

Effect of Infection Control Guidelines on Nurses' Performance among Medical-Surgical, and Obstetrics-Gynecological Departments during Coronavirus

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Abstract: Not only health professionals have been learning infection control concepts currently, but the entire world has been learning infection prevention and control techniques during the Corona virus. Hospital-acquired infection, also known as a nosocomial infection, is a global issue that continues to be the leading cause of death in all clinical settings. This research was aimed to evaluate the effect of infection control guidelines on nurses' performance among medical-surgical and obstetrics - gynecological departments during corona virus. Design A quasi-experimental research design (pre and/or post-test) was conducted. Settings: The current investigation took place at Menoufia University Hospital's medical-surgical and obstetrics-gynecological departments in Menoufia Governorate, Egypt. Sample: 138 nurses who are working in the above departments were selected as a purposive sample in this research. Instruments: Three instruments were used for data collection; the first instrument consists of two parts: sociodemographic characteristics of nurses and their awareness of infection control standards. The second instrument was an observational checklist for nurses' behaviors and performance about infection control rules. The third instrument: Assessment sheet for factors that impede infection control process during corona virus. Results: The nurse's awareness and performance of infection prevention practices improved following the intervention, according to the results of this research. In addition, the nurse's level of knowledge and practice had a positive relation. Conclusion: After the guidelines intervention, the nurses' awareness and habits related to infection control rules improved significantly. Recommendations: Onsite scheduled periodic training updating program courses should become an integral part of all hospital training for nurses and there should be a continuous follow-up and appraisal of the nurses' performance frequently regarding the infection control guidelines.

Keywords: Infection control guidelines, the nurses' knowledge and practice, Corona virus.

1. INTRODUCTION

A hospital-acquired infection (HACI) is a pathogen that develops during a patient's hospitalization but does not show up from the start. Infection control is a high-quality standard of patient care for the patients' well-being and the nurses' and patients' safety. Three agents are necessary to spread infectious pathogens in a healthcare system: a reservoir, a vulnerable host, and a route of transmissions. In the hospital setting, health care personnel and visitors are vulnerable hosts (1).

Use of numerous medical equipment's, like urine catheters, central venous pressure, wound draining catheters, and enteral feeding systems, as well as all invasive and noninvasive patient care procedures, will all influence the risk of healthcare-associated infection. The most prevalent hospitalization-related patient condition all around the world is healthcare-associated infection. As a result, current nursing knowledge and understanding of infection control guidelines are critical to infections control, and nursing staff has the opportunity to exercise infection control guidelines regularly as part of patient care. Infection control standards are the most effective methods for preventing the transmission of health-care-associated pathogens in clinical settings, including surgical, medical, obstetrics, and gynecology departments (2). Inadequate complying with infection control measures, including unsafe procedures like injection, infusion, and all medication procedures, as well as the non-compliance with both standard and transmission-based universal precautions, continues to result in the transfer of all pathogenic bacteria to healthcare professionals all through regularly scheduled health care protocols (3 & 4).

Infection control standards like proper handwashing, sharp objects safety, protective equipment using including gloves, gowns, protective clothing, and eye goggles, equipment safety, and also the application of appropriate infection control standard precautions during invasive and noninvasive techniques are all components of the nursing care principles when directly in touch of body materials. The nursing care guidelines are considered the most simple and low-cost strategies that improve patient health care outcomes. The non-compliance to these infection control guidelines leads to an increase in the liability of infection occurrence whatever systemic or localized, in all patients and medical staff (5 & 6).

Few studies train nurse practitioners on infection prevention recommendations and safety measures for hospitalized patients. As a result, offering educational training for nursing staff on clinical practice guidelines and prevention techniques is the most priority program for the nurses to reduce the risk of healthcare-associated infections.

Significance of the study

Healthcare-associated infection is the most dangerous complication occurred during hospitalization in all clinical settings as medical-surgical, obstetrics gynecological departments. It is the primary cause of death within that population and causes an additional patient burden. It had believed that only 1 in 20 hospitalized patients is at risk of developing an infection, which might be the dangerous cause of death in approximately 99,000 cases per year (13 & 14). In any healthcare setting, evaluating the nurse's commitment to patient safety requirements is critical in infection control improvement process. This study will add to the existing literature and nursing interventions that develop the nurses' skills (7).

During the COVID-19 pandemic, the CDC recommends employing additional infection control methods to the existing measures as routine care for all patients. These guidelines had intended for all patients, not just those who have been diagnosed with SARS-CoV-2. Rules & procedures must be prepared by facilities to assure that the instructions had implemented.

A study of nursing' knowledge and practices related to infection control guidelines seemed to be limited. So, it is essential to promote the further assessment of the nurse's knowledge and its related practices regarding the standards. As a result, the purpose of the research was to evaluate the effect of infection control guidelines on the nurses' performance among medical-surgical and obstetrics-gynecology departments.

Aim of the study:

To evaluate the effect of infection control guidelines on the nurses' performance among medical-surgical and obstetrics gynecological departments during the Coronavirus.

Research hypotheses

- The nurses who attended the infection control guidelines sessions will have a higher knowledge score after the intervention than before.
- The nurses who attended the infection control guidelines sessions will have better practice after the intervention than before.

- Following implementation of infection control guidelines intervention, there will be a positive association between the study' participants knowledge and skills.

2. METHOD

Research Design:

To achieve the current study's aim, a quasi-experimental research design (one group pre-and post-test) had used.

Settings:

The current research had carried out at Menoufia University Hospital's medical-surgical and obstetrics-gynecological departments in Menoufia Governorate, Egypt.

Sample:

A convenience sample of 138 nurses from medical-surgical and obstetrics-gynecology departments who agreed to participate in the study and met the following criteria had selected. Guidelines training sessions about infection control measures during routine nursing care had attended by the research participants. The sample size was calculated statistically at 95 % confidence level to be 138 nurses using the following equation, increasing the study's reliability.

$$Ss \text{ (sample size)} = \frac{Z^2 * (p) * (1-p)}{c^2}$$

Where:

Z = Is the value of Z (e.g. 1.96 for 95% confidence level)

p = percentage of people who make a decision, represented as decimal (0.5 used for sample size needed)

c = confidence interval

Inclusion criteria:-

1. The working experience of the staff nurses is at least one year. Their age group ranges between 20- 50 years old.
2. No history of attending any previous training program about infection control guidelines.
3. Agree to take part in the research.

Exclusion criteria - :

1. The nurses who are more than 50 years old and the nurses who are younger than 20 years old are both excluded.
2. All nurses who are suffering from anxiety disorders, or who are dealing with any stressors or impairments, and/or who are unable to comprehend the researcher's information and instructions.

Instruments:

The researchers used three instruments to meet the study's aim and collect the relevant data as follows:

Instrument I: A structured Interviewing Questionnaire:

This instrument was developed by the researchers and divided into two sections: sociodemographic data as age, marital status, professional features, the educational level and a history of previous infection dangers exposure during their working period. The other one discusses nurses' awareness of infectious diseases.

System of scoring: Correct answer response received 2, incorrect answer received 0, and the incomplete answer received 1. Scores of less than 50% were classified poor, scores of 50 to 75 percent were classified satisfied, and scores of more than 75 percent were rated excellent.

Instrument 2: An observational checklist. The researchers created it to assess the nurses' behaviors and performance about infection control rules containing 14 items related to the participants' practice.

Scoring system: The performed action had scored 1, and the non-performed action had scored 0. The total maximum score had represented as 28, scores < 50 % had considered as non-adherence, scores between 50 and 75 had considered as partial adherence, and scores < 75 had considered as good adherence.

Instrument 3: Assessment sheet for the factors that impede the infection control process during corona virus. The researchers constructed it to assess the variables that limit infection prevention as lack of nurse's knowledge and deficiency of patients care equipment. Each positive response had represented a score of 1, and each negative response had represented as 0. Scores < 75 % had considered as no adequate, and the scores > 75 had considered as adequate.

Validity:

The researchers made a comprehensive literature analysis before developing questionnaires based on previously used instruments and reviewing the relevant literature. Five qualified experts (two experts from the Faculty of Nursing, two physicians from the obstetrics and gynecology department, and the medical-surgical department) designed and cross-checked the questionnaires for content validity.

Test-retest reliability had used to assess the instruments' internal consistency by repeatedly giving the same tool to the participants under the same settings. The correlation coefficients were 0.84 and 0.82, respectively.

Procedure

I-Preparatory phase

- **Formal approval:** After a description of the study's goal, the hospital's directors and head nurses of the medical, surgical, and obstetrics, gynecology departments gave their official consent.
- **Instruments development:** Instruments I and II had designed by the researchers after a comprehensive literature review. A panel of five specialists from the Faculty of Nursing's Medical-Surgical and Obstetrics Nursing Department evaluated their content validity to ensure relevance and completeness.
- **Human rights and ethical considerations:** Following clarifying the research's aim, all participants signed a consent form to participate. They had promised that all information gathered would be kept strictly confidential and utilized exclusively for this research. The participants had also been told that refusing to join in the study would have no negative consequences.
- **Pilot study:** Before data collection, a pilot study was performed on 14 nurses (10%) to assess all instruments for simplicity, objectivity, practicality, and relevance. Also, to detect the time required for data collection and any difficulties while administering the tools. After which, the appropriate changes had modified.

- **Fieldwork for the study:**

The current study was carried out in three phases:

The Pre-test phase: -

- Data were collected over six months, from the beginning of February 2021 to the end of July 2021.
- The researchers started gathering data following obtaining permission to carry out this study.
- The researchers introduced themselves before giving the questionnaire emphasizing that the safety precautions were maintained during the research. After that, the nursing staff had given a brief description of the study's aim.
- The questionnaire had provided to the eligible nurses who agreed to take part in the study. Throughout the data collection, the researchers are present to answer any questions the participants may have on the questionnaire.
- The average time taken for completing the questionnaire was around 20-25 minutes. After completion of the questionnaires, the researchers collected it and make sure that the questionnaire was being filled.

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- The mean time took to complete the questionnaire was approximately 20-25 minutes. The researchers collected the data once they were completed and double-checked that they had filled it out correctly.

Intervention phases

- The researchers employ careful infection control precautions when dealing with the Corona virus. After collection of the data from the study participants (pretest), the intervention was carried out, and the subjects attended four sessions; each session was 30- 45 minutes.
- All study subjects received the two instruments to estimate pre-test assessment for knowledge, performance, and factors that affected their compliance.
- Once the approval was taken to carry out the study, the researchers started to collect the data and implemented the program of intervention in the following way:
 - The nurses were given a booklet about the infection control guidelines.
 - The training sessions were divided by the researchers into 4 sessions; one hour per day, one day every week for four weeks.
 - Knowledge assessment questionnaire was filled by the nurses during the pretest and posttest within 30 minutes.
 - An observational checklist for assessing the nurse's performance was filled by the researchers within 30 minutes during the work in the hospital.
 - The factors affected the nurse's compliance to infection control, and its measures were recorded by the nurses within 30 minutes.
 - The methods of teaching used in the program were lectures, group discussions, and demonstrations of health practice.
 - The standard precautions guidelines sessions were three sessions.
 - **The first session** was geared toward knowledge content about infection and infection control guidelines as hand washing, personal protective measures, and handling sharp instruments. It was given in about (1) hour.
 - **The second session** was geared toward the clinical application of handwashing, personal protective measures, and dealing with sharp instruments. It was given in about (1) hour.
 - **The third session** was regarding the clinical application of environmental hygiene, clinical application of dealing with sharp instruments, caring of wound dressing, intramuscular injection (IM) injection and giving intravenous infusion), It was given in about (1) hour.

Evaluation phase

- Evaluation phase: every nurse was evaluated two times during the research period using two instruments, before and after the intervention within four weeks.
- A comparison between both pretest and posttest was carried out to evaluate the effect of nursing care guidelines regarding infection control on nurses' performance among medical surgical and obstetrics gynecological departments during corona virus.

Statistical Analysis

Using SPSS software, the gathered data was organized, tabulated, and statistically analyzed (Statistical Package for the Social Sciences, version 22 SPSS Inc. Chicago, IL, USA). The range, mean, and standard deviation were determined for quantitative data. A comparison between qualitative data, which is described as a set of data organized into categories by frequency, percentage, or proportion of each category. Pearson's correlation coefficient was used to assess the correlation between variables (r). The significance level for interpreting the findings of tests of significance was set at $p0.05$ (22).

3. RESULTS

Table (1) Socio Demographic Characteristics of the Study Staff Nurses (n= 138)

| Variables. | the Study Nurses | |
|---|------------------|------|
| | No | % |
| Age : (X ±SD) | 33.26±7.06 | |
| Gender | | |
| • Male | 93 | 67.4 |
| •Female | 45 | 32.6 |
| Marital status : | | |
| • Single. | 50 | 36.2 |
| • Married. | 80 | 58.0 |
| • Widow. | 8 | 5.8 |
| Educational level : | | |
| • Nursing Diploma. | 56 | 40.6 |
| • Bachelor of nursing. | 72 | 52.2 |
| • Master of nursing. | 10 | 7.2S |
| Working Clinical area | | |
| • Medical Surgical department. | 56 | 40.3 |
| • Obstetrics Gynecology department. | 82 | 59.7 |
| Presence of hospital infection control training | | |
| • Yes. | 30 | 22.3 |
| • No. | 108 | 77.7 |
| Presence of infection control effective unit | | |
| • Yes. | 44 | 31.7 |
| • No. | 94 | 68.3 |
| Presence of infection control effective recognized team | | |
| • Yes. | 20 | 14.4 |
| • No. | 118 | 85.6 |
| At the unit, there is an infection control handbook guide and an efficient staff. | | |
| • Yes. | 20 | 14.4 |
| • No. | 118 | 85.6 |

Table (1) shows sociodemographic characteristics of the study staff nurses. Concerning infection control training and the presence of effective team and team leaders, most of the study staff nurses (77.7) didn't previously train, and about (85.6) indicated a lack of recognized effective infection control team and team leaders with appropriate manual guidelines.

Table (2): Pre / Post Intervention of Nurses' Practice of Infection Control Guidelines during Corona Virus.

| Guidelines of Infection Control | Study Group (n= 138) | | | | X2 | P value |
|---|----------------------|------|-------------------|------|-------|----------|
| | Pre intervention | | Post intervention | | | |
| | No | % | No | % | | |
| Effective hand hygiene | | | | | | |
| • Done. | 48 | 34.6 | 114 | 82.8 | 65.09 | 0.0001** |
| • Not done. | 90 | 65.4 | 24 | 17.2 | | |
| Personal protective equipment like gloves, mask, gown | | | | | | |
| • Done. | 28 | 20.1 | 95 | 68.4 | 65.83 | 0.0001** |
| • Not done. | 110 | 79.9 | 43 | 31.6 | | |
| Well Handling of sharp instruments | | | | | | |
| • Done. | 34 | 24.5 | 110 | 79.2 | 83.86 | 0.0001** |
| • Not done. | 104 | 75.5 | 28 | 20.8 | | |

| | | | | | | |
|--|----------------|-------------------------|----------------|----------------------|--------|----------|
| Safe injection disposal practice • Done. • Not done. | 55 83 | 39.6 64.4 | 89 49 | 64.8 35.2 | 16.78 | 0.0001** |
| Safe IM injection and giving intravenous injection • Done. • Not done. | 23 115 | 16.6 83.4 | 105 33 | 75.6 24.4 | 97.96 | 0.0001** |
| Safe handling of escaped blood during daily care • Done. • Not done. | 36 102 | 25.9 74.1 | 120 18 | 86.4 13.6 | 104.03 | 0.0001** |
| Safe protocol of cough for both patients and staff • Done. • Not done. | 44 94 | 31.7 68.3 | 100 38 | 72 28 | 45.53 | 0.0001** |
| Safe handling of both thoracentesis and paracentesis to prevent infection transmission • Done. • Not done. | 40 98 | 28.8 71.2 | 107 31 | 77.4 22.6 | 65.33 | 0.0001** |
| Safe handling during perioperative patients transfer • Done. • Not done. | 23 115 | 16.6 83.4 | 105 33 | 75.6 24.4 | 97.96 | 0.0001** |
| -- Safe handling during vaginal delivery or examination • Done. • Not done. | 56 82 | 40.3 59.7 | 92 46 | 66.2 33.8 | 18.88 | 0.0001** |
| Safe handling during all invasive catheterization or intubation during perioperative period • Done. • Not done. | 30 108 | 21.6 78.4 | 120 18 | 86.4 13.6 | 118.28 | 0.0001** |
| Safe handling of the recommended isolated patient • Done. • Not done. | 44 94 | 31.7 68.3 | 112 26 | 80.6 19.4 | 68.17 | 0.0001** |
| Safe handling of correct patient assignments in the clinical area • Done. • Not done. | 13 125 | 9.4 90.6 | 132 6 | 95.4 4.6 | 205.76 | 0.0001** |
| Safe handling of all intraoperative sterile equipment • Done. • Not done. | 25 113 | 18 82 | 118 20 | 84.9 15.1 | 125.51 | 0.0001** |
| Performance levels: • Adherence. • Partially adherence. • No adherence. | 14 44 80 | 10.9% 31.3% 57.8% | 85 29 24 | 61.8 20.9 17.3 | 84.155 | 0.0001** |

Table 2: This table shows a highly statistically significant difference among the study staff nurses pre and post-intervention related to the practice of all infection control guidelines during Corona virus. Also, there is an improvement in the nurses' adherence to the positive practices of infection control guidelines and infection prevention precautions among the study participants after the intervention (P-value <0.001).

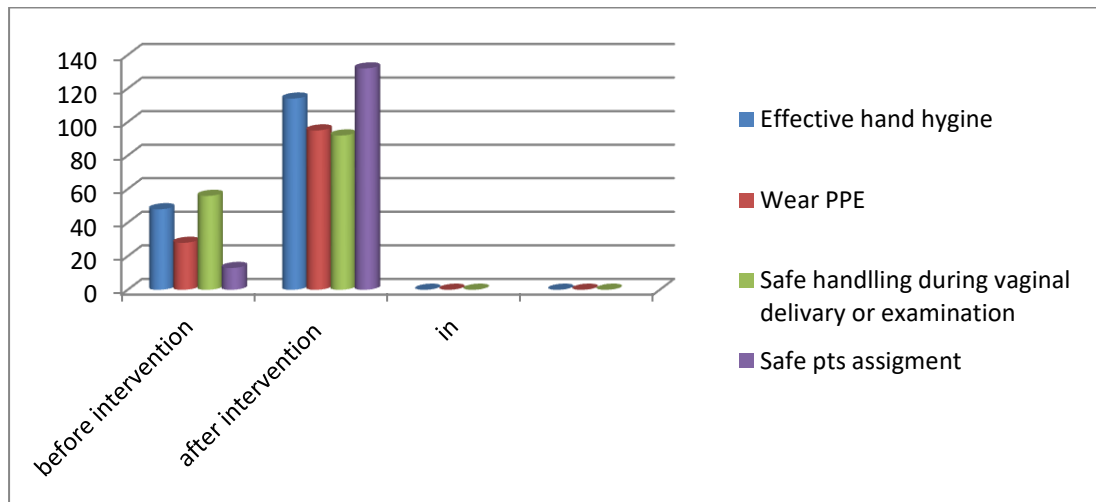


Figure (1) Pre and Post Intervention Nurses' Practices of Infection Control guidelines during Corona virus

Table (3) Pre / Post- Scores of nurses' knowledge regarding infection control guidelines during Corona Virus.

| Items | Study Group (n= 138) | | | | X2 | P value |
|--|----------------------|------|-------------------|------|---------|---------|
| | Pre intervention | | Post intervention | | | |
| | No | % | No | % | | |
| Definition of nosocomial infection control process | | | | | | |
| • Incorrect. | 105 | 75.7 | 18 | 12.9 | 148.822 | 0.0001 |
| • Incomplete. | 28 | 20.6 | 20 | 14.4 | | |
| • Correct. | 5 | 3.7 | 100 | 72.7 | | |
| Chain of process of infection | | | | | | |
| • Incorrect. | 117 | 84.9 | 10 | 7.2 | 172.63 | 0.0001 |
| • Incomplete. | 13 | 9.4 | 32 | 23.4 | | |
| • Correct. | 8 | 5.7 | 96 | 69.4 | | |
| Methods of prevention of nosocomial infection control | | | | | | |
| • Incorrect. | 88 | 63.5 | 14 | 10.8 | 112.59 | 0.0001 |
| • Incomplete. | 30 | 21.6 | 20 | 14.3 | | |
| • Correct. | 20 | 14.9 | 104 | 74.9 | | |
| Methods of transmission | | | | | | |
| • Incorrect. | 90 | 64.9 | 10 | 7.3 | 143.38 | 0.0001 |
| • Incomplete. | 30 | 22.4 | 12 | 8.8 | | |
| • Correct. | 18 | 12.9 | 116 | 83.9 | | |
| Knowing standard universal precautions | | | | | | |
| • Incorrect. | 80 | 57.8 | 24 | 17.3 | 84.155 | 0.0001 |
| • Incomplete. | 44 | 31.3 | 29 | 20.9 | | |
| • Correct. | 14 | 10.9 | 85 | 61.8 | | |
| Knowing transmission based universal precautions | | | | | | |
| • Incorrect. | 78 | 56.0 | 23 | 14.0 | 57.27 | 0.0001 |
| • Incomplete. | 35 | 24.0 | 37 | 30.0 | | |
| • Correct. | 25 | 20.0 | 78 | 56.0 | | |
| Total knowledge score | | | | | | |
| • Good. | 18 | 12.9 | 116 | 83.9 | 143.38 | 0.0001 |
| • Satisfied. | 30 | 21.2 | 10 | 7.2 | | |
| • Poor. | 90 | 65.9 | 12 | 8.9 | | |

Table (3) Show that there were highly statistically significant differences between both before and after the intervention related to the total knowledge score indicating improvement in total knowledge score at (P-value <0.001).

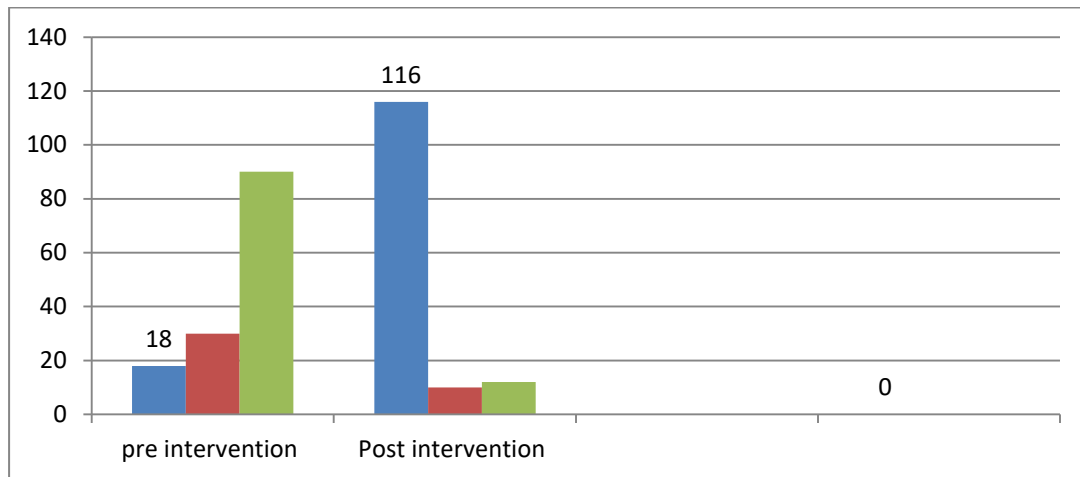


Figure (2) the Nurses' participants' knowledge score regarding the guidelines of infection control during Corona virus at two different intervals (pre and post intervention)

Table (4) the main prerequisites for accomplishing the infection control practice process during Corona Virus

| Items | participant Nurses (n= 138) | | | | X2 | P value |
|--|-----------------------------|--------------|-------------------|--------------|--------|---------|
| | Pre intervention | | Post intervention | | | |
| | No | % | No | % | | |
| Infection control organizational effective unit. • Yes. • No. | 34 104 | 24.5 75.5 | 109 29 | 78.5 21.5 | 81.62 | 0.001 |
| Infection control organizational effective separate team work • Yes. • No. | 58 80 | 41.8 58.2 | 115 23 | 82.9 17.1 | 50.32 | 0.0001 |
| Infection control organizational separate team work leader • Yes. • No. | 46 92 | 33.2 66.8 | 111 27 | 80 20 | 62.41 | 0.0001 |
| Infection control procedure based clinical manual • Yes. • No. | 24 114 | 17.5 82.5 | 125 13 | 90 10 | 148.78 | 0.0001 |
| Infection control organizational supportive other unit. • Yes. • No. | 30 108 | 21.6 78.4 | 113 25 | 81.4 18.6 | 99.97 | 0,0001 |
| Infection control organizational official support • Yes. • No. | 23 115 | 16.6 83.4 | 122 16 | 87.7 12.3 | 142.41 | 0.0001 |
| Infection control enough time for training • Yes. • No. | 15 123 | 10.5 89.5 | 100 38 | 72 28 | 107.70 | 0.0001 |
| Infection control facilities availability Mask, safety box ,gloves and all personal protective equipment • Yes. • No. | 46 92 | 33 67 | 82 56 | 59 41 | 18.88 | 0.0001 |

| | | | | | | |
|------------------------|-----|------|-----|----|--------|--------|
| Scoring system: | | | | | | |
| • Adequate | 15 | 10.5 | 100 | 72 | 107.70 | 0.0001 |
| • Non adequate | 123 | 89.5 | 38 | 28 | | |

Table (4) Show that there were highly statistically significant differences before and after the intervention related to the adequacy of the main requirements or facilities needed for infection control process achievement such as nurses knowledge and deficiency of most patients care equipments.

4. DISCUSSION

This study aimed at evaluating the effect of infection control guidelines on nurses' performance among medical-surgical and obstetrics gynecological departments during corona virus. So, this discussion covered two main sectors:

First: The nurse's knowledge regarding infection control during the Corona virus is being improved.

This current study found that level of knowledge and practice offered by the nursing staff in prevention and control of hospital-acquired infection is dependent on the guidelines intervention. It is supported by (9) who found that the majority of nurses did not follow specific standard operating procedures in healthcare institutions and hospitals, such as wearing protective equipment like gloves, masks, aprons, safely dispose of the needles and sharp instruments, and also recommended that in-service training program be implemented to be effective in improving the nursing health system.

The present study showed that the majority of the study participants weren't trained previously on infection control and prevention precautions guidelines. This result was inconsistent with (10), showed that the educational programs were effective in promoting the participants' knowledge regarding infection control and prevention measures. Also, (11) reported that the application of such programs is beneficial in improving the nurses' knowledge of infection prevention and recommended that infection control programs should be included in in-service training programs.

The present study results revealed that there was an improvement in the overall nursing knowledge score regarding the general information of infection control after the nursing care guidelines intervention as (83.4%) of the study participants exhibit a good knowledge score compared to only (12.9%) before the nursing care guidelines intervention. This result is in hand with (12) evaluated the effectiveness of staff nurses' education and training on infection control measures as handling of the central venous catheter and catheter-associated urinary tract infections and reported that their performance was more effective and improved after the educational training program on infection control guidelines. This finding aligns with (12), which assessed the efficacy of staff nurses' infection prevention and control training and education, including how to handle central venous catheter and manage catheter-associated urinary tract infections. Also, found that their performance was more effective and improved after the educational training program on infection control guidelines.

The present study findings reported a significant improvement in the knowledge level of the study participants regarding infection control standard universal precautions after the guidelines intervention (61%) as compared to (10.9 %) before the guidelines intervention. This result was supported by (13) who reported that half of the nurses and health workers did not know the universal precautions. It is the main reason for noncompliance to the standard universal and isolation precautions. The most study participants (56.0 %) had a considerable improvement in their level of knowledge regarding transmission-based universal precautions after the guidelines intervention compared to (33.5 %) before the guidelines intervention, according to the findings. This was in line with the results of (14), who found significant positive relationships between knowledge, performance, self-reported attitude, and nurses' reported difficulties.

This study found that 83.2 % of them reported a fair score level after the guidelines intervention, compared to 12.9 percent before the guidelines intervention. It was supported by (15), who found that following the guidelines intervention, a statistically significant increase in the level of knowledge regarding all general measures of infection control, and also a significant improvement in overall knowledge from an average to a high level.

Second: The nurses' practice and performance in terms of infection control during the Corona virus are being improved.

Concerning the infection control and prevention practices, the current study found that most of the study participants had good infection control practices, as their performance after the guidelines intervention was found to be higher than before

the guidelines intervention. This result was in the same direction as (16) that evaluated the knowledge and practice of nursing staff towards infection control measures and revealed that nearly more than one-quarter of the participants had a fair level of knowledge that mainly due to deficiency of infection control training courses. The researcher explained this result was due to the similarity of shortage in programs and courses in most universities and nursing institutions and inadequate in-service training programs.

As regards the compliance with infection control practice as an effective hand hygiene practice, the present study findings showed that the majority of study participants (82.8 %) were significantly improved after the guidelines intervention than before the guidelines intervention (34.6%). This finding was supported by (17), indicating that information and knowledge about infection transmission methods were associated with higher compliance with effective hand hygiene practice in all routine care. Also, the present study demonstrated that the study participants who comply with the use of personal protective equipment had high significant compliance after the guidelines intervention than before the guidelines intervention. This result was in the same direction as the study of (18), which studies the relationship between the nurses' knowledge level regarding infection control guidelines and their performance level.

Regarding infection control principles, such as safe handling during the vaginal birth evaluation, immediate newborn care, proper catheter handling, correct handling of sharps, appropriate wound dressing, and adequate handling during all invasive nursing activities, The performance of the majority of the study participants improved significantly following the guidelines intervention. This result was in the same direction with (19) ; (20) who assessed the nurses' practice level regarding infection control measures and demonstrate that the majority of the study participants had good practice levels regarding the infection control to be higher after the educational program than that what was reported before the intervention.

Concerning the needle stick injuries of the nurses, the study results showed the increased risk to its related blood-borne infection exposure before the guidelines intervention (89) than the exposure to it after the guidelines intervention (49) through prevention of needle stick injuries. It was attributed to the educational guidelines intervention about prevention of needle recapping and the use of safer needle devices, sharps collection boxes, gloves, and personal protective gear, and universal precautions. This result was in the same line with (21) who reported that needle stick and sharps injury prevention is essential to control the blood born infection.

Furthermore, a large percentage of study participants reported numerous modified factors that influence the hospital's infection prevention and control processes, as loss of an effective infection control committee to prevent infection, lack of infection control manuals and guidelines, lack of an effective unit, and loss of an effective separate team, and team leader for infection control committee before the guidelines intervention. After the guidelines intervention, all the study participants had all infection control protective supplies and facilities with statistically significant differences. This result was in the same direction as the study of (22) and (23), who studies the correlation between the nurses' knowledge level and their performance level regarding the infection control guidelines.

Additionally, the majority of the study participants reported that there was a great shortage of all infection control protective supplies and facilities all time as surgical gowns, gloves and eye protectors and all disinfectant solution after the guidelines intervention as compared to the before guideline intervention with significant difference at p value (0.0001). It predisposed both nurses and patients before the guidelines intervention to great risk to the hospital-acquired infection. The result was in line with (24) and (25) who study the effect of educational program implementation about infection control guidelines on enhancement of the nurses' total knowledge and performance level.

Finally, the study findings supported the researchers' hypotheses as the nursing guidelines intervention regarding infection control during the Corona virus help in promoting the nurses' knowledge score and improved performance score after the intervention compared to their knowledge score and performance before the guidelines intervention.

5. CONCLUSION

The nurses' knowledge and practices regarding the infection control guidelines during the Corona virus were highly statistically significantly improved after the guidelines intervention than before.

6. RECOMMENDATIONS

Based on the findings of the present study, the following recommendations are suggested: Onsite scheduled periodic training updating programs courses should become an integral part of all hospital training for nurses. Should exist a continuous follow-up and appraisal of the nurses' performance regarding the infection control guidelines during corona virus pandemic. In addition, all hospitals and other healthcare facilities now have more equipped infection control units.

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