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Effectiveness of Evidence-Based Nursing Intervention Program on Nurses' Readiness Regarding Early Warning Systems in Critical Care Units

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ABSTRACT:

Introduction: Clinical deterioration in critical care settings remains a major patient safety concern, with physiological warning signs often detectable hours before adverse events occur. Early Warning Systems (EWS), especially the National Early Warning Score 2 (NEWS2) and SBAR communication framework, are essential for early detection and a timely escalation of deterioration. Nevertheless, in many healthcare settings, the readiness of nurses to implement early warning systems effectively is still suboptimal.

Aim of the Study: To evaluate the effectiveness of an evidence-based nursing intervention program on nurses' clinical readiness — defined as knowledge, attitudes, and self-confidence — regarding the application of NEWS2 and SBAR in critical care units.

Methods: A quasi-experimental, non-equivalent control group design was conducted in governmental hospitals in Najaf Governorate, Iraq, from October 2025 to February 2026. A total of 162 critical care nurses participated (study group n=90, comparative group n=72). A structured educational program (EWS-RPP) was delivered to the study group. Nurses' readiness was evaluated before and after the intervention through a questionnaire comprising three components: a knowledge questionnaire, an attitudes scale, and a self-confidence scale.

Results: At baseline, both groups demonstrated comparable poor knowledge (study: 80.0% poor; comparative: 86.1% poor), balanced-to-supportive attitudes, and moderate self-confidence, with no statistically significant between-group differences. Following the intervention, the study group achieved a 100% good knowledge rate (vs. 20.8% in the comparative group; $p<0.001$), with 97.8% displaying supportive attitudes (vs. 16.7%; $p<0.001$), and 42.2% demonstrating high moderate self-confidence (vs. 1.4%; $p<0.001$).

Conclusion: The structured educational program significantly improved nurses' readiness for applying NEWS2 and SBAR.

Recommendation: Integration of an Evidence-Based Nursing Intervention Program into critical care nursing practice to enhance nurses' readiness for early detection of patient deterioration and improve patient safety outcomes.

INTRODUCTION:

Clinical deterioration refers to a physiological decline that impairs the maintenance of homeostasis and elevates the risk of organ failure, morbidity, and mortality (Thiele et al., 2020). Research consistently demonstrates that noticeable physiologic warning signs precede adverse events—including in-hospital cardiac arrest—by 6 to 24 hours and are manifested as changes in vital signs and level of consciousness (Burgos-Esteban et al., 2022). Although early detection can reverse critical decompensation, deficiencies in critical care contribute to an estimated 8.6 million preventable deaths annually, with up to 31% of inpatient deaths attributed to unrecognized deterioration (Schell et al., 2025); (Burgos-Esteban et al., 2022). The time gap between changes in physiological parameters and the apparent onset of clinical deterioration has prompted the development of early warning systems. EWS were designed to facilitate the early detection of clinical deterioration by converting physiological parameters into numerical scores (Patel et al., 2024). Among these systems and tools, the National Early Warning Score 2 (NEWS2) has demonstrated outperformance. Multiple studies have confirmed its clinical benefits. A prospective study demonstrated its ability to predict aortic dissection as early as 4 hours before onset (Liu et al., 2022). Furthermore, a systematic review demonstrated that the Early Warning Score (EWS) achieved a pooled specificity of 77% in the detection of sepsis and was superior to both SIRS and qSOFA (Chua et al., 2024). Furthermore, results from 28 hospitals in the United Kingdom (UK) showed that NEWS2 classified risk more efficiently than the other four commonly used risk assessment tools, including MEWS, qSOFA, BTF, and SIRS (Riccalton et al., 2025), and another study recorded an AUROC of 0.898 for predicting deterioration within 24 hours and 0.963 for mortality prediction (Chen et al., 2025).

Effective early detection of clinical deterioration in patients in critical care units requires detection tools such as NEWS2 and communication frameworks such as SBAR (situation, background, assessment, and recommendation). SBAR is widely recommended across healthcare settings for effective communication between nurse-physicians (Shrivastava et al., 2025), and significantly enhances clarity, reduces the likelihood of missing critical information, improves the accuracy of documentation, and decreased the total number of clinical errors from 102 before implementation to 25 afterward ($P < 0.0001$ (Tapia et al., 2025);(Toghian Chaharsoughi et al., 2025). Integrating Early Warning Scores (EWS) with the SBAR communication. The integration of EWS and SBAR improved the quality of patient handover and management of clinical deterioration (Ye et al., 2023).

The effective application of NEWS2 and SBAR is therefore closely linked to nurses' readiness, which is defined in this study as the integration of knowledge, attitudes, and confidence required to apply these tools effectively in clinical practice (Konlan et al., 2024); (Kim & Shin, 2022). The most essential determinant in the detection of clinical deterioration has been identified as protocol compliance, including measurement quality and prompt nurse-initiated escalation (Leenen & Mondria, 2024). Nevertheless, studies have reported significant deficits in all three domains of readiness. A study showed that most nurses exhibited inadequate knowledge of early warning systems before the program (Badr et al., 2021) and the poor knowledge coexists with positive self-reported attitudes (Alias & Ludin, 2021). Some nurses view the system as an extra burden that is nothing more than "just marking in a box" (Le Lagadec et al., 2025). In the same context, nurses get disappointed when the level of regulation does not correspond with their clinical judgment, which undermines their confidence in it (Nadaf et al., 2025). These deficiencies are exacerbated by obstacles such as delayed identification of deterioration, erroneous measurement of vital signs, and mistakes in score calculation (Nadr Ebraheim et al., 2023).

Recent literature reviews indicate that limited available studies have examined nurses' readiness toward the implementation of early warning systems in critical care units. Therefore, the current study aims to evaluate the effectiveness of an evidence-based intervention program on nurses' readiness regarding the application of early warning systems in critical care units.

METHODOLOGY:

Study Design and Setting: The study employed a quasi-experimental, non-equivalent control group design. Participants were allocated at the hospital level rather than individually, as randomization was not feasible, thus minimizing contamination, maintaining intervention integrity, and reducing the possibility of information exchange between groups. The study was conducted from October 14, 2025, to February 21, 2026, among nurses in critical care units at hospitals.

The study was conducted in governmental hospitals in Najaf Governorate, Iraq, across their intensive care units (ICUs) and coronary care units (CCUs). The study group was Al-Hakeem Hospital, Al-Furat Al-Awsat Hospital, and Al-Najaf Ashraf Teaching Hospital, and the comparative group was Al-Sadr City Medical Hospital.

Sample and Allocation: A cluster sampling design was applied at the institutional level. Eligible hospitals within Najaf Governorate were organized into three clusters: Al-Furat Al-Awsat Hospital and Al-Hakeem Hospital were combined into a single cluster due to their relatively small nursing staff and single intensive care unit each, while Al-Najaf Teaching Hospital and Al-Sadr Medical City were treated as separate clusters because of their larger nursing populations. Through a random cluster-level allocation process, one cluster (Al-Sadr Medical City) was selected to form the comparative group, with the remaining two clusters assigned to the study group (comprising Al-Najaf Teaching Hospital, Al-Furat Al-Awsat Hospital, and Al-Hakeem Hospital). At the individual level, purposive sampling was used, inviting all nurses present during data collection visits who met the inclusion criteria to participate.

Sample size determination was performed with G*Power for an independent-samples t-test, assuming a medium-to-large effect size (Cohen's d = 0.61), a two-tailed alpha of 0.05, and a power of 0.95, which indicated a required total of 142 participants (71 per group). Although the final analyses employed non-parametric methods due to non-normal distribution, the t-test option was used for initial sample size estimation.

Initially, 180 nurses were enrolled. Fourteen were excluded to minimize bias related to exposure to the instruments and study procedures in the pilot study, three withdrew during the study, and one was excluded due to incomplete data, resulting in a final sample of 162 participants for statistical analysis, 72 participants for the comparative group and 90 for the study group.

Study Instruments: The instruments consist of two parts. Part one: The demographic part of the standard questionnaire was designed to collect basic personal and occupational information about the nursing staff involved in the study. It gathers personal information such as age, sex, and professional information such as department, years of experience, job position, and shift time. It also contains a single item about previous training for EWS. Part two: nurses' readiness scale. It is composed of three major dimensions:

(1) Knowledge of NEWS2 and SBAR; this section comprises sixteen researcher-developed multiple-choice questions, of which twelve assess nurses' knowledge of early warning systems, and four evaluate the SBAR tool, with particular emphasis on the application of NEWS2 and clinical escalation protocols. A mean score of ≤1.49 indicated poor knowledge, while a score of ≥1.50 indicated good knowledge.

(2) Attitudes were assessed through a Likert scale: the subscale includes 22 items adapted from Yalıç and Tülek's (Yalıç & Tülek, 2025) validated tool. The subscale includes four subdomains, which are healthcare quality (6 items), patient outcomes (4 items), and ease of use (7 items). Following authorization from the original publishers, the instrument was translated into Arabic, and seven items were amended by an expert panel to ensure cultural relevance. Responses were recorded on a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) and multidisciplinary communication (5 items). Mean scores of attitudes were categorized as ≤2.33 (resistant attitude), 2.34–3.53 (balanced attitude), and ≥3.54 (supportive attitude).

(3) Self-confidence was assessed through a Likert scale: this subscale comprises 12 items adapted from the Portuguese culturally adapted version of the Self-Confidence Scale, which was adapted and validated by Martins et al. (2014) for nursing students' emergency interventions, modified to measure nurses' confidence regarding Early Warning Systems (EWS), and then translated into Arabic. The instrument responses were assessed on a five-point Likert scale (1 = Not Confident to 5 = Extremely Confident). Mean scores were categorized as ≤2.33 (low self-confidence), 2.34–3.67 (moderate self-confidence), and ≥3.68 (high self-confidence).

Validity and Reliability: An 11-member panel of experts in nursing and medicine established face and content validity for clarity, relevance, and cultural appropriateness; the instrument was considered appropriate for measuring nurses' readiness. Internal consistency reliability was confirmed using Cronbach's alpha: knowledge questionnaires ($\alpha = 0.894$), attitude scale ($\alpha = 0.909$), and self-confidence scale ($\alpha = 0.800$).

Pilot Study: The study was conducted on November 21, 2025 (one day after ethical approval on November 20, 2025), with a sample of 14 nurses. The program was delivered in two segments: the pre-test and the first session on November 21, followed by the second session on November 25, 2025. A readiness post-test was administered three weeks later on December 15, 2025. Data analysis was completed on December 17, 2025. The pilot evaluated the feasibility of the instrument, the content of the program, training requirements, and optimal scheduling within the clinical environment.

Educational Intervention: The early warning systems readiness program (EWS-RP) combines the NEWS2 framework (Royal College of Physicians, UK) with SBAR (Institute for Healthcare Improvement) to improve early identification of clinical deterioration and to standardize communication. Initially developed in English, the material was professionally translated into Arabic by the University of Kufa, College of Languages, and subsequently validated by a panel of 11 experts in critical care nursing, nursing education, and health sciences. The validation assessed content accuracy, objective agreement, clarity of terminology, structural consistency, and appropriateness of instruction. The program outlines five goals: knowledge acquisition, score calculation, risk classifications, clinical application, and effective communication, and is delivered in three didactic lectures and two hands-on sessions in participants' clinical settings.

Data Collection: Data were collected from governmental hospitals within Najaf Governorate following the attainment of the requisite ethical and administrative approvals. Due to shift rotation, pre-tests were conducted during four consecutive days starting December 20, 2025. The educational program, which included five sessions, was implemented in three phases at the intervention sites: The first was at Al-Najaf Al-Ashraf Teaching Hospital on December 24, 2025. The second implementation was at Al-Hakeem General Hospital and Al-Furat Al-Awsat Hospital on January 13, 2026. Post-testing of the study group was conducted three weeks after the final session of the program. The comparative group underwent the same pre- and post-test assessments but at three-week intervals and without any training or educational program. The study was conducted over a period of about two months, from December 20, 2025 to February 21, 2026.

Ethical Considerations: The researcher had received all the necessary official permissions before the study was conducted, including the approval of the Scientific Committee of the College of Nursing at the University of Kufa, ethical approval of the Medical Ethics Committee at the College of Medicine, and the official approval of the Al-Najaf Al-Ashraf Health Directorate and all four hospitals that participated in the study. The participants were informed about the purpose and procedures of the study, provided written informed consent, and were assured that the data would be used only for research purposes and informed of their right to participate voluntarily and to withdraw at any time without any consequences.

Coding and Statistical Analysis: Knowledge items were coded on a binary scale, whereby an incorrect response was assigned a code of (1) and a correct response was assigned a code of (2). Attitude items were coded using a five-point Likert scale ranging from (1) Strongly Disagree, (2) Disagree, (3) Not Sure, (4) Agree, and (5) Strongly Agree. Regarding self-confidence, items were similarly coded on a five-point scale, ranging from (1) Not Confident, (2) Hardly Confident, (3) Confident, (4) Very Confident, and (5) Extremely Confident.

Data were analyzed using SPSS version 31 and Microsoft Excel 2024. The Kolmogorov–Smirnov and Shapiro–Wilk tests for normality indicated a non-normal distribution ($p < 0.05$), and non-parametric tests were used. Frequencies, percentages, means, and standard deviations were used for descriptive statistics. Inferential analyses included the Mann-Whitney U test for between-groups of study comparisons, the Wilcoxon signed-rank test for within-group pre-post comparisons, Spearman's rank correlation coefficient for relationships with continuous variables, and the Kruskal-Wallis test for categorical demographic variables. Statistical significance was at $p \leq 0.05$.

RESULTS

The distribution of the socio-demographic characteristics table (1) showed that the study group exhibited a mean age of 26.76 years, while the comparative group averaged 28.68 years (SD = 5.16), with the majority of participants aged 21–27 years. Females constituted 56.8% of the overall sample, with a higher proportion in the study group (61.1%). Education level was distributed as follows: diploma holders comprised 50.6%, bachelor's degree graduates 46.9%, and postgraduate respondents 2.5%. Nearly all participants were staff nurses (95.7%). Most participants were employed in the intensive care unit (ICU) (77.2%), with the study group showing greater ICU representation (83.3%) compared to the comparative group (69.4%). Notably, about three-quarters of participants (74.1%) had no prior training in early warning scoring (EWS). Table (1) (Mann–Whitney Test) indicates comparable baseline knowledge between the two groups (comparative: 86.1% poor; study: 80.0% poor; $U = 2816.5$, $Z = 1.441$, $p = 0.149$, non-significant).

At post-test, 79.2% of the comparative group remained classified in the poor category, in contrast to 100% of the study group achieved good knowledge ($U = 1$, $Z = -10.98$, $p < 0.001$). The study group also had a higher mean score (MS=1.89) than the comparative group (MS=1.35), indicating the significant effect of the program.

Regarding attitudes, At the pre-test, attitude scores were similar across groups (comparative MS = 3.19, study MS = 3.16; U = 3059.9, Z = -0.609, p = 0.542, non-significant). At the post-test, the comparative group predominantly adopted balanced attitudes (75.0%, MS = 3.11), whereas the study group exhibited supportive attitudes in 97.8% of cases (MS = 4.00), with a highly significant difference (U = 158, Z = -10.394, p < 0.001), indicating the intervention effectively enhanced positive attitudes toward EWS.

At pre-test, both groups showed comparable self-confidence distributions (comparative: 62.5% moderate, study: 57.8% moderate; MS=2.41 vs. 2.38; U=3103.5, Z=-0.461, p=0.644, non-significant), confirming baseline equivalence. At post-test, significant differences were observed (U=140.5, Z=-10.457, p<0.001): the comparative group showed slight deterioration (37.5% low, 61.1% moderate, 1.4% high; MS=2.29, SD=0.55), while the study group demonstrated marked improvement (57.8% moderate, 42.2% high; MS=3.60, SD=0.51), confirming the program's substantial effectiveness in enhancing nurses' self-confidence

Variable	Category	Comparative Group (n=72)		Study Group (n=90)		Total (n=162)	
Age (years)	≤ 20	1	1.40%	0	0.00%	1	0.60%
	21 – 27	31	43.10%	58	64.40%	89	54.90%
	28 – 34	33	45.80%	30	33.30%	63	38.90%
	35 – 41	5	6.90%	2	2.20%	7	4.30%
	42 – 48	1	1.40%	0	0.00%	1	0.60%
	49+	1	1.40%	0	0.00%	1	0.60%
	Mean	**28.68**		**26.76**		_	
	SD	**5.16**		**3.11**		_	
Sex	Male	35	48.60%	35	38.90%	70	43.20%
	Female	37	51.40%	55	61.10%	92	56.80%
Educational Level	Diploma	41	56.90%	41	45.60%	82	50.60%
	Bachelor's Degree	28	38.90%	48	53.30%	76	46.90%
	Postgraduate Studies	3	4.20%	1	1.10%	4	2.50%
Shift time	Morning	4	5.60%	2	2.20%	6	3.70%
	Evening	43	59.70%	78	86.70%	121	74.70%
	Night	25	34.70%	10	11.10%	35	21.60%
Unit / Department	Intensive Care Unit (ICU)	50	69.40%	75	83.30%	125	77.20%
	Coronary Care Unit (CCU)	22	30.60%	15	16.70%	37	22.80%
Years of Experience as	<= 1.00	6	8.30%	8	8.90%	14	8.60%
General	1.01 - 6.00	42	58.30%	62	68.90%	104	64.20%
	6.01 - 11.00	17	23.60%	17	18.90%	34	21.00%
	11.01+	7	9.70%	3	3.30%	10	6.20%

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	Mean	6.09		4.1		_	
	SD	5.44		3.12		_	
Position	Staff nurses	69	95.80%	86	95.60%	155	95.70%
	Head Nurse	1	1.40%	0	0.00%	1	0.60%
	Nursing Supervisor	2	2.80%	4	4.40%	6	3.70%
EWS Formal Training	No	50	69.40%	70	77.80%	120	74.10%
(prior to program)	Yes	22	30.60%	20	22.20%	42	25.90%

Table (1): Distribution of Socio-Demographic Characteristics for both Study and Comparative Groups

Variables	**Responses**	**Statistics**	**Group of Study**		**Mann-Whitney U**	**Z**	**P-value**
			Comparative	**Study**			
Section 1: Overall Nurses' Knowledge							
Overall Nurses' Knowledge (Pretest)	**Poor**	F.	62	72	**2816.5**	-1.441	**0.149 NS**
		%	86.1%	80.0%			
	Good	F.	10	18			
		%	13.9%	20.0%			
	MS		1.32	1.35			
	SD		0.12	0.15			
Overall Nurses' Knowledge (Posttest)	**Poor**	F.	57	0	**1**	-10.98	**< 0.000 S**
		%	79.2%	0.0%			
	Good	F.	15	90			
		%	20.8%	100.0%			
	MS		1.35	1.89			
	SD		0.12	0.09			
Section 2: Overall Nurses' Attitudes							

Overall Nurses' attitudes (pre-test)	**Resistant**	F	6	6	**3059.5**	-0.609	**0.542 NS**
		%	8.3%	6.7%			
	Balanced	F.	29	45			
		%	40.3%	50.0%			
	Supportive	F.	37	39			
		%	51.4%	43.3%			
	MS		3.19	3.16			
	SD		0.46	0.49			
Overall Nurses' Attitude (Posttest)	**Resistant**	F.	6	0	**158**	-10.394	**< 0.000 S**
		%	8.3%	0.0%			
	Balanced	F.	54	2			
		%	75.0%	2.2%			
	Supportive	F.	12	88			
		%	16.7%	97.8%			
	MS		3.11	4			
	SD		0.45	0.28			
Section 3: Overall Nurses' Self Confidant							
Overall Nurses' Self Confidant (Pretest)	**Low**	F.	26	37	**3103.5**	-0.461	**0.644 NS**
		%	36.1%	41.1%			
	Moderate	F.	45	52			
		%	62.5%	57.8%			
	High	F.	1	1			
		%	1.4%	1.1%			

	MS		2.41	2.38			
	SD		0.65	0.55			
Overall Nurses' Self Confidant (Posttest)	**Low**	F.	27	0	**140.5**	-10.457	**< 0.000 S**
		%	37.5%	0.0%			
	Moderate	F.	44	52			
		%	61.1%	57.8%			
	High	F.	1	38			
		%	1.4%	42.2%			
	MS		2.29	3.6			
	SD		0.55	0.51			

Mann-Whitney U Test — Pretest and Posttest Results

NS = Not Significant / S = Statistically Significant (p < 0.000

Table (2) Comparison of Nurses' Readiness (Knowledge, Attitude, and Self-Confidant) Between Comparative and Study Groups

DISCUSSION:

The mean age was 28.68 years for the comparative group and 26.76 years for the study group, which is in agreement with the study of (Ageel & Shbeer, 2022), this may be explained by the demanding physical and mental nature of critical care. Regarding sex, females were predominant in the sample (56.8%), which is in agreement with (Hafedh Ahmed et al., 2024), who reported 53.7% female ICU nurses, attributed to higher female admission and graduation rates in nursing programs.

In the current study, most of the participants had a diploma (50.6%) followed by a bachelor's degree (46.9%), and a small proportion of the participants had a postgraduate degree (2.5%) in agreement with (Yousif & Sadeq, 2025), who reported the varied educational backgrounds working in critical care units. Most (74.7%) worked evening shifts. This is a reflection of the ICU/CCU staffing system which employs limited morning administrative staff and successive 12-hour evening and night shifts. Job Position: Most of the participants were staff nurses and this is consistent with (Le Lagadec et al., 2025) as ICU nurses are the largest group who deliver direct patient care in comparison to administrative or managerial positions.

In addition, the number of nurses participating from intensive care is greater than the number of nurses participating from the coronary care unit, and this is consistent with these studies (Omidi et al., 2023) (Kolagari et al., 2022). This is attributed to the number of beds and nurses in the intensive care unit in the study hospitals being greater than the number in the coronary care unit. Years of Experience: Most of the participants (64.2%) had 1–6 years of experience, which is in line with (Shlash & Mohammed, 2022), who stated that 87.9% of critical care nurses were within the 1–5 year category.

Previous Training and EWS Experience: Roughly three-quarters of the sample (74.1%) had no structured training and no prior EWS experience (74.7%), which agrees with (Olowo et al., 2025), who stated that 74.03% of nurses had not had systematic training and 67.53% were novices in their MEWS knowledge. This is indicative of the poor adoption of early warning systems in clinical practice, leading to limited staff experience and training.

Initially, the study results showed a significant improvement in the readiness of participants toward early warning systems in critical care units. This improvement was evident through three main domains: knowledge, attitudes, and self-confidence.

Nurses' Knowledge in Both Groups at the Pre-Test and Post-Test:

On the pre-test, knowledge was similar in the comparative and study groups, both indicating poor knowledge. This finding aligns with Alias and Ludin (2021), who reported that 98.3% of nurses scored below the passing level, and with Badr et al. (2021), who observed that all participants demonstrated unsatisfactory knowledge before the intervention. On the other hand, Olang et al. (2019) reported 81.25% of nurses possessed adequate knowledge of early warning scores (EWS), and Handayani et al. (2022) found that more than half exhibited good knowledge levels. These variations may reflect differences in institutional policies, available training, prior exposure to EWS, and healthcare setting contexts. The low baseline observed in the current study is likely attributable to limited structured education on NEWS2 and SBAR and to inconsistent implementation of early warning systems in clinical practice. At post-test, the comparative group exhibited only a marginal rise (1.32→1.35), a change plausibly attributable to the Hawthorne effect (Berkhout et al., 2022). In contrast, the study group showed a substantial improvement (1.35→1.89) subsequent to the educational intervention. These results corroborate findings from multiple studies: Adnan et al. (2026) observed knowledge increasing from 69% to 89% in the intervention group; Badr et al. (2021) reported mean scores rising from 7.44 to 13.68 ($p<0.001$); Ghonem and El-Husany (2023) reported sufficient knowledge increasing from 7.5% to 92.8% ($p<0.001$); and Abdulsadah and Al-Abedi (2025) reported substantial improvements in knowledge and communication following SBAR training in Najaf, Iraq. Collectively, these findings support the effectiveness of structured educational programs in markedly enhancing nurses' knowledge of NEWS2 and SBAR, thereby improving clinical readiness for early recognition and escalation of patient deterioration.

Nurses' Attitudes in Both Groups at the Pre-Test and Post-Test:

At pre-test, mean attitude scores were comparable between the comparative (3.19) and study (3.16) groups, with most nurses demonstrating supportive or balanced attitudes toward NEWS2. This aligns with Wei et al. (2026), who found emergency nurses held either supportive or neutral-balanced attitudes toward recognizing clinical deterioration. Similarly, Alias and Ludin (2021) reported 53.7% favorable and 46.3% unfavorable attitudes among Malaysian nurses, while Munianday et al. (2024) found 73% of nurses held positive attitudes. In Saudi Arabia, Alawour et al. (2024) reported that most nurses expressed positive perceptions toward EWS and its role in patient safety. The dominance of supportive and balanced attitudes shows nurses' awareness of the importance of early warning systems. Balanced attitudes suggest uncertainty regarding the practical application and consistent use of escalation protocols. At post-test, the comparative group experienced a marginal decrease (3.19→3.11), indicative of the absence of ongoing reinforcement and consistent with the results of Mølgaard et al. (2022), and Le Lagadec et al. (2025), who collectively found that favorable attitudes toward EWS are fragile without sustained education and support. On the other hand, the study group showed significant improvement (3.16→4.00), with 97.8% displaying supportive attitudes. This finding corresponds with Kaur et al. (2024), who reported 100% positive attitudes post-training. Although directly comparable studies are limited, the findings are supported by related educational intervention research. The results are consistent with studies done by Innab et al. (2022), who noted significant attitude enhancement following a 12-hour program ($p<0.01$), and Gupta et al. (2025), who reported significant attitudinal improvement among critical care nurses after a structured instructional module. In general, the results indicate that nurses' attitudes toward NEWS2 can be improved through structured educational programs. Nevertheless, maintaining favorable attitudes demands ongoing education and reinforcement. As attitudes constitute a critical element of clinical readiness alongside knowledge and confidence, the observed improvement may enhance nurses' readiness to employ early warning systems effectively in clinical practice.

Nurses' Self-Confidence in Both Groups at the Pre-Test and Post-Test:

At baseline, both groups exhibited comparable moderate levels of self-confidence (comparative: 2.41, study: 2.38). This finding aligns with Alseraty et al. (2022), who reported that no nurses felt "very confident" in employing early warning scores (EWS), with the majority classifying themselves as "not confident" or "somewhat confident." In addition, Wood et al. (2019) identified limited confidence as a major barrier to recognizing and escalating clinical deterioration, and O'Neill et al. (2021) also highlighted that insufficient confidence prompts nurses to delay in care escalation, thereby negatively impacting EWS adherence. The moderate scores for the initial assessment could be a reflection of insufficient exposure to structured EWS education, with nurses depending on individual clinical judgement more than standard assessment tools. This implies inadequate readiness to effectively use EWS in critical care units. Following the implementation program, the study group showed marked improvement

in self-confidence (2.38→3.60), while the comparative group showed a slight decline (2.41→2.29). The decline in the comparative group is consistent with Santana and Magro (2025) and Jang et al. (2021), who indicated that confidence drops over time without constant educational reinforcement. The study group's improvement is consistent with multiple studies: Warren et al. (2021) and Lambert et al. (2023) reported that simulation-based deterioration training significantly enhanced nurses' confidence; Alseraty et al. (2022) documented substantial increases in nurses reporting "very confident" post-intervention; Sridhar et al. (2020) found improved confidence in physician communication after Pediatric EWS implementation; and (Saab et al., 2017) confirmed EWS education effectively enhances knowledge and confidence short-term. In contrast, McElroy et al. (2019) noted that 23.3–32.6% of participants showed minimal confidence improvement, attributed to over-reliance on personal judgment, administrative burden, and false-positive scores undermining system trust. The overall results showed that the structured educational programs improve the confidence of the nurses in the application of EWS; this contributed to the improvement of their readiness to apply EWS and SBAR, whereas the decline in the comparative group points towards the importance of continuous support and practical exposure to maintain the confidence levels.

CONCLUSION:

The outcomes of this study demonstrate that a structured educational program on early warning systems substantially enhanced nurses' readiness, reflected in measurable improvements in knowledge, attitudes, and self-confidence, indicating the effectiveness of the program as well as the potential for expanded implementation in critical care settings.

Recommendation for Future Research:

The study had several limitations, which included inconsistent delivery conditions due to shiftwork constraints, potential institutional differences between comparative and study group hospitals, an exclusive focus on nurses without engaging the broader medical team, and an inability to conduct follow-up assessments beyond the post-test, leaving long-term sustainability unexamined. Future studies are recommended to ensure standardized delivery, adopt balanced multicenter designs, incorporate a multidisciplinary approach, conduct follow-up at six to twelve months post-intervention, and examine the relationship between nurses' readiness and patient outcomes, including unexpected deterioration, unplanned ICU admissions, and length of hospital stay.

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