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Outcome of Applying MEWS (Modified Early Warning Score) for High Risk in-Patients in Wihandaeng Hospital, Saraburi Province

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Abstract

➢ ***Background***

Patient safety is a crucial issue for better health care system quality development. One of Wihandaeng hospital patient care development plan was implementation of modified early warning score in specific patients which trigger action such as timely referrals before the patient's condition worsens. MEWS were expected to be useful clinical tool for improving adverse events, mortality and proper patient referrals.

➢ ***Objective:***

To examine the effects of MEWS on time measure in hours from symptoms deteriorated to referral and mortality rate in 48 hours after referral

➢ ***Method:***

Intervention research interrupted time design was done by retrospectively reviewing 64 medical records of patients admitted to Wihandaeng hospital who met high risk criteria. The record data were collected before implementation of MEWS (1 March - 30 June 2020) and after implementation of MEWS (1 July – 31 October 2020). Poisson multiple logistic regression was done for time measure in hours from symptoms deteriorated to referral and both univariate and multivariate logistic regression were used to analyze mortality rate in 48 hours after referral.

➢ ***Result:***

MEWS implementation associated with 5.73±0.65 hours reduction of time counted from critical condition change to referral. (95% CI -7.00, -4.47; p-value < 0.001) and 4.36±0.63 hours reduction (95% CI -5.60, -3.11; p-value < 0.001) after multivariable logistic regression analysis. MEWS implementation is associated with 0.47±0.42 chance of mortality rate after referral in 48 hours. (95% CI 0.08, 2.75; p-value = 0.4) and 0.16±0.21 chance (95% CI 0.01, 1.99; p-value = 0.157) after multivariable logistic regression analysis.

➢ ***Conclusion:***

MEWS is a recommended tool for monitoring of condition deterioration vulnerable immunocompromised high-risk hospitalized patients in resources limiting rural hospitals.

Keyword:- *Modified early warning score (MEWS), Outcome, Referrals, time.*

I. INTRODUCTION

Patient safety is a crucial issue for better health care system quality development stated by WHO and Ministry of public health. [1-2] Medical adverse events like drug allergy, drug and treatment side effects along with worsening patient conditions occur within the in-patient department.

Early warning signs in specific patients can trigger medical intervention in patient care before patient conditions deteriorate as a part of patient care system development.[1] It is essential to improve patient safety, reduce adverse events, reduce cost and more proper patient referrals.[3,4] Therefore, the elaborated design of the patient care system is important and urgent need in primary care service, especially for rural hospitals which are considered as the first contact of patient care.[2]

Wihandaeng hospital, Wihandaeng district Saraburi province, is a 30-beds size rural hospital. The hospital has 40-beds potential and maximal bed-occupancy rate is 133% and average bed-occupancy rate is 50% during a certain time period. This occupancy and workload tend to relate with treatment delay and other adverse events to higher mortality rate after referral or after admission to intensive care unit and more length of stay in the hospital. The patient and caregiver quality of life are also affected. Fragile patients are at high risk such as patients who are old age, diabetes, chronic kidney disease, immunodeficiency or cancer with chemotherapy treatment.[5] This group of patients often have atypical presentation and obscured physical signs. The timely diagnosis might be missed without obvious signs and symptoms.[6,7] Most of the time, the diagnosis is delayed until the patient's conditions are worsened or critically ill. Especially in rural hospital settings

with scarcity of resources and medical utilities. So, the aim to reduce adverse events via early diagnostic tools is warranted. [2–4]

Wihandaeng hospital has implemented modified early warning signs score (MEWS) [8,9] for monitoring vital signs in high risk patients. The tools will help trigger a timely response when vital signs and other parameters change in pursuit of reducing adverse events. MEWS is a clinical tool for assessing patients' signs and symptoms via alteration of 7 parameters including blood pressure, heart rate, respiratory rate, body temperature, oxygen saturation, consciousness level and urine output in 4 hours. The tool was first implemented in July 2020.

In order to demonstrate the efficiency of MEWS implementation for patients' condition monitoring systems in rural hospitals as Wihandaeng hospital in contrast to tertiary hospital in terms of resources. Evaluation both before and after implementation of MEWS which will improve the monitoring system in terms of effectively detecting critical abnormality and aims to reduce mortality rate, reduce observing time to trigger timely refer and reduce mortality rate during 48 hours after referrals.

➢ *Objective*

To assess the effect of implemented MEWS on time measure in hours from symptoms deteriorated to referral and Mortality rate in 48 hours after referral in high risk patients in Wihandaeng hospital.

II. METHODS

***Study design*:-** Intervention research interrupted time design
***Data resource* :-** 32 medical records of hospitalized patients were collected before implementation of MEWS (1 March - 30 June 2020) and 32 medical records were collected after implementation of MEWS (1 July – 31 October 2020).

Patients' medical records were reviewed retrospectively. Demographic data of patients including age, gender, underlying diseases and clinical diagnosis recorded.

➢ *Data collection Data collection form*

Sampling population:- Patients admitted to Wihandaeng hospital whom met high risk criteria both before and after implementation of MEWS during 1st March to 31 October 2020

Samples size calculation N=64 of each group, divided into n=32 each as non-expose and expose to MEWS (interrupted time design).

P (outcome/non-expose) = 0.4, p(outcome/expose) = 0.1 alpha = 0.05, beta 0.2 (power 80%)

Place site of research:- Wihandaeng hospital during 1 March to 31 October 2020

➢ *Inclusion criteria*

- Elderly beyond 70 years-old
- Diabetes mellitus
- Chronic kidney disease stage 4 and above
- Immunodeficiency
- Cancer during chemotherapy treatment
- Cirrhosis

➢ *Exclusion criteria*

- Patients with indication for referral at first medical contact
- Patients whom denied treatment
- Uncomplicated patients with non-urgent appointment with specific admission reasons such as blood transfusion as ambulatory plan or short stay admission for one dose of antibiotics daily
- Trauma patients

❖ *Statistical analysis*

Due to interrupted time design, before and after intervention, each population group has heterogeneous baseline characteristic and non-normal pattern of data distribution. Logistic regression equation was used to analyze results and control confounders due to heterogeneity between before and after groups.

➢ Time measured in hours from symptoms deteriorated to referral analyzed with Poisson multiple logistic regression due to non-normal distribution of data.

Outcome 1: Time to refer, duration of time used to initiate referrals after critical symptoms change. Numerical data.

- Mean +/- SD
- Mean difference

➢ Mortality rate in 48 hours after referral analyzed with univariate and multivariate logistic regression.

Outcome 2: Mortality rate in 48 hours after referral, Continuous numerical data

- Percentage
- Risk ratio difference

❖ *Right to Protection and Research Ethics*

This study has been approved by the committee of research ethics regarding human study of Saraburi Hospital. (The number of projects: EC050/2563. signed on 4 November 2020).

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III. RESULT

There are 64 patients were enrolled. 32 patients were monitored with MEWS and the other 32 patients were monitored with usual standard care. After statistical analysis comparing data before and after implementation of MEWS. The patient characteristics were similar between groups at baseline. Mean age is 61.98±2.3 years (Mean±SD) and 61.34±3.61 years, 62.63±2.93 years in usual care and MEWS group respectively. Elderly with age > 70 years is 39.06% in all groups and 18.75%, 13% in usual care and MEWS group respectively. 35% of subjects are male and 21%, 14% in usual care and MEWS group respectively. 17% of subjects have diabetes mellitus and 11%, 6% in usual care and MEWS group respectively. 7% of subjects have chronic kidney disease and 3%, 4% in usual care and MEWS group respectively. 4% of subjects have HIV infection and 3%, 1% in usual care and MEWS group respectively. 5% of subjects used steroids and 2%, 3% in usual care and MEWS group respectively. 4% of subjects have cirrhosis and 2% in each group.

The 7% of subjects have sepsis and 2% and 5% in usual care and MEWS group respectively. 5% of subjects have septic shock and 1%, 4% in usual care and MEWS group respectively. 19% of subjects have pneumonia and 12%, 17% in usual care and MEWS group respectively. 10% of subjects have urinary tract infection and 5% in each group. 13% of subjects have gastrointestinal infection and 7%, 6% in usual care and MEWS group respectively. 10% of subjects have congestive heart failure and 5% in each group. (Table 1)

Characteristic, n (%)	Total, n = 64	Usual care, n = 32	MEWS, n = 32	P-value
Mean age (±SD)	61.98 (±2.3)	61.34 (±3.61)	62.63 (±2.93)	0.784
Age > 70 years	25 (39.06)	12 (18.75)	13 (20.31)	1.000
Male sex	35 (54.69)	21 (32.81)	14 (21.88)	0.131
Diabetes mellitus	17 (26.56)	11 (17.19)	6 (9.38)	0.257
Chronic kidney disease	7 (10.94)	3 (4.69)	4 (6.25)	1.000
HIV infection	4 (6.25)	3 (4.69)	1 (1.56)	0.302
Steroid used	5 (7.81)	2 (3.13)	3 (4.69)	0.641
Cirrhosis	4 (6.25)	2 (3.13)	2 (3.13)	1.000
Sepsis	52 (81.25)	26 (40.63)	26 (40.63)	1.000
Severe sepsis	7 (10.94)	2 (3.13)	5 (7.81)	0.426
Septic shock	5 (7.81)	1 (1.56)	4 (6.25)	0.355
Pneumonia	19 (29.69)	12 (18.75)	17 (26.56)	0.274
Urinary tract infection	10 (15.63)	5 (7.81)	5 (7.81)	1.000
Gastrointestinal infection	13 (20.31)	7 (10.94)	6 (9.38)	1.000
Congestive heart failure	10 (15.63)	5 (7.81)	5 (7.81)	1.000
Time to refer (±SD)	6.66 (±1.09)	9.53 (±1.97)	3.80 (±0.63)	0.007
48 hours mortality rate after referral	6 (9.38)	4 (6.25)	2 (3.13)	0.672

Table 1:- Baseline characteristics

MEWS implementation associated with 5.73±0.65 hours (95% CI -7.00, -4.47; p-value < 0.001) reduction of time counted from critical condition change to referral and 4.36±0.63 hours reduction (95% CI -5.15, -2.58; p-value < 0.001) after multivariable logistic regression analysis for adjusting confounders.

Time to refer	Time reduced in hours Mean ± SD (95% CI)	P-value
univariate analysis	-5.73 ± 0.65 (-7.00, -4.47)	<0.001
multivariate analysis	-4.36 ± 0.63 (-5.60, -3.11)	<0.001

Table 2:- Result of time counted from critical condition change to referral

MEWS implementation is associated with 0.47±0.42 chance of mortality rate in 48 hours after referral. (95% CI 0.08, 2.75; p-value = 0.4) and 0.17±0.21 chance (95% CI 0.01, 1.99; p-value = 0.157) after multivariable logistic regression analysis for adjusting confounders. (Table 2)

Outcome	Mortality rate in 48 hours after referral, Odd ratios	P-value
uOR (95% CI)	0.47 (0.08, 2.75)	0.400
mOR (95% CI)	0.17 (0.01, 1.99)	0.157

Table 3:- Results of Mortality rate in 48 hours after referral

IV. DISCUSSION

This study was done in a setting of rural hospital in secondary care level with limited resources. The community and population are growing due to industrial development in the area. Both groups of subjects were vulnerable immunocompromised patients. The baseline characteristics are homogenous.

MEWS is convenient to use as a clinical monitoring tool in vulnerable immunocompromised patients for worsening of symptoms. MEWS can improve the quality of referrals in both time cost and mortality rate. The results showed that reduction of time used to refer patients to more advanced hospital is associated with implementation of MEWS. The result is not different from other studies about monitoring critical condition [8,20,22,30]. Saved time could be used to complete other tasks which are urgent and important in small rural hospitals with limited staff and resources. Appropriated referrals and timely action are crucial to a patient's outcome. The result of MEWS implementation on mortality rate after referral in 48 hours is almost half the chance less than usual care monitoring. MEWS might be able to show its true effect of reducing mortality rate after referral in 48 hours with larger sample size in multi-center randomized controlled trial design. However, in this study there is no clear evidence strong enough to claim association of MEWS implementation and mortality rate in 48 hours after referrals in which like the result from some other study [13,23,27,29]. MEWS might not be a competent prognostic tool for predicting mortality.

Limitations in this study are small sample size and single center study. Population of interest are vulnerable patients with high risk to mortality due to their immunocompromised status, hence study results might not be applicable to other populations. The study design is retrospective cohort study in one group comparing before and after implementation of MEWS in which large scale randomized control trials might also be study design of choice in terms of demonstrating definite results and conclusion. Applicability of this study is mainly focused on rural hospitals with limited medical utilities and resources. The advantages of using MEWS are convenience and cost saving. The disadvantages are inter-operator and intra-operator discrepancy in overwhelming workload. [12]

V. CONCLUSION

MEWS implementation is associated with reduction of time from worsening of symptoms to referral comparing to usual care. This research can not demonstrate association of mortality rate in 48 hours after referral and MEWS implementation.

APPLICATION

MEWS is recommended to be used as a monitoring tool in vulnerable immunocompromised patients for worsening of symptoms for in-patient's department of resource limiting rural hospital to reduced time from worsening of symptoms to referral.

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