Development of Clinical Nurses' Competency in Cardiothoracic Intensive Care Unit

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Abstract
Background: Professional competency is a fundamental concept in nursing which has a direct relationship with quality improvement of patient care and public health. Clinical competence is the ability to base clinical decision on prior experiences with particular clinical situations. Aim: The aim of the study was to (1) Evaluate nurses' knowledge, skills, behavior and experience through using self-assessment competency scale of cardiothoracic intensive care and critical care unit, (2) Evaluate the clinical competences of cardiothoracic intensive care nurses by using standardized clinical competency checklists. (3) Developing clinical competence using multileveled competency statements for intensive care unit's nurses. Research Design: Descriptive and Quasi-experimental designs were employed. Sample: All available ICU nurses (23) enrolled in the study. Setting: Cardiothoracic intensive care unit at Tanta Students University Hospital. Tools: Two tools were used in this study Tool I. Self-assessment of basic competence scale of critical and intensive care nursing; Tool II: Standardized clinical observation checklists for seventeen competencies of critical and intensive care nursing were used to evaluate and develop the nurses' competency. Results: The cardiothoracic ICU nurses had self-assessed their basic competence at good level with high statistical significance difference (p<0.05) between the four bases of the scale as revealed respectively, attitude and value base was higher than skills base followed by experience base then knowledge base was least, as the mean scores of the self-assessed clinical competence included the use of Principles of nursing care, and Nursing interventions Clinical guidelines were higher than professional competence that included the use of Ethical activity and familiarity with health care laws, Decision-making, Development work and Collaboration. From the other side, the actual performance of nurses while practice of seventeen clinical procedures on cardiothoracic patients, was observed during day and night shifts. The clinical competency of nurses in the day shift was at high mean scores compared to the night shift. The overall clinical competency of the nurses evaluated at satisfactory level prior training and good level in post training. Conclusion and Recommendations: It recommended continually assessing and developing the intensive care nurses' competency that have a direct impact on the positive clinical outcomes for patients and reduced costs for the healthcare.
Key Words: Critical Care Patients, Cardiothoracic Intensive Care Nursing, Nurses Competence, Clinical Competency, Basic Competence Scale.

I. Introduction

Nursing is a complex profession, requiring a good knowledge base and critical thinking skills. Therefore, the function of nursing education is to produce a competent practitioner, adept in basic knowledge and with the ability to apply critical thinking. Competency involves both the ability to perform in a given context and the capacity to transfer knowledge and skills to new tasks and situations. Performance criteria' outline steps should be followed to achieve competency *(Brunt, 2014)*.

The critical care environment is a constantly changing field with emerging technologies and therapies to aid patient recovery through the often-life-threatening illness. Critical care nurses play a pivotal role in the assessment, care and recovery of patients who experience critical illness. Nurses' experience, competence and knowledge allow them to work both on their own and in partnership with wider multidisciplinary healthcare teams. Nurses are required to provide safe, high quality services for the public, and support improvements in the critical care environment so that the safety and quality of care is continually enhance. Nurses need to ensure

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they develop and maintain competence in practice to meet the challenges presented *(National Competency Framework for Registered Nurses in Adult Critical Care, 2015).*

Critical care unit is units where patients with critical conditions are admit, so nurses working in these units are required to have clinical competences *(Nobahar, 2016).* Furthermore, World Health Organization *(WHO, 2016)* requires all the member countries to report and implement their plans for strengthening nurses and equipping them with professional competency because having competency leads to an improved quality of patient care and an increased patient satisfaction with the nurses and helps promote nursing as a nursing *(Nobahar, 2016).*

The nurses' competence is an important criterion required for providing patients' healthcare. The change in nurses' roles and duties has changed the job to a complicated one and requires having various skills, and has caused the clinical competence is to be considered more *(Behrooz, et al, 2016).* Competences have seen as a complex of knowledge, skills, and attitudes that enable successful task performance and problem solving *(Vare et al., 2019).* According to *Karami et al., (2017)* competence is a fundamental component of nursing care and plays an important role in the quality of care provided by nurses. Competence is a collection of knowledge, skills, attitude, values, and abilities increasing the efficiency and effectiveness in professional work environments *(Faraji et al., 2019).*

Competence is defined by *(American Academy of Ambulatory Care Nursing "AAACN", 2013)* as the ability to demonstrate the technical, interpersonal, and/or clinical skills necessary to perform the responsibilities of the job". Measuring performance is required to demonstrate competence. Moreover, competence described as theoretical and clinical knowledge, together with the set of values and attitudes used in the practice of nursing, incorporating psychomotor and problem-solving abilities, with the goal of providing safe care for patients. Competence evaluation must be evidence- and criterion-based, including both quantitative and qualitative evaluation criteria along with context-specific criteria *(Tommasini et al., 2017).*

Core nursing competency also defined as "the ability to perform clinical nursing care that is based on the nurse's ethical thinking and accurate nursing skills and that is provided to meet the needs of the cared *(Fukada, 2018).* Also, *Lv Y et al., (2016); Valentin and Ferdinande (2011)* defined the core competencies of ICU nurses as the ability to integrate a broad range of professional thinking and technical skills, and it is crucial that this level of competencies be constantly refined and developed. The core competencies of ICU nurses directly and significantly affect the outcomes and prognosis of critically ill patients.

While, clinical competency is defined as the ability to give safe care in a way that looks to the patient from a great perspective and an ability to assess precisely and think critically over the best choice of care by using evidence-based practice. It also directs the nurse's ability to employ meta-cognitive judgment through a utilization of perceived self-knowledge, applicable knowledge and self-appraisal with integrating attributes such as leadership and management *(Meehan, 2016).*

Clinical competence includes general competencies (such as management and communication skills, professional skills, group performance, and ability to provide primary and specialized health care services), and specific competencies (such as quality care assessment, implementation of specific processes, performance monitoring, and ability to monitor health and disease) *(Ghanbari et al., 2017).* Clinical competence is the priority and aim of the nursing profession, because the quality of care depends on the clinical competence of nurses *(Manoochehri et al., 2017).*

The assessment of both competence and competency is a major concern for administrators, educators, as well as, in practice disciplines such as nursing, medicine psychology, and physical/occupational therapy *(Sakurai et al., 2013; Bhalla et al., 2014).* In nursing, there should be growing interest in validating both competences and competencies of professionals' nurses in their work environments *(Case Di Leonardi & Biel, 2012; Przyby, Androwich, & Evans, 2015).* In clinical competence each nurse must take possession of a blend of skills, knowledge, attitudes and capabilities to act activities of distinctive patient care with a view to maintain, promote and reimburse the patient health *(Notarnicola et al., 2016).* Nursing competence can be evaluated in a classroom or simulated setting. Evaluators can create scenarios by which clinicians can apply what they have learned and evaluators can objectively assess performance. Other methods of evaluation include objective structured methods, critical incident reports, self-assessment, case-based evaluations and peer evaluations *(Fotheringham, 2010).*

Developing and measuring competencies are highly relevant issues in critical care nursing globally *(Williams et al., 2015).* Measuring competence as a broad concept is a complex task with many challenges *(Flinkman et al., 2016)*, thus, there is a need to focus on concrete and contextual clinical skills *(Windsor et al., 2012)*. Measuring patient observation skills provides a concrete insight into nursing competence *(Lakanmaa et al., 2012)*, and information can be used in developing education and training. The development of professional competence is important for nurses in intensive care unit forgiving the ability of effective and fast decision-making in the face of life-threatening conditions *(DeGrande et al., 2018).*

Significance of the Study

In intensive care units, complexity care of cardiothoracic patient requires high performance of expert nurses with application of competency proficiency related to nursing activities in contrast with proficiency in using evidence-based to support all areas of nursing practice. Therefore, assessing and measuring nursing competence can help to ensure the delivery of safe, evidence based, high quality patients' care. Assessment of clinical competence in nursing is the core of quality assurance of healthcare systems, workforce planning and human resource management and is consider the key responsibilities of the nurse managers in clinical environments *(Bahreini et al., 2011)*. In this subject, *Lakanmaa et al., (2013),* recognize self-assessment and it is important for nurses to possess self-awareness of their clinical competency and take action to maintain their competencies *(Hassankhani et al., 2018)*.

On the other hand, competency' must be evaluated in the practice setting as competency reflects actual performance in practice *(Dickerson& Chappell, 2016).* The current study proposed that assessing the competence of nurses working in cardiothoracic intensive care unit is necessary to identify the educational needs of nurses, in order to develop the weakened clinical competency and achieve the professional development in nursing. Therefore, a combination of two methods were used including nurses' self-reflection for competence in nursing and direct observations for actual nurses' competency in intensive care unit.

Aim

The aim of the study was developing clinical nurses' competency in intensive care unit through the following specific objectives;

▪ Evaluate nurses' knowledge, skills, behavior and experience through using self-assessment competence scale of intensive and critical care unit.
▪ Evaluate the clinical competency of intensive care nurses by using standardized clinical competency checklists.
▪ Development of clinical competency using multileveled competency statements for intensive care unit nurses.

Research Questions:

▪ How the cardiothoracic intensive care nurses will self-assess their clinical and professional competence based on the bases of knowledge, skills, attitude and value, and experience?
▪ What is the actual nurses' level of clinical competencies?
▪ Is there a difference in the actual performance of nurses' competency between day and night shifts?

Operational Definitions:

The term competence used to define the potential ability to function in a given situation and the nurses will self-assess their competence by using basic competence scale of intensive and critical care nursing which combined clinical competence and professional competence *(Lakanmma et al., 2015).* The term competency used to define the actual performance of nurses in a given situation. These definitions form essentials in developing strategies of assessment and developmental training for nurses *(Dickerson& Chappell, 2016)*.

II. Material and Methods

Design of Research:
Descriptive and Quasi-experimental designs used for integration of study findings.
Setting:
The study established in the Cardiothoracic Intensive Care Unit of the Student Teaching Hospital at the complex of Tanta University Hospitals.
Sample:
The sample of the study involved all available (23) nurses working in the Cardiothoracic Intensive Care Unitat Student Teaching Hospital at Tanta University Hospitals.
Tools of Data Collection:
The Socio-demographic data of participated nurses collected in a separate sheet attached to the first tool. These personal information included nurse name, age, sex, marital status, level of education, years of experience in nursing and in the institution, and previous training or certificates". Qualitative and quantitative sources of data applied for data collections as following;

"Basic Competence Scale"
Intensive and Critical Care Nursing Competence Scale version1(ICCN-CS-1)is a self-assessed scale of basic competence applied for all the nurses working in cardiothoracic intensive care unit at the above mentioned setting. The scale adopted from *(Lakanmma et al., 2015)* with reliability *(r=0.83 – 0.98),* was translated from

English to Arabic language (forward and backward) to self-rate the basic competence of nursing. The scale composed of total 144 items that divided into four equal competence bases of nursing with 36 sub-items per each base; these bases identified as a knowledge, skill, attitude and value, and experience. The scale evaluates two main domains "clinical and professional competences of nursing"; Clinical competence is described in three sub-domains titled as "principles of nursing care - clinical guidelines -and nursing interventions". Professional competence described in four sub-domains "ethical activity and familiarity with healthcare laws - decision-making - work development - and collaboration".

Scoring System:
The scale is based on self-assessed approach and no 'acceptable' score level has been determined. The four bases of nursing competence scale are scored according to the following Likert Scale;
• Knowledge and skills are scored as 1 = very poorly, 2 = poorly, 3 = fair, 4 = good, 5 = very good.
• Attitudes are scored as "1 = fully disagree, 2 =disagree, 3 = fair, 4 = agree, 5 =fully agree".
• Experience are scored as "1 = fully insufficiently, 2 = insufficiently, 3 = fair, 4 = sufficiently, 5 =fully sufficiently".

  The total score of the ICCN-CS-1 scale evaluate overall picture of basic nursing competence of nursing. The score ranged (1–5 points for each item). Scores on the ICCN-CS-1 are categorized as poor competence (=1), moderate competence (=2), good competence (=3) or excellent competence (=4). The mean values of the sum variables also computed alternatively for looking closely at the basic competence in cardiothoracic intensive care unit.

Tool II:"Observational Checklists of Clinical Competencies"
  Seventeen competencies selected by the researcher to evaluate multilevel competency of basic and routine daily nursing activities in the cardiothoracic intensive care unit, and used to demonstrate the actual levels of performance of clinical nurses' competency. The observational checklists of clinical competencies that adopted from *Potter & Perry, (2018),* have made up of (1) Assessment of respiratory system; (2) Assessment of cardiovascular and peripheral vascular systems; (3) Post-operative neurological monitoring and assessment; (4) Post-operative renal monitoring and assessment; (5) Non-Invasive and Invasive ventilation care; (6) Performing mouth care for an unconscious ventilated patients; (7) Positioning patient in bed; (8) Obtaining an arterial blood sample for blood gas analysis; (9) Chest tubes and drainage care; (10) Demonstrating postoperative exercises; (11) Enteral feeding; (12) Nasogastric tube care; (13)Wound care; (14) Performing temporary pacing care; (15) Administration of intra venous infusions therapy; (16) Pain Assessment; and (17) Care of peripherally inserted intra venous catheters.

  The performance standards of the seventeen procedural checklists which used to evaluate the clinical competencies level of the nurses were assessed based on criteria described as following *(Potter & Perry, 2018):*
▪ Identifies indication / rational
▪ Assessing patient
▪ Performing hand hygiene
▪ Gathering equipment
▪ Preparing equipment
▪ Therapeutic communication
▪ Performing clinical procedure
▪ Cleaning and disposing equipment appropriately
▪ Complete documentation

The scoring system of nurses' practice was calculated according to three levels; Excellent Performance = 3, Satisfied Performance = 2, and Needs Practice = 1. The overall competencies levels of nurses' performance were computed throughout the average scores of each clinical competency observed during day and night shifts observations, then, the sum of performed procedures were categorized to following levels:
▪ ≥ 85% -------------Indicates Excellent Performance.
▪ ≥ 70-<85% ---------------Indicates Satisfactory Performance.
▪ <70% -------------Indicates Need Practice.

Ethical Consideration:
  A letter of acceptance from the Dean of Faculty of Nursing at Tanta University and Cardio thoracic unit director was issued. The study reviewed and approved for the protection of human rights. The participants briefed about the study objectives and assured that the data will remain confidential; they informed about their rights to withdraw from the study at any point of time if they chose to do so. The participants weren't informed about the initiation of the first couple of observations (day and night shift) "baseline assessment" in order to

eliminate bias, unreliable performance, anxiety, and to evaluate the actual level of nurses' competence. The nurses were informed about the study before the beginning of the self-assessment of basic competence scale.

Upon obtaining the official approval on the study, the researchers prepared the tools of data collection (tool I and tool II).The first couple two observations (day and night shifts) continued for three months using tool II. The self-assessment of basic competence scale continued for one month. (tool I) during the day shift for 30 minutes with each nurse included explanation of the purpose of the study and the procedures, in addition to, filling up the basic critical care competence scale. The training sessions continued for three months. The second couple two observations (day and night shift) continued for three months using tool II. The study started in August 2018 and ended May 2019 through the following procedures:

- **Selection of the observers:** To evaluate the actual clinical nurses' competency, four observers were selected based on their previous experience on cardiothoracic intensive care nursing. The first and second observers were the head nurses working in the same settings assigned for performing day shift observations. Meanwhile, the third and fourth observers were a faculty member from medical surgical and critical care nursing department at Tanta Faculty of Nursing who was assigned for night shift observation.

- **Training of the observers:** The two head nurses' observers were trained on performing clinical competencies observations for the cardiothoracic intensive care nurses during the provision of direct nursing care activities for patients underwent open heart surgery "post-operative nursing care". The observers had exposed to training sessions extend for 8 hours, over two days that conducted at the Faculty of Nursing, to ensure the standardization of observations and calibration between observers; seventeen procedures were discussed with demonstration on filling up the designated checklists.

- **Preparation of the participants:** In the selected cardiothoracic unit, every individual nurse was enrolled for four observations: First two couple of observations applied in the day and night shifts, followed by results analyses to verify the weakened clinical competencies of nurses then, implementation of focused training on the weakened clinical competencies done, followed by the second couple observations in the day and night shifts which established to reevaluate the competency level of nurses post training.

- **Conduction of the observations:** The interval for each observation was varying according to the workload of the unit. The time consumed for nurses observations also varied from 5-10 minutes according to the type of the procedure and the clinical condition of the patient. The observations were recorded immediately by the observers.

- **Competency training:** Upon the compilation of the baseline assessment of the first couple observations (day and night shifts), the collected data were analyzed, and then the training needs were planed according to weakened competencies in addition to strengthen the other satisfactory competencies. The competency-training timetable which made up from two training sessions (morning and afternoon) were conducted per day over3 days per week for a period of three consecutive weeks. All ICU nurses divided over three groups, each group composed of 7-8 nurses who were allocated to receive and complete the competency training for the seventeen procedures over these 3 days for one week (three procedures per one session).
- The medical surgical and critical care faculty members conducted the competency training sessions. Eight manuals (copies) of the competency checklists were introduced to the nursing unit for guidance and reference.

Statistical Analysis:
Data were collected, coded, tabulated and subjected for statistical analysis. Statistical analysis was performed by statistical analysis package (SPSS version 20). Descriptive statistical analysis included number, percent, mean and standard deviation. Mann-Whitney (U-test) was used to test the variables of the basic competence scale at value $p < 0.05$) and ANOVA tests were utilized at value $p < 0.05$ to test variables of observed clinical competencies.

Study Limitations:
Number of limitations had been found during the research procedures before the initiation of the observations and during the observations, Suctioning competence was practiced to patients by intensive care physicians only according to the internal rules and policy regulation of the unit, which was asserted by the medical director of the unit, even after training, CICU physicians refused nurses to do suctioning.

III. Results and Data Analysis

Table 1: Demographic characteristics of CICU nurses (n=23)

Personal Data	No.	%
Gender		
Male	3	13 %
Female	20	87%
Basic nursing educational preparation		
Technical Nursing	14	61%
Baccalaureate Degree	8	35%
Master Degree	1	4%
Present work position		
Bedside nurse	**22**	**96 %**
Head nurse	**1**	**4 %**
Previous Training		
Yes	13	57 %
No	10	43 %
Age		
20 – 30	16	70 %
31 – 40	7	30 %
Mean ± SD	33 ± 8.10	
Number of years that have been practiced in nursing		
< 10 years	18	78 %
≥ 10 years	5	22 %
Mean ± SD	11± 9.36	
Number of years that have been worked in the ICU		
< 10 years	14	61 %
≥10 years	9	39 %
Mean ± SD	9 ± 9.65	

Table (1) display demographic characteristics of CICU nurses, the females were dominants, for qualifications, more than one third was technical nursing degree with one nurse only undergoing master degree. Regarding previous training, more than half of nurses attended previous training. The mean score of age was ($\bar{x}$ = 33). The mean score of years in practicing nursing was ($\bar{x}$ = 11). Meanwhile, the mean score of years worked in the CICU was ($\bar{x}$ = 9).

Table 2: Bases and domains of basic competence as self-assessed by CICU nurses (n=23)

Variables of basic competence	Scores (1– 5) Mean ± SD			
	Knowledge	Skills	Attitude	Experience
1. Principles of nursing care	3.91±0.51	3.96±0.36	4.1±0.30	3.87±0.34
2. Clinical guidelines	3.96±0.47	3.97±0.40	4.11±0.31	3.87±0.34
3. Nursing interventions	3.91±0.51	4.00±0.52	4.13±0.34	3.87±0.34
Clinical Competence	**3.97±0.41**			
4. Ethical activity and familiarity with health care laws	3.53±1.15	3.54±1.00	3.52±1.24	3.62±0.77
5. Decision-making	3.73±0.97	3.81±0.47	3.75±0.91	3.78±0.51
6. Development work	3.73±0.97	3.78±0.42	3.80±0.92	3.78±0.51
7. Collaboration	3.66±0.94	3.78±3.70	3.80±0.92	3.78±0.51
Professional Competence	**3.71±0.79**			
Total of Bases	**3.80±0.73**	**3.87±0.51**	**3.94±0.62**	**3.81±0.45**
Mann-Whitney (U-test)	244.50	262.50	256.00	236.00
p-value	0.00	0.00	0.01	0.03
BASIC COMPETENCE (Total)	**3.85±0.58** (Good Competence)			

* Statistical significance difference at ≤ 0.05

Table (2) illustrated the distribution of mean scores and standard deviations for the levels of the two main domains of the basic competence scale as self-assessed by ICU nurses. The total mean of the four bases of clinical competence (3.97±0.41) was higher than the professional competence mean (3.71±0.79). The performance standards for the use of principles of care, clinical guidelines, and nursing interventions of clinical competence domain presented in high mean scores respectively in attitude, skills, knowledge, and then experience base. Meanwhile, in the professional domain, the highest mean scores revealed for decision-making, development of work and collaboration related to skills base. Throughout the basic competence scale there were high statistical significance difference (p<0.05) between the four bases of the scale as revealed respectively, attitude and value base was higher than skills base followed by experience base then knowledge base was least.

Table 3: Pre-training comparison of observed clinical competencies between day shift and night shift (n=23)

Observed Clinical Competencies	1=Morning shift Mean ± SD	2=Night shift Mean ± SD	F	Sig. (2 tailed)
1. Respiratory system monitoring and assessment	2.04 ± 0.87	1.74 ± 0.44	2.19	0.14
2. Cardiovascular and peripheral vascular systems monitoring and assessment	2.00 ± 0.90	1.70 ± 0.47	2.04	0.15
3. Postoperative neurological monitoring and assessment	1.74 ± 0.81	1.13 ± 0.34	11.00	0.00*
4. Postoperative renal monitoring and assessment	1.70 ± 0.82	1.52 ± 0.51	0.74	0.39
5. Non-Invasive and Invasive ventilation care	2.00 ± 0.90	1.57 ± 0.59	3.72	0.06
6. Performing mouth care for an unconscious ventilated patients	1.35 ± 0.77	1.22 ± 0.51	0.45	0.50
7. Positioning patient in bed	1.74 ± 0.96	1.26 ± 0.54	4.30	0.04*
8. Obtaining an arterial blood sample for blood gas analysis	2.04 ± 0.92	1.52 ± 0.59	5.16	0.02*
9. Chest tubes and drainage care	2.22 ± 0.90	1.52 ± 0.59	9.54	0.00*
10. Demonstrating postoperative exercises	1.57 ± 0.89	1.22 ± 0.51	2.59	0.11
11. Enteral feeding	2.17 ± 0.93	1.70 ± 0.55	4.42	0.04*
12. Nasogastric tube care	1.83 ± 0.93	1.30 ± 0.55	5.26	0.02*
13. Wound care	2.39 ± 0.83	1.43 ± 0.59	20.01	0.00*
14. Performing temporary pacing care	1.70 ± 0.87	1.30 ± 0.47	3.56	0.06
15. Intra venous infusions therapy	2.09 ± 0.28	1.78 ± 0.42	8.16	0.00*
16. Pain Assessment	2.04 ± 0.20	1.83 ± 0.38	5.61	0.02*
17. Care of peripherally inserted intra venous catheters	2.17 ± 0.38	1.83 ± 0.49	7.11	0.01*
Mean total score	**(x̄ = 1.9)**	**(x̄ = 1.5)**		

* Statistical significance difference at ≤ 0.05

Table (3) revealed pre-training comparison of observed clinical competencies between day and night shift. The mean scores in the day shift were higher than the night shift in the majority of performed competencies, there were statistical significance differences revealed that the weakened observed clinical competencies in the day shift were in Performing mouth care for an unconscious ventilated patients, Demonstrating postoperative exercises, Performing temporary pacing care, Postoperative renal monitoring and assessment, Postoperative neurological monitoring and assessment, Positioning patient in bed and Nasogastric tube care, respectively.

Table 4: Pre-training correlations between nurses' characteristics and observed clinical competencies (n=23)

Observed Clinical Competencies	Shift	Sex	Age	Education	Unit Experience	Position	Nursing Experience	Previous Training
1. Respiratory system monitoring and assessment	**-.463-***	-.308-	-.085-	.364	-.117-	-.158-	.206	.091
2. Cardiovascular and peripheral vascular systems monitoring and assessment	**-.503-***	.051	.218	.048	.238	-.174-	.276	.128
3. Post-operative neurological monitoring and assessment	**-.447-***	-.128-	**.420***	-.003-	.106	-.093-	.119	-.218-
4. Post-operative renal monitoring and assessment	-.129-	.014	**.444***	-.325-	.361	-.075-	.416	.220
5. Non-Invasive and Invasive ventilation care	-.280-	-.146-	**.515***	-.057-	.177	.000	.130	-.214-
6. Performing mouth care for an unconscious ventilated patient	-.101-	.178	**.423***	-.305-	.342	-.142-	**.446***	-.195-
7. Positioning patient in bed	**-.299-***	.304	.353	-.321-	.326	-.242-	.086	-.183-

8.	Obtaining an arterial blood sample for blood gas analysis	**-.469-***	.185	.415	-.515-*	.197	.229	.153	-.030-
9.	Chest tubes and drainage care	**-.522-***	.073	.385	-.135-	.026	.009	.012	-.202-
10.	Demonstrating postoperative exercises	**-.439-***	-.225-	.236	.219	.258	-.337-	.210	.129
11.	Enteral feeding	**-.302-***	-.067-	**.498***	-.017-	.188	-.059-	.189	-.184-
12.	Nasogastric tube care	**-.327-***	.208	.262	.017	.247	-.278-	**.530***	-.126-
13.	Wound care	**-.559-***	-.287-	.261	.096	.087	.041	.091	-.030-
14.	Performing temporary pacing care	-.274-	.315	**.653***	**-.422-***	**.544***	.290	**.654***	-.345-
15.	Intra venous infusions therapy	**-.396-***	-.339-	-.153-	.240	-.301-	-.095-	-.281-	.204
16.	Pain assessment	**-.336-***	**-.550-***	-.039-	.289	-.243-	-.066-	-.183-	.141
17.	Care of peripherally inserted intra venous catheters e	**-.373-***	-.163-	-.025-	.092	-.160-	-.142-	-.089-	.303

* Statistical significance difference at ≤ 0.05

The table illustrates the correlations between the personal data of nurses and the performed clinical competencies as observed before the intervention of related training. Around two third of the observed clinical competencies was correlated significantly in reverse moderate correlations to the type of the worked duty shift except in renal care, ventilation care, mouth care, and temporary pacing care. Theses competencies in addition to the temporary pacing care were conversely correlated positively and significantly to the nurses' age. From the other side, temporary pacing care correlations displayed in relation to previous education, unit experience, and previous experience in nursing as well. Also, a significant moderate correlation revealed in pain assessment related to nurses gender.

Table 5: Post-training comparison of observed clinical competencies between day shift and night shift (n=23)

Observed clinical Competencies	1=Morning shift Mean ± SD	2=Night shift Mean ± SD	F	Sig. (2 tailed)
1. Respiratory system monitoring and assessment	2.83 ± 0.38	2.52± 0.51	5.18	0.02*
2. Cardiovascular and peripheral vascular systems monitoring and assessment	2.74 ± 0.44	2.61 ± 0.49	0.86	0.35
3. Post-operative neurological monitoring and assessment	2.91 ± 0.28	2.87 ± 0.34	0.21	0.64
4. Post-operative renal monitoring and assessment	2.65 ± 0.48	2.35 ± 0.48	6.06	0.01*
5. Non-Invasive and Invasive ventilation care	2.65 ± 0.48	2.65 ± 0.48	0.00	1.00*
6. Performing mouth care for an unconscious ventilated patient	2.83 ± 0.38	2.61 ± 0.58	2.21	0.14
7. Positioning patient in bed	2.65 ± 0.48	2.57 ± 0.59	0.29	0.58
8. Obtaining an arterial blood sample for blood gas analysis	2.61 ± 0.49	2.57± 0.50	0.08	0.77
9. Chest tubes and drainage care	2.57 ± 0.50	2.39 ± 0.49	1.37	0.24
10. Demonstrating postoperative exercises	2.70± 0.47	2.78 ± 0.42	0.43	0.51
11. Enteral feeding	2.74 ± 0.44	2.26 ± 0.44	13.04	0.00*
12. Nasogastric tube care	2.83 ± 0.38	2.61 ± 0.49	2.572	0.10
13. Wound care	2.87± 0.34	2.78 ± 0.42	0.58	0.44
14. Performing temporary pacing care	3.00 ± 0.00	2.87 ± 0.34	3.30	0.76
15. Intra venous infusions therapy	2.91 ± 0.28	2.91 ± 0.28	0.00	1.00*
16. Pain Assessment	2.70 ± 0.47	2.65 ± 0.48	0.09	0.76
17. Care of peripherally inserted intra venous catheters	3.00 ± 0.00	2.96 ± 0.20	1.00	0.32
Mean total score	**(x̄ = 2.8)**	**(x̄ = 2.6)**		

* Statistical significance difference at ≤ 0.05

Table (5) illustrated the comparison of observed clinical competencies between day and night shift post-training. There were marked increases in the clinical competency of nurses in both shifts. Also it was revealed that the higher mean score in the morning and night shift were related to the clinical competencies of Performing temporary pacing care, Care of peripherally inserted intra venous catheters & Intra venous infusions therapy and Postoperative neurological monitoring and assessment respectively.

Figure 1: Average means scores distribution of nurses' clinical competencies at Pre & Post-Training sessions.
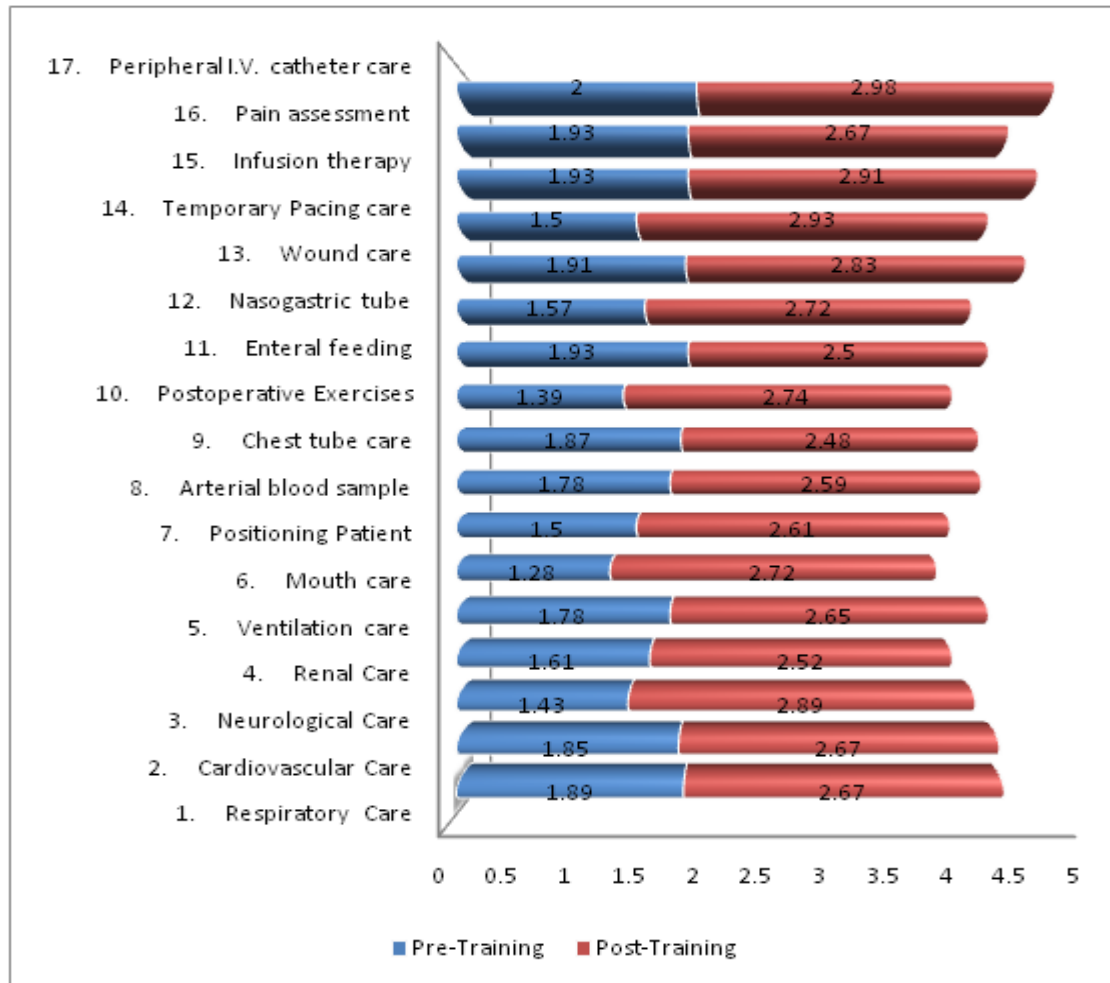

Figure 1 displayed the observed clinical competencies at pre and post training sessions. There was a noticeable increase in the average mean score of nurses' observed clinical competencies at pre and post training sessions**.**

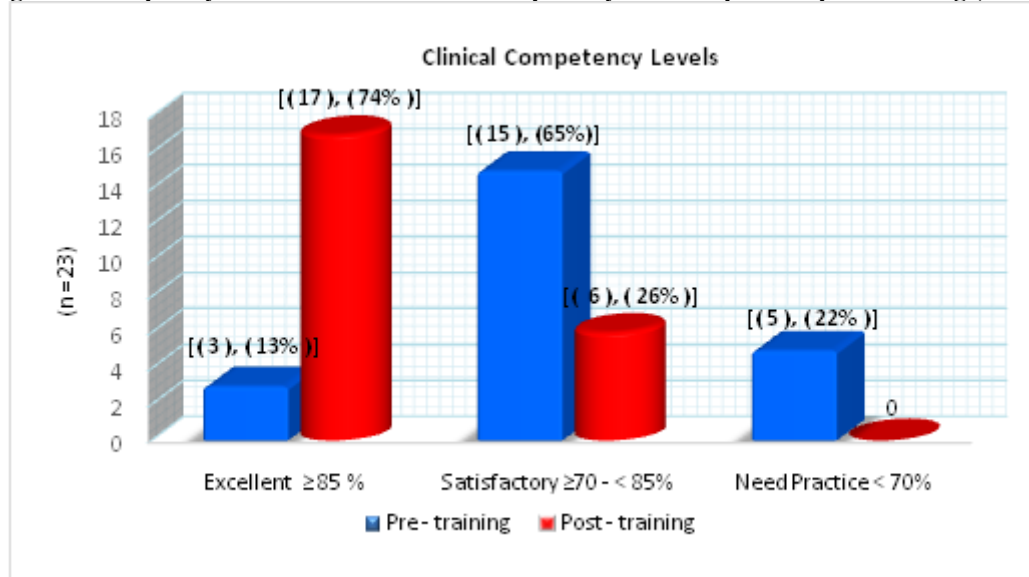**Figure 2: Frequency distribution of clinical competency levels at pre and post-training (n = 23)**

Figure (2) displayed the achieved levels of observed clinical competencies at pre and post training. The descending order for the percentages of performance levels at pre training 13 % excellent, 65% satisfactory and 22 % needed more practicing compared to post training as 74 % excellent, and 26% satisfactory.

IV. Discussion

Competence is the combination of skills, knowledge and attitudes, values and technical abilities that underpin safe and effective critical care nursing care and interventions *(National Competency Framework for Registered Nurses in Adult Critical Care, 2015)*. The present study aimed to evaluate nurses' competencies with regard to their work in post-operative cardiothoracic surgery of intensive care unit and develop the clinical competency that needed more practices and strengthen the satisfactory level as well.

The assessment of both competence and competency is a major concern for administrators, educators and in all practice disciplines including nursing *(Bhalla et al., 2014).* Thus, there should be growing interest in validating both competences and competencies of professional nurses in their work environment *(Przybyl, Androwich & Evans, 2015).* In this context, the Joint Commission requires organizations to assess staff competences and competencies at the time of hire and on an ongoing basis *(Joint Commission, 2015).* However, the work of identifying what knowledge, tasks, duties, and skills should be assessed as well as determining how to assess them is the responsibility of the employer *(Beaver et al., 2016).*

Professional practice of nursing that made up from skills, knowledge, attitudes, values, ethical reasoning leads to independence and a readiness of nurses to care good for the patient by using best available knowledge, and skills as clinical skills include a holistic clinical performance *(Andersson, 2011).* In this concern, a synthesis review conducted to answer the questions of how is clinical competence evaluated and what is evaluated *(Lejonqvist, Eriksson & Meretoja, 2015)*.

As regard to nurse' gender, the current study has shown that females were dominants in the intensive care unit which supported by *Malombe (2015)* that the majority of studied nurses in critical and intensive care unit were females. Concerning qualifications, the findings showed that around two third have technical nursing degree while more than one third have bachelor degree in nursing with one nurse only undergoing master degree. The study of *Shaban, et al., (2016)* showed that all intensive care unit nurses had a bachelor degree in nursing science that controvert with the present study. In this respect, *Gundrosen, Solligård & Aadahl, (2014); Newman et al., (2014)* reported that the level of education does not intervene in the development of nursing competence.

Regarding the previous training courses in critical care nursing or care of cardiothoracic patients or emergency courses, more than half of the nurses had attended some training while the remaining half weren't which may verify that the observed clinical competencies of day shift and night shift before the conduction of training were revealed at satisfied level. This finding mismatched with *Shaban, et al., (2016)* who reported that none of the intensive care unit nurses had attended previous educational in-service training course for developing clinical competencies such as mechanical ventilation and VAP infection prevention.

The mean age was (33.0 ± 8.10) which supported by a parallel study for *Amina (2014)* who reported that the mean age of the studied nurses in intensive care units was (32.32 ± 6.70) with age ranged 20-50 years. In addition, to the years of experience, the majority of nurses (61%) had less than 10 year worked in ICU. In the same background, *Kandeel and Tantawy (2012)* reported that the largest percentage had between 6 and 10 years of ICU experience and others between 1 and 5 years of ICU experience. Also, *(Lakanmaa et al., 2015)* found that the years of experience in ICU as a factor influencing professional competence. Other two studies did not show any relation between professional competence and the years of experience in ICU *(Newman et al., 2014 & Yurdanur, 2016)*

As regard to nurses' self-assessment of basic competence scale, the highest mean scores reveled in the "clinical competence domain" the performance standards for the use of principles of care, clinical guidelines, and nursing interventions of clinical competence domain presented in high mean scores respectively in attitude, skills, knowledge, and then experience base. In "professional competence" the highest mean scores reveled in "decision making and development work "related to all bases of basic competence respectively; skills, attitude, experience and knowledge. From other side, "Ethical activity and familiarity with healthcare laws "revealed lowest mean scores related to all bases of basic competence.

These findings can be explained by the fact that ICU nurses in performing routine and basic bed-side nursing care are more familiar with safe, direct patient-centered care more than adherence or compliance to ethical codes, general health care legislation, and transplantation legislation (literally). While, in "Collaboration" revealed low mean score in knowledge base only, which may reflect the shortage of nurses ratio related to the bed capacity in the worked cardiothoracic intensive care unit. The overall picture of the basic competence scale

displayed high statistical significance difference (p<0.05) between the four bases of the scale respectively, attitude and value base, skills base followed by experience and knowledge base.

The cardiothoracic intensive care unit nurses self-assessed their clinical and professional competence at good level and correspondingly revealed good level in the total mean score of basic competence scale. The reason for this may be due to focused technical supervision by the medical team that drive the clinical skills of the nurses in the CICU, from other side the majority of nurses were technical nursing degree in CICU.

In similar subject, *Rezaie et al., (2013)* and *Habibzadeh et al., (2012)* evaluated the average score of clinical nurses' competence at good level, the lowest score was related to the quality assurance area, and the highest score was related to the treatment measures area which correspond with the present study. The same result agreed with another study conducted in Iran by *Kalantary et al., (2016)* as indicated that the clinical competence of nurses in the intensive care unit was at a favorable level, but the component of "quality assurance" was at the lowest level.

The findings of the current study were also congruent with a study in Finland, which examined nurses' perceptions of competence in different work environment of a university hospital. The study revealed that nurses reported their overall level of competence as good; they felt most competent in the categories of managing situations, diagnostic functions, and helping role and least competent in ensuring quality category *(Meretoja et al., 2004)*.

In respect to prior training, more than half of nurses (65%) were at a satisfactory level and (22%) needed more practice in the observed clinical competencies, some clinical competences were demonstrated as week competence were in Performing mouth care for an unconscious ventilated patients, Postoperative exercises, Performing temporary pacing care, Postoperative renal monitoring and assessment, Postoperative neurological monitoring and assessment, Positioning patient in bed and Nasogastric tube care respectively. These findings disagreed with the study of *Pauline (2015)* who reported that some clinical nursing procedures had very high practice level in performing oral care, early mobilization, patient positioning in bed, breathing exercise. While with similar study the current findings were congruent in which the majority of nurses had seen with adequate practice regarding postural drainage, chest vibration and percussion, oral care of ventilated patient, Endotracheal tube care, Nasogastric tube feeding, change patient's position, ventilator associated pneumonia bundle and ventilator care *(Byomi, Abed Elsattar & Abdelatief, 2017)*.

In the evaluation of the observed clinical competencies which were actually practiced by the nurses on the cardiothoracic intensive care patients before and after the conduction of the training interventions, the results of the seventeen multileveled clinical competencies in the first couple day and night observations pre-training had proven that the mean scores in the day shift were significantly higher than the night shift in the majority of performed clinical competencies, long working hours of night shift, fatigue and complexity of performed clinical competencies during night time may explain this variation, consequently, nurses' achieved low level of clinical performance. In line to this result, *Brown et al., (2016) and Ganesan et al., (2019)* posited that clinical performance was most impaired on nights compared to day shifts.

In relation to post training the observed clinical competencies between day and night shift score displayed remarkable high mean scores almost in all observed clinical competencies post training. This significant development in the nurses performance was demonstrated due to the concision and precision training which given at bedside of patients care, it also may reflect the willingness and motivation of nurses for training. This state of outcome was argued through a study done by *Faraji, et al.,(2019)* that these high scores could be related to many factors such as holding regular educational courses, and periodic evaluation of nurses' clinical competence and audit from Cardiothoracic Intensive Care Unit supervisors. Therefore, by organizing workshops and educational courses or at least sporadic training sessions, it is possible to provide a favorable ground for the development of nurses' clinical competence.

The nurses' level of the overall performed clinical competencies of the present study evaluated as good level that matched their self-assessment for the skill base of the basic competence scale. Several studies in different countries had induced similar outcome such as *Mirlashari et al., (2016)* who assessed the clinical competence of Iranian nurses and showed more than half of the nurses had a moderate level of clinical competence. *Soroush et al., (2016)* revealed that the clinical competencies of Iranian nurses are at a moderate level. *Kim et al., (2015)* found that the clinical competence of nurses in South Korea is above the average. *Jiang et al., (2015)* also indicated that Chinese nurses had moderate to low levels of clinical competence.

The study of *Azam, et al., (2019)* conducted to evaluate the clinical competence and its related demographic factors among critical care nurses in Kermanshah, Iran. The mean score of nurses' clinical competence was at a "very good level". The mean score of using clinical competence in practice was at a "good level". Among the subscales of clinical competence, the highest mean score was related to "managing situation". The mean score of "using clinical competence in practice" was related to the subscale of "therapeutic interventions". There was no statistically significant difference among the score of clinical competence of nurses varying with different gender, age, academic degree, and work experience.

Conceptually, clinical competence is the wisely application of technical and communicational skills, knowledge, clinical reasoning, affections and values in the clinical environment. A person is regarded competent who is able to perform his/her role or a set of professional duties at appropriate level, degree, and quality. Numerous factors impacton acquiring, maintaining, and promoting nurses' clinical competence, among the most important of which the external factors can be referred, that organizing clinical environment, mental atmosphere of ward, continuous educational programs, available technologies, effective management, and control and supervision are among the important factors *(Khanian, 2014)*.

Regarding the correlations between the personal characteristics of nurses and the performed clinical competencies as observed before the intervention of related training. Around two third of the observed clinical competencies was correlated significantly in reverse moderate correlations to the type of the worked duty shift except in renal care, ventilation care, mouth care, and temporary pacing care. Theses competencies in addition to enteral feeding and neurological assessment and monitoring conversely correlated positively and significantly to the nurses' age. From the other side, temporary pacing care correlations displayed in relation to previous education, unit experience, and previous experience in nursing as well. In addition, a significant moderate correlation revealed in pain assessment related to nurses gender.

In line with the correlation results of present study, the study of *Behrooz et al., (2016)* showed that the clinical competence had significant relationship with age, general work experience, in addition to other factors such as monthly salary, job category, location of work and type of employment that was out of the scope of the current study. *Behrooz et al., (2016)* also stated that nurse managers should try to promote organizational commitment, particularly emotional commitment of nurses, so that while increasing trust, durability, and the promotion of nurses' clinical competence, qualified cares are offered to the patients. Also, *O'Leary (2012)* determines that the level of self-assessed nursing competence has a relationship with age and experience in nursing. The longer the nurses 'experience, the greater their self-assessed level of competence.

The relationship between the clinical competence of nurses and the type of the working duty shift may be affected by several factors related to patient condition and sleep period during night shift which minimize the nursing activities with patients, environmental factors or personal factors concerning nurses hating to work night shift duty which is rotated mandatory between nurses according to regulation of the study setting. No significant relationship with the other demographic variables was determined.

V. Conclusion

The cardiothoracic ICU nurses' self-assessed their basic competence at good level as bases of knowledge, skills, attitude, and experience were at high statistical significance difference ($p < 0.05$). The mean scores of self-assessed clinical competence were higher than professional competence. Attitude and value base was higher than skills base followed by experience base then knowledge base was least score.

The observed clinical competencies for seventeen procedures were improved after conduction of the training sessions at bedside of patient care compared to pre-training. The clinical performance of nurses in the day shift was at high mean scores compared to the night shift, which proven by moderate correlations with two thirds of the observed clinical competencies. The clinical competency of the nurses was evaluated at satisfactory level prior training and good level in post training. Finally, competency statements, provide a framework for the development of knowledge and skills specific to critical care nurses, and used in determining training and development needs.

VI. Recommendation

The complexity of the healthcare environment means that nurses must participate in continuous training and knowledge updates to ensure that they have the requisite knowledge, skills, and abilities to provide holistic care individually and as members of healthcare teams without supervision. Validation of competence can have a direct impact on positive outcomes for patients and reduced costs for the healthcare organizations. Therefore, nurses should develop a 'competency passport' that will facilitate career progression and movement between specialties and career paths.

Regarding the current study, it is recommended to continually validate the nurses' competence and competency in ICU as well as other nursing specialties. More researches are recommended to study the reasons behind low nurses performance in the night shifts.

Acknowledgement

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