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THE EFFECT OF EDUCATIONAL INTERVENTION ON THE KNOWLEDGE OF NURSES REGARDING CATHETER INDICATIONS AND CATHETER ASSOCIATED URINARY TRACT INFECTION PREVENTIVE MEASURES

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THE EFFECT OF EDUCATIONAL INTERVENTION ON THE KNOWLEDGE OF NURSES REGARDING CATHETER INDICATIONS AND CATHETER ASSOCIATED URINARY TRACT INFECTION PREVENTIVE MEASURES

Abstract

Catheter associated urinary tract infection (CAUTI) is the fourth leading cause of healthcare associated infections. The single most important predisposing factor for CAUTI is the insertion of urinary catheter. The aim of this study was to assess the effect of educational intervention on the knowledge of nurses regarding catheter indications and CAUTI preventive measures. A Pre-Post-test study design was utilized in this study which was conducted at two university hospitals one in Saida (South Lebanon) and the other one in Beirut in Lebanon. A self-reported questionnaire about catheter insertion and CAUTI prevention was used before and after the educational intervention, where the results of this study revealed that the educational intervention resulted in a significant increase in the level of knowledge among nurse. Thus, the knowledge regarding indication and preventive measures was suboptimal in our study group. There is a tremendous scope of improvement in catheterization practices in the hospital and education induced interventions would be the most appropriate effort toward reducing the incidence of CAUTI.

Keywords

Catheter, Health care personnel, Knowledge, Prevention, Urinary tract, infection

1. INTRODUCTION

The most common hospital-acquired infection is catheter-associated urinary tract infection (CAUTI) accounting for almost 40% of all the nosocomial infections (Tenke, Mezei, Bóde, & Köves, 2017). Catheter-associated UTI (CAUTI) refers to symptomatic UTI in a patient currently or recently catheterized with an indwelling transurethral, suprapubic, intermittent or external catheter. The single most important predisposing factor for CAUTI is the insertion of urinary catheter. Urinary (Foley) catheters are used very frequently in hospitalized patients, and almost 25% of them undergo urinary catheterization during their stay in the hospital (CDC, 2018). Bacteria or fungi can enter the urethra during catheter insertion if the insertion was not done in an aseptic technique or after insertion if the CAUTI bundle was not utilized correctly (Jacobsen, Stickler, Mobley, & Shirtliff, 2008; Dougnon et al., 2016). Around 21% to 50% of urinary catheters are inserted for inappropriate indications (Munasinghe, 2001; Saint et al., 2000). During the presence of the catheter, 26% of patients are at high risk of acquiring bacteriuria if the catheter stays from 2 to 10 days (Saint, 2000). The possibility of acquiring catheter associated urinary tract infection will increase 3 to 7% each day if the catheter is still inserted (Lo et al., 2014). Since CAUTI occur during or after insertion, the most effective way to reduce CAUTI rates is to stop unnecessary catheterization (Meddings et al., 2014). According to the Center of Diseases Control (CDC), indwelling urinary catheters should only be used for appropriate indications such as urinary retention, bladder obstruction, and certain surgeries, monitoring urine volume in critically ill patients, assisting sacral wound healing and in palliative care. Even after limiting the use of catheters, doctors still order urinary catheters although it is not necessary such as its use in incontinent patients and to obtain urine for diagnostic purposes, therefore, researches were done to evaluate the knowledge about catheter indications among doctors and nurses (Gould, Umscheid, Agarwal, Kuntz, & Pegues, 2009). If the catheterization is necessary, CAUTI bundle elements regarding proper insertion and catheter care should be followed. During insertion, only trained doctors or nurses can insert the catheter also the catheterization process should be done in an aseptic technique using sterile equipment. After insertion, the drainage system should be kept closed, and the urine flow should be kept unobstructed by placing the collecting bag below the bladder, emptying the collecting bag when it's $\frac{3}{4}$ full, keeping the collection bag below the level of the bladder and by preventing the collecting tube from kinking. Unfortunately, there are some practices that are still used even though it's not recommended at all. These practices are bladder irrigation, use of antiseptic solutions in daily meatal care and changing the catheters at fixed intervals (Gould et al., 2009). A study done in New Delhi about knowledge regarding catheter indications and preventive measures of CAUTI, revealed that more than 50% of doctors could not identify important catheter indications such as urethral stricture or during surgeries that require large volume of infusions, they also found that almost all participants could not identify practices that are not effective such as bladder irrigation (Jain, Dogra, Mishra, Thakur, & Loomba, 2015). Another study was done in a Lebanese hospital on the impact of implementing a multidimensional infection control approach to reduce catheter associated urinary tract infections in the ICU, this approach included CAUTI bundle implementation, education and surveillance. The rate of CAUTI decreased 83% after implementing this approach (Kanj et al., 2013). Therefore, conducting a study about the effectiveness of the educational intervention regarding catheter indications and CAUTI preventive measures can help in identifying knowledge gaps and can assist in reducing CAUTI rates. The primary objective of this study is to evaluate the effect of the educational intervention on the knowledge of nurses regarding catheter indications and methods of preventing CAUTI.

2. METHODOLOGY

This research is a pre-posttest design involving from two university hospitals one in Saida (South Lebanon) and the other one in Beirut in Lebanon. The study was conducted over a period of three months (January 2019 – March 2019) after receiving the Institutional Review Board (IRB) approval at Beirut Arab University. The sample consisted of 91 nurses both registered and practical who care for hospitalized patients with urinary catheters for at least 6 month of experience to minimize confounding of results with issues related to novice nurses who are adjusting to clinical environment. Convenient sampling was applied. Responders were recruited by contacting them personally, by visiting the mentioned clinical settings and obtaining informed consent from the nurses willing to participate after explaining to them the purpose of the research study. Participation was voluntary and completely anonymous. Participants had the choice of opting out at any stage. After

that, the pre-test questionnaires were distributed and self-administered by the nurses, where the researcher was available to answer any concerns. Following that, an educational interventional sessions regarding the CAUTI magnitude, indications of urinary catheterization and CAUTI care bundle was delivered to the nurses, and then the post-test questionnaires were administered. A valid and reliable self-reported questionnaire that was used in a study in the United States that was done to assess the practice and knowledge about Foley catheter among Minnesota nurses was requested from the author by an E-mail (Jain et al., 2015). The pre-test questionnaire was composed of 4 parts, the first part is about demographics, the second and third parts are about the knowledge regarding urinary catheter indication and CAUTI preventive measures and the last part is about urinary catheter responsibility. The post-test questionnaire was the same as the pre-test questionnaire but without the demographics and catheter responsibility parts. There are two versions of the questionnaire one in English language and one in Arabic language. Likert scale was used to answer the questions, regarding catheter indication part the options are always indicated, usually indicated, unsure, sometimes indicated and never indicated. The answers were classified as indicated if the nurse chose always or usually indicated while it was classified as not indicated if the nurse chose sometimes or never indicated and unsure was considered as a wrong answer for both sides since it indicated lack of knowledge and confidence. Also for CAUTI prevention part a Likert scale is used, the options are very effective, moderately effective, unknown effect, possible effect and not effective. Regarding Catheter responsibility part 5-point Likert scale is used to answer the first two statements, the options are strongly agree equals 1, somewhat agree equals 2, unsure/neutral equals 3, somewhat disagree equals 4 and strongly disagree equals 5. The third question choices are the same as the first two but agree/disagree is substituted with comfortable/uncomfortable. The score for each statement equals the mean value of all the opinions of the participants. Regarding the last question, it is answered by yes or no. Data was entered and analyzed in Statistical Package for Social sciences (SPSS software version 22). Results were expressed in means and percentages, represented in tables. All statistical tests were deemed significant at p value of < 0.05.

3. RESULTS

3.1. Sample Characteristics

One hundred and three nurses from Al-Raei hospital and Al-Makassed General hospital were eligible to participate in the study. As shown in Table 1, the mean age of the participants was 29 years. 33 (32%) of the nurses who participated in the study were males, while 70 (68%) of them were females. In addition, the results showed that 27 (26.2%) nurses had 1 to 5 years of work experience, 17 (16.5%) of them had 6 to 10 years of experience, 10 (9.7%) had 11 to 15 years of experience, 18 (17.5%) had more than 15 years of work experience, and 31 (30.1%) of the nurses had less than one year of experience. Moreover, the findings show that the vast majority; 65 (63.1%) of the nurses who participated in this study were registered nurses, while 25 (24.3%) were practical nurses and only 13 (12.6%) work as head nurses. Regarding the level of education 28 (27.2%) of them have TS, 68 (66%) have BSN and only 7 (6.8%) have MSN. The majority of the participant work in critical care units 44 (42.7%) and on medical surgical floor 40 (3.8%) while the rest of them work in maternity 12 (11.7%) and pediatrics 7 (6.8%) units.

Table 1: Demographic characteristics

Variable	Category	Total number (%)
Gender	Male	33 (32%)
	Female	70 (68%)
Experience	Less than 1 year	31 (30.1%)
	1-5 years	27 (26%)
	6-10 years	17 (16.5%)
	11-15 years	10 (9.7%)
	More than 15 years	18 (17.5%)
Work Position	Head Nurse	13 (12.6%)
	Registered Nurse	65 (63.1%)
	Practical Nurse	25 (24.3%)

Continue Table 1

Education	TS BSN MSN	28 (27.2%) 68 (66%) 7 (6.8%)
Department	medical surgical floor critical care units Pediatric Maternity	40 (38.8%) 44 (42.7%) 7 (6.8%) 12 (11.7%)

3.2. Pre and Post-Test Scores Comparison

A pre and post-test was conducted on 11 questions to assess the knowledge of nurses regarding catheter indications and CAUTI preventive measures. The score was calculated by adding one for each question answered correctly. The results indicate that nurses who participated in the study recorded a mean score of 5.52 (SD=1.81) with a minimum score of 2 and a maximum score of 9 pre-intervention while the mean score of post-intervention was higher, they scored 7.31 (SD=2.43) with a minimum score of 3 and a maximum score of 11 post intervention. Paired T-test was carried out to determine the difference in the knowledge of the nurses regarding catheter indications and CAUTI prevention between pre and post intervention. The results indicated that there is a significant difference between the test scores of pre and post intervention because the P-value equals 0.00 (Table 2).

Table 2: Pre and Post-Test Scores Comparison

	Minimum Score	Maximum Score	Mean (SD)	P-Value
Pre-test Score	2	9	5.52 (1.81)	0.00
Post-test Score	3	11	7.31 (2.43)	

3.3. Comparison of Nurses Perception

The nurses who participated in the study were asked to answer 11 questions before and after conducting the educational session, five of them are about classifying catheter indications into appropriate and in-appropriate and the rest of them are about classifying CAUTI preventive measures into effective and ineffective. The percentage of correct answers in the posttest was higher than the pretest for the entire question except for the one regarding using the catheter when Lasix(diuretic) is prescribed, in this question 65% of nurses answered correctly in the pretest while 62.1% answered it correctly in the post test. Prior to the intervention 66 (64.1%) and 68 (66%) were able to identify critical illness and bladder obstruction respectively as indicated for catheterization (Table3).

Table 3: Nurses Perception Pre and Post Intervention (N=103)

	Pre-intervention N (%)	Post-intervention N (%)	
Catheter Indications			Indicated/ not indicated
Patient with critical illness and tenuous volume status.	66 (64.1%)	89 (86.4%)	Indicated
patient with post-bladder urinary obstruction	68 (66%)	85 (82.5%)	Indicated
Urinary incontinence.	40 (38.8%)	64 (62.1%)	Not Indicated
Patient who is unable to stand to void.	58 (56.3%)	76 (73.8%)	Not Indicated
If a patient has been newly prescribed furosemide (Lasix), or has been prescribed an increased dose of this or another diuretic.	67 (65%)	64 (62.1%)	Not Indicated
CAUTI Prevention			Effective/ Not effective
Removing catheters as early as possible.	65 (63.1%)	87 (84.5%)	Effective
Using a condom catheter instead of a Foley catheter (if possible).	22 (21.4%)	30 (29.1%)	Not effective
Using intermittent catheterization instead of a Foley catheter.	41 (39.8%)	49 (47.6%)	Not effective
Using catheters coated with antimicrobial substances.	42 (40.8%)	59 (57.3%)	Not effective

Continue Table 3

Using antimicrobial agents in the drainage bag.	55 (53.4%)	73 (70.9%)	Not effective
Having automated reminders to discontinue/renew the order for a catheter.	55 (53.4%)	79 (76.7%)	Effective

3.4. Difference in Nurses Knowledge Level before Intervention According to Nurses' Characteristics

An independent T-test was carried out to determine if there is a difference in knowledge between males and females before conduction the educational session. The assumption of homogeneity of variance was assessed by the Levene test. The results showed that there is no significant difference in pre-test scores between males and females ($P=0.754$, $F=-1.18$).

Table 4: Difference in pre-test scores according to gender

	Variable	M	SD	t-test	p-value
Pre-test	Male	5.61	1.71	0.314	0.754
	Female	5.49	1.86		

An ANOVA test was carried out to determine if there is a significant difference in the knowledge of nurses among various age groups, different educational degree and difference in work experience. The test showed that there is no significant difference among different age groups ($F=1.38$, $P=0.13$) and among nurses with different educational level ($F=0.90$, $P=0.41$).

However it showed that there is a significant difference among different work experiences ($F=2.73$, $P=0.03$).

Table 5: Difference in pre-test scores according to nurses' characteristics

Variable		F	p-value
Pre-test	AGE	1.38	0.13
	Degree	0.90	0.41
	Experience	2.73	0.03

3.5. Doctors and Nurses Responsibility Regarding Urinary Catheters

In the third part, nurses were asked to give their opinion in four statements regarding catheter responsibility. Most participants strongly agreed that the patient's physician should decide on the need for placing the Foley catheter because the mean score is 1.23 and it is closer to 1. While most of them somewhat agreed that the patient's nurse should decide on the need for placing a Foley catheter because the mean score is 2.35 which is closer to two than three. Regarding the third statement, the mean score is 1.86, which means that most participants are somewhat comfortable in requesting the removal of unneeded catheters. Only five of the participants said that they will remove unneeded catheter without a physician's order (Table 6).

Table 6: Urinary catheter responsibility

Statement	Agreement mean score	
A patient's physician should be responsible for deciding on the need for placing a Foley catheter''	1.23	
A patient's nurse should be responsible for deciding on the need for placing a Foley catheter''	2.35	
If you feel that a Foley catheter is not needed in caring for a patient, but a catheter is currently in place, do you feel comfortable requesting an order for the catheter to be removed?	1.86	
With regard to the previous question- if you felt that an indwelling catheter was not needed for the care of a patient, would you remove the catheter without a physician's order?	Yes 5	No 98

4. DISCUSSION

4.1. Nurses Knowledge Pre-intervention

The results revealed that the nurses who participated in the study have moderate knowledge level about catheter indications and CAUTI preventive measures. Compared to a similar study that was conducted in 2016 in a tertiary care hospital in Peshawar Pakistan reported that the mean knowledge percentage was good and it was significantly higher than the mean knowledge of this study, so the nurses in the Pakistani study are more aware about proper insertion practices and indications. (Shah et al., 2017). In this study, almost half of the nurses have good knowledge, and the knowledge level of the rest are distributed among the other knowledge level categories. These findings are quiet similar to the findings reported in a study conducted in Nellore India about knowledge about catheter care among nurses, the study showed that almost half of the nurses had adequate knowledge, while the rest had moderately adequate knowledge and inadequate knowledge regarding catheter care (Oman et al., 2012). An Indian study was done to assess the knowledge of nurses and doctors regarding catheter indications and CAUTI prevention method. This study used a questionnaire similar in structure to the questionnaire used in this study, it contained two similar elements regarding catheter indications and four similar elements regarding CAUTI prevention also the number of nurses who participated was close to the sample size of this study. The results regarding each element varied between both studies, in this study more than half of the nurses identified post-bladder obstruction as eligible for catheter insertion and two fifth of them identified incontinence as not indicated for catheterization, while in the Indian study the majority of the participants identified urethral stricture causing urinary obstruction as indicated for catheterization and only one fifth of them were able to classify incontinence as not indicated for catheterization. Regarding the indication section we can conclude that nurses in this study were more aware than those who participated in the Indian study that incontinence is an inappropriate indication, while the Nurses in Indian study were more aware that urethral stricture causing urinary obstruction is suitable for catheterization. With respect to CAUTI prevention section, the results varied between the two studies. Almost all nurses who participated in the Indian study reported that early removal of catheter is effective in reducing CAUTI and less than one fifth reported that using condom or intermittent catheterization is not effective in reducing CAUTI. While in this study around three fifth of the participants reported that early catheter removal is effective in CAUTI reduction, less than a quarter reported that using condom catheters is not effective and two fifth reported that using intermittent catheterization is not effective in CAUTI reduction. According to the differences in percentages we can say that the knowledge varies between different items among both groups but generally still there are knowledge gaps that need to be filled (Jain et al., 2015). The results varied between both studies; regarding the indication part, a large number of nurses answered the two indication elements correctly while in the Indian study, almost all the participants identified the proper insertion practice among them while very few of them identified the inappropriate indication correctly. With respect to CAUTI prevention, almost all nurses who participated in the Indian study were able to identify the most important action to reduce CAUTI, which is early catheter removal while nurses who participated in this study were less aware that early catheter removal is effective in reducing CAUTI. Regarding the use of condom catheter as an alternative to indwelling urinary catheter, nurses in this study are more aware than the nurses in the Indian study that using condom catheters is not associated with reduced CAUTI rates. According to the differences in the results, we can say that the knowledge varies between different items among both groups but generally still there are knowledge gaps that need to be filled (Jain et al., 2015).

4.2. Nurse's Knowledge Post-intervention

The results show that the difference in the knowledge regarding catheter indications and CAUTI preventive measures between pre and post intervention is highly significant. There are a number of similar studies that support this finding by either conducting an educational program or including an educational program in a multimodal intervention. A teaching program was conducted for 55 nurses and they found that the teaching program improved the knowledge and practices of nurses and decreased CAUTI incidence from 26% to 14% (Nasser,2015). In addition to that, Blondal et al., (2016) investigated the effect of CAUTI educational sessions ,conducting sessions resulted in reducing the proportion of catheter days when there is appropriate indication, it also decreased hospitalized patients catheter days after performing the educational sessions (Blondal et al., 2016).

Moreover, a Lebanese study done in the intensive care unit of a tertiary care hospital in 2013 to evaluate the effect of a multi-dimensional intervention including education on CAUTI rates, pre-intervention CAUTI rate was 13.07 per 1000 urinary catheter days while after conduction the intervention the rate decreased by 83% to 2.21 per 1000 urinary catheter days. The implementation of this intervention resulted in a significant reduction in CAUTI rates (Kanj et al., 2013). A systematic review was done to evaluate the effectiveness of behavioral intervention on reducing UTIs and E.coli bacteremia in older adults. Four of the studies that were selected focused on using education and training in reducing UTIs, two of them resulted in reducing CAUTI rates within the hospital significantly. Justus, Wilfong, & Daniel (2016) used a combined learning program that involved using videos and simulators to assist in teaching employees who are responsible for urinary catheter insertion and maintenance about proper insertion technique and catheter care. Gordon (2016) used a similar method involving the use of guidelines regarding catheter insertion and maintenance set by the Centers for Disease Control, traditional education in classrooms and online education using electronic modules .The results of both studies are consistent with the results of this study. Studies done by Singh, Kumar, Sundaram, Kanjilal, & Nair (2012) and Girard et al., (2015) implemented a training program for the geriatric staff, which did not result in a significant reduction in CAUTI rates, thus inconsistent with the results of this study. Justus et al.(2015) found a reduction in CAUTI rate in one of the hospitals included in the study from 33 to 14 in the two weeks duration after the implementation of the program but the overall result of the study did not show any significant reduction in CAUTI rates.

4.3. Catheter Responsibility

The last section of the pre-intervention questionnaire is composed of 2 parts the first one is composed of 2 statements regarding catheter responsibility while the second part is composed of two questions regarding catheter removal. A similar study done in Minnesota in 2010 to assess the knowledge of doctors and nurses regarding catheter indications and CAUTI prevention measures, when the results are compared we find that the population in this study supports more that the physician should decide on the Foley insertion than the American population. While the mean scores for the second statement are almost the same in both studies and show that the participants think that also nurses should decide on the need for catheter placement. So it I apparent that participants in the American study are more confident in removing unnecessary catheters than the participants in this study (Drekonja, Kuskowski, & Johnson, 2010).

5. CONCLUSIONS

- Conducting the educational intervention in both hospitals resulted in a significant increase in the level of knowledge regarding catheter indications and CAUTI preventive measures among the nurses who participated in the study.
- Nurses have contact with hospitalized patient with urinary catheters more than any healthcare worker since they provide Foley care and assist in Foley insertion. Therefore, their knowledge about CAUTI prevention is very important for providing high quality of patient's care. In this study, the educational intervention improved the knowledge of nurses about CAUTI and affect positively the attitude of nurses when it comes for catheter insertion and care .
- The results of this study are consistent with the findings in the literature that revealed the lack of adequate knowledge of nurses regarding CAUTI and that the nurses need more education and training with regard to urinary catheters.
- The results of this study revealed that healthcare facilities and hospitals should work on increasing the knowledge of nurses in order to reduce the incidence of CAUTI.
- Reducing CAUTI rates can be achieved by implementing a continuous nursing education about urinary catheter indications, CAUTI preventive measures and new findings about CAUTI. In addition to that providing a training on insertion procedures and catheter care can assist in reducing CAUTI rates.

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