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KNOWLEDGE OF CARDIAC MONITORING AMONG NURSES WORKING AT CASE HOSPITAL - AN INTERVENTION STUDY

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ABSTRACT

Background

Cardiac monitoring provides important diagnostic information for timely clinical decision making in hospitalized patients. It is within the scope of practice of nurses to place electrodes on patients and to select appropriate leads with which to monitor patients for any dysrhythmias and ST-segment ischemia. Several studies, however, have shown that nurses lack knowledge regarding ST segment monitoring, proper placement of electrodes, lead selection and rhythm interpretation.

Objectives

The purpose of this study was to assess knowledge of cardiac monitoring among intensive care unit (ICU) and emergency unit (EU) nurses working at Case Hospital, a private hospital in Uganda. It had two specific objectives namely; to assess baseline knowledge of interpreting cardiac monitor information and to evaluate post-intervention change in knowledge of interpreting cardiac monitor information.

Methods

The study employed a one group pre- and post-intervention quasi experimental design. It was carried out at Case Hospital among 23 nurses working in ICU and EU. The study utilized a knowledge questionnaire (pre- post test) developed out of the protocol on cardiac monitoring as recommended by the American Association of Critical Care Nurses (AACN) and the American Heart Association(AHA).

Results

A Wilcoxon signed rank matched pairs test showed significant results ($p < .001$, $Z = 4.21$, $r = .88$) indicating a significant increase in knowledge assessment scores from the pretest ($IQR = 54.0$, $Mdn = 31.0$) to the posttest ($IQR = 15.0$, $Mdn = 77.0$).

Conclusion

The education intervention in this study was effective in increasing nurses' knowledge about cardiac monitoring practices and rhythm interpretation.

INTRODUCTION

Cardiac monitoring refers to recording the heart's electrical activity using electrodes placed on the patient's chest. These electrodes detect electrical changes arising from the heart's muscle activity which are reflected on the cardiac monitor (Alinier *et al.* 2006). The ECG contains important diagnostic information used to inform clinical decision making for hospitalized patients (Drew *et al.* 2004). Cardiac monitoring of the critically ill provides basic pieces of information including heart rate and any abnormalities, cardiac rhythm and any disturbances and patterns of ischemia (Fox, Kirkendall & Craney 2010). About 90% of all episodes of myocardial ischemia are not realized because they are clinically silent (Drew *et al.* 2004). Using the conventional single 12-lead ECGs which only provides a snapshot of cardiac muscle activity would miss out on most of the ischemic events, hence the need for continuous cardiac monitoring.

Nurses especially those working in critical and emergency care settings, play a vital role in cardiac monitoring. They are responsible for identifying life threatening dysrhythmias among patients (Drew & Funk 2006). Increased knowledge among nurses on the use of cardiac monitors results in accurate detection of dysrhythmias with a decrease in the incidence of sustained ventricular tachyarrhymias (Cadden 2007; Sumner *et al.* 2012). Studies have shown however that nurses lack knowledge in ST-segment and dysrhythmia monitoring (Cadden 2007 ;Sumner *et al.* 2012; Sangkachand, Sarosario & Funk 2011).

METHODS

Study area

The study was carried out at Case Hospital, a private for profit hospital located in the city centre in Uganda with a total bed capacity of 180. The hospital has a well equipped 9 bed ICU and EU with cardiac monitors. In total, Case Hospital ICU has a staff of 18 nurses and 14 nurses in the EU.

Research design

The study employed a quasi experimental one group pre -and- post test intervention to assess knowledge of cardiac monitoring among ICU and EU nurses.

Sample size

Case Hospital has a total of 18 nurses working in ICU and 14 nurses working at the EU. For the planned dependent sample *t*-test analysis, a priori power analysis indicated a total sample size of 19 to detect a large effect (*Cohen's d = .5*) with α=.05 and 1-β=.95 (Buchner, Erdfelder, Faul, & Lang 2009). To allow for anticipated attrition of ten percent, the researcher aimed at having all 32 nurses participate in the study.

Data collection method and tools

Study participants were asked to fill in a demographic information sheet and complete a written pretest on the first day of the education intervention program. They were taught over a period of eight weeks on: Electrophysiology, Rhythm strip analysis and Basic dysrhythmias, Cardiac monitors (electrode placement and choosing the best lead for particular conditions), ST segment monitoring, and Basic nursing interventions for cardiac dysrhythmias

A 45 minutes face- to-face session with the participants once a week on each unit (ICU and EU) was done, supplemented with a self-study package with material on cardiac monitoring and dysrhythmia interpretation. Study participants then took the post test at the end of the intervention period study.

The questionnaire (pre- posttest) that consisted of 13 questions was developed out of the protocol on cardiac monitoring as recommended by the American Association of Critical Care Nurses (AACN) and the American Heart Association.

Validity:

The questionnaire and teaching materials were given to research and critical care experts for content validity and corrections made as per their advice.

Reliability

The questionnaire was piloted for the reliability on 11 nurses working in ICU at International Hospital Kampala, a similar private for profit hospital in Uganda. Reliability was tested and the Cronbach alpha for the 13 knowledge items was found to be 0.65.

Data Analysis

Data was entered in spreadsheets (Excel) and later exported to SPSS version 20 for statistical analysis. For descriptive statistics, data was analyzed and presented in frequencies and percentages. To test whether an educational intervention improved knowledge, the Wilcoxon signed rank test was used.

Ethical considerations

Approval was obtained from the Institutional Review Board (IRB) of the Faculty of Medicine, Mbarara University of Science and Technology and Case hospital. There was collaboration with the hospital head nurse and administration on how best to implement the project without any disruption of the nursing service.

RESULTS

SAMPLE CHARACTERISTICS

At the start of the study, the majority of ICU and EU nurses were interested (30 out of 32, 94%), however 23 out of 30 (77%) who originally consented to participate completed all three phases of the study. As shown in Table 1, the majority of respondents were female (*n* = 15, 65.2%). More than half were aged between 24 and 28 years (*Mdn* = 28.0, *IQR* = 15.0). Respondents were mostly certificate (*n* = 12, 52.2%) and diploma (*n* = 10, 43.5%) nurses. The majority of respondents had spent less than a year on their respective units (*n* = 13, 56.5%) with no prior training on cardiac monitoring and rhythm interpretation (*n* = 15, 65.2%).

Baseline knowledge about interpreting cardiac monitor information

As shown in Table 2, the majority of the respondents identified a normal sinus rhythm

(n = 17, 73.9%). Three participants (13.0%) correctly identified the five anatomical locations of electrodes in a 5-lead system, the conditions that required QTc monitoring, and effective treatment for Torsades de points.

Figure 1 shows the distribution of scores in the pre-intervention assessment (M = 30.0, SD = 16.9).

Post-intervention change in knowledge on interpreting cardiac monitor information

After the education intervention, respondents were again subjected to the initial knowledge assessment questionnaire to evaluate post-intervention change in knowledge of interpreting cardiac monitor information. In Table 2, results show all respondents correctly identified all five anatomical locations of electrodes in a 5-lead system, identified a normal sinus rhythm and calculated the heart rate after the intervention.

In accordance to the study objectives a Wilcoxon signed rank test evaluated whether a statistically significant difference existed between the knowledge assessment scores before (Pre-) and after (Post-) the intervention. Prior to analysis, the Shapiro-Wilk test revealed the distribution of the mean post-intervention total scores violated the assumption of normality

(p < .001), thus a Wilcoxon signed rank matched pairs test (a non-parametric equivalent to paired sample t test) was used. Results of the matched pairs test were significant

(p < .001, Z = 4.21, r = .88) indicating there was a significant increase in knowledge assessment scores from the pretest (IQR = 54.0, Mdn = 31.0) to the posttest (IQR = 15.0, Mdn = 77.0).

Table 1: Demographic characteristics of respondents. (*N* = 23)

Variable	Frequency/Percentage (%)
Gender	
Male	8(34.8)
Female	15(65.2)
Age(Years) (*Mdn* = 28.0, *IQR* = 15.0)	
24-28	13(56.5)
29-33	8(34.8)
34-38	1(4.3)
>38	1(4.3)
Level of education	
Enrolled nurse(Certificate)	12(52.2)
Registered nurse(Diploma)	10(43.5)
Graduate nurse(Bachelors)	1(4.30)
Unit of work	
Intensive care Unit	12(52.2)
Emergency Unit	11(47.8)
Length of time on the Unit(Months) (*Mdn* = 7.0, *IQR* = 45.0)	
1-10	13(56.5)
11-20	6(26.1)
21-30	3(13.0)
>30	1(4.30)
Length of time in service as a nurse(Years) (*Mdn* = 5.0, *IQR* = 12.0)	12(52.2)
1-5	10(43.5)
6-10	1(4.30)
>10	
Training on Cardiac monitoring and rhythm interpretation	
Yes	8(34.8)
No	15(65.2)

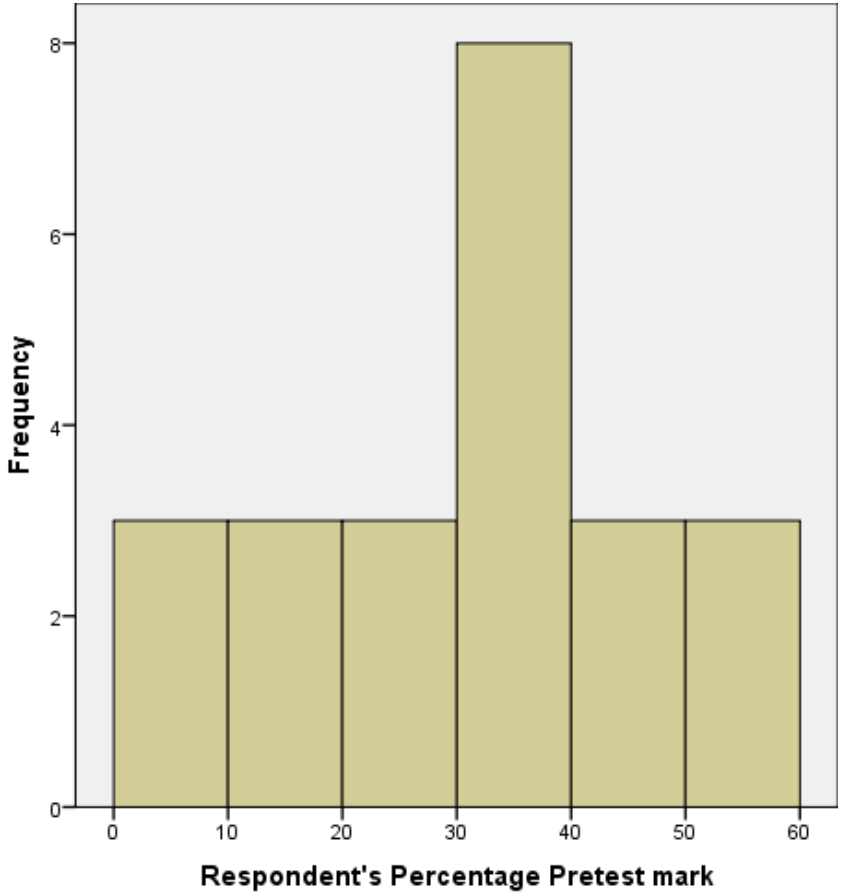
Length of time of prior training on Cardiac monitoring and rhythm interpretation	
Never	15(65.2)
<1 year ago	4(17.4)
>1 year ago	4(17.4)

Table 2. Correct responses per question item before and after the intervention ($N = 23$)

Question	**n (%) of correct response**	
	BEFORE	AFTER
1. Best lead to diagnose atrial activity and measure heart rate	4(17.4)	22(95.7)
2. Conditions that require QTc interval monitoring	3(13.0)	18(78.3)
3. The five anatomical locations of electrodes in a 5-lead ECG system	3(13.0)	23(100)
4. The best way to prepare the skin before placing electrodes	6(26.1)	21(91.3)
5. The steps for applying electrodes on a patient in their correct order	8(34.8)	15(65.2)

6. Pace maker in a normal heart	11(47.8)	22(95.7)
7. Area of the heart viewed by Lead I	4(17.4)	18(78.3)
8. The PR interval measurement	6(26.1)	10(43.5)
9. Waves in a normal ECG wave form	4(17.4)	22(95.7)
10. Effective treatments for Torsades de points	3(13.0)	10(43.5)
11. Rhythm identification(Normal sinus rhythm)	17(73.9)	23(100)
12. Heart rate calculation/ determination	13(56.5)	23(100)
13. Rhythm identification (ventricular tachycardia)	8(34.8)	15(65.2)

Figure 1: Distribution of the percentage pre-intervention marks of the respondents.



DISCUSSION

This study reported a percentage mean total score of 30 percent (*SD* = 16.9) in the pre-intervention test. Pickham *et al.* (2012), also used a 13 question instrument with a percentage mean total score of 46 percent (*SD* = 15.4) in the pre-intervention test. Some questions were left unattempted, perhaps because most of the respondents had not had any training on cardiac monitoring and rhythm interpretation before (65.4%) while others had it more than a year ago (17.4%).

In this study, results of the Wilcoxon signed rank matched pairs test were significant, indicating a significant increase in knowledge assessment scores from the pretest with improvement in mean total score of 51 percentage points. Results of this study are in line with several studies that have shown a statistical significance between pre- and posttest scores after the education intervention (Pickham *et al.* 2012; Sumner *et al.* 2012; Chronister, 2014; Blakeman,Sarsfield &Booker, 2015)

The possible explanations for such a great increase include the fact that respondents were excited about the ECG interpretation course, which most hadn't previously experienced as it is not included in the nursing curricula at levels lower than bachelors' degrees. Chronister (2014), also reported that most of the respondents had no prior training concerning ST segment monitoring, yet that sample also showed a great improvement between pre- and post-test scores. Additionally, the method of teaching which involved a face-to-face session, hands on demonstration and return demonstration where required, and referenced self-study material was effective. VanArsdale (1998) and Jeffries, Woolf & Linde (2003) agree that this method of teaching is an effective method that fosters knowledge retention.

CONCLUSION

The education intervention was effective in increasing nurses' knowledge about

cardiac monitoring practices and rhythm interpretation.

LIMITATIONS OF THE STUDY

This study had the following limitations: First, it was conducted with a small sample size of nurses and therefore results cannot be generalized. Second, nurses were the only staff members included in the study and received the education; however patient outcomes are impacted not only by nurses but also other staff, such as general doctors, resident anesthesiologists and intensivists who are also responsible cardiac monitoring. Third, the study did not look at patient outcomes given its short duration, contrary to Funk et al. (2009) who looked at patient outcomes such as mortality, length of stay, and cost of medical care.

WEAKNESSES OF THIS STUDY DESIGN

Since study participants were few and not randomly assigned, this could limit the generalizability of the results to a larger population. With lack of randomization, the conclusion that cardiac monitoring practices improved following the training (Intervention) is less definitive.

Other factors and influences that could have contributed towards the outcome on cardiac monitoring practices following the training (Intervention) were not taken into account because of less control. For this reason therefore, the researchers cannot be assured that the training was the sole factor causing improvement in cardiac monitoring practices and rhythm interpretation.

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