Early Warning Score (EWS) Education: its effect on Nurses' Performance Regarding Identification and Response to Clinical Deterioration

Mona Nadr Ebraheim[(1)], Gehan Karawan Sayed Sallam[(2)] Shady Samir AbdelHamid Ghait[(3)], Tarek Mahmoud Shaker [(4)]

(1) Assistant professors of Medical Surgical Nursing, Faculty of Nursing - Ain Shams University, Egypt
(2) PhD Medical Surgical Nursing -Ain Shams University, Egypt
(3) Lecturer of Internal Medicine and Gastroenterology and Hepatology Faculty of Medicine- Ain Shams University, Egypt
(4) Lecturer of Medical Surgical Nursing, Faculty of Nursing -Mansoura University, Egypt
Corresponding author: Mona Nadr Ebraheim E –mail: dr.mona.nadr@nursing.asu.edu.eg

Abstract

Background: Early warning score (EWS) systems have been developed to support ward nurses by aiding in identification of clinical deterioration at earlier stages. Nursing education regarding EWS was expected to reduce the knowledge deficit about the application of the EWS and improve their practice to maintain patient safety. **Aim of the study**: This study aimed to evaluate the effect of EWS education on nurses' performance regarding identification and response to clinical deterioration. **Design**: A Quasi experimental research design pre/post intervention was used. **Setting**: The study sample was recruited from the medical departments affiliated to Ain Shams University Hospital and Mansoura University hospitals. **Subjects**: Convenient sample of all available nurses (76) working in medical departments affiliated to Ain Shams University Hospital and Mansoura University Hospitals. **Tools:** I-A nurses self-administered structured questionnaire, II-Nurses' clinical case scenario exam sheet and III-Nurses' Observational Checklist, IV: Nurses' satisfaction scale. **Results:** There was highly statistically significant increase of the total mean scores of total knowledge at post-intervention phase compared to pre-intervention phase ($t = 38.447$ & $p < 0.001$). The total mean score of post-test of clinical scenario exam regarding early warning score system indicate highly statistically evident increase of at post-intervention phase as compared to pre-test score ($t = 62.445$ & $p < 0.001$). Also, there is highly significant increase of total satisfactory level of nurses' practice at pre - and post-intervention phase ($X = 18.414$ & $p < 0.001$). In addition, 67.1% of the nurses under study reported their satisfaction regarding EWS program. **Conclusion:** There was significant improvement of studied nurses' performance regarding identification and response to clinical deterioration due to positive effect of EWS educational program intervention. Also, satisfaction concerning EWS educational program was reported sufficiently among studied nurses after program intervention. **Recommendations:** Nurses' compliance with EWS system and clinical deterioration training should be periodically assessed and validated.

Keywords: Clinical deterioration, Early warning scoring system and Nurses' performance.

Introduction

The Early Warning Score (EWS) system is a bedside tool designed to detect physiological deterioration early by obtaining numerical values of physiological parameters, the results of which can be used to assess the patient's condition. EWS can predict who is at risk for critical illness. Implementation of EWS has so far not been optimal due to barriers such as lack of understanding of physiological deterioration and slow recognition by staff, resulting in deterioration of patients' clinical status, which is related to the level of knowledge and understanding of EWS; failure to complete and measure reliable vital signs, EWS score calculation error **(Damayanti et al., 2019).**

Parameters including level of consciousness, heart rate, oxygen saturation, respiratory rate, systolic blood pressure, and temperature, with each parameter scored from 0 to 3. The sum of these parameters gives the total EWS value. In accordance with the EWS algorithm, the nurse contacts the rapid response team (RRT) when needed, tells the doctor or physician assistant, and checks the patient more regularly. EWS helps nurses anticipate the prognosis of a patient, avoid cardiac arrest, and reduce transfer of patient to higher levels of care (**Janakaraj, 2020**).

Early warning systems were developed to improve the assessment and documentation of vital signs in the hospital setting by introducing a unified, standardized concept on a national basis. It also provides a standardized observation system and continuity of patient care between wards. Which in turn, particular attention can be seen early by a specialized team, reducing the potential risk for adverse events **(Badr et al., 2021).**

Early warning score is also a technique for asses nursing identification and response to patient deterioration, translating research into practice to improve patient safety (**Massey et al., 2017**).

One of the main objectives of health professionals worldwide is to identify clinical deterioration early in order to minimize the problems that arise from failing to perform a rescue. Nonetheless, there is enough proof that hospital responses to clinical deterioration are typically inadequate **(Bucknall et al., 2022).**

Delays in appropriate management and poor detection of clinical deterioration result from failing to identify that a patient's condition is deteriorating in the hospital setting. This condition is often characterized by significant physiological abnormalities for over 24 hours and manifests clinically as disturbances in vital signs. Such deteriorating physiology is linked to major adverse events that result in critical illnesses, prolonged hospital stays, and major impairments or incapabilities. These delays are linked to cardiac arrests, unanticipated deaths, and unscheduled admissions or readmissions to the intensive care unit (ICU) **(Connell et al., 2021).**

Early detection of signs of patient deterioration is important to decrease the rate of mortality and preventable morbidity, as well as length of hospital stay, thereby reducing healthcare costs. Nursing staff are the first point of contact with patients and often remain with them. Nurses always need the skills to accurately assess the extent of deterioration. They play a key role in EWS application. Hence, education, training, and demonstrated competency in the EWS implementation should be mandatory for all healthcare professionals involved in acute patient assessment and monitoring (**Alseraty, 2022**).

Nonetheless, the significance of detecting patient deterioration among patients in hospital wards will increase as the patients who had associated disease comorbidities and who need complex care. The EWS system must be improved and enhanced to meet complicated care demands and ensure patient safety, but little is known about nurses' knowledge, awareness, and experiences with this system. Nurses' knowledge and skills regarding EWS is crucial since the efficiency of such a system depends on their users **(Langkjaer, 2021)**.

Significance of the study

Patient safety has become an important issue in worldwide healthcare. Unexpected clinical deterioration in hospital departments with increased inpatient complexity has received significant attention. Approximately 1 in 30 inpatients met the criteria for calling a rapid response team at a single set of vital signs. Over 20.0% of in-patient's hospital ward with no or low risk of deterioration on admission experienced deteriorating conditions needing escalated care at 24 hours after admission **(Hwang & Kim, 2022)**.

Early identification and prevention of clinical deterioration in hospitalized patients is an important aspect of patient evaluation. Nurses need cognitive and practical skills to accurately assess the severity of patient deterioration in order to intervene early and effectively and prevent deterioration of the patient's condition. Any delay for early recognizing and effectively managing patients' clinical deterioration signs can raise incidence of patients' poor prognosis and even death. Furthermore, nurses may not be aware of abnormalities in vital signs in approximately 50% of patients on general wards, because they have difficulty coping with time pressure and work interruptions during working hours **(Hogan et al., 2020; Warren et al., 2021)**.

Early Warning Scoring System is a standardized system for the education, training, and credentialing of healthcare members. Nurses play a crucial role in implementing EWS **(Langkjaer et al.,2021).** Although a positive effect of clinical education with EWS on nurses' ability to identify, respond and manage clinical deterioration, few studies in Egypt was conducted concerning this topic. Therefore, the goal of this study was to design and implement educational programs regarding early warning score to improve nurses 'performance regarding

identification and response to clinical deterioration of the patient in hospitals.

Aim of the Study

This study aims to evaluate the effect of Early Warning Score (EWS) education on nurses' performance regarding identification and response to clinical deterioration through the following.

1. Assess nurse's knowledge, regarding EWS system and clinical deterioration of the patient.
2. Assess nurse's practice regarding identification and response to clinical deterioration of the patient using EWS system.
3. Design and implement educational programs regarding EWS system to improve nurses 'performance regarding identification and response to clinical deterioration of the patient.
4. Evaluate the effect of educational programs on nurses' performance regarding identification and response to clinical deterioration of the patient using EWS.
5. Assess nurses' satisfaction regarding EWS educational intervention.

Research hypotheses:

- H1. The current study hypothesized that nurses' knowledge regarding identification and response of clinical deterioration of patient using EWS system will increase significantly after EWS education.
- H2. The current study hypothesized that nurses' practice regarding identification and response of clinical deterioration of patient using EWS system will increase significantly after EWS education.
- H3. Nurses' satisfaction regarding EWS education will be reported sufficiently among studied nurses after educational program intervention.

Operational definitions:

- **Clinical deterioration:** It means that the patient moves from one clinical state to a worse clinical state, increasing their risk of disease, organ failure, prolonged hospital stay or death.
- **Early Warning Score:** It was referred to as a bedside tool designed for early identification of physiological deterioration by determining numerical values of physiological parameters. It was used to measure a patient's breathing rate, oxygen saturation, body temperature, blood pressure, pulse/heart rate, as well changes or deterioration in level of consciousness.
- **Performance:** It means knowledge and practice of the nurses regarding early warning score identification and response to clinical deterioration.
- **Response:** Identifies when the nurse takes action to respond to early signs of clinical deterioration according to EWS. This action was identified according to risk level based on physiological parameter measurement.

Subjects and Methods:

This study was portrayed under the four main designs as follows:

I. Technical design.
II. Operational design.
III. Administrative design.
IV. Statistical design.

I. <u>Technical design</u>:

The technical design includes research design, setting, subjects and tools for data collection.

<u>Research design:</u>

A Quasi experimental research design pre/post intervention was used. One-group pre-posttest is one of the most frequently used quasi-experimental research designs in which a single group of research participants is pretested, given some intervention or independent variable manipulation, and then post tested **(Abraham & MacDonald, 2011).**

<u>Setting:</u>

The study sample was recruited from the medical departments affiliated to Ain Shams University Hospital and Mansoura University hospitals. These departments provide specialized medical care to ill patients from different specialties and co-morbidities such as hematological, cardiac, hepatic, gastroenterology, renal and oncology disorders, their clinical

outcomes may be hard to predict given variation in disease pathology, stage, and treatment options and they might have increased susceptibility to end-organ damage or death. In addition, the nursing staffing level in the general ward ranged between 6 to 9 patients per nurse in both settings. Those patients were at risk of clinical deterioration at medical wards due to their illness and due a significant decrease in nurse-to-patient ratios, that why the researchers select this setting to educate nurses how to identify and respond to patients at risk for clinical deterioration.

Subjects:

Convenient sample of all available nurses (76) working in medical departments affiliated to Ain Shams University Hospital (40 nurses) and Mansoura University Hospitals (36 nurses) and agreed to participate in this study.

Tools for data collection:

Three tools were used to collect data pertinent for this study. They included the following:

1-A nurses self-administered structured questionnaire

It is developed by researchers in an Arabic language based on review of recent and related literature and validated by a group of nine experts. It included the following parts:

a. **Part I** addressed the demographic characteristics of nurses under study including age, marital status, qualifications, working hours, experience, in addition to their attendance of previous training regarding EWS.

b. Part II addressed the assessment of knowledge among studied nurses regarding patient's clinical deterioration and EWS. It was developed by researchers based on the related literature **(Royal collage of Physician, 2017; Alias & Ludin, 2021)**. It was assessed pre and post program intervention. It composed of 52 MCQ and true / false questions to assess nurses' knowledge regarding patient's clinical deterioration including definition (2 items) , causes (4 items) and clinical signs of patients' deterioration (4 items) , as well EWS including; EWS definition (3 items) , purposes and importance (2 items), components of EWS (physiological parameters including vital signs) (13 items) ,calculation of the score (7 items), scoring (13 items) and nurses' response (4 items).

c. Scoring system:

Regarding the knowledge items, a correct answer was scored one and the incorrect answer was scored zero. For each area of knowledge, the scores of the items were summed-up and the total score divided by the number of the items. These scores were converted into a percentage score. The total score was 52 grades and nurses' knowledge level was categorized as follows; poor knowledge if the score is < 60% (31 grades) and average knowledge if the score is 60- < 85% (31- < 44 grades) and good level of knowledge for those who had score ≥ 85% (≥44 grades).

II-Nurses' clinical case scenario exam sheet:

It was adapted from **Institute for Healthcare Improvement (IHI), (2018) and Hess (2020)** then, translated into Arabic language to assess nurses' ability to identify and respond to patients' clinical deterioration. The sheet includes five clinical scenario exams regarding different clinical deteriorations and each participant was directed to use the early warning score method to solve it, and the researchers checked their clinical scenario solutions. Each clinical scenario was equipped with 5 MCQ and true/false questions to evaluate participant' ability to identify early signs of clinical deterioration based on EWS (2 questions for each clinical scenario), calculate scoring of EWS (1 question) and choose appropriate response based on EWS system (2 questions). It was assessed pre- and post- program intervention.

Scoring system

Each correct answer was given one grade while incorrect or missed answer was given zero. The total score was 25 grades including 10 grades for identification of early signs of clinical deterioration based on EWS, 5 grades for calculation of EWS score and 10 grades for choosing appropriate response based on EWS system. The total score for each domain as well as for total knowledge was calculated to get mean scores.

III-Nurses' Observational Checklist: -.

It was developed by the researchers based on relevant literature (**Doyle, 2018 & Gerry et al., 2020)** to assess nurses' practice in clinical setting regarding implementation of EWS including checklists for measurements of physiological parameters (respiratory rate, oxygen saturation, temperature, systolic blood pressure, heart rate, level of consciousness), accurate calculation of early warning score (EWS) using EWS record sheet, checklists to assess the early manifestations of clinical deterioration accurately and assuming proper response to each deterioration based on EWS. The number of checklist items may be varied according to the case of clinical deterioration and its response. These checklists were checked before and after educational program intervention.

Scoring system

Every missed or improperly/incompletely done step received a zero, whereas properly completed steps received one grade. The scores for each observational checklist and total score for total practice were summed up and the total score divided by the number of the items. These scores were converted into a percentage score. It was categorized as following; ≥85 % was considered satisfactory while, < 85 % was considered unsatisfactory.

Tool IV: Nurses' satisfaction scale:

It was designed by the researchers after reviewing the related literature (**Ahmed et al., 2019 & Alseraty et al., 2022)** to assess nurses' satisfaction regarding Early Warning Score (EWS) education for deteriorated patient (It was used after the intervention), it was translated into Arabic language and back translated to English and it was consisted of 8 statements to inquire the satisfaction of studied nurses regarding significance of EWS implementation, theoretical content, practical content, methods of education and presentation, media used, educational booklet, evaluation methods and self-confidence regarding care of deteriorated patient.

Scoring system:

The responses for the items were rated on 3-point Likert scale including three responses; not satisfied = 1, somewhat satisfied, = 2 and satisfied = 3. It was considered that the higher the score the higher satisfaction level. The total score was 24 grades. Total level of satisfaction is categorized as satisfactory if score ≥ 70 % (≥17 grades) of the total score and it was considered unsatisfactory if score < 70% (<17 grades) of total score.

Nurses' educational Programs:

It was designed in accordance with previously determined needs of nurses discovered during the assessment process and reviewing related scientific literature. It includes theoretical and practical parts. Regarding the theoretical part, it covered theoretical knowledge about EWS definition, component and how to apply EWS system to save patients life, meaning of patients' clinical deterioration and signs of deterioration and nurses' response to clinical deterioration based on EWS system. The practical part covers the skill practice regarding measurements of physiological parameters in accurately and in a timely manner (respiratory rate, oxygen saturation, temperature, systolic blood pressure, heart rate, level of consciousness), accurate calculation of early warning score (EWS) using EWS record sheet, assessment of the early manifestations of clinical deterioration accurately and assuming proper response to each deterioration based on EWS. An Arabic booklet was distributed to nurses as a reinforcement tool for program content. The effectiveness of the program was evaluated by comparing the scores of knowledge and practice among nurses before and after program intervention.

Operational design:

It includes preparatory phase, tool validity and reliability, pilot study and field work.

Preparatory Phase

It includes reviewing the related literature and theoretical knowledge of varies aspects of the study using books, articles, and periodicals.

Validity and reliability:

Validity:

The tools were revised by a panel of Nine experts from medical surgical nursing specialty, Ain Shams, and Mansoura universities in addition to two medical staff (internal medicine specialty) from faculty of medicine, Ain shams university who reviewed the content of the tools for clarity, simplicity, accuracy, relevance and

comprehensiveness and the necessary modifications were done accordingly.

Reliability*:*

The Cronbach's alpha test was used to assess the study tool's reliability. The reliability test showed a marked significance values with 0.81 for tool (1) nurses self-administered structured questionnaire, 0.851 for tool (2) nurses' clinical case scenario exam sheet, 0.894 for tool (3) nurses' observational checklist and 0.765 for tool (4) nurses' satisfaction scale. All of Cronbach's alpha test values indicate good consistency of study tools.

Ethical Considerations:

Research approval was obtained from the Research Ethics Committee, Faculty of Nursing. Mansoura University with reference code number (0431) on 5/3/2023 as well as from the Scientific Research Ethics Committee, Faculty of Nursing. Ain Shams University with formal approval code number (23.04.54) on 15/3/2023. The researcher clarified the objectives and aim of the study to nurses included before starting. Oral consent was obtained from the nurses before starting the study; a clear and simple explanation was given according to their level of understanding. All participants were secured that all the gathered data was confidential and used for research purposes only. The nurses were informed that they were allowed to choose to participate or not in the study and have the right to withdraw from the study at any time without any consequences.

Pilot Study:

A pilot study was carried out on 10% (7 nurses) of the study subjects to test the feasibility and applicability of the study; as well as to estimate the time that was needed for each tool to be filled in. The modifications were done according to the results of the pilot study. Many modifications were made according to the results of the pilot study, hence, all nurses included in the pilot study were excluded from the study sample.

Field work:

Data collection for this study was conducted for a period of approximately four months extending from the mid of March 2023 to the end of June 2023. It was conducted in three phases: assessment and planning phase, implementation phase and evaluation phase.

Assessment and planning phase:

It was concerned with constructing the study tools, assessment of baseline data (pre-test), designing the nursing educational program, and setting the time plan to deliver the program's contents. The researchers started by obtaining a list of involved nurses in the morning and afternoon shifts from the monthly schedule. The process of data collection, assessment, program intervention and evaluation were done at both settings at the same time.

The selected study settings were visited, and nurses were met during their working shifts where the purpose and nature of the study were explained, and oral consents were obtained from those who agreed to participate in current study. What's app group that was held between the researchers and nurses under study to facilitate communication, deliver electronic link for study tools, plan for program sessions and answer any questions out of their working time at study settings. Then involved nurses were asked to fill out the study instruments (tool I, II, & IV). The researchers (the first and last one) in both settings introduced themselves to the nurses who shared in the study, explained the purpose of the study and methods of data collection. The researcher was available to clarify and answer any questions and to provide any needed explanations. Tools for data collection (tool I, II) either in hard or electronic copies consumed about 25- 35 minutes to be filled by each nurse.

The assessment of baseline data before program intervention was started with assessment of nursing practice using nurses' observational checklist. The researchers simultaneously in both study settings start with assessment of nurses' practice in clinical setting regarding EWS by indirect observation of studied nurses who were approached during their working shifts when caring for their assigned patients. Each nurse was observed how to measure and document vital signs and other physiological parameters in timely manner, to recognize early signs of deterioration through accurate observation of vital signs and calculation of EWS score and how to respond to each change using EWS system. The researchers fill the checklist using the electronic link to facilitate its data entry. Knowledge

regarding patient's clinical deterioration and EWS was assessed using self-administered structured questionnaire. The questionnaire was distributed to the studied nurses either via paper copy or via electronic link according to the time available to each nurse and their preference.

The researcher adapted clinical case scenarios as a significant tool to evaluate nurses' ability to identify early signs of clinical deterioration based on EWS, calculate scoring of EWS and choose appropriate response based on EWS system. Each participant was instructed to solve each clinical scenario exam through using an EWS , then their solutions were evaluated by the researchers. It was assessed prior to and after educational program intervention. The clinical scenario exam was available for study participants in hard and electronic copies. Baseline data assessment took approximately 2 weeks to be accomplished.

According to assessment baseline data, nurses 'needs were identified, the researcher developed an educational program after reviewing the relevant literature to cover both theoretical and practical parts regarding identification and response to clinical deterioration based on EWS system. The content of the program and booklet was reviewed by a panel of seven medical surgical nursing professors to validate the content of the program and attached Arabic booklet.

Implementation phase:

All nurses under study in both study settings simultaneously were divided into 5-6 groups. Each group includes 5-6 nurses. The educational program intervention was discussed in 6 sessions and each session consumed from 30 to 45 minutes. Each session includes five to six nurses. Pre-determined meeting was made with assigned nurses according to their time schedule and working shifts at nursing office. Many teaching-learning strategies were used such as small lecture, small group discussion, clinical scenario-based learning, demonstration and redemonstration of practical skills, video monitoring and zoom meeting.

The first session was for discussing program aim, content, time plan, and pretest exam. The second session was assigned to theoretical content including knowledge regarding patient's clinical deterioration including definition, causes, and clinical signs of patients' deterioration, the third session covered the knowledge regarding EWS including EWS definition, purposes, importance, components of EWS (physiological parameters including vital signs), calculation of the score, scoring and nurses' response.

Fourth and fifth sessions were designed for demonstration and redemonstration of all practical parts of the intervention. It includes accurate measurements of physiological parameters (respiratory rate, oxygen saturation, temperature, systolic blood pressure, heart rate, level of consciousness), accurate calculation of early warning score (EWS) using EWS record sheet, assessment of the early manifestations of clinical deterioration accurately and assuming proper response to each deterioration based on EWS. The clinical scenarios were designed as an effective teaching strategy to train nurses about identification of early signs of clinical deterioration based on EWS, calculation of EWS score and choosing appropriate response based on EWS system. The sixth session was used to summarize the program content, answer participants' questions, post-test exam, and ending the study. WhatsApp chat, zoom meeting and Arabic booklet were used to reinforce information and answer the participant's question.

Nurses' satisfaction scale was delivered to nurses under study after educational program intervention. It was available in hard and electronic copies. It took 5-10 minutes to be fulfilled by study participants.

Evaluation phase:

The effectiveness of educational program about EWS and clinical deterioration was evaluated by reassessing nurses' knowledge and practices immediately after the program intervention using study tools (I, II, III). Nurses' satisfaction was assessed among nurses under study after educational program intervention using study tool IV.

III. Administrative design:

An official approval with a written letter, clarifying the purpose and setting of the study was obtained from the dean of the faculty of nursing, Ain shams university.

IV. Statistical design:

Statistical presentation and analysis of the present study was conducted, using the mean, standard deviation, paired T-test was used to compare between related sample quantitative data, chi-square test was used to compare between groups in qualitative, linear correlation coefficient was used for detection of correlation between two quantitative variables in one group. by (IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.). As regards P value significance, it was set < 0.05 for significant results and <0.001 for high significant result. Non-significant p-values were considered >0.05.

Results

Table (1) illustrates that there is no statistically significant variation noticed concerning demographic characteristics of nurses affiliated to both of Ain Shams & Mansoura hospitals. 47.4 % of participant nurses, their age group ranged between 20-30 years old, and 44.7% of them aged 30:40 years. Concerning gender, 67.1% of the nurses were female. According to nurses' qualifications, 43.4% of nurses is diploma nursing. 67.1% of nurses are married. In addition to, 56.6% of the nurses reported from 50 to less than 10 years of experience. Moreover, nurse to patient ratio ranged between 7-9 to each nurse in both study settings with non-statistically significant variation was detected between them (X=0.77 & p= 0.516). Finally, no nurses reported previous training about clinical deterioration or using EWS. No statistically significant variation was found between participant nurses in both study setting regarding demographic characteristics or either their attendance of training courses regarding clinical deterioration or using EWS (p >0.05).

Table 2 clarifies that there is highly significant increase of nurses' knowledge regrading clinical deterioration (definition, causes, early signs and symptoms) since 32.9% of nurses have average knowledge at post-intervention phase compared to 17.1% of them at pre-test, also, none of nurses had good level of knowledge regarding previously mentioned topic at pre-test compared to 59.2% during post-test with highly statistically significant difference was found (X=95.876 & p <0.001).

As regards knowledge about early warning score system (meaning, components, calculation, and response), it is noticed that there is highly significant increase of nurses' knowledge since none of nurses had average or good during pre-test compared 36.8 and 54 % of them got average and good level at post-intervention phase respectively (X=126.361 & p <0.001). Moreover, a highly statistically evident increase of the total mean scores of knowledge at post-intervention phase compared to pre-intervention phase (t =38.447 & p <0.001).

Table 3 shows highly significant variation among post-test and pre-test (t =31.946 & p <0.001) concerning identification of early signs of clinical deterioration based on EWS, since the mean score during pre-test and post-test are (2.65±1.06) and (8.6±1.23) respectively. As regards calculation of EWS mean score, the post-test mean score is 8.24±2.07 compared to 1.05±0.72 for pre-test score with highly statistically evident differences (t =28.600& p <0.001). Furthermore, concerning choosing appropriate response based on EWS system the mean score during pretest compared to post test is 0.87±0.43 and 7.98±1.87 respectively which show highly statistically significant difference between them. Finally, the total mean score of post-test of clinical scenario exam regarding clinical deterioration and early warning score system indicate highly statistically evident increase of at post-intervention phase as compared to pre-test score (t =62.445 & p <0.001).

Table 4 illustrates that there is highly significant increase of total satisfactory level of nurses' practice concerning identification and response of clinical deterioration and early warning score system at post-intervention phase as compared to pre- intervention phase (X=32.832 & p <0.001). The findings illustrate that 57.9 % of the studied nurses have satisfactory level of practice regarding measurements of physiological parameters in a timely manner at post-intervention phase compared to 23.7 % at pre-intervention phase with highly statistically evident variation at p <0.001. Furthermore, compared to 15.8% of nurses under study during the pre-intervention period, 46.1% of nurses had a satisfactory level of practice regarding identifying the early signs of clinical deterioration during the post-intervention phase. In addition, 47.4 % of the nurses under study have satisfactory practice after program intervention concerning calculation of EWS compared to 0% before program intervention. Finally, 38.2 % of the nurses have

satisfactory practice after program intervention concerning proper response to each deterioration compared to 0% before program intervention.

Table 5 clarifies the nurse's satisfaction regarding early warning score post educational intervention, 85.5 % of the nurses under study agree concerning significance of early warning score implementation, 73.7% and 78.9 % of them agree concerning both of relevance of theoretical and practical content respectively. In addition, 75% of the nurses reported their agreement about methods of education and presentation. In relation to self- confidence regarding care of deteriorated patients, 40.8 % of the nurses reported their disagreement regarding this issue. Finally, 46.1% of the nurses were to somewhat agree about the applicability of EWS educational intervention.

As illustrated from figure (1), it was found that 67.1% of the nurses under study reported their satisfaction regarding EWS educational program at post intervention phase, meanwhile 32.9% of them were not satisfied.

Table 6 clarifies that there is a positive highly significant correlation among studied nurses practice and both of knowledge and clinical scenario exam scores at pre-intervention phase (r=.0.384, 0.317respectively & p <0.001). Also, there is a positive highly significant correlation among nurses 'practice scores and both of knowledge and clinical scenario exam scores during post-test phase (r=.0.755, 0.508 respectively & p <0.001).

Table (1): Percentage distribution of the studied nurses according to their demographic characteristics and their previous training (N=76).

Items	Ain shams University H. (n=40)		Mansoura University H. (n=36)		TOTAL (n=76)		Test	
	No	%	No	%	No	%	X^2	P-value
Age (years)								
• 20 - <30	21	52.5	15	41.7	36	47.4		
• 30 - <40	16	40.0	18	50	34	44.7	0.910	0.635
• ≥ 40	3	7.5	3	8.3	6	7.9		
Mean ± SD	27.2 ±3.25		26.87±4.13		27.04±3.61			
Gender								
• Male	11	27.5	14	38.9	25	32.9	1.113	0.291
• Female	29	72.5	22	61.1	51	67.1		
Qualifications:								
• Diploma nursing	18	45	15	41.7	33	43.4		
• Technical Nursing institute	13	32.5	11	30.6	24	31.6	0.742	0.863
• Bachelor's degree	5	12.5	4	11.1	9	11.8		
• Post-graduate degree	4	10	6	16.6	10	13.2		
Marital status:								
• Single	15	37.5	10	27.8	25	32.9	0.811	0.368
• Married	25	62.5	26	72.2	51	67.1		
Years of experience (years)								
• < 5	15	37.5	12	33.3	27	35.5		
• 5 - < 10	20	50	23	63.9	43	56.6	3.007	0.222
• +10	5	12.5	1	2.8	6	7.9		
• **Mean ± SD**	6.65 ± 2.13		6.81±3.12		6.73±2.7			
Nurse to patient ratio								
Ratio	1: 8-9		1: 7-9				0.77	0.516
Previous training courses about clinical deterioration or using EWS:								
• Yes	0	0	0	0	0	0	0.000	1.000
• No	40	100	36	100	76	100		

Non-significant>0.05

Table (2): Differences between pre- and post- program intervention level of knowledge regarding clinical deterioration and early warning score system among the studied nurses (N=76).

Level of knowledge	Pre-intervention n=76		Post-intervention n=76		Tests	
	NO	%	NO	%	t/X^2	P-value
Knowledge regarding clinical deterioration (definition, causes, early signs, and symptoms)						
▪ **Poor**	63	82.9	6	7.9	95.876	<0.001**
▪ **Average**	13	17.1	25	32.9		
▪ **Good**	0	0	45	59.2		
Knowledge regarding Early Warning Score system (meaning, components, calculation, and response)						
▪ **Poor**	76	100	7	9.2	126.361	<0.001**
▪ **Average**	0	0	28	36.8		
▪ **Good**	0	0	41	54		
Total mean scores (Min-Max.)	5.98± 1.45 (4-17)		38.63 ±7.26 (24-48)		38.447	<0.001**

High significant <0.001**

Table (3): Differences between pre- and post- program intervention total mean scores of clinical scenario exam regarding clinical deterioration and early warning score system among the studied nurses (N=76).

Items	Pre- n=76	Post n=76	Paired t-test	
	Mean ± SD (Min-Max.)	Mean ± SD (Min-Max.)	t	P-value
▪ Identification of early signs of clinical deterioration based on EWS	2.65±1.06 (0-5)	8.6±1.23 (4-10)	31.946	<0.001*
▪ Calculation of EWS score	1.05±0.72 (0-3)	8.24±2.07 (2-5)	28.600	<0.001*
▪ Choosing appropriate response based on EWS system	0.87±0.43 (0-3)	7.98±1.87 (5-10)	32.303	<0.001*
▪ Total score	1.56 ±0.71 (0-6)	19.9±2.46 (10-25)	62.445	<0.001*

High significant <0.001**

Table (4): Differences between pre- and post- program intervention level of practice regarding identification and response of clinical deterioration and early warning score system among the studied nurses (N=76).

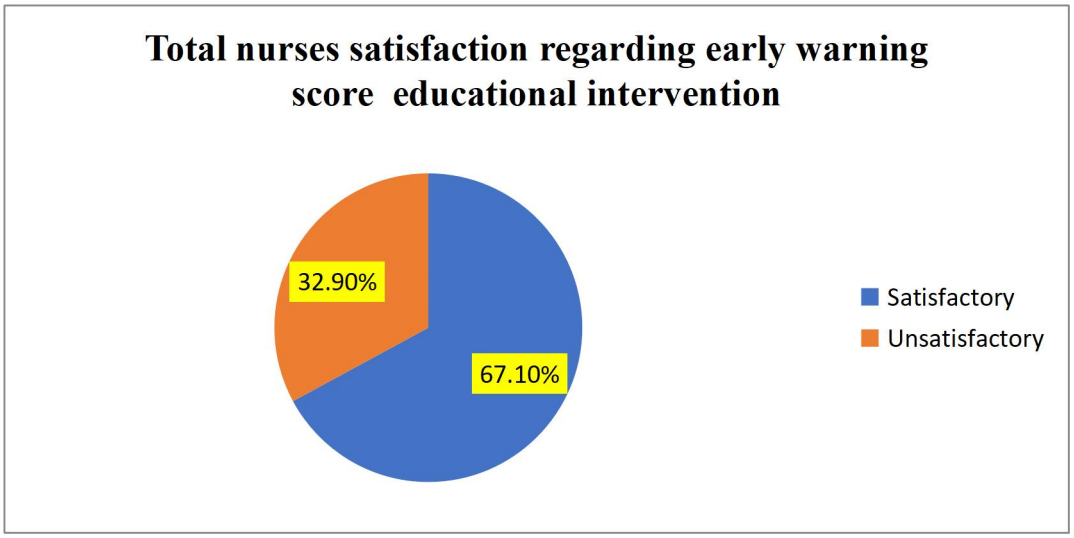
Items	Satisfactory level Pre- n=76		Satisfactory level Post n=76		Chi-square	
	NO	%	NO	%	X^2	P-value
▪ Measurements of physiological parameters in a timely manner	18	23.7	44	57.9	18.414	<0.001**
▪ Identification of the early manifestations of clinical deterioration.	12	15.8	35	46.1	16.293	<0.001**
▪ Calculation of EWS score	0	0	36	47.4	47.172	<0.001**
▪ Proper response to each deterioration	0	0	29	38.2	35.837	<0.001**
▪ **Total**	0	0	27	35.5	32.832	<0.001**

High significant <0.001** ≥85 % was considered satisfactory.

Table (5): Distribution of studied nurses according to their reported satisfaction regarding EWS education after program intervention (N=76).

Items	Agree		To somewhat Agree		Disagree	
	NO	%	NO	%	NO	%
▪ Significance of EWS implementation	65	85.5	11	14.5	0	0.0
▪ Relevance of theoretical content	56	73.7	20	26.3	0	0.0
▪ Relevance of practical content	60	78.9	13	17.1	3	3.9
▪ Methods of education and presentation	57	75.0	19	25.0	0	0.0
▪ Effectiveness of educational booklet and other media used	63	82.9	13	17.1	0	0.0
▪ Evaluation methods	48	63.2	20	26.3	8	10.5
▪ Self-confidence regarding care of deteriorated patient.	25	32.9	20	26.3	31	40.8
▪ Applicability	22	28.9	35	46.1	19	25.0

Figure (1): Total satisfaction regarding Early Warning Score (EWS) educational program among studied nurses after program intervention (N=76).



Satisfactory level if of the total score ≥ 70 %

Table (6): Correlations between the studied nurses' knowledge, clinical scenario exam scores and practice regarding identification and response of clinical deterioration and early warning score system at pre - and post-program intervention (N=76).

	Knowledge		Clinical scenario exam scores	
	r	P-value	r	P-value
Pre-program intervention phase				
Clinical scenario exam scores	0.427	<0.001**		
Practice	0.384	<0.001**	0.317	<0.001**
Post-program intervention phase				
Clinical scenario exam scores	0.401	<0.001**		
Practice	0.755	<0.001**	0.508	<0.001**

*Statistically significant at P≤0.05 ** highly statistically significant at P≤0.01 Not significant at P>0.05

Discussion:

Early warning systems are extensively used, and research indicates that using EWS enhances the identification of aberrant vital signs. Unfortunately, failure to identify clinical indicators of clinical deterioration has resulted from inconsistent and erroneous vital sign documentation. Keeping an eye on a patient's vital signs is important for obtaining baseline data on their health, enabling early detection and management of in-patient deterioration. An Early Warning Sign (EWS) is the word used to describe this process. It displays clinical decision making and uses vital signs to classify the degree of a patient's physiological deterioration. The goal of EWS system was to assist nurses to monitor the adult patients admitted to the hospital to early identify any clinical decline in their health condition to avoid unplanned ICU transfers, cardiac arrest, and mortality as well improve the patients 'outcomes. For this reason, it's critical that nurses be equipped with adequate resources, training, and education to assess patients effectively and to identify if they are deteriorating **(Samani & Rattani, 2023)**.

This study was conducted in the in-patient medical departments affiliated to Ain Shams University hospital and Mansoura University hospitals to evaluate the effect of Early Warning Score (EWS) education on nurses' performance regarding identification and response to clinical deterioration. It was hypothesized that nurses' knowledge and practice regarding identification and response of clinical deterioration of patient using EWS system will increase significantly after EWS education and nurses' satisfaction regarding EWS education will be reported sufficiently among studied nurses after educational program intervention.

The current study sample consisted of convenient sample of 76 nurses working in medical departments affiliated to Ain Shams and Mansoura university hospitals. It was found that nearly half of them aged between 20-30 years, slightly more than two-thirds of them were females. Moreover, more than two fifths of studied nurses are diploma nursing graduates and two thirds of them are married. In addition, more than half of studied nurses reported that their years of experience ranged between 5 to less than 10 years with mean years of experience = 6.73±2.7 years. These findings agree to somewhat with the study titled " Effect of the National Early Warning Score Education Program on Nurses' Knowledge at an Emergency Hospital" and found that nearly two-thirds of participated nurses were aged (22-23) years and about two-thirds of them were females **(Badr et al., 2021)**.

Nur et al. (2020) in their study titled ″ Knowledge and Skill in Relation to the Speed and Accuracy of the Nurses When Assessing Using an Early Warning System″ which conducted in inpatient care for internal medicine, in Malang, found that most of the nurses involved in study were educated to diploma level, only a small proportion had attended EWS training.

Also, a study conducted by **Damayanti et al. (2019)** to assess the effects of Early Warning Score (EWS) tutorial simulation on nurses' knowledge and clinical performance showed that more than half of the studied nurses in the intervention group were women and aged 30 to 39 years and the majority of respondents hold diploma education and had working experiences of less than five years.

In the current study, no nurses from both study settings reported previous training about clinical deterioration or using EWS. This means that the nurses under study from both study settings has insufficient prerequisite regarding the Early Warning Score (EWS) system in addition to identification and response to clinical deterioration. This may be due to lack of hospitals policy and procedures for EWS as standardized compulsory system helps health care providers to identify and response to clinical deterioration. Hence, the current study recommends its use especially in in-patient wards in hospital settings.

No statistically significant variation was found between participant nurses in both study setting regarding demographic characteristics or either their attendance of training courses regarding clinical deterioration or using EWS. This means that nurses in both study settings had the same characteristics, had the same educational background regarding study

educational topic. This confirms the homogeneity of the research sample and enhances the credibility of the results.

Nurses are often in frontline positions and are challenged by complex clinical situations requiring skillful application of knowledge for decision making and recognizing signs of patient deterioration **(Badr et al., 2021)**.

As regards level of knowledge bout clinical deterioration and early warning score system among the studied nurses, the current study finding reveals that most of studied nurses had poor level of knowledge about clinical deterioration while all of them had poor level of knowledge regarding early warning score system before educational program intervention. This might be attributed to many reasons including absence of teaching/ training courses about EWS system and its importance for identification and response to clinical deterioration, lack of hospital policy for EWS system as a mandatory tool for patient especially in general wards in addition to poor qualifications of studied nurses since three quarters of them were diploma and technical institute nursing graduates.

The previously mentioned finding was in line with findings of the study conducted by **Liwa et al. (2016)** about the effectiveness of a web-based simulation in improving nurses' workplace practice with deteriorating ward patients and revealed that the level of knowledge among participant nurses was mostly in the poor category. Additionally, a study titled "Effect of the National Early Warning Score Education Program on Nurses' Knowledge at an Emergency Hospital" declared that all nurses had an unsatisfactory knowledge level at pre-educational program regarding the early warning scoring system **(Badr et al., 2021)**.

Moreover, the present study showed a highly significant increase of nurses' level of knowledge regarding clinical deterioration and early warning score system at post-intervention phase compared to their level of knowledge at pre-intervention phase. In addition, highly statistically significant increase of the total mean scores of overall knowledge at post-intervention phase compared to pre-intervention phase. A possible explanation may be due to the successful program intervention which enable studied nurses to gain the essential and comprehensive theoretical knowledge regarding clinical deterioration and early warning score system, nurses' interest regarding early warning score system and its importance since they had poor prerequisite regarding it, effectiveness of educational strategies and media used in program intervention (small lecture, small group discussion, feedback, quizzing, case scenario & videos) in addition to effective reinforcement through effective summary and closing to each theoretical session, distribution of Arabic booklet including all theoretical information, online follow up of participants through WhatsApp chat and zoom meetings. This result demonstrates the positive effect of educational program intervention on raising nurses' levels of knowledge significantly and validates the first research hypothesis.

There are many studies that were in line with the findings of the current study. A study conducted by **Abdala et al. (2018)** in a study titled " Effect of an Evidence Based Nursing Intervention on the Early Detection of Pediatric Warning Signs" and showed that the overall level of nurses' knowledge was significantly improved with the intervention on post and follow-up tests. Also, **Chandran et al. (2020)** in their study about effectiveness of competency training program on modified early warning system (mews) upon the knowledge of nurses revealed that there is an increase in mean scores of post-test knowledge scores among experimental group after competency training program. Similar findings in recent studies supported the previous finding and evidenced the effectiveness of nursing education on improving participated nurses' knowledge after their implementation **(Badr et al., 2021, Warren et al., 2021 & Bubphamalo et al., 2023).**

Case scenario-based teaching also encourages learners to engage in reflective practice as they cooperate with others to solve the cases and share views during case scenario analysis and presentation **(Seshan et al., 2021)**. In the light of present study, the findings revealed a highly statistically significant increase in mean scores of post-test of clinical scenario exam compared to pre-test mean

scores among studied nurses regarding identification of early signs of clinical deterioration based on EWS, calculation of EWS and choosing appropriate response based on EWS system. Furthermore, the overall total mean score of post-test of clinical scenario exam indicate highly statistically evident increase at post-intervention phase as compared to pre-test score.

The above result might be attributed to a variety of factors, including an improvement in theoretical knowledge among the nurses investigated following educational intervention, as indicated by research findings and effectiveness of case scenario-based teaching as an effective teaching strategy help nurses to improve their problem solving and decision -making skills regarding identification and response of clinical deterioration. This is further supported by **Liaw et al. (2016),** who indicate that simulation-based teaching programs can increase nurses' knowledge and clinical performance, as well as help in dealing with clinical deterioration of patients in a simulation setting rather than a true inpatient room.

Efficiency of scenario-based teaching was emphasized by earlier study conducted by **Devlin et al. (2008)** and concluded that scenario-based learning resulted in the better performance of the nurses in the intervention group and helped them have correct recognition of the delirium in in the critical care unit.

Also, the previous finding was emphasized with study conducted by **Damayanti et al (2019)** and found that the clinical performance scores of EWS simulation among studied nurses in intervention group were significantly increased after the implementation of EWS simulation. Moreover, the scenario performance scores used for the post-test simulation assessment were significantly increased as compared to baseline testing as reported by **Liaw et al. (2014)** in a study titled "Improving Clinical Performances in Assessing and Managing Clinical Deterioration: Randomized Controlled Trial".

Recognizing and managing a deteriorating patient necessitates continuing training, behavioural changes, and a culture transformation to guarantee the safe delivery of effective quality care.to enable the safe delivery of effective quality care. it is important for the nurses to be introduced with knowledge and practice or how to use of EWS early in their nursing training to avoid mistakes during working in hospital (**Foley & Dowling, 2018)**.

Based on result analysis of this study, it was illustrated that almost three fifths of nurses got satisfactory level of practice regarding measurements of physiological parameters in a timely manner at post-intervention phase compared to slightly more than one fifth of them at pre-intervention phase with highly statistically evident variation. Also, nearly one half of the nurses have satisfactory level of practice regarding identification of the early manifestations of clinical deterioration during post-intervention phase compared to slightly more than one tenth of them at pre-intervention phase. In addition, about a half of the nurses under study have satisfactory level of practice after program intervention concerning calculation of EWS compared to none of them before program intervention. Furthermore, nearly two fifths of the nurses have satisfactory practice after program intervention concerning proper response to each deterioration compared to none of them before program intervention.

In the light of previous findings, it was clear that most studied nurses had unsatisfactory practice regarding identification and response of clinical deterioration and early warning score system before program intervention. This could be rationalized by absence of previous training regarding EWS and clinical deterioration, lack of knowledge among studied nurses, absence of hospital policy and manual regarding its application in addition to low nurse to patient ratios in medical wards which hinder nurses to accurately and timely measure and document vital signs and consequently lead to poor recognition of clinical deterioration signs.

In addition**, Dall'Ora et al. (2021)** in their study supported this explanation and reported in their study that assessing and documenting vital signs is a time-consuming task, and nurses consider that several evaluations are not necessary for low-risk patients. As a result, nurses prioritize

things other than vital signs. This results in poor patients' outcomes.

Similarly, a study conducted by **Merriel et al. (2016)** in their study titled "Identifying deteriorating patients through multidisciplinary team training" illustrates that the nurses did not apply good practice in using EWS. They added that the nurses clarified that it could be due to high workload and overtasking which result in their poor adherence to procedure in addition to the EWS score range three to six which is still considered as low risk. The nurses displayed that they didn't perform the scoring as frequently as they think it is over-monitoring and, in these instances, it was described as interfering with workflow and unnecessary. **Merriel et al.** also found that nurses were more likely to calculate early warning scores correctly post -test in comparison to pre -test.

Congruently, **Alias and Ludin (2021)** in their study regarding assessment of knowledge, practice and attitudes of nurses using early warning sign and found that nurses under study had competency regarding management of patient using EWS score to prevent further deterioration of the patients. This discrepancy may be due to the difference between pre-requisite and clinical management system between participants and settings of both studies.

Concerning total level of practice regarding identification and response of clinical deterioration and early warning score system among the studied nurses, findings illustrates that there is highly significant increase of total satisfactory level of nurses' practice concerning identification and response of clinical deterioration and early warning score system after program intervention as compared to pre-intervention phase. From point of view, this may be due to effectiveness of practical part of the program, effective teaching strategies (demonstration &redemonstration, clinical scenario-based learning), increased knowledge after program intervention. Consequently, the second study hypothesis was supported as the intervention of the educational program led to a notable rise in the practice of nurses following educational program intervention.

Similarly, the clinical performance scores were significantly improved after the implementation of EWS tutorial simulation among nurses in comparison to those who did not as evidenced from the findings of the study performed by **Damayanti et al. (2019).** Also, the study conducted by **Liaw et al. (2014)** was compatible with findings of current study and reported that nursing students' practice regarding assessing and managing clinical deterioration was improved significantly immediately and 2.5 months following a fully automated virtual patient simulation and a facilitator -led mannequin -based simulation. Additional support to this finding was evidenced by a similar study which showed that studied nurses' practice using EWSS was improved significantly after the intervention (**Alseraty et al., 2022).**

On the contrary, **Kyriacos et al. (2015)** in their study titled "Early warning scoring systems versus standard observations charts for wards in South Africa" found that modified EWS training was not associated with a significant change in response to deterioration among trained nurses. They explained this failure due to the complexity of introducing an EWS system to their study setting.

As well, this study findings displayed that there are highly significant positive correlations among studied nurses practice and both of knowledge and clinical scenario exam scores at pre- and post-intervention phases. According to the researchers' point of view, the educational program was helpful in improving nurses' knowledge and practice regarding early identification and response of clinical deterioration, and as the nurses' knowledge increased, so did their practice at post-intervention phase in comparison to pre-intervention phase.

This was in the same line with findings of **Salem et al. (2022)** in their study called "The Effect of Educational Program on Nurses' Performance regarding Rapid Response Code to prevent Cardiopulmonary Arrest" and reported that there were strong positive correlations between nurse' practices and knowledge regarding rapid response code at pre, post and follow-up phases. Additionally, **Warren et al., (2021)** in their study titled "Impact of a modified early warning score on nurses' recognition and response to clinical

deterioration in US" who found that simulation-based intervention notably improved nurse knowledge, their self-confidence and chart reviews which consequently improve in nurse practice in response to signs of clinical deterioration.

Concerning total satisfaction regarding Early Warning Score educational program among studied nurses at post intervention phase, the current research illustrates that slightly more than two thirds of the studied nurses reported their satisfaction with EWS educational program after program intervention, meanwhile one third of them are not satisfied. Most of nurses under study accepted their satisfaction regarding significance of EWS implementation, relevance of theoretical and practical content, methods of education and presentation in addition to effectiveness of educational booklet and other media used. These findings indicate the effectiveness of educational program and its strategies and media to increase nurses' satisfaction which reflected positively on their performance regarding clinical deterioration identification and management.

In this respect, **Damayanti et al. (2019)** revealed that training using simulation improves nurses' clinical performance and increases nurses' satisfaction with care of deteriorated patients. In addition, **Sridhar et al. (2020)** claimed that carrying out EWS system education raises confidence and satisfaction among studied nurses and empower them.

This abovementioned finding supports the third hypothesis to great extent since nurses' satisfaction regarding EWS education was reported among more than two thirds of studied nurses after educational program intervention. This suggests further study to assess factors affecting nurses' satisfaction regarding EWS education.

This study displayed a statistically significant increase of knowledge and practice regarding identification and response to clinical deterioration immediately after EWS educational program intervention. It remains unknown if this improvement is maintained over time and suggest future studies to evaluate effectiveness of program for long periods and evaluate its effectiveness on patient outcomes.

Conclusion

There was a highly statistically significant improvement of studied nurses' knowledge and practice regarding identification and response to clinical deterioration due to positive effect of EWS educational program intervention. Also, satisfaction concerning EWS educational program was reported sufficiently among studied nurses after program intervention.

Recommendations:

- A proposed policy regarding the EWS system should be held and implemented in all hospitals as a mandatory tool of their assessment in hospital wards.
- In-service educational program regarding EWS system and clinical deterioration should be implemented to all nurses in hospitals.
- Close monitoring, guidance, and supervision of staff nurses' performance in hospital wards regarding vital signs measurement in a timely manner is highly recommended to improve their performance regarding clinical deterioration identification and improve outcomes of patients.
- Nurses' compliance with EWS system and clinical deterioration training should be periodically assessed and validated.
- Raising the number of nursing staffing level in hospital wards and addressing the ratio of nurses to patients within the acceptable standardized proportions to reduce rates and complications of clinical deterioration and improve the quality of care.
- Future research to evaluate the effect of EWS nursing education on outcomes of patients.
- Replication of the study with a larger sample size in different geographical areas is required for findings to be generalized.

Electronic Links for study tools:

- Nurses self-administered structured questionnaire and clinical scenario exam sheet https://forms.gle/vj3RHDNmVTU5wf8H8
- Nurses Satisfaction scale https://forms.gle/JzHS999nDM8i44ZV6
- **Nurses' Observational Checklist** https://forms.gle/TgwEDmo9ZmPH2UzdA

References

Abdala , F., Khalifa, M. , Okby, O. and Fathala, A. (2018): Effect of an Evidence Based Nursing Intervention on the Early Detection of Pediatric Warning Signs, Menoufia Nursing Journal, 3(1), : 163-174.

Abraham, l. and MacDonald,. (2011): Quasi-Experimental Design Research Methodologies. LOWA state university library guide available from https://instr.iastate.libguides.com/researchmethods/quasiexperimental at 7/1/2023

Ahmed, E., Hassan , A., and Mehany, M., (2019): Effect of simulation on critical thinking, satisfaction and self-confidence of nursing students during care of pneumonic child, International Journal of Advance Research in Nursing, 2, (1), 131-137.

Alias, A. L., and Ludin, S. M. (2021): Knowledge, Attitudes and Practice of Nurses in Assessing Patients using Early Warning Sign (EWS) Scoring in a teaching hospital in Kuantan Pahang, Malaysia. International Journal of Care Scholars, 4(1), 48–57. DOI: https://doi.org/10.31436/ijcs.v4iSupp1.218

Alseraty, W., Khalil, H., Amin, F., Abouelala, F. and El-Adham, N. (2022): Effects of Patient Deterioration Early Warning Score System Simulation Training on Nurses' Performance Self-confidence and Satisfaction, Assiut Scientific Nursing Journal, 1 (33),: pp 12 – 19. DOI: 10. 21608/ ASNJ. 2022.143236.1392.

Badr, M., Khalil, N. and Mukhtar,A.(2021): Effect of the National Early Warning Score Education Program on Nurses' Knowledge at an Emergency Hospital, Medico-legal Update, 21 (4). DOI: https:// doi. org/ 10.37506/ mlu.v21i4.3140.

Bubphamalo, P., Nookong, A., and Rungamornrat, S. (2023): Effects of Nursing Practice Guidelines of Early Warning System on Nurses' Knowledge, Practice and Abnormal Signs Detection in At-risk Neonates. Nursing Science Journal of Thailand, 41(3), 79–93. Retrieved from https://he02.tci-thaijo.org/index.php/ns/article/view/261203 at 12/7/2023.

Bucknall, T. K., Considine, J., Harvey, G., Graham, I. D., Rycroft-Malone, J., Mitchell, I., and Hutchinson, A. (2022): Prioritising Responses Of Nurses To deteriorating patient Observations (PRONTO) protocol: testing the effectiveness of a facilitation intervention in a pragmatic, cluster-randomised trial with an embedded process evaluation and cost analysis. Implement Sci. 2017 Jul 11;12(1):85, doi: 10.1186/s13012-017-0617-5.

Chandran,A., Gnanarani, J. , and Venkatesan, L. (2020): Effectiveness of Competency Training Program on Modified Early Warning System (MEWS) upon the Knowledge of Nurses in Selected Hospitals, Chennai, Asian Pacific Journal of Nursing and Health Sciences,1(01). DOI: 10.46811/apjnh/1.1.5

Connell, C. J., Endacott, R., and Cooper, S. (2021): The prevalence and management of deteriorating patients in an Australian emergency department. Australasian Emergency Care, 24(2), 112-120, doi: 10.1016/j.auec.2020.07.008.

Dall'Ora, C., Griffiths, P., Hope, J., Briggs, J., Jeremy, J., Gerry, S. and Redfern, O.C. (2021): How Long Do Nursing Staff Take to Measure and Record Patients' Vital Signs Observations in Hospital? A Time-and-Motion Study. International Journal of Nursing Studies, 118(1), doi: 10. 1016/ j.ijnurstu.2021.103921.

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), 231-241. DOI:10.14710/nmjn.v9i2.24821.

Devlin, JW., Marquis, F., Riker, RR., Robbins T, Garpestad, E. and Fong, JJ., (2008): Combined didactic and scenario-based education improves the ability of intensive care unit staff to recognize delirium at the bedside. Critical Care. 12 (1): R19.

Doyle ,D. (2018): Clinical Early Warning Scores: New Clinical Tools in Evolution, The Open Anesthesia Journal, 12(1): 26-33. DOI: 10.2174/2589645801812010026.

Foley, C. and Dowling, M. (2018): How do nurses use the early warning score in their practice? A case study from an acute medical unit., J Clin Nurs., 28(7-8):1183-1192, doi: 10.1111/jocn.14713.

Gerry, S., Bonnici, T., Birks, J., Kirtley, S., Virdee, P., Watkinson, P. and Collins, G. (2020): Early warning scores for detecting deterioration in adult hospital patients: systematic review and critical appraisal of methodology. BMJ, 369(1), doi: https://doi.org/10.1136/bmj.m1501.

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.

Hwang, J., and Kim, S, (2022): Using an Early Warning Score for Nurse Shift Patient Handover: Before-and-after Study. Asian Nursing Research 16(1), 18-24. DOI: 10.1016/j.anr.2021.12.005

Institute for Healthcare Improvement. (IHI.) (2018): Early warning systems: Score cards that save lives. Retrieved from http://www.ihi.org/resources/Pages/ImprovementStories/EarlyWarningSystemsScorecardsThatSaveLives.aspx at 7/11/2022.

Janakaraj, S., (2020): Effectiveness of Education on Modified Early Warning System for System for Nurses. Walden Dissertations and Doctoral Studies. Avialabe from https://scholarworks.waldenu.edu/dissertations/1014 at 1/12/2022.

Kyriacos, U., Jelsma, J., James, M. and Jordan, S. (2015): Early warning scoring systems versus standard observations charts for wards in South Africa: a cluster randomized controlled trial. Trials, 16(1):103, doi: 10.1186/s13063-019-3916-0.

Langkjaer, C., Bove D., Nielsen, P., Iversen, K., Bestle, M. and Bunkenborg G. (2021): Nurses' Experiences and Perceptions of two Early Warning Score systems to Identify Patient Deterioration—A Focus Group Study. Nurs Open.; 8(1):1788– 1796. DOI: 10. 1002/ nop2. 821.

Liaw, S. Y., Wong, L. F., Lim, E. Y., Ang, S. B., Mujumdar, S., Ho, J. T. and Ang, E. N. (2016): Effectiveness of a web-based simulation in improving nurses' workplace practice with deteriorating Ward Patients: A pre- and Postintervention Study. Journal of Medical Internet Research, 18 (2): e37. doi:10.2196/jmir.5294.

Liaw, S., Chan, S., Chen, F., Hooi, S. and Siau, C. (2014): Comparison of Virtual Patient Simulation With Mannequin-Based Simulation for Improving Clinical Performances in Assessing and Managing Clinical Deterioration: Randomized Controlled Trial J Med Internet Res.; 16(9): e214 doi: 10.2196/jmir.3322.

Massey, D., Chaboyer, W. and Anderson, V. (2017): What factors influence ward nurses' recognition of and response to patient deterioration? An integrative review of the literature, Nurs Open, 26;4(1):6-23, doi: 10.1002/nop2.53.

Merriel A., van der Nelson, H. and Merriel S (2016): Identifying deteriorating patients through multidisciplinary team training. Am J Med Qual, 31(6):589-595, doi: 10.1177/1062860615598573.

Nur, Q., Nursalam, N, and Ahsan, A. (2020): Knowledge and Skill in Relation to the Speed and Accuracy of the Nurses When Assessing Using an Early Warning System (EWS), Jurnal Ners, Special Issues, 15(2); 531-537, doi: https://doi.org/10.20473/jn.v15i1Sp.20522.

Royal collage of Physician, (2017): National Early Warning Score (NEWS); Standardizing the assessment of acute-illness severity in the NHS. Retrieved from: https://www.rcplondon.ac.uk. at 6/12/2022.

Saab, M., McCarthy, B., Andrews, T, Savage, E., Drummond, F., Walshe, N., Forde, M.,

Breen, D., Henn, P., Drennan, J. and Hegarty, J. (2017): The effect of adult Early Warning Systems education on nurses' knowledge, confidence and clinical performance: A systematic review, J Adv Nurs.. 73(11):2506-2521, doi: 10.1111/jan.13322.

Salem, A. , Ali,Z. and Taha, N. (2022): The Effect of Educational Program on Nurses' Performance regarding Rapid Response Code to prevent Cardiopulmonary Arrest, Helwan International Journal for Nursing Research and Pratctice 1(2), Available from https://hijnrp.journals.ekb.eg/ on 16/11/2022.

Samani, S. and Rattani, S.A. (2023): Recognizing Early Warning Signs (EWS) in Patients Is Critically Important. Open Journal of Nursing, 13 (1), 53-64. DOI: 10.4236/ojn.2023.131004.

Seshan, V., Matua, G., Raghavan D, Arulappan, J., Al Hashmi, I., Roach, E., Sunderraj, S. and Prince, E. (2021): Case Study Analysis as an Effective Teaching Strategy: Perceptions of Undergraduate Nursing Students From a Middle Eastern Country. SAGE Open Nurs. ;7(1): 23779 6 0 8 2 1 1059265, doi: 10. 1177/ 2 3 7 7 9 6 0 8 2 1 1059265.

Sridhar, S., Schmid, A., Biziyaremye, F., Hodge, S., Patient, N. and Wilson, K. (2020): Implementation of a Pediatric Early Warning Score to Improve Communication and Nursing Empowerment in a Rural District Hospital in Rwanda. Glob Health Sci Pract.;8(4):838-845.doi: 10.9745/GHSP-D-20-00075.

Warren, T., Moore, L. C., 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), 1141-1148, doi: 10.1111/jonm.13252