Effect of Infection Control Training Program on Nurse's Performance and Microbial Results on GIT Endoscopes

Zeinab Hossen Ali [(1)] **& Nadia Mohammed Taha**[(2)]
[(1)] Assisat. Prof. of Adult Health Nursing-Faculty of Nursing- Helwan University
[(2)] Assisat. Prof. of Medical Surgical Nursing- Faculty of Nursing-Zagazig University

Abstract:
Background: Gastrointestinal (GI) endoscopy is an important tool for the identification and treatment disorders of the gastrointestinal tract. Thorough understanding of infection control and its application to GI endoscopy is crucial to prevent lapses in reprocessing and the possibility of transmission of infection **(**Nelson, DB.2003). **Aim of the study:** The aim of this study was to evaluation the effect of infection control training program on nurse's performance and microbial results on GIT Endoscopes. **Setting & Subjects:** It was conducted at Elnaser Insurance Hospital at Helwan City in Egypt. Purposive sample included all available (40) nurses, and 5 GIT endoscopes. **Study tools:** Tools used for data collection included self-administered questionnaire sheet, an observation checklist, and microbiological assessment sheet. **Results:** The mean ± SD age of the studied nurses were 29.5 ±5.76, about two thirds were female and diploma nurse, and more than phases, these indicated for decrease the presence of microbial infection. **Conclusion:** there were a statistical significance difference between pre implementation of infection control training program and post implementation the endoscopic reprocessing program lead to improve nurses' knowledge and skills as well as decrease the incidence of microbial infection transmission through GIT three years of experience, these experience from working, There was a highly significant difference in nurses' level of knowledge and skills as well as microbiological testes throughout the study endoscope. **Recommendations:** Continuous educational infection control training programs are recommended. So incorporation of such interventions apply in all endoscope unite all over Egypt.

Keywords: Infection Control, Nurse's Performance, Microbial Results

Introduction:
The beneficial role of Gastrointestinal (GI) endoscopy for the prevention, diagnosis, and treatment of many digestive diseases and cancer is well established. Like many sophisticated medical devices, the endoscope is a complex, reusable instrument that requires reprocessing before being used on subsequent patients. The most commonly used methods for reprocessing endoscopes result in high-level disinfection. To date, all published occurrences of pathogen transmission related to GI endoscopy have been associated with failure to follow established cleaning and disinfection/sterilization guidelines or use of defective equipment. [(1)]

The American Society for Gastrointestinal Endoscopy (ASGE) has estimated that the overall risk of patient to patient transmission of a serious infection at endoscopy is 1 in 1.8 million examinations. Since this estimate is based on retrospective rather than prospective studies, it is almost certainly a significant underestimation, but it does indicate the rarity of patient to patient transmission of serious infectious diseases. The risk of endoscopy associated infections due to the contamination of instrument or accessory items by health care facility environmental pathogens, or infection with the patient's own flora, is very significantly higher. [(2)]

Each year in the United States alone, approximately 34 million gastrointestinal procedures are

performed using flexible endoscopes.[3] Estimate of the risk of infection from this type of procedure is one in 10 million. [4] However, despite the low overall rates of infection associated with flexible gastrointestinal procedures, flexible endoscopes are still the most common cause of healthcare device- associated outbreaks, according to the American Society for Gastrointestinal Endoscopy. [3,5] Moreover, the Emergency Care Research Institute (ECRI) ranked flexible endoscope cross contamination as the No. 1 hazard in today's healthcare facilities.[6] The need for continued emphasis on infection control issues remains paramount. Failure to adhere to established reprocessing guidelines accounts for most, if not all, of the reported cases of bacterial and viral transmissions. [7]

Infection control during gastrointestinal (GI) endoscopy is a very broad topic that encompasses a number of different aspects of endoscopy (each requiring distinct and quite different approaches). Conceptually it helps to divide it into three major categories: endogenous infectious complications (or those that result from the patient's own bacterial flora), exogenous infectious complications (resulting from patient-to-patient transmission of pathogens), and the potential for healthcare worker exposure to infection. [8]

Endoscopes are considered semi-critical and should at a minimum receive high level disinfection with a liquid sterilant/disinfectant approved by the United States Food & Drug Administration (FDA). Complex endoscope design features may allow organic debris and microorganisms to accumulate, making manual cleaning essential. Biofilm formation may harbor microorganisms, making strict and meticulous adherence to reprocessing guidelines imperative in order to prevent cross-contamination between patients and hospital-acquired infections. [9] Prompt efficient cleaning processes are the best defense against biofilm formation. [10]

The risk of transmission of any pathogen from an endoscope depends on many factors including the susceptibility of the exposed individual, the infectivity load of the tissues, the amount of contaminating tissue (in part related to the type of procedure done) and the effectiveness of the decontamination processes. [11] The Society of Gastroenterology Nurses and Associates, (SGNA)[12] recognizes the need for increased emphasis and education on infection prevention. A critical part of GI/endoscopy nursing, infection prevention is an issue that impacts every procedure, every patient and every professional in the GI unit.

Endoscopy nurses play a critical role in the provision of safe, high quality endoscopy. They provide nursing care, which includes supporting, disease prevention, health education, training, management and infection prevention. [13]

Significance of the study:

Infection control practices are critical for the prevention of infection in any medical setting. There are now numerous examples of pathogen transmission from the improper use/reuse of Gastrointestinal (GI) endoscopy. [4] In the study setting (Elnaser Insurance Hospital), there are cumulative number of 90 upper gastrointestinal tract endoscopic procedure either for investigation, biopsy or treatment with five endoscopes per day in rotation that make the importance of follow effective endoscopies reprocessing technique under controlled universal precaution to prevent microbial infection and promote nursing and

patients safety. So all staff in any setting where gastrointestinal endoscopy is performed must adhere to infection control principles that will maintain a safe environment, free from the possibility of spreading infection.

Aim of the study:

The aim of this study was to determine the effect of training program on improving nurse's performance and reduction of microbial infections among GIT endoscopy through the following objectives:

- Assess nurse's knowledge and practice regarding reprocessing technique of upper GIT endoscopies
- Assess nurse's knowledge regarding universal precaution during reprocessing technique of upper GIT endoscopies
- Detect the incidence of microbial infections on the GIT endoscopy after routine reprocessing.
- Plan and implement of the training educational program to improve nurse's knowledge and practice regarding endoscopies reprocessing procedure.
- Evaluate the effect of training program on nurse's knowledge and practice regarding universal precaution during reprocessing of upper GIT endoscopy and presence of microbial infections.

Hypotheses:

- Nurses will have improved in their knowledge and practice regarding reprocessing of upper GIT endoscopy after implementation of a training educational program.
- The nurses will follow universal precaution during reprocessing technique of upper GIT endoscopy after implementation of a training educational program.
- The presence of microbial infections on the GIT endoscopy after implementation of the program will be absent

Subjects and method:

Research Design:

A quasi experimental research design was used in the current study with pre-post and follow up assessment.

Study Setting:

The study was conducted in Endoscopy Units in Elnaser Insurance Hospital.

Subjects:

A purposive sample of this study included two groups, group of nurses (40), and 5 gastrointestinal (GIT) endoscopes were used 30 times during period of the study. The nurses' group consisted of all available (40) nurses (14 males and 26 females) working on the study setting, who are dealing with endoscopies reprocessing.

Tools of data collection:

Three tools were used for data collection, self-administered questionnaire to assess nurses' knowledge, an observation checklist for their practice, and microbiological tests sheet.

- **Tool (I): Self administered questionnaire:** It was constructed by the researchers and consisted of two parts:
  - **The first part:** covered nurse's socio-demographic data.
  - **The second part**: covered nurses' knowledge consisted of 10 questions on infection control (true and false) and 38 open questions to assess nurse's basic knowledge regarding universal precaution during reprocessing procedure, the questions concentrated on six main items; *first* about purposes of using endoscope which contain eight questions, *second* for method of transferring endoscope for reprocessing, that contain six

questions , *third* about dangerous of inadequate endoscope reprocessing which contain eight questions, *fourth* about Universal Precaution during endoscope reprocessing, it contain 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 [14] The use of questionnaire is an easy and reliable at 0.986. Nurse's responses were checked with model answers and given two mark if correct answer, one for incomplete and zero for incorrect answer. Total scores (86) 60% or more was considered as satisfactory knowledge and < 60% was considered as unsatisfactory.

- **Tool (II): observation checklist for nurse's practice:** wearing protective barrier (hand washing, wearing gloves, gowns, shoe covers, head covers, masks, respirators, and eye protection =10 degrees), and reprocessing procedure for endoscope disinfection were developed by the researchers based on related literature. [15] It included eight steps, *first;* pre manual cleaning stage that include 7 steps, *second;* test the leak that constitute 2 steps, *third;* manual cleaning and rinsing which contains 8 steps, *fourth;* rinsing, which contains 5 steps, *fifth;* sterilization, that contains 10 steps, *sixth;* dryness that contain 4 steps, *seventh;* storage that contains 2 steps, and *eighth;* recording and documentations, that contains 2 steps, with total number 40 steps=80 degrees. The observed practice was compared with standardized procedures. Accordingly, the nurse was given two points if the step was correctly done, one score for need more practice and zero for incorrectly done or not done. A total score (90) 60% or more was considered as adequate practice and < 60% was considered as inadequate practice. Reliability test was done, using Cronbach`s alpha that measured the degree of reliability. It showed high reliability of the total scale, Alpha = 0.986.
- **Tool (III): The microbiological assessment sheet:** It was developed by the researchers to identify the presence of microbial infectious on the endoscopes before, and after implementation of the program. It was designed to detect the presence of microbial infections like, Streptococcus, Neisseria spp, Serratia marcescens, Helicobacter pylori, Klebsiella pneumoniae, Pseudomonas aeruginosa, Meticillin-resistant Staphylococcus Aureus (MRSA), Enterobacter cloacae, Escherichia coli, and Candida albicans.

Content validity:

Content validity of the tools was established by a panel of seven experts in medical / surgical nursing and in medicine who reviewed them for clarity, relevance, comprehensiveness, understanding, applicability, and ease for administration. Minor modifications were required.

Pilot study:

A pilot study was carried out on ten nurses to assess the applicability and relevance of the tools and test clarity of the designed questionnaire as well as to estimate the time needed to answer them. It helped in detection of difficulties in some items. This led to omission of certain items and addition of others, then the necessary modification was done. These nurses were excluded from the study sample.

Field work:

The study was implemented through assessment, planning, implementation, and evaluation phases. The study lasted from November 2012 to September 2013. The researchers were available three days weekly.

- **Assessment phase:** Upon finalization of the tools and getting official permissions, the researchers started to recruit the samples. A sample of 40 nurses working in the endoscopic unite were invited to participate. Their knowledge was assessed using the self administered questionnaire; followed by observing their practice with endoscopic reprocessing in morning and afternoon shifts using the observation checklist. This phase lasted from January to March 2013. As well in the same time microbiological test was done for 30 swabs from five endoscopies, that were used in the endoscopic unite and disinfectant by the nurses.
- **Planning phase:** Based on analysis of the collected data, and using pertinent literature, the researchers developed a training program for nurses that includes handout booklet in Arabic language, video tabs, in addition to demonstration and re-demonstration training in the endoscopic unite. The objectives were to improve nurses' knowledge, and practice regarding endoscopies reprocessing.
- **Implementation phase:** The program was covered by 14 sessions, 4 sessions for theoretical part and 7 sessions for practice; demonstration and redemonstration till the nurse acquired well practice and good information, 2 sessions for pretest, 2 sessions for posttest and one session for follow up. Swabs from five endoscopies were taken during these sessions. The teaching media included illustrative pictures, videotapes and handouts. Each theoretical session took half hours, and each practical session took 55-75 minutes.
  - **Theoretical part**: covered endoscopy definition, indications, alternatives, types, complications, types of transmitted infectious disease through endoscopies, importance of follow correct steps of endoscopies reprocessing, importance of follow Universal precaution during endoscopies reprocessing, cleaning, disinfectant, sterilization and infection control in unit.
  - **practical part**; covered wearing protective barrier (hand washing, wearing gloves, gowns, shoe covers, head covers, masks, respirators, and eye protection), preparing patients, preparing equipments and supplies, steps of endoscopies reprocessing as follow [(10-15 minutes for Pre manual cleaning stage, 3-5minutes for test the leak, 10-15 minute for Manual Cleaning and Rinsing, 5-6 minutes for Rinsing, which contains (5 steps),10-15 minutes for sterilization, that contains (10 steps) 5-7minutes for dryness that contain (4 steps) contains, 5 -7 minute for Storage, that contains, 2 steps, and 4-5 minute for Recording and documentations, 3 minutes)].
  - This phase lasted for three months from April to June 2013. At the beginning of the first theoretical and practical session, an orientation to the program and its purpose was presented. Each session started

by a summary about what had been taught in the previous session and the objectives of the new one, taking into consideration the use of simple language to suit the level of nurses. The researchers used motivation and reinforcement during the educational sessions to enhance learning. Direct reinforcement in the form of a copy of the training guidelines was offered for each nurse to use it as future reference, and one copy was left in the endoscopic unite to be follow after the program

- **Evaluation phase:** The evaluation of the training program effects on nurses knowledge and practice, and consequently on endoscopies infection was carried out using the same assessment tools. Each nurse was evaluated three times before the program (pre-test), immediately after implementation of the program (post-test), and 6 months after implementation of the program (follow-up), As regarded microbial swabs were also done three times pre (after routine disinfectant), immediately post and after 6 months following implementation of the training program.

Administrative and Ethical considerations:

To carry out this study, the necessary approvals were obtained from the Head of endoscopies unite, and from the General Director of the Hospital after explaining the aim of the study in order to obtain permission and cooperation. At the initial encounter with each nurse, an oral consent was secured them after being informed about the nature, purpose, procedures, and benefits of the study, and that participation is voluntary. Confidentiality and anonymity of any obtained information were ensured through coding all data. The researcher reassured participants that the data collected would be used only for the purpose of the study and to improve system of endoscopies reprocessing as well as nurses and patients well being. No harm could be anticipated from any maneuver in the implementation of the study.

Statistical analysis:

Data entry and statistical analysis were done using SPSS 16.0 statistical software package. Quantitative continuous data were compared using Chi-square test, McNemar's test in case of comparisons between phases of the study. When normal distribution of the data could not be assumed, categorical variables were compared using chi-square test. Paired t-test used to test, Level of Progress among nurses knowledge and practice related to Endoscopic processing through study phases. To detect the correlation between ages, experience on knowledge and practice r-test was used. In order to identify the independent predictors of knowledge and practice scores and the incidence of microbial contamination, Microbial titers (CFU/ mL) were used. [16,17]

Results:

The study sample of nurses consisted of 65.0% females, and 35.0% male with mean age 29.5± 5.76, as seen in **Table (1)**. Nearly two thirds of them had diploma nurses (65.0%), had 3 years experience (57.5%), the majority of them (92.5%) had their experience regarding endoscopic reprocessing from working area.

Table (2): Demonstrated that only 7.5% nurses had total satisfactory knowledge before implementation of the program. The nurses had statistically significant scores in each items at post program phase $p<0.001$. This improvement continued after 6 month of the program implementation

(follow-up) with slightly decline in two areas of knowledge as wearing protective clothes 97.50% and endoscopies transferring technique 95.0% with (p<0.001) for all.

Table (3): Indicates that most of nurses had inadequate practices regarding any area of endoscope reprocessing as wearing protective clothes (82.5%), pre manual cleaning steps 87.5,%, leak test 97.5, manual cleaning 95,0%, rinsing 60,0%, sterilization, 67.5,%, drying 97.5,% and transferring, storage and documentation (100,0%) for each items before the implementation of the program. The post program phase showed statistically significant improvements in nurses' practices (p<0.0001), all the nurses' having adequate practice, the improvement in practice persisted throughout the follow-up (p<0.0001).

Concerning levels of knowledge and Practice Progress in relation to endoscope disinfection among nurses, through phases of the study, **table (4)** shows a high significance progress in levels of knowledge among nurses through phases of the study regarding endoscope reprocessing, most of the studied nurses (92.5%) had incorrect knowledge in the pre-program stage, progress to become (75.0%) of them had correct knowledge in the post-program stage persist to become (67.5%) in the follow up stage, with (p > 0.0001). The same table indicated that more than half of nurses (85.0%) had unsatisfactory level of practice in the pre-program stage progress to become more than four fifth (82.5%) of them in the post program stage had satisfactory done of practice and persist in the follow –up stage to become (77.5%) of nurses had high level of practice (p > 0.0001)

Table (5): Demonstrates the significance differences between phases of study regarding level of knowledge among studied nurses, it shows that there was a highly significance difference between Pre & Post (Mean± SD=4.26 ± 3.35), Pre & follow up (Mean± SD=73.15±10.14), P=0.0001 for both of them similar the same table indicated significance differences through phases of study regarding level of practice among studied nurses, it shows that there was a highly significance difference between Pre & Post (Mean±SD =5.79±14.46), Pre & follow up (Mean ± SD = 82.78±11.47), P=0.0001

Table (6): Demonstrates that, statistically significance correlation between nurses age and endoscope reprocessing knowledge as well as practice (p-value = < 0.05) for both of them, but there were not significance correlation between level of experience and knowledge or practice (p-value => 0.05)

Table (7): Revealed effect of training program through study phases of microbial contamination of endoscopes during Upper Gastrointestinal endoscopy, it was appeared that, in the pre-intervention phase there were Streptococcus spp in 9 of 18 positive cases , followed by Neisseria spp in three of 7 positive cases, H. pylori grew was in three of 5 positive cases and Klebsiella pneumonia was one of two positive case Less frequently, P. aeruginosa, whose growth is favored by moist environments was one of one positive case, and endogenous intestinal flora such as Klebsiella spp was one of two positive cases., while MRSA, E. cloacae and E. coli and Candida albicans microbes were not detected from the endoscope. While in the post and follow- up phases there were not any microbe was detected from the endoscope which indicate the effectiveness of the training program in the elevating of microbes from the GIT endoscope.

Discussion:

This study was carried out to test the hypotheses that implementing infection control program for gastrointestinal endoscope reprocessing and training nurses in their application would improve their related knowledge and practice, with consequent positive effect on the incidence of microbial contamination in the used endoscopes in the endoscopic unites. The study results demonstrated significant improvements in nurses' knowledge and practice, associated with significant decreases in the incidence of microbial contamination on the used endoscopes in the endoscopic unites. The findings lead to accepting the set hypotheses, with confirmation of the effectiveness of the educational program.

The results of the current study revealed that about two thirds were females with diploma degrees in nursing and in middle age. This is the often reported pattern representing nurses' characteristics in similar settings. [18] The higher percentage of female nurses may be due to the increased in the number of female nurse as compared with males. However, the study could not identify any influence of nurses' gender on their practice of endoscope reprocessing. Moreover, only three of the nurses in the current study sample reported having information about endoscope reprocessing through training, i.e. less than one-fourth, whereas almost double of this number reported practice as their source of information. This means that the wrong practices or misconception would extend to nurses from previous generations, and this will be perpetual. In agreement with this, Ramsey, Oemig, Davis, et al [19] which founded in their study that, most of the nurses did not receive any special education or in-service training about endoscope reprocessing practices. The present study result may be due to that there was no special guidelines that regulate the application of endoscope reprocessing in endoscopic unite, this was in agreement with Robinson, Moreau, and McCann [18] which stated that, the critical units has a ratio 1:1, and 1:5 in medical units. It might, also be due to lack of workshops and Educational programs, offered to them and that the new members have to learn and acquire the knowledge from old staff that is overloaded with the high flow of patients.

In view of the foregoing, it was quite expected to find very low levels of knowledge among the nurses in the present study before implementation of the program. This was noticed in all the tested areas of knowledge like (wearing protective clothes, transferring endoscope for cleaning, pre-manual cleaning stage, test leak, manual cleaning stage, rinsing, sterilization and dryness, dangerous of inadequate endoscope disinfection, storage and documentation). This lack of knowledge would have a negative impact on the endoscope reprocessing procedure. Additionally, it might lead to microbial contamination in the endoscopies that used in the endoscopic unite that may lead to health problems to the patients whom undergoing GIT endoscopic procedure. The finding is in agreement with Ramsey et al. [19] which recommended that, it is very important for endoscopy nurse to receive continues educational and training guideline program for endoscopies reprocessing, that help in effective performance and control infection.

The significant improvements demonstrated at the post-guidelines program phase indicate that these nurses were in real need for such information. Moreover, the acquired knowledge was retained with no

declines throughout the six-month follow-up. The effect of the intervention was confirmed through statically analysis that identified the program attendance as a strong positive independent predictor of the knowledge score. The finding further indicates that the nurses continually use their knowledge and apply it to their daily practice, which helps recall and memorization.

It also shows that they were eager to learn and know about correct information regarding this practice of daily work. This eagerness to learn might be explained by the fact that many nurses believe that the importance of the provided guidelines for nurses as well as competence of the procedure; however, feel it is required in some situations for the safety of the patient. They consider it as a "necessary evil "as reported by California Department of Health Services (CDHS) [20] Therefore, if they are forced to do it, they need to know how to do it properly without harming themselves by follow the Universal precaution during the procedure. Our findings are in agreement with Alfa, Olson, and Degagne [21] which recommended that, Healthcare facilities and healthcare providers should establish procedures and provide training for staff to ensure that reusable devices are, cleaned, and sterilized according to the manufacturer's instructions.

The improvement in nurses' practices after the intervention was also noticeable since their practices before the guidelines were even worse compared with knowledge. In fact none of them had adequate practice at the pre-program phase. Like knowledge, the adequate practice continued throughout the follow-up, and the attendance of the program was the only independent predictor that positively influenced the practice score. In agreement with our findings, El-Shamaa [22] recommended the important of an educational program for the endoscopy staff and patients safety .The findings of the current study as well as El-Shamaa [22], highlight the need to provide short-term in-service education programs in all types of endoscopes unites.

According to the present study findings, nurses' experience had no influence on their knowledge and practice scores' improvements. This indicates that the intervention program was beneficial to all nurses regardless their qualification or experience. This might be explained by the fact that the knowledge and practice scores were very low at the pre-program phase, so that no relation could be detected. Only the age had a positive impact on nurses' knowledge and practice score change; this indicates that older nurses got more experience from the worked area compared to younger ones, which might be due to the fact that older may spend more period in working unite compared with the younger ones who spend less period in endoscopic unite. These findings could be as a result of did not attended any training program regarding endoscope reprocessing, consistent with those of El-Shamaa [22], in her study, reported that, about half of nurses have a satisfactory level of knowledge about universal Precautions and infection control policies in the endoscopic unite.

The most common microbial contamination among the current study endoscopies swab results were Streptococcus, Neisseria, H. pylori grew, Klebsiella pneumoniae, P. aeruginosa, and Klebsiella., which is consistent with a public health agency of Canada [23], which reported that the post-procedure infection rate related to inadequate reprocessing is difficult to determine, but the most common exogenous microbial contamination of

endoscopies are Mycobacterium tuberculosis, Pseudomonas aeruginosa, Helicobacter pylori, Salmonella species, Enterobacteriaceae (e.g., Escherichia coli, Serratia sp). These may be due to lack in nurses' knowledge and practice for endoscope's contamination and inadequate reprocessing. Carl, Alvarado and Mark [24] reported similar results regarding The most common factors associated with transmission have Involved inadequate manual cleaning, inadequate exposure of surfaces to the disinfectant, inadequate rinsing and drying, and use of automated endoscope re-processors. In the same line Public Health Agency of Canada [23] discussed that, exogenous infections arise from microorganisms introduced into the patient's body by the flexible endoscope or by the accessories used in the procedure, such infections are preventable with strict adherence to accepted reprocessing guidelines.

Before the implementation of the guidelines, the current studied endoscopies were found to have many types of microbial contamination related to inadequate endoscopies reprocessing and the total number of contamination ranged between nine of eighteen, three of seven, three of five and one of one positive case. The most commonly encountered contamination were the lack of adequate knowledge and practice related to , pre-manual cleaning stage and test leak, manual cleaning stage, rinsing, sterilization, dryness and storage. Similar to this Weber and Rutala [25] which reported that, Outbreaks associated with flexible endoscopy have most often been associated with breaks in the cleaning and/or disinfection/sterilization stage of flexible endoscope reprocessing. As well Cowen [26], has described how the currently used reprocessing protocols provide a very narrow margin of safety and any slight deviation from the recommended steps may result in an increased risk of infection transmission by flexible endoscopes, in the same consequence, and in relation to test leak, Canadian Standards Association [27], reported that, During the manual cleaning process, trained personnel should inspect devices for functionality and damage. As regarded to wearing protective clothes, Alfa et al. [21] recommended that, during the endoscopic procedure and while cleaning endoscopes, endoscopy personnel should wear protective attire (including gloves, masks, eye protection, and moisture-resistant gowns or aprons) as needed to protect themselves from exposure to blood and body fluids. Such items of personal protective equipment should be readily accessible in the endoscopy area. Concerning transportation, the endoscope should be transported to the reprocessing area in an enclosed container. Do not transport contaminated and clean endoscopes in the same container at the same Time. [28]

As regarded to importance of manual cleaning, Society of Gastroenterology Nurses and Associates [29] wrote 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 penetration and destruction by germicides, therefore contributing to disinfection or sterilization failure. This must be beginning immediately after the patient procedure to prevent drying of secretions on both the external surface and inner channels of the endoscope.

In relation to applying reprocessing steps correctly which include rinsing,

storage, documentation and decreasing microbial contamination results of our study indicated effectiveness of the provided program towered this issues, as well Rutala and Weber [30] documented that; the endoscope should be rinsed and all channels flushed to remove the disinfectant and sterility. The use of sterile or bacteria-free water is preferred but tap water can be used followed by a subsequent 70-90% alcohol rinse is critical between each patient use and discard the rinse water after each use/ cycle, as regarded to storage, clean storage space, which is physically separate from decontamination and cleaning areas, should be provided, as well American Institute of Architects [31] reported that, endoscopes should be stored uncoiled, hanging vertically in a clean, dry, ventilated area that prevents recontamination or damage in relation to documentation.

The implementation of the present study educational program led to significant absent in all types of microbial contamination among studied endoscopies. This is certainly due to the effect of the educational guidelines which improved nurses' knowledge and practice. In fact, nurses' knowledge and practice scores turned to be strongly and positively correlated. The findings were confirmed through statically analysis that identified the intervention as a negative independent predictor of contamination among studied endoscopies. This is in fact an objective proof of the success of the guidelines intervention and the authenticity of our third hypothesis.

The reduction in the frequency of contamination among studied endoscopies in the current study may be attributed to the changes in nurses' practice which became adequate and based on satisfactory knowledge acquired during the program. The findings are in agreement with Mehta, Prakash and Garland [32] who demonstrated that Infection Control and Prevention is a critical part of the orientation and continuing education for all personnel, including physicians, nurses, and technical staff who work in the endoscopy setting. As well Vergis, Thomson and Pieroni [33] wrote that, competent personnel that maintain consistent excellence in practice are crucial to proper cleaning and disinfection of endoscopes.

Conclusion:

The study concludes that relatively short-term in-service training can significantly improve nurses' knowledge and practice concerning endoscopic reprocessing, with subsequent reductions in the frequency of related endoscopies contamination. This success is attributed to that the infection control educational program is based on needs assessment and integrates updated technology. However, the findings should be interpreted cautiously because of limitations of the study being quasi-experimental rather than non-randomized design, and also because of possibility of observer's bias in the assessment of the nurse's practices. However, the objective assessment of incidence of microbial contamination might show that the possibility of this bias to have occurred is rather low.

Recommendations:

Therefore, this educational program should be adopted as an essential component of the continuing training program for all the nurses worked in endoscopic unites.

Table) 1): Demographic Characteristics of study Nurses

Items	No.	%
Age	mean ± SD	29.5± 5.76
Sex		
▪ Female	26	65
▪ Male	14	35
Level of education	No.	
▪ Diploma	26	65
▪ Higher education	14	35
Years of experience		
▪ 1-3 years	17	42.5
▪ > 3 years	23	57.5
source of Experience		
▪ training	3	7.5
▪ working	37	92.5

Table (2): Progress in Nurse's knowledge Towered Endoscope Disinfection through Phases of the Study (No. 40)

Item	Pre		Post		Follow up		Chi-square	
	N	%	N	%	N	%	X^2	P-value
Wearing protective clothes :								
▪ Satisfactory	12	30	40	100	39	97.5	68.84	0.0001**
▪ unsatisfactory	28	70	0	0	1	2.5		
Method of transferring endoscope for cleaning:								
▪ Satisfactory	2	5	40	100	38	95	102.9	0.0001**
▪ unsatisfactory	38	95	0	0	2	5		
Pre- manual cleaning stage of endoscope disinfection and leak test:								
▪ Satisfactory	8	20	40	100	40	100	87.27	0.0001**
▪ unsatisfactory	32	80	0	0	0	0		
Manual cleaning stage for rinsing, sterilization and dryness								
▪ Satisfactory	1	2.5	40	100	40	100	115.6	0.0001**
▪ unsatisfactory	39	97.5	0	0	0	0		
Dangerous of inadequate endoscope disinfection:								
▪ Satisfactory	2	5	39	97.5	40	100	106.9	0.0001**
▪ unsatisfactory	38	95	1	2.5	0	0		
Endoscope storage and documentation:								
▪ Satisfactory	1	2.5	40	100	40	100	115.6	0.0001**
▪ unsatisfactory	39	97.5	0	0	0	0		
Total Satisfactory Knowledge	3	7.5	30	75.0	27	67.5	37.6	0.0001**

*** P value at 0.01 indicate significance progress*

Table (3): progress in the nurses practices toward endoscope disinfection through phases of the study (n=40)

Variable	Pre				Post				Flow up				Chi-square	
	incorrect done		correct done		incorrect done		correct done		incorrect done		correct done			
	No	%	No	%	No	%	No	%	No	%	No	%	X^2	P-value
Wearing protective clothes	33	82.5	7	17.5	0	0	40	100	0	0	40	100	91.03	0.0001**
Pre manual cleaning steps	35	87.5	5	12.5	0	0	40	100	0	0	40	100	98.82	0.0001**
Leak Test	39	97.5	1	2.5	0	0	40	100	0	0	40	100	115.6	0.0001**
Manual Cleaning	38	95	2	5	0	0	40	100	0	0	40	100	111.2	0.0001**
Rinsing	24	60	16	40	0	0	40	100	0	0	40	100	60.01	0.0001**
Sterilization	27	67.5	13	32.5	0	0	40	100	0	0	40	100	69.7	0.0001**
Drying	39	97.5	1	2.5	0	0	40	100	0	0	40	100	115.6	0.0001**
Transferring	40	100	0	0	0	0	40	100	0	0	40	100	120	0.0001**
Storage	40	100	0	0	0	0	40	100	0	0	40	100	120	0.0001**
Recording and documentations	40	100	0	0	0	0	40	100	3	7.5	37	92.5	107.9	0.0001**

*** P value at 0.01 indicate significance progress*

Table (4): levels of knowledge and Practice Progress in relation to Endoscope Disinfection among Nurses through Phases of the Study

Items		Pre-intervention		Post-intervention		Follow -up		Pre/post X2* P-value	pre/follow- X2* P-value
		No	(%)	NO	(%)	NO	(%)		
Endoscope disinfection Knowledge	**Correct**	3	7.5	30	75	27	67.5	37.6 0.0001**	30.72 0.0001**
	Incorrect	37	92.5	10	25	13	32.5	26.95 0.0029**	20.59 0.0338**
Endoscope disinfection Practices	**Done**	6	15	33	82.5	31	77.5	36.47 0.0001**	31.43 0.0001**
	Not done	34	85.0	7	17.5	9	21.5	36.67 0.0001**	29.88 0.0001**

X2 Mc Nemar's test ** P value at 0.01 indicate significance progress*

Table (5): Level of Progress among Nurses Knowledge and practice Related to Endoscopic Disinfection Through study phases

Items		Score		Paired t-test		
		Range	Mean± SD	Relation	t	P-value
Knowledge	Pre	0 - 13	4.26 ± 3.35	Pre & Post	39.87	0.0001**
	Post	38 - 76	73.15±10.14	Pre & follow up	40.82	0.0001**
	Follow up	38 - 76	72.75±10.07	Post &follow up	0.17	0.8617
Practice	Pre	0 - 43	5.79±14.46	Pre & Post	26.38	0.0001**
	Post	43 - 86	82.78±11.47	Pre & follow up	26.17	0.0001**
	Follow up	43 - 86	81.63±11.24	Post & follow up	0.46	0.6518

Table (6): Correlation between Age, Experience and Progress in Knowledge and Skills Related to Endoscopic processing among Studied Nurses

Items		Endoscope disinfection Knowledge	Endoscope disinfection practice
Age	r	0.34	0.31
	P-value	< 0.05	< 0.05
Experience	r	0.27	0.18
	P-value	> 0.05	> 0.05

Table (7): Incidence of Microbial Contamination in Studied Endoscopies through Phases of the Study N=30

Infectious agent	Endoscopic Disinfection procedures Pre-program			Endoscopic Disinfection procedures Post-program			Endoscopic Disinfection procedures Follow up		
	Before	Microbial titers (CFU/mL)	After	Before	Microbial titers (CFU/mL)	After	Before	Microbial titers (CFU/mL)	After
▪ Streptococcus	18/30a	10^4–2×10^6	9/30	24/30	10^4–4×10^6	0/30	18/30a	10^4–2×10^6	0/30
▪ Neisseria spp.	7/30	10^3–4×10^6	3/30	13/30	10^4–5×10^6	0/30	7/30	10^3–4×10^6	0/30
▪ Serratia marcescens	3/30	10^4–10^5	1/30	1/30	10^5	0/30	3/30	10^4–10^5	0/30
▪ Helicobacter pylori	5/30	5×10^3	3/30	2/30	2×10^3–2×10^4	0/30	1/30	5×10^3	0/30
▪ Klebsiella pneumoniae	2/30	5×10^3–10^4	1/30	1/30	10^5	0/30	2/30	5×10^3–10^4	0/30
▪ Pseudomonas aeruginosa	1/30	10^4	1/30	1/30	2×10^4	0/30	1/30	10^4	0/30
▪ MRSA	ND	----------	-------	2/30	10^5–2×10^6	0/30	ND	----------	------
▪ Enterobacter cloacae	ND	----------	-------	2/30	10^3–2×10^5	0/30	ND		0/30
▪ Escherichia coli	1/30	10^4	0/30	ND	----------	ND	1/30	10^4	0/30
▪ Candida albicans	ND	----------	-------	1/30	10^3	0/30	ND	----------	0/30

MRSA, meticillin-resistant Staphylococcus aureus; CFU, colony-forming units; ND, not detected.

[a] *Data represent the number(s) of positive cases per 30 cases (endoscope)*

References:

1. Bret T, Jennifer C, Jonathan C, Peter B, David A: Multisociety Guideline on Reprocessing Flexible GI Endoscopes. *Infection control and hospital epidemiology*. 2011; 32(6): 528:534
2. Superdome L.S.: Reprocessing of flexible gastrointestinal endoscopes. *International Journal of Academic Research*. 2010. 2 (4): 218- 227
3. American Society of Gastrointestinal Endoscopy. 2009. Available at: http://www.asge.org/PressroomIndex.aspx?id=6858. Accessed on July 2012.
4. Nelson DB. & Muscarella LF.: Current Issues in Endoscope Reprocessing and Infection Control during Gastrointestinal Endoscopy. *World Journal of Gastroenterology*; 2006 July 7; 12(25): 3953-3964
5. Gillespie E., Kotsanas D. & Stuart R: Microbiological Monitoring of Endoscopes: 5-year review. *J Gastroenterol Hepatol*. 2008; 23(7):1069-74
6. Ford O: Contaminated Endoscopes Top ECRI's Hazard List. Medical Device Daily, 2010. Availbale at: http://www.hcpro.com/INF-255900-6987/Contaminated-endoscopes-a-primary-concern.html . Accessed on 15 / 11/ 2014 at 9.30 am
7. American Society for Gastrointestinal Endoscopy (ASGE): Transmission of infection by gastrointestinal endoscopy. *Gastrointestinal Endoscopy*. 2001; 54(6), 824-828
8. Salfiti N. & Nelson D (2008): Infection Control Measures in Gastrointestinal Endoscopy U S Surgery. *GASTROINTESTINAL ENDOSCOPY*. 2008;67(6): www.giejournal.org 11/3/2014 at 6.45 am
9. Alvarado CJ. & Reichelderfer M.: APIC guidelines for infection prevention and control in flexible endoscopy. *American Journal of Infection Control*. 2000; 28: 138-55.
10. Nelson D: Recent advances in epidemiology and prevention of Gastrointestinal related infections. *Current Opinions in Infectious Diseases*. 2005; 18: 326- 330.
11. Bramble MG. & Ironside JW.: Creutzfeldt-Jakob disease: implications for gastroenterology. *Gut*.2002; 50:888-90.
12. Society of Gastroenterology Nurses and Associates (SGNA): Standards of infection control in reprocessing of flexible gastrointestinal endoscopes. *Gastroenterology Nursing. 2010;* 33(1), 70-80.
13. European Society of Gastroenterology and Endoscopy Nurses and Associates: ESGENA Core curriculum for endoscopy nursing. 2008. Available at: www.esgena.org. Accessed on: 6/4/2012.10.23am
14. Public health agency of Canada: Infection Prevention and Control Guideline for Flexible Gastrointestinal Endoscopy and Flexible Bronchoscopy,2011.Availbel at: www.publichealth.gc.ca Accessed on 6/4/2012.6.38 pm
15. Olympus America Inc.: QUICK TRACK Reprocessing Checklist for GI Endoscopes. 2003. Available at: *olympusamerica.com/.../files/custome_cleaning_checkl* . Accessed on 6/4/2012 at 10.7 am
16. Rosie S.: Statistics: 1.1 Paired t-tests Mathematically Learning Support Center Discovering statistics using SPSS 2nd ed. Sage Publications SIGMA, 2003
17. Michael P. : Exact McNemar's Test and Matching Condence Intervals, August 25, 2003 available at: http://cran.r-roject.org/web/packages/exact2x2/vignettes /exact McNemar. pdf . Accessed on: 9/4/2014 at 6pm

18. Robinson J., Moreau D., & McCann J.: *Hand Book of Medical-Surgical Nursing*. 3rd ed., Pennsylvania: Springhouse, 2002; pp. 303-310.
19. Ramsey AH., Oemig TV., Davis JP, et al,: An Outbreak of Bronchoscopy-Related Mycobacterium tuberculosis Infections Due to Lack of Bronchoscope Leak Testing. *Chest.* 2002;121:976-81
20. California Department of Health Services (CDHS): State Health Department Releases RevisedNurse-To-Patient ratios for public comment. 2003; Available at: http://www.dhs.ca.gov. Accessed on: 6/4/2012. 10 am
21. Alfa MJ., Olson N., & Degagne P.: Automated washing with the Reliance Endoscope Processing System and its equivalence to optimal manual cleaning. *AJIC* 2006;34:561
22. El-Shamaa E.: Developing A Control Action Plan For Infection Prevention At The Endoscopy Unit. *International Journal Of Academic Research*. July 2010, 2(4): 1 - 10
23. Public Health Agency of Canada: Infection Prevention and Control Guideline for Flexible Gastrointestinal Endoscopy and Flexible Bronchoscopy.2010. Available at: http://www.phac-aspc.gc.ca. accessed on 6/4/2012 at 11.50 am
24. Carl J. & Mark R.: APIC guideline for infection prevention and control in flexible endoscopy, *AJIC* .2000; 28:138-55
25. Weber DJ. & Rutala WA.: Lessons from outbreaks associated with bronchoscopy. *J Hosp Infect.* 2001; 22:403-8
26. Cowen AE.:The clinical risks of infection associated with endoscopy. *Can J Gastroenterol.* 2001; 15:321-31.
27. Canadian Standards Association. Decontamination of Reusable Medical Devices. Mississauga, Ontario. 2008. Report No.: Z314.8-08. Available at: http://canadianbestpracticequalityaudits.com/wp-content/uploads/2012/ 11/ Thermal-Disinfection.pdf. Accessed on 26/4/2012
28. SGNA Practice Committee. Standards of Infection Control in Reprocessing of Flexible Gastrointestinal Endoscopes: Chicago, IL: SGNA Headquarters; 2008. http://www.sgna.org/Portals/0/sgna_stand_of_infection_control_0712_FINAL.pdf. Accessed on 26/4/2012
29. Society of Gastroenterology Nurses and Associates. Guidelines for the use of high-level disinfectants and sterilants for reprocessing of flexible gastrointestinal endoscopes. In: Abrutyn E., Goldmann DA. & Scheckler WE. Saunders. Infection Control Reference Service: The Experts' Guide to the Guidelines. 2nd ed. Philadelphia, PA: W.B. Saunders Company; 2001. p. 402-7.
30. Rutala WA. & Weber DJ: Reprocessing endoscopes: United States perspective. *J Hosp Infect.* 2004;56:S27-S39
31. American Institute of Architects: Gastrointestinal Endoscopy Facilities Guidelines for Design and Construction, Hospital and Health Care Facilities. American Institute of Architects. ASHRAE Journal. 2006, 48
32. Mehta AC., Prakash UBS., Garland R., et al: American College of Chest Physicians and American Association for Bronchology Consensus Statement: Prevention of Flexible Bronchoscopy-Associated Infection. *Chest* 2005; 128:1742-55.
33. Vergis AS., Thomson D. & Pieroni P., et al: Reprocessing Flexible Gastrointestinal Endoscopes After a Period of Disuse: Is It Necessary? *Endoscopy*. 2007; 39:737-9.

تأثير برنامج تدريبى لمكافحة العدوى على اداء الممرضات ونتائج العدوى الميكروبية في مناظير الجهاز الهضمي

زينب حسين علي[١]، نادية محمد طه [٢]
[١] أستاذ مساعد تمريض البالغين- كلية التمريض- جامعة حلوان ، [٢]أستاذ مساعد التمريض الباطنى الجراحي -كلية التمريض- جامعة الزقازيق

مقدمة:
منظار الجهاز الهضمي هو أداة مهمة للوقاية والتشخيص وعلاج اضطرابات الجهاز الهضمي. ولمكافحة العدوى يتطلب معالجة قبل استخدامها على المرضى، وأكثر الطرق شيوعا لإعادة المعالجة تكون باستخدام التطهير عالي المستوى، وقد ارتبط انتقال العدوى عن طريق المنظار بعدم إتباع الممرضات لقواعد التنظيف الراسخة والمبادئ التوجيهية للتطهير / تعقيم أو استخدام معدات معيبة.

هدف الدراسة:
هدفت الدراسة الى تقييم تأثير البرنامج التدريبي لمكافحة العدوى على أداء الممرضات ونتائج العدوى الميكروبية فى مناظر الجهاز الهضمي

طرق وأدوات البحث

مكان و عينة البحث:
مكان الدراسة اجرى البحث فى مستشفى النصر للتأمين الصحي بحلوان
عينة الدراسة اشتملت الدراسة على عينة هادفة من الممرضات (٤٠) ، و خمس مناظير للجهاز الهضمي.

أدوات جمع البيانات:
وتشمل الأدوات المستخدمة لجمع البيانات ثلاث أدوات تم تصميمها بواسطة الباحثين استنادا إلى المراجع العلمية وهى ورقة الاستبيان ذاتية قائمة مرجعية للمراقبة ورقة تقييم الميكروبيولوجية

التداخلات التمريضية:
تم إعداد ارشادات للتداخلات التمريضية من قبل الباحثين على أساس تقليل نسبة العدوى داخل وحدة المناظير وتحسين اداء (معلومات ومهارات) الممرضات فى تلك الوحدات، مقارنة النتائج التى تم الحصول عليها من تطبيق أدوات الدراسة قبل التدخل ونتائج البحوث المماثلة.
تم عمل دراسة استطلاعية على عشر من المرضى وتم تعديل الأدوات بناء على نتائجها.
قد استغرقت عملية جمع البيانات والمعلومات سنة ا ابتداء من نوفمبر ٢٠١٢ الى سبتمبر ٢٠١٣.

النتائج :
أسفرت الدراسة عن النتائج التالية:
يتراوح سن الممرضات بين ٢٩,٥ ± ٥,٧٦ وكانت حوالي ثلثي العينة من الإناث ودبلوم تمرض، وجود نقص في معلومات وممارسات الممرضات تجاة مكافحة العدوى وطريقة تطهير وتجفيف وتخزين المنظار وكذلك وجود عدوى ميكروبية بعد تطهير المنظار بالطريقة التقليدية قبل تطبيق البرنامج التدريبى. الاستنتاج: هناك فرق ذو دلالة إحصائية بين مرحلة ما قبل تنفيذ برنامج التدريب على مكافحة العدوى وتنفيذ برنامج إعادة معالجة تطهير المنظار.

الخلاصة:
تحسين معارف ومهارات الممرضات وكذلك تقليل نسبة حدوث انتقال العدوى الميكروبية من خلال منظار الجهاز الهضمي

التوصيات:
ينصح بتطبيق البرامج التدريبية التعليمية المستمرة لمكافحة العدوى. ودمج هذه التدخلات وتطبيقها في جميع وحدات المناظير التى توجد فى جميع أنحاء مصر.