

Effect of Infection Control Guidelines on Improving Nurses' Performance Regarding Patients with Burn Injury

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Abstract: Burns provide a convenient area for bacterial growth and explosive sources of infection than other types of wounds, essentially due to massive and deep extent of burned areas and longer length of hospital stay. The effective approach to reduce infection should be based on detailed knowledge of burn care and infection control. Aim of the study: was to evaluate effectiveness of infection control guidelines on improving nurses' performance regarding patients with burn injury. Method: quasi-experimental research design was conducted in Plastic, Reconstructive and Burn Surgery Center - Mansoura University. The data was collected from a convenient sample of (30) nurses where three tools were used for data collection included nurses' infection control knowledge questionnaire, nurses' performance observational checklists & hospital environment observational checklist. Results: indicated an improvement in both total nurses knowledge & practice with statistically significant differences between the pre- and posttests' scores ($P= 0.001$). Conclusion: applying infection control guidelines was effective in improving both nurses' knowledge and practice.

Keywords: burn, infection control, knowledge, practice. ⁴ Lecturer of Plastic Surgery, Faculty of Medicine, Mansoura University, Egypt

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I. Introduction

Burns are a significant global health problem and considered one of the most destructive circumstances encountered the medical field and comprises a unique subset of traumatic injuries resulting in long-lasting sequelae. In spite of, respectable improvements in burn care; burn injury still continue to be an essential source for morbidity and mortality¹. Hospital acquired infection is assorted as one of the most common complications affecting hospitalized burned patient due to immunity alternation secondary to burn injury. This infection leads to increased duration of hospital of stay, prolonged treatment, and too much costs². The microorganisms that colonize or infect burn patients originate from not only the patient's flora but also from the hospital environment and healthcare personnel^{3,4,5}.

Among nosocomial infections in patients with burn injury burn wound infection (BWI) is the more common occurring. This is attributed to the fact that surface of burn wound is rich with protein and presence of necrotic tissue, so it can be easily infected⁶.

Detection and prevention of infection is considered a curricular part of the nurses' role during the acute phase of burn care. Nurses are accountable for providing a secure and clean environment for burn wound to observe early indicators of infection^{7,8}. Also nurses keep the patient away from origin of contamination, involving surrounding patients, working staff, visitors, and medical equipment⁹.

Aim of the study: The aim of the study was to evaluate the effectiveness of infection control guidelines on nurses' knowledge & performance.

II. Methodology

Research design:

Quasi experimental research design was used in this study.

Research hypothesis:

There will be a difference with improvement between nurses' knowledge and performance before and after applying infection control guidelines.

Setting:

This study was conducted at Plastic, Reconstructive and Burn Surgery Center - Mansoura University–Egypt.

Subject:

All available nurses (30) work in the previously mentioned setting who provide direct patient care and accepted to participate in the study with different age, qualification, level of education and years of experience.

Tools:

The following tools were utilized to collect data for this study. All tools were developed by the researcher based on thorough up to date literature review.

Tool I: Nurses' infection control knowledge questionnaire:

This tool aimed to explore nurses' knowledge regarding infection control.

Part 1: Socio-demographic data for nurses

It was comprised nurses' socio-demographic characteristics (e.g. age, gender, marital status, level of education, number of experience years in burn unit) and attendance of infection control courses.

Part 2: Nurses' knowledge about infection control

This part consisted of 100 close ended questions to assess nurses knowledge regarding infection control measures as the following and each correct answer was given one score while incorrect answer was given zero:

1. Nurses' knowledge about burn injury (**10 questions**).
2. Nurses' knowledge about nosocomial infection (**20 questions**).
3. Nurses' knowledge about infection control measures **32 questions** in total and include three categories: standard precautions (6 questions), hand washing (10 questions), and personal protective equipment (PPE) divided to gloves (8 questions), plastic apron (2 questions), overhead (1 questions), masks (3 questions), overshoes (2 questions).
4. Nurses' knowledge about infection control measure for burned patients

14 questions in total and include three categories: nursing care for burn wound dressing (5 questions), nursing care for injection and the installation of solutions (5 questions), nursing care for urinary catheter (4 questions).

5. Nurses' knowledge about waste management (**6 questions**).
6. Nurses' knowledge about linen management (**5 questions**).
7. Nurses' knowledge about sterilization and disinfection (**9 questions**).
8. Nurses' knowledge about burned patients visiting policy (**4 questions**).

Tool II: Nurses' performance observational checklists

This tool consisted of observational checklists to assess nurse^s performance for most common procedures adopted in burn unit regarding infection control measures as the following:

1. Hand washing (**22 items**).
2. Hand scrubbing before burn wound dressing (**21 items**).
3. Donning and removing sterile gloves (**17 items**).
4. Burn wound dressing (**21 items**).
5. Vein puncture/insertion of peripheral IV line (**24 items**).
6. Urinary catheter care (**7 items**).
7. Proper use of personal protective equipment (PPE) **36 items** in total and included four categories: Gloves (14 items), aprons and gowns (5 items), overhead (2items), face Masks (7 items), sequence for putting on personal protective equipment (PPE) (4 items), sequence for removing personal protective equipment (PPE) (4 items).

Each item in the checklist has three options done correctly, done incorrectly or not done to be checked by the investigator. All subjects observed if he /she done correctly, done incorrectly or not done for each item except the observed performance for proper use of personal protective equipment has two options yes or no. The items observed to be done correctly were scored "2", done incorrectly"1" and not done"0". Observed performance for proper use of personal protective equipment which scored yes "1" and no "0".

Tool III: Hospital environment observational checklist

This tool aimed to assess adherence to hospital infection control measures and consisted of 132 items distributed as the following.

Observational checklist for assessment of housekeeping process **79 items**, linen management observational checklist **13 items**, waste Management observational checklist **27 items** & visitors' policy observational checklist **13 items**.

Scoring system:

Regarding scoring system, any correct answer for knowledge was given score of one point, otherwise zero score was given. Also for practice, the items observed to be done correctly were scored "2", done incorrectly "1" and not done "0". The discrete scores for the different knowledge and practice domains were summed and overall knowledge and practice score was obtained. The scoring for nurses' knowledge was distributed as follows: Above 75% represented high, 50- 74% represented moderate and below 50% represented low knowledge as the same for nurses' practice & environmental assessment above 75% represented good, 50- 74% represented moderate fair and below 50% represented poor practice

Method:

Once the needed approvals were granted, the study proceeded. The investigator emphasized that participation is absolutely voluntary and anonymity, privacy, rights, nurses was absolutely assured from the beginning of the study.

The data were collected throughout the study tools. The data collection covered a period 14 month. Verbal consent was also obtained from nurses prior to the study after clarification of the nature and aims of the study. The content validity was established by a panel of ten experts from faculty of nursing & faculty of medicine - Mansoura University - Egypt, who reviewed the tools for clarity, relevance, comprehensiveness, understanding, applicability and simplicity for implementation and according to their opinion some modifications were applied accordingly. Reliability testing was done using Cronbach's alpha to measure its internal consistency to evaluate how well the tool consistency measure what they are designed to measure. A pilot study was carried out on 10% of total number of nurses. An interview schedule was used for data collection and nurses interviewed individually by the investigator in the nursing room to accomplish nurses knowledge questionnaire according to their working schedule, their performance was observed indirectly during morning and afternoon shifts and environment also assessed by using study tools. A program was implemented and an instructional booklet was given to nurses. Nurses' knowledge, practice & environment were evaluated by using the same tools of pre- test.

Statistical analysis

After data were collected it was revised, coded and fed to statistical software IBM SPSS version 21. The given graphs were constructed using Microsoft excel software. All statistical analysis was done using two tailed tests and alpha error of 0.05. P value less than or equal to 0.05 was considered to be statistically significant. Categorical data was analyzed by Pearson's chi square test, Mont Carlo exact test, Fishers exact test and Friedman test.

III. Result

Table (1): Shows socio-demographic characteristics frequency distribution of studied nurses (n=30)

This table clarifies that (66.7%) of studied nurses was aged from 20 <30 years. Females were more prevalent in the study sample than males, they constitute (70%) of nurses. Two third of nurses were married (66.7%). Regarding the educational level of nurses (63.3%) had technical health institute and only (13.3%) nursing schools. Concerning years of experience the study also showed that (60.0%) of nurses had experience less than 5 years and the highest proportions of studied nurses (86.7%) did not attend training courses about infection control.

Table (1): Socio-demographic characteristics' frequency distribution of studied nurses (n=30)

Nurses' Socio-demographic characteristics (n=30)	No	%
Age of nurse		
• 20-	20	66.7%
• 30-	10	33.3%
Nurse Gender		
• Female	21	70.0%
• Male	9	30.0%
Marital status		
• Single	10	33.3%
• Married	20	66.7%
Education		
• Bachelor	7	23.3%

• Technical health institute	19	63.3%
• Nursing school	4	13.3%
Years of experience		
• <5	18	60.0%
• 5-	8	26.7%
• 10-	4	13.3%
Training courses about infection control		
• Yes	4	13.3%
• No	26	86.7%

Table (2): Reflects infection control knowledge distribution of studied nurses (n=30)

Regarding burn injuries knowledge, low knowledge level was the prominent one where represented (70%) of them meanwhile both immediate post and one month post intervention low level decreased to represent only (16.7% & 20%) respectively. Hospital acquired infection knowledge level also was low (60%) through pre intervention phase which achieved observable reduction ((16.7% & 20%) respectively) in both two post intervention phases. Knowledge of infection control measures did not differ from the previous domains where (73.3%) of them had low level in pre-intervention phase which noticed to decrease in immediate post phase to reach (16.7%) and (20%) one month post intervention. Nurses attained equal low and high level in burn infection precautions knowledge before intervention with the same percentage (46.7%) in which low level decreased to reach only (3.3%) in both immediate post phase. Waste management knowledge levels were high in all study phases with percentages of (50.0%), (46.7%), (36.7%) respectively. Regarding dirty linen management, only (13.3%) of studied nurses obtained high knowledge level in pre intervention phase which continued to raise to reach high levels in both immediately post and one month post intervention with percentages of (66.7% & 60.0%) respectively. In respect to sterilization knowledge level, exactly half of studied nurses obtained low level in pre intervention phase that decreased to reach only (13.3%) for both immediately and one month post intervention. Pointing to visits knowledge nurses obtained high level in all phase of study with percentage of (46.7%), (80.0%), (83.3%) consecutively. Also, this table demonstrates that there was a high statistically significance improvement in pre, immediate post and one month post intervention ($P=0.001$) in all domains of knowledge.

Table (2): Infection control knowledge domains distribution of studied nurses (n=30)

Nurses' knowledge domains	Phase						χ^2 (P)
	Pre intervention		Immediately post intervention		One month post intervention		
	No	%	No	%	No	%	
Burn injury knowledge							
• Low	21	70.0%	5	16.7%	6	20.0%	23.5 (0.001)*
• Moderate	2	6.7%	8	26.7%	7	23.3%	
• High	7	23.3%	17	56.7%	17	56.7%	
HAI knowledge							
• Low	18	60.0%	5	16.7%	6	20.0%	16.7 (0.001)*
• Moderate	6	20.0%	9	30.0%	8	26.7%	
• High	6	20.0%	16	53.3%	16	53.3%	
Infection control measures knowledge							
• Low	22	73.3%	5	16.7%	6	20.0%	30.5 (0.001)*
• Moderate	6	20.0%	7	23.3%	11	36.7%	
• High	2	6.7%	18	60.0%	13	43.3%	
Burn infection precautions knowledge							
• Low	14	46.7%	1	3.3%	1	3.3%	32.8 (0.001)*
• Moderate	2	6.7%	11	36.7%	17	56.7%	
• High	14	46.7%	18	60.0%	12	40.0%	
Waste disposal knowledge							
• Low	7	23.3%	1	3.3%	1	3.3%	10.9 (0.001)*
• Moderate	8	26.7%	15	50.0%	18	60.0%	
• High	15	50.0%	14	46.7%	11	36.7%	
Dirty linen management knowledge							
• Low	10	33.3%	4	13.3%	1	3.3%	20.6 (0.001)*
• Moderate	16	53.3%	6	20.0%	11	36.7%	
• High	4	13.3%	20	66.7%	18	60.0%	
Sterilization knowledge							
• Low	15	50.0%	4	13.3%	4	13.3%	15.4 (0.001)*
• Moderate	12	40.0%	11	36.7%	13	43.3%	

• High	3	10.0%	15	50.0%	13	43.3%	
Practice domains	Phase						X ² (P)
• Moderate	13	43.3%	6	20.0%	5	16.7%	12.9
• High	14	46.7%	24	80.0%	25	83.3%	(0.003)*

X2: Friedman test for repeated measure* P < 0.05 (significant)

Figure (1): Overall nurses' knowledge pre, immediate post and one month post intervention (n=30)

As illustrated in figure (1) the percentage of nurses had high knowledge level raised from a pre-intervention level of (6.70%) to attain (53.30%) & (46.70%) at immediate post & one month post intervention respectively. Overall knowledge improvement had high statistical significant difference (P= 0.001).

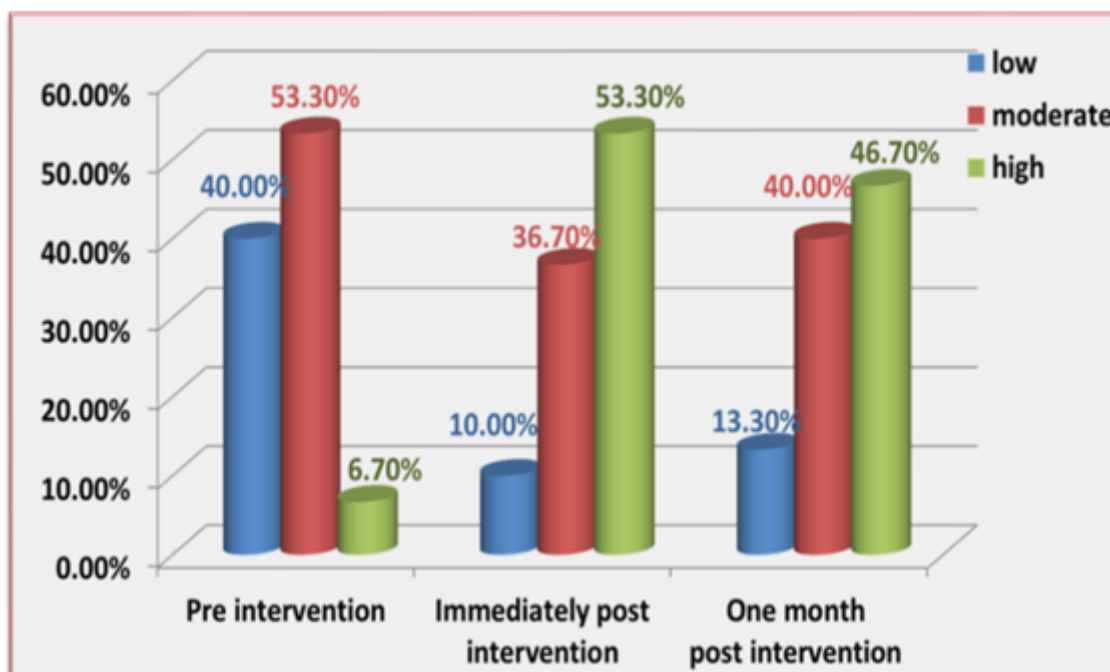


Figure (1): Overall nurses' knowledge pre, immediate post and one month post intervention (n=30)

Table (3): Describes infection control practice domains distribution of studied nurses (n=30).

Concerning hand washing nurses' practice in pre intervention was poor with percentage of (96.7%) that decreased to achieve (0%) in the immediate post and (10%) one month post intervention. As regard for hand scrubbing, all studied nurses showed poor practice in pre intervention phase where their performance improved and low poor level decreased to register (0%) and (23.3%) in immediate post & one month post intervention phase consecutively.

Nurses' practice regarding donning and removing sterile gloves attained a poor level (80%) which decreased to achieve (0%) & (20%) in both post intervention phases respectively. Pointing to burn wound dressing at pre intervention phase (93.3%) of nurses got poor practice that decreased to reach (66.7%) immediately post intervention and (0%) one month post intervention. Vein puncture/insertion of peripheral IV line practice level showed good level by only (10%) in pre intervention phase that elevated to attain to reach (36.7%) and (66.7%) in both immediately post & one month post intervention.

Nurses' practice regarding urinary catheter care during pre-intervention phase revealed poor level with percentage of (90.0%) that reduced to reach (0% & 20%) in both immediate post & one month post intervention phase consecutively. Personal protective equipment practice level was fair for all studied nurses which also showed improvement where all nurses attained good practice level in both post intervention phases. It was observable that there was an improvement with statistical significant difference regarding practice level in all study phases.

Table (3): Infection control practice domains distribution of studied nurses (n=30)

	Pre intervention		Immediately post intervention		One month post intervention		
	No	%	No	%	No	%	
Hand washing							
• Poor	29	96.7%	0	0.0%	3	10.0%	74.3 (0.001)*
• Fair	1	3.3%	12	40.0%	22	73.3%	
• Good	0	0.0%	18	60.0%	5	16.7%	
Hand scrubbing							
• Poor	30	100.0%	0	0.0%	7	23.3%	96.5 (0.001)*
• Fair	0	0.0%	1	3.3%	21	70.0%	
• Good	0	0.0%	29	96.7%	2	6.7%	
Donning and removing sterile gloves							
• Poor	24	80.0%	0	0.0%	6	20.0%	92.7 (0.001)*
• Fair	6	20.0%	1	3.3%	24	80.0%	
• Good	0	0.0%	29	96.7%	0	0.0%	
Burn wound dressing							
• Poor	28	93.3%	20	66.7%	0	0.0%	52.9 (0.001)*
• Fair	2	6.7%	6	20.0%	4	13.3%	
• Good	0	0.0%	4	13.3%	26	86.7%	
Vein puncture/ insertion of peripheral IV line							
• Poor	15	50.0%	19	63.3%	4	13.3%	30.7 (0.001)*
• Fair	12	40.0%	0	0.0%	6	20.0%	
• Good	3	10.0%	11	36.7%	20	66.7%	
Urinary catheter care							
• Poor	27	90.0%	0	0.0%	6	20.0%	62.8 (0.001)*
• Fair	3	10.0%	1	3.3%	1	3.3%	
• Good	0	0.0%	29	96.7%	23	76.7%	
Personal protective equipment							
• Poor	0	0.0%	0	0.0%	0	0.0%	85.4 (0.001)*
• Fair	30	100.0%	0	0.0%	0	0.0%	
• Good	0	0.0%	30	100.0%	30	100.0%	

Friedman test for repeated measures* P < 0.05 (significant)

Figure (2): Total nurses' practice levels pre, immediate post and one month post intervention (n=30)

Figure 2 reveals that majority of nurses' practice level (96.70%) was poor in pre-intervention phase which shifted to reach good level (96.70%) & fair level (93.30%) at immediate post & one month post intervention respectively. Total practice improvement had high statistical significant difference (P= 0.001).

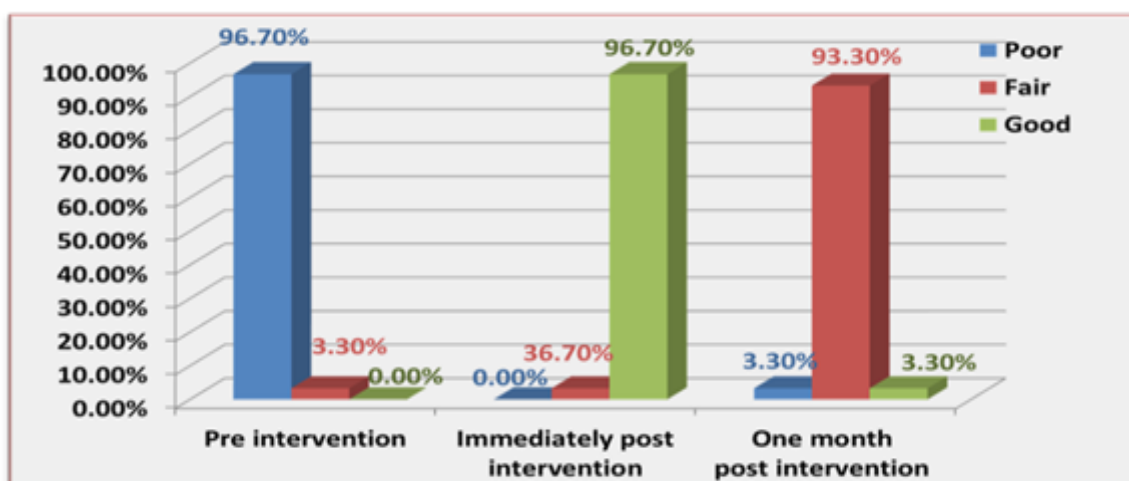
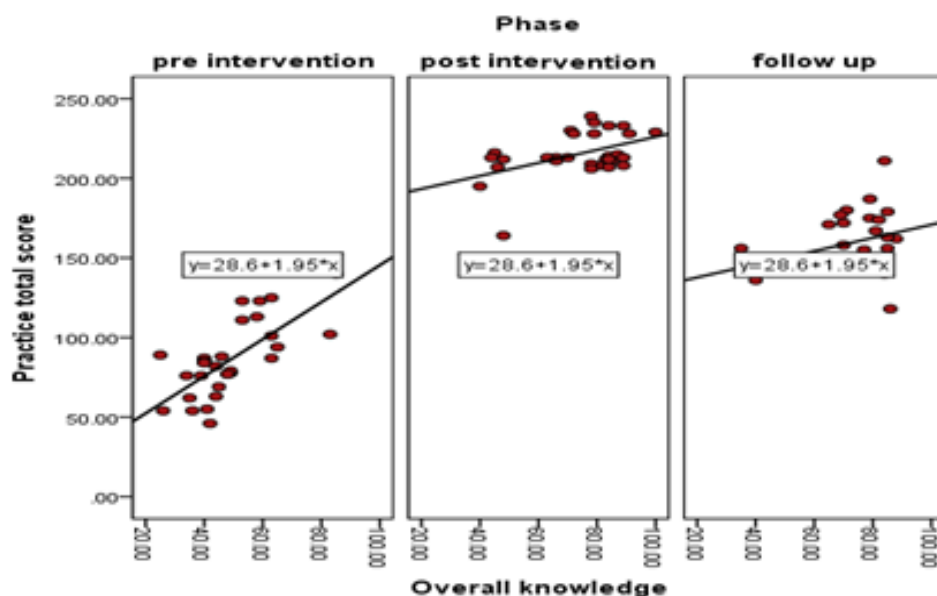


Figure (2): Total nurses' practice pre, immediate post and one month post intervention (n=30)

Figure (3): represents correlation between nurses' knowledge and practice levels in pre, immediately after, and one-month after implementing the guideline (n=30)

As showed in figure (3), there is a significant strong positive correlation between nurses knowledge and practice before applying the intervention program ($r=0.71$; $P<0.05$). Also immediately after intervention the correlation was significant intermediate ($r=0.52$; $P<0.05$) and also during follow up period ($r=0.64$; $P<0.05$). The degree of correlation was reduced after intervention and at follow up means that nurses practice was more improved than their knowledge (both improved but practice more) and this is a very good sign as practice is not easy to be improved but the current study program did.



P=0.001 r=0.52: P=0.029 r=0.64: P=0.002

Figure (3): represents correlation between nurses’ knowledge and practice levels in all study phases

Table (4): reveals environmental assessment domains pre, immediately post and one month post intervention

Regarding housekeeping process was poor in pre intervention phase with percentage of 66.7% and became good with percentage of 66.7% in immediately & one month post intervention phase. Linen management was totally poor 100% in pre intervention phase then converted and became good 100% then became fair with percentage of 66.7% in one month post intervention phase. Concerning waste management was totally fair 100% then totally good 100% and returned again to be totally fair 100% in pre, immediately post and one month post intervention consecutively. Visitors' policy was totally poor 100% in pre and one month post intervention phase and totally good in immediately post phase. There was a statistical significant difference between pre, immediately post and one month post intervention in total environmental assessment.

Table (4): Environmental assessment domains pre, immediately post and one month post intervention

Environmental assessment	Phase						X ² (P)
	Pre intervention		Immediately post intervention		One month post intervention		
	No	%	No	%	No	%	
Housekeeping process							7.3 (0.025)*
• Poor	2	66.7%	0	0.0%	0	0.0%	
• Fair	1	33.3%	1	33.3%	1	33.3%	
• Good	0	0.0%	2	66.7%	2	66.7%	
Linen management							11.6 (0.009)*
• Poor	3	100.0%	0	0.0%	1	33.3%	
• Fair	0	0.0%	0	0.0%	2	66.7%	
• Good	0	0.0%	3	100.0%	0	0.0%	
Waste Management							9.0 (0.011)*
• Poor	0	0.0%	0	0.0%	0	0.0%	
• Fair	3	100.0%	0	0.0%	3	100.0%	
• Good	0	0.0%	3	100.0%	0	0.0%	
Visitors' policy							8.6 (0.012)*
• Poor	3	100.0%	0	0.0%	3	100.0%	

• Fair	0	0.0%	3	100.0%	0	0.0%
• Good	0	0.0%	0	0.0%	0	0.0%

χ^2 : Friedman test for repeated measures * P < 0.05 (significant)

IV. Discussion

Burn patients are ranked among the patients at greater risk for nosocomial infections. This attributed to the fact of losing a considerable portion of their skin that provides a great protection from microorganisms' invasion. Burn injuries negatively affect local and systemic immunity. Infections are the most widely recognized reason for mortality in burn patients¹⁰. Bacterial infection likely causes the majority of infections in burn care centers. Infection results in deterioration of the wound healing process and severe systemic complications¹¹. The environmental conditions and the burn unit may be the most essential contributor to infection^{12,13}.

The findings generally indicate a positive impact on nurses' knowledge and practice with less effect on burned patient. This could be attributed to effective educational and training sessions that designed by the investigators according their needs & requirement and available supplies. It may also due to frequent observation and follow up. The program also directed through the principles of adult learning, with student-centered, problem-based approaches, with teaching strategies as discussion, and demonstration-re-demonstration. This agreed with the finding of other studies **Ahmed et al (2016)**¹⁴. Additionally **Ahmad et al (2012)**¹⁵ who concluded an improvement regarding nurses' knowledge & practice after applying infection control program which also in the same line with current study findings.

The current study showed that overall nurses' knowledge of infection control in study setting demonstrated statistically significant improvements at the post-intervention test in all areas of knowledge. These findings come in the agreement with **Elnour et al (2015)**¹⁶ in their work about studying the impacts of health education on knowledge and practice of hospital staff with regard to Healthcare waste management at White Nile State main hospitals, Sudan. In the same line also **El sayed (2016)**¹⁷ stressed in his study about Nursing Guidelines and Its Effects on Nurses' Knowledge and Patient Safety Regarding Nosocomial Infection Control Measures in Burn Unit that there was a statistical improvement in nurses knowledge after nursing guideline application, moreover **Moqbel et al (2016)**¹⁸ who was in agreement with this finding. Also there was a statistical significant relation between total knowledge in pre and immediate post with education which was in contrast with **Ezz Eldeen et al (2016)**¹⁹.

The current study showed that overall nurses' practice in study setting revealed statistically significant improvements at the post-intervention test in all areas of practice. This finding in congruence with **Ramya& Neethu(2013)**²⁰; they reported statistically significant differences between the pre- and posttests' scores of nurses' total knowledge about infection control.

These findings come in the agreement with **Elnour et al (2015)**¹⁶ in their work about studying the impacts of health education on knowledge and practice of hospital staff with regard to Healthcare waste management at White Nile State main hospitals, Sudan. In the same line also **El sayed (2016)**¹⁷ stressed in his study about Nursing Guidelines and Its Effects on Nurses' Knowledge and Patient Safety Regarding Nosocomial Infection Control Measures in Burn Unit that there was a statistical improvement in nurses knowledge after nursing guideline application. Additionally, **Galal et al (2014)**²¹ who stated also improvement in nurses practice after program application. Also there was a statistical significant relation between total practice in immediate post and one month post intervention with education which was in contrast with ¹⁹ & ¹⁷. Additionally there was statistical relationship between total practice in immediate post with years of experience which also contradicted with **El sayed (2016)**¹⁷.

Referring to overall environmental assessment there was a statistically significant difference indicates improvement in all aspects of studied domains after applying infection control guidelines this may contributed to effective educational and training sessions that agreed with **Tayh (2011)**¹² & **Elnour et al (2015)**¹⁶ and also **Ahmed et al (2016)**¹⁴ who mentioned improved environment in respect infection control guidelines.

The study revealed that there was a significant strong positive correlation between nurses' knowledge and practice before applying the intervention program, immediately after and one month post implementation. This was in the agreement with **Hamid et al (2010)**²² & **Eskander et al (2013)**²³ where their results stated also statistically significant positive correlation was found between knowledge and practice. On the other hand **Gijare (2012)**²⁴ who stated in his study about effectiveness of teaching on infection control practices among health care professionals that there was no correlation between pre and posttest knowledge and practice.

V. Conclusion

The study concluded that the implementation of infection control guidelines was effective on improving nurses' knowledge and practice regarding patients with burn injury.

VI. Recommendation

Based on these study findings the following recommendations are suggested

- Nurses' compliance with infection control guidelines should be emphasized with establishing a periodical evaluation of nurses' knowledge and performance.
- Training for nursing staff in nosocomial infections control programs through continuous education of hospital on principles of infection control by training and re-training should be advocated.

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