Research Article

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Journal of Intensive and Critical Care
ISSN 2471-8505

2020
Vol.6 No.1:1

DOI: 10.36648/2471-8505.6.1.1

Simulation-Based Learning to Reduce CAUTI Rates among ICU Patients

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Citation: Haimour AF, Amirah MF, Badawi MH, Abusyriah FM, Birao JNE, et al. (2020) Simulation-Based Learning to Reduce CAUTI Rates among ICU Patients. J Intensive & Crit Care Vol.6 No.1:1

Abstract

Background: Preventing healthcare-associated infections, such as Catheter-Associated Urinary Tract Infection (CAUTI), is a high priority for health care institutions. Each day the indwelling urinary catheter remains, a patient has a 3%-7% increased risk of acquiring CAUTI. This study primarily aims to focus on determining the effect of simulation-based learning to the reduction of CAUTI's.

Method: This quasi-experimental study was conducted for eighty-six (86) staff nurses working in two critical care units at King Saud Medical City in Saudi Arabia within Riyadh region. The two areas have critically ill patients who have different medical and surgical health- related problems.

Results: The results showed that there was no significant difference in reducing CAUTI rates and Device Utilization Ratios (DUR's) (P=0.67, P=0.60). However, simulation training shows superiority in improving staff nurses' knowledge compared to the traditional method of teaching (P=0.005). Results also showed a strong correlation with increased participants' level of satisfaction and self-confidence (R=0.889, 0.962 respectively) as well as the improvement on staff nurses' performance related to CAUTI prevention.

Conclusion: Simulation training is not associated with reducing CAUTI rates and DUR. Nevertheless, simulation training proved to be an effective teaching methodology in improving staff nurses' knowledge, satisfaction, confidence, and level of performance related to CAUTI prevention.

Keywords: Simulation-based learning; Knowledge; Satisfaction; Confidence

Abbreviations: CAUTI: Catheter Associated Urinary Tract Infection; IUC: Indwelling Urinary Catheter; DUR: Device Utilization Ratio; ICU: Intensive Care Unit

Received: January 13, 2020; **Accepted:** January 19, 2020; **Published:** February 05, 2020

Introduction

Numerous patients around the world are foreseen to be affected by hospital-associated infections annually as estimated by the World Health Organization [1]. In intensive care units, for instance, catheter-associated urinary tract infections (CAUTI), being the most common device-related healthcare-associated infections have led to a prolonged hospital stay, bacterial resistance, morbidity and sky-rocketing health care expenditures [2,3].

Saint and colleagues [4] have estimated the cost brought by CAUTI. A single episode can cost more than $600 per patient. When case worsens and causes sepsis, expenses increase to $2800 per patient. Consequently, this leads to increased morbidity and mortality with an estimate of 13,000 attributable deaths annually and increased length of stay for 2-4 days. This huge impact in health care is expected to rise as the years go by.

CAUTI cases will tremendously affect patients in ICU where 76% of the indwelling urinary catheters (IUC) are administered in a hospital setting [5]. Approximately, 12%-16% of adult hospital inpatients have an indwelling urinary catheter at some time during their hospitalization, and each day the indwelling urinary catheter remains, a patient has a 3%-7% increased risk of acquiring a CAUTI [6].

A large cross sectional study investigated the several risk factors associated with the incidence of CAUTI demonstrated that each additional day of catheter use is a CAUTI hazard. The study emphasized that attention should be given to patients carrying some risk factors such as females or those with mobility issues such as cerebrovascular diseases [7].

Literature for CAUTI prevention and the use of guidelines, interventions, and education are extensive. Many different interventions and combinations of interventions have been used to address the many facets of CAUTI preventions. The improvement in CAUTI prevention has benefited from the guidelines established through evidence-based research. It is estimated that up to 69% of CAUTIs could be avoided if evidenced-based practices were used reliably.

Evidence-based recommendations for CAUTI prevention are readily available from various institutions such as Healthcare Infection Control Practices Advisory Committee (HICPAC), Association for Professionals in Infection Control and Epidemiology (APIC), Infectious Diseases Society of America (IDSA) and the most well-known Centers for Disease Control and Prevention (CDC). Several studies have been implemented to utilize the guidelines derived from these various institutions to further help in decreasing CAUTI rates.

In a prospective study conducted in cardiac ICU of San Paulo Hospital, the researchers concluded that the implementation of multifaceted interventions, monitoring of process and outcomes, so with feedback, training sessions, improvements in infrastructure, and involvement of the relevant health care professionals showed reduction in CAUTI incidence from 11.42 to 4.40 cases per 100 catheter days.

Another study utilized a multimodal intervention including training sessions, urinary catheterization reminders, surveillance systems, and mechanisms for staff feedback of results were effective in reducing CAUTI rate and its frequency [8].

A quasi-experimental study involving multiple interventions to reduce the incidence of CAUTI was conducted in a medical-surgical intensive care unit (ICU) and in 2 step-down units (SDUs). Marra and colleagues [9] have implemented the Institute for Healthcare Improvement's bladder bundle for all ICU and SDU patients requiring urinary catheters. Similarly, the study yielded an improvement of CAUTI rate from 7.6 per 1,000 catheter- days before the intervention to 5.0 per 1,000 catheter-days after the intervention.

Moreover, an observational study was conducted in a tertiary care children's hospital with 500 bed capacity in ICU specifically to assess the impact of a CAUTI quality improvement prevention bundle that included institution-wide standardization of and training on urinary catheter insertion and maintenance practices, daily review of catheter necessity, and rapid review of all CAUTIs. The implementation of the bundle had reduced the mean monthly CAUTI rate from 5.41 to 2.49 per 1000 catheter days [10].

CAUTI prevention begins from the time of insertion to deciding its removal. Considering that numerous guidelines are already in place, the implementation of each strategy relies greatly on the hands of the health care providers, particularly physicians and nurses.

Fonseca et al. [11] performed a systematic review focused on strategies for implementing guidelines by healthcare providers. They brought up important points for reducing CAUTI rates and intrauterine catheter (IUC) use. Strategies implemented together produced better results than implementing them individually and the use of effective education was seen as a starting point for all practice changes. They concluded that having strategies only was not enough to prevent CAUTIs and catheter use, but changes can occur when healthcare professionals become aware and motivated.

One of the challenges discovered in CAUTI prevention is bringing CAUTI awareness to the nurses' minds. A hospital in Louisiana (USA) addressed this concern by creating a CAUTI team which utilized an action-oriented model based from implementation science called "The Four E's" which stands for "Engage, Educate, Execute, and Evaluate". This intervention reduced the CAUTI rate of the hospital by 74%. This simple study has proven how evidence-based research played an important role in CAUTI prevention.

Literature has emphasized the importance of staff education to increase staff competency level such as in the prevention of infections within healthcare facilities. Despite that only few studies were particularly focused on staff education for CAUTI prevention, studies have shown that the essential elements for its prevention include staff education, ongoing monitoring of CAUTI incidence, monitoring catheter insertion and ensuring prompt removal, and careful attention to techniques for catheterization and catheter care.

The current trend in the field of education involves simulation-based learning. Simulations are used in the different areas of health care as well as across all levels of education. The use of simulation as an innovative teaching strategy promotes student's critical thinking skills, learning, and confidence. Moreover, it helps them learn to make sound clinical decisions to improve patient outcomes [12].

Theoretical framework

Kirkpatrick's Levels of Evaluation Model [13] provides a useful framework for categorizing evaluations of simulation interventions [14]. The four levels of evaluation described in the framework are (1) reaction (2) learning (3) behaviour and (4) outcomes.

In the first level (reaction), evaluation outcomes include affective - whether participants liked the simulation intervention; and instrumental - whether participants found the training useful. While in the second level (learning), evaluation outcomes involve attitudes (feeling), knowledge (knowing), or skills (doing).

Due to nursing educations' complex nature, the evaluations at the behavior and outcome level, respectively, are not commonly completed and feasible [15]. The behavior level refers to the transfer of skills to real clinical settings while the outcome level is manifested in the patient care results.

Major contributions in filling research gaps

This research study is of utmost importance as there is only limited literature focusing on the evaluation of the use of an evidence-based guideline through simulation-based education for CAUTI prevention in the ICU setting.

Further, the measurement outcome of simulation activity in patient's outcome level, such as the problem of interest, either internationally or globally, is not heavily researched.

This makes this research project novel and which can significantly contribute to improving patient outcome in every health care institution.

Evidence to address the Gaps-in-practice

The gaps in nursing practice for CAUTI prevention at this practice site were observed in both experienced and novice nurses that include knowledge deficit regarding the updated CDC criteria for indwelling urinary catheterization insertion; lack of knowledge on aseptic insertion techniques; variations in maintenance and care of an IUC; long dwelling times; absence of daily questioning for IUC use; knowledge deficit for use of alternatives and bladder scanning; and lastly, no accountability for adherence to interventions or guidelines.

Aims of the study

This study aims to answer the following research questions:

1. Can simulation-based learning for nurses reduce the CAUTI rates among ICU patients?

2. What is the effect of using evidence-based simulation training in improving nurse's satisfaction and confidence levels for urinary catheterization insertion and care?

3. Which is a more effective teaching methodology - simulation-based learning or traditional educational method?

Methods

Study design

This study employs a quasi-experimental research design that focuses on determining the effect of simulation-based learning on the prevention of catheter-associated urinary tract infections (CAUTI). Specifically, this involves data comparison of CAUTI rates and device-utilization ratios (DUR), obtained before and after the implementation of research intervention.

The study also compared the effectiveness of simulation-based learning to traditional teaching method in terms of preventing CAUTI's. Further, the satisfaction and competence level in performing urinary catheterization of the research participants were also determined.

Study setting

The study was conducted in two of the critical care units of King Saud Medical City, Riyadh, Saudi Arabia. The areas named T1A1 and T1B1, are separated into 2 units only for area maximization but cater to a similar type of patients with medical-surgical cases and have the same scope of service. Each unit has a 25-bed capacity.

King Saud Medical City is one of the biggest tertiary health care facility with 1500 bed capacity and high occupancy rate. King Saud Medical City senior management has made a commitment to make quality and patient safety a top priority. Preventing healthcare-associated infections; including Catheter-Associated Urinary Tract Infection (CAUTI) is a high priority for the hospital. The staff nurse's competency level of care plays a vital role in providing the best evidence-based practices to minimize CAUTI incidences.

Study population

The study included all of the eighty-six (86) staff nurses in T1A1and T1B1. As such, no specific sampling technique was employed in the selection of research participants.

Research intervention

The study intervention was conducted for 2 months. Initially, staff nurses from both areas, T1A1 and T1B1 were provided with the traditional method of education whereby a copy of video-presentation on CAUTI prevention was circulated to all for self-paced learning followed by onsite/in-classroom didactic discussions. The presentation was adopted from the Tennessee Center for Patient Safety (TCPS) CAUTI Prevention Simulation Project. The level of knowledge and effectiveness of teaching was evaluated using a formulated 10-item multiple choice post-test question. Following the traditional method is the implementation of simulation-based education. The area T1A1 was randomly selected to receive the intervention (simulation-based learning). T1A1 comprised the experimental group of the study.

All participants of the experimental group were tasked to perform the insertion and removal of urinary catheter (Foley's) using the training manikin, Nursing Anne. The participants' performances were guided by the Streamlined-Evidence-Based RN Tool on CAUTI Prevention by the American Nurses Association (ANA, 2009). This instrument- checklist matches the CDC Guidelines on CAUTI prevention.

Data collection and measurement

To determine the effect of simulation-based education on CAUTI prevention, the CAUTI rates and DUR's were obtained and compared 6 months before and 6 months after the research intervention for both areas. The active surveillance of CAUTI and DUR is based on the criteria established by the National Healthcare Safety Network (2018).

The Surveillance for CAUTI rates aims to identify patients at risk of developing the infection; excluding those discharged patients. While the surveillance of DUR provides a direct reflection of improvement efforts focused on reducing inappropriate urinary catheter use. CAUTI rate per 1000 urinary catheter days is calculated by dividing the number of CAUTIs by the number of catheter days and multiplying the result by 1000. On the other hand, DUR is calculated by dividing the number of urinary catheter days by the number of patient days and multiplying the result by 100 (CDC, 2018) [16].

To determine the effect of simulation-based learning on the population's practices of CAUTI prevention, a tool by the National League for Nursing (2005), entitled, "Student Satisfaction and Self-

Confidence in Learning" was utilized. This is a 13-item instrument using a 5-point Likert scale. The reliability of this tool was tested using Cronbach's alpha: satisfaction=0.94; self-confidence=0.87.

To determine the effectiveness of simulation-based learning as compared to the traditional method of education, the results of the pre- and post-test results were used against the results of the simulation training tool.

Statistical considerations

The data obtained were analyzed using SPSS version 24.0. The level of significance is set at 0.05. The effectiveness of the traditional method of teaching was determined by comparing the results of pre- and post-tests using Chi-square test. The McNemar test was then used to determine the significance of the changes from incorrect to correct responses.

The effectiveness of simulation-based education was determined using a paired t-test. Pearson R Correlation factor was then used to measure the strength of relationship among the different variables. Further, t-test was employed to analyze the continuous data derived from the study.

Ethical considerations

The study primarily focused on preventing CAUTI through the improvement of nursing practices related to insertion, care, and removal of urinary catheterization by providing education through traditional and simulation-based learning. The effectiveness of the conducted interventions was reflected in the CAUTI rates and DUR's. No direct patient data/information was utilized for the study; hence, no patient treatment plan was affected nor was confidentiality threat implicated. The confidentiality and anonymity of the data collected were maintained and only made accessible to research team members.

The entire research population was treated equally in this study. The demographical data e.g. age, gender, level of education, years of experience and previous exposure to simulation training, were obtained to describe the characteristics of the population and were not intended for any inclusion/exclusion from the study. Although the relationship between the level of education and years of experience with the participant's level of performance related to CAUTI prevention were evaluated.

In line with this, a request for a waiver of informed consent was obtained based on the following:

• The risk and benefit are balanced for the subjects.

• The waiver does not adversely affect the rights and welfare of subjects.

• The subjects were provided with pertinent information after participation whenever possible.

Results

In this section, the results of the study are presented and discussed with reference to the aim of the study, which was to determine the effectiveness of simulation-based learning on the prevention of CAUTI's. Further, the results of the two (2) sub-aims of the study are also presented. The sub-aims are comparison of simulation-based learning to traditional method of teaching in terms of improving CAUTI and DUR's and improvement of staff satisfaction and competence level in performing urinary catheterization.

Table 1 presents the demographics of the study participants. The population includes 86 female staff nurses. Majority of them (90.7%) belong to 25 to 34 year - age bracket. Most of the participants (88.4%) are BS Nursing graduate and only few were diploma in nursing graduate (8.1%) and have master's degree (3.5%). Almost all of the participants have more than 5 years of staff nurse work experiences.

Table 2 shows the analysis of each question item in terms of participant's correctly and incorrectly answered questions before and after the traditional method of teaching. The results were analyzed using Chi-Square test. As shown in **Table 2**, only questions 2, 3, 5, 7, 8, and 10 have statistical difference in terms of participant's response pre- and post- teaching. Thereafter, the percentage of pre- and post-test was compared using paired T- test. The results similarly yielded to statistical significant difference (P=0.000). This significance proves that traditional method of teaching is effective in educating CAUTI prevention.

Table 3 shows the comparison between the effectiveness of traditional method of teaching to simulation-based learning. The results show that simulation training is more effective than the traditional method (P=0.005).

Table 4 presents the analysis of the satisfaction and confidence of the participants in simulation training. It is evident in the results that the participants have high level of satisfaction and self- confidence through simulation-based learning. This result confirms the effectiveness of simulation over traditional method. In terms of simulation training, the staff level of performance was compared before and after simulation training. Each performance domain was also compared.

Table 5 demonstrates the analysis of the comparison. Statistical difference was observed between pre- and post- simulation training for statement numbers 1, 2, 3, 5, 6, 7, and, 8.

Table 1 Demographical Data.

Demographic Characteristics		Frequency	Percentage (%)
Gender	Male	0	0.0
	Female	86	100.0
	Total	86	100.0
Age (Years)	18-24	3	3.5
	25-34	78	90.7
	35-44	5	5.8
	Total	86	100.0
Level of Education	Bachelor's Degree	76	88.4
	Diploma Degree	7	8.1
	Master's Degree	3	3.5
	Total	86	100.0
Years of Experience	<1 Year	2	2.3
	2-4 Years	20	23.3
	5-7 Years	43	50.0
	>7 Years	21	24.4
	Total	86	100.0

Table 2 Traditional Method Question Items.

Question Item	Chi-Square Tests				
	Pearson Chi-Square	Likelihood Ratio	Linear-by Linear Association	Fisher Exact test: Exact Significance (2-tailed)	McNemar Test: Exact Significance (2-tailed)
Q1	1.534	1.837	1.516	0.286	0.265
Q2	1.070	1.104	1.057	0.444	0.000
Q3	3.588	2.847	3.546	0.121	0.000
Q4	0.007	0.006	0.006	1.000	0.804
Q5	1.707	2.935	1.688	0.336	0.023
Q6	No statistics are computed because no difference between both values (No change)				
Q7	4.037	6.398	3.990	0.052	0.000
Q8	1.546	2.286	1.528	0.504	0.000
Q9	0.822	0.821	0.812	0.383	0.418
Q10	0.361	0.345	0.357	0.507	0.000

Table 3 Traditional vs. Simulation Training Effectiveness.

Traditional Method Vs. Simulation Training	Levene's Test for Equality of Variances		t-test for Equality of Means				
	F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
	4.993	.028	-2.916	76	.005	-8.75740	3.00275

Table 4 The Relationship of Simulation Training to Staff Satisfaction and Self-confidence in Learning.

Variable	Statistics	Simulation Training	Satisfaction	Self-confidence
Simulation Training	Pearson Correlation	1	.889**	.962**
	Sig. (2-tailed)		.000	.000
Satisfaction	Pearson Correlation	.889**	1	.729**
	Sig. (2-tailed)	.000		.000
Self- confidence	Pearson Correlation	.962**	.729**	1
	Sig. (2-tailed)	.000	.000	

For each domain, all, except for the after insertion steps, showed significant differences as seen in **Table 6**.

Table 7 shows some factors which may have influenced the participants' performance during the simulation experience have also been considered in this study, namely, level of education (P=0.848) and duration of work experience (P=0.486). All results yielded to no significant relationships between the said variables to the staff performance in CAUTI prevention through simulation experience.

Surveillance on CAUTI rate and DUR (**Figures 1-3**) has been done for both intervention and control groups, six months before the intervention. **Table 8** reveals the difference between CAUTI rates and DUR's before and after simulation training. The results show that there are no statistical differences between the treatment (P=0.67) and control (P=0.60) groups in terms of improving CAUTI rates and DUR's.

Discussion

This section highlights the statistical findings of this research study. The study is focused on determining the effect of simulation-based learning in reducing CAUTI rates and DUR's. Moreover, the author ventured into determining which teaching method is preferred by learners with improving catheter-associated UTIs.

Based on Kirkpatrick's first level of evaluation model, this study found that the participants' perception of their simulation-learning experience on CAUTI prevention resulted in a high level of satisfaction and increased confidence level.

Meanwhile, in terms of increasing knowledge and/or skill and change in attitudes (Kirkpatrick Model of Evaluation Level 2), the pre-post test results showed statistically significant improvement in knowledge acquisition for both control and experimental groups. There was also a significant difference in the results of the experimental/simulation group compared to the control group who received the traditional method of teaching. These results are supported in a systematic review conducted by Boling & Pierce [17], seventeen (17) papers showed an increase in nurse technical skill and 13 of those studies demonstrated improvements in knowledge and confidence of nurses after using the simulation-based education method. This study has concluded that simulation can be used as an adjunct for clinical practice, not merely a replacement for everyday practice [18].

The results of the study in terms of comparison of simulation method to the traditional method of learning support other kinds of literature which show that simulation-based learning

Table 5 CAUTI Prevention Checklist Item.

Statement\Domain	Paired Differences			t	Df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean			
Before IUC Insertion						
1. Determine if IUC is appropriate per the CDC Guidelines	-.15385	.36552	.05853	-2.629	38	.012
2. Select smallest appropriate IUC	-.10256	.30735	.04922	-2.084	38	.044
3. Obtain assistance to facilitate appropriate visualization/ insertion technique	-.10256	.30735	.04922	-2.084	38	.044
4. Perform hand hygiene	The correlation and t cannot be computed because the standard error of the difference is 0.					
Patient Preparation/Insertion of IUC:						
5. Perform peri-care, then, re-perform hand hygiene	-.17949	.38878	.06225	-2.883	38	.006
6. Maintain strict aseptic technique throughout the actual IUC insertion procedure, re-perform hand hygiene upon completion	-.82051	.38878	.06225	-13.180	38	.000
7. Insert IUC to appropriate length and check urine flow before balloon inflation to prevent urethral trauma	-.53846	.50504	.08087	-6.658	38	.000
8. Inflate IUC balloon correctly	-.15385	.36552	.05853	-2.629	38	.012
After IUC insertion completion						
Perform Triple Action for IUC/Drainage System: • Secure IUC to prevent urethral irritation. • Position drainage bag below the bladder • Check system for closed connections and no obstructions/kinks.	The correlation and t cannot be computed because the standard error of the difference is 0.					

Table 6 CAUTI Prevention Checklist Domain.

Checklist Domain	Paired Differences			t	Df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean			
Before IUC Insertion	-.35897	.48597	.07782	-4.613	38	.000
Patient Preparation/Insertion of IUC	-1.69231	.97748	.15652	-10.812	38	.000
After IUC insertion completion	The correlation and t cannot be computed because the standard error of the difference is 0.					

Table 7 Relationship of Simulation Performance to Level of Education and Years of Experience.

Variables		Sum of Squares	df	Mean Square	F	Sig.
Performance Vs. Level of Education	Between Groups	6.471	2	3.235	.166	.848
	Within Groups	702.614	36	19.517		
	Total	709.085	38			
Performance Vs. Experience	Between Groups	47.122	3	15.707	.830	.486
	Within Groups	661.964	35	18.913		
	Total	709.085	38			

Table 8 CAUTI rate and DURs Pre- and Post-Simulation.

Parameters	Difference after research intervention	Z value	Two sided P-Value
DUR - Control Group	87.2	0.5204	0.6028
DUR- Treatment Group	86.9		
CAUTI - Control Group	3.1	0.4246	0.6711
CAUTI - Treatment Group	1.7		

demonstrates superiority in terms of satisfaction and preference of the study participants. Nevertheless, both interventions are reported to yield an increase in staff knowledge level regardless of the methods used [19,20].

In Kirkpatrick level 3 evaluation method, the results of the study proved a significant change in the pre and post-simulation performance using the Streamlined-Evidence-Based RN Tool on CAUTI Prevention by the American Nurses Association (ANA).

Several research studies utilizing simulation learning supported the findings in this research. Most of these studies conclude that simulation has brought about an improvement in the staff performance and the ability to function in the real clinical

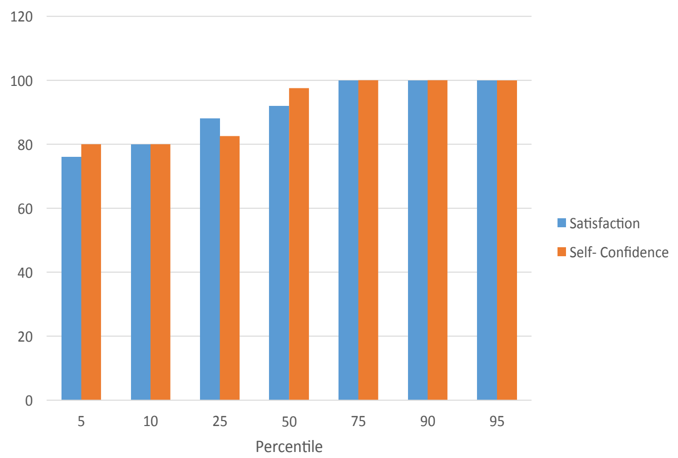


Figure 1 Participants level of satisfaction and self-confidence in learning.

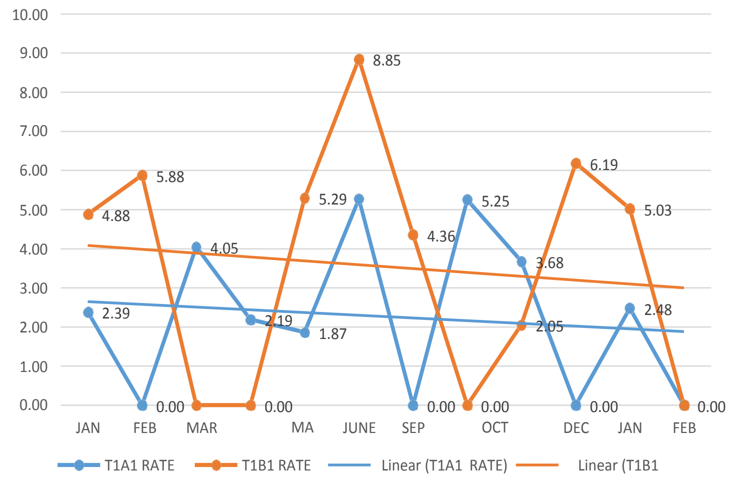
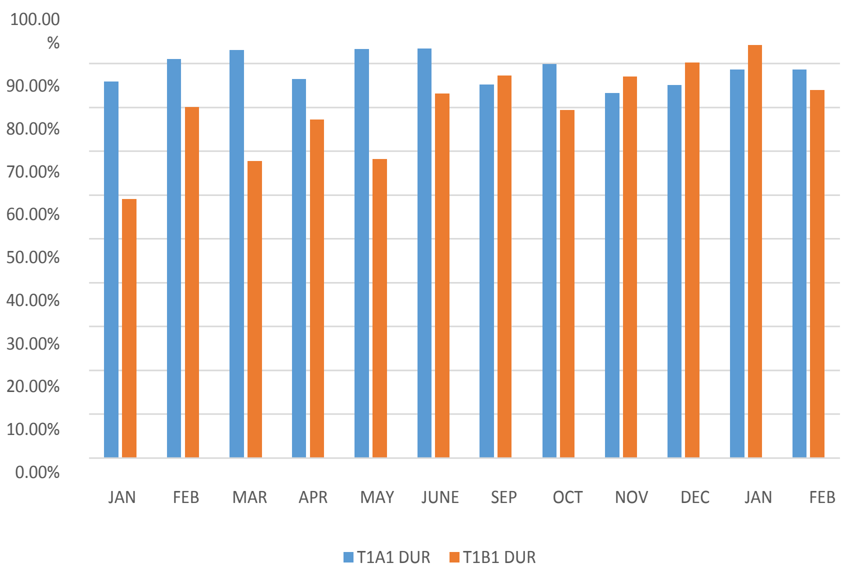


Figure 2 Critical Care Units Monthly CAUTI Rates.



Note- The surveillance period for CAUTI & DUR was done 6 months before and 6 months after the simulation training, in both areas (T1A1 & T1B1). During months of July & August the surveillance was on hold to give away for implementation of the research intervention

Figure 3 Critical Care Units Monthly DURs.

situation [20-23]. Similar findings were reported in two Quasi-Experimental studies compared simulation with other strategies [24,25].

In terms of measuring the outcome of the learning as stated in the Kirkpatrick Model of Evaluation Level Four, the study resulted in no statistical differences in CAUTI and DUR before and after the simulation-based training. Even though it was supported in the literature that educating nurses on the use, care, and maintenance of IUCs can have a large impact on reducing risk of CAUTIs [6]. Similarly, it was evident in another study that education on the performance and compliance in catheter care and hand washing reduces CAUTI rate from 21.3 to 12.39 per 1,000 catheter-days using the combined measures [26].

Although simulation is proven to be an effective teaching methodology in terms of learners' satisfaction and confidence as well as while translating them into actual patient care, its actual effect in reducing CAUTI and DUR is not evident. Other compounding factors which can cause CAUTI's such as prolonged catheter use, patient's comorbidities, sexual anatomy, etc. [7]. Additionally, literature suggests CAUTI prevention is multifaceted and that the use of a guideline combined with an effective educational method will decrease CAUTI rates [11].

Study Limitations

This study is limited to determining the effect of simulation teaching method in improving CAUTI rates. The study also compared the difference of simulation to the traditional method of teaching in terms of participants' level of satisfaction and confidence in performing the various measures of CAUTI prevention.

The researchers did not explore other educational benefits of simulation-based learning on the study participants over an extended period to show the transitional impact of improving staff practices in the area and its contribution in improving patient's outcome.

Furthermore, researchers did not extensively look into other associated factors that may influence CAUTI rate and IUC utilization in ICU such as availability of equipment, other research participant's demographics, unit to unit patient transfers, patient comorbidities, the reporting process, and the possible effect of administrative support.

Besides, due to the high staff turnover and workload in ICU, not all of the expected population were included in the study that might have influenced the reliability of the results. These caused major challenges during the implementation of the research intervention and staff scheduling to attend the didactic sessions and simulation training. To add to this, some staff from other units were also floated to ICU and have inserted IUC without receiving the training or intervention.

Conclusion

Catheter-associated urinary tract infections continue to be a significant cause of preventable harm to patients in the ICU. This research project's purpose was to evaluate the use of simulation based-education in imparting evidence-based guidelines of CAUTI prevention to the study's population.

The research intervention addressed multiple variations being used in clinical practices for CAUTI prevention in the ICU. An evidence-based guideline brought together all of the proven practices in one place; while, the use of simulation addressed the knowledge and clinical deficiencies occurring in this project's site.

After comparing the statistical data of CAUTI rates and DURs in a 25-bed ICU over 6 months, the results showed that there is no significant decrease in CAUTI rates after the intervention was introduced. Despite this, simulation training proved to be effective as compared to the traditional method of teaching based on the participants' level of satisfaction and confidence in performing the strategies of CAUTI prevention.

Based on these findings, the researchers hereby recommend the integration of simulation training in adjunct to other methods of training novice nurses in ICU. Furthermore, evidence-based guidelines and simulation should be trialled for other Hospital-acquired infections (HAIs), such as Central-line Associated Blood Stream Infections (CLASBI). Lastly, future simulation research needs to address the research gaps in quantifying the relationship between performance in simulation activities and inpatient care situations, examining the validity and reliability of the simulator as well as to investigate the impact of simulation training on patient outcome measures.

Acknowledgments

The researchers would like to express their gratitude to Dr. P.J. Parameaswari, Ph.D., specialist biostatistician for assistance with statistical analysis and to Dr. Sandra L. Holmes, Ph.D., RN, CHPE, CHSE, CPHQ, NE-BC, RN-BC for her constructive comments, guidance and supervision that greatly assisted in the formulation of this research endeavour.

Conflicts of Interest

The authors confirm that this article content has no conflict of interest.

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