Effect of Educational Sessions on Marburg Viral Infection at Fever and Chest Outpatient Clinics in Mansoura Hospitals

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Abstract

Background: The recent spread of human Marburg viral infection outbreaks has posed a new public health challenge, underscoring the importance of conducting studies to enhance our understanding of infectious diseases and contribute to sustainable development goals**. Aim:** This study aimed to assess the effect of educational sessions on Marburg viral infection at Fever and Chest outpatient clinics in Mansoura Hospitals**. Design**: A quasi-experimental design with pre- and post-tests was employed for this research**. Setting:** The research was conducted at Fever and Chest outpatient and emergency clinics in Mansoura hospitals**. Sampling**: A convenience sample of 80 nurses, comprising 50 from Chest Hospital and 30 from Fever Hospital, was included**. Data Collection Tools**: Two instruments were used. Tool (I) consisted of a self-administered questionnaire divided into three sections: Nurses' characteristics, their knowledge, and practices related to Marburg viral infection. Tool (II) assessed nurses' attitudes toward Marburg viral infection**. Results**: Initially, 12.5% of the participating nurses demonstrated good knowledge about Marburg viral infection, which improved to 76.3% after the educational intervention. Furthermore, the overall level of practices increased from 47.5% pre-sessions to 87.5% post-implementation, with a slight decrease to 77.5% during follow-up. Similarly, the level of nurses' attitudes exhibited a positive change, with Positive Attitudes among 15% of nurses pre-intervention, increasing to 81.3% post-intervention ($p<0.001$). **Conclusion**: The implementation of educational sessions resulted in enhanced knowledge, practices, and attitudes of nurses regarding Marburg viral infection. Post-test scores for knowledge, practices, and attitudes were higher compared to pre-test scores**. Recommendations**: Continuous educational interventions are crucial to further enhance nurses' knowledge and practices, as effective outbreak control requires collaborative efforts from skilled healthcare professionals.

Keywords: Marburg Viral Infection, Educational Sessions, Fever Hospital, Chest Hospital, Nurses.

Introduction

Marburg Viral Infection (MVI) was initially identified in 1967 during an outbreak in Germany and the former Yugoslavia, which was linked to contact with monkeys imported from Uganda. The virus is capable of transmission from bats to humans through prolonged exposure to mines and caves inhabited by bat colonies, as well as through contact with bat saliva, feces, and contaminated fruits. Notably, in 2009, researchers managed to isolate MVI from healthy Egyptian fruit bats that were captured from a mine in Uganda **(European Center for Disease Prevention and Control, 2019).**

The etiological agent responsible for MVI is the Lake Victoria Marburg virus, a filovirus akin to the Ebola virus **(Gordon et al., 2019)**. Marburg hemorrhagic fever can be transmitted both from animals to humans and from human to human through direct contact with infected individuals' blood, secretions, or bodily fluids. Additionally, transmission can occur through contact with contaminated surfaces and materials like bed sheets and clothing that have been exposed to these fluids and secretions. Viral transmission is possible during the handling of a deceased infected body, and there are indications that sexual transmission is feasible, as the virus has been detected in the semen of a previously infected client. It is advised for male survivors of MVI to practice safer sex after 12 months or until their semen tests negative **(World Health Organization, 2022).**

Over the past two decades, the Marburg virus has gained notoriety due to its high fatality rates and its potential for widespread transmission. With the expansion of global transportation and international trade, the risk of the disease spreading globally has become a realistic concern. Nurses must be well-informed about the potential risks associated with Marburg hemorrhagic fever, capable of recognizing its symptoms, and knowledgeable in its management and prevention **(Bebell and Riley, 2015)**.

Following an incubation period of 3 to 10 days, Marburg hemorrhagic fever manifests suddenly with symptoms such as high fever, chills, severe frontal headache, and myalgia. Around the fifth day after symptom onset, maculopapular rashes may appear, predominantly on the trunk (chest, back, stomach), accompanied by nausea, vomiting, diarrhea, abdominal pain, chest pain, and sore throat. The rash's characteristics can range from absent or transient to nonspecific or petechial. Hemorrhagic manifestations include bleeding from the nose, lungs, stomach, or gums. Symptoms can escalate in severity, leading to jaundice, pancreatitis, weight loss, delirium, shock, liver failure, and multi-organ dysfunction. Death often occurs 6 to 9 days after symptoms appear. Recovery from the disease can be prolonged and may be accompanied by complications like orchitis, hepatitis, transverse myelitis, uveitis, or parotitis. During the previous major outbreak in the Democratic Republic of the Congo from 1998 to 2000, the fatality rate reached 83%. In comparison, Ebola hemorrhagic fever exhibits fatality rates ranging from 53% to 88%, contingent on the virus strain. Person-to-person transmission risk heightens during the later stages of the disease **(Feldmann, 2023).**

Laboratory assessment of suspected cases should encompass complete blood cell counts alongside liver function tests, urinalysis, chemistry, blood cultures, and urine cultures. Leukopenia and thrombocytopenia can heighten vulnerability to viral hemorrhagic fever, although these findings are nonspecific. Blood cultures might aid in diagnosing bacterial infections, while a peripheral blood smear can help rule out malaria. Diagnostic methods such as polymerase chain reaction (PCR), virus isolation, enzyme-linked immunosorbent assay (ELISA), and IgM capture ELISA tests can confirm the diagnosis within a few days after symptom onset, though their availability is not universal. Often, the disease is confirmed well after an initial emergency department visit **(Okonji et al., 2022)**

Community health nurse tending to clients suspected or confirmed to have the Marburg virus should implement additional infection control measures to prevent contact with the individual's blood, bodily fluids, and contaminated surfaces or materials, including clothing and bedding. Healthcare workers in close proximity (within 1 meter) of MVI clients should wear a face shield (or a medical mask and goggles), a clean, non-sterile long-sleeved gown, and gloves. Laboratory workers are also at risk. Specimens from humans and animals for Marburg infection investigation must be handled by trained personnel and processed in adequately equipped laboratories **(Anywaine et al., 2022)**

Significance of the study:

Education and knowledge regarding MVI play a pivotal role in fostering a sense of preparedness and safety among both clients and their families. Frequent educational initiatives led by nurses can significantly enhance the effectiveness of preventive measures against MVI. By augmenting awareness about MVI in Egypt and other affected nations, a substantial reduction in the number of infections could be achieved. The primary objective is to curtail the outbreak of the disease, prioritizing prevention over treating already infected individuals. This objective is achieved through disseminating information concerning the signs, symptoms, and modes of transmission of MVI **(Kortepeter et al., 2020).**

Currently, the educational landscape is characterized by fluctuation and instability, with sporadic and discontinuous educational efforts. Consequently, the dissemination of knowledge about MVI is uneven. To address this, the establishment of dedicated educational nurses to conduct mandatory MVI courses across various hospital departments could effectively elevate staff members' understanding of the disease. By enhancing nurses' knowledge in educational techniques and client-focused teaching methodologies, the transmission of infectious diseases can be notably diminished **(World Health Organization, 2022)**. This approach underscores the crucial role of nurses not only in direct client care but also in the broader scope of public health awareness and disease prevention**.**

Aim of the study:

This study aimed to assess the effect of educational sessions on Marburg viral infection at Fever and Chest outpatient clinics in Mansoura Hospitals. To achieve this overarching goal, the following specific objectives were pursued:

1. To determine the level of knowledge among nurses regarding Marburg viral infection before and after participating in nursing education sessions.
2. To assess nurses' attitudes toward Marburg viral infection prior to and following the nursing educational sessions.
3. To evaluate the practices of nurses concerning Marburg viral infection before and after the nursing educational sessions.
4. To implement and subsequently evaluate the effectiveness of an educational intervention aimed at enhancing nurses' knowledge and attitudes regarding Marburg viral infection.

1.1. Hypotheses for the Research:

H1: The knowledge scores of nurses regarding Marburg viral infection will show improvement following the nursing education intervention.

H2: Nurses' practices related to Marburg viral infection will exhibit enhancement due to the nursing education intervention.

H3: Nurses' attitudes toward Marburg viral infection will positively transform after the nursing education intervention.

Subjects and methods

Design of the study:

A quasi-experimental research design was employed to fulfill the study's objectives.

Setting:

The study was conducted at Fever and Chest outpatient and emergency clinics in Mansoura hospitals.

Sampling:

A total of 80 nurses were included in the study, with 30 from Fever Hospital and 50 from Chest Hospital. These nurses work in outpatient and emergency clinics that operate seven days a week, catering to a weekly average of 250 to 270 clients.

The data collection process of this research involved the utilization of two tools:

Tool I: A self-administered questionnaire was meticulously developed through an in-depth review of pertinent literature. This questionnaire consisted of three distinct sections:

- **Part A:** This section comprises 8 questions designed to capture the characteristics of the participating nurses. These questions encompassed closed-ended inquiries concerning age, gender, marital status, educational level, years of experience, hospital affiliation, and prior attendance of training programs related to Marburg's disease.
- **Part B:** To assess the nurses' knowledge regarding Marburg viral infection, a self-administered questionnaire was employed. This questionnaire, shaped by the researchers' insights and guided by **Oladimeji et al. (2015)**, consisted of 36 questions. These questions were distributed as follows: 2 questions elucidated the definition of Marburg viral infection, 1 question delved into the incubation period, 7 questions focused on the signs and symptoms, 10 questions examined the modes of transmissions, 6 questions addressed infection control precautions within hospitals and healthcare settings, 5 questions covered complications, 1 question tackled vaccinations, and 4 questions encompassed treatment aspects.

Scoring system:

When it comes to assessing knowledge, we classify scores as follows**:**

- Scores below 50% are categorized as poor**.**
- Scores ranging from 50% to 65% are deemed fair**.**
- Scores surpassing 65% are regarded as good.

- **Part C:** This section includes an additional 15 questions tailored to evaluate nurses' practical knowledge about Marburg viral infection. The development of this tool was informed by the researchers and guided by **Jalloh et al. (2017)**. The questions covered two domains: precautions measures for preventing the spread of Marburg viral infection to other clients and actions related to suspected Viral Hemorrhagic fever cases. For example, questions encompassed measures such as hand hygiene, glove usage, mask and protective goggle utilization, safe disposal of waste, disinfection of medical equipment, and proper identification of suspect cases.
- **Scoring System:** for Practical Knowledge: Scores below 60% are categorized as poor,

while scores of 60% or higher are considered good.

Tool II: A self-administered questionnaire was employed to ascertain the attitudes of nurses towards Marburg viral infection. This questionnaire utilized a Likert scale and was developed by the researchers, and guided by **Ristanović et al. (2020).** The questionnaire included 13 statements graded on a three-point Likert scale (Agree, Neutral, Disagree). These statements explored nurses' opinions and attitudes regarding Marburg viral disease. Statements touched upon various aspects, such as the perceived ability to control the disease, opinions on Egypt's capability to manage the virus, thoughts on media coverage, interest in learning more about emerging diseases, and concerns about traveling to regions with Marburg virus.

Scoring system:

For Attitudes: Scores below 60% are classified as negative, while scores of 60% or higher are deemed positive.

Tools developments:

The researchers made some modifications on the tools after reviewing recent literature

Content Validity and Reliability:

For assessing content validity, the present study underwent evaluation by of five academic nursing experts specialized in Community Health Nursing and Medical Surgical Nursing at Zagazig University's Faculty of Nursing. These experts scrutinized the study's content for appropriateness and clarity, providing valuable recommendations for refinement. The suggested modifications were subsequently incorporated into the study materials.

Furthermore, to measure the internal consistency of the questionnaires, Cronbach's alpha values were calculated. The Cronbach's alpha values for the different domains, these were as follows: 0.897 for nurses' knowledge, 0.891 for nurses' attitudes, and 0.902 for nurses' practices. These alpha values indicate strong internal consistency, suggesting that the questions within each domain of the questionnaires were reliably measuring the intended constructs.

Ethical Considerations:

Upon being provided with a clear explanation of the study's objectives, the nurses expressed their willingness to participate and before initiating the data collection process, they were thoroughly briefed about the study's purpose and its overall nature. They were explicitly informed about their right to decline participation or withdraw from the study at any stage or giving any reasons without any obligations. Furthermore, a crucial emphasis was placed on maintaining the confidentiality of the information they provided, ensuring that the collected data would be used solely for research purposes.

It is important to underscore that participation in this study was entirely voluntary, and the researchers took measures to preserve the anonymity of the participants by encoding their data. The study received ethical approval from the Human Research Ethics Committee of the Faculty of Nursing at Zagazig University on January 1, 2023. This ethical clearance validated the study's adherence to ethical standards and the safeguarding of participants' rights and confidentiality.

Fieldwork:

The researchers carried out the study in the following manner:

Pilot study:

Prior to initiating the primary study, a pilot study was conducted involving 8 nurses from the Chest hospital. These participants were subsequently excluded from the main study sample. The pilot study served multiple purposes, including providing valuable insights into the questionnaire administration process and aiding the researchers in estimating the time needed for participants to complete the forms.

The comprehensive data collection process spanned duration of approximately seventh months, commencing in beginning January 2023 and concluding in end of the July 2023. This extensive timeframe enabled the researchers to effectively collect data from the participants and ensure the accuracy and reliability of the findings.

Program Implementation:

The educational intervention for nurses at Chest and Fever hospitals in Mansoura was executed through the following sequential phases:

I. Assessment Phase (Pre-intervention Phase):

Upon obtaining permission to proceed with the study, the researchers visited the study settings and introduced the study's purpose to the participating nurses. The initial interaction involved the researchers introducing themselves, explaining the study's aim and nature concisely, and assuring the nurses that any obtained information would remain strictly confidential and exclusively utilized for research purposes.

II. Planning Phase:

Guided by a comprehensive literature review, the characteristics of the sample, and the outcomes of the assessment phase, the researchers developed the content for the intervention sessions. Additionally, an illustrated learning booklet was developed and reviewed for accuracy. This booklet was subsequently distributed to nurses at both Chest and Fever hospitals in Mansoura, intended to serve as a self-learning and reference after the intervention guide. The educational sessions emphasized raising awareness about MVI, its significance, and its signs and symptoms. The educational intervention followed the subsequent steps:

a. Setting the Program Objectives:

General objective: To evaluate the impact of educational sessions on Marburg viral infection on nurses' performance by enhancing their satisfactory the knowledge, adequate practices, and positive attitudes at Fever and Chest hospitals in Mansoura City.

Specific objectives: After implementing this study, nurses from both Fever and Chest hospitals in Mansoura City should be able to:

- Define Marburg viral infection.
- Discuss the modes of transmission of Marburg viral infection.
- Identify high-risk groups for Marburg viral infection.
- Describe the incubation period of Marburg viral infection.
- Enumerate the signs and symptoms of Marburg viral infection.
- Explain the diagnosis of Marburg viral infection.
- Discuss the complications of Marburg viral infection.
- Describe prevention and practice methods for Marburg viral infection.
- Discuss the treatment of Marburg viral infection.
- Explain the role of nurses in managing Marburg viral infection.
- Foster positive attitudes among nurses toward Marburg viral infection.

III. Implementation Phase:

All participating nurses underwent the health education intervention. The intervention was delivered using a question-and-answer approach to encourage active participation. The sessions concentrated on enhancing nurses' satisfactory knowledge, adequate practice, and positive attitudes toward MVI. Additionally, details about the incubation period, the abrupt onset of Marburg hemorrhagic fever (characterized by high fever, chills, severe frontal headache, and myalgia), and the appearance of maculopapular rashes around the fifth day were conveyed. A PowerPoint presentation supplemented this information, followed by group discussions to reinforce comprehension. Furthermore, the researchers emphasized that controlling MVI outbreaks necessitates a combination of case identification, contact tracing, client isolation, and laboratory diagnosis. The complexity of clinically diagnosing MVI early is due to symptoms overlap with other tropical diseases (such as malaria, rickettsial infections, and typhoid fever) was also highlighted.

Moreover, the researchers underscored the importance of reducing the risk of human-to-human transmission by minimizing direct or close contact with infected clients' bodily fluids. Wearing gloves and appropriate personal protective equipment was emphasized when caring for clients and the necessity of hand hygiene after visiting sick relatives in the hospital or providing care at home was highlighted. Additionally, measures to contain the outbreak, including safe burial practices, contact tracing, and maintaining good hygiene and a clean environment, were discussed. During this phase, nurses were encouraged to provide feedback to enhance their knowledge, practice, and attitudes. Brochures containing visually appealing images and clear, concise information were distributed in booklet form, acting as a reference guide following the intervention.

The educational intervention comprised five theoretical sessions and three practical sessions at each hospital, totaling ten theoretical sessions and six practical sessions. Each session lasted between 30 to 45 minutes, inclusive of discussion periods. Post-tests were administered immediately following the intervention.

IV. Evaluation Phase:

The evaluation phase was conducted twice: one month after the intervention (March 2023) and three months later (July 2023). Utilizing the same tools, the researchers assessed the program's efficacy by comparing variances between pre-intervention, post-intervention, and follow-up test results. This evaluation enabled the researchers to gauge the improvement in the participants' knowledge, practices, and attitudes regarding Marburg viral infection as a result of the educational intervention.

Statistical Design

All statistical analyses were performed using SPSS for windows version 20.0 (SPSS, Chicago, IL). Continuous data were normally distributed and were expressed in mean ±standard deviation (SD). Categorical data were expressed in number and percentage. Chi-square test (or fisher's exact test when applicable) was used for comparison of variables with categorical data. The reliability (internal consistency) test for the questionnaires used in the study was calculated. Statistical significance was set at $p<0.05$.

Results:

Table 1 provides a breakdown of the study sample's demographic characteristics. Among the participants, 82.5% were females, and 53.8% fell within the age range of 25 to 30 years. Moreover, 41.3% of the participants had received nursing education at the institute level, and 83.8% were married. In terms of professional experience, 36.3% had accumulated 5 to <10 years of experience. Additionally, the highest percentage, accounting for 62.5% of the participants, was affiliated with Chest Hospital in Mansoura.

Table 2 reveals notable improvements in all domains of knowledge following the implementation of the educational program. The percentage of the study sample correctly identifying the definition of Marburg viral disease increased from 27.5% before the program to 86.3% post-intervention and slightly decreased to 81.3% three months after follow-up. A substantial shift was observed in the understanding of the mode of transmission, where the proportion of participants with accurate knowledge increased from 30% pre-program to 86.3% post-program, and then to 75% at the follow-up stage. This shift was consistent among both male and female nurses, and the differences were statistically significant ($X^2 = 51.998$, $p < 0.001$). Moreover, the domain with the highest level of knowledge after the intervention pertained to the complications of Marburg hemorrhagic fever, where 88.8% of participants demonstrated understanding. This was closely followed by knowledge of the treatment of Marburg hemorrhagic fever, which stood at 90.0% among male and female nurses. This difference was statistically significant ($X^2 = 66.788$, $p < 0.001$).

Figure (1) visually represents the distribution of knowledge levels among the studied nurses. Prior to the intervention, only 12.5% of the nurses exhibited a good level of knowledge. However, this proportion significantly increased to 76.3% following the intervention. Subsequently, during the follow-up period, the percentage of nurses with a good level of knowledge slightly decreased to 66.3%.

Table (3) presents the distribution of attitude levels among the studied nurses. Prior to the intervention, only 15% of the nurses demonstrated a positive attitude. Following the intervention, this percentage significantly increased to 81.3%. However, during the follow-up period, the proportion of nurses with a positive attitude slightly decreased to 73.8%, with high statistically significant differences ($X^2 = 70.323$, $p < 0.001$).

Table (4) highlights the variations in different domains of practices concerning Marburg Viral Infection among nurses across the study phases. Notably, highly statistically significant differences were observed in all domains of practices throughout the study phases, with a p-value less than 0.001. The total level of practices displayed a notable improvement, rising from 47.5% during the pre-intervention phase to 87.5% post-implementation. However, there was a slight decline to 77.5% during the follow-up phase.

Table (5) outlines the statistical relationships observed between nurse's scores for total knowledge and education in the post-intervention and follow-up phases, with X^2 values of 28.892 ($P < 0.001$) and 20.470 ($P = 0.002$) respectively. Additionally, significant correlations were identified between nurses' knowledge scores in the post-intervention and follow-up periods and their years of experience, with X^2 values of 13.735 ($P = 0.032$) and 20.620 ($P = 0.002$) respectively.

Table (6) demonstrates the highly statistically significant relationships observed between nurse's scores for total attitude and education in the post-intervention and follow-up phases, with X^2 values of 21.267 (P < 0.001) and 41.422 (P < 0.001) respectively. Moreover, significant correlations were identified between nurses' attitude scores in the post-intervention and follow-up periods and their years of experience, with X^2 values of 12.444 (P = 0.006) and 14.562 (P = 0.002) respectively.

Table (7) outlines the statistically significant relationships observed in the study. There was a significant correlation between nurses' post-intervention scores for total practice and their marital status, with an X^2 value of 4.737 (P = 0.030). Furthermore, significant differences were noted between nurses' practice scores in the post-intervention and follow-up phases and their education levels, with X^2 values of 18.323 (P < 0.001) and 26.582 (P < 0.001) respectively. Additionally, statistically significant correlation were found between nurses' practice scores in the post-intervention and follow-up phases and their years of experience, with X^2 values of 12.338 (P = 0.001) and 11.487 (P = 0.009) respectively.

Table (8) shows the statistical relationships identified in the study. The total level of knowledge scores in the post-intervention and follow-up periods demonstrated statistically significant correlations with positive attitudes, with X^2 values of 9.285 (P = 0.009) and 18.140 (P < 0.001) respectively. Additionally, the nurse's knowledge score in the post-intervention and follow-up periods exhibited statistically significant correlations with their practice scores, with X^2 values of 33.521 (P < 0.001) and 19.623 (P < 0.001) respectively.

Table (1): Frequency distribution of the demographic characteristics among the studied sample (n=80)

Demographic characteristics	N	%
Age (years)		
< 25	6	7.5
25 – <30	43	53.8
30 –< 35	16	20.0
35+	15	18.8
Mean ±SD	30.25 ±5.26	
Gender		
Male	14	17.5
Female	66	82.5
Marital status		
Married	67	83.8
Single	13	16.3
Educational level		
Secondary nursing	13	16.3
Institute nursing	33	41.3
BSc	26	32.5
Master	8	10.0
Experience (Years)		
< 5	26	32.5
5 – <10	29	36.3
10 – <15	11	13.8
15+	14	17.5
Hospital Ward		
Chest	50	62.5
Fever	30	37.5

Table (2): Frequency distribution of the knowledge domains and total score among the studied sample (n=80)

Knowledge Domains	Pre – Intervention				Post – Intervention				Follow – Up				Chi – Square			
	Incorrect		Correct		Incorrect		Correct		Incorrect		Correct		(Pre / Post)		(Pre / Follow)	
	N	%	N	%	n	%	N	%	N	%	n	%	X^2	P	X^2	P
Definition	58	72.5	22	27.5	11	13.8	69	86.3	15	18.8	65	81.3	56.289	<0.001**	46.581	<0.001**
Incubation period	56	70.0	24	30.0	13	16.3	67	83.8	18	22.5	62	77.5	47.115	<0.001**	36.304	<0.001**
Sign and symptoms	62	77.5	18	22.5	13	16.3	67	83.8	20	25.0	60	75.0	60.260	<0.001**	44.127	<0.001**
Mode of transmission	56	70.0	24	30.0	11	13.8	69	86.3	20	25.0	60	75.0	51.998	<0.001**	32.481	<0.001**
Precautions infection control in hospital	63	78.8	17	21.3	9	11.3	71	88.8	15	18.8	65	81.3	73.636	<0.001**	57.636	<0.001**
Complication	59	73.8	21	26.3	7	8.8	73	91.3	19	23.8	61	76.3	69.735	<0.001**	40.025	<0.001**
Vaccination	62	77.5	18	22.5	13	16.3	67	83.8	15	18.8	65	81.3	60.260	<0.001**	55.302	<0.001**
Treatment	59	73.8	21	26.3	8	10.0	72	90.0	21	26.3	59	73.8	66.788	<0.001**	36.098	<0.001**

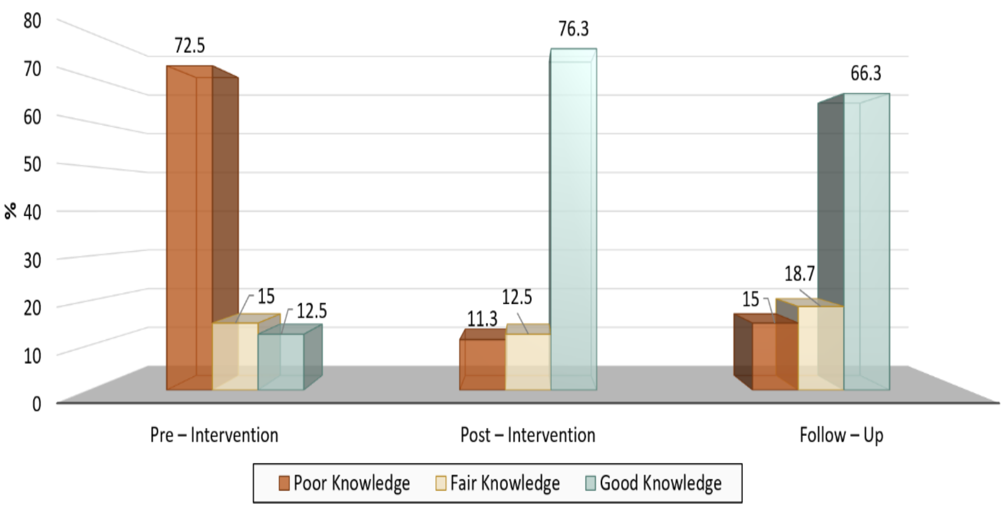

Figure (1). Frequency distribution of the knowledge total score among the studied sample **(n=80)**

Table (3): Frequency distribution of the attitude total score among the studied sample **(n=80)**

Attitude	Pre – Intervention		Post – Intervention		Follow – Up		Chi – Square (Pre / Post)		Chi – Square (Pre / Follow)	
	N	%	N	%	n	%	X^2	P	X^2	P
Negative Attitude	68	85.0	15	18.8	21	26.2				
Positive Attitude	12	15.0	65	81.3	59	73.8	70.323	<0.001**	55.932	<0.001**

Table (4): Frequency distribution of the practice level among the studied sample

Practice Domains	Pre – Intervention				Post – Intervention				Follow – Up				Chi – Square			
	Poor Practice		Good Practice		Poor Practice		Good Practice		Poor Practice		Good Practice		(Pre / Post)		(Pre / Follow)	
	No	%	No	%	No	%	No	%	No	%	No	%	X^2	P	X^2	P
Taking precautions in my daily clinical practice	39	48.8	41	51.3	12	15.0	68	85.0	20	25.0	60	75.0	20.982	<0.001**	9.692	0.002*
Executing tasks when Identifying Viral Hemorrhagic	45	56.3	35	43.8	9	11.3	71	88.8	17	21.3	63	78.8	36.226	<0.001**	20.645	<0.001**
Following measures when Identifying Viral Hemorrhagic	43	53.8	37	46.3	11	13.8	69	86.3	19	23.8	61	76.3	28.623	<0.001**	15.167	<0.001**
Practice Total Level	42	52.5	38	47.5	10	12.5	70	87.5	18	22.5	62	77.5	81.339	<0.001**	60.260	<0.001**

Table (5): Association between socio-demographic characteristics and total knowledge level

Variables	Pre – Intervention						Post – Intervention						Follow – Up					
	Poor (n=58)		Fair (n=12)		Good (n=10)		Poor (n=9)		Fair (n=10)		Good (n=61)		Poor (n=12)		Fair (n=15)		Good (n=53)	
	N	%	N	%	N	%	n	%	N	%	n	%	n	%	n	%	n	%
Age (years)																		
< 25	6	10.3	0	0.0	0	0.0	1	11.1	0	0.0	5	8.2	0	0.0	0	0.0	6	11.3
25 – >30	29	50.0	9	75.0	5	50.0	7	77.8	5	50.0	31	50.8	7	58.3	10	66.7	26	49.1
30 – >35	11	19.0	2	16.7	3	30.0	0	0.0	4	40.0	12	19.7	2	16.7	2	13.3	12	22.6
35+	12	20.7	1	8.3	2	20.0	1	11.1	1	10.0	13	21.3	3	25.0	3	20.0	9	17.0
Chi – Square	X^2=4.879, P=0.559						X^2=6.741, P=0.345						X^2=4.722, P=0.580					
Gender																		
Male	11	19.0	2	16.7	1	10.0	1	11.1	3	30.0	10	16.4	3	25.0	0	0.0	11	20.8
Female	47	81.0	10	83.3	9	90.0	8	88.9	7	70.0	51	83.6	9	75.0	15	100.0	42	79.2
Fisher's exact test	X^2=0.482, P=0.786						X^2=1.388, P=0.499						X^2=4.038, P=0.133					
Marital Status																		
Married	49	84.5	10	83.3	8	80.0	9	100.0	8	80.0	50	82.0	10	83.3	13	86.7	44	83.0
Single	9	15.5	2	16.7	2	20.0	0	0.0	2	20.0	11	18.0	2	16.7	2	13.3	9	17.0
Fisher's exact test	X^2=0.128, P=0.938						X^2=1.992, P=0.369						X^2=0.116, P=0.944					
Educational Level																		
Secondary nursing	11	19.0	1	8.3	1	10.0	6	66.7	4	40.0	3	4.9	6	50.0	2	13.3	5	9.4
Institute nursing	25	43.1	7	58.3	1	10.0	3	33.3	3	30.0	27	44.3	6	50.0	5	33.3	22	41.5
BSc	16	27.6	3	25.0	7	70.0	0	0.0	3	30.0	23	37.7	0	0.0	8	53.3	18	34.0
Master	6	10.3	1	8.3	1	10.0	0	0.0	0	0.0	8	13.1	0	0.0	0	0.0	8	15.1
Chi – Square	X^2=9.237, P=0.160						X^2=28.892, P<0.001**						X^2=20.470, P=0.002*					
Experience (Years)																		
< 5	18	31.0	3	25.0	5	50.0	6	66.7	5	50.0	15	24.6	6	50.0	5	33.3	15	28.3
5 – 10	22	37.9	5	41.7	2	20.0	3	33.3	5	50.0	21	34.4	6	50.0	10	66.7	13	24.5
10 – 15	6	10.3	3	25.0	2	20.0	0	0.0	0	0.0	11	18.0	0	0.0	0	0.0	11	20.8
> 15	12	20.7	1	8.3	1	10.0	0	0.0	0	0.0	14	23.0	0	0.0	0	0.0	14	26.4
Chi – Square	X^2=5.172, P=0.522						X^2=13.735, P=0.032*						X^2=20.620, P=0.002*					
Hospital Ward																		
Chest	38	65.5	8	66.7	4	40.0	7	77.8	5	50.0	38	62.3	7	58.3	8	53.3	35	66.0
Fever	20	34.5	4	33.3	6	60.0	2	22.2	5	50.0	23	37.7	5	41.7	7	46.7	18	34.0
Fisher's exact test	X^2=2.474, P=0.290						X^2=1.564, P=0.457						X^2=0.910, P=0.635					

Table (6): Association between socio-demographic characteristics and total attitude level

Variables	Pre – Intervention				Post – Intervention				Follow – Up			
	Negative (n=68)		Positive (n=12)		Negative (n=15)		Positive (n=65)		Negative (n=21)		Positive (n=59)	
	N	%	N	%	N	%	N	%	n	%	n	%
Age (years)												
< 25	3	4.4	3	25.0	2	13.3	4	6.2	1	4.8	5	8.5
25 – 30	37	54.4	6	50.0	7	46.7	36	55.4	13	61.9	30	50.8
30 – 35	15	22.1	1	8.3	3	20.0	13	20.0	4	19.0	12	20.3
> 35	13	19.1	2	16.7	3	20.0	12	18.5	3	14.3	12	20.3
Fisher's exact test	X^2=6.795, P=0.079				X^2=1.025, P=0.795				X^2=0.953, P=0.813			
Gender												
Male	10	14.7	4	33.3	4	26.7	10	15.4	3	14.3	11	18.6
Female	58	85.3	8	66.7	11	73.3	55	84.6	18	85.7	48	81.4
Fisher's exact test	X^2=2.451, P=0.117				X^2=1.074, P=0.300				X^2=0.204, P=0.652			
Marital Status												
Married	58	85.3	9	75.0	13	86.7	54	83.1	18	85.7	49	83.1
Single	10	14.7	3	25.0	2	13.3	11	16.9	3	14.3	10	16.9
Fisher's exact test	X^2=0.794, P=0.373				X^2=0.115, P=0.734				X^2=0.081, P=0.776			
Educational Level												
Secondary nursing	13	19.1	0	0.0	8	53.3	5	7.7	12	57.1	1	1.7
Institute nursing	25	36.8	8	66.7	6	40.0	27	41.5	9	42.9	24	40.7
BSc	23	33.8	3	25.0	1	6.7	25	38.5	0	0.0	26	44.1
Master	7	10.3	1	8.3	0	0.0	8	12.3	0	0.0	8	13.6
Fisher's exact test	X^2=4.789, P=0.188				X^2=21.267, P<0.001**				X^2=41.422, P<0.001**			
Experience (Years)												
< 5	22	32.4	4	33.3	10	66.7	16	24.6	12	57.1	14	23.7
5 – 10	23	33.8	6	50.0	5	33.7	24	36.9	9	42.9	20	33.9
10 – 15	10	14.7	1	8.3	0	0.0	11	16.9	0	0.0	11	18.6
> 15	13	19.1	1	8.3	0	0.0	14	21.5	0	0.0	14	23.7
Fisher's exact test	X^2=1.718, P=0.633				X^2=12.444, P=0.006*				X^2=14.562, P=0.002*			
Hospital Ward												
Chest	44	64.7	6	50.0	9	60.0	41	63.1	15	71.4	35	59.3
Fever	24	35.3	6	50.0	6	40.0	24	36.9	6	28.6	24	40.7
Fisher's exact test	X^2=0.941,P=0.332				X^2=0.049, P=0.824				X^2=0.969, P=0.325			

Table (7): Association between socio-demographic characteristics and total practice level

Variables	Pre – Intervention				Post – Intervention				Follow – Up			
	Poor (n=42)		Good (n=38)		Poor (n=10)		Good (n=70)		Poor (n=18)		Good (n=62)	
	N	%	N	%	N	%	N	%	n	%	n	%
Age (years)												
< 25	4	9.5	2	5.3	2	20.0	4	5.7	3	16.7	3	4.8
25 – 30	20	47.6	23	60.5	6	60.0	37	52.9	11	61.1	32	51.6
30 – 35	7	16.7	9	23.7	1	10.0	15	21.4	3	16.7	13	21.0
> 35	11	26.2	4	10.5	1	10.0	14	20.0	1	5.6	14	22.6
Fisher's exact test	X^2=4.203, P=0.240				X^2=3.502, P=0.320				X^2=5.122, P=0.163			
Gender												
Male	5	11.9	9	23.7	2	20.0	12	17.1	3	16.7	11	17.7
Female	37	88.1	29	76.3	8	80.0	58	82.9	15	83.3	51	82.3
Fisher's exact test	X^2=1.917, P=0.166				X^2=0.049, P=0.824				X^2=0.011, P=0.916			
Marital Status												
Married	37	88.1	30	78.9	6	60.0	61	87.1	13	72.2	54	87.1
Single	5	11.9	8	21.1	4	40.0	9	12.9	5	27.8	8	12.9
Chi – Square / Fisher's exact test	X^2=1.227, P=0.268				X^2=4.737, P=0.030*				X^2=2.268, P=0.132			
Educational Level												
Secondary nursing	8	19.0	5	13.2	6	60.0	7	10.0	9	50.0	4	6.5
Institute nursing	13	31.0	20	52.6	4	40.0	29	41.4	9	50.0	24	38.7
BSc	16	38.1	10	26.3	0	0.0	26	37.1	0	0.0	26	41.9
Master	5	11.9	3	7.9	0	0.0	8	11.4	0	0.0	8	12.9
Fisher's exact test	X^2=3.871, P=0.276				X^2=18.323, P<0.001**				X^2=26.582, P<0.001**			
Experience (Years)												
< 5	11	26.2	15	39.5	8	80.0	18	25.7	10	55.6	16	25.8
5 – 10	15	35.7	14	36.8	2	20.0	27	38.6	8	44.4	21	33.9
10 – 15	5	11.9	6	15.8	0	0.0	11	15.7	0	0.0	11	17.7
> 15	11	26.2	3	7.9	0	0.0	14	20.0	0	0.0	14	22.6
Fisher's exact test	X^2=5.125, P=0.163				X^2=12.338, P=0.006*				X^2=11.487, P=0.009*			
Hospital Ward												
Chest	25	59.5	25	65.8	8	80.0	42	60.0	12	66.7	38	61.3
Fever	17	40.5	13	34.2	2	20.0	28	40.0	6	33.3	24	38.7
Chi – Square / Fisher's exact test	X^2=0.334, P=0.563				X^2=1.493, P=0.222				X^2=0.172, P=0.678			

Table (8): Association between knowledge level with attitude and practice levels

Variables	Pre – Intervention						Post – Intervention						Follow – Up					
	Poor (n=58)		Fair (n=12)		Good (n=10)		Poor (n=9)		Fair (n=10)		Good (n=61)		Poor (n=12)		Fair (n=15)		Good (n=53)	
	N	%	N	%	N	%	N	%	n	%	n	%	n	%	n	%	n	%
Attitude																		
Negative Attitude	47	81.0	11	91.7	10	100.0	5	55.6	2	20.0	8	13.1	9	75.0	4	26.7	8	15.1
Positive Attitude	11	19.0	1	8.3	0	0.0	4	44.4	8	80.0	53	86.9	3	25.0	11	73.3	45	84.9
Fisher's exact test	X^2=2.898, P=0.235						X^2=9.285, P=0.009*						X^2=18.140, P<0.001**					
Practice																		
Poor Practice	28	48.3	6	50.0	8	80.0	6	66.7	3	30.0	1	1.6	8	66.7	5	33.3	5	9.4
Good Practice	30	51.7	6	50.0	2	20.0	3	33.3	7	70.0	60	98.4	4	33.3	10	66.7	48	90.6
Fisher's exact test	X^2=3.478, P=0.176						X^2=33.521, P<0.001**						X^2=19.623, P<0.001**					

Discussion

Marburg hemorrhagic fever (MHF), with its highly contagious and fatal nature, presents a pressing public health challenge. This challenge intersects with sustainable development goals as outlined by the United Nations. Sustainable Development Goal 3, which focuses on ensuring healthy lives and promoting well-being for all at all ages, directly relates to addressing the health risks posed by diseases like MHF. The MHF's impact on healthcare personnel, particularly nurses, and family members caring for patients underscores the need for comprehensive strategies to mitigate its spread. Raising awareness within communities and healthcare providers, especially nurses, about the clinical symptoms of MHF aligns with Sustainable Development Goal 3's objective of strengthening health systems and providing access to quality care.

The present study emphasizes the pivotal role of awareness in enhancing preparedness and prevention efforts. By informing healthcare providers and families about MHF symptoms, early identification becomes possible. This can result in quicker implementation of robust precautions, curbing the transmission of the Marburg virus. Such measures contribute to Sustainable Development Goal 3's aim of reducing the global burden of diseases and preventing avoidable deaths **(Kassa, 2019).**

In the present study, the primary objective of the first research hypothesis in this study, which aimed to assess nurses' knowledge scores regarding Marburg viral infection and the potential improvement after educational intervention, the findings were affirmative. The results revealed a significant enhancement across all knowledge domains following the educational program. The proportion of participants who correctly identified the definition of Marburg viral disease increased considerably from pre-program to post-program assessments. An evident shift in knowledge was also noted regarding the mode of transmission, with a substantial increase from pre to post intervention. Moreover, the highest domain of knowledge in the post-intervention phase pertained to complications of Marburg hemorrhagic fever, followed by treatment, signifying positive outcomes for health professionals. The overall level of knowledge improved significantly, demonstrating the success of the educational program. These findings are consistent with those of a study conducted by **Nyakarahuka et al. (2017) in Uganda,** which found that a significant portion of participants exhibited good knowledge about Marburg virus diseases. These results underscore the importance of well-designed educational interventions in enhancing awareness among healthcare providers.

Similarly, the second research hypothesis of the study aimed to assess the improvement of nurses' practices concerning Marburg viral infection after educational intervention. The study's findings indicated a statistically significant increase in nurses' practices following the educational program, showcasing better adherence to proper practices compared to the pre-intervention phase. These results are congruent with those of the study carried out by **Koo et al. (2016)**, which observed enhanced nursing practices after attending continuing nursing education sessions. Other research studies, including **Ozekcin et al. (2015) and Elasrag et al. (2021),** further supported the notion that nursing education programs have a positive impact on improving knowledge and practices among nurses. Additionally, the positive correlation between nurses' knowledge and practices was demonstrated by **Mahmoud et al. (2022),** which highlights the interconnectedness of knowledge and implementation in healthcare practices.

The third research hypothesis focused on evaluating changes in nurses' attitudes toward Marburg viral infection following educational intervention. The study's outcomes revealed a highly significant difference in attitudes after the educational program. These findings are in line with those of study conducted by **Nyakarahuka et al. (2017) in Uganda**, which observed a majority of participants exhibiting positive attitude towards control and prevention of Marburg virus diseases. This positive shift in attitudes post-intervention suggests that tailored educational interventions can effectively influence healthcare providers' perceptions and approaches towards infectious diseases.

The present study results also identified statistically significant correlations between nurses' post-intervention and follow-up attitude scores and education, highlighting the enduring impact of the educational programs on attitude improvement. Furthermore, a connection between nurses' attitude scores post-intervention and follow-up and their years of experience was also found, which echoes the findings of **Zhang et al. (2020)**, emphasizing the role of knowledge in shaping attitudes and subsequent preventive practices among healthcare workers.

Conclusion

This study underscores the critical role of educational interventions in enhancing nurses' knowledge, practices, and attitudes concerning Marburg viral infection. The positive shifts observed in knowledge, practices, and attitudes can contribute to more effective disease prevention and control efforts. The results support the need for continuous educational programs to ensure that nurses remain well-informed and adept in managing outbreaks and infectious diseases. The findings of this study also hold broader implications for healthcare providers' preparedness and responsiveness to emerging infectious diseases.

Recommendations:

1. Given the positive impact of educational sessions on nurses' knowledge, practices, and attitudes towards Marburg viral infection, it is recommended to continue offering educational interventions at regular intervals. The dynamic nature of healthcare necessitates continuous updates to keep nurses well-informed by raising their awareness about the latest developments in Marburg viral infection management.

2. Design educational sessions that are tailored to the specific needs and challenges faced by nurses in the field. Incorporate case studies, real-world scenarios, and interactive discussions to engage nurses and enhance their understanding of Marburg viral infection prevention, management, and control.

3. Expand the scope of educational sessions to include interdisciplinary collaboration. Collaborative training involving nurses, physicians, infection control specialists, and public health experts can lead to a more comprehensive approach to Marburg viral infection prevention and management.

References;

Anywaine, Z., Barry, H., Anzala, O., Mutua, G., Sirima, S.B., & Eholie, S. (2022). Safety and immunogenicity of 2-dose heterologous Ad26.ZEBOV, MVA-BN-Filo Ebola vaccination in children and adolescents in Africa: A randomised, placebo-controlled, multicentre Phase II clinical trial. PLoS Med. Jan;19(1), e1003865. Available at: https://www.ncbi.nlm.nih.gov/pubmed/35015777.

Bebell, L.M., & Riley, L.E. (2015). Ebola virus disease and Marburg disease in pregnancy: A review and management considerations for filovirus infection. Obstet Gynecol. Jun;125(6), 1293-8. Available at: https://www.ncbi.nlm.nih.gov/pubmed/26000499.

Elasrag, H., Hassan, N.E., Elsayed, W.A., & Hassan, R.M. (2021). Effect of educational intervention on knowledge and practice of nurses regarding prevention of infection for critically ill neonates. Journal of Nursing Education and Practice; 11(2), 10-22. https://doi.org/10.5430/jnep.v11n2p10

European Centre for Disease Prevention and Control (2019). Ebola and Marburg virus diseases - Annual Epidemiological Report for 2019. 2021. Available at: https://www.ecdc.europa.eu/sites/default/files/documents/AER-Ebola-and-Marburg-2019.pdf.

Feldmann, H. (2023). Virus in Semen and the Risk of Sexual Transmission. N Engl J Med. Apr 12;378(15), 1440-1441. Available at: https://www.ncbi.nlm.nih.gov/pubmed/29641967.

Gordon, T.B., Hayward, J.A., Marsh, G.A., Baker, M.L., & Tachedjian, G. (2019). Host and viral proteins modulating ebola and Marburg virus egress. viruses. Jan 3;11(1) Available at: https://www.ncbi.nlm.nih.gov/pubmed/30609802.

Jalloh, M.F., Sengeh, P., Monasch, R., Jalloh, M.B., DeLuca, N., & Dyson, M. (2017). National survey of Ebola -related knowledge, attitudes and practices before the outbreak peak in Sierra Leone: August 2014. BMJ Glob Health; 2(4).

Kassa, M.A. (2019). Understanding and Preparedness of Nurses in the Prevention of Marburg Viral Infection in Healthcare Settings.

Koo, Y.W., Kwon, M.S., Jeong, I.S., Kim, J W., & Moon, Y.S. (2016). The effects of a continuing education program on infection control for clinical nurses. Journal of Korean Academy of Nursing Administration, 22(1), 91-100. http://www.korea science.or.kr/article/ArticleFullRecord.jsp?cn=DJBBBU_2016_v22n1_91

Kortepeter, M.G., Dierberg, K., Shenoy, E.S., & Cieslak, T.J. (2020). Medical Countermeasures Working Group of the National Ebola Training and Education Center's (NETEC) Special Pathogens Research Network (SPRN). Marburg virus disease: A summary for clinicians. Int J Infect Dis. Oct;99:233-242. doi: 10.1016/j.ijid.2020.07.042. Epub 2020 Aug 3. PMID: 32758690; PMCID: PMC7397931.

Mahmoud, S.F., Mosa, H. A., El-Din, A. N., & Ahmed, A. H. (2022). The impact of a training program on the knowledge and practices of health care providers in maternal care services. Journal of Nursing and Health Sciences, 11(1), 75-85. https://doi.org/10.9790/1959-1101077585.

Nyakarahuka, L., Skjerve, E., Nabadda, D., Sitali, D.C., Mumba, C., Mwiine, F.N., & Lutwama, J.J. (2017). Knowledge and attitude towards Marburg virus disease in Kween District, Eastern Uganda. BMC Public Health, 17(1), 791. https://doi.org/10.1186/s12889-017-4792-5.

Okonji, O.C., Okonji, E.F., Mohanan, P., Babar, M.S., Saleem, A., & Khawaja, U.A. (2022). Marburg virus disease outbreak amidst COVID-19 in the Republic of Guinea: A point of contention for the fragile health system? Clin Epidemiol Glob Health. Jan-Feb;13:100920. Available at: https://www.ncbi.nlm.nih.gov/pubmed/34901523.

Oladimeji AM, Gidado S, Nguku P, Nwangwu IG, Patil ND, Oladosu F. (2015). Ebola virus disease –gaps in knowledge and practice among healthcare workers in Lagos, August 2014. Tropical Medicine & International Health; 20(9):1162–70.

Ozekcin, G., Kapucu, S., Guneysel, O., & Elmas, E. (2015). The effect of education given to nurses about viral hepatitis on their knowledge and attitude. International Journal of Caring Sciences; 8(1), 91-100. http://www.internationaljournalofcaringsciences.org/docs/Vol8_Issue1_14_Ozekcin.pdf

Ristanović ES, Kokoškov NS, Crozier I, Kuhn JH, Gligić AS. (2020). A Forgotten Episode of Marburg Virus Disease: Belgrade, Yugoslavia, 1967. Microbiol Mol Biol Rev. May 13;84(2):e00095-19. doi: 10.1128/MMBR.00095-19. PMID: 32404328; PMCID: PMC7233485.

World Health Organization. (2022). Regional Office for Africa. Ghana declares first-ever outbreak of Marburg virus disease, 17 July 2022. Brazaville: WHO AFRO. Available at: https://www.afro.who.int/countries/ghana/news/ghana-declares-first-ever-outbreak-marburg-virus-disease-0.

Zhang, H., Lu, L., Chen, M., Liu, Q., & Luo, S. (2020). Knowledge, attitude, and practice regarding COVID-19 among healthcare workers in Henan, China. Journal of Hospital Infection, 105(2), 183-187. https://doi.org/10.1016/j.jhin.2020.04.012.