

EFFECT OF EDUCATIONAL SESSIONS ON HUMAN MONKEYPOX VIRAL INFECTION AMONG NURSES: A QUASI-EXPERIMENTAL IN EGYPT

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Abstract

Background: Human monkeypox outbreaks in non-endemic areas have recently spawned a new public health concern. Aim: to evaluate educational sessions about monkeypox disease affected nurses' knowledge and attitudes at the fever, liver, and digestive system hospital in Benha city.

Design: A quasi-experimental design with a pre- and post-test was used in this study. Setting: The research was carried out at the fever, liver, and digestive system hospital in Benha city's outpatient clinic, Egypt. Subjects: A convenient sample size of 100 nurses was used. Data collection tools:

There were two tools used: Tool (I): A self-administered questionnaire divided into two sections: Part one discusses the nurses' characteristics, and part two discusses the nurses' knowledge of monkeypox disease. Tool (II): Concerned about nurses' attitudes toward monkeypox disease.

Results: The mean total knowledge and attitude scores before and after program application differed statistically significantly ($P < 0.001$). Conclusion: The use of educational sessions increased nurses' knowledge and attitude toward monkeypox. Nurses' posttest knowledge, practice knowledge, and attitudes were higher than their pretest scores. Recommendations: Continuous campaigns to increase nurses' knowledge are necessary because controlling outbreaks necessitates

extensive collaboration from knowledgeable and skilled healthcare providers through educational courses and awareness programs.

Keywords: Monkeypox, Educational sessions, Fever, Liver and Digestive system Hospital, Nurses.

Introduction

The monkeypox virus causes a zoonotic viral infection that can spread from animals to humans. Additionally, it can transmit from humans or the environment to humans [1]. The highest prevalence of monkeypox is in the Democratic Republic of the Congo, located in central and western Africa. Although it was first isolated in 1958 in captive monkeys (hence the name), the available evidence indicates that African rodents are the natural reservoir. It has infected squirrels, prairie dogs, rats, monkeys, and humans. In 1970, the first human case of monkeypox was reported. Currently, two genetically distinct clades have been identified. The Central African clade is reported more frequently than the West African clade, and human-to-human transmission has been documented [2-3]. Monkeypox can be transmitted to humans through contact with an infected animal. Transmission of monkeypox typically occurs via direct or indirect contact with the rash, bodily fluids (such as fluid, pus, or blood from skin lesions), or scabs. Towels, bedding, clothing, and objects such as eating utensils/dishes contaminated with the virus due to contact with an infected individual can infect others. The virus could be transmitted through skin-to-skin contact from a pregnant woman to her fetus through the placenta and from an infected parent to their child during or after birth [4]. The incubation period (time between infection and onset of symptoms) for monkeypox is typically between 6 and 13 days but can range between 5 and 21 days. Monkeypox typically has two stages: prodrome and eruptive. The prodromal period lasts 1 to 4 days. Monkeypox is distinguished from smallpox by fever, severe headache, back pain, myalgia, asthenia, and lymphadenopathy [5-6]. Within one to three days of the onset of fever, the eruptive phase commences. The rash was most prevalent on the face (95%) and extremities, such as the palms of the hands and soles of the feet (75%), oral mucous membranes (70%), genitalia (30%), conjunctivae (10%), and cornea (20%). The rash progresses from macules to papules to vesicles to pustules to crusts that dry and fall off. Monkeypox is a self-limiting disease with an average duration of two to four weeks. After all, the clients are no longer considered infectious because the crusts have fallen off [7]. Polymerase Chain Reaction (PCR) is the preferred laboratory test for monkeypox due to its precision and sensitivity. Monkeypox is best diagnosed through skin lesions (the roof or fluid from vesicles, pustules, and dry crusts). Lesion samples must be stored in a sterile, dry, and refrigerated tube. Monkeypox treatment focuses on symptom relief, complications management, and preventing long-term sequelae. Clients should drink fluids and eat foods that keep their nutritional status stable. The European Medicines Agency (EMA) has approved tecovirimat as a monkeypox antiviral agent [1]. Community health nurses are the primary responders to disease situations during epidemic events in various clinical settings. Their role in disease prevention and surveillance is crucial in the case of management. In the face of epidemic outbreaks, community health nurses are expected to maintain a high level of awareness and safeguard the community [8].

Significance of the study

Egypt discovered the first case of monkeypox in an Egyptian resident (42 years) of Europe who frequently visits the continent. The male patient was discovered during the ministry's epidemiological surveillance procedures. Since July, the ministry has increased surveillance and diagnostic tool availability at all land and sea ports and raised medical personnel awareness and training regarding diagnosis and referral [9]. Nurses are the backbone of the hospital, but they are more susceptible to infection. To respond to monkeypox outbreaks and other pandemics, nurses must provide protection. Global concern is the lack of adequate support and safety measures for nurses during significant outbreaks of infectious diseases. Collaboration between nurses, health agencies, and authorities is essential for establishing a reasonable response to an outbreak of monkeypox. Assisting patients with suspected or confirmed monkeypox virus infection were nurses. Those handling samples from these patients must take standard precautions for infection control, such as wearing a single-use N95 respirator, head and shoe covers, isolation gown, goggles, hand hygiene, and gloves [10].

Study's goal

The purpose of our research is to evaluate effect of educational sessions about monkeypox disease on knowledge and attitudes of nurses at Fever, Liver and digestive system hospital in Benha city; this could be achieved by carrying out the following specific goals:

1. Evaluate the nurses' knowledge about monkeypox before and after nursing education sessions.
2. Evaluate nurses' attitudes toward monkeypox before and after the nursing educational sessions.
3. Creating, implementing, and evaluating the efficacy of an educational intervention on the knowledge and attitudes of nurses regarding monkeypox.

Hypothesis for research

Nurses' knowledge and attitudes regarding monkeypox will be improved through nursing education.

Subject and method

Design of the study

To achieve the purpose of the study, a quasi-experimental research design (pre and posttest) was employed.

Setting

The research was carried out at the outpatient clinic at Fever, Liver and Digestive system Hospital in Benha City; it is located in Kafer El Saraia, North of Benha city in Qalyoubia Governorate, and contains 163 beds. Among other infectious diseases, this hospital treats patients with influenza, COVID-19, dengue fever, hepatitis A, B, and C, salmonella, Maltese and typhoid fever, AIDS, pneumonia, bronchitis, and other food-borne diseases. The hospital treats those patients and isolates them to prevent the spread of infection. It provides a wide range of health care services for rural and urban population in Benha city.

Sampling

A convenience sample of 100 nurses comprises nurses who work in outpatient and emergency clinics. In addition, ten nurses participated in the pilot study. The clinic is open seven days a week, and the daily caseload ranges from 6 to 10 clients, with a weekly caseload of 50 to 70 clients.

Data collection tools:

This research and its objectives were achieved with the aid of two resources.

Tool I: Researchers created a self-administered questionnaire by reviewing relevant literature. It **contains three components:**

Part one: The characteristics of the studied nurses included (8) closed-ended questions such as age, gender, educational qualifications, years of experience, residence, and completion of an infection control training program. Additionally this part asks about source of knowledge about monkeypox.

Part two: Self-administered questionnaire for evaluating:

(a) Nurses' knowledge concerning monkeypox. It consisted of 44 questions, as following (3 questions covered nurses' knowledge regarding the definition of monkeypox, only one question about pathogen, 5 questions covered prevalence, 11 questions covered mode of transmission, only one question covered the incubation period, 10 questions covered the signs and symptoms, 3 questions covered diagnosis, 2 questions covered the complications, 4 questions covered the preventive methods, and 4 questions covered the treatment).

(b) Nurses' knowledge regarding practices related to monkeypox. It consisted of 20 questions, as following the protective measures for nurses dealing with clients have monkeypox (5 questions), the infectious sores (3 Q). Furthermore, this part assess precautions steps before collecting samples of monkeypox (3Q), and nine questions ask about precautions measures how to prevent the spread of monkeypox to the other clients.

Total knowledge scoring system

For knowledge items, nurses who checked the correct answer were given (1), while the one who checked the incorrect answer was given (0). The sum of item scores and totals for each knowledge domain is divided by the number of items to determine the average score for the section. The total number of acquired knowledge points was 64. This data was converted to a percentage. Total knowledge scores were considered reasonable if they were at least 65 percent (41 points), average if they were 50-65 percent (32-41 points), and poor if they were less than 50 percent (32 points).

Tool II: Nurses' attitudes toward monkeypox were assessed using a self-administered Likert scale adopted from [11]. Ten statements were graded on a Likert scale of three points (the answers were either agree, neutral, or disagree), which included their opinions on the ability of the world's populations to control the monkeypox epidemic, the availability of appropriate preventive and control measures, and whether or not they had negative feelings toward monkeypox. Additionally, they were asked about their interest in learning more about monkeypox and the epidemiology of emerging diseases.

Scoring system

Nurses' answers were scored on a three-point Likert scale (disagree = 1, neutral = 2, and agree =3). The score is a total of 30 points. The total attitude score was considered positive if it was less than

60 percent (less than 18 points) and negative if it was greater than 60 percent (greater than 18 points).

Content validity

To test the instrument's content validity, the current study was presented to five academic nursing staff in the field of Community Health Nursing. The recommended changes were made based on the academic nursing experts' evaluation of the content's appropriateness and the sentences' clarity.

Reliability

The Cronbach's Alpha test was used to ensure that the two data collection instruments contained items with comparable levels of homogeneity (reliability for knowledge was 0.901, and the attitude was 0.903).

Considerations for ethics

After being informed of the purpose of the study, nurses agreed to participate. Before data collection, nurses were informed of the purpose and nature of the study. They could refuse to participate or withdraw from the study at any time. Additionally, they were assured that the information would be kept confidential and used solely for research. The researchers emphasize that participation in the study is entirely voluntary and that anonymity was ensured by encoding the participants' data. The local ethics committee was consulted before the start of the study.

Pilot research

The pilot study included 10 percent of the nurses. The pilot study sought to evaluate the tool's feasibility, clarity, applicability, and time required to complete each sheet. Since all modifications were made, the pilot study sample was omitted from the total sample size.

Fieldwork

The program's assessment, planning, implementation, and evaluation were utilized to accomplish the study's objective. These phases lasted five months, beginning in May 2022 and concluding in September 2022. The researchers frequently visit the research site from 10 a.m. to 12 p.m on Monday and Thursday.

Phase of evaluation

Before the intervention, data were collected for baseline assessment. The researchers briefed the hospital's directors and nurses on their background and the purpose of this study. In addition, during this phase, all nurses working in the outpatient clinic were interviewed, and their verbal consent to participate was obtained. Demographic characteristics, knowledge, and attitude questionnaire were distributed before the intervention, and reassured them that the knowledge obtained would be treated as strictly confidential and would not be used for any purposes other than research. Following the post-test sessions, the same questionnaire was administered. Each nurse required an average of 15 to 20 minutes to complete the study questionnaire. The primary purpose of the data analysis was to provide a basis for designing the intervention sessions.

Phase of preparation

The content of the educational sessions was determined by the results of the evaluation phase. The educational illustrated booklet was created by the researchers, and its content was validated before its distribution to the nurses for use as a self-learning guide.

The educational intervention for the subjects under study was carried out in the following steps:

a. Defining the program's goals and objectives

Aim: To evaluate the effect of educational sessions about monkeypox disease on knowledge and attitudes of nurses at Fever, Liver and digestive system hospital in Benha city.

Specific objectives of the nurses' sessions were to provide knowledge, practice, and a positive attitude toward monkeypox to trained nurses.

Specific goals

The trained nurses should be able to do the following by the end of the sessions:

1. Define the virus monkeypox.
2. Identify the pathogen of the monkeypox virus.
3. Identify the prevalence of the monkeypox virus.
4. Discuss modes of transmission of the monkeypox virus.
5. Describe the high-risk group for the monkeypox virus.
6. Know the incubation period of the monkeypox virus.
7. List signs and symptoms of the monkeypox virus and the hotline for ensured or suspected cases.
8. Describe the diagnosis of the monkeypox virus.
9. Discuss complications of the monkeypox virus.
10. Explain the prevention methods for the monkeypox virus.
11. Discuss the treatment of the monkeypox virus.
12. Explain the role of the nurse regarding the monkeypox virus.
13. Motivate the nurse's positive attitudes regarding monkeypox.

Phase of implementation

The educational program was delivered in hospital lecture hall sessions. Numerous instructional methods were employed, including lectures, group discussions, and brainstorming. Video and images displaying laptop data were added to the sessions to facilitate and clarify instructions. Each session begins with a summary of the previous session's content, followed by the session's objectives to ensure that nurses comprehend the material. The program was divided into four sessions, each lasting 30 to 45 minutes, including discussion periods. Three to four nurses per day participated in each session, and the posttest was administered immediately. The researchers welcomed and introduced themselves to the nurses at the start of the first session. The session's purpose, the topic's importance, contents, and time are all explained. Researchers provided basic knowledge related to monkeypox as definition, pathogen, the natural host of monkeypox, and outbreaks. In subsequent sessions, the researchers demonstrated modes of transmission of the monkeypox virus, high-risk groups, signs and symptoms of the monkeypox virus, phases of the infection, fatality rate, diagnosis, a hotline for ensured or suspected cases, complications, treatment, prevention methods of monkeypox virus, and role of the nurses regarding monkeypox virus. Following each session, participants provided feedback on the previous session and discussed the objectives of the new topics. A PowerPoint presentation supported this, followed by a group discussion about the contents. In addition, the researchers helped nurses gain Knowledge

and Practice from feedback. Also, brochures with attractive images with simple and clear text were distributed in a booklet as a guide to be referred to after the intervention.

Phase of evaluation

To ensure the program's efficacy, nurses' pre- and post-educational knowledge and attitudes about monkeypox were compared using the same assessment tools.

Statistical evaluation

We collected, coded, sorted, tabulated, and ran the appropriate statistical analysis on all the data we gathered. SPSS, version 20, was used to analyze the data by computing frequencies and percentages, means and standard deviations, and testing statistical significance and associations with the Chi-square test (χ^2) and correlation to identify any ties between the variables (p-value). A p-value (≤ 0.001 highly significant, ≤ 0.05 significant, > 0.05 insignificant) was used to characterize the level of statistical significance.

Results

Demographic Characteristics of the studied pregnant women

Table (1) revealed that 50% of the nurses studied were between the ages of 30 and 35, with a mean \pm SD of (32.3 \pm 2.5) and 88% were female. Furthermore, 43% had a diploma in nursing, 36% had 11 < 15 years of experience, and 69% lived in rural areas. Moreover, 85% of the studied nurses obtained training programs in infection control for more than six months for 51.8% of them.

Table 1: Characteristics of the sampled nurses and how often they occur

Demographic characteristics	N	%
Age (years)		
< 25	7	7.0
25 < 30	16	16.0
30 < 35	51	51.0
35 < 40	26	26.0
Mean \pmSD	32.3 \pm2.5	
Gender		
Male	12	12.0
Female	88	88.0
Educational qualifications		
Bachelor of Nursing	37	37.0
Technical institute of nursing	20	20.0
Diploma in Nursing	43	43.0
Experience (Years)		
Less than 5	14	14.0
5 – 10	33	33.0
11 – 15	36	36.0
More than 15	17	17.0

Residence		
Urban	31	31.0
Rural	69	69.0
Obtaining training programs about infection control		
No	15	15.0
Yes	85	85.0
If yes, since when (n=85)		
6 or less	41	48.2
More than 6	44	51.8

Figure 1: presents the main information sources for nurses' monkeypox were the medical team (48%), followed by mass media (39%), and friends (13%).

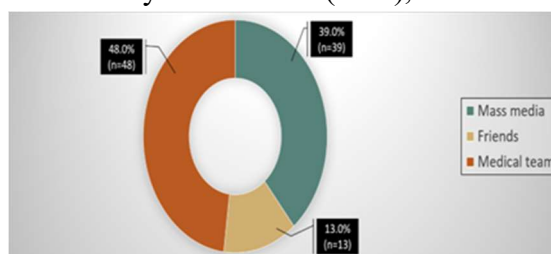


Figure 1: The percentage breakdown of where the nurses in this study learned about monkeypox Table (2): Reveals that only 12% of studied nurses identified the meaning of monkeypox pretest compared to 98% at posttest. The studied nurses' pathogen, prevalence, mode of transmission, incubation period, symptoms, diagnosis, complications, and treatment were all drastically different before and after the program implementation. As well, 98% of them identified prevention methods for monkeypox post-program.

Table 2: Knowledge of monkeypox amongst the studied nurses (n=100) before and after the intervention

Knowledge about monkeypox	Pre intervention				Post intervention				Chi-Square	
	Incorrect		Correct		Incorrect		Correct		X ²	P
	N	%	N	%	N	%	N	%		
Definition of monkeypox virus	88	88.0	12	12.0	2	2.0	98	98.0	149.414	<0.001*
The pathogen	66	66.0	34	34.0	6	6.0	94	94.0	78.125	<0.001*
Prevalence	68	68.0	32	32.0	5	5.0	95	95.0	85.621	<0.001*
Mode of transmission	73	73.0	27	27.0	5	5.0	95	95.0	97.183	<0.001*
Incubation period	55	55.0	45	45.0	4	4.0	96	96.0	62.531	<0.001*

Signs and Symptoms	65	65.0	3 5	35.0	3	3.0	97	97. 0	85.650	<0.001* *
Diagnosis	71	71.0	2 9	29.0	1	1.0	99	99. 0	106.336	<0.001* *
Complications	77	77.0	2 3	23.0	6	6.0	94	94. 0	103.820	<0.001* *
Methods of prevention	62	62.0	3 8	38.0	2	2.0	98	98. 0	82.720	<0.001* *
Treatment	74	74.0	2 6	26.0	3	3.0	97	97. 0	106.451	<0.001* *

Figure (2) is demonstrated that the complete knowledge of studied nurses about monkeypox increased from 7% in the pretest to 85% after the nursing intervention was implemented.

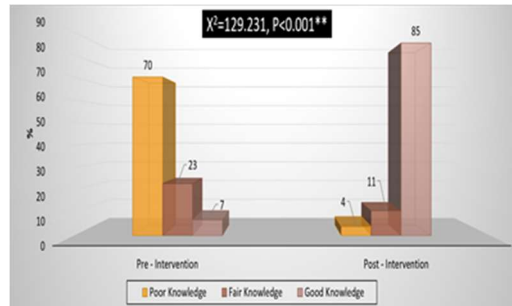


Figure 2: Analysis of pre- and post-intervention levels of monkeypox-related knowledge

Figure (3) clarifies that after the nursing intervention, 74 percent of nurses had at least some knowledge of best practices for dealing with monkeypox, up from 18 percent before the sessions.

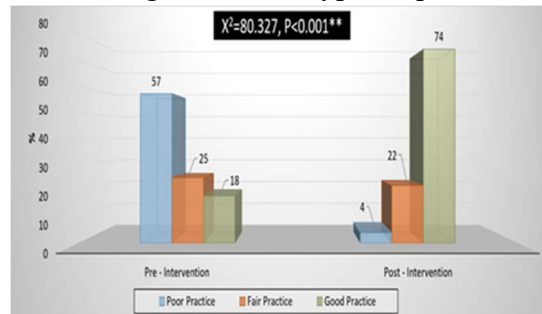


Figure 3: Scores before and after intervention were compared on a knowledge-based monkeypox scale

Figure (4) shows that the complete knowledge of the nurses studied increased from 12% before the intervention to 79% after it was implemented.

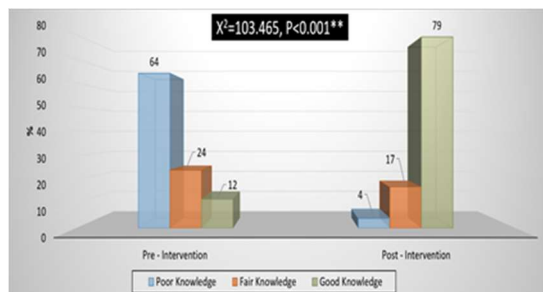


Figure 4: Overall knowledge was compared before and after the intervention

Figure (5) demonstrates that the total attitude score of the studied nurses increased from 22% before the intervention to 78% after it was implemented

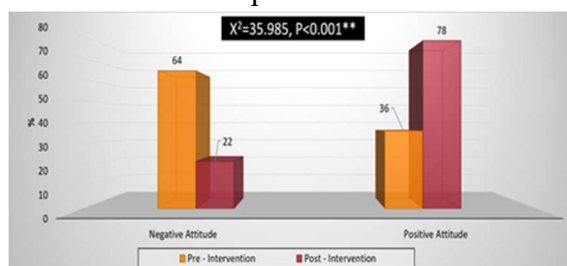


Figure 5. Comparison of total attitude scores before and after intervention

From table (3), the results show significant differences in nurses' knowledge, education, and experience after implementing an infection control training program $P < 0.001$.

Table 3: Analysis of the participants' demographics concerning their baseline and post-intervention levels of knowledge in the nursing profession

Demographic characteristics	Knowledge (Total)															
	Pre – Intervention						Post – intervention									
	Poor Knowledge		Fair Knowledge		Good Knowledge		Poor Knowledge		Fair Knowledge		Good Knowledge					
	N	%	N	%	N	%	N	%	N	%	N	%				
Age (years)																
Less than 25	4	6.3	0	0.0	3	25.0	0	0.0	1	5.9	6	7.6				
25 – 30	9	14.1	7	29.2	0	0.0	1	25.0	2	11.8	13	16.5				
30 – 35	33	51.6	10	41.7	8	66.7	2	50.0	9	52.9	40	50.6				
35 – 40	18	28.1	7	29.2	1	8.3	1	25.0	5	29.4	20	25.3				
Chi – Square [X^2 , P]	$X^2 = 14.592$				$P = 0.024^*$				$X^2 = 0.861$				$P = 0.990$			
Gender																
Male	10	15.6	2	8.3	0	0.0	0	0.0	2	11.8	10	12.7				

Female	54	84.4	22	91.7	12	100.0	4	100.0	15	88.2	69	87.3
Chi – Square [X^2 , P]	$X^2=2.738$			P=0.254			$X^2=0.579$			P=0.749		
Educational qualifications												
Bachelor of Nursing	24	37.5	8	33.3	5	41.7	4	100.0	15	88.2	18	22.8
Technical institute of nursing	14	21.9	6	25.0	0	0.0	0	0.0	2	11.8	18	22.8
Diploma in Nursing	26	40.6	10	41.7	7	58.3	0	0.0	0	0.0	43	54.4
Chi – Square [X^2 , P]	$X^2=3.725$			P=0.445			$X^2=33.780$			P < 0.001**		
Experience (Years)												
< 5	9	14.1	2	8.3	3	25.0	4	100.0	2	11.8	8	10.2
5 – 10	19	29.7	13	54.2	1	8.3	0	0.0	7	41.2	26	32.9
11 – 15	25	39.1	6	25.0	5	41.7	0	0.0	5	29.4	31	39.2
More than 15	11	17.2	3	12.5	3	25.0	0	0.0	3	17.6	14	17.7
Chi – Square [X^2 , P]	$X^2=9.091$			P=0.169			$X^2=26.287$			P<0.001**		
Residence												
Urban	17	26.6	10	41.7	4	33.3	2	50.0	5	29.4	24	30.4
Rural	47	73.4	14	58.3	8	66.7	2	50.0	12	70.6	55	69.6
Chi – Square [X^2 , P]	$X^2=1.896$			P=0.387			$X^2=0.709$			P=0.701		
Obtaining training programs about infection control												
No	9	14.1	5	20.8	1	8.3	4	100.0	5	29.4	6	7.6
Yes	55	85.9	19	79.2	11	91.7	0	0.0	12	70.6	73	92.4
Chi – Square [X^2 , P]	$X^2=1.103$			P=0.576			$X^2=28.834$			P<0.001**		

If yes, since when (n=85)												
6 or less	26	47.3	10	52.6	5	45.5	3	100.0	10	83.3	28	40.0
More than 6	29	52.7	9	47.4	6	54.5	0	0.0	2	16.7	42	60.0
Chi – Square [X^2 , P]	$X^2=0.202$			P=0.904			$X^2=11.041$			P=0.004*		
Source of knowledge about monkeypox												
Mass media	30	46.9	5	20.8	4	33.3	2	50.0	8	47.1	29	36.7
Friends	9	14.1	3	12.5	1	8.3	0	0.0	4	23.5	9	11.4
Medical team	25	39.1	16	66.7	7	58.3	2	50.0	5	29.4	41	51.9
Chi – Square [X^2 , P]	$X^2=6.483$			P=0.166			$X^2=4.118$			P=0.390		

The table (4), shows a discernible variation in nurse outlook, credentialing, and experience.

Table 4: Pre- and post-intervention changes in nurses' attitudes and how they relate to the nurses' demographic characteristics

Table 7. The relationship between demographic characteristics and overall attitude score										
	Pre – Intervention				Post – intervention					
	Negative Attitude Score		Positive attitude score		Negative attitude score		Positive attitude score			
	n	%	n	%	n	%	n	%		
Age (years)										
Less than 25	4	6.3	3	8.3	3	13.6	4	5.1		
25 – 30	9	14.1	7	19.4	0	0.0	16	20.5		
30 – 35	38	59.4	13	36.1	12	54.5	39	50.0		
35 – 40	13	20.3	13	36.1	7	31.8	19	24.4		
Chi – Square [X^2, P]	$X^2=5.217$			P=0.157		$X^2=6.724$		P=0.081		
Gender										
Male	10	15.6	2	5.6	2	9.1	10	12.8		
Female	54	84.4	34	94.4	20	90.9	68	87.2		
Chi – Square [X^2, P]	$X^2 = 2.212$			P = 0.137		$X^2 = 0.226$		P = 0.634		
Educational qualifications										
Bachelor of Nursing	25	39.0	12	33.3	10	72.7	21	26.9		
Technical institute of nursing	11	17.2	9	25.0	6	27.3	14	17.9		
Diploma in Nursing	28	43.8	15	41.7	0	0.0	43	55.2		

Chi – Square [X², P]	X ² = 0.931		P = 0.627		X ² = 2 2.604		P < 0.001**	
Experience (Years)								
> 5	7	10.9	7	19.4	10	45.5	4	5.1
5 – 10	20	31.3	13	36.1	9	40.9	24	30.8
11 – 15	27	42.2	9	25.0	3	13.6	33	42.3
More than 15	10	15.6	7	19.4	0	0.0	17	21.8
Chi – Square [X², P]	X ² = 3.444		P = 0.328		X ² = 29.181		P < 0.001**	
Residence								
Urban	18	28.1	13	36.1	6	27.3	25	32.1
Rural	46	71.9	23	63.9	16	72.7	53	67.9
Chi – Square [X², P]	X ² = 0.687		P = 0.407		X ² = 0.183		P = 0.669	
Obtaining training programs about infection control								
No	10	15.6	5	13.9	10	45.5	5	6.4
Yes	54	84.4	31	86.1	22	54.5	73	93.6
Chi – Square [X², P]	X ² = 0.054		P = 0.815		X ² = 4.977		P = 0.026*	
If yes, since when (n=85)								
6 or less	31	57.4	10	32.3	14	63.6	27	42.9
More than 6	23	42.6	21	67.7	8	36.4	36	57.1
Chi – Square [X², P]	X ² = 4.989		P = 0.026*		X ² = 2.820		P = 0.093	
Source of knowledge about monkeypox								
Mass media	25	39.1	14	38.9	11	50.0	28	35.9
Friends	8	12.5	5	13.9	3	13.6	10	12.8
Medical team	31	48.4	17	47.2	8	36.4	40	51.3
Chi – Square [X², P]	X ² = 0.041		P = 0.979		X ² = 1.680		P = 0.432	

And finally from table (5), nursing staff's positive attitudes were significantly correlated with their depth of monkeypox knowledge and experience.

Table (5): Total pre- and post-intervention knowledge and attitude about monkeypox among the studied nurses were positively correlated.

knowledge (Total)	Attitude (Total)							
	Pre-intervention				Post-intervention			
	Negative attitude (n=64)		Positive attitude (n=36)		Negative attitude (n=22)		Positive attitude (n=78)	
	N	%	N	%	N	%	N	%
Knowledge Regarding Monkeypox								
Poor Knowledge	46	71.9	24	66.7	4	18.2	0	0.0
Fair Knowledge	16	25.0	7	19.4	4	18.2	7	9.0
Good Knowledge	2	3.1	5	13.9	14	63.6	71	91.0

Chi – Square [X^2 , P]	$X^2=4.212$		P=0.122		$X^2=17.019$		P<0.001**	
Practice Regarding Monkeypox								
Poor Practice	41	64.1	16	44.4	4	18.2	0	0.0
Fair Practice	13	20.3	12	33.3	14	63.6	8	10.3
Good Practice	10	15.6	8	22.2	4	18.2	70	89.7
Chi – Square [X^2 , P]	$X^2=3.675$		P=0.159		$X^2=48.283$		P<0.001**	
Total Knowledge Score								
Poor Knowledge	45	70.3	19	52.8	4	18.2	0	0.0
Fair Knowledge	12	18.8	12	33.3	11	50.0	6	7.7
Good Knowledge	7	10.9	2	5.6	7	31.8	72	92.3
Chi – Square [X^2 , P]	$X^2=3.316$		P=0.191		$X^2=40.198$		P<0.001**	

Discussion

The increased number of human monkeypox cases highlights the critical role of healthcare workers in prevention, early detection, prompt response, and management. However, according to the WHO report, one of the challenges in preventing monkeypox was a lack of knowledge, particularly among healthcare workers. As a result, healthcare workers in various regions must be informed about and prepared for monkeypox cases. The current study's target group was nurses because nurses will be on the frontlines responding to this health emergency, primarily by providing health education on prevention and infection control. They should also have access to up-to-date knowledge on modes of transmission, prevention, diagnosis, treatment, infection control procedures, counseling, and care through in-service or continuing education. Nurses and other healthcare workers often do not have access to proper protection against infectious diseases. Training and professional guidelines are required, along with PPE, to protect and prevent the spread of this disease. This discussion covered the main result findings as follows: Demographic characteristics of studied nurses. More than half of the nurses in the sample were found to be between the ages of 30 and 35, with a mean age of 32.3 ± 2.5 ; the majority of nurses were also female, which may be because nursing faculties were originally only open to women. These findings are in line with [12] in Iran, which found that the study's nurses were overwhelmingly young and female (under 40). In terms of years of experience, less than half of them had 11 to 15 years of experience; this could be due to their young ages, so their experience was older than 11 years. This finding contradicted the findings of [13] that less than half of the nurses in Egypt had more than five years of experience, according to a study done there. Additionally, less than half of them had a diploma in nursing, and more than one-third had a Bachelor of nursing. This finding agreed with [14]. It was found that fewer than half of the nurses surveyed had completed formal nursing education. However, these findings disagreed with [15], in Egypt, who discovered that nearly three-quarters of the nurses studied had a technical institute diploma and more than one-quarter had a bachelor's degree in nursing. Two-thirds of the nurses also had less than five years

of experience. Similarly, [16], in Lebanon, according to a study, most nurses had a bachelor's or master's degree. This could be attributed to the rural nature of the Qalyoubia governorate, as less than three-quarters of the nurses studied were from rural areas. These findings were in line with [17], in German, who reported that the majority of nurses came from rural areas regarding infection control training, the present research revealed that most studied nurses obtained infection control training. More than half of them obtained this program for more than six months. This might be due to the hospital having a staff development program, and this is one of the hospital's policies. This result is supported by the research carried out in Saudi Arabia by [18], which demonstrated that more than two-thirds of nurses received training in infection control. The result was also consistent with an Egyptian study by [19], which demonstrated that around three-quarters of the sample obtained an infection control program. According to the current research's findings, the primary sources of information about monkeypox were the medical team, the news media, and friends. This might be because they work in the same hospital and spend a lot of time there. Also, mass media plays an essential role in enriching people with information. The findings of this research were consistent with [20], who found that the primary sources were healthcare professionals and officials, followed by social media, then friends.

Regarding nurses' knowledge about monkeypox

According to the current research, approximately three-quarters of the studied nurses had inadequate knowledge before the educational program. In contrast, most had good knowledge after the educational program was implemented, with a highly significant difference between the pre- and post-test after the program. This could be due to a lack of pretest knowledge due to monkeypox being a new pandemic disease. In contrast, the results of the nursing education sessions for monkeypox demonstrated a high level of disease knowledge. This improvement could be attributed to their eagerness to participate in the program; as a result, the program has improved nurses' knowledge of monkeypox. The results are in line with the study provided by [21] in Saudi Arabia. They stated that approximately three-quarters of respondents had inadequate levels of knowledge, while more than one-quarter had adequate levels. In addition, these results were comparable to a study by [22]. They discovered that over three-quarters of the participants lacked adequate knowledge of the Zika virus. This study matched the study done by [23] in Egypt. Knowledge of COVID-19 diseases among the studied nurses increased from 50.7% in pre-educational sessions to 100% in post-educational sessions and follow-up tests. All observed differences were statistically significant ($p=0.001$).

Regarding nurse's knowledge about Preventive measure for monkeypox and isolation precaution
This research found statistically significant differences between pre- and post-education knowledge about monkeypox preventive measures for nurses and isolation precautions for clients. This study discovered a gap in practice regarding protective measures for monkeypox prevention, such as hand washing, wearing gloves, surgical masks, gowns, and client isolation in the pre-education program. Knowledge of preventive measures is critical to disease control. As a result, if nurses' staff is knowledgeable about preventive measures, they can share this knowledge with the rest of the communities who come into contact with them daily. This result is agreed by [10] in

Iraq; they clarified that nurses play a crucial role in combating the outbreak of monkeypox by disseminating health education on prevention and infection control. Regarding attitude, the current research found positive attitudes improved significantly between the pretest and posttest phases of the intervention. Moreover, their overall scores improve (one month after the program) from about one quarter to more than three quarters. That could be due to the educational program's effect on improving nurses' attitudes. These observations agreed with [24] in Taiwan; they found no significant difference in attitude scores between the intervention and control groups before the educational intervention. But, after the intervention, the scores of attitudes in the intervention group (one-month post-intervention) were significantly higher than those of the control group.

Concerning the relationship between the total scores for nurses' knowledge and attitudes and their **demographics:**

The current research discovered a statistically significant difference between nurses' knowledge and their educational qualification and years of experience; this may be due to factors such as years of experience and educational qualification, which contribute to knowledge achievement and positively alter attitudes. These findings disagreed with [25] in Jordan; they discovered a significantly stronger relationship between HMPX K-Score and participants' gender and educational level. Age and place of residence did not exhibit statistically significant differences based on HMPX K-Scores. It was also contradicted by [21] in Saudi Arabia, who discovered that age, gender, level of work, work sector, and previous medical training all impact knowledge, without distinctions based on specialization or years of experience. Also, the current research displayed a highly significant difference between nurses' attitude and their educational qualifications and experience. This finding disagrees with Francis et al. [26], who reported a statistically significant difference in nurses' attitudes based on their gender, level of education, and income in Taiwan.

Concerning the relationship between the total knowledge score and the nurses' attitudes

Scores

After the educational program, there was a statistically significant difference in knowledge and attitude, according to the present study. This study agreed with [27] in Italy, who stated that knowledge affects the attitude regarding monkeypox.

Conclusion

According to the findings of this research, it is possible to conclude that educational sessions improved the knowledge and attitude of nurses regarding monkeypox. Nurses' posttest knowledge, practice knowledge, and attitudes were higher than their pretest scores. Based on the findings of this study, the following recommendation was made: Because controlling outbreaks requires significant cooperation from knowledgeable and skilled healthcare providers, ongoing campaigns to increase nurses' knowledge are essential.

Ethical considerations

An approval was being taken from the Research Ethics Committee of the faculty of nursing, Benha University. An official permission was granted by submission of an official letter from the Faculty

of Nursing to the responsible authorities of the study setting to obtain their permission for data collection.

Consent

The study protocol was explained to all participants, and written informed consent was taken from all before clinical examination or evaluation procedures.

References:

- (1) World Health Organization: Monkeypox. https://www.who.int/news-room/questions-and-answers/item/monkeypox?gclid=EAIaIQobChMIqs291-Oj-wIVwutRCh35jwAWEAAAYASABEgIkwpD_BwE. 2022.
- (2) Sklenovská N, Ranst M. Emergence of Monkeypox as the Most Important Orthopoxvirus Infection in Humans. *Front public health*. 2018; 6: 241.
- (3) Alakunle E, Moens U, Nchinda G, Okeke M. Monkeypox Virus in Nigeria: Infection Biology, Epidemiology, and Evolution. *Viruses*. 2020; 12(11): 1257.
- (4) Pan American Health Organization. Monkeypox. <https://www.paho.org/en/monkeypox>. 2020.
- (5) McCollum A, Damon I. Human monkeypox. *Clin Infect Dis*. 2014; 58(12): 1792
- (6) Salim N, Septadina I, Permata M, Hudari H. Knowledge, Attitude, and perception of anticipating 2022 global human monkeypox infection among internal medicine residents at Palembang Indonesia: an online survey. *Journal Kedokteran dan Kesehatan*. 2022; 9(3).
- (7) Moore M, Rathish B, Zahra F. Monkeypox. 2022. <https://www.ncbi.nlm.nih.gov/books/NBK574519/>
- (8) Baack S, Alfred D. Nurses' preparedness and perceived competence in managing disasters. *J. Nurs. Scholarsh*. 2013; 45: 281–287.
- (9) World Health Organization: First case of monkeypox reported in WHO's Eastern Mediterranean Region. <https://www.emro.who.int/media/news/first-case-of-monkeypox-reported-in-whos-eastern-mediterranean-region.html>, 2022.
- (10) Ibrahim P, Abdulrahman D, Ali H. The 2022 monkeypox outbreak-Special attention to nurses' protection should be a top priority. *Ann Med Surg (Lond)*. 2022; 82: 104615.
- (11) Alshahrani N, Mitra S, Alkuwaiti A, Alhumam M, Altmimi S, Alamri M, Albalawi Z, et al. Medical students' perception regarding the reemerging monkeypox virus: An institution-based cross-sectional study from Saudi Arabia. *Cureus*. 2022; 14(8): e28060, doi 10.7759/cureus.28060.
- (12) Nemati M, Ebrahimi B, Nemati F. Assessment of Iranian nurses' knowledge and anxiety toward COVID-19 during the current outbreak in Iran. *Arch Clin Infect Dis*. 2020; 15(COVID-19): e102848.
- (13) Yousef Y, Elashirb U, Mahmoudc S, Maghraby N. The effect of nursing educational program on knowledge and practice of nurses regarding infection control measures for children under hemodialysis. *Egyptian Nursing Journal*. 2022; 16(1): doi: 10.4103/2090-6021.257964.
- (14) EL-Shafey S, El-Dakhkhny A, Mohammed B. Effect of an educational training program for nurses about infection control precautions in their practice in the pediatric critical care. *Afro-Egypt J Infect Endem Dis*. 2019; 9(1): 20-30

- (15) AbdElAziz M, Abdelhafez N, Sayed S. Effect of nursing educational program on nurses' knowledge and practices regarding pandemic Covid-19 in isolation unit. *Egyptian Journal of Health Care*. 2021; 12 (4): 248- 263.
- (16) Saadeh D, Sacre H, Hallit S, et al. Knowledge, attitudes, and practices toward the coronavirus disease (COVID-19) among nurses in Lebanon. *Perspectives in Psychiatric Care*. 2020; doi: 10.1111/ppc.12676
- (17) Strautmann A, Allers K, Fassmer A, Hoffmann F. Nursing home staffs perspective on end-of- life care of German nursing home residents: A cross- sectional survey. *BMC palliative care*. 2020; 19(1): 1-9.
- (18) Almohammed O, Aldwihi L, Alragas A, Almoteer A, Gopalakrishnan S, Alqahtani N. Knowledge, Attitude, and practices associated with COVID-19 among healthcare workers in hospitals: A cross-sectional study in Saudi Arabia. *Frontiers in public health*. 2021; 9, doi: 10.3389/fpubh.2021.643053
- (19) Mahmoud F, Abozead S, Ahmed G. A survey study: Nurses' knowledge and attitude regarding hepatitis C virus. *Assiut scientific nursing journal*. 2022; 10(3): 1-10.
- (20) Malik A, Winters M, Omer S. Attitudes of the US general public towards monkeypox. 2022; doi: <https://doi.org/10.1101/2022.06.20.22276527>.
- (21) Alshahrani N, Algethami M, Alarifi A, Alzahrani F, Sheerah H, Abdelaal A, Morales N. Knowledge and Attitude regarding monkeypox virus among physicians in Saudi Arabia, a cross-sectional study. *Vaccine*. 2022; 39(22): 3067–3080.
- (22) Ibrahim K, Moshref H, Moshref H, Walid B, Alsati S. Knowledge and attitudes towards Zika virus among medical students in King Abdulaziz University, Jeddah, Saudi Arabia. *J Infect Public Health*. 2018; 11: 18-23.
- (23) Mahmoud S, Ibrahim M. Effect of educational sessions about coronavirus disease 2019 (covid-19) on knowledge, practice and attitudes of nurses in Zagazig fever hospital. *American journal of nursing research*. 2021; 9 (4): 133-142.
- (24) Hsiao B, Ya-Ling Tzeng Y, Lee K, Lu S, Lin Y. Impact of an educational program on improving nurses' management of fever: An Experimental study. *Healthcare*. 2022; 10: 1135.
- (25) Sallam M, Al-Mahzoum K, Al-Tammemi A, Alkurtas M, Mirzaei F, Kareem N, et al. Assessing healthcare workers' knowledge and their confidence in the diagnosis and management of human Monkeypox: A Cross-sectional study in a Middle Eastern Country. *Healthcare*. 2022; 10: 1722.
- (26) Francis D, Wongsin U, Chien S, Hsu Y, Lohmeyer F, Jian W, Li-Fong Lin L, Iqbal U. Assessment of knowledge, attitudes, and practices towards Zika virus among healthcare workers in St. Kitts. *BMC Infectious Diseases*. 2021; 21: 237.
- (27) Riccò M, Ferraro P, Camisa V, Satta E, Zaniboni A, Ranzieri S, et al. When a Neglected Tropical Disease Goes Global: Knowledge, Attitudes and Practices of Italian Physicians towards Monkeypox, Preliminary Results. *Tropical medicine infectious disease*. 2022; 7: 135.