Original Research

# Knowledge and Skill in Relation to the Speed and Accuracy of the Nurses When Assessing Using an Early Warning System (EWS)

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## ABSTRACT

**Introduction:** Errors when filling in or interpreting the results of the EWS assessment causes delays and inaccuracies for the nurses when providing a clinical response. The aim of this study was to explain the relationship between the nurse's knowledge and skill with the speed and accuracy of the nurse when assessing via EWS.

**Methods:** This study used a correlation design with a cross-sectional approach. The sample consisted of 104 nurses working in the inpatient ward of internal medicine according to the inclusion criteria. The sample was obtained through purposive sampling. The independent variable was the nurses' knowledge and skill while the dependent variable was the nurse's speed and accuracy when assessing using the EWS. The instruments used were questionnaires and observation sheets. The data was analyzed using Spearman Rho.

**Results:** The results of the study showed that there was a very strong correlation between the knowledge-accuracy of the nurses when assessing using the EWS ($r = 0.805$; $p = 0.000$) and the nurse's skill-accuracy when assessing using the EWS ($r = 0.823$; $p = 0.000$). There was a strong correlation between the knowledge-speed of nurses assessing using the EWS ($r = 0.269$; $p = 0.006$) and the nurse's skill and speed when assessing using the EWS ($r = 0.262$; $p = 0.007$).

**Conclusion:** The nurse's knowledge and skill has a stronger relationship with accuracy when assessing using the EWS when compared to the nurses' speed. The nurse's knowledge about the EWS and the nurse's skill needs to be improved in order to support the increased speed and accuracy needed by the nurses when assessing patients using the EWS. The development of an appropriate method needs to be done to improve the nurses' knowledge and skill related to the EWS.

## INTRODUCTION

The Early Warning System (EWS) is a detection system used to spot changes in a patient's worsening condition(Peate, 2014). The EWS has proven to be a very effective system for detecting patients who are at risk of deterioration in a clinical conditions up to the point of death(Peate, 2014). This system is expected to provide better quality care for the patients and it is able to reduce mortality(Alam et al., 2014). This system aims to assist the clinical staff when identifying the early danger signs of critical patients while in the inpatient room before there is a decline in the widespread clinical conditions(Stafseth, Grønbeck, Lien, Randen, & Lerdal, 2016)(Keene, Kong, Clarke, & Brysiewicz, 2017). This is done to prevent unwanted events(Komisi Akreditasai Rumah Sakit;, 2017). It

will also encourage the provision of action as early as possible with the aim of improving patient outcomes(Peate, 2014). Errors when filling in or interpreting the results of the EWS assessment causes a delay and inaccuracy in the clinical response. This will worsen the patient's condition which can increase the mortality rate of the patients in the inpatient room(Alam et al., 2014).

Preliminary data from 20 nurses about the implementation of the EWS in an Internal Medicine Inpatient Installation Hospital in Malang explained that 75% (15 people) had difficulty applying the EWS, 50% (10 people) made errors when completing the EWS instruments, 50% (10 people) made errors when interpreting the EWS instruments, 100% (20 people) had never received the necessary EWS training but they had received information about the EWS. In addition, 80% (16 people) said that the observation sheets were not practical because they had to read their interpretations on different sheets. Several previous studies have attempted to uncover the nurses' knowledge of the EWS assessments such as those conducted by Dyah Restuning Prihati and Maulidta Karunianingtyas Wirawati (2019), and Desi Ratnasari Manurung (2018) and Augustinus Solagratia Situmorang (2018) who examined the nurses' attitudes toward the EWS assessments(Restuning & Karunianingtyas, 2019)(Manurung, 2018)(Situmorang, 2019). Errors when conducting the EWS assessment can be prevented by requiring every health worker to attend education, training and demonstrations on the implementation of an EWS in the hospital(Physicians;, 2012). Timeliness and competence when conducting EWS assessments can improve patient safety(Royal Colloge of Physicians, 2017). Delay and inaccuracy in an assessment using the EWS will result in a worsening of the patient's condition which pairs with an increase in the mortality risk in the inpatient room(Tesalonike, 2019)(Widiastuti, 2017).

The EWS has been widely applied by several hospitals in Indonesia, especially since the Hospital Accreditation Commission in Indonesia (KARs) established the EWS in the National Accreditation Standard known as the SNARS Edition 1 in 2017(Komisi Akreditasai Rumah Sakit;, 2017). An explanation of the EWS is listed in the Patient Focused Service Standards: Chapter 4 Patient Services and Care (PAP) 3.1 about Detection (Recognizing) Changes in Patient Condition(Komisi Akreditasai Rumah Sakit;, 2017). The EWS system allocates points in a weighted manner based on the derangement of a predetermined set of vital signs from an arbitrarily agreed "normal" range. The early warning scoring system (EWSS) was introduced by Morgan, et al in 1997 as a simple tool that can be applied by the ward staff to identify patients developing a critical illness(Jarvis et al., 2015). In 2012, the Royal College of Physicians conducted an EWSS evaluation and standardization. It came to be known as the National Early Warning Score (NEWS).

NEWS is a systematic approach that uses scoring to identify changes in someone's condition while determining the next step that must be done(Physicians;, 2012). A standardized NEWS has been introduced for use in the National Health Service (NHS) in the UK(Physicians;, 2012).

The RCP recommended that an EWS assessment should be performed on adult patients (16 years or older) to assess an acute disease, to detect clinical decline and to initiate timely and appropriate clinical responses. It is used as an aid for clinical judgment and not as a substitute for competent clinical judgment. It is also used for the initial assessment of acute illness and for the ongoing monitoring of a patient's condition during their stay in the hospital, for prehospital assessments where there is an acute patient conditions conducted first responders such as the ambulance services, primary health services and the public health center to optimize the communication of the patient condition before they are received by the destination hospital (Physicians;, 2012). The determination of NEWS is based on 6 physiological parameters namely respiratory rate, oxygen saturation, temperature, systolic blood pressure, pulse rate and the level of consciousness(Physicians;, 2012). EWS scoring is allocated to each parameter measured. The magnitude of the score reflects how extreme the parameters differ from normal conditions(Physicians;, 2012). Each important mark is allocated a numerical value from 0 to 3 with an observation color code chart (a score of 0 is the most desired and a score of 3 is the most undesirable(A.; & P., 2020). The total score indicates whether someone needs oxygen or not(Physicians;, 2012).

Knowledge is influenced by several factors, including age, education, occupation, environment and culture(Soekijo Notoadmodjo, 2014). The nurse's knowledge of the EWS involves the level of the nurses' understanding of the EWS instruments and how to apply them in terms of scoring, interpretation, and determining the most appropriate clinical response. The nurse's skill of assessing using the EWS refers to the nurse's capacity to use the EWS instrument. This includes the skill when scoring and interpreting the results, and determining the nurse's response. Nurses play a central role in implementing an NEWS and it is important to capture their 'voice' when evaluating the effectiveness of the tool. Timeliness contributes to the review mechanism that will inform development(Fox & Elliott, 2015). The speed of the nurses when conducting the EWS assessments refers to the time required by the nurses to score, interpret the results and determine the clinical responses that are best for the patients. The sum of the allocated points is used to indicate a patient's severity in terms of their illness and to inform if there is a need to increase the patient's physiological monitoring or to deliver expert help to their bedside(Jarvis et al., 2015). The speed of the nurses when assessing using the EWS is the time required by the nurses to conduct the scoring, the interpretation of the results, and the

Table 1. Characteristics of the Respondent Nurses in the Internal Medicine Inpatient Room (n=104)

| Characteristics of the Respondents | Parameter | Σ (N=104) | % |
|---|---|---|---|
| Gender | Male | 41 | 39.42 |
| | Female | 63 | 60.58 |
| | **Total** | 104 | 100 |
| Age | 25-29 years | 26 | 25.00 |
| | 30-34 years | 49 | 47.11 |
| | $\geq$35 years | 29 | 27.89 |
| | **Total** | 104 | 100 |
| Last education | Diploma | 73 | 70.20 |
| | Bachelor's | 31 | 29.80 |
| | **Total** | 104 | 100 |
| Length of working | 1-5 years | 35 | 33.65 |
| | 6-10 years | 26 | 25.00 |
| | $\geq$10 years | 43 | 41.35 |
| | **Total** | 104 | 100 |
| Position | Nurse Associate | 87 | 83.65 |
| | Nurse Primer | 17 | 16.35 |
| | **Total** | 104 | 100 |

determination of the clinical responses that will be given to patients. The accuracy of the EWS assessment is a match between the results of the scoring, their interpretation, and the clinical response determined by the nurse. The aim of this study is to explain the relationship between the level of knowledge and skill of the nurses with the speed and accuracy of the nurses when assessing using the EWS.

## MATERIALS AND METHODS

This study used a correlational design with a cross-sectional approach that explains the relationship between the nurse's knowledge and skill when conducting an assessment using the EWS compared against the nurse's speed and accuracy when assessing using the EWS. The study was conducted between December 2019 and February 2020 in Malang, East Java. The researchers involved a population of nurses from an internal hospital with 143 people. A total of 104 samples were obtained based on purposive sampling, population size estimates formulas, and several inclusion criteria. The inclusion criteria used included: nurses who had served in the inpatient ward conducting inpatient care for internal medicine, who had a minimum education level of a diploma, and who had worked for a minimum of 3 years in the hospital. The independent variable was the nurses' knowledge and skill while the dependent variable was the speed and accuracy of the nurse when assessing using the EWS.

The initial stage of this research was to provide informed consent to the respondents. The informed consent explained the purpose, benefits and procedures of the research that were to be carried out. The nurses who agreed to be respondents were given the research questionnaire. The demographic data was assessed using gender, age, last education, length of working and position. Collecting the data on the level of the nurse's knowledge was done using a questionnaire that had previously been tested for validity and reliability. The results of the calculation

of the validity test found that of the 15 questions, all items were declared to be valid. The questionnaire consisted of 15 question items which included the definition of the news, the purpose of writing the news, the parameters of the news, the requirements for news, news documentation, the news score, the interpretation of news and the clinical response of the nurses to the results of the scoring. A correct answer score was given 1 and a wrong answer score was given 0. The maximum score that a nurse can get if she answered correctly is 15 while the minimum score for a nurse's skill possible is 0. The assessment of the nurses' skill in terms of the scoring, interpretation, and determination of the clinical responses showed that the researchers were helped with the observation sheets. A score of 1 was given for a correct answer while a score of 0 was given for an incorrect answer. The maximum score that a nurse could get if they answered correctly was 10 while the minimum score was 0.

Descriptive analysis was used to analyze the characteristics of the respondents. The analysis of the relationship of the dependent variables independently was done using Spearman Rho with the statistical significance level set at $p < 0.05$. The ethical clearance was provided by Dr. Saiful Anwar's Hospital-Malang number 400/261 / K.3 / 302/2019 on November 22th 2019.

## RESULTS

Table 1 explains that the majority of respondents in the research totaled 63 women (60.58%). Most had an age range of 30-34 years totaling 49 people (47.11%). Most had a diploma as their last level education totaling as many as 73 people (70.20%). Most had had more than 10 years of service (41.35%) and most of the respondents were a Nurse Associate (83.65%).

Table 2 explains that from the 104 nurse respondents who filled in the questionnaire about their EWS knowledge, the majority of the nurses

Table 2. Evaluation Results of the Nurse's Knowledge Levels about EWS in the Inpatients Rooms in Internal Medicine (n=104)

| Knowledge | Parameter | Score | Σ(n=104) | % |
|---|---|---|---|---|
| Basic EWS | Well | $\geq 76$ | 74 | 71.15 |
| | Enough | 56 – 75 | 23 | 22.11 |
| | Less | $\leq 55$ | 7 | 6.74 |
| | **Total** | | 104 | 100 |
| Scoring | Well | $\geq 76$ | 35 | 33.65 |
| | Enough | 56 – 75 | 64 | 61.54 |
| | Less | $\leq 55$ | 5 | 4.81 |
| | **Total** | | 104 | 100 |
| Interpretation | Well | $\geq 76$ | 3 | 2.88 |
| | Enough | 56 – 75 | 21 | 20.19 |
| | Less | $\leq 55$ | 80 | 76.93 |
| | **Total** | | 104 | 100 |
| Clinical response | Well | $\geq 76$ | 28 | 26.92 |
| | Enough | 56 – 75 | 55 | 52.89 |
| | Less | $\leq 55$ | 21 | 20.19 |
| | **Total** | | 104 | 100 |

Table 3. Evaluation Results of the Nurses' Capabilities in IRNA 1 When Assessing Using the EWS (n=104)

| Nurse's skill | Parameter | Score | Σ(n=104) | % |
|---|---|---|---|---|
| EWS scoring | Well | $\geq 76$ | 98 | 94.23 |
| | Enough | 56 – 75 | 6 | 5.77 |
| | Less | $\leq 55$ | 0 | 0.00 |
| | **Total** | | 104 | 100 |
| EWS interpretation | Well | $\geq 76$ | 56 | 53.85 |
| | Enough | 56 – 75 | 48 | 46.15 |
| | Less | $\leq 55$ | 0 | 0.00 |
| | **Total** | | 104 | 100 |
| EWS clinical response | Well | $\geq 76$ | 72 | 69.23 |
| | Enough | 56 – 75 | 32 | 30.77 |
| | Less | $\leq 55$ | 0 | 0.00 |
| | **Total** | | 104 | 100 |

totaling 74 people (71.15%) had good basic knowledge of the EWS. However, as many as 80 people (76.93%) had less knowledge about the interpretation of the EWS results. In general, most of the nurses (60%) have less knowledge.

Table 3 explains that most of the nurse respondents have good skill when it comes to documenting the results of the EWS examination, especially regarding the EWS scoring of 98 nurses (94.23%) followed by the skill needed to interpret the EWS and the clinical response of the EWS.

Table 4 explains that only a few nurses (19.23%) have EWS training certificates, thus only 20 nurses have attended EWS training.

Based on Table 5, it was found that the majority of nurses (63.00%) need time in the range of 61 to 120 seconds to assess using the EWS. From this data, it can be seen that the average time needed by the nurses to assess using the EWS is 123 seconds.

Table 6 explains that the majority (69.00%) of nurses were able to carry out an EWS assessment appropriately, namely the appropriateness of the results of the scoring, interpretation, and clinical response determined.

Based on the data in Table 7, it can be determined that there are still many (80%) rooms that have not implemented the EWS optimally.

Table 8 explains that only 10.00% of the internal medicine treatment rooms have EWS implementation guidelines.

Table 9 shows the Spearman-Rho analysis. These results show that there is a very strong correlation between the knowledge and accuracy of nurses when assessing using the EWS (r = 0.805; p = 0.000). There was a strong correlation between knowledge and the speed of nurses when assessing using the EWS (r = 0.269; p = 0.006). There is a very strong correlation between the nurse's skill and accuracy when assessing using the EWS (r = 0.823; p = 0.000). There is a strong correlation between the nurse's skill and speed when assessing using the EWS (r = 0.262; p = 0.007).

## DISCUSSION

EWS, which is applied in the internal medicine wards in one hospital in Malang City, was adopted from NEWS 2012 with some adjustments according to the condition of the hospital. The parameters used include respiration, pulse, systolic blood pressure, body temperature, critical values, level of consciousness and additional oxygen, but only the parameters of respiration, pulse, systolic blood pressure and body temperature are scored. The clinical interpretations and responses used include Green (score 0-1) TTV monitoring per 6 hours; Yellow

Table 4. Data on the Nurses Attending EWS Training in the Internal Medicine Inpatient Installation

| EWS Training Certificate | Σ(N=104) | % |
|---|---|---|
| Have | 20 | 19.23 |
| Did not have | 84 | 80.77 |
| **Total** | 104 | 100 |

Table 5. Speed of the Nurses When Performing the EWS Assessment

| Time (seconds) | Σ(N=104) | % |
|---|---|---|
| ≥60 | 6 | 6.00 |
| 61 – 120 | 66 | 63.00 |
| ≥ 120 | 32 | 31.00 |
| **Total** | 104 | 100 |

Table 6. Accuracy of the Nurses When Assessing Using the EWS

| Accuracy | Σ(N=104) | % |
|---|---|---|
| Correct | 72 | 69.00 |
| Incorrect | 32 | 31.00 |
| **Total** | 104 | 100 |

(score 2-3): TTV monitoring per 2 hours, reporting to the attending doctor; Orange (score 4-5): TTV monitoring per 1 hour, nurse reporting to the on-duty doctor and the doctor reporting to the DPJP doctor and Red (score> 6): monitoring TTV per half hour, nurse reporting to the on-duty doctor and the doctor reporting to the DPJP.

The nurse's knowledge of the EWS is the basis for conducting EWS assessments. Every nurse needs to receive socialization related to the basic knowledge of EWS including definition, scoring, interpretation, the clinical response, requirements, goals and the benefits of the EWS assessment. The results of the research conducted by Suwaryo, Putra, Sutopo, Rahmat, Utoyo and Bambang explain that the socialization of an EWS is expected to increase the nurses' knowledge(Suwaryo, Sutopo;Rahmat, & Utoyo, 2019). Based on the data obtained by the researchers, nurses who have less knowledge have lower levels of speed and accuracy compared to the nurses who have good levels of knowledge. Based on the research data obtained, the level of the nurse's knowledge related to the EWS is influenced by the level of education and information that they have on the EWS(Bylow et al., 2019). Most of the nurses (70.20%) involved in this study were educated to diploma level. Only a small proportion (19.23%) had attended EWS training since the EWS observation sheet was socialized in 2017 at the internal medicine inpatient facility. Each nurse must complete a training program before conducting an EWS assessment(Fox & Elliott, 2015). In general, the level of knowledge of the nurses about the EWS mostly (60.00%) indicates less knowledge. The results of the research by Dyah Restuning Prihati and Maulidta Karunianingtyas Wirawati (2019) and Desi Ratnasari Manurung (2018) revealed that more nurses have implemented an EWS (51.4%) who have enough knowledge than those who had good knowledge(Restuning & Karunianingtyas, 2019)(Manurung, 2018).

The results of the field study have shown that the nurse's skill when assessing using the EWS is measured in terms of speed and accuracy when scoring, in addition to the interpretation of results and the determination of the clinical responses. Most of the nurses (63.00%) were able to determine the clinical response in 61-120 seconds with an average of 123 seconds. The time needed to score is longer than when interpreting the results and determining the clinical response. Furthermore, 69.00% of the nurses were able to perform correctly at the time of scoring, in the interpretation of the results and when determining the clinical response. The three abilities within the scoring skill play an important role when assessing using EWS. Accuracy in scoring at 100.00% indicates good accuracy in relation to the interpretation of results and the determination of the clinical response.

The level of knowledge and skill was also influenced by the nurses' experience of conducting EWS assessments. Based on the results of the survey conducted in the internal medicine ward, out of 10 rooms, the implementation of the EWS has not been running optimally. Only 20.00% of the rooms have been proven to be active at implementing EWS in relation to recognizing hereditary clinical conditions. This data is supported by the results of the study of Augustinus Solagratia Situmorang (2018) showing that the nurses' lack of knowledge about the EWS is the cause of the EWS not running optimally(Situmorang, 2019). Nurses who often carry out EWS assessments have higher levels of speed and accuracy when compared to the rooms that have not been optimal when implementing the EWS. The nurse's level of knowledge about the EWS and the skill of the nurses when conducting an EWS assessment has an influence on the speed and accuracy of the nurses when assessing. A good understanding of the nurses about the EWS can help the nurses to identify physiological changes in the patients so then the patients receive quality care safely [19].

This study shows that there is a very strong correlation between knowledge and accuracy and a strong correlation between the knowledge and speed of the nurses when assessing using the EWS. The

nurses with good knowledge will have a higher value for speed and accuracy compared to the medical personnel with sufficient or less knowledge. There is a very strong correlation between the nurse's skill-accuracy when assessing using the EWS and there is also a strong correlation between the nurse's skill-speed when assessing using EWS. Nurses with the skill to conduct EWS assessments better will have an improved level of speed and accuracy when compared to the nurses who have either sufficient or less skill.

The result of this study can be used as a reference for the hospital in order to develop an appropriate method to improve the nurses' knowledge and skill when assessing using EWS, thereby enhancing the rapid response system, decreasing the mortality rate and improving the patient clinical outcomes.

## CONCLUSION

The nurse's level of knowledge about the EWS and the skills of the nurses when conducting an EWS assessment has an influence on the speed and accuracy of the nurses when assessing using EWS. The nurse's knowledge and skills related to EWS has a stronger relationship with accuracy compared to the nurses' speed when assessing using EWS. The nurse's knowledge and skill related to assessing using EWS concerning the internal medicine inpatients needs to be improved, to support the increased speed and accuracy of the nurses when conducting assessments using the EWS. A rapid and appropriate EWS assessment will improve the prevention of a worsening patient condition in the inpatient room. The development of an appropriate method needs to be done to improve the nurses' knowledge and skills when assessing patients using the EWS.

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