The Effect of Implementing an Educational Training on Nurses' Knowledge, and Performance regarding Medical Instrument Reprocessing

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ABSTRACT

Proper processing of instruments and other items that have come in contact with patients' body fluids is critical in reducing the transmission of infections during clinical procedures and patient care. This study is aiming to assess the effect of implementing an educational training on nurses' knowledge, and performance regarding medical instrument reprocessing. **Method:** A quasi-experimental (one group -posttest) research design used to fulfill the aim of the study. The study conducted at Mansoura Emergency Hospital affiliated with Mansoura University, Egypt. the study was carried out on 60 nurses who are responsible for instrument processing. The researcher used four self-administered structured questionnaires for data collection as the following**:** Self-administered structured questionnaire about nurses' demographic and occupational data. Self-administered structured questionnaire about nurses' knowledge regarding medical instrument reprocessing. Nurses' performance observational checklist. self-administered structured scale to assess nurses' feedback about the educational program. **Results:** the current study indicates that nurses total score level of knowledge regarding medical instrument reprocessing was 86.7% in immediate post intervention and improper performance was 70% with mean 218.0000(7.50141). **Conclusion:** most of the studied nurses had good level of knowledge, most of them had improper performance level and the mean of total positive attitude was .884(.0721). **Recommendation:** all nursing staff must be aware of instrument reprocessing policies, continuing education must be obtained at a regular interval and documented, and the manager and all supervisors involved in reprocessing must be qualified and had certification course in reprocessing practices.

Keywords: *cleaning, disinfection, sterilization, reprocessing*

Introduction

The cornerstones of hospital infection control efforts are sterilization and disinfection. Numerous hospitals undertake a range of surgical operations on a daily basis. In certain medical institutes, even more intrusive procedures are carried out. There is a higher chance of pathogens entering the patient's body when a medical device or surgical tool comes into touchwithsterile tissue or the   patient's mucous membrane during a procedure (Mohapatra, S., 2017).

Effective cleaning and disinfection/ sterilization using a properly validated washer-disinfector/sterilizer will protect patients and staff from infection; prolong the life of the equipment and ensure the quality of the diagnostic/ therapeutic procedure. (Hakizimana, B.,2015). Reprocessing has changed, placing more emphasis on quality control systems and verified cleaning, disinfection, and sterilization instructions in response to the growing complexity of medical equipment and the rise in infection rates (Shrestha, G.N.,2018).

With the right handling and cleaning, the microbial burden and the biofilm that might cause an outbreak can be reduced. To achieve this, medical practitioners will need support from specific manufacturer recommendations and instructions. Medical professionals should also get training to raise awareness of the necessity of proper handling and cleaning of such medical equipment (Yiek, W.K., et al., 2021).

Centre for Disease Control and Prevention (CDC) recommended that using processing equipment in clinical and surgical operations involves two phases: The first step is the decontamination procedure, which is crucial because outbreaks linked to improper and insufficient decontamination tools. This procedure will impact how well the items that have been sterilized are preserved or how well the subsequent disinfection or sterilization procedures operate. The second step is disinfection or sterilization (National Guidelines Infection Prevention & Control, 2020)

The World Health Organization (WHO) divided reused medical devices (RMDs) into three categories based on their intended use and the amount of reprocessing that is necessary to make them safe for reuse: critical, semi-critical, low, and non-critical. The "Spaulding classification" refers to this. (National Guidelines Infection Prevention & Control, 2020).

The department of central sterile supply is in charge of reprocessing instruments and other reusable medical devices (RMD). Reprocessed items must be handled, gathered, transported, sorted, disassembled, cleaned, disinfected, inspected, packaged, sterilized, stored, and distributed. The goal is when the decontamination life cycle is carried out correctly, sterilization and disinfection may guarantee the security of both invasive and noninvasive medical devices. However, current sterilization and disinfection recommendations must be adhered to (CDC, 2019).

Moreover, all nurses must adhere to established procedures and possess a modest degree of nursing knowledge regarding nosocomial infections to minimize the transmission of infection in any healthcare environment and ensure the well-being of every patient in the hospital. (Miah, B., 2023).

Reinforcing the nurses' knowledge and practice regarding infection control is a necessity as it is an essential component of the continuing educational and training program. This training should be provided for health care providers and the staff who are responsible for the medical devices and equipment decontamination for interrupting the infection cycle and preventing cross infection (El-Maghawry, & El-Hawy, 2019).

For that the nursing staff should have sufficient information and practical skills regarding the instrument reprocessing cycle and examining any medical device before use because it is the critical step in protecting thepatient's safety. In addition, the head of department must record and maintain training records, all personnel responsible for cleaning, handling, and reprocessing to ensure competence in the decontamination process. (El-Maghawry, & El-Hawy, 2019).

2.Aim of the study

This study is aiming to assess the effect of implementing an educational training on nurses' knowledge, and performance regarding medical instrument reprocessing.

Research Hypotheses

Nurses' level of knowledge will be improved after implementing an educational training regarding medical instrument reprocessing.

Nurses' performance will be improved after implementing an educational training regarding medical instrument reprocessing.

3. Method

Study Design

A quasi-experimental (one group -posttest) research design used to assess the knowledge, performance and attitude of nurses who are responsible for medical instrument reprocessing to fulfill the aim of the study.

Settings

The researchers conducted this study at the emergency room and central sterilized unit, in Mansoura Emergency Hospital affiliated with Mansoura University, Egypt.

Sampling technique

The participants in this study selected through convenience technique.

Participants and sample size

All the nurses (60 nurses) who responsible for instrument reprocessing in sterilization unit and the emergency room in Mansoura Emergency Hospital affiliated with Mansoura University, Egypt was included in the study. Staff nurses have different qualifications and have different years of experience at the previous mentioned setting and fulfilling the inclusion criteria.

Tools of data collection

The researchers designed five self-administered structured questionnaires tools (I-V) after reviewing the relevant literature.

Tool I: Nurses' Demographic and Occupational Data.

The researchers used this tool to assess demographic and occupational data of nurses such as age, sex, educational level, working area, years of experience, and attending training programs about medical instrument reprocessing.

Tool II: Nurses' Knowledge Regarding Medical Instrument Reprocessing.

The researcher used this tool to assess nurses' knowledge regarding the medical instrument reprocessing process. It includes questions in the form of multiple-choice questions (definition, hand washing, using Personal Protective Equipment (PPE), chemical disinfectant used, collecting, and transporting the contaminated

instruments, receiving, processing (cleaning, disinfection and / or sterilization) and storage or immediate use to explore in depth nurse's

knowledge. the researcher used open ended question.

Scoring system

One mark is awarded for each correct answer, the false, missed incomplete or unknown answer is given zero. The total score level was 92 items as the following:

- Definition of decontamination and cleaning (2 items).
- Manual cleaning (4 items).
- Steps of manual cleaning process (7 items).
- Tools used in manual cleaning (5 items)
- Cleaning instrument that can be disassembled (6 items)
- Mechanical cleaning (7 items)
- Definition of disinfection and disinfectant (2 items)
- Chemical disinfectants (5 items)
- Steps for disinfection with glutaraldehyde or cidex (6 items)
- Sterilization and sterilization methods (4 items)
- Medical instruments classification (3 items)
- Instructions for sterilization (5 items)
- Steps before sterilization of multipart instruments (6 items)
- Steps before sterilization of one-part instruments (4 items)
- loading autoclave device (5 items)
- Information on the label of package (3 items)
- Instructions after sterilization (4 items)
- Quality of sterilization process (3 items)
- Separation of contaminated instrument (3 items)
- Storage (8 items)

The total score involved three categories:

- Poor = scores less than 65% of total scores =less than 59.8 scores.
- Fair = scores 65% to 75% of total scores = 59.8 to 69 scores.

- Good = scores more than 75% of total scores= more than 69 scores.

Tool III: Nurses' Performance Observational Checklist

The researchers used this tool to assess the performances of nurses regarding steps of medical instrument reprocessing (cleaning, disinfection, inspection, packing, sterilization, transport, storage, use and infection control measure precaution (hand washing, gloving, Personal Protective Equipment) during the different working shifts.

Scoring system:

The score of each item rated as follows: score 1is awarded for complete and correct performance. Score 0 is awarded for incomplete or incorrect. The total score level was 100 items as the following:

- Monitor- defibrillator / cardiac shock device (DC), ventilator and Bipap devices, Blood pressure, and stethoscope (6 items)
- Portable suction unit (11 items)
- Blood Gas Analyzer (BGA) (14 items)
- Infusion pump, Glucometer and diagnostic ECG machine (21 items)
- Hand hygiene (22 items)
- Personal protective equipment (15 items)
- Environmental Infection Prevention and Control (11 items)

level of nurses' performance was categorized into two levels as:

- proper if the percent score was ≥75% = Equal or more than 75 scores
- improper if the percent score was < 75% = Less than 75 scores.

Tool IV: Assess Nurses'Feedback About the Educational Program

The researchers used Likert rating scale with 5 continuums (excellent, very good, good, fair, and poor) to obtain feedback clarity and applicability of the educational program (topic of the program, scientific content, benefits from program, time of program, goals achieved, clearance of the program as well as teaching methods and media (lectures, discussion, power point) which used in the implementation of the

Phases of the Study

1.Administrative Stage:

Ethical Considerations:

- The researchers obtained the ethical approval from the Research Ethics Committee of the Faculty of Nursing, Mansoura University to carry out the study. Then get permission from the Committee of Community Health Nursing Department, Faculty of Nursing, Mansoura University to carry out the study.

- An official letter issued from the Faculty of Nursing, Mansoura University to the managers of the appropriate authorities in the selected setting to obtain their permission for conducting the current study.

- The researchers obtained informed oral consent from the study participants after being informed about the purpose of the study and assured that their identities and responses to the questionnaire will be confidential; their answers will be voluntary, and their participation (or not) will have no effect on their work conditions.

- The researchers designed the tools after reviewing the relevant literature.

Development of the Study Tools:

literature review:

The researchers designed tools of data collection after reviewing the relevant and recent literature.

Content validity: A jury of five experts in the field of community health nursing, infection prevention and control and health education will tested the developed tools to evaluate if the designed tools covers all relevant parts of the construct it aims to measure

- **Face validity:** is concerned with testing the clarity, relevance, and appropriateness of the designed tools for measuring adequately the intended variables.

- **Pilot study:** the researchers will conduct the **Pilot study** which is preliminary study conducted on 10% (n=6 nurses of study participants) and excluded from the study. Pilot study uses the results to guide the methodology of the large-scale investigation and determine the feasibility of the study.

- **Reliability:** Reliability of scales will be tested by Cronbach's coefficient alpha that tests internal consistency for scale items. Its value is .846

II. Implementation phases:

Phase 1: Development of an educational session regarding medical devices processing, the researcher developed the content of the educational session that contains different learning materials.

- Considering the existing evidence-based literature, required knowledge and practice; determine the program strategies; time, table sessions, teaching methods, media used, learners' activities and evaluation methods, selecting the teaching place (nurses' working unit).

Phase 2: Implementation phase:

- The program sessions conducted at Mansoura Emergency hospital affiliated to Mansoura University, Egypt for nurses in the Emergency room and central sterilized unit that presented in clear, and concise form according to the nurses working schedule.

- (60) nurses were involved in the educational program divided into (4) groups each group included (15) nurse and received two sessions per week; each session lasts for about (45) minutes.

- Different teaching methods as group discussion, brainstorming, and role play demonstration, and re-demonstration; as well, different teaching materials used, such as audiovisual aids as PowerPoint presentations and videos handout, posters, colored pictures.

- The researcher used brief, clear and simple words during session and summarized the content at the end of each session.

Phase 3: Evaluation phase:

- After completion of the education session, the researcher evaluated nurses' knowledge, and performance, regarding medical instrument reprocessing process using (Tool II, III and IV) immediately post intervention.

- Evaluate nurses' opinion regarding the educational program using (Tool V).

Results

Table (1): represents the socio-demographic and occupational characteristics of nursing staff. Results indicates that the mean age of the nursing staff was 37.16 (38.41) years. More than half of them (51.7%) were less than 30 years old. Most of nursing personnel (71.7%) are female, about (75%) of them are working at the emergency room and 25% are working at the Central sterilization unit. Regarding the qualification (43.3%) of nursing staff had nursing diploma and (45%) of them had

technical of nursing institute. The mean years of experience 10.86 (9.42) years and the mean number of days of training courses is 0.316 (.567) days.

Table (2): represents the score level of nurses' knowledge immediately post intervention was good regarding: definition of decontamination and cleaning, (98.3%). Chemical disinfectants, (85%). Steps for disinfection with glutaraldehyde or cidex, (76.7%). Sterilization methods, (90%). Medical instruments classification, (86.7%), Instructions for sterilization, (98.3%). Steps before sterilization of multipart instruments, (66.7%). Steps before sterilization of one-part instruments, (86.7%). loading autoclave device, (75%). Information on the label of package, (90%). Instructions after sterilization, (90%). Quality of sterilization process, (88.3%). Separation of contaminated instrument, (76.7%) and Storage, (91.7%)

Table (3): shows the nurses' total knowledge score level about medical instrument reprocessing. It was observed that 86.7% of the nurses had good score level of knowledge immediately post intervention.

Table (4): illustrates the total score level of nurses' performance about respiratory instrument processing. It was observed that (63.3%) of them had proper performance score level immediately post intervention.

Table (5): represents the total score level of nurses' performance about cleaning the equipment and devices in emergency room immediately post intervention. It was observed that the nurses had proper score level of performance for Monitor- DC, ventilator, Bipap devices and Blood pressure, stethoscope was (81.7%). While shows improper score level of performance regarding portable suction unit, (96.7%). Blood gas analyzer, (78.3%)

and Infusion pump, Glucometer, and diagnostic ECG machine, (68.3%).

Table (6): documents the total score level of nurses' performance regarding their adherence to the standard precautions of infection control in central sterilization unit and the emergency room. This table reveals that nursing staff had improper performance regarding hand washing (100%). While nurses had a proper score level of performance regarding personal protective equipment, it was (18.7%). Environmental infection prevention and control (71.7%). The total proper score level of nurse's performance was (30%).

Table (7): indicates nurses' feedback and opinion about the educational program regarding medical instrument reprocessing. It was noticed that most of the studied nurses, 78.3%, 75%, 76.7%, 83.3%, and 78.3%, give an excellent evaluation for the educational program regarding the subject's importance for the target group, the significance of the topic, the clarity and representativeness of the objectives, matching the content with the objective of the study, and the content is meeting the target group's needs, respectively. Moreover, 61.7%, 60%, 61.7%, 63.3% of nurses give an excellent evaluation of the following: the educational materials and activities are appropriate, these materials and activities facilitate nurses learning, the duration of the educational program is appropriate to the content and the presentation hall was prepared well respectively. Also, most of nurses 73.3%, 76.7%,78.3% give an excellent evaluation of the following: the educational program provides opportunity to apply what has been learned, the extent of benefit from this educational program content in general, respectively.

Table (1): Socio-Demographic and Occupational Characteristics of Nursing Staff (N=60)

Item	N (60)	%
Age		
20 > 30	31	51.7
30 >40	16	26.7
40 >50	10	16.7
50 or more	3	5
Mean *(SD)* 37.16 (38.41)		
Gender		
Male	17	28.3
Female	43	71.7
Section (work place)		
Emergency room	45	75
Central sterilization unit	15	25
Qualifications		

Diploma in Nursing	26	43.3
Technical of Nursing Institute	27	45
Bachelor of Nursing	6	10
Postgraduate studies	1	1.7
Years of work experience		
0 > 10	38	63.2
10 >20	8	13.3
20 and more	14	23.4
Mean *(SD)* *10.86 (9.42)*		

Item	N (60)	%
Participating in training program	11	18.3
Number days of training courses		
0 > 2 days	59	98.3
2 days and more	1	1.7
Mean *(SD)* 0.316 (.567)		

Table (2): Nurses' Score level of Knowledge Regarding Medical Instrument Reprocessing.

Knowledge level	Test time N = 60	
	Immediately post Intervention	
	N	%
Definition of decontamination and cleaning (2 items)		
Poor	1	1.7
Good	59	98.3
Chemical disinfectants (5 items)		
Poor	9	15
Good	51	85
Steps for disinfection with glutaraldehyde or cidex (6 items)		
Poor	5	8.3
Fair	9	15
Good	46	76.7
sterilization methods (4 items)		
Poor	6	10
Good	54	90
Medical instruments classification (3 items)		
poor	1	1.7
Fair	5	8.3
Good	52	86.7
Instructions for sterilization (5 items)		
Poor	2	3.3
Good	58	98.3
loading autoclave device (5 items)		
Poor	15	25
Good	45	75
Information on the label of package (3 items)		
Poor	2	3.3
Fair	4	6.7
Good	54	90
Instructions after sterilization (4 items)		
Poor	6	10
Good	54	90

Quality of sterilization process (3 items)		
Poor	2	3.3
Fair	5	8.3
Good	53	88.3
Separation of contaminated instrument (3 items)		
Poor	3	5
Fair	11	18.3
Good	46	76.7
Storage (8 items)		
Poor	5	8.3
Good	55	91.7

Table (3): Nurses' total score level of knowledge regarding medical instrument reprocessing.

Item	Immediately post Intervention					
	Poor		Fair		Good	
Medical instrument reprocessing (92 items)	N	%	N	%	N	%
	3	5	5	8.3	52	86.7

Table (4): Nurses' Total score level of Performance for Processing the Respiratory Instrument.

Practice level	Test time N = 60	
	Immediately post Intervention	
	N	%
Proper	38	63.3
Improper	22	36.7

Table (5): Nurses' Total score Level of Performance For Cleaning the Equipment and Devices in Emergency Room.

Practice level	Test time N = 60	
	Immediately post Intervention	
	N	%
Cleaning the equipment and devices in emergency room (52 Items)		
Monitor- DC, ventilator and Bipap devices and Blood **pressure, stethoscope (6items)**		
Proper	49	81.7
Improper	11	18.3
Portable suction unit (11 items)		
Proper	2	3.3
Improper	58	96.7
Blood gas analyzer (BGA 14 items)		
Proper	13	21.7
Improper	47	78.3
Infusion pump Glucometer and diagnostic ECG machine (21 items)		
Proper	19	31.7
Improper	41	68.3

Table (6): performance of Nursing Staff According to Adherence of the Stander Precautions of Infection Control in Central Sterilization Unit and the Emergency Room.

Practice level	Test time N = 60		
	Immediately post Intervention		
	N		%
Standard precautions (Hand hygiene 22 items)			
Improper	60		100
Standard precautions (Personal Protective Equipment 15 items)			
Proper	11		18.7
Improper	49		81.7
Environmental Infection Prevention and Control (11 items)			
Proper	43		71.7
Improper	17		28.3
Nurses' total score level of performance			
Proper	18		30.0
Improper	42		70.0

Table (7): Nurses' Feedback About the Educational Program (N=60).

Item	Poor		Fair		Good		Very good		Excellence	
	N	%	N	%	N	%	N	%	N	%
The topic is important for the target group	4	6.7	2	3.3	0	0	7	11.7	47	78.3
The topic is significant	4	6.7	1	1.7	2	3.3	8	13.3	45	75
Objectives are clear and representative	3	5	1	1.7	1	1.7	9	15	46	76.7
The content matches with the objective of the study	3	5	1	1.7	1	1.7	5	8.3	50	83.3
The content meets the need of the target group	3	5	1	1.7	0	0	9	15	47	78.3
The educational materials display the content in an attractive way	3	5	1	1.7	4	6.7	15	25	37	61.7
The educational materials display the content in an organized way	3	5	1	1.7	3	5	17	28.3	36	60
The duration of the educational sessions is appropriate.	4	6.7	1	1.7	2	3.3	16	26.7	37	61.7
degrees of satisfaction with practical part.	5	8.3	1	1.7	2	3.3	8	13.3	44	73.3
The presentation hall has been prepared to facilitate the learning.	4	6.7	1	1.7	5	8.3	12	20	38	63.3
The language is suitable for the target group education	4	6.7	1	1.7	2	3.3	7	11.7	46	76.7
degrees of satisfaction with the educational program content.	4	6.7	1	1.7	2	3.3	6	10	47	78.3

Discussion

In the current study, four sections of the study results were discussed, beginning with the first part: Socio-demographic and occupational characteristics of nursing staff. The results of the current study revealed that the mean age of the nursing staff was 37.16 (38.41) years. More than half of them were less than 30 years old. Most of the nursing personnel are female; and work in the emergency room, and one quarter work at the central sterilization unit. Regarding the qualification, less than half of nursing staff had a nursing diploma and had a technical nursing

institute. more than two thirds had less than 10 years of experience, and around one quarter had 20 years of experience or more. Regarding attendance training courses, less than one quarter of nurses attended the training courses about sterilization, and few of them attended 2 days or more.

Regarding the decontaminating processes (cleaning, disinfecting, and sterilizing), The present study showed that most of the nurses had a good score level of knowledge.

The current findings are consistence with the findings of **Krause, et al., 2021** who conducted study in regional hospital in the Czech Republic revealed that most of sterilization staff had good level of knowledge regarding decontamination process and most of nurses correctly using the Spaulding classification, mechanical cleaning and more than half of nurses had knowledge of the preparation of the disinfectant solution respectively, Also, **Sahiledengle, et al., 2019** revealed that the nursing staff in Ethiopia, had good level of knowledge regarding disinfection process, The same result found in findings of, **Panta, 2022.**

Concerning nursing staff knowledge to steps of manual cleaning process, the current study showed that about three quarters of the studied nurses had good level of knowledge.

The current findings are in harmony with **Amer, et al., 2015.** Who conducts the study in Gastrointestinal Endoscopy Unit at Zagazig University Hospital and assessed the Nurses' Knowledge and Practice Regarding Gastrointestinal Endoscopy and Suggested Nursing guidelines and found that they had a satisfactory level of knowledge regarding Gastrointestinal Endoscopy, the majority of them had unsatisfactory level of practice before, during and after GI endoscope, and discharge instructions and manual disinfection of endoscopy.

Regarding the steps of disinfection with glutaraldehyde or cidex, the current study shows that more than three quarters of the studied nurses had a good level of knowledge. These results were inconsistent with the findings of **Elkady, 2022,** who stated that the nursing staff had a poor level of knowledge regarding disinfection processes and disinfectants.

Regarding the sterilization methods, this study revealed that most of nursing staff had a good level of knowledge. These results are somewhat like **Panta, 2022** findings in Nepal, who found that more than two thirds of healthcare workers in primary and secondary care public hospitals had proper knowledge about different aspects of sterilization and reuse of medical devices in a few areas.

Regarding the loading of autoclave device, the current study indicates that three quarters of nursing staff had a good level of knowledge. These results are consistently with the finding of **Panta, 2022** who stated that most of the healthcare workers had correct knowledge and positive attitudes towards most areas of sterilization and reuse of medical devices.

Concerning the processing of the respiratory instrument, the results of the present study illustrated that more than half of nurses had a proper level of performance immediately post-intervention. This finding is inconsistence with **Amer, et al., 2015.** Who found that the majority of nurses had unsatisfactory level of practice before, during and after GI endoscope and manual disinfection of endoscopy, In addition to, **Elkady, 2022.** findings who clarified that nursing staff had improper performance regarding disinfection of the respiratory instrument in all the studied hospitals.

Regarding cleaning the equipment and devices in the emergency room. The current study revealed that most of the studied nurses had improper performance level regarding the cleaning practice of portable suction units, blood gas analyzers (BGA), infusion pumps, glucometers, and diagnostic ECG machines.

As for the nurses' cleaning practice of **monitor, cardiac defibrillator device (DC), ventilator, and Bipap devices, blood pressure, and stethoscope,** most of the studied nurses had proper performance and less than one quarter of them had improper performance These results were somewhat similar to **Shrestha, & Thapa, 2018** Finding who assessed the knowledge and practice on infection prevention among nurses of Bir Hospital, Kathmandu. Their results indicated that less than half of the respondents had good practice on infection prevention, and more than half of the respondents had poor practice.

The current study has some similarity to **Birlie, et al., 2021** findings who conducted the study in north-central Ethiopia and assessed the cleaning practice of non-critical medical equipment (NCME) in the era of coronavirus disease-2019 of nurses working in Debre- Tabor comprehensive specialized hospital (DTCSH), north-central Ethiopia. The results indicate that there was poor cleaning practice of stethoscopes, thermometers, blood pressure (BP.) cuffs, pulse oximeters, and glucometers among nurses working in DTCSH.

According to nurse's adherence to the standard precautions, it was observed that most of nursing staff had poor performance level. This result is compatible with the findings of **Elkady, 2022** who clarified that more than half of nursing staff had improper performance regarding hand hygiene and personal protective equipment.

Panta, et al., 2022 study revealed that most of the healthcare workers had correct knowledge towards most areas of sterilization and reuse of medical devices.

Regarding the nurses' feedback about the educational program. It was noticed that most of the studied nurses give an excellent evaluation for the educational program regarding the subject's importance for the target group, the significance of the topic, the clarity and representativeness of the objectives, matching the content with the objective of the study, and the content is meeting the target group's needs, respectively. Moreover, most of nurses give an excellent evaluation as: the educational materials and activities are appropriate, these materials and activities facilitate nurses learning, the duration of the educational program is appropriate to the content and the presentation hall was prepared well. Also, most of nurses give an excellent evaluation of the following: the educational program provides opportunity to apply what has been learned, the extent of benefit from this educational program, they are satisfied with the educational program in general.

Finally, the present study confirmed the hypothesis that nurses' level of knowledge was improved after implementing the educational training regarding medical instrument reprocessing.

Conclusion

The current study findings showed that after implementing the educational program the majority of the nurses had good score level of knowledge and one third of them had proper score level of performance. The most of them reported that the program was excellent related to the topic selection, content, materials, application and preparation of presentation hall.

Recommendation

All nursing staff must be aware of instrument reprocessing policies and procedures, continuing education must be obtained at a regular interval and documented, the manager and all supervisors involved in reprocessing must be qualified and had certification course in reprocessing practices.

Reference:

- Amer, W. M., Taha, N. M., Zaton, H. K., (2015). Nurses Knowledge and Practice Regarding Gastrointestinal Endoscopy and Suggested Nursing

- Birlie, A. T., Amare, A. T., Tassew, S. F., Emiru, T. D., Feleke, D. G., & Chanie, E. S., (2021). Nurses' cleaning practice of non-critical medical equipment in the era of COVID 19: A cross-sectional study in Debre-Tabor comprehensive specialized hospital. north-central Ethiopia. 7(7): e07626. doi: 10.1016/j.heliyon. 2021.e07626. Epub 2021 Jul 19. PMID: 34307954; PMCID: PMC8288225. Retrieved 2021 Jul from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8288225/

- CDC, (2019). Guideline for Disinfection and Sterilization in Healthcare Facilities, 2008, 56. Retrieved May 2019 from https://www.cdc.gov/infectioncontrol/guidelines/disinfection/

- Elkady, S. T. A., (2022). Nurses' knowledge, Performance and Attitude regarding Respiratory Instrument Processing in Mansoura Hospitals. Mansoura Nursing Journal. 9(2), Print ISSN: 2735 – 4121 Online ISSN: 2735 – 413X from https://mnj.journals.ekb.eg

- El-Maghawry, H. A., & El-Hawy, L. L., (2019). Effect Of Training Educational Program on Nurses' Performance as Regarding Infection Control Procedures and Endoscopies Reprocessing Techniques in Git Endoscopy Unit. *Egyptian Journal of Occupational Medicine*,43(1), 57-73.

- Guidelines. *Afro-Egyptian Journal of Infectious and Endemic Diseases*, 5(2), 115-130. DOI: 10.21608/aeji.2015.17820 retrieved June 2015 from https://journals.ekb.eg/article_17820.html

- Krause, M., Dolák, F., & Froňková, M., (2021). The knowledge of nurses on the disinfection of reusable objects and surfaces in clinical practice. *Kontakt / Journal of nursing and social sciences related to health and illness.* 23(1), 8–13, EISSN 1804-7122 ISSN 1212-4117 DOI: 10.32725/kont.2021.008. retrieved 2021-02-26 from http://kont.zsf.jcu.cz

- Mohapatra, S., (2017). Sterilization and Disinfection. Essentials of Neuroanesthesia. 929–944. doi: 10.1016/B978-0-12-805299-

0.00059-2. Epub 2017 Mar 31. PMCID: PMC7158362 from https://www.ncbi.nlm.nih.gov articles PMC7158362

- National Infection prevention and Control Guidelines, (2020). medical device and instrument reprocessing: (cleaning, disinfection and sterilization), 1st. part (4th. Ed.),137-139.

- Panta, G., Richardson, A. K., Shaw, I. C., & Coope, P. A., (2022). Healthcare workers' knowledge and attitudes towards sterilization and reuse of medical devices in primary and secondary care public hospitals in Nepal: A multi-centre cross-sectional survey. Nepal, 17(8), e0272248. doi: 10.1371/journal.pone.0272248. PMID: 35913951; PMCID: PMC9342727. Retrieved 2022 Aug from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9342727/

- Prabhaka, H., (2017). Essentials of Neuroanesthesia. United Kingdom: Elsevier Science. *930*

- Sahiledengle, B. (2019). Decontamination of patient equipment: nurses' self-reported decontamination practice in hospitals of southeast Ethiopia. *BMC Res Notes* **12**, 392 https://doi.org/10.1186/s13104-019-4427-5

- Shrestha, G.N., & Thapa, B., (2018). Knowledge and Practice on Infection Prevention among Nurses of Bir Hospital, Kathmandu, *J Nepal Health Res Counc,* 16(40). NO. 3, 330-5, DOI: http://dx.doi.org/10.3126/ jnhrc. v16i3.21433. Retrieved Jul - Sep 2018.

- Yiek, W.K., Coenen, O., Nillesen, M., Ingen, J.V., Bowles, E., & Tostmann,A., (2021). Outbreaks of healthcare-associated infections linked to water-containing hospital equipment: a literature review. Antimicrob Resist Infect Control. 10, 77. https://doi.org/10.1186/s13756-021-00935-6.