Critical Care Nurses' Competency Regarding Early Prediction and Interpretation of Life-Threatening Dysrhythmias: Life – Saving Opportunity

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ABSTRACT

Background: Life-threatening dysrhythmia, especially the ventricular, is one of these conditions that if not predicted and treated promptly can cost a patient's life. Also, it remains one of the most common causes of sudden death in critically ill patients. Early prediction of life-threatening – dysrhythmias can be considered as a life–saving opportunity for critically ill patients (Maurice et al., 2017; Dinnah, 2018). **Aims** were to assess the critical care nurses' competency (knowledge) towards early prediction and interpretation of life-threatening dysrhythmias and to identify the obstacles that prevent nurses from acquiring competency regarding the early prediction and interpretation of life-threatening dysrhythmias. **Methods*:*** A descriptive cross-sectional study design was recruited to conduct the study. Data was collected from a convenient sample of 100 nurses working in critical care settings at Main University Hospital. A self-reported three-part-questionnaire using a paper-pencil was used to collect the data of this study. **Results:** the result of the current study showed that critical care nurses had a very low level of competency required for early prediction and interpretation of life-threatening dysrhythmias (75% of the participants failed to identify or determine the types of dysrhythmia). Moreover, nearly three fourth of nurses did not attend any educational training about dysrhythmias. Significant correlations were found between nurses' competency, level of education, and nurses' position in the critical care units [(most nurses who failed to answer all questions were diploma graduate (85.5) and (excellent knowledge score was significantly higher in staff nurses than other positions although their frequency was relatively low (MCp.001)]. However, there was no significant correlation existed between the level of nurses' competency and other variables such as age, sex marital status. Finally, four obstacles were identified preventing the acquiring of required competency. **Conclusions:** critical care nurses have a drastic low level of knowledge concerning the competency of early prediction and interpretation of life-threatening dysrhythmias. Moreover, significant correlations were found between nurses' competency, level of education, and their position in critical care units. However, there was no significant correlation between the nurses' competency and other variables such as age, sex, and marital status more than three-quarters of the nurses did not attend any training related to dysrhythmia. Finally, four factors were identified by the nurses as obstacles for acquiring competency of early prediction and interpretation of life-threatening dysrhythmias.

Keywords: Critical Care Nurses, Competency, Prediction, and Management of Life-Threatening Dysrhythmias

INTRODUCTION

Nurses' competency has been considered as a mandatory and basic component of nursing care. It refers to the provision of nursing care based on professional standards and it has been extensively addressed in the literature and correlated with safety and quality of nursing care (Khodayarian et al. 2011). Moreover, nursing competency is defined as a combination of knowledge, psychomotor skills attitudes, and abilities that bring about effective performance in professional nursing positions. Having competency contributes to an improved quality of patient care and enhances the patient's safety (Heydari et al., 2016; Nobahar, 2016). One of the life-threatening health problems that necessitate continuous monitoring is cardiac dysrhythmia (Singh, 2016).

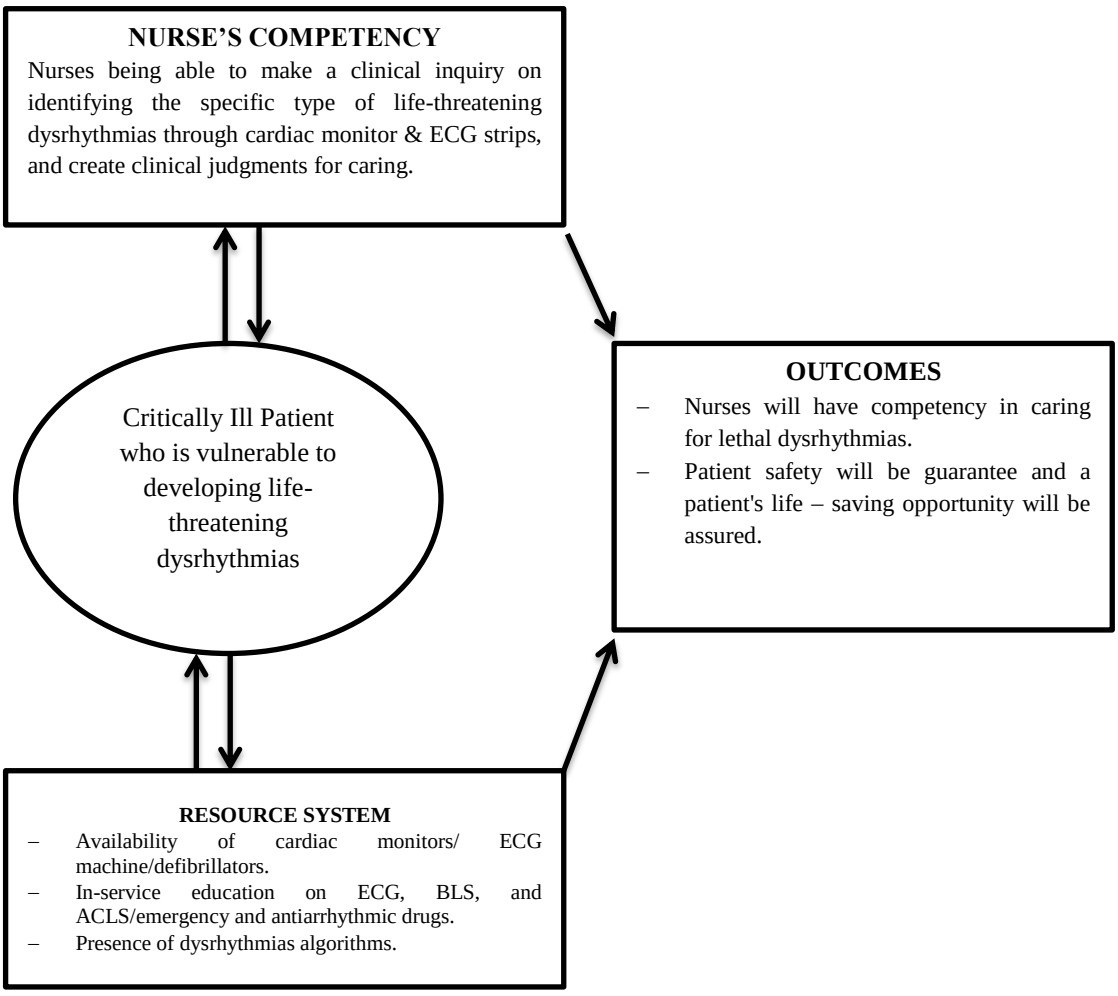
A cardiac dysrhythmia is defined as a deviation of the cardiac rhythm or rate from the normal. It results from abnormalities in electrical impulse formation, electrical conduction, or both. When the heart does not work and pump blood effectively, this affects the perfusion and oxygenation and contributes to a decrease in cardiac output to vital organs and peripheral tissues, resulting in organ dysfunction or failure. Dysrhythmias range from asymptomatic rhythm to symptomatic lethal rhythm including ventricular tachycardia (VT), ventricular fibrillation (VF), pulseless ventricular tachycardia, pulseless electrical activity, complete heart block, asystole, and torsade de point rhythm resulting in sudden death (Dinnah, 2018; Baird, 2011; Charles et al., 2011).

Critically ill patients admitted to the ICUs have multiple risk factors contributing to life-threatening dysrhythmias. These include, but are not limited to, infection, electrolyte disturbances, adverse effects of medications or procedures, ischemia, hypoxia, anemia, and changes in volume status and hemodynamics. Prompt assessment and immediate management of life-threatening dysrhythmias are critical and are an opportunity for saving the patient's life. Critical care nurses must recognize that continuous monitoring is a nursing responsibility, and competence in this skill must be assured (Dinnah, 2018; Nahla et al., 2018; Baird, 2011).

Critical care nurses spend significant time alongside their critically ill patients and are often the first person recognizing the patient's problem. The role of the critical care nurse in dysrhythmias is vital. She/he responsible for taking emergency actions in fatal dysrhythmias including assessment of disturbed rhythm reflected on the cardiac monitor and obtaining 12- lead ECG to identify the type of dysrhythmia. Also, while administering prescribed medication, monitor the patient for possible adverse drug reactions. Furthermore, In case of lethal dysrhythmias, the nurse should initiate rapid and safe basic and advanced cardiac life support protocols either alone or as a member of a resuscitation team (Ronda, 2007; Curley, 1998).

Early prediction of life-threatening dysrhythmias was described

by the modified synergy model for patient care which was developed by the American Association of Critical-Care Nurses (AACN). It describes the relationship between nurses' competency and organizational resources concerning the early prediction and life-threatening dysrhythmias to optimize skills and knowledge of the nurses' and patients' safety outcomes (Kechi, 2016).



Modified Synergy Model for Patient Care of the American Association of Critical-Care Nurses (AACN).

Significance of the Study

Among all the health care team, critical care, nurses play a pivotal role in ensuring patient safety by assessing the patients for deterioration, predicting of any life – threatening problems including cardiac dysrhythmias. Because the nurses' competencies are the sum of what they studied during the study period in the schools of nursing and are empowered through more and more practice in the real environment. The findings of the current study with suggested recommendations will be submitted to the nursing schools and the critical care settings at Main University hospital, especially the Directorate of nursing services, in order to provide a reference for further actions to be taken to improve the nurses' competency and overcome the obstacles.

Aims:

Aims of the current study were to:

1. Assess the critical care nurses' competency (knowledge) towards early prediction and interpretation of life-threatening dysrhythmias
2. Identify the obstacles that prevent nurses from acquiring competency regarding the early prediction and interpretation of life-threatening dysrhythmias

Research Questions

1. Do the critical care nurses have the competency of early prediction and interpretation of life-threatening dysrhythmias?
2. What are the obstacles that prevent critical care nurses from acquiring competency regarding the early prediction and interpretation of life-threatening dysrhythmias?

Materials & Methods

Study Design: A descriptive cross-sectional study design was recruited to conduct this study.

Sample: A convenient sample (100 nurses) of all nurses categories working in the critical care units, was available during the data collection period, and agreed to participate in the study were eligible and included in the study.

Settings: The study was conducted in the Medical, Surgical, and General Critical Care Units at the Main University Hospital. These units were designated to receive and manage critically ill patients either admitted directly to the hospital or transferred from other hospital general units.

The general unit is located on the grounded floor and consists of 10 beds; each bed is equipped with one ventilator and one monitor and every 3 beds share one crash cart. The other two units are located in a separate building, first and second floors. They consist of two halls and they are identical in the design, the number of beds, and equipment.

Tool: A self-reported three-part-questionnaire using a paper-pencil was used to collect the data of this study. The questionnaire was developed by the researcher based on reviewing the related literature (Malek et al, 2014; Linda, 2017; Mary, 2020; Cramer, 2011) and it was translated into Arabic based on the request and

recommendation of an expert group who was involved in the validation of the questionnaire. ***Part one: "***Sociodemographic and Clinical Data of the Participants" includes age, sex, marital status, level of education, type of ICU, professional year of experience in ICU, current position in ICU; did you ever attend a workshop, lecture, or training regarding the dysrhythmias? (Yes or No). ***Part two:*** "Early Prediction and Interpretation of Life-Threatening Dysrhythmias", was developed by the researcher to assess the nurses' competency (knowledge) regarding the early prediction and interpretation of the life-threatening dysrhythmias. This part includes two types of questions; seven multiple-choice questions (MCQs) and 8 ECG traces or strips. The participants were asked to choose the correct type of dysrhythmia. As regards the ECG traces, nurses were asked to write the name of dysrhythmia.

The participants' overall responses (level of competency) were compared against the grading or scoring system: failed < 60 %, bad 60 – 69 %, good 70 – 79 %, very good 80 – 89 %, and excellent ≥ 90%. ***Part three "***Obstacles that Prevent Nurses from Acquiring Competency regarding the Early Prediction and Interpretation of Life-Threatening Dysrhythmias***"*** consists of one open – end question. Here the participants were asked to write the obstacles for acquiring competency regarding early prediction and interpretation of life-threatening dysrhythmias

Validation & Reliability of the Questionnaire

The Questionnaire was tested for its content and face validity by ten experts in the field of critical care nursing (clinical and academia) and it was pre-tested for internal reliability by a group of nurses (n=10) who was not involved in the study. The reliability of the questionnaire was assessed by Cronbach's alpha (α=0.84).

A pilot study of the Questionnaire

The questionnaire was piloted on 10 nurses (10% of the sample size) working in critical care units and were not included in the study sample. The pilot of the research instrument aimed to determine the difficulty and simplicity indices of the questionnaire and to check whether was able to collect desired information that is relevant to the current study. Nurses' responses were assessed to determine if questions were well-understood. The questionnaire was translated into Arabic based on the recommendation of the validation panel.

Ethical Considerations

The ethical approval to conduct the study was obtained from the ethical committee in the Faculty of Nursing at the University of Alexandria. Permission to conduct the study was obtained from the general supervisor of the critical care units (Medical, Surgical & General). Informed written consent was obtained from the participants who agreed to participate in the study. Confidentiality was assured by using code for each participant, no names were used. The participants were assured that, no risks or harms expected

from their participation in the study. Besides, they informed that no financial incentives were expected.

Data Analysis

All statistical tests were two-sided and were performed using IBM SPSS statistics program version 21. Quantitative data were described by median as measures of central tendency, Minimum, maximum, and inter-quartile range as measures of dispersion, while categorical variables were summarized by frequency and percent. The questions correctly answered by participants were summed to calculate the total knowledge score per each domain of nurses' knowledge regarding emergency management of life-threatening dysrhythmias and knowledge regarding the early prediction of life-threatening dysrhythmias. The score was converted into percentage by the following equation: Percentage= (the sum total of score/ maximum possible score)*100. Then the frequency and percentage of participants with knowledge scores were calculated according to the following grading system: failed < 60 %, bad 60 – 69 %, good 70 – 79 %, very good 80 – 89 %, and excellent ≥ 90%. A Chi-square test was used to study a significant association between two categorical variables. Monte-Carlo significance was used if more than 20% of the total expected cell counts <5 at .05 level of significance. Mann-Whitney or Kruskal-Wallis tests were performed to compare median quantitative knowledge scores between different dichotomous variables. Pairwise comparison was performed by the Bonferroni test for significant results of the Kruskal-Wallis test. The choice of tests was based on variables' distribution by the Kolmogorov-Smirnov test.

Results

Table 1 illustrates the socio-demographic and clinical characteristics of the study participants. Half of the nurses were aged 25– 35 years old. Only 2% of nurses were more than 46 years old. Nearly half of them were females. Married nurses contributed to 47% of the sample. Almost three fourth of nurses attained a Diploma level of education. Two third of the included participants have 6 months and less than 5 years of experience. Also, almost two-third of nurses worked in the medical ICU. Most of the nurses (87%) were staff nurses while only 1% was nurse educator.

Figure 1 depicts the nurses' competency regarding the early prediction of life-threatening dysrhythmias. Only 3 % of nurses got excellent knowledge scores compared to more than 75% of nurses with fail knowledge levels.

Table 2 shows nurses' attendance for previous training and workshops. Nearly three fourth of nurses did not attend Lecture(S) about Life-Threatening Dysrhythmias.

Table 3 illustrates the association between different socio-demographic and clinical characteristics of the study participants with nurses' knowledge level regarding the early prediction of life-threatening dysrhythmias. An insignificant association existed between nurses at different age groups and knowledge level (MCp.301). Also, the distribution of knowledge level among nurses whether fail, bad, good, very

good or excellent did not differ significantly between males and females (MCp.897). The proportion of fail knowledge level was high and not significantly different between single (51.3%) and married nurses (48.7%) (MCp.973). However, most nurses who failed to answer all questions were diploma graduates (85.5) compared to Bachelor (11.8%) and master's degrees (2.6%) (MCp.003). None of the nurses with less than 5 years' experience attained excellent knowledge grade and around three fourth of them got fail score (MCp.010). Surprisingly, the Knowledge level of nurses who work in medical ICU was significantly much lower than those in general ICU or surgical ICU (MCp.019). Excellent knowledge score was significantly higher in staff nurses than other positions although their frequency was relatively low (MCp.001).

Table 4 shows that 82% of nurses with fail knowledge scores reported that they did not attend any workshop(s) or lecture(s) regarding life-threatening dysrhythmias. Two out of the only three nurses with excellent knowledge attended previous training (MCp.022).

Table 5 shows that, out of 100 participants, 88 of the participants claimed the heavy workload and high numbers of patients as an obstacle preventing them from acquiring the competency. Additionally, inadequate preparation during the undergraduate period was identified as an obstacle by 63 participants. Lack of motivation (financial incentives, certificates, etc.) and it is not the nurses' responsibility, were also identified as obstacles by 34 and 13 of participants.

Table (1): Sociodemographic and Clinical Characteristics of the Study Participants

Item	Frequency (%) (n =100)
Age	
– ≤ 25	41
– 25 ≤ 35	51
– 36 ≤ 45	6
– ≥ 46	2
Sex	
– Female	52
– Male	48
Marital Status	
– Single	53
– Married	47
Level of Education	
– Diploma	73
– Bachelor	25
– Master	2
Professional Year(s) of Experience In ICU	
– 6 months to less than 5 Years	65
– 5 years to less than 10 Years	20
– 10 years to less than 15 Years	11
– 15 Years & More	4
Type of ICU	
– Medical ICU	63
– Surgical ICU	4
– General ICU	33
Current Position in ICU	
– Staff Nurse	87
– Charge Nurse	9
– Head Nurse	3
– Nurse Educator	1

Figure (1): Distribution of Nurses' Competency Regarding Early Prediction of Life-Threatening Dysrhythmias

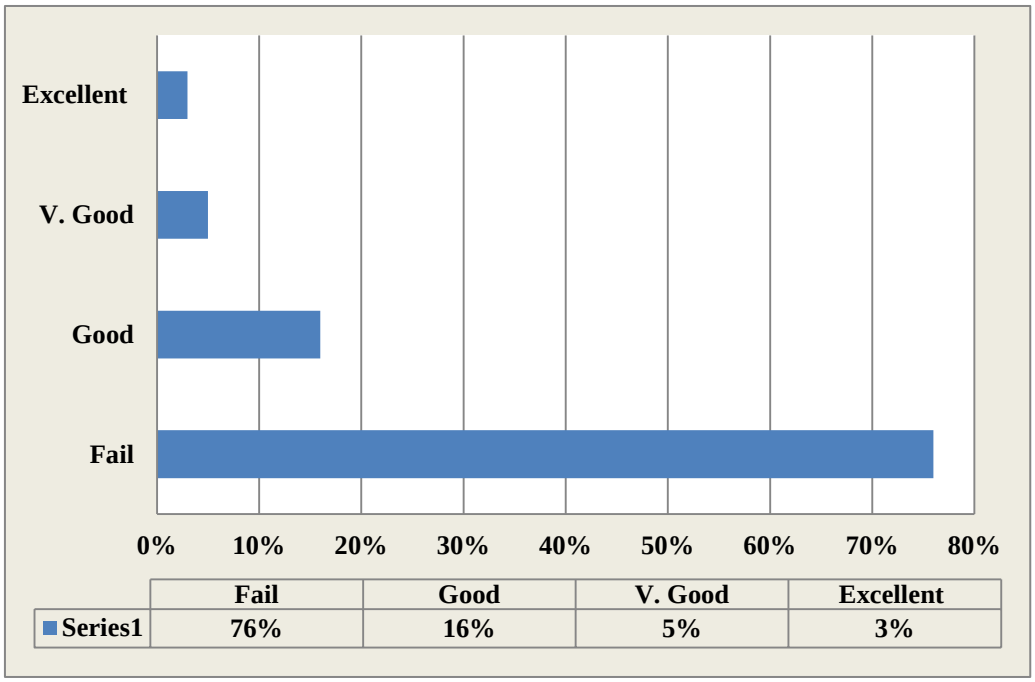


Table (2): Attendance of Lectures, Training, and/or Workshops Regarding Life-Threatening Dysrhythmias.

Item	Frequency (%) (n = 100)
Attendance of Workshop(s) or Lecture(s) about Life-Threatening Dysrhythmias.	
No	77
Yes	23

Table (3): Correlation between the Nurses' Competency Regarding Early Prediction of Life-Threatening Dysrhythmias with Socio-Demographic and Clinical Characteristics

Item	Competency (Knowledge Level) (n = 100)				Sig.
	Fail	Good	V. Good	Excellent	
Age					
– Less than 25	30(39.5)	8(50)	3(60)	0(0)	
– 25– 35	42(55.3)	6(37.5)	1(20)	2(66.7)	MCp.301
– 36 – 45	2(2.6)	2(12.5)	1(20)	1(33.3)	
– More than 46	2(2.6)	0	0	0	
Sex					
– Female	39(51.3)	9(56.3)	2(40)	2(66.7)	MCp.897
– Male	37(48.7)	7(43.8)	3(60)	1(33.3)	
Marital Status					
– Single	39(51.3)	9(56.3)	3(60)	2(66.7)	MCp.973
– Married	37(48.7)	7(43.8)	2(40)	1(33.3)	
Level of Education					
– Diploma	65(85.5)	5(31.3)	1(20)	2(66.7)	
– Bachelor	9(11.8)	11(68.8)	4(80)	1(33.3)	MCp.003*
– Master	2(2.6)	0	0	0	
Professional Year(s) of Experience in ICU					
– 6 Months to Less Than 5 Years	54(71.1)	9(56.3)	2(40)	0	
– 5 years to less than 10 Years	16(21.1)	1(6.3)	2(40)	1(33.3)	MCp.010*
– 10 years to less than 15 Years	5(6.6)	5(31.3)	0	1(33.3)	
– 15 Years & More	1(1.3)	1(6.3)	1(20)	1(33.3)	
Type of ICU					
– Medical ICU	56(73.7)	5(31.3)	1(20)	1(33.3)	
– Surgical ICU	3(3.9)	1(6.3)	0	0	MCp.019*
– General ICU	17(22.4)	10(62.5)	4(80)	2(66.7)	
Current Position in ICU					
– Staff Nurse	71(93.4)	10(62.5)	4(80)	2(66.7)	
– Charge Nurse	4(5.3)	5(31.3)	0	0	MCp.001*
– Head Nurse	1(1.3)	1(6.3)	1(20)	0	
– Nurse Educator	0	0	0	1(33.3)	

MCp: Monte-Carlo significance

Table (4): Correlation between Nurses' Competency Regarding Early Prediction and Interpretation of Life-Threatening Dysrhythmias and Attendance of Lectures, Training, and/or Workshops

Item	Knowledge level				Sig
	Fail	Good	V. Good	Excellent	
Did you attend any workshop(s) or lecture(s) regarding life-threatening dysrhythmias?					
No	64(82.2)	9(56.3)	3(60)	1(33.3)	MCp.022*
Yes	12(15.8)	7(43.8)	2(40)	2(66.7)	

MCp: Monte-Carlo significance

Table (5): Obstacles that Prevent Nurses from Acquiring Competency regarding the early Prediction and Interpretation of Life-Threatening Dysrhythmias

Obstacles	Number (n = 100)
1. Heavy workload and high numbers of patients prevent the nurses from attending the workshops or training.	88
2. Inadequate preparation during the undergraduate period.	63
3. Lack of motivation (financial incentives, certificates, etc.) for nurses who are willing to advance their knowledge or practice.	34
4. It is not our responsibility, it is the physician role.	13

Discussion

The present study was aimed to assess the critical care nurses' competency regarding early prediction and interpretation of life-threatening dysrhythmias and to identify the obstacles that prevent the nurses from acquiring this competency. To fulfill these aims, a convenient sample of 100 nurses working in the critical care units at the main university hospital was recruited. The results of the current study highlighted that nurses had a drastic low level of competency (more than 75% of nurses failed to identify and interpret the type of dysrhythmias). This result indicates that critically ill patients admitted to the critical care units suffering from or having a risk of life-threatening dysrhythmias are at great risk to lose their lives. Lack of nurses' competency could be explained and/or attributed to two factors; the clinical characteristics of the study sample and the obstacles mentioned by the nurses.

The clinical characteristics of the study sample were surprising; age, level of education, years of experience, and the number of nurses attended in-service education related to the study subject. The findings of the current study revealed that 41% of the sample belonged to the less than 25 years of age group and about two-thirds of the sample had less than 5 years of experience (65%), this indicates that most nurses are younger in the career. Ideally, the development of professional competence is growing with the nurses' age and years and experience. The finding of the study enables healthcare organizations to take proactive approaches to enhance nurses' competence by providing support and assistance.

Additionally, about three-quarters of the nurses (73%) hold a diploma degree, comparing to 25% who had a bachelor's degree and 2% had a master's degree. This result could explain the low level of nurses' competence. Many studies found that nurses with higher education are significantly associated with delivering high quality of care and patient safety (Estabrooks et al., 2015; Tourangeau et al., 2007). For instance, Tourangeau et al found that increasing the proportion of bachelorette nurses by 10% significantly led to a decrease in the mortality rate by nine cases among a thousand discharged patients (Wheelen, 2015). Furthermore, highly educated and involved healthcare providers help to be more patient-centered to improve quality of care and patient safety (Linda, 2015). This fact directs the health organizations' attention towards the need for upgrading the nurses' competence by developing structured training, programs for their appointed staff. Furthermore, a low level of nurses' competency was related to inadequate in-service training; 77% did not attend any lecture, workshop, or training concerning the early prediction and interpretation of dysrhythmias.

Clinical characteristics of the study sample were in contrast with the ideal characteristics of critical care nurse mentioned by the American Association of Critical-Care Nurses (AACN), and the World Health Organization that mentioned "patients who are dangerously ill or suffering from life-threatening injuries that require advanced care must have cared with critical care nurses who have completed post-qualification education specialist in critical care (or intensive care) nursing, which builds upon initial generalist nursing education" (WHO, 2003; Aya, 2020).

The low level of nurses' competency might also be attributed to some obstacles, as explained by the nurses. More than three-quarters of the sample related their low level of competency to the heavy workload and high numbers of patients. Additionally, about two-thirds of the sample claimed educational preparation during the study period. While, the least obstacles perceived by the nurses were lack of motivation (financial incentives, certificates, etc.) for nurses who are willing to advance their knowledge, practice, or educational level. Finally, some nurses found the early prediction and management of dysrhythmia are the responsibility of the physicians. These obstacles might have a negative consequence on the nurses' level of commitment or loyalty to the profession, and this could lead to job

dissatisfaction, frustration, absenteeism, and leaving the profession.

Lack of nurse' competency is in agreement with a study conducted by Fekry et al, (2020). She aimed to assess nurses' performance regarding life-threatening ventricular dysrhythmia among critically ill patients and she concluded that the studied nurses had an unsatisfactory level of competency regarding lethal dysrhythmias and need to be improved. Similarly, Ruhwanya et al, (2018) reported that the studied nurses had poor knowledge and skills regarding life-threatening arrhythmias. Moreover, El Naeem et al., (2016) concluded that the level of competency of the majority of studied nurses generally was poor, which could be related to the fact that the majority of participants hold nursing diplomas. Additionally, the result of the current study is agreed with Ayad et al., (2016) who found that more than two-thirds of nurses had unsatisfactory level of competency (knowledge) regarding ventricular dysrhythmias. As well, our finding is consistent with Malek et al, (2014) who assessed the critical care nurses' knowledge related to cardiac dysrhythmias at Benha University Hospital as well as Mahrous who studied the standards of nursing care for a cardiac arrhythmic patient at Ain Shams University hospital and revealed that that majority of the nurses were having an insufficient knowledge regarding the interpretation of cardiac dysrhythmias.

In contrast or contrary to the results revealed by the current study, Rajput, (2016) highlighted that near 50% of staff nurses had very good knowledge regarding the interpretation and management of cardiac dysrhythmias. [30] Similarly, Dinnah et al. assessed the knowledge and skill level of nurses in the identification of life-threatening dysrhythmias and the required patient care. They concluded that most of the participants got a high score in their level of knowledge regarding life-threatening arrhythmias. In another study conducted by Mohan (2010) in India, he assessed cardiac nurses, knowledge regarding the interpretation of life-threatening arrhythmias and emergency management, The results show that nurses had an excellent knowledge score whereby 88.88% scored between 86% and 100%.

Conclusion

Critical care nurses have a drastic low level of knowledge concerning the competency of early prediction and interpretation of life-threatening dysrhythmias. Moreover, significant correlations were found between nurses' competency, level of education, and their position in critical care units. However, there was no significant correlation between the nurses' competency and other variables such as age, sex, and marital status more than three-quarters of the nurses did not attend any training related to dysrhythmia. Finally, four factors were identified by the nurses as obstacles for acquiring competency of early prediction and interpretation of life-threatening dysrhythmias.

Recommendations

Recommendations for Schools of Nursing

- Ensure proper and competent preparation of the new graduates before they transition to the real workplace. This could be done by the

hiring of qualified instructors and faculty and developing of Competency or Outcomes-Based Curriculum.

- Develop a nursing curriculum that aims to bridge the gap between theory and practice.
- Schools of nursing that offer nurse internship program should evaluate the effectiveness of the program in improving the retention of nurses, expanding competencies, and improving patient outcomes.
- Schools of nursing, in collaboration with workplaces, should design and implement early and continuous interprofessional collaboration through joint classroom and clinical training opportunities.

Recommendations for Healthcare Institutions

- Develop a preceptorship program for new graduates.
- Conduct an in-service - education program for new graduate nurses and ensure that nurses engage in lifelong learning.
- Work towards increasing the nurses' commitment and affiliation to the profession by providing motivation, incentives, and increasing salaries.
- Because of the complex conditions of critically ill patients, the hospital authorities should work toward increasing the proportion of nurses with a baccalaureate degree, by hiring professional nurses or encouraging the young nurses with associate's and diploma degrees to continue their education.

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