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Original Article

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Educational Intervention on the Knowledge of Monkeypox Virus among Undergraduate Students in Rawalpindi; a Single Institution Quasi-Experimental Study

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ABSTRACT

BACKGROUND & OBJECTIVES: The multi-country outbreak of Monkeypox (Mpox) in several regions has threatened the world, which is still confronted by the COVID-19 pandem-ic. To assess the effect of educational intervention on knowledge of epidemiology, preven-tion, and control of Monkeypox in undergraduate students.

METHODOLOGY: The study is a single-institution educational intervention conducted from 1st July to 30th December 2022 among students enrolled in the Bachelor's Program at the National University of Medical Sciences. The pre-post educational intervention without control groups using Quasi-experimental, non-randomized design was conducted among the study population through non-probability consecutive sampling. McNemar's paired difference of proportions test was used to determine association. The p-value of ≤0.05 was considered statistically significant.

RESULTS: The total sample of 79 students, 53 (67%) were females, with a mean age of 20.5±1.25 years. The knowledge regarding the epidemiology of the Mpox virus was relatively low in the pre-test, where only 10 (12.7%) correctly identified this viral infection circulating in wildlife in Central and West Africa, also only 11(13.6%) respondents had knowledge of the first human identification of Mpox in the 1970s in the Democratic Republic of the Congo. In Comparison of rightly chosen responses to correct and incorrect options regarding infection prevention and precautions for Mpox, only 24(30.4%) respondents correctly identified the use of personal protective equipment (PPE) when caring for patients as significant, with 73(92.4%) agreeing to it in the post-test (χ^2=47.02, p≤0.001). Most respondents in the pre-test correctly identified the isolation of patients with Mpox (χ^2=5.143, p≤ 0.016).

CONCLUSION: The intervention entailing education showed improvement in knowledge in terms of epidemiology, ecology, prevention, and control of Mpox among undergraduate stu-dents.

KEYWORDS: Epidemiology, Monkey Pox, One Health, Prevention.

INTRODUCTION

The Human Mpox (monkeypox) virus became a public health concern with an outbreak in May-June 2022, distressing populations already confronting the COVID-19 pandemic [1]. The World Health Organization (WHO) in July 2022 announced the human Mpox virus as a public health emergency of international concern [2]. WHO emphasized using the term "Mpox" as a synonym for monkeypox in November 2022 [2]. More than 14500 cases were reported across all WHO regions in 72 countries, mainly in the European region between 1st January 2022, and 20th July 2022; the transmission was especially without links to disease-endemic countries[3]. Pakistan reported its first laboratory-confirmed cases of Mpox recently on April 17, 2023 in the city of Rawalpindi [4].

Mpox is a zoonotic communicable disease caused by a double-stranded DNA virus of the genus Orth-poxviruses of the Poxviridae family, including vaccinia (cowpox) and variola (smallpox) viruses [1,3].

The first isolation of the monkeypox virus was from monkeys; however, the natural hosts include tree squirrels, rope squirrels, rodents-dormice, and Gambian pouched rats [3-5].

The transmission of monkeypox to humans is from animals,

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such as rodents and primates (animals-to-humans), or infected individuals to other humans [3-5]. The virus is transmitted through; hunting or consuming disease-ridden animals; large aerosol droplets; direct contact with infectious sores, scabs, body fluids, or shared contaminated bedding/ clothing [5-6].

The current outbreak traced cases of sexual transmission, especially in individuals who identified as gay and bisexual men who had sex with men (MSM). In 1958 the first discovery of the Mpox virus in research monkeys in a Danish laboratory led to its name. The first human case of Mpox was diagnosed in 1970 in Zaire, now the Democratic Republic of the Congo (DRC); the concentration remained in central and West African regions, and cases outside Africa have emerged in recent years with an ambiguous extent and impact [5-6].

The incubation period of Mpox is 5–21 days, with clinical manifestations similar but less severe than smallpox. Patients suffering from Mpox usually go through a prodrome after exposure, ranging from 4 to 17 days, which often includes headache, fever, lymphadenopathy, especially in the cervical and maxillary region, back pain, and myalgia [7]. A maculopapular rash with centrifugal distribution follows the prodrome; the well-circumscribed lesions are often umbilicate (or become confluent), progressing over time to scabs [7-8]. The typical centrifugal rash can also be distributed, as reported recently, with lesions mainly in the genital and perianal region with no prodromal symptoms like fever. The atypical appearance makes the Mpox infection resemble varicella zoster or syphilis (sexually transmitted infections, STIs). Complications following Mpox include encephalitis, pneumonitis, keratitis, and other bacterial infections. However, mortality is low, ranging from 1% to 10% [8].

Prevention and timely management of Mpox are important for healthcare workers and the general population, as awareness can help them prevent this infection. A public sensitization campaign is needed to promote appropriate prevention and the stigma attached to the community [9-11]. The Mpox Virus could be eliminated by educating the public, risk assessment, and implementing the One Health approach [12]. The research aimed to evaluate whether an educational intervention on epidemiology, ecology, prevention, and control of the Mpox virus can enhance the knowledge and awareness regarding Mpox in undergraduate students.

Pakistan faces many challenges in combating the complex dynamics of Mpox transmission. Proactive measures, health literacy, and promotion to educate the masses to take measures to prevent the outbreak are imminent. Therefore, it is crucial that relevant health authorities in Pakistan work towards educating the public on effective precautionary measures to keep them safe from Mpox infection.

METHODOLOGY

The study is a single institution educational intervention using Quasi-experimental, non-randomized design conducted among the bachelor's students with the assessment done before and after the educational intervention without control groups (pre-post intervention study). The study was conducted at the National University of Medical Sciences after taking permission from Institutional Ethical Review Committee (06/ORIC/2022-04).

The study was carried out from 1st July to 30th December 2022 among students enrolled in the bachelor's Program of Public Health and Social Sciences (students enrolled in globalization and public health courses) included by convenience sampling. Students were eligible if they were enrolled in the NUMS bachelor's Program of Public Health and enrolled in globalization & Health and public health courses from other programs as well. The sample size was calculated using the Rao sample size calculator with a 5% margin of error, 95% Confidence Interval, a response rate of 50%, and a population size of 113. The sample size came out to be 88, but only a total of 82 students from the first, second, and third years agreed to participate in the study with verbal and written consent, and 79 in total completed the post-test and were available for post-intervention response.

All the study participants were administered a pre-tested, semi-structured questionnaire. The idea and basic purpose of the questionnaire were explained to each of the respondents. Proper written and verbal instructions were given to the respondents for proper filling of the questionnaire. In addition to participants' socio-demographic information, the questionnaire assessed the knowledge about Mpox, such as epidemiological aspects, mode of transmission, clinical signs, prevention, and control of Mpox transmission.

The Mpox questionnaire was designed by doing a literature review; items were designed for this study [13-14]. The questionnaire was piloted on fourteen test respondents on two different occasions to assess test–retest reliability who completed the questionnaire and were not part of the final analysis. The questionnaire initially included 57 items, but 25 were discarded, with no duplication. Feedback from the faculty of Public Health was taken to refine the questionnaire. The items included in the questionnaire when the test-retest reliability coefficient was >0.8 and was considered "consistent".

Pretesting assessment on knowledge of Mpox was done using the self-administered questionnaire before educational intervention. The educational intervention was given for a duration of three hours each on three separate occasions. Each intervention was carried out in two phases: a lecture with audio-visual aid for 2 hours on topics covering Mpox epidemiology and one health ecology along with clinical features followed by prevention and control, and lastly, a 25 mins short film to re-emphasize the same aspects. Half an hour was given for a question-answer session and discussion among the cohort. After one and a half months, the same research tool (questionnaire) was administered to collect post-test data.

Data were stored and analysed using SPSS version 28. Frequency and percentages were recorded for nominal variables. McNemar's test was applied to make statistical

decisions (using the Chi-Square test statistic) to determine if a statistically significant change occurred after the intervention.

RESULTS

A total of 79 students who completed questionnaires from both the pre-and post-intervention sessions were included in the study. Fifty-three (67%) were females in the total of 79 students, with a mean age of 20.5±1.25 years, a minimum age recorded as 18, and a maximum age was 23 years of age. Participants' characteristics are tabulated (Table-I). The study participants were aware of Mpox and its transmission to human beings. The highest reporting source of information was mentioned to be social media by more than 85% in the pre-test (this question was not asked in the post-test). The respondents were questioned about the fatality of monkeypox, and it was identified by only 2(3%) respondents on the pre-test and 70 (88.6%) on the post-test ($p<0.001$).

Mpox was considered the next pandemic due to the uprise in cases in several outbreaks at the time of conducting the study. The knowledge regarding the epidemiology of the Mpox virus was relatively low in the pre-test, where only 10 (12.7%) correctly identified this viral infection circulating in wildlife in Central and West Africa, also only 11(13.6%) respondents had knowledge of the first human identification of Mpox in the 1970s in the Democratic Republic of the Congo.

Table-I: Characteristics of the study population (n=79).

Variables	n(%)
Age (mean) 20.5 ± 1.25 years	
18-20	37 (46.8)
21-23	42 (53.2)
Gender	
Male	26 (33%)
Female	53 (67%)
Year of Study	
First-year	20 (25%)
Second year	25 (32%)
Third year	34 (43%)
Subject Combination in Higher Secondary/Cambridge	
Biological Sciences/Pre-Medical	62 (78.5%)
Maths/Computers/Pre-Engineering	5(6.3%)
Humanities/Arts	12(15.2 %)
Student's Living Place	
With Parents	45 (57%)
Hostel	31 (39%)
Others/Guardians	3 (4%)

Table-II: Correctly Identified Responses for Mpox Transmission.

Variable		Responses n (%) Before Intervention	Responses n(%) After Intervention	McNemar Test Statistic χ^2	p-value
Monkeypox can be transmitted from person to person through:	Respiratory droplets	13 (16.5)	64 (81)	49.02	≤ 0.001
	Skin Lesions	9 (11.4)	75 (94.9)	64.01	≤ 0.001
	Contaminated materials and surfaces	48 (60.8)	77 (97.5)	27.03	≤ 0.001
	Body Fluids	28 (35.4)	67 (84.8)	40.024	≤ 0.001
Animals Reported transmitting Mpox to humans.	Rodents[a]	13 (16.5)	63 (79.7)	48.020	≤ 0.001
	Monkeys[a]	74 (93.7)	78 (98.7)	1.5	0.219
	Birds and Poultry[b]	33 (41.8)	75 (94.9)	38.205	≤ 0.001

[a]Correct option
[b]Incorrect options
**p-values calculated using McNemar's paired difference of proportions test.*

Table-II shows the correctly identified responses for Mpox transmission from person to person through respiratory droplets, skin lesions, contaminated material, and body fluids. Only 9 (11.4%) respondents correctly identified skin lesions as a transmission mode in the pre-test, which was improved to 75(94.9%), $\chi^2=64.01$, $p\leq0.001$.

Respondents were also asked about the animals responsible for the transmission of disease. Most of the participants correctly identified the monkeys and rodents as being responsible for the disease, 33 (41.8%) participants wrongly identified poultry as the reservoir of the disease, which was later improved in the post-test 75(94.9%) correctly identified, $\chi^2=38.205$, $p\leq 0.001$).

In Comparison of rightly chosen responses to correct and incorrect options regarding infection prevention and precautions for Mpox, only 24(30.4%) respondents correctly identified the use of Personal Protective Equipment (PPE) when caring for patients as significant, with 73(92.4%) agreeing to it in the post-test ($\chi^2=47.02$, $p\leq0.001$). Most respondents in the pre-test correctly identified the isolation of patients with Mpox ($\chi^2=5.143$, $p\leq 0.016$) (Table-III).

The response regarding One Health as an approach to achieve better public health outcomes about Mpox was reported correctly by 63(80%) (pre-test) and 70(90%) (post-test) ($\chi^2=3.50$, $p=0.057$. The responses to the endemicity of Mpox in Pakistan were correctly identified by only 40(50.6%), which improved after the intervention with a significant association ($\chi^2=23.75$, $p\leq 0.001$) (Table-IV).

Table-III: Comparison of Responses Regarding Infection Prevention and Precautions for Mpox (Monkeypox).

Variable	Responses n (%) Before Intervention	Responses n(%) After Intervention	McNemar Test Statistic	p-value
Personal Protective Equipment used when caring for patients	24 (30.4)	73 (92.4)	47.02	≤ 0.001
Hand hygiene practices before and after touching a patient	40 (50.6)	68 (86.1)	19.18	≤ 0.001
Hand hygiene practices Before carrying out a clean or aseptic procedure	34 (43.1)	77 (97.5)	40.024	≤ 0.001
Hand hygiene practices Before and after exposure to body fluids	28 (35.4)	67 (84)	40.04	≤ 0.001
Hand hygiene practices After touching the patient's surroundings	48 (60.8)	77 (97.5)	27.034	≤ 0.001
Isolation of patients	69 (87.3)	76 (96.2)	5.143	0.016
Hand hygiene practices	34 (43.6%)	77 (97.5%)	40.024	≤ 0.001

Table-IV: Pre- and post-educational interventional responses regarding Control of Mpox.

Variable	Responses n (%) Pre-test	Responses n (%) Post-test	McNemar Test Statistic	p-value
Bioterrorism	42 (53)	75 (95)	11.8	≤0.001
Case finding involves Health and community personnel systematically looking for recent or new monkeypox cases	66 (83.5)	75 (95)	5.818	0.012
Safe and dignified burial of persons who have died of or with monkeypox	64 (81)	73 (92.4)	3.048	0.081
Contribution of the approach (One Health) to achieve better public health outcomes.	63 (80)	70 (88.6)	3.50	0.057
Pakistan is endemic to Monkeypox.[b]	40 (50.6)	69 (87.3)	23.75	≤0.001
Routine Surveillance should be done.[b]	26(33)	47 (60)	9.302	0.02

[b]*Incorrect options*

DISCUSSION

Comparison of rightly chosen responses to correct and incorrect options regarding infection prevention, precautions, and control for Mpox (monkeypox) included using personal protective equipment, isolation of patients, hand hygiene practices, beliefs, endemicity, One Health and surveillance

The open-ended question about the endemicity of Mpox was reported incorrectly by many students as most of them mentioned the outbreak cases. In the pretest, 40 (50.6%) reported Pakistan to be endemic though the country did not even have an epidemic of this disease, and post-test, 69 (87.3%). Only 33(42%) reported African regions to be endemic to the disease but not with specific country names, and 75(94.9%) respondents reported the United States of America as endemic to the disease.

Participants were asked whether they have knowledge about One Health, and 72 (91%) in the pretest and 100% in the post-test knew about it. The probe into how One Health is related to better outcomes of Public Health led to developing programs, legislation, policies, and research for the human-animal-environment interface in which different sectors work together to achieve better public Health the following responses in post-test 9(12%) developing programs for the better human-animal-environment interface, and 70(90%) research for the human-animal-environment interface in which different sectors work together to achieve better public Health.

Participants were also asked about the control of the disease, and the most frequent answer in the pretest was case finding and contact tracing.

The re-emergence of the Mpox outbreak in some countries is linked to waning immunity due to the discontinuation of smallpox vaccination [15]. The increase in the median ages of individuals suffering from Mpox and the re-emergence of Mpox outbreaks in countries after an absence of three to four decades is a global concern [2-3]. The geographical spread of human-to-human transmission of Mpox in the pandemic-threatening environment has raised concerns about the seriousness of this issue, which should not be underestimated.

The recently reported cases of Mpox in Pakistan are alarming situations requiring immediate prevention and control to limit the spread. In Pakistan, the limited resources in healthcare settings in low-middle-income countries require appropriate measures to address the emerging and remerging viruses keeping in view the epidemiological, social and economic constraints [16-17]. Control of this global outbreak requires careful coordination among all stakeholders that, include public health officials, clinicians, future healthcare professionals, and the community [18]. It requires authentic dissemination of information, obtaining appropriate diagnostic testing, employing contact tracing, and making medical care accessible for affected individuals and their contacts [18].

A recent study in Saudi Arabia reported that 77% of the respondents from the general population believed it to be an infectious disease and did not link it to bioterrorism, but on the contrary, a study conducted in a Jordanian health school reported 50% of the study participants linked the study with bioterrorism whereas in our study 69 % rejected the idea with an improvement of 100% in the post-test. In our study, more than 85.0 % of the respondents identified social media as a source of information for Mpox, the study by Alshahrani NZ et al. reported 75.0 % of the individuals [19]. A study conducted in Kuwait reported a high prevalence of believing in conspiratorial theories regarding emerging viral infections, which is worrying, and requires proper interventions [20].

Sometimes media awareness campaigns do not work effectively in raising awareness campaigns. A study done in Nigeria, Africa, reported that media campaigns to raise awareness remained ineffective in changing public health behaviours regarding the Mpox disease [21]. Our study targeted the future public health professionals in a systematic educational program to address the challenging public health crises during WHO alert.

In a recent study from Saudi Arabia, about 61.3% of the public was interested in seeking knowledge regarding Mpox, and it correlated positively with their worriedness and disease awareness. It showed that only 50% of the healthcare workers correctly identified the animal-to-human transmission of Mpox; however, 64.8% agreed about direct skin contact as a mode of human-to-human transmission [22]. A study in Italy showed that most participants (78.5%) knew about the transmission of Mpox from respiratory droplets, direct contact, and body fluids. The majority (74.8%) of healthcare professionals in this study, including public health professionals, acknowledged that the protocols for prevention help avoid infection[23]. However, only 44.4% understood Mpox as a pathogen circulating among various hosts, not only primates, and 42.3% had knowledge of the long survival of Mpox on contaminated surfaces. The authors emphasized that public Health plays a crucial role in managing incident cases, including contact tracing to implement preventive measures in the community, and across the workplaces, including vaccination campaigns.

A study published in Jordan by Sallam M et al. reported that less than 40% of the participants knew about the easy human-to-human transmission of Mpox [24]. However, knowledge gaps in Mpox were reported by medical professionals in Italy [23]. Similarly, other studies conducted in Indonesia showed that other rare outbreaks were associated with low knowledge among healthcare professionals, while they had high knowledge about Indonesia's endemic outbreaks [25,26]. Most respondents in our study knew about skin lesions as a symptom and transmission of disease through droplets and body fluids [25]. This may result from social media, which facilitates the speedy dissemination of information regarding Mpox. Easy access to health information among the public can help gain knowledge, de-escalate emerging cases and limit the spread of the virus in the developing world.

In a research study carried out in Saudi Arabia public (46.5%) knew about Mpox transmission via sexual contact and body fluids. The scientific evidence suggests the recent epidemic be consistent with a sexually transmitted infection (STI). The transmission dynamics of Mpox demand the incorporation of a sexual health framework to the response. The limitations of this research include a small sample size without a control group. The carrying out of randomization was not possible at the university with a small sample size. Minor differences could potentially impact findings and might also account for at least a portion of the difference in learning outcomes and perceptions across semesters.

CONCLUSION

Knowledge of Mpox regarding the reservoir, mode of transmission, ecology, prevention, and control after educational intervention showed a significant increase among undergraduate students.

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Author's Contribution:

Hina Shan: Involved in the conception, design, methodology, and statistical analysis of the research proposal.
Maryam Shan: Contributed to the data collection along with the interpretation of results.
Huzaifa Akram: Contributed to the statistical analysis and writeup.
Uzma Hassan: Did data collection along with writeup.
Raima Asif: Did the write-up and final approval of the version to be published.
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