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Using an Early Warning Score System in the acute medicine unit of a medical city in Saudi Arabia is feasible and reduces admissions to Intensive care.

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Abstract

Background: Early Warning Scoring Systems (EWSS) are based on vital signs that are intended to help in detecting and defining clinical deterioration. Several studies have demonstrated that when combined with a system of prompt and appropriate clinical responses, the use of EWSS does improve the overall outcome. However, there are very few high-quality studies and the literature is somewhat contradictory. Moreover, no study has yet been conducted on EWSS in the hospitals of Middle East.

Methods: A cross-sectional study was performed on the use of the Physiological Early Warning System (PEWS) in the Acute Medicine Unit (AMU) of a large tertiary hospital (1500 bed medical city) in Saudi Arabia.

Results: The study demonstrated that the use of PEWS was feasible in this setting without ward-based medical cover. PEWS did not affect the average length of stay of patient. Similarly, Critical Care Response Team (CCRT) activation was not reduced. However, admission rate to the intensive care unit (ICU) was significantly reduced.

Conclusion: The studied data suggest that the use of EWSS in this clinical setting improved the responses to deteriorating patients by primary teams and thereby reduced admissions to ICU. However, CCRT involvement was not reduced because the PEWS escalation algorithm overlaps with that for CCRT activation. Further studies are required to determine whether the use of EWSS can improve outcomes whilst reducing the need for CCRT and thereby the costs of treating deteriorating medical inpatients.

Keywords: Acute medical unit; intensive care unit; early warning score system; Saudi Arabia.

1. Introduction:

A delay in identifying and responding to clinical deterioration in acutely unwell patients may result in unplanned admissions to the intensive care units (ICU) or even in patients' deaths. Similarly, provision

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of suboptimal care to patients in general wards may increase the chances of cardiopulmonary arrest, and increase the ratio of mortality either in terms of ICU or hospital mortality [1].“Early Warning Scoring Systems” (EWSS) are based on vital signs that are intended to help in early detection and definition of clinical deteriorations [2]. The EWS is an instrument used for evaluation at bedside of a patient, built on five physiological factors which are systolic blood pressure, respiratory rate, pulse rate, temperature and Alert Verbal Painful Unresponsiveness (AVPU) scale [3]. Several studies have demonstrated that the use of EWSS improves the eventual outcome when combined with a system of prompt and appropriate clinical response. For example, it has been reported that the use of EWSS reduces length of stay (LOS) and hospital readmissions [2, 4, 5]. As a result, a standardized National Early Warning Score (NEWS) has been implemented across the United Kingdom [6].

In Europe and North America, this system is utilized in surgical wards and emergency units for early identification of critically ill patients and helps them in their prompt transfer to intensive care if required [5, 7-9], thereby reducing cardiac arrest rate, duration of stay in critical care, readmission in ICU and mortality [10]. Many studies have reported that EWSS is effective in evaluating not only the patient’s physiological condition but also in precluding loss of time and effort of healthcare teams when used in ICU, emergency unit and postoperative surgical unit [7-9, 11, 12].

A core goal of Vision 2030 of the Kingdom of Saudi Arabia (KSA) is to enhance the standard and quality of health care services whilst increasing the efficiency and productivity of care simultaneously (Vision 2030, KSA). This can only be achieved if existing resources are used more effectively. One potential solution is the use of an early warning score system (EWSS) such as the Physiological Early Warning System (PEWS; Table 1) to direct resources to deteriorating patients. By improving the interpretation of routinely collected clinical data and thereby the response to the deteriorating patient, the use of the EWSS in Saudi Arabia should improve outcomes without any significant cost increase.

However there are no data on the use of any EWSS in the Middle East. Furthermore, there are very few well-designed, high quality studies around use of EWSS and not all studies have reported improved outcomes. The aim of this study was to evaluate the feasibility of the use of the PEWS in patients admitted to an acute medicine unit in a tertiary hospital in KSA to determine the effect on length of hospital stay (LOS), admission to the intensive care unit and mortality in this setting.

2. Material and Methods:

2.1 Study Design

A cross-sectional study was conducted in the King Abdulaziz Medical City, Riyadh during the period between Nov’2011 and the end of May’2012.

2.2 Setting

King Abdulaziz Medical City, Riyadh is a tertiary hospital with 1500 beds and staffed by healthcare workers from over 44 different countries. The acute medical unit (AMU) was staffed to accommodate 20 patients. Whilst the nursing establishment was ward-based, medical cover was provided by several different consultant led teams from the department of internal medicine. Unselected medical patients who were expected to remain in the hospital for less than 72 hours were preferentially admitted to AMU rather than directly to a general medical ward. Any patients remaining in the AMU more than 72 hours could be listed for transfer to a general medical ward at the discretion of the attending physician. The timing of the transfer however depended on the availability of ward beds.

2.3 Study Population and Data Collection

Data were collected on all adult patients (>18 years) admitted to the AMU in KAMC. Patients' vital signs were monitored for at least 6 hours unless more or less frequent observations were requested by the treating physicians. The physiological early warning system (PEWS) used in this study is shown in table 1. Use of the PEWS was introduced to the AMU on 15/03/12. Physicians were not allowed to adjust the parameters of the PEWS scoring system in this study.

Demographic data were collected about date of admission, age, sex and diagnosis upon admission. Feasibility was assessed by reviewing the clinical records of the data required to calculate PEWS and the response of healthcare professionals to the score. Effect on outcomes was considered by comparing the use of the critical care rapid response team (CCRT) and transfer to ICU as well as the final outcome (i.e. discharge from hospital or death), readmission rates and length of inpatient stay (LOS) before and after introduction of the PEWS to the AMU.

Table 1. Physiological Early Warning System – Adult Patients and Score Evaluation.

PEWS Score	3	2	1	0	1	2	3
Respiratory Rate	9	10	11	12-20	21-24	25-27	28-29
SaO_2	86-87 RA	88-89 RA	90-94 RA	95-100 RA	95-100 O2	93-94 O2	91-92 O2
Pulse	41-50	50-54	55-59	60-100	101-105	106-115	116-129
Systolic BP	91-92	93-94	95-99	100-140	141-150	151-160	160-199
Temperature	<35	35-35.4	35.5-35.9	36-37	37.1-37.5	37.6-38	>38
Glasgow Coma Scale	<7/15 Trach No Sedation	(8-10)/15 Trach No Sedation	10/15 Trach No Sedation	15/15 RA No Sedation	14/15 RA No Sedation	13/15 RA No Sedation	>13/15 RA No Sedation

TOTAL Score of EWSS	**ACTION**
0	The nurse will reassess the patient as per ward routine
1-2	The nurse will inform the physician within one hour
3-6	The nurse will inform the physician immediately
7-10	The physician will assess the patient within 25 minutes
>10	The physician will assess the patient within 10 minutes
Patient has 2 indicators with score 3 at the same time	The physician will assess the patient within 10 minutes

2.4 Statistical analysis

Statistical analyses were performed using Statistical Package for the Social Sciences (SPSS; SPSS Inc, USA). Continuous data are presented as mean ± standard deviation were assessed using Student's T test. Categorical data were analyzed using the Chi-squared test.

2.5 Power calculation

Assuming an incidence of admission to ICU of 0.5% and considering a 50% reduction to 0.25% as clinically significant (alpha error 5% and beta error 30%) a sample size of at least 147 patients was required.

2.6 Ethical approval

Ethical approval was obtained from the Institutional Review Board (IRB) of King Abdulaziz Medical City, Riyadh, Saudi Arabia (KAMC) prior to the start of this study.

3. Results

3.1 Demographics

A total of 389 adults (190 men, aged 62.3years, SD ± 1.7 and 199 women aged 62.8years, SD ± 1.4) were admitted to the AMU between the study period. There was no loss to follow up, so data collected from all patients was included in the study. The characteristics of the study population are shown in Table 2.

Table 2. General Characteristics of Subjects.

Parameter	Males	Females
N	190	199
Age (years)	62.3 ± 1.7	62.8 ± 1.4
% Code Blue	1 (0.5)	0 (0)
% of CCRT activated	18 (9.5)	10 (5.0)
% Final Outcome		
Discharged	142 (74.7)	164 (82.4)
Transferred to ICU	12 (6.3)	5 (2.5)
Transferred to ward	28 (14.7)	27 (13.6)
Expired	2 (1.1)	2 (1.0)
No code	6 (3.2)	1 (0.5)
Readmission within a month	17 (8.9)	30 (15.1)
Mean Length of Hospital Stay (days)	19.5 ± 2.6	17.1 ± 2.5
Mean Length of Stay at Ward 23 (days)	8.1 ± 1.0	8.4 ± 1.4
Length of Stay According to Days		
≤ 2 days	56 (29.5)	55 (27.6)
3-5 days	47 (24.7)	53 (26.6)
6-8 days	30 (15.8)	38 (19.1)
9-11 days	11 (5.8)	17 (8.5)
12-14 days	16 (8.4)	11 (5.5)
≥ 15 days	30 (15.8)	25 (12.6)

3.2 Calculation of PEWS score and response of healthcare professionals to scores

Compliance with the measurement of the vital signs, calculation of the PEWS score and the response to the score was high and increased during the trial period. This is illustrated in Figure 1 which shows the compliance with the measurement of the required parameters and the calculation of the PEWS.

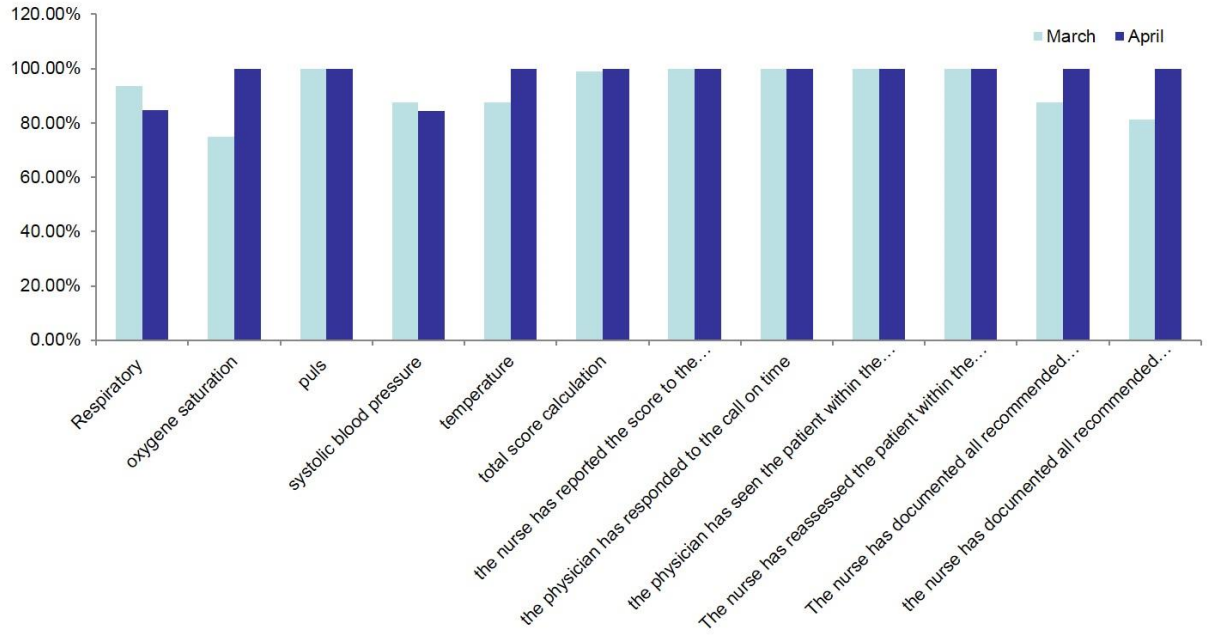

Figure 1. Percentage (%) compliance of patients from the Months of March to April 2012.

3.3 Length of stay and readmission rates

Figure 2 illustrates the average LOS (range 5.09 – 10.7 days). Introduction of the PEWS did not affect the average LOS. Readmission rates are illustrated in Figure 3. These were generally low ranging from 0.08 to 0.36% of admissions every fortnight. This was not affected by the introduction of the PEWS.

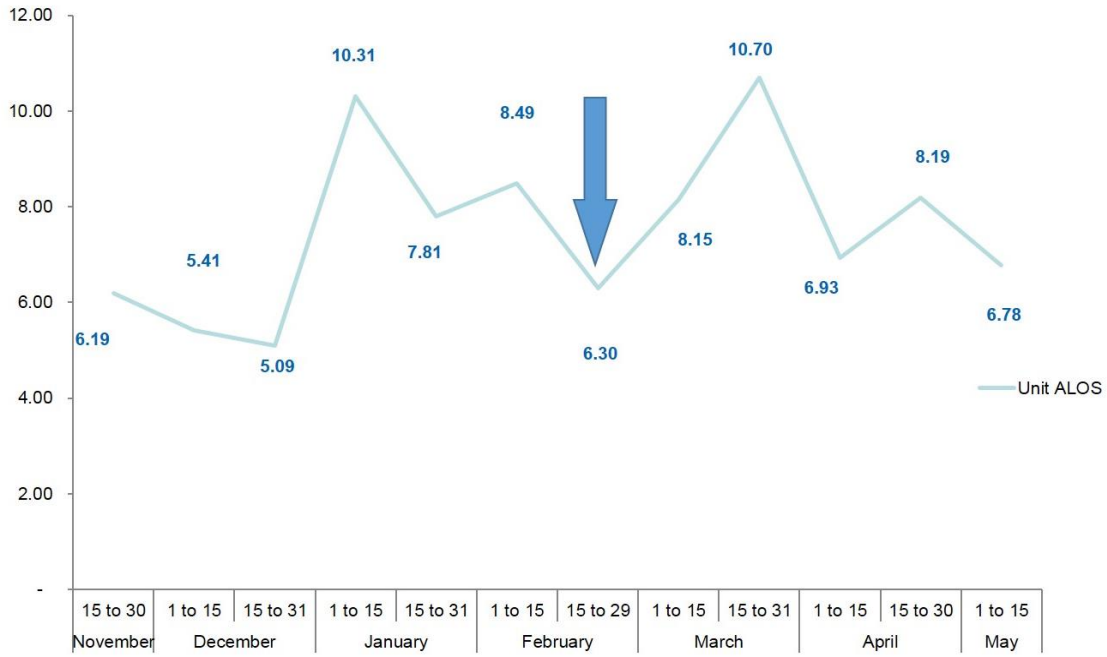

Figure 2. Average Length of Stay (ALOS) of patients from November 2011 to May 2012.

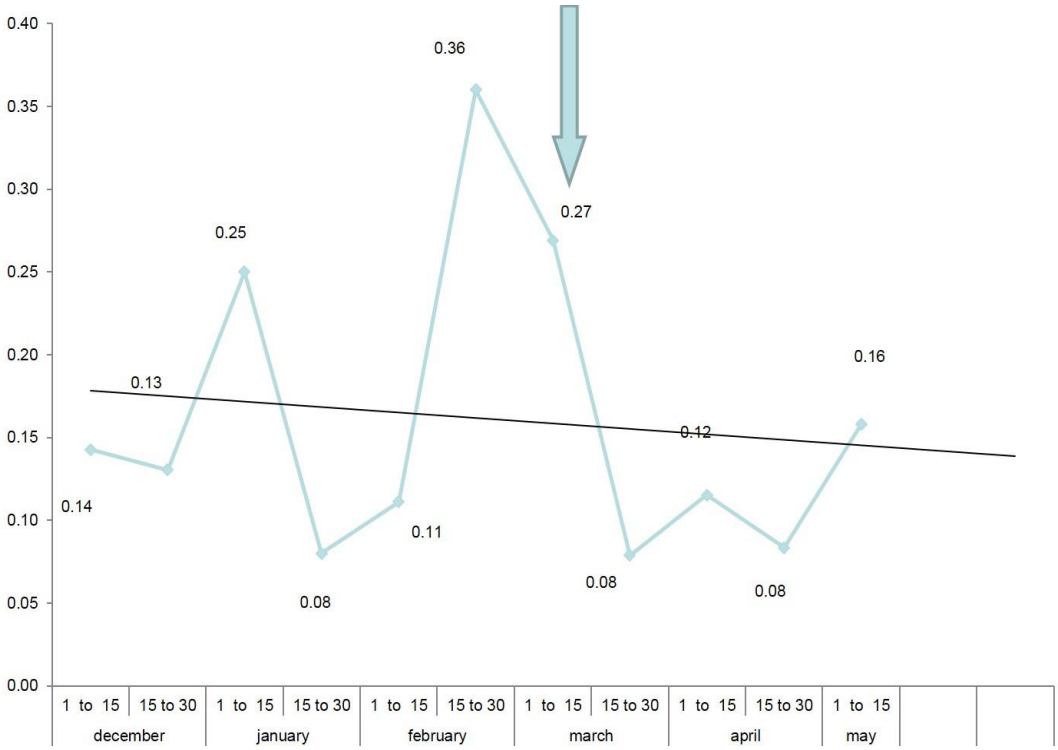

Figure 3. Readmission Rates of Patients from December 2011 to May 2012.

3.4 Use of CCRT, transfer to ICU and mortality

Figure 4 illustrates the use of the CCRT. This was generally low and was not significantly reduced by introduction of PEWS. However whilst rates of transfer to the intensive care unit were low (range 0 – 0.17% of admissions every 2 weeks) this was significantly reduced by introduction of the PEWS to the AMU (Figure 5). The mortality in this cohort was very low and the study was not powered to detect effects on mortality. So, it is not surprising that the introduction of EWSS did not reduce mortality in this study.

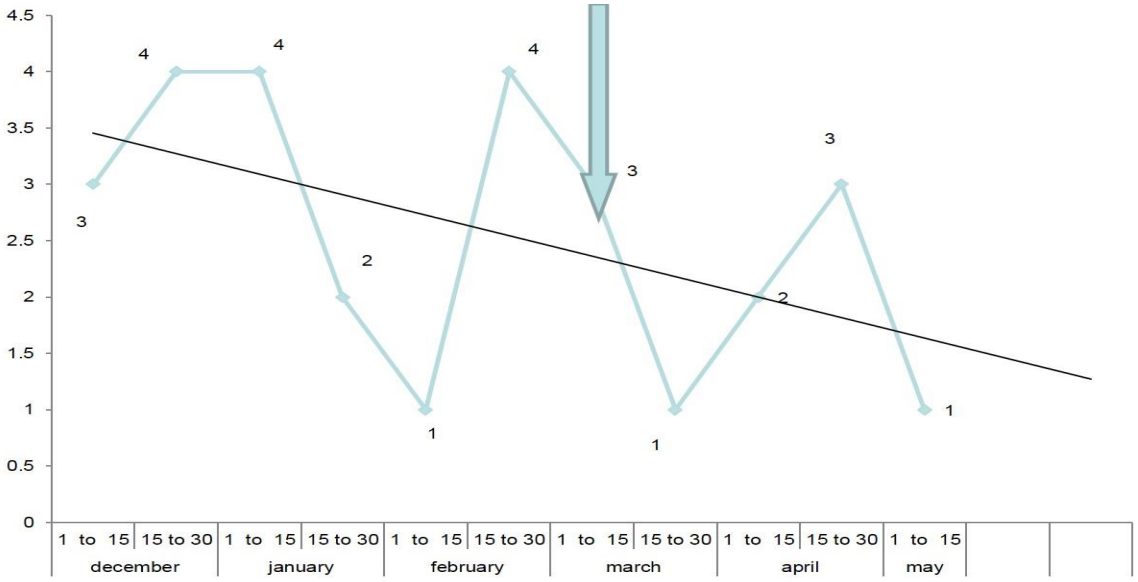

Figure 4. CCRT for the months of December 2011 to May 2012.

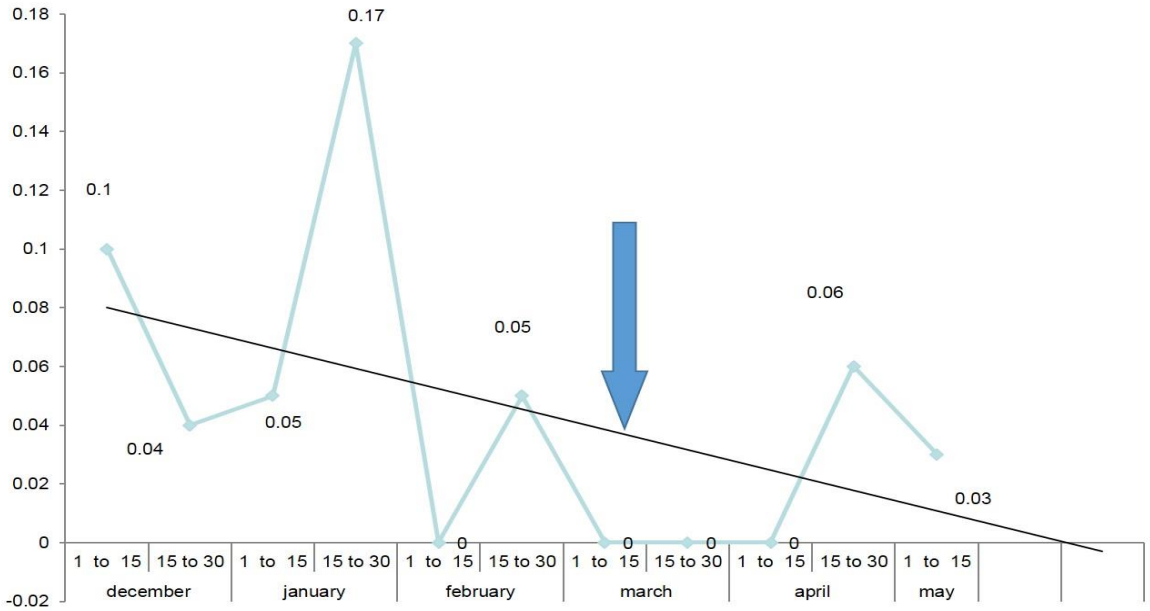

Figure 5. Rates of Transfer to ICU from the Months of December 2011 to May 2012

4. Discussion

Early warning score systems such as PEWS guide the interpretation of routinely collected physiological data (i.e. vital signs). They can be used to rapidly determine the severity of a patient's illness, facilitate clinical decision making and improve communication between healthcare professionals [13]. This enables timely initiation of interventions to prevent further deterioration [5, 10].

To achieve this, all front-line healthcare professionals must buy-in to the philosophy that routine use of EWSS for all patients can improve outcomes. In the current study, the high rate of calculation of the score and the appropriate clinical responses to these scores highlight the engagement of clinical staff with the PEWS. This demonstrates the feasibility of the introduction and application of the PEWS score in this clinical environment without ward-based medical cover.

Previous studies have reported that the use of EWSS reduces length of stay (LOS) and hospital readmissions [2, 4, 5], however we were not able to confirm this as lengths of stay and readmission rates were not reduced by the use of PEWS during our study. This may in part be because admissions, LOS and readmissions are often influenced by non-clinical factors as well [14, 15].

Several hospitals have introduced CCRT to improve the outcomes of deteriorating inpatients. However, the literature on CCRT is contradictory and their involvement is associated with a high incidence of admission to intensive care [16]. In this cohort, CCRT involvement was not reduced by the introduction of PEWS to the AMU. This is most likely because the criteria for CCRT activation overlapped with the PEWS score criteria for escalation. However admissions to ICU were probably reduced by improved communication between healthcare professionals about deteriorating patients in a setting without ward-based medical cover. This would have improved the timeliness and efficacy of interventions by the primary medical team for this cohort of patients.

These data suggests that the use of EWSS could reduce the need for CCRT. However, further studies, which can distinguish CCRT activation criteria from EWSS escalation thresholds, are required for confirmation. It is also important to consider whether similar benefits would be obtained if EWSS are introduced into settings with ward-based medical cover.

4.1 Limitations

Besides the intrinsic limitations of cross-sectional studies, the constraints of this study include the fact that the data was collected in only one ward of the medical city. As the study was powered to detect reduction in admission to the ICU, conclusions about other outcomes are difficult to interpret. Although the utility of PEWS in the AMU was verified in this context, its use cannot be generalized based only on these results. Apart from this, the present data are consistent with several other studies that report improved outcomes with the use of EWSS.

5. Conclusion

This study is the first to demonstrate the feasibility and benefit of using the PEWS in an AMU without ward-based medical cover in a multi-cultural tertiary hospital with a CCRT in Saudi Arabia. In the context of previous studies which report similar outcomes in various other settings; our data supports the implementation of EWSS in KSA. This can ensure effective and judicious utilization of overburdened acute services and can minimize adverse eventualities by improving outcomes without increasing cost, reducing ICU admissions, and possibly even the need for CCRTs. Use of EWSS can improve the quality of health care services whilst increasing the overall efficiency.

6. Conflict of interest:

None declared.

7. Funding

No funding Sources.

8. References

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