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Design an Educational Booklet about Infection Control Measures of Urinary Catheter for Intensive Care Unit Nurses

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1.ABSTRACT

Urinary catheter is associated with up to 80% of health care–associated UTIs. Therefore, appropriate control measures of CAUTIs are of most importance for health care personnel. The study aimed to design an educational booklet about infection control measures of urinary catheter for Intensive Care Unit nurses. This had done through a hybrid study design: that combined a cross sectional study design, and Delphi, had carried out Intensive Care Unit (ICU), and affiliated to Mansoura University Hospital. on a convenience sample included all on job ICU nurses (144), and a judgmental sample included 15 experts in the felid of education, infection control, and urology to evaluate the designed booklet; using four tools to assess ICU nurses' socio-demographic, and occupational characteristics, as well their knowledge, practice, and attitude about regarding CAUTI and its control measures, in addition to a tool to evaluate the designed educational booklet. Results illustrated that, 61.1%, 52.8%, and 75.0% of ICU nurses had poor total knowledge score, proper total practice score, and total positive attitude score; regarding urinary catheter and catheter associated urinary tract infections respectively, finally, all fifteen experts as well, fifteen ICU nurses had consensuses to all evaluation elements of the designed educational booklet in second Delphi's round. Finally, it is recommended to adopt, as well available of the designed educational booklet to nurses in their work settings, and on job training programs to nurses on infection control of urinary catheter.

Keywords: Design, Educational Booklet, Infection Control Measures, Intensive Care Unit, Nurses, Urinary Catheter.

2.Introduction:

Healthcare associated infections (HCAIs) considered a major health problem worldwide; which occurring in hospitalized patients and wasn't existing or incubating during admission (Kaushal, 2015). It is increase the rates of patients' morbidity, mortality, and increase cost of healthcare (American Nurses Association, 2015).

According to World Health Organization, estimates approximately 15% of all hospitalized patients suffer from infections. During hospitalization, patients are exposed to pathogens through different sources environment, healthcare staff, and other infected patients (WHO 2016 & Misal, Maulingkar & Bhonsle, 2017). Among them, catheter associated urinary tract infection (CAUTI) account for about 40% of HCAIs, and its development is directly related to the usage duration of this device. The main consequences of CAUTI are bacterial resistance, morbidity and mortality, and increased costs of health care (Gould, Umscheid, Agarwal, Kuntz, Pegues., 2018).

Urinary tract infections (UTIs) defined as an infection involving the kidneys, urethra, ureters, or bladder (Henry, 2018). UTIs are among the most common bacterial infections worldwide, with significant consequences for morbidity, mortality, and substantial financial implications (CDC, 2016). Urinary catheter considered a major risk factor, which associated with up to 80% of health care–associated UTIs. Moreover, 30% of initial urinary catheterizations are unjustified in a standard hospital setting. Even though CAUTIs is considered an preventable adverse event, it still signifies a challenge for quality healthcare (Gould, Umscheid, Agarwal, Kuntz & Pegues., 2017).

Contribute to such infection; the increased patients load, level of awareness regarding infection prevention, absence of aseptic practices by janitors, and health care workers, non-adherence to safe practices by health workers (Tolera, Marami, Abate & Dheresa., 2020).

Nurses educated in use, and management of IUCs can impact the development of CAUTI, and serve to reduce CAUTI risks. CDC, guidelines recommend education to illustrate proper insertion techniques for IUCs, management, appropriate indications, duration, and prevention of potential

complications with IUCs. But still the nurses not follow the right actions during catheter care of patient therefore; the infection rate is still high (CDC, 2015). Hence, suitable prevention, and management of CAUTIs are significant for every urologist, and other health care workers (Gould, Umscheid, Agarwal, Kuntz & Pegues., 2017).

Aim of the Study

Design an educational booklet about infection control measures of urinary catheter for Intensive Care Unit nurses.

Research Questions

1. What is the nurses' knowledge related to CAUTIs?
2. What is the nurses' practice related to CAUTIs?
3. What is the nurses' attitude regarding CAUTIs?
4. What are the perspectives of Intensive Care Unit nurses about the designed educational booklet?
5. How do experts in related fields found the designed educational booklet?

3. Method

Study Design

Hybrid study design: that combined a cross sectional study design and experts' opinions (Delphi), used to conduct this study. Nursing researchers concerned with connecting expert knowledge on an extensive aspects of health and well-being topics are increasingly using Delphi as a means of taking shared opinion. The method has been assumed through a wide range of health, social care and well-being studies associated with policy, clinical practice, planning and evaluation (Brüggen 2009).

Setting

This study was conducted in Intensive Care Unit (ICU), affiliated to Mansoura University Hospital.

Participants

There were two participants groups in the current study as the following:

1. All on job ICU nurses in the above mentioned setting, and fulfilling the following criteria: both genders, different qualifications, assigned to give direct care to patients, and at least one year experience.
2. Experts in the field of education, infection control and urology.

Sampling

Sample of preliminary assessment. All (144) on job ICU nurses was participated in the study to accomplish preliminary assessment for ICU nurses' knowledge, practices, and attitude in relation to CAUTI. They were recruited conveniently.

Sample to evaluate the designed booklet. According to Day and Bobeva (2005), the experts' number was enough for evaluation of the designed booklet because results could be obtained from sample size and homogenous group from tem to fifteen experts. Delphi panel was established by used non probability judgmental sampling technique.

Accordingly purposive sampling technique was included 15 experts in the field of education, infection control and urology. As well a convenient sampling technique was included 15 ICU nurses to evaluate the designed booklet.

Study Tools

After reviewing the related scientific literatures five tools were developed by the researcher and used in this study for data collection.

Tool I: ICU nurses' demographic and occupational characteristics structured self-administrated questionnaire. This questionnaire was used to assess socio-demographic and occupational characteristics of ICU nurses (age, gender, marital status, residence, education, year of experience, and attending training programs / workshops, and its number.

Tool II: ICU nurses' knowledge structured self-administrated questionnaire. This questionnaire was developed to assess the ICU nurses' knowledge regarding CAUTI and its control measures; which consisted of 18 questions (4 multiple choice and 14 fill in the blank questions), included:

- Definition of urinary tract infection, indication of urinary catheterization, type of urinary tract infection, and signs, and symptoms of urinary tract infection.
- Definition of catheter associated urinary tract infection, risk factors, complications, and causes of urinary tract infection.
- Symptoms, diagnosis, risk factors and complications of catheter associated urinary tract infection.
- Nursing intervention to prevent catheter associated urinary tract infection (CAUTI); prior to insertion and nursing action to prevent infections from urinary catheter.

- Best action in cases of obstructed urinary catheter, high risk patients for CAUTI, proper technique used for catheter insertion and best time to remove urinary catheter postoperatively.

Scoring system. One mark was awarded for each correct response. The total scores of the knowledge ranged from 0 to 68. Based on the researcher cut of point the knowledge levels were consisted of three categories as the following:

- Poor < 50% of total scores (< 34)
- Fair = 50% to 75% of total sores (34 - 51)
- Good > 75% of total scores (> 51)

Tool III: ICU nurses' practice observation checklist about CAUTI. This **observation checklist** was used to assess ICU nurses' practice related to CAUTI control measures. It was consisted of four parts including practice prior to catheter insertion, practice during catheter insertion, practice after catheter insertion, maintenance of indwelling catheter, emptying the Foley catheter collection system, specimen collection, and catheter removal.

Scoring system. One mark was awarded for each correct step. The total scores of the practice ranged from 0 to 79. Based on the researcher cut of point the practice levels were categorized into two categories as: proper, and improper as the following:

- Proper: 75% or more of total scores (≥ 59.25)
- Improper: less than 75% of total scores (< 59.25)

Tool IV: ICU nurses' attitude self-administrated scale. This scale was developed to assess ICU nurses' attitudes toward control measures for CAUTI. 22 statements requiring a response on a 4 point Likert- rating scale with 4 continuum (Strongly Disagree=1, Disagree=2, Agree=3, Strongly Agree=4).

Scoring system. It was used to quantify the nurses' attitude which made up a total score of 88 marks. Based on the researcher cut of point the attitude levels were categorized into two categories as: negative, and positive as the following:

- Negative: less than 60% of total score. (less than 52.8)
- Positive: 60% of total score and more. (52.8 or more)

Tool V: A checklist to evaluate the designed educational booklet. This checklist was used to evaluate the designed educational booklet by experts in the field of education, infection prevention, and control, and urologist, as well, ICU nurses. It was classified into eight categories; which consisted of 65 questions. Statements from 1 to 64 were Lickert scale ranged from 0 to 2 degrees. Question number 65 was open ended question about any comments or suggestions from the experts.

Consensus. A consensus level on total items equates with at least 75%. This was suggested by the researcher as a strong cut-off point as the following:

- Disagree = scores less than 50% of total scores (0 – less than 64)
- Neutral = scores 50% to 75% of total scores (64 –96)
- Agree = scores more than 75% of total scores (more than 96)

Phases of the Study

This study was accomplished throughout two main stages

I- Preparation phase

Administrative stage. An official letter from the Faculty of Nursing was submitted to the Director of Mansoura University Hospital to obtain their approval for conducting the study.The director was informed about the aim of the study and its process in order to gain their cooperation and support during data collection.

Literature review. Review of national and international literatures on the various aspects of the CAUTI, and its control measures using scientific published articles, internet search, and textbooks. This review was a guide for developing the study tools.

Developing of the study tools. Tools of data collection (I, II, IV, and V) were constructed by the researcher after revising the appropriate literature.

Face and content validity. According to Litwin, (1995); Maruish, (2011); Miller, (2010); Polit and Beck, (2006) and Tavakol and Dennick, (2011) face validity was recognized when an expert on the research subject reviewing the instrument decided that it measures the trait of interest. Content validity decides to which degree the instrument fully assesses the construct of interest. Study tools were tested for appropriateness and had relevant items, by five experts in related fields of education, infection prevention, and control and urology.

The reliability of scales as measured by using the Cronbach's alpha test was 0.85.

Pilot study was conducted on 10 % (14) of ICU nurses they selected conveniently from the same settings and omitted from the studied sample to evaluate the clarity, applicability, and consistency of the study tools and estimate the required time for data gathering. Therefore the required adjustment was done.

II- Operational phase

Data collection

- The duration of data collection lasted approximately six months from June to December 2019; six days per week, covering the three work shifts.
- The researcher introduced herself to the ICU nurses and provided them a transitory orientation regarding aim of the study.
- The self-administrated questionnaire, and scale (Tools I, II and IV) were distributed on ICU nurses at their units, and collected immediately after completion to accomplish preliminary assessment for ICU nurses' socio-demographic, and occupational characteristics, knowledge, practices, and attitude in relation to control measures of CAUTI.
- Concerning ICU nurses' practice related to CAUTI control measures observed by the researcher using (Tool III).

Designing the educational booklet

- This booklet was designed by the researcher based on his preliminary assessment to ICU nurses' knowledge, practice, and attitude related to control measures of CAUTI.
- Based on these findings, and after reviewing literatures, the educational booklet was designed to raise the awareness of ICU nurse about previous subjects. Evaluation of the designed educational booklet
- At this stage several Delphi rounds will be conducted with ICU nurses and experts that starting from the front draft of the booklet until the production of the final version.
- The designed educational booklet was submitted to a group of expertise (n=15); were (14) academic staff members as well as (1) urologist in addition to ICU nurses (n=15) to appraise the content validity, and format.
- All advices, and comments from expertise, and ICU nurses were considered in the construction of the final booklet, and feedback from their revision was used to modify it. Figure (1) illustrated Delphi rounds to evaluate the designed educational booklet.

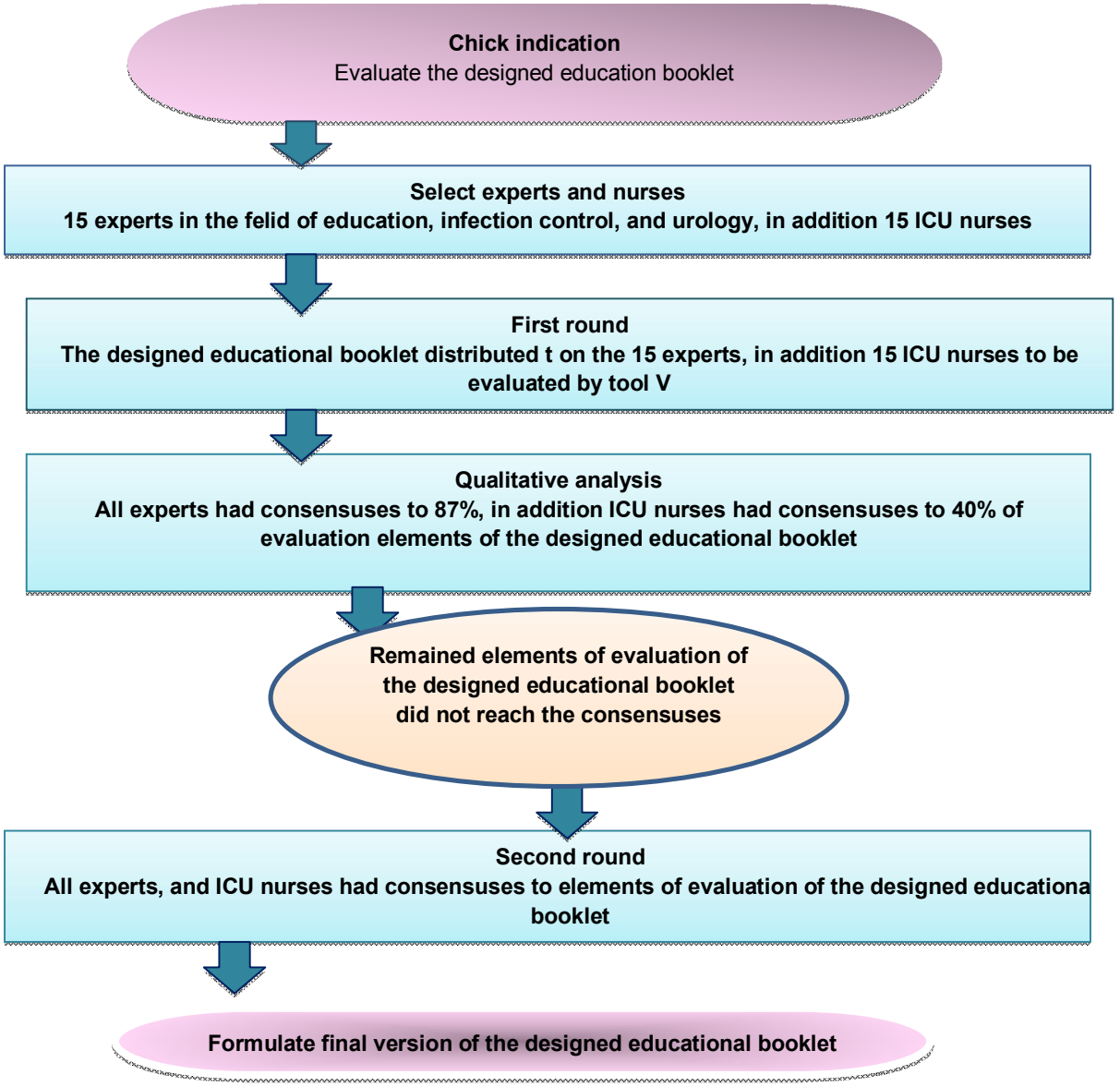

Figure 1. Experts' and nurses' Delphi rounds to evaluate the designed educational booklet

Ethical Consideration

- Ethical authorization was gotten from Research Ethics Commission, Faculty of Nursing, Mansoura University.
- Another authorization was gotten from the studied nurses by using oral informed consent. They were assured that their involvement in the study was voluntary and that gathered data are confidential, and just used to improve health services. Participants informed that they had the right to withdraw at any time from the study without any responsibility, and without giving any reason.

Statistical Analysis

After data collection it was revised, coded, processed and then analyzed using the statistical software IBM SPSS version 21. The quantitative data was presented in mean and standard deviation (SD), while the qualitative data was presented as number (n) and percent (%). Pearson correlation was done between variables. The difference was considered significant at P 0.05. Regarding scoring system, the items discrete scores for each scale were summed together then the sum of scores for each dimension and total score was calculated by summing the scores given for its responses. All scores were transformed into score % as follow:

Score % = (the observed score / the maximum score) × 100.

4. Results

Table (1) reveals that, 59.7% of ICU nurses were aged from 20 to less than 30 years, with mean age 28.9 ± 5.3. Female gender represented 92.4% of ICU nurses, and 80.6% were married. In relation to educational level 36.1% of ICU nurses graduated from secondary schools. Concerning with years of experience, and attending training programs / workshops 36.1%, and 8.3% of ICU nurses had 1 to5 years of experience, and attending training programs / workshops from 1 up to 4 times respectively.

Table (2) shows that, 61.1% of ICU nurses had poor knowledge regarding urinary catheter and catheter associated urinary tract infections compared to only 29.2 % had good knowledge.

Table (3) illustrates that, 64.6%, 57.1 %, 53.5%, 66.7%, and 52.1% of ICU nurses had proper practice regarding catheter insertion, providing proper care after catheter insertion, maintenance of indwelling catheter, specimen collection, and remove catheter respectively, but 69.4% had improper practice regarding preparation for catheter insertion; with 52.8% proper total practice score.

Table (4) indicates that, positive attitude documented by 61.1% of ICU nurses regarding maintenance practice of urinary catheter, and 100.0% regarding challenges in prevention of the CAUTI at unit where they work, but negative attitude documented by 75% of the studied nurses regarding seriousness of CAUTI, finally total positive attitude score documented by 75.0% of ICU nurses.

First Delphi's round. Experts' evaluation to the designed educational booklet reported that, 87% of experts had consensuses to all elements of evaluation of the designed educational booklet, whereas 13% of them are neutral (Figure 2).

Second Delphi's round. Experts' evaluation to the designed educational booklet reported that, all fifteen experts had consensuses to all elements of evaluation of the designed educational booklet (Figure 3).

First Delphi's round. Fifteen ICU nurses' evaluation to the designed educational booklet reported that, 40% had consensuses to all elements of evaluation of the designed educational booklet, and 40% stated neutral choice, whereas 20% disagreed with the evaluation elements of the designed educational booklet (Figure 4).

Second Delphi's round. Fifteen ICU nurses' evaluation to the designed educational booklet reported that all fifteen nurses had consensuses to all evaluation elements of the designed educational booklet (Figure 5).

Table 1 ***ICU nurses' socio-demographic and occupational characteristics (n=144)***

Items	**N = (144)**	**(%)**
Age		
20-<30years	86	59.7
30-<40 years	49	34.1
40-50	9	6.2
B S.D 28.9 (5.3 years)		
Gender		
Males	11	7.6
Females	133	92.4
Marital status		
Single	22	15.3
Married	116	80.6
Divorced	2	1.4
Widow	4	2.8
Residence		
Urban	27	18.8
Rural	117	81.3
Educational level		

Secondary	52	36.1
Technical	49	34.0
Bachelor	40	27.8
Post graduate	3	2.1
Years of experience		
1-5	52	36.1
6-10	50	34.7
11-15	17	11.8
16-20	25	17.4
Attending training programs / workshops		
Yes	12	8.3
Number of training courses		
1-2	5	3.4
3-4	7	4.9

Table 2*ICU nurses' total knowledge levels score regarding urinary catheter and CAUTI (n=144)*

knowledge Levels	**N = (144)**	**(%)**
Poor	88	61.1
Fair	14	9.7
Good	42	29.2
B ± SD	**46.35(7.45)**	

Table 3*ICU nurses' total practice score regarding urinary catheter and CAUTI (n=144)*

	Proper		**Improper**	
Competencies	**N**	**(%)**	**N**	**(%)**
Preparation for catheter insertion	44	30.6	100	69.4
Catheter insertion	93	64.6	51	35.4
Care after catheter insertion	83	57.1	61	42.4
Maintenance of indwelling catheter	53	53.5	67	46.1
Emptying of collection system	72	50.0	72	50.0
Specimen collection	96	66.7	48	33.3
Catheter removal	75	52.1	68	47.2
Total practice score	76	52.8	68	47.2
B ± SD	43.36 ± 4.75			

Table 4 *ICU nurses' attitude regarding urinary catheter and Infection Control Measures of CAUTI (n=144)*

Attitude	**Negative**		**Positive**	
	N	**(%)**	**N**	**(%)**
The seriousness of CAUTI	108	75	36	25
Practice on maintenance	65	38.9	88	61.1
Challenges in prevention of the CAUTI at your unit	0	0.0	144	100.0
Total attitude score	36	25	108	75
B ± SD		36.5 ±1.9		

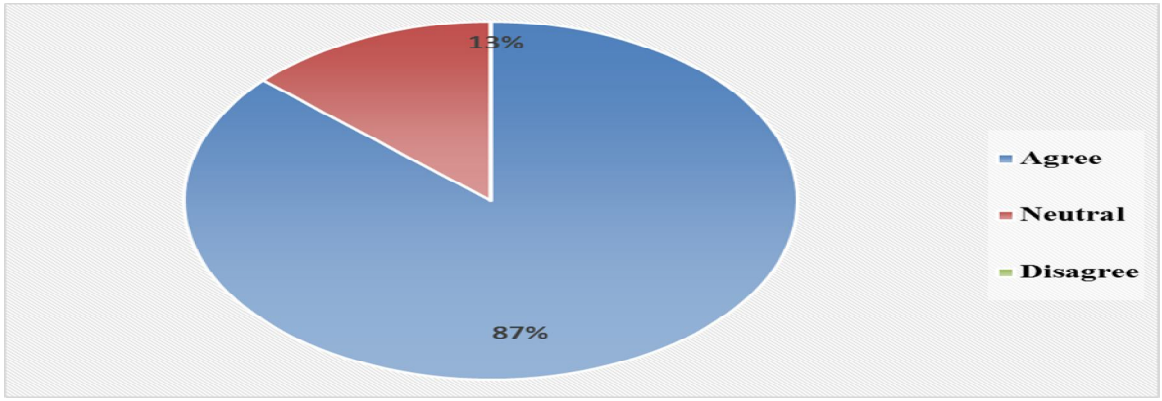

Figure 2. First Delphi's round of experts' evaluation to the designed educational booklet (*n*=15)

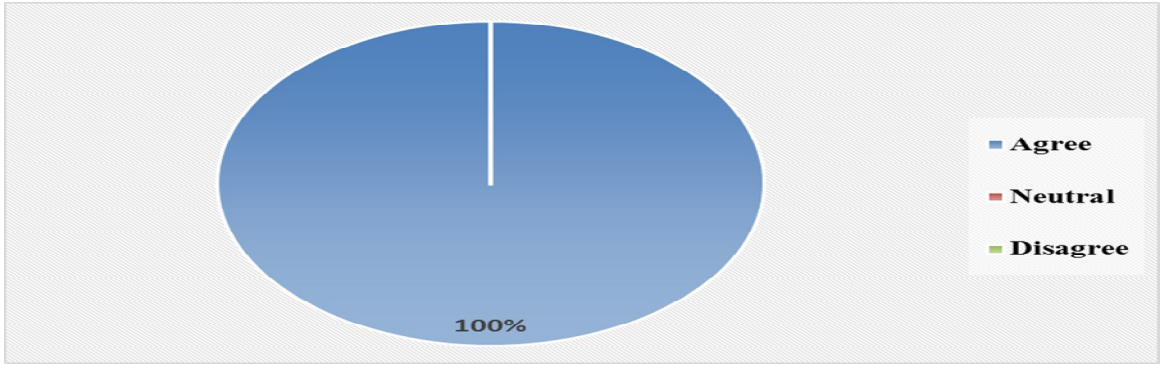

Figure 3. Second Delphi's round of experts' evaluation to the designed educational booklet (*n*=15)

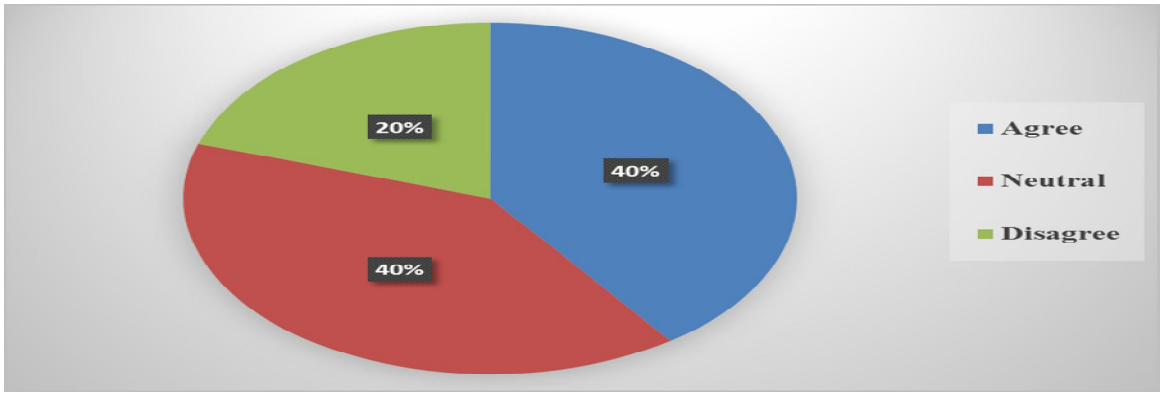

Figure 4. First Delphi's round of ICU nurses' evaluation to the designed educational booklet (*n*=15)

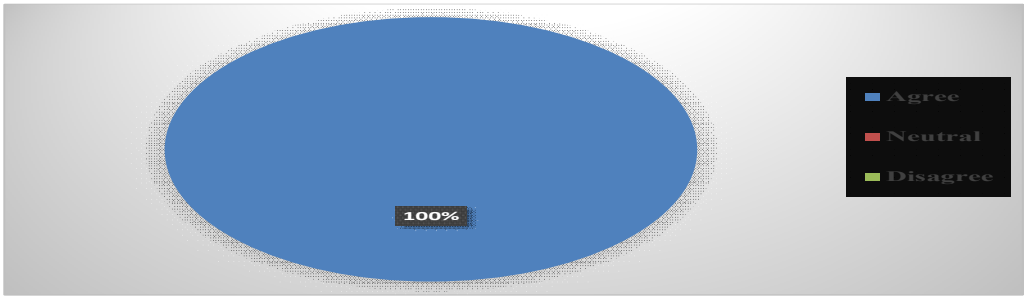

Figure5. Second Delphi's round of ICU nurses' evaluation to the designed educational booklet (*n*=15)

5. Discussion

Indwelling urinary catheter is a common ICU practice used for precise calculation of urine output in critically ill, post-operative patients, conditions necessitating prolonged immobilization, and others. However, urinary catheters are responsible for 20% to 30% of HAI resulting in high cost due to over use of antimicrobials, increased length of hospital stay, morbidity and mortality (Tyson, 2020).

According to Kachare, Sanders, Myatt, Fitzgerald and Zervos, (2014), infection control protocols, encouraging staff nurses to assess patient's need for continuing catheterization, and removal of urinary catheters as soon as possible are measures have been linked to substantial reductions in total catheter days, catheter use and CAUTI rate.

Implementation of infection control measures are significant, and help to reduce the incidence of CAUTI. Appropriate use of urinary catheter according to patients' condition, use of aseptic technique during insertion, and maintenance, removal of urinary catheter as soon as possible, and use of hand hygiene technique are strategies used before, and after placement of urinary catheters to prevent CAUTI. The main approach to improve competence is the capability to put knowledge into action. Main infection control measures for safe delivery of healthcare is planned into different, consistent, infection control domains. All standards of care provide a guide to the knowledge, skills, judgment, and attitudes that are needed to practice safely. They describe what each nurse is accountable, and responsible for in practice (CDC., 2017). So, the aim of this study is to design education booklet for ICU nurses about infection control measures of urinary catheter.

In relation to nurses' knowledge levels score; results of the current study presents that almost two thirds of the studied nurses have poor knowledge regarding urinary catheter, and catheter associated urinary tract infections compared to almost one third have good knowledge. This may be attributed to; more than three fourth of studied nurses had graduated from secondary school, and technical institute of nursing, this could be illustrates needs for on job education to improve nurses' knowledge.

These results agree with Jain, Dogra, Mishra, Thakur and Loomba, (2018) report that, nurses knowledge about guidelines for prevention of catheter associated urinary tract infection is low but after educational intervention there is high statistical significant improvement in knowledge of nurses. As well, Prasanna and Radhika, (2015) find that nursing staff have a low level of knowledge regarding catheter associated urinary tract infection, and issues regarding urinary catheter care, and needs improvement, and education.

In the same line, Banks and Willmann, (2018) emphasize that; there is a huge gap in nurses' education of CAUTI, as they lack knowledge regarding catheter care practice. Furthermore, Shah et al., (2017) state a distinct lack of awareness amongst nurses about the consequences of CAUTI. Catheters are frequently inserted for the wrong reasons, and the care and maintenance of catheters is often non evidence based. They also discover a lack of consistent documentation of catheter insertion, and care. Also, Mukakamanzi, (2018) documents slightly less than half of studied nurses have adequate knowledge level about infection control measures regarding urethral catheter.

Regarding studied nurses' practice levels score related urinary catheter, and catheter associated urinary tract infections, findings of the current study reveal that more than two thirds of the studied nurse have proper practice related to catheter insertion, and specimen collection, moreover, more than half of the studied nurses have proper practice regarding care after catheter insertion, maintenance of indwelling catheter, and remove urinary catheter. On the opposite side, more than two thirds of studied nurse have improper practice regarding preparation for catheter insertion. These results can be explained in the light of; almost two thirds of the studied nurses have inadequate experience; as they aged from 20-<30years, in addition to only 12 out of 144 are attending training programs / workshops.

These findings are in agreement with the findings of Mukakamanzi, (2018) finds that only half of the studied sample has good practice about infection control measures related to the use of urethral catheter. The same results document by Taleschian-Tabrizi et al., (2015) report that nurses' total practice level is satisfactory in only half of ICUs' healthcare staff. The most frequent pitfalls are: defective aseptic technique during catheter insertion, and emptying urinary bag, using multiple-use lubricant gel, antibiotic prescription before catheter insertion, lack of appropriate perineal care, and drainage of urine bag into a common container for many patients. In a study carried out in Taiwan, by Lai, (2017) confirms that, nursing care practice are lowest regarding catheter

insertion, cleaning of the perineum, followed by hand hygiene.

The same results report by Holte, Underland and Hafstad, (2016) mention that, total practice level of ICU staff is low and significantly improved after applying educational intervention regarding CAUTI, and consequently the incidence of CAUTI significantly decreased as a result of improved knowledge, and practice of ICUs' staff. Al-Hameed, (2018) declares that, the initial screening of urinary catheter on ICU admission is the furthermost lacking intervention as several patients admitted are critical, and physicians are engaged in stabilizing the patients, maintenance of closed system by the nursing staff. Al Nasser et al., (2016), conclude that, rates of CAUTI significantly decreased after the application of the established strategies to prevent CAUTI in adult ICUs.

Regarding the studied nurses' attitude regarding urinary catheter, and infection control measures of CAUTI, results of the present study reveal that, total positive attitude score document by three fourth of the studied nurses. These findings are in agreement with the findings of Mukakamanzi, (2018) states that, nurses have positive attitude regarding CAUTI, and infection control measures related to catheter insertion, and catheter care.

Another study by Al-Hameed., (2018) pointes that, nurses' positive attitude gradually increased regarding the compliance of the CAUTI standard preventive measures with persistent efforts from the team leaders along with prioritizing the needs of the patients safety, periodical educational programs, evaluating nurse's competency for maintenance of measures, delivery of sufficient supplies from logistics, sustained daily reminders during rounds by the nurse manager regarding renewal or removal of the catheter.

Furthermore, Tedja, Wentink, O'Horo, Thompson and Sampathkumar., (2015) emphasize that, up to date knowledge, and refined practical nursing skills can play important roles in preventing infection. Nurses should have the opportunity to practice infection control on a day-to-day basis as an integral part of patients' care. Healthcare professionals have positive attitude, and always are concerned with avoiding infection through utilizing infection control standard precautions.

In relation to experts' evaluation to the designed educational booklet, the majority have consensuses to all evaluation elements of the designed educational booklet in the first Delphi's round, whereas, in the second Delphi's round, all have consensuses to all evaluation elements of the designed educational booklet. These results convey the accuracy, and completeness of the designed booklet based on review of the recent related literatures, and international guidelines.

These findings are in agreement with the findings of Markmann et al., (2020) find that, Delphi method or Delphi technique is a structured communication technique or method, originally developed as a systematic, interactive predicting method which relies on a panel of experts that has certain advantages over another structured forecasting approaches. Another study by Mauksch et al., (2020) point out that, Delphi is based on the principle that forecasts from a structured group of individuals are more accurate than those from unstructured groups. The experts answer questionnaires in two or more rounds. Thus, experts are encouraged to revise their earlier answers in light of the replies of other members of their panel.

Furthermore, Negrini et al,. (2020) state that Delphi techniques are used to advance an expert-based judgment regarding an epistemic question, based on the hypothesis that a group of experts, and the multitude of associated perspectives will produce a more valid result than a judgment given by an individual expert, even if this expert is the best in his or her field.

According to Wang et al, (2015), Delphi is a structured approache that aggregate diverse opinions from groups and have advantages of prediction derive from the possibility to provide incentives for participation as it can motivate people to participate to reveal their true beliefs, and aggregate information and instantly incorporate new information in the forecast. Banno, Tsujimoto and Kataoka, (2020) emphasize that, Delphi seems to have advantages over prediction markets, as it is easier to maintain confidentiality, potentially quicker predictions if experts are readily available and participants reveal their reasoning.

Contrary to the results of the current study, studies by Niederberger and Spranger, (2020) find decrease in both carrying out, and reporting Delphi techniques, and highlight the absence of an epistemological, and methodological basis for Delphi techniques. In terms of the key categories examined there is a need for additional research, and discussion, particularly of a methodological nature, in Delphi variants, the use of these variants could generate contextual and methodological value, and experts, cognitive diversity in the

composition of the expert panel is important for the robustness and validity of the findings.

According to nurses' evaluation to the designed educational booklet more than one third have consensuses, as well, neutral to all evaluation elements of the designed educational booklet, in the first Delphi's round, while, in the second Delphi's round all have consensuses to all evaluation elements of the designed educational booklet. These results express the importance of nurses' evaluation to the given knowledge in the designed educational booklet to fit in all with different experience and educational levels.

The current study concerns to reach nurses' consensus on the designed educational booklet, before final print as, since it is targeted to them; furthermore, they are in the first line of patients' care so their evaluation is valuable. In this respect Jain et al., (2015) and Sampathkumar et al., (2016) confirm that nurse's knowledge, and attitude toward the prevention is another way to prevent CAUTI, and can affect outcomes, and to avoid unexpected outcomes, nurses, and physicians in collaboration with administration, and policy-makers, must work together to enhance the safety of patients and to promote optimal outcomes.

Finally, it is obvious the importance of continuous educational development of nursing, updating their knowledge, and practice and, enhance positive attitude toward the infection control measures of urinary catheter. On the other hand, there is a burden of conducting training programs, as well; probable contradictions between times of training programs, with work times, therefore the researcher designed this educational booklet to address this gap.

6. Conclusion

The majority, and slightly more than half of ICU nurses have poor total knowledge score, had total proper practice score; regarding urinary catheter, and catheter associated urinary tract infections, respectively, Total positive attitude score documented by three fourth of ICU nurses regarding urinary catheter, and infection control measures of catheter associated urinary tract infections. All fifteen experts and fifteen ICU nurses have consensuses to all evaluation elements of the designed educational booklet in second Delphi's round.

7. Recommendations

- Adopt, as well available of the designed educational booklet to nurses in their work settings.
- On job training programs to nurses on infection control of urinary catheter.
- Further researches to explore factors contribute to nurses adhered on infection control.

8.References

- Kachare S, Sanders C, Myatt K, Fitzgerald T, Zervos E. (2014). Toward eliminating catheter-associated urinary tract infections in an academic health center. J Surg Res. 2014;192:280-285).
- Tyson A, Campbell E, Spangler L, Ross S, Reinke C, Passaretti C, and Sing R. (2020). Implementation of a Nurse-Driven Protocol for Catheter Removal to Decrease Catheter-Associated Urinary Tract. Journal of Intensive Care Medicine 2020, Vol. 35(8) 738-744 DOI: 10.1177/0885066618781304 journals.sagepub.com/home/jic
- Centers for Disease Control and Prevention. (2017). Urinary Tract Infection (Catheter-Associated Urinary Tract Infection [CAUTI] and Non-CatheterAssociated Urinary Tract Infection [UTI]) and Other Urinary System Infection [USI]) Events. In: 2016 NHSN Patient Safety Component Manual [Internet]. 2016. p. 1– 16. Available from: http://www.cdc.gov/nhsn/pdfs/pscmanual/ 7psccauticurrent.pdf.
- Jain M, Dogra V, Mishra B, Thakur A, Loomba P. (2018). Knowledge and attitude of doctors and nurses regarding indication for catheterization and prevention of catheterassociated urinary tract infection in a tertiary care hospital. Indian J Crit Care Med [Internet]. 2015 Feb [cited 2018 Jun 18];19(2):76. Available from: http://www.ncbi.nlm.nih.gov/pubmed/25722548
- Prasanna K, Radhika M. (2015). Knowledge regarding Catheter care among Staff Nurses. Int J Appl Res [Internet]. 2015 [cited 2018 Jun 18];1(8):182–6. Available from: www.allresearchjournal.com
- Mukakamanzi J. (2018). Knowledge, attitude and practice of nurses towards the prevention of catheter associated urinary tract infection in selected referral hospitals in Rwanda.. 2017 [cited 2018 Jun 18]; Available from: http://dr.ur.ac.rw/bitstream/handle/123456

789/324/MUKAKAMANZI Jacqueline.pdf?sequence=1&isAllowed=y.

- Shah M, Wahab F, Ullah F, Gul U, Aziz A, Ullah Z. (2017). Infection Control in the Use of Urethral Catheter: Knowledge and Practises of Nurses. Am J Adv Drug Deliv [Internet]. 2017 [cited 2018 Jun 18];05(01). Available from: http://www.imedpub.com/advanced-drugdelivery/
- Banks R, Willmann H. (2018). Nursing Interventions Aimed at Reducing the Incidence of Hospital Acquired CatheterAssociated Urinary Tract Infections. 2016 [cited 2018 Jun 7]; Available from: https://www.theseus.fi/bitstream/handle/10 024/112505/Banks_Hannah.pdf?sequence =1
- Lai C-C, Lee C-M, Chiang H-T, Hung CT, Chen Y-C, Su L-H, et al. (2017). Implementation of a national bundle care program to reduce catheter-associated urinary tract infection in high-risk units of hospitals in Taiwan. J Microbiol Immunol Infect [Internet]. 2017 Aug [cited 2018 May 26];50(4):464–70. Available from: http://www.ncbi.nlm.nih.gov/pubmed/287 11430
- Taleschian-Tabrizi N, Farhadi F, Madani N, Mokhtarkhani M, Kolahdouzan K, Hajebrahimi S. (2015). Compliance With Guideline Statements for Urethral Catheterization in an Iranian Teaching Hospital. Int J Heal Policy Manag. 2015 Jul 14 [cited 2018 May 29];4(12):805–11. Available from: http://ijhpm.com/article_3056_616.html
- Al Nasser W, El-Saed A, Al-Jardani A, Althaqafi A, Alansari H, Alsalman J, et al. (2016). Rates of catheter-associated urinary tract infection in tertiary care hospitals in 3 Arabian Gulf countries: A 6-year surveillance study. Am J Infect Control 2016; 44: 1589-1594.
- Al-Hameed F, Ahmed G, AlSaedi A, Bhutta M, Al-Hameed F, AlShamrani M. (2018). Applying preventive measures leading to significant reduction of catheter associated urinary tract infections in adult intensive care unit Saudi Med J 2018; Vol. 39 (1): 97-102 doi: 10.15537/smj.2018.1.20999.
- Holte HH, Underland V, Hafstad E. (2016). Systematic Reviews on Preventing Catheter-Associated Urinary Tract Infection [Internet]. Systematic Reviews on Preventing Catheter-Associated Urinary Tract Infection. 2016. Available from: http://www.ncbi.nlm.nih.gov/pubmed/295 53654
- Sampathkumar, P., Barth, J. W., Johnson, M., Marosek, N., Johnson, M., Worden, W., . . . Dhanorker, S. (2016). Mayo Clinic reduces catheter-associated urinary tract infections through a bundled 6-C approach. The Joint Commission Journal on Quality and Patient Safety, 42(6), 254-AP254.
- Behrend, L. (2020). Revisiting CAUTI Prevention: A Multifaceted Approach using Lean Six Sigma. [Doctoral project, University of St Augustine for Health Sciences]. SOAR @ USA: Student Scholarly Projects Collection. https://doi.org/10.46409/sr.OGPH7615.
- Uwaezuoke S.N, and Obu H.A, (2013). Nosocomial infections in neonatal intensive care units: cost-effective control strategies in resource-limited countries. Niger J Paed; 40 (2): 125-132.
- Scanlon, K. A., Wells, C. M., Woolforde, L., Khameraj, A., & Baumgarten, J. (2017). Saving lives and reducing harm: A CAUTI reduction program. Nursing Economics, 35(3), 134.
- Gesmundo, M. (2016). Enhancing Nurses' Knowledge on Catheter-Associated Urinary Tract Infection (CAUTI) Prevention. Kai Tiaki Nursing Research, 7(1), 32-40.
- Kubiak, T. M., & Benbow, D. W. (2017). The Certified Six Sigma Black Belt Handbook (3rd ed.). Milwaukee, WI: ASQ Quality Press.
- Mauksch et al. (2020). Who is an expert for foresight? A review of identification methods. In: Technological Forecasting and Social Change. Vol. 154, 119982, doi:10.1016/j.techfore.2020.119982.
- Markmann, C. et al. (2020). Improving the question formulation in Delphi□like surveys: Analysis of the effects of abstract language and amount of information on response behavior. In: Futures & Foresight Science. e56, doi:10.1002/ffo2.56.
- Negrini S, Armijo-Olivo S, Patrini M, Frontera WR, Heinemann AW, Machalicek W, et al. (2020). The randomized controlled trials rehabilitation checklist: methodology of development of a reporting guideline specific to rehabilitation. Am J Phys Med Rehabil. (2020) 99:210–5. doi: 10.1097/PHM.0000000000001370.

- Banno, M; Tsujimoto, Y; Kataoka, Y (2020). "The majority of reporting guidelines are not developed with the Delphi method: a systematic review of reporting guidelines". Journal of Clinical Epidemiology. 124: 50–57. doi:10.1016/j.jclinepi.2020.04.010. PMID 32302679.
- Wang, X; Chen, Y; Yang, N; Deng, W; Wang, Q; Li, N; Yao, L; Wei, D; Chen, G; Yang, K (2015). "Methodology and reporting quality of reporting guidelines: systematic review". BMC Medical Research Methodology. 15 (74): 74. doi:10.1186/s12874-015-0069-z. PMC 4579604. PMID 26395179.
- Niederberger M & Spranger J. (2020). Delphi Technique in Health Sciences: A Map. Front. Public Health, https://doi.org/10.3389/fpubh.2020.00457
- Sampathkumar, P., Barth, J. W., Johnson, M., Marosek, N., Johnson, M., Worden, W., . . . Dhanorker, S. (2016). Mayo Clinic reduces catheter-associated urinary tract infections through a bundled 6-C approach. The Joint Commission Journal on Quality and Patient Safety, 42(6), 254-AP254.
- Jain M, Dogra V, Mishra B, Thakur A, Loomba P. (2018). Knowledge and attitude of doctors and nurses regarding indication for catheterization and prevention of catheterassociated urinary tract infection in a tertiary care hospital. Indian J Crit Care Med [Internet]. 2015 Feb [cited 2018 Jun 18];19(2):76. Available from: http://www.ncbi.nlm.nih.gov/pubmed/25722548
- Sampathkumar, P., Barth, J. W., Johnson, M., Marosek, N., Johnson, M., Worden, W., . . . Dhanorker, S. (2016). Mayo Clinic reduces catheter-associated urinary tract infections through a bundled 6-C approach. The Joint Commission Journal on Quality and Patient Safety, 42(6), 254-AP254.
- Tedja R, Wentink J, O'Horo JC, Thompson R, Sampathkumar P. (2015). Catheter Associated Urinary Tract Infections in Intensive Care Unit Patients. Infect Control Hosp Epidemiol [Internet]. 2015;36(11):1330–4. Available from: http://www.ncbi.nlm.nih.gov/pubmed/26190686.
- Parker, V., Giles, M., Graham, L., Suthers, B., Watts, W., O'Brien, T., & Searles, A. (2017). Avoiding inappropriate urinary catheter use and catheter-associated urinary tract infection (CAUTI): a pre-post control intervention study. BMC health services research, 17(1). doi:10.1186/s12913-017-2268-2.
- Shaver, B., Eyerly-Webb, S. A., Gibney, Z., Silverman, L., Pineda, C., & Solomon, R. J. (2018). Trauma and intensive care nursing knowledge and attitude of Foley catheter insertion and maintenance. Journal of Trauma Nursing, 25(1), 66-72.
- Day, J., & Bobeva, M. (2005). A generic toolkit for the successful management of Delphi studies. The Electronic Journal of Business Research Methodology, 3(2), 103-116.
- Tolera M, Marami D, Abate D & Dheresa M. (2020). Risk of Healthcare-Associated Infections among the Admitted Patients at Hiwot Fana Specialized University Hospital, Eastern Ethiopia? Advances in Preventive Medicine Volume 2020, Article ID 6875463, 7 pages https://doi.org/10.1155/2020/6875463
- American Nurses Association. (2015). ANA CAUTI Prevention Tool. Retrieved from http://nursingworld.org.
- Kaushal, G.(2015). Impact of training on knowledge, attitude and practices scores of ICU nurses regarding standard precautions of infection control in a super speciality hospital of Delhi. Indian Journal of Research, 4(8), 282-285.
- Centers for Disease Control and Prevention. (2015). Centre of Disease Control Catheter-Associated Urinary Tract Infection Guideline.
- Henry, M. (2018). Evaluation of evidence-based practice of catheter associated urinary tract infections prevention in a critical care setting: An integrative review. Journal of Nursing Education and Practice, 8(7), 22.
- Gould, C. V., Umscheid, C. A., Agarwal, R. K., Kuntz, G., & Pegues, D. A. (2017). Guideline for Prevention of Catheter - Associated Urinary Tract Infections 2009, Healthcare Infection Control Practices Advisory Committee.
- Gould CV, Umscheid CA, Agarwal RK, Kuntz G, Pegues DA. (2018). Healthcare Infection Control Practices Advisory Committee. Guideline for Prevention of Catheter-Associated Urinary Tract Infections [Internet]. US: Centers for Disease Control and

Prevention, 2017 [cited 2018 Feb 10]. Available from: https://www.cdc.gov/infectioncontrol/guidelines/cauti/

- Misal D, Maulingkar S & Bhonsle S. (2017). Economic burden of antibiotic treatment of healthcare-associated infections at a tertiary care hospital ICU in Goa, India. Tropical Doctor. Vol. 47(3) 197–201. DOI: 10.1177/0049475516653068.
- WHO (2016) Guidelines on core components of infection prevention and control programmers at the national and acute health care facility level. Geneva: World Health Organization; 2016 (http://www.who.int/infectionprevention/publications/ipc-components-guidelines/en/, accessed 23 January 2020).