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Exploration of awareness of Monkeypox virus (MPXV) among healthcare professionals; a qualitative study

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ABSTRACT

The rapid spread of disease, whether epidemic or endemic, poses a significant thread of escalating into a pandemic, with devastating consequences for global health and humanity. This study explores the awareness of the monkeypox virus (MPXV) among healthcare professionals, their perceptions and concerns, associated with their day-to-day experience with the management of infectious diseases. A qualitative semi-structured study using face-to-face interviews was conducted in healthcare settings. Eligible participants included qualified doctors, pharmacists, and nurses. The interviews explored healthcare professionals' knowledge gaps regarding monkeypox virus in various healthcare settings, including hospitals and retail pharmacies. Results were analyzed through the Braun and Clarke's thematic analysis method. Participants were provided informed consents who willingly shared their perspectives during the interview related to the management and handling of the patients of Monkeypox virus. Common to all participants was their concern about the alarming lack of awareness surrounding monkeypox virus among healthcare professionals and the general population. Participants proposed a multi-faceted approach to prevent monkeypox transmission, including enhanced border screening, hospital-based isolation facilities, and focused monitoring of immunocompromised individuals to minimize the risk of infection. This qualitative study underscores the significance of educating healthcare professionals about Monkeypox virus,

ultimately facilitating better disease outcomes and more effective response to outbreaks. Despite progress, a significant concern persists, authorities and officials must commit to ongoing awareness initiatives, ensuring that frontline personnel possess the knowledge required to respond effectively.

Keywords: Awareness campaigns, Monkeypox virus, smallpox, emerging infectious diseases,

Introduction:

The emergence of Monkeypox virus (MPXV) in humans has gained attention worldwide prompting the World Health Organization (WHO) to declare it as a global health emergency. The largest documented outbreak of MPXV was reported in Nigeria in 2017 where 500 suspected cases with a fatality rate of 6% was reported.[1]

The history dates back to 1959, when the first-ever monkeypox virus was discovered in monkeys at Copenhagen Research Institute, Denmark.[2] Later on, it led to the discovery of the first human pathogen in the 20th century in a 9-month-old infant in Basankusu Hospital in the Democratic Republic of Congo in 1970.[3] In the 21st century (2003), the first humanpathogen was found in North America although the orthopoxviral gene is endemic to Central Africa.[4]

The double stranded DNA MPVX belongs to the orthopox virus genus of the Poxviridae family.[5] Based on transmission, two main clades of human monkeypox virus (MPXV) have been discovered;the West African Strain (WA) and the Congo Basin Strain (CB) (responsible for human-human transmission) (Ellen). WA type is considered less transmissible than CB.[6]

The zoonotic virus presents itself with an unusual pattern of symptoms including few lesions and less fever. Although vaccination against smallpox has beenconsidered protective against the Monkeypox virus, only the MVA-BN vaccine (2019) and Tecovirimat (TPOXX or ST-246) (2022) are approved against the Monkeypox virus.[7] WHO has published a list of recommendations related to case investigation, contact tracing, risk communication, community engagement, large gatherings, clinical management and infection prevention, and control in healthcare settings for surveillance and reporting of the Monkeypox virus.[8] It is believed that the zoonotic virus takes 2 to 4 weeks to run its course but it may lead tocertain other fatal complications such as pneumonia and encephalitis.

Concerns about the potential spread of Monkeypox virus in Pakistan emerged after several cases were reported in adult males in Islamabad, the capital city, back in 2022.[9] The Ministry of National Health Services (NHS)and National Command and Operation Centre (NCOC) alerted the provincial governments after WHO declared the Monkeypox virus as a global health emergency. Although there is limited evidence on the spread of the monkeypox

virus**,** the emergence of **a** few cases in Islamabad [10] followed by the reporting of few cases in Karachi and Lahore paved the way for the need to raise awareness among healthcare professionals as well general public to prepare themselves for any major outbreak.[11] Interestingly a knowledge gap exists in Pakistan regarding healthcare professional's' awareness and perceptions of the Monkeypox virus, as no studies have investigated this area.. This research therefore aims to explore theknowledge gaps about MPXV symptoms, preventive measures, susceptibility, and awareness of healthcare workers about the probability index of the associated disease in Pakistan.

Objectives of the study:

1. To explore the knowledge of health care professionals encompassing practitioners including medical doctors, hospital and retail pharmacists and nurses about MPXV in reference to its risk factors, diagnosis and spread.
2. To explore the perception of healthcare professionals about the presentation strategies against the transmission of monkeypox virus.
3. To identify facilitators and barriers to effective education and preparedness related to monkeypox virus.

Methods:

This study used a qualitative approach to gain an in-depth insight into the knowledge of healthcare professionals about monkeypox virus. Given the exploratory nature of qualitative study, this study was designed by the researchers to gain a holistic and rich understanding of the participants' knowledge, perceptions and awareness about the disease. The study was ethically approved by the university research and ethics support committee (RESC-018-2022).

A semi-structured interview guide comprising of 18 open-ended questions was developed by the research team and was used to conduct face-to-face or telephonic interviews with a convenient sample of participants. Participants were recruited in the study through the circulation of invitations and snow ball sampling technique, who recruited these personnel based on the maximum visits of patients at these places. Participants were recruited after getting approval from the research ethics and support committee (RESC) of university,starting from

December 02, 2022, from two different cities and venues including hospitals, and retail pharmacies, and the recruitment ended with the completion of data collection on July 14, 2023. The studies involving human participants were reviewed and approved by Research Ethics and Support Committee of university (RESC). Written informed consent to participate in this study was provided by the [patient/participants' OR patient/participants' legal guardian/next of kin]. Participants who consented to participate in the study were interviewed through an in depth semi structured face to face interviews lasting for 25-30 minutes almost and were audio- recorded. Participants were recruited in the study only after they provided an informed written consent through which they were informed about the purpose of study, anonymity of the data and their free will to withdraw at any time from the research work. The recruited participants included healthcare professionals such as doctors, nurses and pharmacists across Pakistan in various health settings including hospitals and community pharmacies with a minimum of more than two years of practice as demonstrated in Table I above. No financial incentive was offered to the participants. Interviews were conducted during May to July 2023. Data saturation as defined by authors was achieved with 19 interviews at the point where no new codes were developed from analysis of ensuing interviews. The researchers felt that they had gathered a comprehensive understanding of the phenomenon being studied with no emergence of new themes or codes.

The interviews were audio-recorded and were conducted in English language that lasted around 25-30 minutes. The audio recordings were transcribed verbatim using NVivo software. Braun and Clarke's inductive method of thematic analysis was conducted to analyze the qualitative data.[12] To begin with, the data was initially familiarized through a thorough reading and rereading of the entire data. After familiarizing with the data set, initial codes were generated from the data by using axial coding methodology by two authors (RA and EC). Any variations in the coding process were resolved through discussion. After the generation of initial codes, codes were then assigned to potential themes. Themes were then reviewed and refined through iterative process to ensure they were appropriate in relation to the codes. Finally, generated themes were checked again by RA and EC to ensure rigor in the qualitative analysis. Following thick description methodology, the detailed description and participant quotes were provided in the final reporting to enhance transparency and credibility.

Key themes and summary of findings:

A total of nineteen participants practicing in a diverse range of settings such as multiple hospitalwards, retail chain of pharmacy, and hospital pharmacy were included in the current study. Maleparticipants were four while females were fifteen of various age groups.

Thematic Analysis:

We have identified three major themes and almost 10 sub themes from the data presented in Table II above. As obvious from the table, some key points need to be addressed regarding the spread of the Monkeypox virus. The general public receives insufficient information and education about the MPXV, making them unaware of its existence and potential transmission.

Awareness about MPXV:

Participants were of the view that in general there were no such campaign workshops or seminars except at a few places that could provide them with the risk factors or symptoms or any other key points regarding the spread of a contagious virus that may have gained attention in certain parts of the world. As assessed by the comment of a participant,

"No, no such thing ever I came across".

Whether a hospital, retail setup or any other health care unit, the major concern of the participants was either no awareness session or maybe one to two workshops or seminars regarding awareness campaigns about the spread of the monkeypox virus. Most of the participants gave their valuable input about the information of survivors of the viral attack which they acquired by word of mouth rather than any awareness campaign.

Nearly all participants demonstrated an understanding that the monkeypox virus is zoonotic, transmitting from animals to humans, and also capable of human-to-human transmission, as evident from their responses,

"I have not seen any patient personally. I have listened to about 2 patients who are travelers. It's a zoonotic type of disease that started from monkeys, but it spreads from humans to humans as well".

Risk Factors for the disease:

The partipants' responses identified key risk factors facilitating the spread of monkeypox, highlighting the prominent role of cultural factors like Pakistani greeting customs and travel patterns in potentially accelerating the virus's transmission.

"*It can spread through travelers so if we control or screen at the level of traveling areas, would be better".*

Given that the first two monkeypox cases in Pakistan involved travelers deported from Saudi Arabia, it is imperative to establish a rigorous and systematic screening process at international airports to identify and isolate infected or suspected individuals promptly

"The history of traveling was there in these 2 cases, so people travelling from UK, USA or Africa to Pakistan, so potential shows to spread".

The typical culture and norm of Pakistan to greet and observe hospitality may play a major role in the spread of the contagious virus. Participants counted the said norms to be a major concernas a risk factor for the spread of the disease.

"Yes, 1-2 patients have been reported. Actually, in our culture, we need to hug each other, and people have multiple parties and get-togethers. Although we have no direct contact with zoonoticbut our cultural background compromises our hygienic conditions"

Several participants identified Pakistan's fragile healthcare system, including the suboptimal state of clinics and hospitals, as a significant vulnerability in controlling the spread of monkeypox. Financial constraints, inadequate manpower, and inefficiencies in both public and private healthcare setups exacerbate the challenge.

"Yes, it can be due to hygienic conditions, it can spread from person to person, and travelers can cause. So, we should be careful".

Keeping pets and vulnerable ages as well as the presence of co-morbidities, all were considered the most optimum conditions to get the monkeypox viral attack. The disease is zoonotic so the presence of pets may endanger the situation as stated by many participants:

"Yes, if they are exposed to the virus because the life cycle of MPXV is long, they basically reside in zoonotic animals especially the rodents. They transmit the disease by their feces so ifany individual is exposed to the feces of the affected animals, then they can get the disease".

"Yes, I think it can spread by animals, hygiene, and homosexuality".

"The extreme old and extremely young are more susceptible"

"Yes, co-morbidities increase chance of lethal disease".

"*Yes, if a person has these diseases, then their immunity system must be weak, so they may besusceptible to getting more infection than other population*".

Diagnosis/Prevention:

Participants considered the only method available as per the guidelines of WHO was PCR (Polymerase chain reaction) which was performed by taking material from a skin lesion andsending it to a laboratory for identification and diagnosis.

"I think we can take the wet specimen through the lesions for their antibodies and PCR so that it can be diagnosed and also from the feces and blood as well".

"PCR available for MPXV, from skin lesions. We take sample from skin and lesions of the patient, we send it to laboratory, they perform PCR and it can be diagnosed".

"*Yes, the WHO has very specific guidelines regarding how we are going to take sample, how we are going to carry out PCR in that and how to maintain the chain during transport. So, I think they are in line with the guidelines of WHO".*

Participants were of the view to apply strict restrictions on the travelers by screening them at the airports or arrival venues while maintaining a proper distance/ isolation from such travelers to avoid the spread of disease. They were of the view that patients must be quarantined for a specific period of time and one must observe precautionary measures while assessing their healthor serving them. This may include the use of gloves, mask etc.

One participant identified the use of vaccine in certain countries as a trial to combat the hazardous effects of the viral disease, but the vaccine is not available in our homeland so it was recommended by him to observe strict prohibition of social activities of any suspected individual.

"Prevention I guess, infected people should be isolated for the duration of the infected period. Infected lesions should be covered. Getting MPX vaccine can help prevent MPX. But I don't think it's available in Pakistan".

"*Observe hygienic measures. Keep your distance from travelers*".

Discussion:

This pioneering qualitative study examines the awareness of monkeypox virus among Pakistani healthcare professionals, including doctors, pharmacists and nurses. The participants who were recruited from local community healthcare settings, demonstrated a general understanding of the disease's name and severity. However, their knowledge was primarily acquired through informal channels, such as the word of mouth and news reports of deported individuals with monkeypox. Notably all participants expressed concern and emphasized the importance of raising awareness about the disease, its outcomes, prevention strategies and related information through various platforms

In Islamabad, Pakistan's capital city, several individuals were identified as potential monkeypox cases and underwent testing, which unfortunately confirmed the presence of disease. These individuals had recently travelled from Kingdom of Saudi Arabia to Pakistan by air. To prevent the spread of the infection, they were isolated and quarantined for two months. Their positive test results triggered a surge in activity at Pakistani healthcare centers and healthcare ministries. In response, seminars and awareness campaigns were organized in various parts of the country to educate the public about monkeypox, its symptoms and prevention strategies.

WHO in collaboration with certain other organizations such as FAO (Food and Agriculture Organization of United Nations), OIE (World Animal Health Organization), and USAID (UnitedStates Agency for International Development), etc. encouraged one health approach through a robust coordination mechanism in 2016 to fight the public health stress related to zoonotic diseases.[13,14] Refresher training and additional guidance for monkeypox virus surveillance may help to improve the knowledge of the disease in healthcare workers who may

have to deal with the patients in wards and clinics regularly. [15,16] It was depicted during the interviews thatmost of the participants dealing in the hospital had little or no prior knowledge about the clinical manifestation of the monkeypox disease or the management of the disease.

The associated factors that could raise the risk of the virus gaining a foothold in human communities were highlighted by the participants as narrated previously by Mary**.** These included climate change, human-mediated habitat modification, human encounters with virus-infected animals, etc.

Participants were inquired if their little exposure to the monkeypox virus awareness could narrateany similarity between the monkeypox virus and the smallpox virus.[17] Most of the participants stated that lymphadenopathy seemed to be the only difference between the two which was dominant in ninty percent of cases of monkeypox virus disease.[18,19] They highlighted the similarity ratio of monkeypox and smallpox virus stressing the need to enforce smallpox vaccination in the farthest and widest places on earth to put a halt to any such disease which could appear as an alternate of smallpox.[20] According to a health blog of Shifa International Hospital, Islamabad, the disease is considered infectious and may spread through contact with animals, diseased persons, and materials if any used by the infected person. Since the virus enters the body through the respiratory tract, lesions, broken skin, and mucous membranes of the eyes, nose, or mouth so animal to animal-to-human transmission may occur by bite or scratch, indirect contact with lesion material, or direct contact with body fluids or lesion material. Human-to-human transmission may occur through large respiratory droplets. The Shifa admin has informed through their blog about the symptoms and signs of the virus including fever, chills, lesions, headache, muscle aches, and exhaustion.

Awareness of the monkeypox virus among healthcare professionals vary varies globally, influenced by factors such as prior experience with outbreaks, availability of resources, and institutional support. Comparative studies across different countries reveal these disparities. Congo has initiated a vaccination drive to combat the Monkeypox outbreak, focusing on adults at risk and frontline workers. This move underscores the recognition of the virus's impact and the need for healthcare professionals to be well-informed and equipped to handle the situation effectively. The DRC has faced significant challenges with Monkeypox, reporting over 15,600 confirmed cases and more than 500 deaths in a single year. Healthcare professionals in the region

have been on high alert, dealing with a rapidly mutating strain (clade Ib) that has complicated response efforts. The healthcare system's capacity to manage the outbreak has been strained, highlighting the need for enhanced awareness and resources among medical staff.[21] In response to the Monkeypox outbreak, Spain has implemented enhanced measures, including health screenings and close monitoring of arrivals at major airports. Healthcare professionals have been urged to be proactive in identifying symptoms and managing cases, reflecting an increased awareness and preparedness within the medical community.[22] In response to the Monkeypox outbreak, the Indian government directed the National Centre for Disease Control (NCDC) and the Indian Council of Medical Research (ICMR) to monitor the situation closely. Healthcare professionals were instructed to remain vigilant, with guidelines issued to isolate and test any sick passengers with a travel history to affected countries.[23]

This study provides a preliminary step in understanding the necessities and steps required by the government to promote awareness campaigns and general know-how in the common man as wellas in healthcare professionals who are dealing with patients on a day-to-day basis. Some participants praised the occasional seminars, workshops and presentations held at their departmental levels, which focused on the symptoms, preventive measures and management of monkeypox. They stressed the importance of continuing such initiatives to effectively manage symptoms if they appear in patients, to distinguish monkeypox from other similar infectious diseases, to educate individuals about risk factors, such as, pet ownership, climatic conditions or immunocompromised states. These sessions may help reduce the susceptibility to monkeypox and promote awareness among healthcare professionals.

It’s the need of time to strengthen the monkeypox surveillance in the region.[24] Hatami et al emphasized the need to screen monkeypox virus for varicella zoster virus or human immunodeficiency virus coinfection to take necessary measures if a possible correlation is there between these infections.[25]

There are potential reasons that may explain differences in Monkeypox virus awareness across various healthcare settings. Continuous professional education or difference in formal trainings regarding emerging infectious diseases among hospitals, primary care, specialized units, or rural versus urban settings. Health care settings that previously handled infectious

disease outbreaks as (E-Bola, COVID-19) may have heightened alertness, experience, and consequently greater awareness of Monkeypox. Organizational culture and individual attitudes towards emerging infectious diseases, perceived risk, or vaccine acceptance may influence willingness to engage in training and proactive learning, thus affecting overall awareness.

Since our homeland has certain limitations in terms of finance, infrastructure, and educated and well-equipped teams to fight the situation we must emphasize the importance of timely preparation against any havoc. Pakistan's shared border with Iran and China, both countries with confirmed monkeypox cases, increase the risk of transmission through travelers. This highlights the need for educating healthcare workers and the public on controlling the spread of the disease. The World Health Organization (WHO) emphasizes the importance of immediate action, recommending the implementation of public health measures such as isolation and quarantine in the event of a surge in patient numbers. By taking proactive steps, Pakistan can mitigate the risk of monkeypox transmission and protect its citizens.

Conclusions:

The qualitative study involving representatives of the healthcare community signifies the importance of awareness of the Monkeypox virus among healthcare professionals. The associated risks and challenges were highlighted raising the need to launch awareness campaigns and sessions to provide ubiquitous knowledge to all those who have to play their part at the front desk. The findings of this study suggest a way forward for regulators of healthcare communities related to the safety and health of citizens as well as academic institutions aspiring to nurture and instill a healthy carefree environment for our people. There should be mandatory continuous medical education programs focusing on MPXV for all healthcare professionals emphasizing on disease transmission pathways, infection prevention and control measures, management protocols and appropriate use of personal protective equipment (PPE). Evidence-based national or institutional guidelines and protocols clearly outlining management approaches and infection control measures must be developed and disseminated to increase the confidence of healthcare workers in handling MPXV cases. Surveillance and reporting system must be strengthened by implementing mandatory

reporting of confirmed and suspected MPXV cases by healthcare facilities. General awareness and vigilance must be enhanced by launching awareness campaigns targeted at healthcare professionals. It may be achieved by utilizing digital platforms, educational apps, websites and public health messaging.

Table I: Demographic representation of the participants:

SN	Gender	Job Title	Length of practice
1	Male	In charge Medicine department	11 years
2	Female	Senior Registrar General Health department	14 years
3	Female	Senior Registrar Pediatric department	12 years
4	Female	Senior Registrar Dermatology department	13 years
5	Male	Resident 3rd year Emergency medicine department	6 years
6	Female	Resident 3rd year Intensive care medicine department	6 years
7	Male	Post-graduate Resident, Pediatric department	5 years
8	Female	Resident of 2nd year, Medicine department	5 years
9	Female	Post graduate trainee, Pediatric department	2.5 years
10	Female	Resident 4th year, Oncology department	9 years
11	Female	Postgraduate Resident, Pediatric department	9 years
12	Female	Postgraduate Resident, General medicine department	5 years
13	Female	PGI- Resident, Pediatric department	2 years
14	Female	PG- Resident, Medicine department	6 years
15	Female	PG- Resident, 2nd year, Pediatric department	3 years

16	Male	Retail Pharmacist	8 years
17	Female	Hospital Pharmacist	7 years
18	Female	Hospital Nurse	7 years
19	Female	Hospital Nurse	6 years

Table II: Key themes and subthemes:

SN.	Themes	Sub-themes	Supporting Comments
1	Awareness about MPXV	Lack of training Merely any workshop Information by word of mouth	Unfortunately, no. Yes, 1-2 workshops have been conducted in our department. I have not seen any patients personally. I have listened to about 2 patients who are travelers. It's a zoonotic type of disease that started from monkeys, but it spreads from humans to humans as well.

2	Risk factors for the disease	Traveling	Yes, particularly there is a role of travelers as the 2 cases we have encountered in Pakistan, they were both deported from Saudi Arabia and they were the first 2 cases reported in Pakistan so obviously as their disease is endemic in USA and UK, currently and in Africa too. So, there is a role of traveling from there back to Pakistan.
		Customs of greeting	I don't have exact statistics regarding this but yes it can be an endemic in Pakistan. Pakistan has a weak health system, financial limitations especially in terms of infectious diseases control, also we have a massive number of flights coming from the region where MPXV is thriving. So, the travelers may be a cause of spreading the virus
		Age/pets	Yes, if they are exposed to virus because the life cycle of MPXV is long, they basically reside in zoonotic animals especially the rodents. They transmit the disease by their feces, so if any individual exposed to the feces from the infected animals, then they can get the disease.
		Co-morbidities present	Yes, immunocompromised are more prone to develop
3	Diagnosis/Prevention	PCR of skin lesion	Currently, the method that is available for diagnosis is that we have to take the PCR, we have to identify that virus via PCR from the skin lesions, skin fluids, if there is any vesicular region, then we are going to clean that for PCR, and that is going to be helpful. Monoclonal antibodies or the antibodies against the virus are in progress, might be in the future they would be available for diagnosis.
		Isolation/Quarantine	This disease can spread by means of secretions, and by direct contact with the lesion, so we should isolate the patient and we should avoid direct contact with the patient and secretions.
		Hygiene/Mask usage	We should use mask and gloves while going near the patient.
		Similarity with small pox	Personal hygiene, screening of travelers and airports. Isolate those who are already patients. Lymphadenopathy is only specific for MPXV however skin lesions, flu fever and other symptoms are quite similar in both small pox virus and monkeypox virus

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Availability of data and materials:

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

Ethics approval and consent to participate:

The study was approved by the Office of Research and Innovation Centre (ORIC). All procedures were performed in compliance with relevant laws and institutional guidelines and have been approved by the appropriate institutional committee(s), i. e. Research Ethics Committee of UMT, dated December 02, 2022 (Reference no. RESC-018-2022)

Consent for publication:

Informed consent was obtained from each participant before they participated in the research for their quotes to be used for publication.

Competing interests:

The authors declare that they have no competing interests.

References:

1. Durski KN, McCollum AM, Nakazawa Y, et al. (2018). Emergence of Monkeypox- West and Central Africa, 1970-2017. *MMWR Morb Mortal Wkly* Rep.**67**,306-310. Doi: http://dx.doi.org/10.15585/mmwr.mm6710a5
2. Alakunle E, Moens U, Nchinda G, Okeke MI (2020). Monkeypox Virus in Nigeria: InfectionBiology, Epidemiology, and Evolution. *Viruses***12**(11):1257.
3. Beer EM, Rao VB (2019) A systematic review of the epidemiology of human monkeypox outbreaks and implications for outbreak strategy. *PLOS Negl Trop Dis.* **13**(10)
4. Fleischauer AT, Kile JC, Davidson M, Fischer M, Karem KL, Teclaw R, et al. (2005). Evaluation of human-to-human transmission of monkeypox from infected patients to health care workers. *Clin Infect Dis* **40**(5):689-94.
5. Reynolds MG,Davidson WB, Curns AT, Conover CS, Huhn G, Davis JP, et al.(2007). Spectrum of infection and risk factors for Human monkeypox, United States, 2003. *Emerg. Infect. Dis*.**13**, 1332-9.
6. Bunge EM, Hoet B, Chen L, Lienert F, Weidenthaler H, Baer LR, et al. (2022). The changing epidemiology of human monkeypox-A potential threat? A systematic review. *PLoS Negl Trop Dis*. 16(2)
7. Brown K, Leggat PA. (2016). Human Monkeypox: Current State of Knowledge and Implicationsfor the Future. *Trop Med Infect Dis*.**1**(1):8. Doi:10.3390/tropicalmed1010008. PMID: 30270859; PMCID: PMC6082047.
8. World Health Organization. Mpox (Monkeypox) Outbreak Update 2022. Available online: **https://www.who.int/emergencies/situations/monkeypox-oubreak-2022** (accessed on 26 April 2023).
9. Najeeb H, Huda Z. Monkeypox virus: A spreading threat for Pakistan? Ann Med Surg (Lond). (2022) Jun 11;79:103977. doi: 10.1016/j.amsu.2022.103977. PMID: 35860147; PMCID: PMC9289342.
10. Javed, Saad et al.(2024). MPox threat: Pakistan must act now The Lancet, Volume 404, Issue 10457, 1012 - 1013
11. Ata I, Riaz N, Mallhi TH. (2023). Monkeypox: A rising health concern in Pakistan and wake-upcall for the government. *Disaster Med Public Health Prep.* **17**, 1–2.
12. Mansoor H, Abbas S, Rehan ST, Hasan MM. (2022). Monkeypox virus: A future scourge to thePakistani Healthcare system. *Ann Med Surg (Lond).* 79:103978.

doi:10.1016/j.amsu.2022.103978.

13. Najeeb H, Huda Z (2022). Monkeypox virus: A spreading threat for Pakistan? *Ann Med Surg (Lond).* **79**:103977. doi: 10.1016/j.amsu.2022.103977.
14. Rao AK, Schulte J, Chen TH, Hughes CM, Davidson W, Neff JM, et al. (2022). Monkeypox Response Team. Monkeypox in a Traveler Returning from Nigeria - Dallas, Texas. *MMWR Morb Mortal Wkly Rep***.71**(14):509-516. doi: 10.15585/mmwr.mm7114a1.
15. World Health Organization. (2017). Report on the One Health Technical and Ministerial Meeting to Address Zoonotic Diseases and Related Public Health Threats. https://www.afro.who.int/sites/default/files/2017-08/Report.
16. Doshi RH, Guagliardo SAJ, Doty JB, Babeaux AD, Matheny A, Burgado J, et al. (2019). Epidemiologic and Ecologic Investigations of Monkeypox, Likouala Department, Republic of the Congo. *Emerg Infect Dis.* **25**, 281-289.
17. Reynolds MG, Doty JB, McCollum AM,Olson VA ,Nakazawa Y. (2019). Monkeypox re-emergence in Africa: a call toexpand the concept and practice of One Health, Expert *Review of Anti-infective Therapy*, **17**, 129-139.
18. Shoaib HM. (2023). Monkeypox as a potential emerging pandemic: a discussion on future risks and preparedness in Saudi Arabia. *Front. Public Health*.**11**: 1254545.
19. Puca E, Shapo L. (2022). For how long can monkeypox reach the Balkan region? *Travel. Med. Infect. Dis*. **49**:102382.
20. Shafaati M, Zandi M, Choudhary OP, (2022). Monkeypox virus crosstalk with HIV; where do we stand now?,*Int J Surgery*. **105**,106897.
21. Izera S, Ali EH, Unkwiye H, Mugabakazi AB, Uwase S, Benimana D, et al. (2024). Monkeypox Outbreak in the Democratic Republic of Congo, A Comprehensive Review of Clinical Outcomes, Public Health Implication, and Security Measures. *Immunity, Inflammation and Disease.*
22. https://www.travelandtourworld.com/news/article/spain-on-high-alert-as-major-airports-enforce-tighter-controls-to-prevent-monkey-pox-spread-travel-industry-may-cripple-like-covid-19-times/

23. William A, Madan M. Monkeypox scenario in India: a review study. Med Rev (2021). 2023 May 26;3(3):270-276. doi: 10.1515/mr-2023-0004. PMID: 37789959; PMCID: PMC10542878

24. Zandi M, Shafaati M, Hosseini F. (2023). Mechanisms of immune evasion of monkeypox virus. *Front. Microbiol.* **14**:1106247.

25. Hatami H, Jamshidi P, Arbabi M, Safavi-Naini SAA, Farokh P, Izadi-Jorshari G, et al. (2023). Demographic, Epidemiologic, and Clinical Characteristics of Human Monkeypox Disease Pre- and Post-2022 Outbreaks: A Systematic Review and Meta-Analysis. *Biomedicines.* **11**(3):957.