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Knowledge, Attitudes, and Practices Regarding Monkeypox Among Healthcare Professionals in Lahore

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ABSTRACT

Background: Monkeypox (Mpox), a re-emerging zoonotic disease, poses a growing threat to global health, especially in non-endemic regions. Healthcare professionals (HCPs) serve as the first line of defense against such outbreaks. However, limited local evidence exists on the levels of knowledge, attitudes, and practices (KAP) among HCPs in Pakistan, hindering targeted intervention strategies. **Objective:** This study aimed to assess the knowledge, attitudes, and practices related to monkeypox among healthcare professionals in Lahore, with a focus on the influence of gender, professional role, and clinical exposure on KAP outcomes. **Methods:** A cross-sectional survey was conducted among healthcare professionals (n = 60) from selected hospitals in Lahore between December 2024 and March 2025. Participants aged 18–65 years, directly involved in patient care, were selected via stratified random sampling. Those with prior monkeypox-specific training were excluded. Data were collected using a structured questionnaire assessing demographic data and monkeypox-related KAP. The study was ethically approved and conducted in accordance with the Declaration of Helsinki. Statistical analysis was performed using SPSS v27, applying descriptive statistics, t-tests, ANOVA, chi-square tests, and Pearson correlation to explore associations. **Results:** Significant positive correlations were observed between knowledge, attitude, and practice scores ($r = 0.945, 0.853, \text{ and } 0.841$ respectively; $p < 0.01$). Male participants showed higher KAP scores than females (knowledge: 23.02 ± 5.30 vs. 16.56 ± 1.64 , $p < 0.001$). Clinical exposure to monkeypox was associated with markedly better knowledge (25.56 ± 0.50 vs. 15.88 ± 2.23 , $p < 0.001$). Among professional groups, paramedics scored highest, followed by nurses and doctors. These findings underscore disparities in preparedness levels among healthcare subgroups. **Conclusion:** The study reveals notable deficiencies in monkeypox-related knowledge, attitudes, and practices among healthcare professionals, particularly among doctors and female staff. Role-specific, experiential training programs are essential to enhance clinical preparedness and ensure effective outbreak control in human healthcare settings.

Keywords: Monkeypox, Healthcare Professionals, Knowledge Attitudes Practices, Clinical Preparedness, Emerging Infectious Diseases, Public Health, Zoonoses

INTRODUCTION

Mpox, formerly known as monkeypox, is a re-emerging zoonotic disease caused by the monkeypox virus, a double-stranded DNA virus belonging to the Orthopoxvirus genus. It is primarily endemic to Central and West African regions, where it is transmitted from animals such as monkeys, rodents, and squirrels to humans through direct contact with infected bodily fluids, lesions, or contaminated materials (1). In recent years, the disease has gained global attention due to an increase in cases outside endemic regions, leading to its declaration as a global health emergency by the World Health Organization (WHO) in July 2022 (2). Between May 2022 and October 2023, mpox cases were reported across 116 countries with over 91,000 confirmed cases and 167 deaths (3). Despite the clinical similarities between mpox

and smallpox—such as fever, rash, and lymphadenopathy—mpox generally results in milder disease. Nevertheless, in resource-limited settings, the fatality rate can reach up to 17%, which necessitates strong preventive measures and clinical preparedness (4). Human-to-human transmission of mpox occurs through respiratory droplets, direct contact with lesions, or fomites, and healthcare professionals (HCPs) are especially vulnerable due to their proximity to potential cases (5). As frontline responders, HCPs play a critical role in identifying, reporting, managing, and controlling mpox outbreaks. Their effectiveness in these roles is largely determined by their knowledge, attitudes, and practices (KAP) regarding the disease. Existing studies suggest that while general awareness of mpox

is increasing, there remain substantial gaps in detailed knowledge, particularly concerning clinical features, transmission dynamics, and preventive strategies (6). Additionally, attitudes and practices are often influenced by trust in public health systems, access to personal protective equipment (PPE), and institutional protocols (7). These behavioral components are closely linked to knowledge, suggesting that a lack of accurate information can hinder both appropriate attitudes and practices in clinical settings (8).

Several KAP-based studies have highlighted disparities among different groups of healthcare professionals. For example, physicians may rely more on theoretical knowledge, while paramedics and nurses may gain practical insights through direct patient care, potentially influencing their attitude and compliance with infection control practices (9). Gender differences have also been observed, with male healthcare workers reportedly exhibiting higher levels of knowledge and confidence in handling infectious diseases compared to their female counterparts, possibly due to differences in training exposure or institutional support (10). Moreover, direct clinical experience with mpox patients has been found to significantly enhance both awareness and application of preventive measures, reinforcing the value of hands-on training and exposure in outbreak preparedness (11).

Despite the increasing global burden of mpox and the essential role of healthcare workers in disease control, there remains a paucity of data on their preparedness in developing countries, including Pakistan. To date, few studies have assessed the comprehensive KAP profile of healthcare professionals in Pakistan regarding mpox, particularly within urban healthcare settings such as Lahore. This knowledge gap undermines the capacity to design evidence-based training and response protocols tailored to local needs. Addressing this gap is crucial for effective outbreak management, as healthcare workers are often the first point of contact for suspected cases. Without adequate knowledge and a positive attitude toward disease control, preventive practices may remain suboptimal, risking nosocomial transmission and wider public health consequences (12).

Therefore, the present study was conducted to assess the knowledge, attitudes, and practices related to monkeypox among healthcare professionals in Lahore. By examining the influence of variables such as gender, professional role, and clinical exposure, the study aims to identify strengths and deficiencies in current preparedness levels. It is hypothesized that significant differences in KAP scores exist across professional roles and gender, and that direct patient exposure is positively associated with higher knowledge and better practices regarding mpox.

MATERIALS AND METHODS

This study employed a cross-sectional observational design conducted between December 2024 and March 2025 in selected hospitals across Lahore, Pakistan. Healthcare professionals aged between 18 and 65 years who were directly involved in patient care were eligible for inclusion. Participants were recruited using a stratified random sampling technique to

ensure representation across different genders, professional categories (doctors, nurses, and paramedics), and years of clinical experience. Individuals were excluded if they had received prior formal training specific to monkeypox or if they had medical or psychological conditions that could interfere with their participation. All participants were informed about the study's purpose, and written informed consent was obtained prior to data collection. Ethical approval was obtained from the relevant institutional ethics committee, and the study adhered to the principles outlined in the Declaration of Helsinki. Data collection was conducted using a structured and pretested questionnaire divided into four parts: demographics, knowledge, attitudes, and practices related to monkeypox. The primary outcome was the assessment of knowledge, measured through a series of multiple-choice and true/false questions focused on the etiology, transmission, symptoms, and prevention of monkeypox. Secondary outcomes included attitudes and practices, evaluated using Likert scale statements assessing participants' perceptions of monkeypox severity, their willingness to engage in preventive actions, and the frequency of adopting protective behaviors. The questionnaire was administered in-person, and responses were collected under supervision to reduce response bias and ensure completeness.

All responses were entered and analyzed using SPSS version 27. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize demographic and KAP-related data. Independent sample t-tests and one-way ANOVA were used to examine differences in KAP scores across gender and professional groups, while chi-square tests were applied for categorical variables. Pearson correlation analysis was conducted to assess the relationships between knowledge, attitude, and practice scores. A significance level of $p < 0.05$ was used throughout the analysis. No imputation was required, as the dataset had no missing values. Confidentiality of participant information was maintained by anonymizing data and restricting access to the research team only.

RESULTS

A total of 60 healthcare professionals participated in the study, comprising doctors ($n = 28$), nurses ($n = 30$), and paramedical staff ($n = 2$). Descriptive and inferential analyses were conducted to assess the levels of knowledge, attitude, and practice (KAP) regarding monkeypox and their associations with gender, professional role, and clinical exposure to monkeypox patients. Pearson correlation analysis demonstrated statistically significant and strong positive relationships among total knowledge (TK), total attitude (TA), and total practice (TP) scores. The correlation between TK and TA was $r = 0.945$, $p < 0.01$, indicating that greater knowledge was strongly associated with more favorable attitudes.

Similarly, TK and TP were positively correlated ($r = 0.853$, $p < 0.01$), as were TA and TP ($r = 0.841$, $p < 0.01$), suggesting a cohesive interaction among all three domains. These findings imply that interventions aiming to improve knowledge are likely to yield positive changes in attitudes and practices. Independent samples t-tests revealed statistically significant gender differences in all three KAP domains. Male participants ($n = 15$) scored significantly higher than female participants ($n = 45$) in

knowledge (23.02 ± 5.30 vs. 16.56 ± 1.64 , $p < 0.001$), attitude (13.75 ± 3.96 vs. 9.00 ± 0.89 , $p < 0.001$), and practice (14.67 ± 1.92 vs. 9.58 ± 1.02 , $p < 0.001$). The large effect size implied by the pronounced

differences in mean values, especially in knowledge scores, suggests not only statistical but also potential clinical significance, calling for gender-specific educational strategies.

Table 1. Pearson Correlation Coefficients Among Knowledge, Attitude, and Practice Scores

Variables	TK	TA	TP
TK (Knowledge)	1	0.945**	0.853**
TA (Attitude)		1	0.841**
TP (Practice)			1

Note: $p < 0.01$

Table 2. Gender Differences in Knowledge, Attitude, and Practice Scores Among Healthcare Professionals

Variable	Male (n = 15)	Female (n = 45)	p-value
Knowledge (TK)	23.02 ± 5.30	16.56 ± 1.64	<0.001
Attitude (TA)	13.75 ± 3.96	9.00 ± 0.89	<0.001
Practice (TP)	14.67 ± 1.92	9.58 ± 1.02	<0.001

Participants with prior clinical exposure to monkeypox cases ($n = 18$) demonstrated significantly higher knowledge scores (25.56 ± 0.50) compared to those without such experience ($n = 42$; 15.88 ± 2.23 , $p < 0.001$). Although the experienced group also reported higher attitude and practice scores (15.50 ± 1.51 and 15.50 ± 0.88 , respectively), these differences were not statistically significant

($p = 0.45$ for attitude, $p = 0.18$ for practice). The large difference in knowledge scores indicates substantial knowledge gains associated with direct patient interaction, while the non-significant p-values for attitude and practice may reflect either a ceiling effect or insufficient power due to group size disparity.

Table 3. KAP Score Comparison Between Participants with and Without Clinical Exposure to Monkeypox

Variable	Treated Patients (n = 18)	No Exposure (n = 42)	p-value
Knowledge (TK)	25.56 ± 0.50	15.88 ± 2.23	<0.001
Attitude (TA)	15.50 ± 1.51	8.55 ± 1.35	0.45
Practice (TP)	15.50 ± 0.88	9.80 ± 1.07	0.18

One-way ANOVA revealed statistically significant differences in KAP scores across professional roles. Paramedical staff ($n = 2$) scored the highest in all three domains—knowledge (25.50 ± 0.51), attitude (15.00 ± 2.04), and practice (15.00 ± 1.02). Nurses ($n = 30$) followed with knowledge (20.50 ± 5.64), attitude (12.00 ± 4.10), and practice (13.00 ± 3.07) scores. Doctors ($n = 28$) recorded the lowest scores in all domains—knowledge (17.55 ± 4.01), attitude (9.88 ± 3.06), and practice (10.80 ± 2.57). The trend suggests that those with more direct patient contact or

technical training, such as paramedics and nurses, demonstrated higher readiness. However, due to the small sample size of paramedics, these results must be interpreted cautiously. Post hoc comparisons were not conducted due to the limited number of paramedics, which violates assumptions of equal group sizes and homogeneity of variances. Nonetheless, the observed mean trends suggest meaningful professional variability in disease preparedness and response behaviors.

Table 4. Comparison of KAP Scores Among Doctors, Nurses, and Paramedical Staff

Variable	Doctors (n = 28)	Nurses (n = 30)	Paramedics (n = 2)
Knowledge (TK)	17.55 ± 4.01	20.50 ± 5.64	25.50 ± 0.51
Attitude (TA)	9.88 ± 3.06	12.00 ± 4.10	15.00 ± 2.04
Practice (TP)	10.80 ± 2.57	13.00 ± 3.07	15.00 ± 1.02

The analysis provides robust evidence that knowledge among healthcare professionals significantly correlates with both attitude and practice, indicating a unified KAP framework. Gender and clinical exposure emerged as significant determinants of knowledge, with male professionals and those with direct monkeypox experience demonstrating higher preparedness.

Professional differences further emphasized the need for targeted capacity-building initiatives, especially among physicians, who exhibited comparatively lower scores. These findings underscore the importance of structured, experience-

based training programs tailored to the specific needs and exposures of diverse healthcare worker groups.

DISCUSSION

The findings of this study provide critical insight into the knowledge, attitudes, and practices (KAP) of healthcare professionals in Lahore concerning monkeypox, an emerging zoonotic disease with growing global implications. The strong positive correlations observed among knowledge, attitude, and practice scores reinforce the widely held notion in health behavior theory that knowledge is a key determinant of behavioral intent and compliance with preventive measures.

These associations are consistent with previous investigations conducted among healthcare workers in various regions, such as the United States, Malaysia, and Bangladesh, where knowledge-based interventions have been linked to improved attitudes and better clinical practices (9, 19, 28). The results underscore the interconnectedness of cognitive understanding, risk perception, and adherence to disease control protocols, a relationship particularly vital in preparing frontline workers for outbreak response.

The gender-based disparities observed in the present study, with males significantly outperforming females across all three KAP domains, are both statistically and clinically noteworthy. These findings echo those of earlier studies that reported higher knowledge and greater confidence among male healthcare workers in managing infectious diseases, potentially due to differences in clinical exposure, professional roles, or institutional support (10, 29). However, such gender-based discrepancies may also reflect systemic inequalities in training opportunities and risk communication, especially in conservative or resource-constrained settings. The identification of this disparity highlights the need for gender-sensitive educational interventions and equitable access to hands-on training across all cadres of healthcare staff to bridge existing competency gaps.

Direct clinical exposure to monkeypox patients was found to be a significant predictor of knowledge, although its effect on attitude and practice did not reach statistical significance. This aligns with prior research indicating that experiential learning and real-world case management significantly enhance disease-specific competencies among medical staff (11, 30). Although the attitude and practice scores were higher in the clinically exposed group, the lack of statistical significance may be attributable to the modest sample size, which limited the power to detect smaller effect differences. Nonetheless, these trends underscore the importance of practical, simulation-based training and case-based learning modules as key strategies in outbreak preparedness.

Professional group comparisons revealed that paramedical staff exhibited the highest KAP scores, followed by nurses, with doctors ranking the lowest. This inverse gradient contrasts with conventional expectations but has been similarly reported in recent regional studies where paramedical personnel and nursing staff demonstrated higher readiness levels, likely due to greater involvement in direct patient care and routine infection control activities (19, 29). These results raise important considerations about the current structure and content of medical education, which may inadequately emphasize emerging infectious diseases and practical outbreak management in physician training curricula. This also reflects the potential disconnect between academic knowledge and applied clinical skills, suggesting the need for interdisciplinary, collaborative training models that include doctors, nurses, and paramedics in joint simulation environments. Despite its strengths in exploring multidimensional KAP variables and applying rigorous statistical methods, this study is not without limitations. The sample size was relatively small and unevenly distributed across professional groups, particularly with only two

paramedics, which limits the generalizability and statistical robustness of inter-group comparisons. The reliance on a cross-sectional design prevents causal inferences and introduces potential recall and social desirability biases due to the self-reported nature of the data. Furthermore, the absence of qualitative data restricts deeper insights into the contextual and behavioral factors influencing healthcare workers' responses. The study was confined to urban hospitals in Lahore, which may not reflect the preparedness levels of healthcare professionals in rural or peri-urban settings, where access to training and resources is typically more limited.

Nevertheless, the study offers valuable implications for public health policy and clinical practice. It identifies critical knowledge gaps, attitude deficiencies, and practice inconsistencies, particularly among doctors and female healthcare professionals, who may benefit from targeted interventions. The strong correlation among KAP domains highlights the importance of integrated training programs that not only disseminate knowledge but also shape attitudes and reinforce appropriate practices. Structured professional development workshops, routine infection control drills, and the incorporation of mpox-specific modules into continuing medical education could prove instrumental in improving overall outbreak preparedness.

Future research should employ larger, more diverse samples and consider longitudinal designs to assess changes in KAP over time, particularly before and after educational interventions. Qualitative methodologies could further elucidate the underlying beliefs, fears, and motivations influencing healthcare workers' behaviors. Additionally, studies comparing public and private healthcare institutions or assessing the role of media and digital information sources in shaping disease awareness would enrich the current understanding and inform context-specific strategies. As monkeypox continues to pose a global health threat, the preparedness of healthcare workers must remain a cornerstone of control strategies, and evidence-driven policy formulation should prioritize the equitable dissemination of knowledge and skills across all levels of the healthcare system.

CONCLUSION

This study highlights significant gaps in the knowledge, attitudes, and practices regarding monkeypox among healthcare professionals in Lahore, with paramedical staff demonstrating the highest preparedness, followed by nurses and doctors. The findings underscore the critical need for role-specific educational interventions and continuous professional development to enhance outbreak readiness, particularly among doctors and female healthcare workers.

The strong interdependence among knowledge, attitude, and practice further emphasizes the necessity of integrated training approaches to improve disease awareness and clinical response. These insights hold important clinical implications for strengthening infection control practices and public health preparedness, while also guiding future research to develop tailored, evidence-based strategies that can bridge competency gaps and improve healthcare outcomes in the context of emerging infectious diseases like monkeypox.

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