23rd October to 23rd November 2024. The target population consisted of Iraqi medical college students and registered health care workers practising in various Iraqi provinces.

Data were obtained by a standardised, structured, self-administered questionnaire adapted from previously published studies [21,22] and slightly modified by the supervisor and researcher, based on the information about Monkeypox virus acquired from WHO, to suit this study. The questionnaire was designed using Google Forms and distributed electronically to voluntary participants using social media applications, including Facebook, Telegram, and WhatsApp. Ethical approval was obtained from the Institutional Ethics Committee (Approval No: 25/2024)

Measures

The survey consists of 37 questions divided into four sections:

- **Sociodemographic:** this first section contains 5 questions about the participant, including age, gender, residence (rural or urban), education level and occupation
- **Knowledge**: the second section contains 11 questions about the pathogen, mode of transmission, groups vulnerable to infection, signs and symptoms, and preventive measures. Each question had a correct and incorrect response
- **Attitude**: the third section evaluated attitude, including 12 items that were assessed on a three-point Likert scale (yes, no and unknown)
- **Practice**: the fourth section covered 9 items toward the Mpox vaccine. Each question received a response of Yes, No or Maybe

Scoring criteria

In this study, two scores were calculated, one for knowledge and one for attitude. For the knowledge score, each correct answer scored 1 point, and each wrong answer scored 0 point. The maximum knowledge score was 15 and the minimum was 0. After calculating the knowledge scores, participants were categorized into three groups: poor knowledge (≤9), moderate knowledge (10-12), and excellent knowledge (≥13). For attitude score each yes = 3, uncertain = 2 and no = 1. The maximum attitude score was 36 and the minimum was 12. A score of 27 was taken as a cutoff point, participants who scored 27 or less were considered to have a negative attitude, whereas participants who scored more than 27 were considered to have a positive attitude towards the vaccine.

Statistical Analysis

Utilising the statistical software IBM SPSS V 29 (SPSS Inc., Chicago, IL, USA), the data were described and analysed. Categorical variables were analysed using frequency, percentage, cross-tabs and the Pearson Chi-square test. While continuous variables like scores of both (knowledge and attitude) were performed using the ANOVA test. $P<0.05$ was considered to indicate statistical significance.

- **Sampling method:** A convenience sampling technique was used
- **Inclusion criteria:** Iraqi healthcare workers and medical students aged ≥18 years who agreed to participate
- **Exclusion criteria:** Incomplete or duplicate responses were excluded from analysis

RESULTS

Distribution of Sociodemographic Characteristics of Participants

A total of 334 individuals participated in this study. Of them, 262 (78.4%), fall within the age range of 18–30 years, with a male predominance of 174 (52.1%). Most of them, 229 (68.6%), hold a bachelor's degree. Moreover, 179 (53.6%) of the survey respondents were from urban areas. Participants' occupations included medical students (64, 19.2%), physicians (26, 7.8%), dentists (13, 3.9%), pharmacists (19, 5.7%), nurses (127, 38.0%), laboratory analysts (46, 13.8%), and others (39, 11.7%) (Table 1).

Table 1: Frequency Distribution of the Socio-Demographic Profile of the Respondents

Variable	Item	Frequency	Percentage
Age group	18-30	262	78.4
	31-40	59	17.7
	41-50	13	3.9
Sex	Male	174	52.1
	Female	160	47.9
Education level	Diploma	51	15.3
	Bachelor	229	68.6
	Postgraduate	54	16.2
Residence	Rural	155	46.4
	Urban	179	53.6
Occupation	Medical student	64	19.2
	Physician	26	7.8
	Dentist	13	3.9
	Pharmacist	19	5.7
	Nurse	127	38.0
	Analyst	46	13.8
	Other	39	11.7

Table 2: Participants' Knowledge of Mpox

	Answers	
Knowledge scale	Correct No. (%)	Incorrect No. (%)
Is Mpox a zoonotic disease but can transferred from human to human?	305 (91.3%)	29 (8.7%)
The causative agent of Mpox infection is virus?	252 (75.4%)	82 (24.6%)
Is Mpox a new variant?	135 (40.4%)	199 (59.6%)
Is Mpox infectious?	306 (91.6%)	28 (8.4 %)
Is Mpox is prevalent in Middle east?	92 (27.5%)	242 (72.5%)
Are there cases of Mpox in Iraq?	149 (44.6%)	185 (55.4%)
Is Mpox able to survive for several days on contaminated surface?	160 (47.9%)	174 (52.1%)
Can smallpox vaccine protect against Mpox?	102 (30.5%)	232 (69.5%)
Is there a specific vaccine for Mpox?	133 (39.8%)	201 (60.2%)
Is there a specific treatment for Mpox?	129 (38.6%)	205 (61.4%)
Can Mpox be transmitted by bite or scratch of infected animals?	237 (71%)	97 (29%)
Can Mpox be transmitted sexually?	98 (29.3%)	236 (70.7%)
Can Mpox be transmitted via the respiratory route?	123 (36.8%)	211 (63.2%)
Can Mpox be transmitted by close contact with an infected person?	207 (62%)	127 (38%)
Can Mpox be transmitted through contaminated food and water?	215 (64.4%)	119 (35.6%)

Table 3: Distribution of Participants' Knowledge Levels (Poor, Moderate, Excellent) in Relation to their Demographic Characteristics

		Poor knowledge		Moderate knowledge		Excellent knowledge			
Demographic characteristics		N	Percentage	N	Percentage	N	Percentage	Total	p value
Age group	18-30	24	9.2%	175	66.8%	63	24%	262 (100%)	0.8
	31-40	7	11.9%	39	66.1%	13	22%	59 (100%)	
	41-50	0	0.0%	10	76.9%	3	23.1%	13 (100%)	
Total		31 (9.3%)		224 (67 %)		79 (23.7%)		334 (100%)	-
Sex	Male	14	8%	123	70.7%	37	21.3%	174 (100%)	0.16
	Female	17	10.6%	101	63.1%	42	26.3%	160 (100%)	
Total		31 (9.3%)		224 (67 %)		79 (23.7%)		334 (100%)	-
Education level	Diploma	7	13.7%	33	64.7%	11	21.6%	51 (100%)	0.319
	Bachelor	20	8.7%	150	65.5%	59	25.8%	229 (100%)	
	Postgraduate	4	7.4%	41	75.9%	9	16.7%	54 (100%)	
		31 (9.3%)		224 (67 %)		79 (23.7%)		334 (100%)	-
Residence	Rural	13	8.4%	108	69.7%	34	21.9%	155 (100%)	0.350
	Urban	18	10.1%	116	64.8%	45	25.1%	179 (100%)	
Total		31 (9.3%)		224 (67 %)		79 (23.7%)		334 (100%)	-
Occupation	Medical student	7	10.9%	36	56.3%	21	32.8%	64 (100%)	*0.017
	Physician	2	7.7%	18	69.2%	6	23.1%	26 (100%)	
	Dentist	0	0.0%	8	61.5%	5	38.5%	13 (100%)	
	Pharmacist	1	5.3%	14	73.7%	4	21%	19 (100%)	
	Nurse	13	10.2%	88	69.3%	26	20.5%	127 (100%)	
	Analyst	1	2.2%	33	71.7%	12	26.1%	46 (100%)	
	Other	7	18%	27	69.2%	5	12.8%	39 (100%)	
Total		31 (9.3%)		224 (67 %)		79 (23.7%)		334 (100%)	-

Analysis of the Knowledge of Study Participants about Mpox:

As shown in Table 2, a significant majority, 305 (91.3%), of participants recognised Mpox as a zoonotic disease that can be transmitted from human to human.

Regarding the causative agent, most of the participants, 252 (75.4%), believed that the Mpox infection is caused by the virus, which was the correct answer. When asked if Mpox is a new variant, 199 (59.6%) of participants mistakenly thought it was the same variant, while 135 (40.4%) correctly answered. Most participants, 306 (91.6%), agreed that Mpox is infectious. Regarding the prevalence of Mpox in the Middle East, only 92 (27.5%) of the respondents disagreed with its prevalence in the Middle East. Additionally, 149 (44.6%) of them knew that there were no recorded cases of Mpox in Iraq.

Approximately half of the participants, 160 (47.9%), thought that the virus is able to survivefor several days on a contaminated surface, which is the correct answer. Regarding vaccines, only 102 (30.5%) knew the smallpox vaccine could protect against the disease, while 133 (39.8%) of them pointed out that there is a specific vaccine for Mpox. About 232 (69.5%) of respondents incorrectly answered that the smallpox vaccine cannot provide protection against Mpox, while 201 (60.2%) of them incorrectly pointed out that there is a specific vaccine for Mpox. Furthermore, 129 (38.6%) of the respondents disagreed the presence of specific treatment for Mpox.

Regarding Mpox transmission routes, there were some mixed responses. Bite or scratch of infected animals was the most identified route of transmission, followed by close contact with an infected person, 237 (71%) and 207 (62%) of participants, respectively. Respiratory routes were identified by 123 (36.8%), while the sexual route was identified by 98 (29.3%). Around 119 (35.6%) of participants mistakenly thought that Mpox can be transmitted by contaminated food and water.

The participants' knowledge levels were assessed as (poor, moderate, excellent) in relation to their demographic characteristics, Table 3. Moderate knowledge regarding Mpox was observed in 224 67% of respondents, while only 79 23.7% of them demonstrated an excellent level of knowledge. Regarding age, all participants aged between 41-50 years showed acceptable cognitive level towards Mpox, as 76.9% of them presented a moderate level of knowledge and 23.1% with excellent level, while none of them showed a poor level, followed by those aged between 18-30 years as 66.8% and 24% of them showed moderate and excellent levels of knowledge, respectively. However, there was no significant difference between age groups ($p = 0.8$).

Furthermore, 70.7% of males demonstrated a moderate level of knowledge about Mpox compared to females 63.1% of female, while females constituted the higher percentage within those with an excellent level 26.3% compared to male participants 21.3%, however the difference was insignificant 0.16.

Educationally, those with postgraduate degrees were collectively more aware about Mpox as 75.9% of those showed moderate level and 16.4% showed excellent level of knowledge about M pox, followed by bachelor degree holders 65.5% with moderate level and 25.8% with excellent level, even though there was no significant difference $p = 0.319$. Regarding residence, rural dwellers showed significantly higher awareness 69.7% and 21.9% compared to urban dwellers 64.8% and 25.1% with $p = 0.350$.

Finally, there was a significant increase in knowledge level observed among dentists 61.5% and 38.5%, while the lowest knowledge level was observed among those with other health professions 69.2% and 2.8% compared to other occupation categories $p = 0.017$.

Analysis of the Attitude of Study Participants towards Mpox

According to results obtained during this study, the majority of participants 243 (72.8%) expressed concern that Mpox might become a global pandemic, while 64 (19.2%) disagreed, and 27 (8.1%) were unsure. Regarding the declaration of Mpox as a public health emergency, approximately a half of participants 186 (55.7%) agreed, while 92 (27.5%) were neutral, and 56 (16.8%) were disagreed. When asked if Mpox can be easily transmitted in Iraq, 251(75.1%) of participants affirmed this, while 53 (15.9%) disagreed, and 30 (9.0%) were unsure. In addition, most participants 297 (88.9%) agreed that Mpox adds an extra burden to the healthcare system, while fewer 22 (6.6%) disagreed or were unsure 15 (4.5%).

Opinions on infection prevention and control (IPC) measures were less optimistic, with only 99 participants (29.6%) feeling sufficient measures are available, while 198 (59.3%) disagreed, and 37 (11.1%) were unsure. A majority (252 participants, 75.4%) stated they would accept an Mpox vaccine, and 253 (75.7%) would encourage others to do the same. However, the rate of those who agreed with making the vaccine mandatory for healthcare workers (HCWs) was 219 (65.6%), while 53 (15.9%) were neutral, and 62 (18.6%) opposed the idea. In terms of vaccine necessity, 221 participants (66.2%) believed the vaccine is essential and that the immune system alone is insufficient, while 61 (18.3%) believed otherwise, and 52 (15.6%) were unsure. Regarding the effectiveness of vaccination as a prevention method, 238 participants (71.3%) agreed, 45 (13.5%) disagreed, and 51 (15.3%) were uncertain. Participants were divided on curfews and quarantines as prevention strategies, with 167 (50.0%) agreeing, 133 (39.8%) disagreeing, and 34 (10.2%) uncertain. Lastly, a strong majority (271 participants, 81.1%) expressed interest in learning more about Mpox, while fewer were uninterested (44, 13.2%) or unsure (19, 5.7%).

133 (39.8%) disagreeing, and 34 (10.2%) uncertain. Lastly, a strong majority (271 participants, 81.1%) expressed interest in learning more about Mpox, while fewer were uninterested (44, 13.2%) or unsure (19, 5.7%), Table 4.

Table 5 illustrates attitudes of participants (positive or negative) toward Mpox, stratified by demographic characteristics. Half of the participants exhibited a No significant

Table 4: Attitude of Study Participants toward the Mpox

Attitude scale	Answers		
	Agree No (%)	Disagree No (%)	Neutral No (%)
Are you worried that Mpox might become a worldwide pandemic?	243 (72.8%)	64 (19.2%)	27 (8.1%)
Do you agree with declaring Mpox as a public health emergency?	186 (55.7%)	56 (16.8%)	92 (27.5%)
Do you see that Mpox can be transmitted easily in Iraq?	251 (75.1%)	53 (15.9%)	30 (9.0%)
Does Mpox cause an extra burden on the healthcare system?	297 (88.9%)	22 (6.6%)	15 (4.5%)
Do you feel enough IPC measures for Mpox are available?	99 (29.6%)	198 (59.3%)	37 (11.1%)
Will you accept the Mpox vaccine?	252 (75.4%)	46 (13.8%)	36 (10.8%)
Will you encourage others to accept the Mpox vaccine?	253 (75.7%)	41 (12.3%)	40 (12.0%)
Do you agree to make the vaccine compulsory for HCWs?	219 (65.6%)	62 (18.5%)	53 (15.9%)
Do you believe the Mpox vaccine is unnecessary and immune system is enough?	61 (18.3%)	221 (66.2%)	52 (15.6%)
Do you think getting a vaccination is an effective way of preventing the spread of the disease?	238 (71.3%)	45 (13.5%)	51 (15.3%)
Do you think the curfew and quarantine are effective ways of preventing the spread of the disease?	167 (50.0%)	133 (39.8%)	34 (10.2%)
Are you interested in learning more about Mpox?	271 (81.1%)	44 (13.2%)	19 (5.7%)

Table 5: Participants' Characteristics according to Attitude Categories

Demographic characteristics		Positive attitude		Negative attitude		Total	p value
		N	Percentage	N	Percentage		
Age group	18-30	133	50.8%	129	49.2%	262 (100%)	0.241
	31-40	27	45.8%	32	54.2%	59 (100%)	
	41-50	7	53.8%	6	46.2%	13 (100%)	
Total		167 (50%)		167 (50%)		334 (100%)	
Sex	Male	86	49.4%	88	50.6%	174 (100%)	0.289
	Female	81	50.6%	79	49.4%	160 (100%)	
Total		167 (50%)		167 (50%)		334 (100%)	
Education level	Diploma	25	49%	26	51%	51 (100%)	0.169
	Bachelor	119	52%	110	48%	229 (100%)	
	Postgraduate	23	42.6%	31	57.4%	54 (100%)	
Total		167 (50%)		167 (50%)		334 (100%)	
Residence	Rural	87	56.1%	68	43.9%	155 (100%)	0.058
	Urban	80	44.7%	99	55.3%	179 (100%)	
Total		167 (50%)		167 (50%)		334 (100%)	
Occupation	Medical student	28	43.75%	36	56.25%	64 (100%)	0.185
	Physician	9	34.6%	17	65.4%	26 (100%)	
	Dentist	7	53.8%	6	46.2%	13 (100%)	
	Pharmacist	10	52.6%	9	47.4%	19 (100%)	
	Nurse	66	52%	61	48%	127 (100%)	
	Analysist	24	52.2%	22	47.8%	46 (100%)	
	Other	23	59%	16	41%	39 (100%)	
Total		167 (50%)		167 (50%)		334 (100%)	

association was found between knowledge level and attitudeThose aged between 41-50 years showed the highest rate (53.8%) with a positive attitude, followed by (50.8%) of those aged 18-30, compared to only (45.8%) of those aged between 31-40 years. Even though the difference was statistically insignificant (p = 0.241). In addition, females insignificantly displayed a higher positive attitude (50.6%) compared to males (49.4%), (p = 0.241). When analysing educational levels, bachelor's degree holders exhibited the highest positive attitudes (52%) compared with other education categories; the difference was insignificant (p = 0.169).

Regarding residence, unexpectedly, rural residents exhibited a higher positive attitude (56.1%) compared to urban residents (44.7%). However, the difference failed to reach statistical significance (p = 0.058). Occupationally, physicians displayed the lowest positive attitude (34.6%), compared to other health professions (59%), followed by dentists (53.8%). Also, the difference was statistically insignificant (p = 0.185).

Relationship between knowledge, attitude, and practice towards the COVID-19 vaccine:

Figure 1 compares knowledge categories of participants (poor, moderate, and excellent) with their attitudes toward Mpox (positive or negative). Among those with poor knowledge, 16 (4.8%) exhibited a positive attitude, while 15 (4.5%) had a negative attitude, accounting for a total of 9.3% of participants. Those with moderate knowledge formed the largest group, with 108 (32.3%) showing a positive attitude and 116 (34.7%) a negative attitude, totaling 67%. Those with excellent knowledge represented 43 (12.9%) with positive attitudes and 36 (10.8%) with negative attitudes, making up 23.7% of the sample.

Overall, attitudes were evenly distributed between positive and negative categories (50.0% each) across the knowledge levels. The statistical analysis yielded a p-value of 0.626, indicating no significant association between vaccine knowledge and attitudes toward Mpox.

This suggests that the level of knowledge does not strongly influence whether participants hold a positive or negative attitude toward Mpox.

Table 6: Knowledge and Attitude Compared with the Practice of Mpox

Q1/ Do you expect Mpox will cause a pandemic disease like COVID 19?						
Knowledge	Variables	Yes		No	Maybe	p-value
	Poor	N (%)	13 (3.9%)	9 (2.7%)	9 (2.7%)	0.23
	Moderate	N (%)	67 (20.1%)	90 (26.9%)	67 (20.1%)	
	Excellent	N (%)	32 (9.6%)	31(9.3%)	16 (4.8%)	
Attitude	Positive	N (%)	77 (23.1%)	44 (13.2%)	46 (13.8%)	<0.001
	Negative	N (%)	35 (10.5%)	86 (25.7%)	46 (13.8%)	
Q2/ Do you think that Mpox will affect life as COVED19?						p-value
Knowledge	Variables	Yes		No	Maybe	
	Poor	N (%)	11(3.3%)	12 (3.6%)	8 (2.4%)	0.9
	Moderate	N (%)	80 (24.0%)	91 (27.2%)	53 (15.9%)	
	Excellent	N (%)	33 (9.9%)	29 (8.7%)	17 (5.1%)	
Attitude	Positive	N (%)	83 (24.9%)	46 (13.8%)	38 (11.4%)	<0.001
	Negative	N (%)	41 (12.3%)	86 (25.7%)	40 (12.0%)	
Q3/Do you expect that travelling to other countries with the new Mpox outbreak is a risk?						p-Value
Knowledge	Variables	Yes		No	Maybe	
	Poor	N (%)	25 (7.5%)	3 (0.9%)	3 (0.9%)	0.38
	Moderate	N (%)	187 (56.0%)	13 (3.9%)	24 (7.2%)	
	Excellent	N (%)	70 (21.0%)	6 (1.8%)	3 (0.9%)	
Attitude	Positive	N (%)	152 (45.5%)	3 (0.9%)	12 (3.6%)	0.001
	Negative	N (%)	130 (38.9%)	19 (5.7%)	18 (5.4%)	
Q4/Do you think Mpox cases will increase in Iraq?						p-value
Knowledge	Variables	Yes		No	Maybe	
	Poor	N (%)	14 (4.2%)	10 (3.0%)	7 (2.1%)	0.8
	Moderate	N (%)	90 (26.9%)	61 (18.3%)	73 (21.9%)	
	Excellent	N (%)	31 (9.3%)	23 (6.9%)	25 (7.5%)	
Attitude	Positive	N (%)	90 (26.9%)	28 (8.4%)	49 (14.7%)	<0.001
	Negative	N (%)	45 (13.5%)	66 (19.8%)	56 (16.8%)	
Q5/Do you think Mpox will cause a more severe disease compared to smallpox?						p-value
	Variables	Yes		No	Maybe	
Knowledge	Poor	N (%)	18 (5.4%)	7 92.1%)	6 (1.8%)	0.15
	Moderate	N (%)	98 (29.3%)	56 (16.8%)	70 (21.0%)	
	Excellent	N (%)	42 (12.6%)	11 (3.3%)	26 (7.8%)	
Attitude	Positive	N (%)	100 (29.9%)	20 (6.0%)	47 (14.1%)	<0.001
	Negative	N (%)	58 (17.4%)	54 (16.2%)	55 (16.5%)	
Q6/Do you think Mpox affect daily activity?						p-value
Knowledge	Variables	Yes		No	Maybe	
	Poor	N (%)	21(6.3%)	6 (1.8%)	4 (1.2%)	0.4
	Moderate	N (%)	149 (44.6%)	31 (9.3%)	44 (13.2%)	
	Excellent	N (%)	57 (17.1%)	13 (3.9%)	9 (2.7%)	
Attitude	Positive	N (%)	136 (40.7%)	8 (2.4%)	23 (6.9%)	<0.001
	Negative	N (%)	91 (27.2%)	42 (12.6%)	34 (10.2%)	
Q7/Do you think the smallpox vaccine is an effective way to control Mpox ?						p-value
	Variables	Yes		No	Maybe	
Knowledge	Poor	N (%)	12 (3.6%)	11 (3.3%)	8 (2.4%)	0.25
	Moderate	N (%)	115 (34.4%)	42 (12.6%)	67 (20.1%)	
	Excellent	N (%)	43 (12.9%)	16 (4.8%)	20 (6.0%)	
Attitude	Positive	N (%)	107 (32.0%)	20 (6.0%)	40 (12.0%)	<0.001
	Negative	N (%)	63 (18.9%)	49 (14.7%)	55 (16.5%)	
Q8/Do you think Mpox vaccine is unsafe?						p-value
Knowledge	Variables	Yes		No	Maybe	
	Poor	N (%)	9 (2.7%)	12 (3.6%)	10 (3.0%)	0.53
	Moderate	N (%)	38 (11.4%)	116 (34.7%)	70 (21.0%)	
	Excellent	N (%)	15 (4.5%)	38 (11.4%)	26 (7.8%)	
Attitude	Positive	N (%)	24 (7.2%)	101 (30.2%)	42 (12.6%)	<0.001
	Negative	N (%)	38 (11.4%)	65 (19.5%)	64 (19.2%)	
Q9/Do you think benefits of Mpox vaccine outweigh possible side effect?						p-value
Knowledge	Variables	Yes		No	Maybe	
	Poor	N (%)	13 (3.9%)	7 (2.1%)	11 (3.3%)	0.26
	Moderate	N (%)	98 (29.3%)	32 (9.6%)	94 (28.1%)	
	Excellent	N (%)	44 (13.2%)	9 (2.7%)	26 (7.8%)	
Attitude	Positive	N (%)	94 (28.1%)	13 (3.9%)	60 (18.0%)	<0.001
	Negative	N (%)	61 (18.3%)	35 (10.5%)	71 (21.3%)	

Results in Table 6 showed the knowledge and attitude of participants compared with practice towards Mpox. When analysing the association between participants' knowledge and attitudes regarding their expectations of Mpox becoming

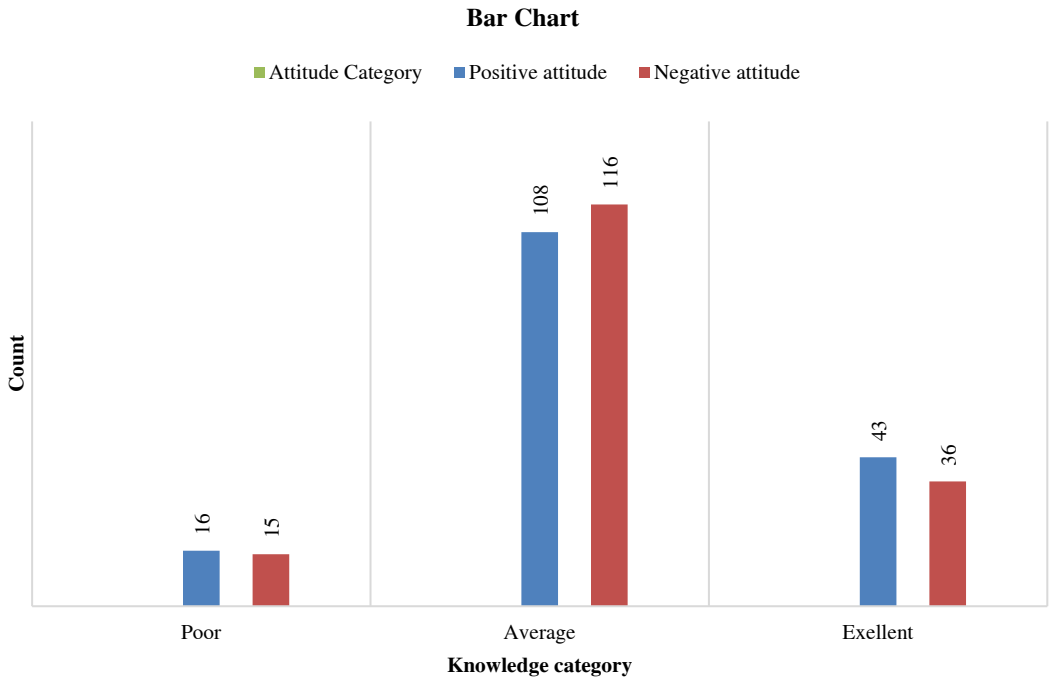

Figure 1: Compares Knowledge Categories of Participants (Poor, Moderate, and Excellent) with their Attitudes toward Mpox (Positive or Negative)

a pandemic. No statistically significant association was observed among those who believed Mpox might cause a pandemic and those who did not expect Mpox to become a pandemic or were uncertain (p = 0.23). In contrast, attitude showed a significant relationship (p<0.001). Participants with a positive attitude were more likely to believe Mpox could become a pandemic, with 77 individuals (23.1%), while negative attitudes were more prevalent among those not expecting Mpox to become a pandemic, with 86 participants (25.7%).

Regarding the relationship between participants' knowledge and attitudes with their perceptions of Mpox's potential impact on life compared to COVID-19. Again, there was no statistically significant association between knowledge levels and this perception (p = 0.9). Attitudes, however, showed a significant association (p<0.001). Participants with a positive attitude were more likely to perceive Mpox as having a significant impact, with 83 individuals (24.9%) holding this belief, compared to 86 (25.7%) with a negative attitude among those who did not believe Mpox would affect life significantly.

Moreover, evaluating the association between participants' knowledge and attitudes with their perception of travelling to other countries as a risk amid the Mpox outbreak. This belief is more prevalent among participants with moderate or high levels of knowledge, 187 (56.0%) and 70 (21.0%), respectively. However, the association was statistically insignificant (p = 0.38). Conversely, the study found that participants' attitudes significantly influenced their perception of travelling as a risk during the Mpox outbreak. Among those perceiving travel as risky, 152 participants (45.5%) exhibited a positive attitude, compared to only 3 (0.9%) having a positive attitude among those who did not perceive travel as risky. Those uncertain about risks have fairly evenly distributed attitudes, with 12 (3.6%) showing a positive attitude and 18 (5.4%) a negative one.

The analysis explores participants' perceptions about the potential increase in Mpox cases in Iraq, assessed in relation to their knowledge and attitudes. Although there were no statistically significant relationships between their level of knowledge and perception (p = 0.8), a discrepancy was observed in perception regardless the level of knowledge, as their opinion conflicted between supporters, opponents 61 (18.3%), and neutral. Attitudes, however, demonstrated a significant association (p<0.001). Among participants with a positive attitude, 90 (26.9%) expected an increase in cases, 28 (8.4%) did not expect an increase, and 49 (14.7%) were uncertain. In contrast, among participants with a negative attitude, 45 (13.5%) anticipated an increase, 66 (19.8%) did not, and 56 (16.8%) were uncertain.

When comparing participants' perceptions of whether Mpox will cause a more severe disease than smallpox with their knowledge and attitude, the results show significant patterns. Although, a high percentage of participants with a moderate or excellent level of knowledge had an incorrect pessimistic opinion towards the severity of Mpox 98 (29.3%) and 42 (12.6%), respectively, the relationship failed to reach the statistically significant (P = 0.15). Regarding attitudes, a significantly higher proportion of individuals with a positive attitude toward the severity of Mpox 100 (29.9%) believed it could be more severe than smallpox, while 20 (6.0%) disagreed, and 47 (14.1%) were unsure. Those with a

negative attitude showed a more balanced distribution, with 58 (17.4%) believing Mpox would be more severe, 54 (16.2%) disagreeing, and 55 (16.5%) uncertain.

When examining whether participants believe that Mpox would affect daily activities, the data reveals notable differences in both knowledge and attitude. Regarding knowledge, among those who believed Mpox would affect daily activity, 21 participants (6.3%) had poor knowledge, 149 (44.6%) had moderate knowledge, and 57 (17.1%) had excellent knowledge. In contrast, those who disagreed with the statement showed 6 participants (1.8%) with poor knowledge, 31 (9.3%) with moderate knowledge, and 13 (3.9%) with excellent knowledge. Among those uncertain about the impact of Mpox on daily activity, 4 participants (1.2%) had poor knowledge, 44 (13.2%) had moderate knowledge, and 9 (2.7%) had excellent knowledge. Concerning attitudes, a larger proportion of participants with a positive attitude believed that Mpox would affect daily activities. Specifically, 136 participants (40.7%) supported this view, while 8 (2.4%) disagreed, and 23 (6.9%) were unsure. For those with a negative attitude, 91 participants (27.2%) believed Mpox would affect daily life, while 42 (12.6%) disagreed, and 34 (10.2%) were uncertain. These results underscore the influence of both knowledge and attitude on perceptions of Mpox's impact on daily activities.

When considering whether the smallpox vaccine is an effective way to control Mpox, there are notable trends in both knowledge and attitude. In terms of knowledge, 12 participants (3.6%) with poor knowledge believed the smallpox vaccine would be effective in controlling Mpox, while 11 (3.3%) disagreed, and 8 (2.4%) were uncertain. Among those with average knowledge, 115 participants (34.4%) believed in the vaccine's effectiveness, 42 (12.6%) disagreed, and 67 (20.1%) were unsure. Among those with excellent knowledge, 43 participants (12.9%) thought the smallpox vaccine would be effective, 16 (4.8%) disagreed, and 20 (6.0%) were unsure. Regarding attitude, 107 participants (32.0%) with a positive attitude believed the smallpox vaccine was an effective way to control Mpox, 20 (6.0%) disagreed, and 40 (12.0%) were uncertain. In contrast, among those with a negative attitude, 63 participants (18.9%) believed the vaccine would be effective, 49 (14.7%) disagreed, and 55 (16.5%) were unsure. These findings suggest that positive attitudes are strongly associated with a belief in the vaccine's effectiveness, while the level of knowledge has a less pronounced impact.

When evaluating whether the Mpox vaccine is considered unsafe, significant differences in both knowledge and attitude are observed. In terms of knowledge, among those with poor knowledge, 9 participants (2.7%) believed the Mpox vaccine is unsafe, 12 (3.6%) disagreed, and 10 (3.0%) were unsure. For those with average knowledge, 38 participants (11.4%) thought the vaccine was unsafe, 116 (34.7%) disagreed, and 70 (21.0%) were uncertain. Among those with excellent knowledge, 15 participants (4.5%) viewed the vaccine as unsafe, 38 (11.4%) disagreed, and 26 (7.8%) were unsure. Regarding attitude, 24 participants (7.2%) with a positive attitude considered the vaccine unsafe, while 101 (30.2%) disagreed, and 42 (12.6%) were uncertain. In contrast, 38 participants (11.4%) with a negative attitude considered the vaccine unsafe, 65 (19.5%) disagreed, and 64 (19.2%) were unsure. These results indicate that individuals with a positive attitude towards Mpox are less likely to consider the vaccine unsafe compared to those with a negative attitude. Knowledge also plays a role, though the differences are less striking.

Regarding the perception of whether the benefits of the Mpox vaccine outweigh its possible side effects, a clear distinction is seen between knowledge levels and attitudes. For those with poor knowledge, 13 participants (3.9%) agreed that the benefits outweigh the risks, 7 (2.1%) disagreed, and 11 (3.3%) were unsure. Among those with average knowledge, 98 participants (29.3%) felt the benefits outweigh the risks, 32 (9.6%) disagreed, and 94 (28.1%) were uncertain. Those with excellent knowledge had 44 participants (13.2%) who agreed with the statement, 9 (2.7%) disagreed, and 26 (7.8%) were unsure. In terms of attitude, 94 participants (28.1%) with a positive attitude believed the benefits outweigh the risks, 13 (3.9%) disagreed, and 60 (18.0%) were unsure. Conversely, 61 participants (18.3%) with a negative attitude agreed with the statement, 35 (10.5%) disagreed, and 71 (21.3%) were unsure. These results highlight that individuals with a positive attitude towards Mpox are more likely to perceive the benefits of the vaccine as outweighing the risks, and this trend is less prominent in those with a negative attitude. Knowledge, however, shows less variation in perception.

DISCUSSION

The present study assessed the knowledge, attitudes, and perceptions of HCWs and medical students towards Mpox. Regarding Mpox awareness, the results of the study indicate that there is a disparity in the level of knowledge among the participants, as it was found that the majority (67%) of HCWs and medical students have a marginally satisfactory level of knowledge, while about a quarter (23.7%) of them demonstrated an excellent level of knowledge about Mpox. However, 9.3% of the participants suffer from a lack of basic information about its prevalence, transmission methods, and methods of prevention. These gaps may be due to the lack of updated educational resources or the lack of awareness campaigns directed at healthcare workers.

These findings are consistent with similar studies conducted in other regions, where a moderate level of knowledge was observed among healthcare workers [21,22]. However, a multi-country cross-sectional study among healthcare personnel in Arabic regions showed a low proportion of the participants had a good level of knowledge towards Mpox [23]. An Iraqi study conducted in the Kurdistan region revealed that HCWs exhibit a relatively low level of knowledge and attitude towards Mpox [24]. Comparing the assessment of knowledge of HCWs and medical students across studies has led to inconsistencies in

the analysis of results due to differences in many factors, such as the timing of the survey, sample size, and sociodemographic characteristics of the participants, including age, years of experience, type of healthcare workers, specialisation, and educational stages of medical students.

There was a relationship between knowledge level and some demographic factors, such as age, education level, and professional experience. For example, all older participants or those with more experience in the health field showed an acceptable knowledge level towards Mpox. This suggests that practical experience plays a major role in enhancing knowledge about infectious diseases, which is supported by previous studies in epidemiology [22,25].

Moreover, the study identifies disparities in awareness levels of Mpox across individuals with different educational backgrounds. The results showed that individuals with a postgraduate degree tend to possess greater knowledge of Mpox. The reasons behinds this gap in knowledge is that while transferring to the clinical phase of medical school, the typical undergraduate medical curriculum frequently ignores fundamental scientific information. Another reason could be that no recommendations have been established that distinguish between the classical and the new variant of Mpox. This contradicts the conclusions drawn by AlBalas *et al* [22] while it became consistent with the results of other studies [24,25].

The overall attitude of HCWs and medical students who participated can be regarded as sensible. The results showed that while most participants recognised the seriousness of the disease, their perceptions of its rapid spread and potential to become a global pandemic varied. Some participants expressed unrealistic fears, fueled by conspiracy theories about the new viral infection, which emerged as a result of its continued spread in many countries around the world. This highlights the need for accurate scientific awareness to curb unjustified panic. The main concern expressed by the majority of respondents is that Mpox imposes an additional burden on Iraq's healthcare system. This aligns with the results of earlier research [6,26]. The results also highlighted participants' doubts about infection control in Iraqi society due to a lack of IPC measures and poor hygienic practice, consistent with the opinion of Egyptian HCWs obtained by a similar study conducted by Amer *et al.* [23]. This negative view may be due to the weakness of the health sector, which both countries suffer from [26].

Furthermore, the majority of participants (71.3%) believed in the effectiveness of vaccination to prevent the spread of Mpox, which is consistent with findings from Amer *et al.* [6,23] which showed that 71% of Egyptian medical students and healthcare workers thought that vaccination was effective. This percentage is somewhat lower than that of Alshahrani *et al.* [25,27], who discovered that the Saudi Ministry of Health had a 78.6% confidence level in its capacity to control Mpox locally.

Regarding the relationship between knowledge, attitudes and practices, our findings showed that the positive attitude towards Mpox accompanied a high level of knowledge, and was associated with willingness to be vaccinated and take preventive measures [27]. This suggests that changing attitudes may be more effective than simply increasing knowledge in promoting prevention. These findings highlight the urgent need for structured educational interventions targeting healthcare workers and students to improve preparedness for emerging infectious diseases.

CONCLUSIONS

The study revealed suboptimal knowledge, attitude, and practices toward Mpox among Iraqi healthcare workers and medical students. Strengthening educational programs and integrating Mpox-related content into medical curricula are essential to improve preparedness.

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