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Implementation of Early Warning Scoring System (EWSS) to Improve 'ICU without Walls'

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ABSTRACT

The development of the concept of 'ICU without walls', or intensive services that are not only provided in intensive rooms but also given in inpatient rooms / general wards . needs to be developed in overcoming the limitations of intensive care rooms

The aim of study was investigate the influence of the implementation of the Early Warning Scoring System (EWSS) on the improvement of 'ICU without walls'.

The Quasi experiment with analytical descriptive design. This study identified changes in the level of deterioration conditions based on the Early Warning Scoring System (EWSS) before and after the actions of clinical responses were presented. In addition, this study identified the places of treatment involved before and after the implementation of the Early Warning Scoring System (EWSS) to see the improvement of 'ICU without walls'.

The results showed that the decrease in the EWSS scores led to decrease in referrals to ICU care; it means that the patients could still be treated in the non-ICU wards. The percentage of patients treated in ICU decreased, from 82.88% to 26.5%, It means that the non-ICU wards were able to provide emergency treatments according to the algorithm of clinical response based on the EWSS scores. So, the implementation of the EWSS was able to reduce the number of ICU occupancy and length of ICU care (BOR and AvLOS of ICU) by optimizing the use of non-ICU wards in overcoming patients' clinical emergencies. In other words, non-ICU wards are able to serve as 'ICU without walls' in caring for critical patients

Keywords: *EWSS + ICU without walls*

INTRODUCTION

The principle of Critical Nursing is to provide care for patients with rapid pathophysiological deterioration that can lead to death. The rooms for handling critical patients in hospitals consist of Emergency Room (ER), Intensive Care Unit (ICU), Intensive Coronary Care Unit (ICCU), and other intensive services. Along with the development, the need for intensive rooms in hospitals tends to increase so that intensive services cannot be accommodated well enough because of limited space. This situation encourages the development of the concept of 'ICU without walls', namely intensive services that are not only provided in intensive rooms but also given in inpatient rooms / general wards. In other words, in certain circumstances, intensive services do not have to be provided in the ICU when critical patient care does not require special procedures and / or equipment.

Research Purposes

This study aimed to explain the influence of the implementation of the Early Warning Scoring System (EWSS) on the improvement of 'ICU without walls'.

MATERIAL AND METHODS

This type of research uses Quasy experiment with analytical descriptive design. This study identified changes in the level of deterioration conditions based on the Early Warning Scoring System (EWSS) before and after the actions of clinical responses were presented. In addition, this study identified the places of treatment involved before and after the implementation of the Early Warning Scoring System (EWSS) to see the improvement of 'ICU without walls'.

The population in this study were inpatients at RSUD dr. Soeratno, Gemolong –Sragen, Indonesia. The number of samples taken in this study was the total number of samples that matched the inclusion and exclusion criteria. The samples of this study were 34 respondents. The sample inclusion criteria were: inpatients in the wards, patients with medical surgery cases and not maternity cases, and adult patients (aged 18+ years).

RESULT AND DISCUSSION

Characteristics of Respondents Based on Age and Gender

The mean of the respondents' ages was 51.6 years with the standard of deviation of 9.78 years. The youngest age was 35 years and the oldest age was 74 years. The number of male respondents was 22 (64.7%) and the number of female respondents was 12 (35.3%) - Table 1.

TABLE 1: Characteristics Based on Age and Gender

Variable	FF	%	Mean	SD	Min-Max	N
Age			51.6	9.78	35-74	34
Gender						
Male	22	64.7				
Female	12	35.3				

Characteristics of Respondents Based on the Place of Treatment in the Initial EWSS Measurement

In the initial measurement, all respondents were patients with EWSS scores in the high-risk category, 4 respondents (11.8%) indicated that they were treated in the non-ICU wards, and 30 respondents (88.2%) indicated that they were treated in the ICU (Table 2)

TABLE 2: Distribution of Care Points Based on the Initial EWSS Scores

EWSS Category	Indication in the Treatment Place				Total	
	Non-ICU		ICU			
	F	%	F	%	F	%
Very Low Risk	0	0	0	0	0	0
Low Risk	0	0	0	0	0	0
Medium Risk	0	0	0	0	0	0
High Risk	4	11.8	30	88.2	34	100
Very High Risk	0	0	0	0	0	0
Total	4	11.8	30	88.2	34	100

Characteristics of Respondents Based on the Place of Treatment in the Final EWSS Measurement

In the final measurement (the sixth 30 minutes), 17 respondents were patients with medium-risk category of EWSS, of whom 16 (94.1%) were treated in the non-ICU wards and 1 was treated in the ICU. 13 respondents were included in the high-risk category of EWSS, of whom 8 (61.5%)

were treated in the ICU and 5 (38.5%) were treated in non-ICU (Table 3).

TABLE 3: Distribution of Places of Treatment Based on the Final EWSS Score

EWSS Category	Indication in the Treatment Place				Total	
	Non-ICU		ICU			
	F	%	F	%	F	%
Very Low Risk	0	0	0	0	0	0
Low Risk	4	100	0	0	4	100
Medium Risk	16	94.1	1	5.9	17	100
High Risk	5	38.5	8	61.5	13	100
Very High Risk	0	0	0	0	0	0
Total	25	73.5	9	26.5	34	100

Analysis of the Correlation between the EWSS Score Category and the Place of Treatment

The results of statistical analysis showed that 17 respondents were patients with the medium-risk category of EWSS of whom 16 people (94.1%) were treated in the Non-ICU wards and 1 person was treated in the ICU. 13 people were included in the high-risk category of EWSS of whom 8 people (61.5%) were treated in the ICU and 5 people (38.5%) were treated in non-ICU. The results of the analysis on the correlation between the EWSS score and the place of treatment obtained p value = 0.001, meaning that there is a correlation between the EWSS score and the place of treatment (Table 4).

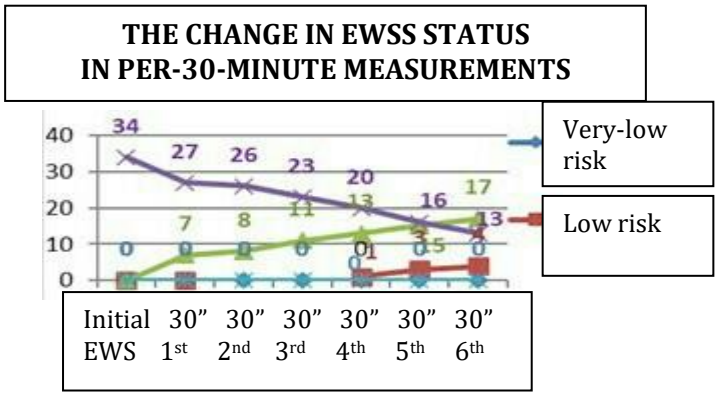
TABLE 4: Analysis of the Correlation between the EWSS Score Category and the Place of Treatment

EWSS Category	Place of Treatment				Total		P Value
	Non-ICU		ICU				
	F	%	F	%	F	%	
Low Risk	4	100	0	0	4	100	0.001
Medium Risk	16	94.1	1	5.9	17	100	
High Risk	5	38.5	8	61.5	13	100	

Analysis of the Implementation of Clinical Response According to the EWSS Score

Based on the scores in the initial measurement of EWSS, 34 people were included in the high-risk category. There was change in the last 30 minutes of monitoring as the scores decreased, resulting in 13 people were in the high-risk category, 17 people were in the medium-risk category, and 4 people were in the low-risk category (Table 5).

TABLE 5: Analysis of the Implementation of Clinical Response According to the EWSS Score



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The mean of the EWSS scores which decreased every 30 minutes of monitoring is described in the table below (table 6).

TABLE 6: Decrease of EWSS Score Per-30-minute Monitoring

EWSS Monitoring	Mean	Standard of Deviation	Min-Max	N
Initial EWSS	9.38	2.075	7-15	34
First 30 minutes	9.39	2.45	5-16	34
Second 30 minutes	8.41	2.595	5-16	34
Third 30 minutes	7.74	2.597	5-16	34
Fourth 30 minutes	7.12	2.306	4-15	34
Fifth 30 minutes	6.82	2.329	4-15	34
Sixth 30 minutes	6.68	2.483	4-16	34

The mean of EWSS scores decreased, meaning that there was an improvement in the EWSS scores after clinical responses. The EWSS score mean in the initial measurement was 9.38, which then decreased to 6.68 in the sixth 30-minute measurement.

DISCUSSION

The mean of the respondents' ages was 51.6 years, of which the youngest age was 35 years and the oldest was 74 years. Old age is closely related to disease. The elderly people have a high risk of experiencing critical illness because of decreased function and structure of multi-organs in the body. According to Vera, Endang Evacuasiany & Yuvens Richardo (2011), the decline in health status in the elderly people is caused by the following conditions:

1. Multipatology, a condition in which there is more than one disease in a patient which is generally chronic degenerative in nature
2. Decreased physiological reserve, which causes the elderly to easily get into failed-to recover condition (failure-to-thrive)
3. Changes in signs and symptoms of the disease from the usual ones
4. Disruption of functional status, namely the loss of a person's ability to carry out daily life activities.

Elderly patients with critical condition are usually transferred to the intensive care unit by the treating doctor. This will increase the demand for the use of the intensive care unit (ICU). Nevertheless, being young does not necessarily mean free from various threats of disease, not to mention critical illness. The lifestyle that is currently completely instantaneous, unhealthy eating patterns and high stress levels are factors that trigger the high number of critical illnesses that attack young people. Based on the data from the Ministry of Health of 2018, there were at least 109.9 thousand stroke sufferers who were in the age range between 35 and 44 years, and 42.6 thousand stroke sufferers were still in the adolescent and young adult category (15-24 years). According to the research data from Einstein Medical Center, Philadelphia, in 2016, at least one third of people with hypertension were young adults. This number has also continued to increase since ten years ago. About 50 percent of hypertensive patients from young adults are still untreated for various reasons. Some are not aware of it and some are underestimating it. In fact, if left untreated, hypertension can lead to heart disease and other diseases.

The number of male respondents was nearly twice the number of female respondents, which was 22 men (64.7%) and 12 women (35.3%). Sex/gender is also associated with critical illness in the form of multi-organ disorders. For example, men are more at risk of hypertension. The prevalence of hypertension cases found in several studies is almost all comparing between men and women. Hypertension cases in men are easier to find because when men have work problems, they supposedly tend to vent by smoking and drinking alcohol as well as eating unhealthy foods. These make their blood pressure high. Men generally do more activities so that fatigue along with unhealthy eating patterns and unhealthy living is a risk factor of hypertension (Amanda & Martini, 2018).

Research conducted by Louisa, Sulistiyani, & Joko (2018) showed that the prevalence of

hypertension in men was greater than that in women, which was 60%. Different research from Setyanda, Sulastri, & Lestari (2015) stated that smoking habits and incidence of hypertension were found a lot in males aged 35-65 years. Additionally, the ratio of the increase in blood pressure in men reached 2.29 for the increase in systolic blood pressure and 3.76 for the increase in diastolic blood pressure. This is because the heart rest rate and cardiac index in men are lower and the peripheral pressure is higher compared to that in women (Amanda & Martini, 2018).

Standard for Referral to ICU based on Clinical Response from the EWSS

According to the Decree of the Minister of Health of the Republic of Indonesia Number 1778 / MENKES / SK / XII / 2010 concerning Guidelines for the Implementation of ICU Services in hospitals, ICU is used to meet the needs of observation, treatment and therapy services for patients suffering from disease, injury or other complications threatening life or potentially threatening life, with *dubia* prognosis which is expected to be reversible (Ministry of Health, 2010).

According to the Decree of the Minister of Health of the Republic of Indonesia Number 1778 / MENKES / SK / XII / 2010, patients who deserve to be treated in the ICU are as follows:

1. Patients who require immediate medical intervention by the intensive care team
2. Patients who require a coordinated and continuous management of organ system functions so that constant monitoring and titration therapy methods can be carried out
3. Critically ill patients who require continuous monitoring and immediate action to prevent physiological decompensation

The results of this study stated that all respondents were in the high-risk category and indicated that they had to be admitted to the ICU. The indication for ICU care was based on the EWSS score more than 7. EWSS score more than 7 illustrates the worsening of life-threatening conditions manifested by worsening or abnormalities of vital signs (Jones et al., 2013). The application of the EWSS aims to early detect the condition of patients who experience deterioration and require emergency action so that appropriate and prompt action can be taken. These actions are carried out based on a predetermined algorithm (Duncan, K. D., McMullan, C., Mills, 2012).

An increase in the EWSS score indicates a deterioration in a patient and can be used to determine a higher level of care such as the ICU or HCU. Intensive management in the form of a clinical response which is a medical action according to a patient's condition does not have to be done in the ICU but, within certain limits, it can be done in the ward. The ability of nurses in the ward to carry out the EWSS and the preparedness of the medical team to respond to clinical conditions are the main factors in handling the worsening of patients' condition. The accuracy in EWSS monitoring and the accuracy in responding to patients' condition greatly determine the actions in handling emergency condition or deterioration of patients' condition in accordance with indications, safety, and quality (Gordo & Abella, 2014).

The decrease in the number of patients potentially treated in the ICU will save on care costs and reduce the burden of care in the ICU so that it will impact on the improvement of overall services. The increase in care costs is the consequence of the need to use more complex support techniques, the increasing need for vital support, and the longer length of stay (Robert et al., 2012).

This goes along with the statement of International Societies of Intensive Care Medicine (2012) telling that a good medical care is that which is appropriate to the needs, has high quality, and is completely safe for the patient.

Analysis of the Correlation between EWSS Score and Place of Treatment

This study concluded that there was a decrease in the EWSS scores from high-risk category to low-risk category at the rate of 38, 2%. These results indicate that there was a decrease in the ICU admissions after medical treatment based on clinical response in accordance with the EWSS scores. This illustrates that there was improvement in the patients' condition and a decrease in the rate of potential for ICU cares. The decrease in the rate of potential for ICU cares was due to the implementation of accurate and prompt EWSS monitoring and medical treatment based on the action algorithm in response to worsening conditions. The mean of the decrease rates of the potential for ICU cares based on the

EWSS scores ranged from 9.38 at the initial measurement to 6.68 at the final measurement (the sixth 30 minutes). This shows that periodic monitoring of the patients' condition (every 30 minutes) and medical treatments based on the algorithm could reduce the potential for ICU cares so that the treatments could still be continued in the ward. This is in accordance with the experts' opinion stating that the implementation of EWSS on patients' clinical changes is categorized as good if all stages of EWSS implementation on patients' clinical changes are carried out well and the reporting of the resulting score is from periodic assessments (Duncan, K. D., McMullan, C., Mills, 2012).

The decrease in the potential for ICU care is largely determined by the accuracy and promptness of the monitoring of patients' condition by applying the EWSS to early identify patients at risk and using multi parameters. One of the parameters assessed is the change in vital signs (Dean, 2018).

The application of EWSS to patients' clinical changes can assess acute disease, changes in patients' condition, and good and timely clinical responses (Dean, 2018). The EWSS for clinical changes in patients uses physiological parameter assessment which include systolic blood pressure, pulse, temperature, oxygen saturation, need for oxygen aids, urine production, and status of consciousness, which is aimed to detect the deterioration of patients' condition for reducing inpatient mortality and preventing irreversible condition changes of inpatients. (Dean, 2018).

The results of this study are in line with the research conducted by Peris (2012) showing that EWSS monitoring in post-surgery cases could reduce patient referrals to the ICU. This is due to the accuracy of the application of medical treatments as a response to the deterioration of clinical conditions in patients so that they do not require treatments in the ICU and the treatments can just be given in the ward or HCU (High Care Unit). A similar study from Moon (2011) also concluded that the application of EWSS to patient clinical changes decreased ICU admissions in hospitals.

However, the results of a different study from Bokhari (2010) stated that the application of EWSS to patient clinical changes increased the number of ICU admissions in haematological cases, but this study also concluded that the causes of the increased admissions to the ICU were delayed response, assessment errors, and inadequate therapy during the application of the EWSS to patient clinical changes.

The availability of ICU beds is so limited that, often in many hospitals, the selection of patients who can be admitted in the ICU requires a very thorough triage. The scarcity of unoccupied ICU beds sometimes leads to refusal or delay in ICU admission, or early discharge of ICU patients because of the accumulating number of patients requiring ICU care (Robert et al., 2012).

Cardoso et al (2011) reported that each hour of delay in admission to the ICU was associated with 1.5% increased risk of death in the ICU and 1% increase of hospital mortality (Cardoso et al., 2011). In addition, Sakr et al. (2012) stated that patients who re-entered the ICU had fourfold increased risk of death and twofold length of stay in the hospital (Sakr et al., 2012).

Implementation of EWSS in Enhancing ICU without Walls

'ICU without walls' is an emergency service system by optimizing services in inpatient wards by utilizing human resources, equipment and hospital policies. 'ICU without walls' refers to innovative management in intensive care, based on two key elements: (1) collaboration of all medical and nursing staff involved in patient care during inpatient treatment and (2) technological support for protocols of early detection on severity by identifying patients at risk of worsening at all hospitals based on the assessment of vital signs and / or laboratory test values, with a clear purpose of improving the safety of critical patients during the process of inpatient treatment (Gordo & Abella, 2014).

According to Gordo & Abella, 2014, there are five main diagnoses leading patients to be admitted in the ICU, namely respiratory insufficiency / failure, post-surgery management, ischemic heart disorders, sepsis, and heart failure. The five medical diagnoses require intensive care with a relatively long length of stay in the ICU whereas the availability of ICU beds is very limited. Currently, along with the Covid-19 pandemic, in most hospitals, the BOR (Bed Occupancy Ratio) of the ICU is very high and the AvLOS (Average Length of Stay) is increasing (Gordo & Abella, 2014).

Not all potentially acute patients are admitted to the ICU. However, by empowering the resources and technology in the wards, such patients can be treated in the wards with close monitoring and intensive action. So, patients are admitted to the ICU only in very urgent circumstances. Chen et al. recently reported that 70% of patients with the death-risk estimation of more than 30% were not admitted to the ICU, and instead, they received treatments in conventional inpatient wards (Chen et al., 2012).

One solution in dealing with the problems mentioned above is the application of the 'ICU without walls'. 'ICU without walls' is an intensive service model that has recently been developed and adopted in intensive care, aiming at accelerating emergency services and reducing ICU cares. The implementation of 'ICU without walls' must meet two important elements. They are:

1. Collaboration of all medical and nursing staff involved in patient care during hospitalization

2. Technological support in the form of EWSS which is a procedure of early detection for patients' severity based on the assessment of vital signs

The implementation of 'ICU without walls' aims to improve patients' safety during the inpatient process in wards, from hospital admission to discharge. The monitoring of worsening condition of patients is carried out by applying the EWSS which contains systematic monitoring indicators including vital signs, oxygen saturation, consciousness, risk of respiratory arrest and cardiac arrest (Calvo Herranz, Mozo Martín, & Gordo Vidal, 2011).

Patients who experience a deteriorating condition must be monitored continuously in the inpatient wards and immediately given medical treatments according to the EWSS algorithm so that the progress of the condition can be seen minute by minute. The application of the EWSS can help the process of ICU triage so that the use of ICU inpatient rooms can be minimized, and the rooms are only used for patients who really have an indication of ICU care. According to Winters et al., many hospitals have implemented rapid response systems over the past 15 years to improve identification and response to deteriorating patients in public hospital wards. Furthermore, Winters, et al.(2013) stated that the use of rapid response systems (RRSs) was associated with decreased rates of cardiac arrest and mortality Early application of EWSS to patients will be able to identify worsening conditions and then be able to provide a reference for implementing medical aid algorithm to prevent massive worsening of the condition. However, if the EWSS monitoring finds a serious clinical problem, the patient will be immediately referred to the ICU promptly and accurately so that there will be no delay in the medication and other treatments. In other words, if a patient's clinical condition enables diagnostic reorientation or enhanced therapeutic measures, clinical improvement can be achieved in the ward and the patient does not need to be treated in the ICU.

CONCLUSION

1. The EWSS monitoring done periodically every 30 minutes for 3 hours, followed by the implementation of action algorithm, could lower the EWSS category from high-risk category to medium-risk category and low-risk category.
2. The EWSS score determines the place of treatment. Statistically, it has been proven that the EWSS score is related to the place of patient treatment (p value = 0.001).
3. The decrease in the EWSS scores could reduce ICU care referrals, from 82.88% to 26.5%, and the patients could still be treated in the non-ICU wards, meaning that the non-ICU wards were able to provide emergency treatments according to the clinical response algorithm based on the EWSS scores.
4. The implementation of EWSS could minimize the number of ICU care referrals and the length of ICU care (BOR and AvLOS) by optimizing the use of non-ICU wards in dealing with patients' clinical emergencies, meaning that the non-ICU wards were able to function as 'ICU without walls' in caring for critical patients.

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