The Effect of Educational Program on Nurses' Performance regarding Rapid Response Code to prevent Cardiopulmonary Arrest

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Abstract

Post inter hospital cardiac arrest survival rate range from 17 - 32%. Early Warning Signs developed for the inpatient cases, Scoring system generated using the bedside assessment of physiologic parameters to detect of unwell patients and decreases in cardiac arrest rates. **The aim of this study** was to evaluate the Effect of Educational Program on Nurse's Performance Regarding Rapid Response Code to Prevent Cardiopulmonary Arrest. A quasi experimental **design** was used to conduct this study. The study was conducted in inpatient unit at Elaraby hospital, Egypt. **Convince sample** of all Inpatient nurses. **Method;** Study lasted from the beginning of February 2020 to beginning of December 2020. **Tools:** three tools for data collection. Self-administered questionnaire for nurses consisted of demographic characteristics and nurse's knowledge, observation checklist, and nurse's attitude. **Results;** the study finding revealed that, nurse's satisfactory knowledge pre educational program was Zero percentage, post educational program improved to 66%. Nurse's satisfactory practice pre educational program was 16%, post educational program improved to 60%. Also, the nurse's Positive attitude pre educational program was P 16%, post educational program improved to P 56%. Finally, the inpatient arrested cases in last month/critical cases number significant reduced; pre educational program P 7.6%, post educational program P 0%. **Conclusion,** Application of rapid response code for inpatient unit showed an improvement of inpatient cardiopulmonary arrest that clearly reduced. **The study recommended that;** increase awareness of Nurses regarding rapid response code to empower and motivate them to adhere to rapid response code guidance for prevent cardiopulmonary arrest.

Key words: *Cardiopulmonary Arrest, Educational Program, Nurse's Performance, Rapid Response Code.*

Introduction:

Patient deterioration is a significant clinical and financial burden for patients, providers, and healthcare systems. As the volume of hospitalizations for critical patients continues to rise, providers are challenged to manage more acute, resource intensive populations in a resource constrained environment. Compounded with a scarcity of beds in higher acuity care areas, patient status may be

underestimated, and transferred to lower acuity care areas. This may be attributable to a relative lack of resources and a significant decrease in nurse to patient ratios **(Mitchell et al., 2019)**.

Early Warning Signs (EWS) was developed for the inpatient cases in England since 1997. The scoring system generated a simple weighted score using the bedside assessment of five physiologic parameters, including (HR) heart rate, (SBP) systolic blood pressure, (RR) respiratory rate, temperature, and response to stimulus. A total score of three points or more triggered immediate escalation of care **(Nagarajah et al., 2022).**

Hospital has two different teams, Rapid Response Team (RRT) which acts when a patient presents with clinical deterioration, and the code blue which is called when the patient has cardiac arrest. An Intensive Care Unit (ICU) senior physician leads the RRT, plus unit Incharge and Assigned Nurse. Any code is alerted by dialing a particular number well known throughout the hospital. Almost code team is composed of a senior ICU physician, a medical resident and ICU nurse, and they bring with them an emergency cart, anyone can activate the code and all hospital wards can be reached within 3 minutes / code blue and 5 minutes / RRT **(Viana et al., 2021)**.

Rapid Response System (RRS) is based on 4 essential components; the afferent limb includes EWS, physicians and nurses of general hospital wards, which called triggering limb., the efferent limb is the RRT that can be nurse or physician-led and can include a respiratory therapist, which called response limb., the administrative limb oversees all system components, allows the working of the team and provides necessary resources., and the quality improvement limb analyzes events data, provides feedback on the team function, monitors quality indicators like the staff satisfaction, and collects data on outcome measures **(Difonzo, 2017).**

Significance of the study:

Resuscitation teams are called to between one and five Inter Hospital Cardiac Arrest (IHCA) / 1000 hospital admissions amounting to around 20,000 arrests in NHS hospitals in England / year. Survival discharge is around 13–20%. 66% of IHCA patients show abnormal signs up to 6 hours prior to IHCA. Moreover, nursing staff may be unaware of abnormal vital signs in almost 50% of patients in the general ward as they struggle to manage time pressures and work interruptions throughout their shift. This led to the development of RRS which focus on detect EWS **(Hogan et al., 2020).**

Historically, more recent literature is supportive of the positive effect of RRTs. Notably, decreases in mortality rates post implementation of an RRT within a hospital. Also, reported decreases in code blue calls and unplanned intubations as a result of the RRT model. Ultimately, the bedside nurse's role during these emergencies is to promote the best outcomes for the patient while promoting effective collaboration with RRT. Therefore the nurse play an important role in providing Educational Program regarding Rapid Response Code to prevent Cardiopulmonary Arrest **(Dobuzinsky, 2017)**.

Aim of the study:

The aim of the study was to evaluate the Effect of Educational Program on Nurse's Performance Regarding Rapid Response Code to Prevent Cardiopulmonary Arrest. This aim will be achieved through:

1. Assess nurse's Knowledge, Practice and Attitude regarding rapid response code to prevent cardiopulmonary arrest.
2. Design educational program regarding rapid response code based on nurse's basic assessment.
3. Implement the educational program regarding rapid response code to improve nurse's Knowledge, Practice and Attitude.
4. Evaluate the effect of educational program on nurse's Knowledge, Practice and Attitude regarding rapid response code to prevent cardiopulmonary arrest.

Sample and Methods:

Design:

A quasi-experimental research design was utilized to conduct the study.

Participants:

A convenience sample of all inpatient nurses. They were all included (50) in the inpatient unit at Elaraby Hospital.

Research tools:

Three tools were utilized for data collection, designed in Arabic form, they were:

Tool I: Self Administered Questionnaire:

Consisted of two parts:

Part I: Socio-Demographic Characteristics: Concerned with assessment of socio-demographic characteristics of nurses. Consisted of 8 questions as MCQ and yes or no questions. Including: age, gender, marital status, education level and job; years of experience, ICU background, Training Courses and No of arrested cases. The number of arrested cases was assessed in the Pre, immediate post and follow up phases the implementation of the educational program.

Part II: Nurses' Knowledge: Concerned with assessment of Nurses' Knowledge related Rapid Response Code Parameter, Early Warning Signs and Rapid Response Team. It was assessed in the Pre, immediate post and follow up phases of the implementation of the educational program, developed by

the researcher guided by **(Rashid et al., 2014)** and **(Peter et al., 2015)**. It consisted of 33 questions. as MCQ and yes or no questions. It covered the following items:

1. Rapid Response Code Parameters: It consists of Seven questions: pulse, O2 saturation, pain, blood pressure, RR, Temperature and GCS.

2. Early Warning Signs: It consists of Six questions: respiration, O2 saturation, heart rate, systolic blood pressure, temperature and level of consciousness.

3. Rapid Response Team: It consists of four questions covering the following: what is it, roles of team members, Team decision and who responsible to activate the code.

- Unsatisfactory level of Knowledge: for those who had score < 70%.
- Satisfactory level of Knowledge: for those who had score ≥ 70%.

Tool II: Observational Check List:

It was used by the investigator while observing nurses conducting the parameters of rapid response code. It consisted of eight observations as pre procedure, temperature, pulse, respiration, blood pressure, oxygen saturation, glasgow coma scale and post procedure, which including 36 items, as: done and not done for each item. It was assessed in the Pre, immediate post and follow up phases of the implementation of the educational program. Was adopted from **(Lynn, & LeBon, 2017)**.

- Unsatisfactory practices: for those who had score < 85%.
- Satisfactory practices: for those who had a score of ≥ 85%.

Tool III: Nurses' Attitude:

Was developed by the researcher based on literature review, under supervision and guided by **Rawia et al., (2017)**. It was used in pre, immediate post and follow up phases. It was used to assess nursing attitude in terms of their satisfaction with nursing care regarding rapid response code. It consisted of 15 MCQ. It consisted of one dependent variables:

Note: Some questions were formulated in a negative format and the scoring was coded in reversed order.

- Negative Attitude: for those who had score < 60%.
- Positive Attitude: for those who had score ≥ 60%.

Content validity and reliability:

Content validity was used for the modified tools and the designed booklet to determine whether the tools covered the aim or not. It was evaluated by a jury of five experts, two professors of medical surgical nursing, one professors of critical nursing, one professor of nursing administration from Faculty of nursing-Zagazig and Helwan University and one professor of critical medicine from Faculty of Medicine Beni Suef University. Modifications were done according to their recommendations. In the present study the overall reliability of tools (cronbach's alpha (0.86), acceptable).

Pilot study:

A pilot study for tools of data collection was carried out on Five Nurses (10%) within selected criteria in order to test for clarity, relevance, comprehensiveness, understandability, feasible, applicability and ease for implementation. Nurses who shared in the pilot study were included in the main study sample because no modification was done in the tools.

Field work:

Program lasted over a period of 10 months, from beginning of February 2020 to beginning of December 2020, the researcher interviewed nurses in groups; one group/day/two days/week (10 Nurses) at day shift from 9:00 am to 5:00 pm (one theoretical session in first day and 3 practical sessions in second day) in inpatient unit/ training room, follow up phase from 9.00 am to 5:00 pm in inpatient unit (once/week), data collection done by using three tools; Tool I: Self Administered Questionnaire, Tool II: Observational Check List, Tool III: Nurses' Attitude.

Ethical considerations:

All ethical issues were taken into consideration during all phases of the study. The ethical research considerations in this study included the following: The research approval was obtained before the educational program implementation; the objectives and the aims of the study were explained to the participants. The researcher confirmed the anonymity and confidentiality of subjects. Subjects were allowed to choose to participate or not and the right to withdraw from the study at any time without penalty. Researcher confirmed that the data collected would be confidential and used only to improve the nurses' performance and patient condition.

Statistical analysis:

Data collected throughout questionnaire and outcome measures coded, entered and analyzed using Microsoft Excel software. Data were then imported into Statistical Package for the Social Sciences (SPSS version 20.0) software for analysis. According to the type of data, qualitative data was presented as number and percentage, quantitative continues group presented by mean $\pm$ SD, the following tests were used to test differences for significance; Differences between frequencies (qualitative variables) and percentages by Chi-square test. Differences between parametric quantitative by t test in non-parametric by Man Whitney, correlation by Pearson's or Spearman's correlation. P value was set at <0.05 for significant results & <0.001 for high significant result.

Results:

Table (1): Frequency and Percentage Distribution of Socio-Demographic Characteristics for the Nurses (n=50).

Demographic Characteristics	Study Sample (n= 50)	
	No	%
Age in years:		
18 - 34	37	74.0
35 - 44	13	26.0
Gender:		
Male	24	48.0
Female	26	52.0
Marital Status:		
Single	9	18.0
Married	35	70.0
Widow	2	4.0
Divorced	4	8.0
Education Level:		
Institute	19	38.0
Bachelor	27	54.0
Master	4	8.0
Years of Experience:		
1-4	15	30.0
5-9	33	66.0
10-14	2	4.0
ICU Experience:		
Yes	8	16.0
No	42	84.0
Training Courses (First Aid or CPR):		
Yes	43	86.0
No	7	14.0

Table (1): showed that study sample consists of 50 inpatient nurses; age of nurses ranged from 18 to 44 years, as 18-34 and 35-44 years old of nurses (74% and 26% respectively). Additionally 52% of the nurses were female and 70% of the nurses were married. Also, 54% of nurses were bachelor degree. Concerning occupation, 66% of nurses have 5-9 years experience. 84% of the nurses were not worked before in ICU. Finally 86% of the nurses were trained on first aid and CPR.

Table 2: Frequency and Percentage Distribution of Total satisfactory Knowledge of Nurses' about Rapid Response Code throughout the Study Phases (n= 50).

Total Satisfactory Knowledge	Pre		Post		Follow up		X2 (Sig)
	No	%	No	%	No	%	
Part I (Rapid Response Code Parameters)	7	14.0	35	70.0	35	70.0	41.843 (0.000**)
Part II (Early Warning Signs)	0	0.0	32	64.0	28	56.0	50.667 (0.000**)
Part III (Team dynamics of Rapid Response code)	0	0.0	33	66.0	29	58.0	53.501 (0.000**)
Total Knowledge	0	0.0	33	66.0	29	58.0	53.501 (0.000**)

X2 Chi Square test   ** Highly statistically significant at p≤0.01

Table (2) shows that the nurses' satisfactory knowledge regarding Rapid Response Code Parameters through pre, post and follow-up phases were (14%, 70%, 70% respectively) and had statistically significant relation P value (0.000). While the nurses' knowledge regarding Early Warning Signs through pre, post and follow-up phases were (0%, 64%, 56% respectively) and had statistically significant relation P value (0.000). Meanwhile the nurses' knowledge regarding Team dynamics of Rapid Response code through pre, post and follow-up phases were (0%, 66%, 58% respectively) and had statistically significant relation P value (0.000). Finally the total satisfactory nurses' knowledge regarding Rapid Response code through pre, post and follow-up phases were (0%, 66%, 58% respectively) and had statistically significant relation P value (0.000).

Table 3: Frequency and Percentage Distribution of Total Nurses' Practices about Rapid Response Code Parameters throughout the Study Phases (n= 50).

Satisfactory Practices	Pre		Post		Follow up		X2 (Sig)
	No	%	No	%	No	%	
Pre-Procedure	0	0.0	29	58.0	25	50.0	42.882 (0.000**)
Temperature	8	16.0	19	38.0	16	32.0	6.325 (0.042*)
Heart Rate	10	20.0	30	60.0	26	52.0	18.182 (0.000**)
Respiration	8	16.0	24	48.0	19	38.0	11.943 (0.003**)
Blood Pressure	8	16.0	20	40.0	17	34.0	7.429 (0.024*)
O2 Saturation	21	42.0	33	66.0	33	66.0	7.882 (0.019*)
Glasgow Coma Scale	4	8.0	31	62.0	26	52.0	34.205 (0.000**)
Post-Procedure	8	16.0	29	58.0	25	50.0	20.510 (0.000**)

Total Satisfactory Practices	8	16.0	30	60.0	25	50.0	21.839 (0.000**)

X² Chi Square test   * Statistically significant at p≤0.05   ** Highly statistically significant at p≤0.01

Table (3) shows that the nurses satisfactory practices regarding rapid response code parameters regarding Heart Rate through pre, post and follow-up phases were (20%, 60%, 52% respectively) and had statistically significant relation P value (0.000). Additionally, Nurses satisfactory practices regarding rapid response code parameters regarding glasgow coma scale through pre, post and follow-up phases were (8%, 62%, 52% respectively) and had statistically significant relation P value (0.000). Finally, Satisfactory total Nurses practices regarding rapid response code parameters through pre, post and follow-up phases were (16%, 60%, 50% respectively) and had statistically significant relation P value (0.000).

Table 4: Frequency and Percentage Distribution of Total Nurses' Positive Attitude regarding Rapid Response Code throughout the Study Phases (n= 50). Hypothesis (n3)

Total Positive Attitude	Pre		Post		Follow up		X2 (Sig)
	No	%	No	%	No	%	
	8	16.0	28	56.0	23	46.0	18.160 (0.000**)

X² Chi Square test   ** Highly statistically significant at p≤0.01

Table (4) shows that the total positive attitude regarding rapid response code through pre, post and follow-up phases were (16%, 56%, 46% respectively) and had statistically significant relation P value (0.000).

Table 5: Frequency and Percentage Distribution of Inpatient Arrested / Critical Cases in the Last Month throughout the Study Phases. (n= 50).

Total Inpatient Arrested Cases / Critical Cases	Pre (no 65)		Post (no 42)		Follow up (no 51)	
	No	%	No	%	No	%
	5	7.6	0	0.0	1	1.9

X² Chi Square test

Table (5) reveals that the inpatient arrested cases in last month/critical cases number pre (March 2020), post (July 2020) and follow-up (Nov 2020) program implementation had (10%, 0% , 2% respectively), Which was statistically significant difference relation regarding total arrested cases through post and follow up phases were noticed.

Items	Attitude Post Phase	X²

Table 6: Relation between Nurses' knowledge and Demographic Characteristics regarding Rapid Response Code throughout Post Phase (n= 50).

X2   Chi   Square   test
FE   Expected   cell   count   less   than   5,   Fisher's   Exact   test   was   used.
* Statistically significant at p≤0.05.

Table (6) clarifies that there was statistically significant relation between the Nurses' knowledge and ICU experience through post phase. Nurses who haven't experience had satisfactory knowledge 75.8%, P value (0.039).

Demographic Characteristics	Unsatisfactory		Satisfactory		(Sig)
	No.	%	No.	%	
Age in years:					
18 - 34	14	63.6	23	82.1	2.193
35 - 44	8	36.4	5	17.9	0.139
Gender:					
Male	11	50.0	13	46.4	0.063
Female	11	50.0	15	53.6	0.802
Marital Status:					
Single	4	18.2	5	17.9	
Married	16	72.7	19	67.9	0.498[FE]
Widow	0	0.0	2	7.1	0.768
Divorced	2	9.1	2	7.1	
Education Level:					
Institute	9	40.9	10	35.7	
Bachelor	10	45.5	17	60.7	2.109[FE]
Master	3	13.6	1	3.6	0.340
Years of Experience:					
1-4	3	13.6	12	42.9	
5-9	17	77.3	16	57.1	6.378[FE]
10-14	2	9.1	0	0.0	0.022*
ICU experience:					
Yes	1	4.5	7	25.0	FE
No	21	95.5	21	75.0	0.064
Training Courses (First Aid or CPR) :					
Yes	20	90.9	23	82.1	FE
No	2	9.1	5	17.9	0.444

Table 7: Relation between Nurses' Attitude and Demographic Characteristics regarding Rapid Response Code throughout Post Phase (n= 50).

X^2 Chi Square test

[FE] Expected cell count less than 5, Fisher's Exact test was used.

Table (7) clarifies that there was statistically significant relation between the Nurses' Attitude and their years of experience through post phase. Nurses who have years of experience 5-9 years had positive attitude 57.1% P value (0.022).

Table 8: Correlation between Practices and Attitudes throughout Study Phases (n= 50).

Items	Practices					
	Pre		Post		Follow up	
Attitudes	r	Sig.	r	Sig.	r	Sig.
	0.231	0.106	0.707	0.000**	0.403	0.004**

r Pearson Correlation test   ** Highly statistically significant at p≤0.01

Table (8) shows correlation between nurse' practices and attitude regarding Rapid Response Code through pre, post and follow-up phases were (0.231, 0.707, 0.403 respectively), which statistically significant relation were noticed through post and follow-up phase P value (0.106, 0.000, 0.004 respectively).

Table 9: Correlation between Total Knowledge, Practices and Attitudes throughout Study Phases (n= 50).

Items	Knowledge					
	Pre		Post		Follow up	
	r	Sig.	r	Sig.	r	Sig.
Practices	0.871	0.000**	0.829	0.000**	0.779	0.000**
Attitudes	0.249	0.081	0.773	0.000**	0.583	0.000**

r Pearson Correlation test   ** Highly statistically significant at p≤0.01

Table (9) shows correlation between nurse' knowledge and practices regarding Rapid Response Code through pre, post and follow-up phases were (0.871, 0.829, 0.779 respectively), which statistically significant relation were noticed through pre, post and follow-up phase P value (0.000, 0.000, 0.000 respectively). In addition, correlation between nurse' knowledge and attitude about rapid response code through pre, post and follow-up phases were (0.249, 0.773, 0.583 respectively), which statistically significant relation were noticed through post and follow-up phase P value (0.000, 0.000 respectively).

Discussion:

Patient clinical deterioration is the worsening of a patient's physical condition, thereby increasing their risk of critical illness or death. As a major safety concern, RRT initiated 24/7 service team. The goal is that the RRT is to be activated as soon as the first signs and symptoms of patient deterioration are recognized. Study at Australian hospital show outcomes of the RRT events (n=1939) on medical and surgical units over a 92-month study period were: stabilization (59%), transfer to higher level of care (39%), and cardiopulmonary arrest (2%), however, researchers have found that delays in activation occur and have resulted in longer hospitalizations and increased mortality **(Fitzgerald, 2021)**.

Peter et al., (2021) show result that utilization of a EWS by an RRT has potential to provide earlier recognition of deterioration and mortality risk among hospitalized inpatients. As **(Lindsay, 2021)** desired outcomes of increased RRT calls, decreased ICU transfers and cardiopulmonary arrest was achieved. Plans to overcome compliance include integration of the NEWS2 in the electronic

medical record (EMR). NEWS2 integration into the EMR with best practice advisory may increase compliance by decreasing the workload of score calculation and providing a notification for staff that must be acknowledged. NEWS2 education for new hire orientation may increase compliance and foster a culture of patient safety.

As **Bellomo, (2018)** Show that Patients in hospitals may develop a significant worsening of their condition, abnormal vital signs and such change may herald the risk of a major adverse event. Despite such patients being in hospital, however, the doctors and nurses responsible for their care may fail to respond in a timely and/or appropriate manner. This failure to respond is termed "failure to rescue". Rapid referral to personnel with appropriate expertise and equipment is likely beneficial. The RRT is part of a system without which the team cannot deliver improved care. Nurse is essential member in RRS as a general and in RRT as specific, so the nurse play crucial role in RRS success.

Concerning the study sample, it constitutes of 50 inpatient nurses included as study sample who received Educational Program on their Performance Regarding Rapid Response Code to Prevent Cardiopulmonary Arrest; More than two third of study sample aged 18-34 years old. More than half of study sample were female. Whereas more than two third of study sample were married. While more than half of study sample had Bachelor degree. Two third of study sample had 5-9 years experience. The majority of study sample hadn't previous ICU work and trained on CPR.

Concerning Nurses' Knowledge about Rapid Response Code, The present study clarified that all of nurses through pre program implantation hadn't knowledge regarding Rapid Response Code in study sample. This might be due to lack of Nurses' knowledge as result of lack of training/ education regarding Rapid Response Code. Agreed with **Warren et al., (2021)** who conduct study about Impact of a modified early warning score on nurses' recognition and response to clinical deterioration in US, who found the simulation based intervention significantly improved nurses' knowledge.

The present study clarified that more than two third of nurses through post program implantation had statistical significant increase in nurses' level of knowledge regarding Rapid Response Code in study sample. This might be due to nurses receiving motivation and knowledge regarding Rapid Response Code. Similarly **Pamela, & Jenkins, (2013)** in study titled Nursing Students' Clinical Judgment Regarding Rapid Response The Influence of a Clinical Simulation Education Intervention in UK, who found that nursing students who received the innovative education intervention had significantly higher posttest scores.

Also, the present study clarified that more than two third of nurses through post program implantation had statistical significant increase in nurses' level of knowledge regarding EWS in study sample. This could be that nurses had more knowledgeable regarding EWS. Agreed with **Damayanti et al., (2019)** in a study Effects of Early Warning Score (EWS) Tutorial Simulation on Nurses' Knowledge and Clinical Performance in Indonesia, who present that EWS tutorial simulation can be used as one of the training methods to increase nurses' knowledge and clinical performance in EWS.

In addition, the present study clarified that more than two third of nurses through post program implantation had statistical significant increase in nurses' level of knowledge regarding RRT in study sample. This might be that nurses had more knowledgeable regarding RRT. Similarly with

Shirley, (2017) in his study Rapid response teams in UK, that the nurses had knowledge and believe that RRTs are helpful in managing sick patients post the study.

On the contrary **Azimirad et al., (2020)** in a study Nurses' ability to timely activate rapid response systems for deteriorating patients: A comparative case scenario study between Finnish and British nurses in Finland, who found that identified gaps in nurses' knowledge in management of deteriorating patients and case scenarios was suboptimal.

Concerning Nurses' Practices about Rapid Response Code Parameters, The present study clarified that less than quarter of nurses through pre program implantation hadn't practice regarding Rapid Response Code in study sample. This might be due to lack of education and training regarding Rapid Response Code. This agreed with **Tilley, & Spencer, (2021)** in study titled Perceived Barriers to Rapid Response Team Activation among Nurses in Canada, who present that Eight barriers were identified as having an impact on RRT activation, Suggestions for overcoming these barriers include RRT education for nurses and physicians.

The present study clarified that more than half of nurses through post program implementation in study sample had significant increase in their level of practices regarding Rapid Response Code Parameters. This could be a result that nurses become more knowledgeable and trained about Rapid Response Code Parameters. Congruently **Jensen, & Skår, (2017)** who conducted study about the impact of Early Warning Score and Rapid Response Systems on nurses' competence in US, who found in his study the impact of the early warning score and rapid response systems on nurses' competence in identifying and managing deteriorating patients is beneficial.

The present study clarified that more than half of nurses through post program implementation in study sample had significant increase in their level of practices regarding Pre procedure, HR, GCS and post procedure. This could be a result that nurses were good applied what they learned about Rapid Response Code Parameters / vital signs. Supported by **Areia et al., (2022)** who present in a study about experiences of current vital signs monitoring practices and views of wearable monitoring in US, found that nurses described using several strategies to investigate and troubleshoot potentially erroneous vital signs readings related to patient condition and when they were worried about accuracy, they described instinctively returning to manual measurements to ensure the data were reliable.

This disagree with **McGaughey et al., (2017)** in a study about Early warning systems and rapid response to the deteriorating patient in hospital in UK, showed that nurses had a negative implementation of the Rapid Response System, resulting from ward cultures, workload and staffing resources.

Concerning the Nurses' Attitude about Rapid Response Code, present study clarified that more than half of nurses through post program implementation in study sample had positive attitude regarding Rapid Response Code. This might be a result that nurses become more aware with the importance of Rapid Response Code. This approach is also supported by **Loisa et al., (2021)** who conducted study about Rapid response team nurses' attitudes and barriers to the rapid response system

in Finland, found that RRT nurses consider their RRT work meaningful and think that RRT nurse duties have improved their critical care skills.

The present study clarified that majority of nurses through post program implementation in study sample had positive attitude regarding Inpatient unit nurses have a great role in avoiding cardiopulmonary arrest. This might be a result that nurses become more aware with the importance of Rapid Response Code. This approach is also supported by **Ko et al., (2021)** who conducted study about Staff perception and attitudes towards a medical rapid response team with a multi-tiered response in Singapore, found that RRT users continue to acknowledge the important role that the ward team can play in the RRS and reducing IHCA.

The present study clarified that more than half of nurses through post program implementation in study sample had positive attitude regarding Early detection of the warning signs is essential. This might be a result that nurses become more aware with the importance of EWS. This agreed with **Thomas et al., (2020)** who conducted study about Identifying predictive factors of rapid response/code blue in US, found that nurses reported that an increased heart rate, and an increased respiratory rate are all statistically significant predictors that contribute to acute patient deterioration up to 12 hours before an RRT or code blue occurs.

Concerning the cardiac arrest, the results of this study clarified that total arrested cases in last month / total inpatient critical cases had statistically significant reduced through post program implementation were noticed. This finding agreed with **Custo, and Trapani, (2020)** in his study the impact of rapid response systems on mortality and cardiac arrests in Malta, who found that rapid response systems significantly decrease mortality and cardiac arrests.

As well, **Lee et al., (2019)** in a study Effect of a rapid response system on code rates and in-hospital mortality in medical wards in South Korea, found that Implementation of an RRS was associated with significant reductions in code rates during RRS operating times and in-hospital mortality in medical wards. Also, (**Rose et al., 2016**) in his study Effectiveness of rapid response teams on rates of in-hospital cardiopulmonary arrest and mortality in US, found that Implementation of an RRT/MET is associated with a reduction in both hospital mortality and non-ICU cardiopulmonary arrests.

This disagree with **Zeb, (2021)** in study titled Effects Of Rapid Response Teams on Patient Outcomes After Nursing Education in UK, illustrated When analyzing the number of rapid response calls, showed significance in the number of rapid response calls after nursing education, but There were no significant results in the data regarding improvement in cardiac arrest rates after nursing education.

Concerning the relation between the Nurses' knowledge and ICU experience regarding Rapid Response Code, present study clarified that majority of nurses that haven't ICU Experience through post program implementation in study sample had significant increase in level of their knowledge. This might be a result that nurses become more knowledgeable about Rapid Response Code. Agreed with **Dwyer et al., (2022)** who conducted study about Critical Care Resource Nurse Team (CCRNT)

in US, that the CCRNT supports 24/7 RRT, Code Blue, simulation team training, and bedside nurse support and mentoring.

Also, Agreed with **Danis, (2019)** who conducted study Role of Rapid Response Nurses in Improving Patient Safety in US, that EWS may be missed by nurses on a medical/surgical floor who may have less experience with clinically declining patients, Patient prognosis continues to decline as the number of abnormal physiological parameters increase.

Concerning the correlation between the Nurses' knowledge and practices, between Nurses' knowledge and attitude, between Nurses' Practices and attitude regarding Rapid Response Code had strong significant relation through post program implementation in study sample. This might be a result that nurses become more knowledgeable, Caution and appreciate Rapid Response Code. Agreed with **Danis, (2019)** who conducted study about The Role of Rapid Response Nurses in Improving Patient Safety in US, that hospital RRT implementation is now a Joint Commission requirement, that enabled nurses achieve clinical and leadership competency when transitioning into the RRT role.

Similarly **Warren et al., (2021)** in his study Impact of a modified early warning score on nurses' recognition and response to clinical deterioration in US, who found The simulation based intervention significantly improved nurse knowledge, self-confidence and Chart reviews found increase in nurse action taken in response to signs of clinical deterioration.

Conclusion:

On the light of the current study results, it can be concluded that, the studied nurses had an improvement in their level of performance (knowledge, practice and attitude) post program implementation, as there was a distinguished satisfactory level of inpatient nurses' level of knowledge and competent level of practice regarding rapid response code after the educational program implementation. Furthermore, there was obvious reducing in cardiopulmonary arrest at inpatient unit.

Recommendation:

- Adequate education and training for increasing awareness of Nurses regarding Rapid Response Code on prevention cardiopulmonary arrest.
- Periodic evaluation and validation of the training given, and training programs should be included both theoretical and practical.
- Empower and motivate nurses to adhere to Rapid Response Code Guidance.
- Further studies are necessary to identify the effects of Rapid Response Code application via electronic system.

References:

1. **Areia, C., King, E., Ede, J.,Young, L., Tarassenko, L., Watkinson, P and Vollam, S., (2022):** Experiences of current vital signs monitoring practices and views of wearable monitoring. *Journal of Advanced Nursing*; 78 (3), PP: 810-822.

2. **Azimirad, M., Magnusson, c ., Wiseman, A., Selander , T., Parviainen, L., Turunen, H., (2020):** Nurses' ability to timely activate rapid response systems for deteriorating patients. Available at: sciencedirect.com/science/article/abs/pii/S0964339720300744. Accessed on 14/01 / 2022 at 3 am.

3. **Bellomo, R., (2018)**: Rapid response teams, *ICU Management & Practice*; 18 (2), PP:(92 - 96).

4. **Custo, R., and Trapani, J., (2020):** The impact of rapid response systems on mortality and cardiac arrests. *Intensive and Critical Care Nursing*; 59. Available at: pubmed.ncbi.nlm.nih.gov/32253121/ Accessed on 14/01 / 2022 at 1 am.

5. **Damayanti, R., Trisyani, Y and Nuraeni, A., (2019):** Effects of Early Warning Score (EWS) Tutorial Simulation on Nurses' Knowledge and Clinical Performance. Nurse Media Journal of Nursing; 9 (2), PP: 273-238.

6. **Danis, C., (2019):** The Role of Rapid Response Nurses in Improving Patient Safety. *Master of Science Thesis*; University Of California, US. PP: 25-26.

7. **Difonzo, M., (2017):** Rapid Response Systems: how to interpret levels of evidence. *Clinical Management Issues;* 11 (2), PP: 71-88.

8. **Dobuzinsky, A., (2017):** The role of the bedside nurse during a rapid response call. *MedSurg Nursing*; 26 (2), PP 4-5.

9. **Dwyer, C., Scanlon, K., and Crimlisk, J., (2022):** Critical Care Resource Nurse Team. *Dimensions of Critical Care Nursing;* 41 (1), PP: 46-53

10. **Fitzgerald, L., (2021):** Nurses' Experiences with Activating Rapid Response Teams: A Qualitative Study. *Queen's University Kingston;* Canada, PP: 1-2.

11. **Hogan, H., Hutchings, A., Wulff, J., Carver, C., Holdsworth, E., Nolan, J., Welch, J., Harrison, D and Black, N., (2020):** Type of Track and Trigger system and incidence of in-hospital cardiac arrest: an observational registry-based study. BMC Health Services Research; 20 (885), PP: 2-9.

12. **Jensen, J., and Skår, R., (2017):** The impact of Early Warning Score and Rapid Response Systems on nurses' competence: An integrative literature review and synthesis. *Journal of Clinical Nursing;* 27 (7-8), PP: 1256-1274.

13. **Ko, J., Ng, L., Goh, K., Chai, H., Phua, G and Tan, Q., (2021)**: Staff perception and attitudes towards a medical rapid response team with a multi-tiered response. *Singapore Medical Journal;* PP: 1-23

14. **Lee. H., Lee, J., Lee, S., Kim,S., Yang, E., Lee, H., Lee, H., Ryu, H., Oh, S., Ha,E.,   Ko, S and Cho, J., (2019):** Effect of a rapid response system on code rates and in-hospital mortality in medical wards. *Acute Crit Care.* 34(4), PP: 246–254.

15. **Loisa, E., Hoppu, S., Hytönen, S and Tirkkonen, J., (2021):** Rapid response team nurses' attitudes and barriers to the rapid response system: A multicentre survey. Acta Anaesthesiol Scand. 65 (5), PP: 695-701.

16. **McGaughey, J., O'Halloran, P., Porter, S., Trinder, J and Blackwood, B., (2017):** Early warning systems and rapid response to the deteriorating patient in hospital: A realist evaluation. *Journal of Advanced Nursing*; 73 (12), PP: 2-3.

17. **Mitchell, J., Motschwiller, C., Horowitz, J., Friedman, O., Nichol, G., Evans, L and Mukherjee, V., (2019):** Rapid Response and Cardiac Arrest Teams: A Descriptive Analysis of 103 American Hospitals. *Critical Care Explorations;* 1 (0031), PP: 2-7.

18. **Nagarajah, S., Krzyzanowska, M and Murphy, T., (2022):** Early Warning Scores and Their Application in the Inpatient Oncology Settings. *American* Society of Clinical Oncology;available at: DOI https://doi. org/10.1200/OP.21. 00532. Accessed on 04/02/2020 at 4 pm.

19. **Olsen, S., Søreide, E and Hansen, B., (2022):** Hospital Rapid Response System. *Journal of Patient Safety;* 00 (00), PP: 1-6.

20. **Pamela, L.,   and Jenkins, S., (2013):** Nursing Students' Clinical Judgment Regarding Rapid Response: The Influence of a Clinical Simulation Education Intervention. *Nursing Forum*; 48 (1), PP: 61-70.

21. **Peter A., Michael T., Kher, H., Deutsch, J., and Daya, S. (2015):** Improving Resident Performance Through a Simulated Rapid Response Team. *The Journal of the American Osteopathic Association*; 115 (7). Pp: 444-450.

22. **Peter, M., Seely, a., Fernando, S., Didcote, S., Strachan, L., Baudino, J and Kyeremanteng, K.,(2021):** Can Early Warning Systems Enhance Detection of High Risk Patients by Rapid Response Teams?. *Journal of Intensive Care Medicine;* 36 (5), PP: 542-549.

23. **Rashid, M., et al., (2014):** Evaluation of rapid response team implementation in medical emergencies. *International Journal of critical illness and injury science*; 4(1). Pp: 3-9.

24. **Rawia AI, Kamelia FA, Osama SA, Sabah SM., (2017):** Effect of nursing care standards on nurses' performance in caring for patients with cardiac arrhythmias. Egyptian Nursing Journal. 14(3), Pp: 251-258.

25. **Shirley, A., (2017):** Rapid response teams. Nursing Critical Care; 12 (6), PP: 16-23.

26. **Thomas, B., Knapp, H and Patmon, F., (2020):** Identifying predictive factors of rapid response/code blue. *Research square.* PP: 2-9.

27. **Tilley, M and Spencer, k., (2021):** Perceived Barriers to Rapid Response Team Activation among Nurses. *American Journal of Nursing;* 120 (7), PP: :52-60.

28. **Viana, M., Nunes, D., Teixeira, C., Vieira, S., Torres, G., Brauner, J., Müller, H., Butelli, T and Boniatti, M., (2021):** Changes in cardiac arrest profiles after the implementation of a Rapid Response Team. *Rev Bras Ter Intensiva;* 33 (1), PP: 96-101.

29. **Warren, T., Moore, L., Roberts, S and Darby, L., (2021):** Impact of a modified early warning score on nurses' recognition and response to clinical deterioration. Journal of Nursing Management; 29 (5), PP: 1141-1148.

30. **Zeb, A., (2021)**: Effects of Rapid Response Teams on Patient Outcomes After Nursing Education. Doctor of Nursing Practice thesis, Pittsburg State University; UK, PP: 2-3.