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EFFECT OF TRAINING EDUCATIONAL PROGRAM ON NURSES' PERFORMANCE AS REGARDING INFECTION CONTROL PROCEDURES AND ENDOSCOPIES REPROCESSING TECHNIQUES IN GIT ENDOSCOPY UNIT

By

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Abstract

Introduction: Endoscopy is a diagnostic procedure in which a flexible fiber optic tube passed into the esophagus, stomach and upper small intestine depending on the level at which lesions are anticipated. Because flexible endoscopes enter body cavities, they may acquire high levels of microbial contamination. Organic material (eg, blood, feces, and respiratory secretions) that collects in the channels and parts of the endoscope can be difficult to be removed. **Aim of work:** To assess nurses' knowledge and practice regarding infection control procedures during GIT endoscopies, to assess nurses' knowledge and practice regarding universal precautions during reprocessing techniques of GIT endoscopies, to evaluate the effect of training program on nurses' knowledge and practice regarding infection control procedures and endoscopies reprocessing procedures. **Materials and methods:** An experimental study (pre-post test) was conducted in GIT endoscopy unit in General Surgery department, Zagazig University Hospitals. All endoscopy nursing staff (38 nurses) who is dealing with endoscopies reprocessing were included in the study. First tool was questionnaire sheet, to assess nurses' knowledge. The second tool was observational checklist to assess nurses' practice. The study was carried out on 3 stages: I- pre-intervention stage, II- Intervention stage (by implementation of the educational program), III- Post-

intervention stage. **Results:** The study sample of nurses consisted of 38 female nurses with mean age 36.8 ± 6.1 years. There was an improvement in total level of nurses' knowledge and practice regarding infection control with highly statistically significant difference before and after implementation of the educational program as regarding infection control, precautions post endoscopy procedures (endoscopy reprocessing). **Conclusion:** The study concludes that relatively short-term in-service training can significantly improve nurses' knowledge and practice concerning infection control procedures and endoscopies reprocessing techniques in GIT endoscopy unit. It is a must to keep reinforcing the knowledge and practice regarding infection control.
Keywords: Infection control, GIT endoscopy, Endoscopic reprocessing, Educational program, Knowledge and Practice.

Introduction

Endoscopy is a diagnostic procedure in which a flexible fiber optic tube passed into the esophagus, stomach and upper small intestine depending on the level at which lesions are anticipated.

Correctly processing flexible endoscopes is essential in helping to prevent infection transmission (Marie, 2016).

Because flexible endoscopes enter body cavities, they may acquire high levels of microbial contamination. Organic material (eg, blood, feces, and respiratory secretions) that collects in the channels and parts of the endoscope can be difficult to be removed (Marie, 2016).

Endoscopy related infection may occur under the following circumstances: (1) microorganisms may spread from the gastrointestinal tract via the bloodstream during an endoscopy to susceptible organs or prostheses, or may spread to adjacent tissues that are reached as a result of the endoscopic procedure (endogenous infections), (2) microorganisms may be spread from patient to patient by contaminated equipment (exogenous infections), or (3) microorganisms may be transmitted from patients to endoscopy personnel and perhaps from endoscopy personnel to patients (American Society for Gastrointestinal Endoscopy, 2014).

As regard the importance of manual cleaning, Society of Gastroenterology Nurses and Associates mentioned that, meticulous manual cleaning of endoscopes and accessories is critical to the success of subsequent disinfection. Manual cleaning refers to the physical removal of organic material and/or soil. The presence of residual organic material and/or soil may protect microorganisms from destruction by germicides, therefore contributing to disinfection or sterilization failure. This must begin

immediately after the patient procedure to prevent drying of secretions on both the external surface and inner channels of the endoscope (Abd-Elhamid et al., 2016).

Endoscopy personnel may facilitate the transmission of infection from patient to patient if they fail to carefully adhere to general infection control principles (Macedo, et al., 2005).

Nursing care for patient undergoing upper endoscopy; the nurses should inform the patient about the procedure, take a formal consent, any preparation pre and post-procedure (Abd El- All, 2014).

Infection control practices are critical for the prevention of infection in any medical setting.

Previous studies on endoscopy units concluded that training can significantly improve nurses' knowledge and practice concerning infection control procedures and endoscopic reprocessing techniques (Abd-Elhamid et al., 2016).

Implementing an educational program at GIT endoscopy unit in General Surgery department, Zagazig University Hospitals was not done yet.

Aim of work

To assess nurses' knowledge and practice regarding infection control procedures during GIT endoscopies, to assess nurses' knowledge and practice regarding universal precautions during reprocessing techniques of GIT endoscopies, to evaluate the effect of training program on nurses' knowledge and practice regarding infection control procedures and endoscopies reprocessing procedures.

Materials and methods

Study design: A quasi experimental study (pre-post test).

Place and duration of the study: The study was conducted in GIT endoscopy unit in General Surgery department, Zagazig University Hospitals during the period from the 1st of July 2017 to the end of January 2018.

In the study setting (GIT endoscopy unit is present in General Surgery department, Zagazig University Hospitals), there are about five gastrointestinal tract endoscopic procedures either for diagnostic or therapeutic purposes with four endoscopes (two Duodenoscope, one Gastroscope and one Colonoscope) per day that make the importance of follow effective infection

control procedures and effective endoscopies reprocessing techniques under controlled universal precaution to prevent microbial infection and promote nursing and patients safety.

Study Sample: all endoscopy nursing staffs (38 nurses) who is dealing with endoscopies reprocessing was involved in the study.

Study method:

Two tools are used for data collection from nurses in the unit included:

1- Questionnaire: It consisted of three sections:

- Section A: contains questions about socio-demographic data of nurses such as age, occupation, education, and experience in endoscopy unit, training courses regarding infection control procedures in GIT endoscopy unit (Hossen and Mohammed, 2014).

- Section B: contains questions to assess the endoscopy nurse's knowledge related to infection, chain of infection, standard precautions, and principles of aseptic technique, waste management, nurses' knowledge about cleaning, level of disinfection, sterilization (Abd-Elhamid et al., 2016).

- Section C: contains questions to assess nurse's basic knowledge regarding universal precaution during reprocessing procedures, the questions concentrated on six main items; first about purposes of using endoscope which contain eight questions, second for the method of transferring endoscope for reprocessing, that contains six questions , third about the dangerous of inadequate endoscope reprocessing which contains eight questions, fourth about the universal precautions during endoscope reprocessing, it contains six questions , fifth about endoscope reprocessing steps which contain eight questions, and sixth for documentation that contain two questions. The questions were based on pertinent literature (Public Health Agency of Canada, 2012).

2- Observational check list : to assess their practice level regarding infection control procedures contain items about:

- Hand washing and wearing personal protective equipments (gloves, gowns, shoe covers, head covers, masks, respirators, and eye protection).
- Reprocessing procedure for endoscope disinfection. It include eight steps, first; pre manual clean-

ing stage, second; test the leak, third; manual cleaning and rinsing, fourth; rinsing, fifth; sterilization, sixth; dryness, seventh; storage and eighth; recording and documentations (CDC, 2017).

Pilot study: A pilot study was conducted prior to starting the field study to pretest the data collection tools, procedure of data collection and the duration of the study. It was done to test the contents of the questionnaire and the checklist. Therefore some difficult and unclear questions were modified into easier and clearer ones.

Technical design:

The study was carried out as follows:

I- Pre-test or pre-intervention stage.

II- Intervention stage.

III- Post-intervention stage.

I- Pre-test or pre-intervention stage:

Duration: 3 months from the 1st of July 2017 to the end of September 2017.

Assessment of nurses' socio-demographic data and knowledge about infection control procedures, nurse's basic knowledge regarding universal precaution during reprocessing of endoscopes through a questionnaire. The infection control procedures adopted in the unit of General Surgery department and steps of endoscopes reprocessing was observed regularly during the visits for completion of the checklists which was done weekly.

II-The intervention phase

Duration: 1 month

Field work: Health education intervention was implemented targeting all nurses in the GIT endoscopy unit at General Surgery department, Zagazig University Hospitals; including (38) nurses who was included in the study. The Association for Professionals in Infection Control and Epidemiology (APIC) guidelines for infection prevention and control in flexible endoscopy was disseminated in the unit as:

1. Booklet in Arabic language was prepared by the researcher in pure Arabic details to all nurses in the unit to improve their practice within the studied institution.
2. Lectures (power point including videos for demonstration of the practical steps) and open discussion was used.

The health education message included:

1. Definition of endoscope.
2. Uses, importance and indication of endoscope.
3. Patient preparation and complications.
4. Definition of infection, nosocomial infection and chain of infection,
5. Diseases transmitted through endoscope,
6. Standers universal precautions and aseptic techniques.
7. Endoscopy reprocessing (pre-cleaning, leak test, manual cleaning, rinsing, disinfection, drying, and storage) (Society of Gastroenterology Nurses and Associates, 2012).

Two teaching sessions per week for four weeks was organized and scheduled in the unit. The duration of each session was determined according to the contents needed to inform the nurses. The program was written in Arabic language to be understood easily.

III-post intervention:

Duration: 3 months from the 1st of November 2017 to the end of January 2018.

Reassessment of nurses' socio-demographic data and knowledge about infection control procedures, nurse's basic knowledge regarding universal precautions during reprocessing of endoscopes through the same questionnaire which was used in the pre-intervention phase. The infection control procedures adopted in the unit and steps of endoscopes reprocessing were observed regularly during the visits for completion of the same checklist which was used in the pre-intervention phase.

The scoring system:

1- Knowledge questionnaires:

- Two mark if correct answer.
- One mark for incomplete.
- Zero for incorrect answer.

Total scores 60% or more will be considered as satisfactory knowledge and < 60% will be considered as unsatisfactory (Ali and Taha, 2014).

2- Observational checklists:

- Two marks if the step was correctly done.
- One mark for need more practice.
- Zero for incorrectly done or not done.

A total score 60% or more will be considered as adequate practice and <

60% will be considered as inadequate practice (Ali and Taha, 2014).

Consent

The purpose of the study was explained to the nurses and oral consent was obtained to participate in the study. They were given an opportunity to withdraw from the study at any time. Confidentiality of information was protected. Ethics, values, culture, and beliefs were respected

Ethical approval

Approval by an Institutional Review Board (IRB) for Medical Research Ethics, Faculty of Medicine, Zagazig University, was obtained prior to implementation of the study (ZU-IRB 4303). An official approval for the implementation of the study was obtained from the Gastrointestinal Colonoscopy Unit of General Surgery department, Zagazig University.

Data management

All collected data were organized, categorized, tabulated, entered, and analyzed by using SPSS (Statistical Package for Social Sciences); version 16, which was applied to frequency tables and statistical significance. The statistical significance and associations were assessed using, the arithmetic mean, the standard deviation (SD). McNemar's test was used to detect the relation between the variables. Tables and graphs were done for data visualization.

Results

The study sample of nurses consisted of 38 female nurses with mean age 36.8 ± 6.1 years.

Table (1): Socio-demographic characteristics of the studied nurses.

Items	No	%
Age (years):		
- < 35	13	34.2
- > 35	25	65.8
Mean ± SD	36.8 ± 6.1	
Range	24	
Education:		
- 2ry school of nursing	34	89.4
- Higher education #	4	10.6
Years of experience:		
- 1-3 years	15	39.5
- 3> years	23	60.5
Training courses:		
- Yes	13	34.2
- NO	25	65.8

Institute of nursing or Baccalaureate of nursing.

Table (1) revealed that 65.8% of nurses aged more than 35 years. Most of them (89.4) had secondary school of nursing and 60.5% had experience more than 3 years. Only 34.2% received training courses.

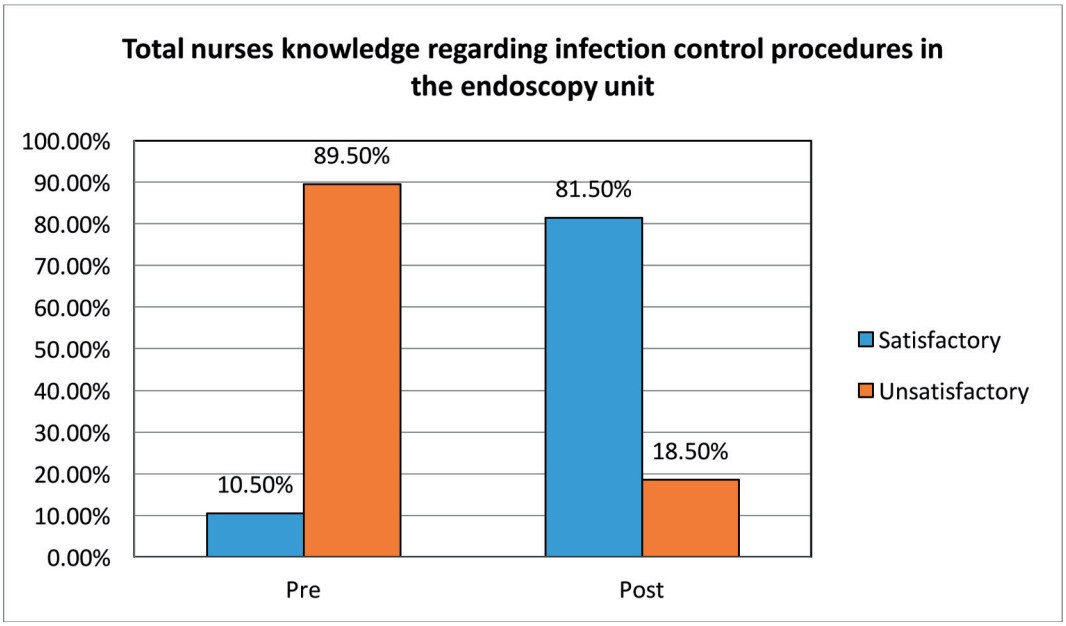

Figure (1): Bar chart showing total nurses' knowledge regarding infection control procedures in the endoscopy unit.

Figure (1) showed the distribution of the studied sample according to their knowledge, it was noticed that the majority of nurses (89.5%) had inadequate knowledge before applying health education program and only (10.5%) of them had adequate knowledge, while after applying health education program the nurse's knowledge was satisfactory (81.5%).

Table (2): Effect of the health education program on nurses' knowledge about Infection Control Precautions post Endoscopy Procedures (endoscopy reprocessing) (No=38).

Procedures	Nurses› knowledge				McNemar›s test p value
	Pre-intervention (Phase I)		Post-intervention (Phase III)		
	No	%	No	%	
Pre-cleaning:					
- Satisfactory	2	5.2	37	97.4	**0.000****
- Unsatisfactory	36	94.8	1	2.6	
Leakage testing:					
- Satisfactory	8	21.1	37	97.4	**0.000****
- Unsatisfactory	30	78.9	1	2.6	
Manual cleaning:					
- Satisfactory	2	5.2	35	92.1	**0.000****
- Unsatisfactory	36	94.8	3	7.9	
High level disinfection:					
- Satisfactory	3	7.9	36	94.8	**0.001****
- Unsatisfactory	35	92.1	2	5.2	
Manual disinfection and rinse:					
- Satisfactory	4	10.6	37	97.4	**0.000****
- Unsatisfactory	34	89.4	1	2.6	
Automated disinfection and rinse:					
- Satisfactory	3	7.9	37	97.4	**0.000****
- Unsatisfactory	35	92.1	1	2.6	
Endoscopy handling:					
- Satisfactory	1	2.7	34	89.5	**0.000****
- Unsatisfactory	37	97.3	4	10.5	
Endoscopy storage:					
- Satisfactory	1	2.7	36	94.8	**0.000****
- Unsatisfactory	37	97.3	2	5.2	
Total post procedure:					
- Satisfactory	2	5.2	21	55.2	**0.000****
- Unsatisfactory	36	94.8	17	44.8	

**: Highly statistically significant at $P < 0.001$ level

Table (2) demonstrated that only (5.2%) of nurses had total satisfactory knowledge about infection control precautions post endoscopy procedures (endoscopy reprocessing) before implementation of the program. The nurses had statistically significant scores in all items at post program phase p<0.001 for all.

Table (3): Total nurses' practice regarding infection control procedures in the endoscopy unit (No=38).

Total practice	Nurses practice				McNemar›s test p value
	Pre-intervention (Phase I)		Post-intervention (Phase III)		
	No	%	No	%	
Satisfactory	2	5.3	30	78.9	**0.000****
Unsatisfactory	36	94.7	8	21.1	

** Highly statistically significant at P < 0.001 level

Table (3) showed that the majority of nurses (94.7%) had unsatisfactory practice before applying health education program, while after applying health education program the nurses' practice was satisfactory (78.9%).

Table (4): Effect of the health education program on nurses' practice about Infection Control Precautions post Endoscopy Procedures (No =38)

Procedures	Nurses› practice				McNemar›s test p value
	Pre-intervention (Phase I)		Post-intervention (Phase III)		
	No	%	No	%	
Pre-cleaning:					
- Satisfactory	3	7.9	31	81.6	
- Unsatisfactory	35	92.1	7	18.4	
Leakage testing:					
- Satisfactory	1	2.7	27	71.1	**0.000****
- Unsatisfactory	37	97.3	11	28.9	
Manual cleaning:					
- Satisfactory	2	5.2	30	78.9	
- Unsatisfactory	36	94.8	8	21.1	**0.000****
High level disinfection:					
- Satisfactory	6	15.7	26	68.4	
- Unsatisfactory	32	84.3	12	31.6	**0.000****
Manual disinfection and rinse:					
- Satisfactory	2	5.2	28	73.6	
- Unsatisfactory	36	94.8	10	26.4	**0.000****
Automated disinfection and rinse:					
- Satisfactory	4	10.5	19	50.0	
- Unsatisfactory	34	89.5	19	50.0	**0.000****
Endoscopy handling:					
- Satisfactory	33	86.6	37	97.3	0.219
- Unsatisfactory	5	13.2	1	2.7	
Endoscopy storage:					
- Satisfactory	12	31.6	36	94.8	
- Unsatisfactory	26	68.4	2	5.2	**0.000****
Total post procedure:					
- Satisfactory	4	10.5	20	52.6	
- Unsatisfactory	34	89.5	18	47.4	**0.000****

** Highly statistically significant at $p < 0.001$ level

Table (4) showed that there were highly statistically improvement in practice level regarding infection control in all table items namely pre-cleaning, leakage testing, manual cleaning, high level disinfected, manual disinfecting, endoscopy storage, and nurses total post procedure after application of the educational programs (P≤0.001).

Discussion

This study was carried out to test the hypotheses that implementation of educational program will improve nurses' knowledge and practices about infection control procedures and reprocessing techniques of endoscopy at GIT endoscopy unit in General Surgery department, Zagazig University Hospital. The study results demonstrated significant improvements in nurses' knowledge and practice in the endoscopic units. The findings lead to accepting the set hypotheses, with confirmation of the effectiveness of the educational program.

As regarding nurses' characteristics, the finding of the present study revealed that slightly less than two third of nurses were in the age group of more than 35 years old with mean age 36.8 ± 6.1 years (Table 1). This result was in disagreement with Moqbel et al., who reported that the most of nurses (67%) age less than 30 years old with mean age 30.1 ± 4.7 years (Moqbel et al., 2015).

However this finding goes in the same line with Abd-Elhamid et al., who founded that that more than two third of nurses were in the age group of more than 40 years with mean age 42.2 ± 8.4 years (Abd-Elhamid et al., 2016).

As regarding education level the majority of the sample had completed their secondary nursing school education while only ten percent of them had higher education in Nursing (Table1). This result was in agreement with El Ghatey et al. who found that the majority of nurses had Diploma Degree in Nursing while minority of them had Bachelor Degree in Nursing (El Ghatey et al., 2013). Also, Ali and Taha, 2014 revealed that about two thirds were females with Diploma Degree in Nursing.

In relation to years of experience, more than half of nurses had experience more than 3 years (Table 1). This finding is consistent with Ali and Taha, 2014 who revealed that more than half of nurses had experience more than 3 years. This finding is in contrast with Soliman who found that, slightly more than half of the nurses had more than 10 years of experience in hemodialysis unit (56.8%) (Soliman, 2013).

More than one third of the studied nurses did not receive training program about infection control (34.2%) (Table 1). It can be explained in the light of the belief that training within the unit is enough; also it may be due to lack of nurses' interest about the infection control training that done by the infection control team in the hospital. This justify is appreciated by Kandeel et al., 2006 who stated that the experience of developing and implementing an infection control (IC) program in Egypt has highlighted many constraints that are common in developing countries, including the lack of trained health care professionals and IC specialists who can implement IC programs.

The results of this study was in agreement with Abolwafa et al. who reported about 10% of the studied sample had previous attendance training courses about infection control (Abolwafa et al., 2013). Also, Hosoglu et al. mentioned that less than one-third of the participants, in their study, had been trained on the prevention of bloodborne diseases and the risks of occupational injuries (Hosoglu et al., 2011).

The current results showed that there was highly significant statistical difference regarding the improvement in the total nurse's knowledge about infection in general, infection control precaution, and endoscopy reprocessing after implementation of the educational program, ($P \leq 0.001$) (Figure 1). This study also revealed that 10.5% only of nurses knowledge was satisfactory in pre educational program; increased to more than three quarters in post phase of educational program. This lack of knowledge would have a negative impact on the endoscope reprocessing procedure. Additionally, it might lead to microbial contamination in the endoscopies used in the endoscopic unit which may lead to health problems to the patients whom undergoing GIT endoscopic procedure.

This is in agreement with Abd-Elhamid et al., 2016 who mentioned that, there was an improvement in the total nurses' knowledge including (infection in general, nosocomial infection, principle of disinfection, infection control precaution, and endoscopy reprocessing) when comparing pre and post, pre and follow up implementation of educational program.

The present study finding was supported by the study carried out by Abd Elaziz et al., 2013 who reported an improvement on nurse's knowledge after implementation of the infection control

program. There was a statistical significant difference ($p<0.01$) between the improvement of nurse's knowledge and the implementation of the infection control program.

This was in line with the study carried out in India by Koshy and Patel, 2015 who compared between the posttest and pretest knowledge scores of staff nurses regarding the infection control measures and they found to be highly significant ($p<0.05$) .

In relation to nurses' knowledge about infection control precautions post endoscopy procedures (endoscopy reprocessing), there was low levels of knowledge among nurses in the present study before implementation of the program. This was noticed in all the tested areas of knowledge like transferring endoscope for cleaning, pre-manual cleaning stage, test leak, manual cleaning stage, high level disinfection, manual and automated disinfection and rinsing, endoscopic handling and storage. There was a statistical significant difference ($p<0.001$) between the improvement of nurse's knowledge and the implementation of the infection control program (Table 2). These findings were in agreement with Moqbel et al., who stated that there was low level of knowledge among nurses before implementation of the program (Moqbel et al., 2015).

The current study illustrated that there were a highly statistically significant improvement of total nurses practice level regarding infection control in endoscopy unit, ($p\leq0.001$) (Table 3). As satisfactory level was 5.3% before implementation of the educational program increased to more than three fourth of study subjects after implementation of the educational program.

This result was congruent with El Ghatey et al. who reported that there were highly statistically significant differences between nurses practice pre and post program implementation (El Ghatey et al., 2013).

Also these findings went in the same line with Abd-Elhamid et al., 2016 who illustrated that there were a significant statistical improvement of total nurses practice level regarding infection control in endoscopy unit. As satisfactory level was 0% in pre intervention program increased to most of study subjects in post intervention program, and more than three fourth in follow up after implementation of educational program (Abd-Elhamid et al., 2016). As well Gijare, (2012) who reported that there was a highly statistically significant differ-

ence in the overall practice of infection control protocols among nurses during posttest showing that the overall effect of training was good (Gijare, 2012).

The current results revealed that none of nurses had satisfactory practice in pre-cleaning, leakage testing, manual cleaning, and manual disinfecting before implementation of the educational program and improved to more than three fourth of nurses after implementation of the educational program (Table 4).

As regarding high level disinfection, manual and automated disinfection; the present study showed that there was a highly statistically significant improvement of nurses practice level ($p \leq 0.001$) (Table 4). This finding was in agreement with Abd-Elhamid et al., 2016 who showed that there was a minority of the study subjects had satisfactory practice in pre intervention program , which increased to three fourth after program implementation. As regarding endoscopy handling, the present study showed that there was insignificant statistical difference of nurses practice level ($p \leq 0.001$) as there was a satisfactory level before implementation of the education program (Table 4).

Conclusion:

Short-term in-service training can significantly improve nurses' knowledge and practice concerning infection control procedures and endoscopies reprocessing techniques in GIT endoscopy unit. It is a must to keep reinforcing the knowledge and practice regarding infection control.

Recommendations:

This educational program should be adopted as an essential component of the continuing educational and training program for all the nurses and all healthcare providers working in endoscopic units. Annual training for all health team members in endoscopy unit is very important.

Conflict of interest

None.

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