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Identifying critically ill patients: Triage, Early Warning Scores and Rapid Response Teams

Tim Baker*, Jamie Rylance, David Konrad
*Correspondence Email: timothy.baker@karolinska.se

Summary

This article describes the principles of triage of newly admitted patients and those who deteriorate on the ward. The existing systems are explained and the authors suggest those that are best suited to practice in a low-resource setting.

Dr Tim Baker MB ChB
Department of Physiology and Pharmacology
Karolinska Institute
Section for Anaesthesia and Intensive Care
Karolinska University Hospital
Stockholm
Sweden

Dr Jamie Rylance BMBS
Malawi-Liverpool-Wellcome Trust
Blantyre
Malawi

Dr David Konrad MD PhD
Department of Physiology and Pharmacology
Karolinska Institute
Section for Anaesthesia and Intensive Care
Karolinska University Hospital
Stockholm
Sweden

INTRODUCTION

One of the most important tasks in a hospital is prioritising which patients to treat first. This is known as triage and should involve the quick and accurate detection of life threatening or serious illness. Triage facilitates timely clinical care and prioritises the use of the hospital's resources according to clinical need. The patients at highest risk can be cared for in emergency rooms or intensive care units, so that equipment and human resources can be concentrated at the point of greatest need.

In emergency departments in high income countries, formal triage systems are ubiquitous. In low income countries, triage is often absent or of insufficient quality and may be one of the weakest parts of the health system. Queue-based systems are common, without effective mechanisms to prioritise the critically ill.

Further identification of critical illness also takes place after admission to hospital. Such ward-based triage involves the regular assessment of clinical needs in order to detect the deteriorating in-patient.[1] Rapid Response Teams, that may include staff from the intensive care unit, are called to provide emergency and critical care for ward patients identified by triggers in ward-based triage. Ward-based triage and Rapid Response Teams are relatively new and are becoming increasingly utilised in high income countries, but remain in their infancy in low income countries.

In this article we describe the available methods for triage and make recommendations for triage-on-arrival, ward-based triage and Rapid Response Teams that are realistic and feasible for use in hospitals in low-resource settings.

FORMS OF TRIAGE

The methods for prioritising patients, including their advantages and disadvantages, are summarised in Table 1. Some of the methods such as vital signs and danger signs are suitable for prioritising according to clinical need and will be described in detail below. Others, such as prioritising by ability to pay, or unselective queue systems are in common use but do not help in identifying the critically ill.

Patient report

The patients themselves provide the first source of triage information. However, assessing a patient's illness severity through self-report is confounded by problems of both under reporting due to a lack of recognition and by over reporting in order to gain quicker medical attention.

Nurse or clinician intuition

Utilising the intuition of experienced clinical staff is quick and simple and many critically ill patients will be correctly identified in this way. However, such a subjective assessment is prone to considerable bias if used alone. Intuition has been adopted into most triage systems in high-income countries as an additional criterion for increasing sensitivity.

Ability to walk

Patients who are unable to walk by themselves are often critically ill. Noting the inability of a patient to walk is almost instantaneous and in a number of studies inability to walk has correlated with outcome.[2] It is likely that this is a proxy measurement for a number of abnormalities, including reduced conscious level.

Vital signs

Abnormal vital signs (heart rate, respiratory rate, systolic blood pressure, conscious level, body temperature, oxygen saturation) have been shown to predict mortality in a low-income setting. In a Single Parameter Score (SPS) system, triggers are defined for each vital sign and any patient with one or more observation falling beyond these triggers is categorised as an emergency (see Table 2). The sensitivity and specificity of SPS depends on the defined triggers, and one limitation is that some seriously ill patients will be missed. SPS is well suited to inpatient use where time or resources are limited because of its simplicity, particularly when combined with a nurse's intuition.

Heart rate

Heart rate at either extreme is associated with increased mortality; bradycardia is often a pre-terminal event and tachycardia a common finding in critical illness. Co-interpretation of heart rate and blood pressure abnormalities can be particularly useful.

Table 1. *Methods for prioritising patients.*

Method	Advantages	Disadvantages
Patient report Incorporated into most triage systems (patient history)	Quick and simple	Liable to distortion, or difficult to interpret
Intuition The intuition of an experienced health staff	Quick and simple. May incorporate considerable clinical information	Medical professionals may not accurately identify patients at risk
Ability to walk	Quick and simple Proxy measurement for a number of abnormalities	If used alone will miss some critically ill patients and include some stable patients
Vital signs Single Parameter Score (SPS)	Quick and simple. Uses routinely collected medical data. Well validated in high-income countries	May miss some critically ill patients
Compound physiological abnormalities Early warning Scores	Scoring systems are well validated in high-income settings	Time-consuming Minimum information available on the performance of the scores in resource limited settings
Danger signs ETAT[3] World Health Organisation quick check	Incorporates early emergency management with triage. System shown to be beneficial when non-skilled staff provide healthcare (for example in children using IMCI)	May be time-consuming Emergency treatments may delay the triage of other patients.
Complex triage systems SATS[4] Manchester Triage System	Sophisticated, likely to have good sensitivity and specificity SATS validated in South Africa	Complex, requires training. Not validated in low-income setting
Specialty e.g. Pregnant women redirected to the obstetrician. Trauma teams represent a hybrid system with multiple specialties involved	Rapid directed care by specialist	Minimal use of severity markers; may delay the point at which action is taken
Queuing First-come-first-served	Simple. Requires minimal oversight therefore personnel concentrate on healthcare delivery	Doesn't prioritise according to clinical need
Means to pay Direct admission to a fee-paying ward		Ethically difficult to defend Does not promote equity of access to healthcare.

ETAT=Emergency Triage and Treatment; IMCI=Integrated Management of Childhood Illness; SATS= South African Triage Score

Table 2. *Single parameter score.*

	Adult normal range	Critical illness triggers
Heart rate	50-90	<40min^{-1} >130min^{-1}
Respiratory rate	10-20	<8min^{-1} >30min^{-1}
Systolic BP	100-140	<90mmHg
Conscious level	Awake, alert	Any sudden deterioration
		Responds only to Pain or Unresponsive
Temperature	36°C - 37.5°C	>39°C
Oxygen saturation	≥95%	<90%

Respiratory rate

Respiratory rate is one of the most sensitive single physiological parameters in prediction of mortality. However, medical staff are often reluctant to count respiratory rate due to perceived time pressure and it is unfortunately often omitted.

Systolic blood pressure

Hypotension is a good marker of severe disease and can reflect diverse pathologies such as depleted intravascular volume, loss of vascular tone in septic shock, poisonings or cardiac failure. Although both systolic and diastolic values are relevant, for simplicity in triage, the systolic alone can be used.

Conscious level

Reduced conscious level is a common finding in critically ill patients. The simple AVPU scale of conscious level (A = Awake; V = responds to Voice; P = responds to Pain; U = Unresponsive) allows conscious level to be objectively measured and documented, and deterioration identified. The Glasgow Coma Scale is good for predicting prognosis, but may be overly complex for triage.

Body temperature

Abnormal temperature can indicate severe illness. However, temperature has relatively less value where febrile illness may be trivial but common, for example adult malaria in endemic regions.

Oxygen saturation

The World Health Organization recommends the use of oxygen for patients with raised respiratory rate or oxygen saturations less than 90%. Where pulse oximeters and oxygen concentrators or other delivery devices are available, using hypoxaemia as a marker of critical illness is reasonable. Research is required in low-income country settings to identify which patients would benefit most from oxygen therapy.

Compound scores of physiological abnormality - Early Warning Scores (EWS)

Combining several vital signs may improve the accuracy of triage decisions. Compound scores encompass multiple measurements, each of which may be graded according to the degree of derangement. An aggregated score summarises all of this data into a single number (see Table 3). With increasing score the risk of mortality rises.[2] A threshold can be chosen above which the patient is labelled as critically ill or an action is taken. For example a healthy person with all measurements within the normal range has an EWS of 0, whereas a critically ill patient has been defined as anyone with a score of 5 or more.

Table 3. *Early Warning Scores.*

	3	2	1	0	1	2	3
Commonly used EWS							
Respiratory Rate		<9		9-14	15-20	21-29	>29
Heart rate		<41	41-50	51-100	101-110	111-129	>129
Systolic BP	<71	71-80	81-100	101-199		>199	
Temperature		<35		35-38.4		≥38.5	
Conscious level (AVPU)				Alert	Reacts to voice	Reacts to Pain	Unresponsive
The South African Triage Score (SATS) adds the following							
Trauma				No	Yes		
Mobility				Waking	with help	stretcher/ immobile	

Note: EWS= Early Warning Score; BP= Blood Pressure; the threshold for critical illness is ≥5 for EWS or ≥7 for SATS
Example: A patient with a respiratory rate of 32 (3 points), heart rate 120 (2 points), systolic BP 110 (0 points), temperature 37 (0 points) and conscious level V (1 point) has an EWS of 6 points and is therefore critically ill.

Early Warning Scores give a fuller picture of physiological derangement than single parameter scores and are generally more sensitive, but less specific, depending on the chosen threshold. In other words most patients who are critically ill will be identified using an EWS, however in addition some stable patients will be mistakenly labelled 'critically ill'. Scoring systems have been further refined by the addition of other factors, for example taking into account age as part of a modified EWS, age specific values to improve paediatric use, or the presence of trauma (South African Triage Score, see Table 3). A recently proposed score from the UK includes the electrocardiogram (ECG) as a parameter, further improving sensitivity, but increasing complexity.[5]

Early Warning Scores have been devised from data from well resourced settings with relatively low rates of HIV. In other areas, such as in sub-Saharan Africa, the limited evidence available suggests that EWS perform less well. Differences in study endpoints, however, have made comparisons difficult and the impact of the higher prevalence of HIV is not well known. Such limitations require that EWS systems are properly validated in the setting in which they will be used.

Danger signs

Danger signs are physiological findings or conditions that indicate that the patient is critically ill. This is the basis for the Paediatric Emergency Triage and Treatment (ETAT) guidelines that have been developed by the World Health Organization.[3] The danger signs form a checklist that is simple to follow, standardizes the triage process and allows coupling of triage to early life saving interventions. A patient with any danger sign is classified as an emergency and the checklist indicates which investigations or treatments should be initiated. For example a patient showing the danger sign 'reduced conscious level' is an emergency, hypoglycaemia should be suspected and the airway should be kept clear. The introduction of ETAT in resource limited settings has been shown to reduce mortality, but adult guidelines have been harder to draft.

Complex triage systems

In high-income countries, triage systems based on algorithms involving diagnosis and physiological parameters are most commonly used. Examples are the Manchester Triage System and the Australian Triage Scale. The validity of these systems in low-income countries has not been determined, they are time consuming and their implementation requires extensive training. The triage system with most relevance to low-income countries is the South African Triage Scale (SATS).[4]

SATS (previously called the Cape Triage Score) is a nationwide triage system in South Africa established in 2006.[4] It is based on a modified EWS using physiological signs (see Table 3) and adds in several diagnoses and clinical signs termed 'discriminators', such as pain, hypoglycaemia, seizures and nurse's intuition, that can modify the triage category. Each patient is given one of four categories: red (immediate), orange (very urgent – see within 10 minutes), yellow (urgent – see within 60 minutes) and green (delayed priority). SATS assessment takes 2-4 minutes. It has been validated in South Africa, and is increasingly promoted in similar settings in other countries.

Combining triage and treatment

Many triage systems categorise patients into three levels of urgency: Emergency; Priority; Non-urgent. Clear documentation of the triage findings and the patient's category of urgency can be done with a stamp on the patient's notes, or colour coding stickers, such as red for emergency, yellow for priority and green for routine.

Integrating the triage system with the provision of clinical care allows rapid action to be taken.[6] Emergency patients can be transferred to a resuscitation room, a senior clinician can be called and emergency treatments can be given. Where danger signs are used, emergency treatments can be recommended for each finding. However, with increasing complexity of intervention, the system becomes less of a triage tool and more a management guide. Provision of clinical care may delay the triage of subsequent patients.

Ward-based triage and Rapid Response Teams

Physiological derangement amongst in-patients is a precursor to adverse events such as cardiac arrest and death. This observation has led to the development of systems for early recognition and treatment of such individuals, and the advent of Rapid Response Teams (RRT), also known as Medical Emergency Teams (MET). Regular and systematic ward-based triage can be used for all patients based on single parameter or compound scores. Where ward staff recognise abnormalities beyond a predefined trigger level, they call for medical support. The RRT may consist of physicians, specialist nurses, anaesthetists or others with specific skills in acute medical care. Some are combined with ICU outreach services, whilst others are independent. Such heterogeneity of structure and service makes generalisation of their impact difficult. Before-and-after studies in single centres have shown reduced cardiac arrest rates and even reduced hospital mortality by approximately 20% in high-income countries.[7] These findings have been confirmed by a recent meta-analysis.[8]

RRTs are uncommon and have not been formally studied in low-income countries. While the model is attractive, significant alterations may be necessary depending on the available facilities. Research should be directed at identifying areas of maximum impact.

RECOMMENDATIONS

The following are the authors' recommendations for triage in a hospital with limited resources. Suggested audit criteria for triage-on-arrival are presented in Table 4.

Triage on arrival to hospital

Every hospital should have a formal triage system for new patients. It is important to consider when and where triage should be done, who should do it and how it should be done.

When and where

Triage should precede registration processes and payment for services, where these are demanded. Emergency patients should be triaged and treated irrespective of ability-to-pay. The triage area should be close to the hospital entrance and should provide privacy. A resuscitation or emergency room should be situated nearby for the immediate treatment of the critically ill.

Who

As triage has the potential to save lives and reduce costs, it should

be a prioritized activity and senior staff should be appointed where possible. This is often a skilled nurse with specific training. However, where resources are limited, triage can be performed by any staff member – doctor, nurse, auxiliary nurse, porter, gateman, record clerk, cleaner – as long as they understand the principles of triage and have been trained in recognising the emergency patient.

Table 4. *Suggested audit criteria for triage-on-arrival.*

Triage initiated	• Patients arriving to hospital should be given a triage category • There should be sufficient documented evidence to support this decision
Triage action appropriate	• There should be documentation of all vital signs: walking status, airway patency, HR, RR, SBP, conscious level, temperature and, where available, oxygen saturation • A patient with reduced conscious level should have their blood glucose checked or sugar given, within 5 minutes • A patient with any overt bleeding should have immediate measures to prevent further blood loss • A patient with respiratory distress (RR >30min^{-1} or oxygen saturation <90%) should be given oxygen within 5 minutes
Triage decision implemented	• Emergency patients should be seen by a clinician within 10 minutes • Urgent patients should be seen by a clinician within 60 minutes
Triage categories reasonable	• Patients who die within 48 hours of admission should have been classified as emergency

HR= Heart Rate; RR= Respiratory Rate; SBP= Systolic Blood Pressure

How

Triage must be quick and simple. After a triage decision has been made, patients should be moved quickly to appropriate areas in order to decongest the assessment area. The choice of triage system should depend on the available human and physical resources. Whichever is used, it should be fairly and consistently applied. The most useful methods of triage are likely to be the vital signs, ability to walk, the triage nurse's intuition and the danger signs described above.

Ward based triage

Staff shortages often preclude regular full reassessment in resource-poor settings. Identifying the deteriorating inpatient is however necessary for reducing mortality and all hospitals should have at least a basic ward-based triage system. Vital signs should be checked regularly and we recommend the use of the Single Parameter Score system with the triggers in Table 2. An EWS could also be used but it is more complex and time-consuming and may be difficult to implement. The intuition of the ward nurse is a valid additional criterion.

Rapid Response Teams

Where patient deterioration has been identified, an immediate response should follow. Interventions can include emergency 'ABC' treatments such as freeing a blocked airway, providing oxygen, or intravenous fluids, or calling senior staff and ensuring that the patient is seen first on the ward round. Staff should be trained in the acute management of the critically ill patient and there should be clear guidelines for the most common emergencies. Rapid response teams should be considered where resources allow, but may only be useful where intensive care facilities are present.

CONCLUSION

Although seen as a vital part of hospital systems in much of the world, triage in low-income countries has been neglected. Introducing simple and realistic triage for patients on arrival and on the wards prioritises resources, based on clinical need, and has the potential to reduce mortality.[6] Research is required into the optimal methods of triage when resources are limited; which triggers should be used for instituting medical care and which treatments are appropriate; the effects of HIV status on triage scores; and the cost-effectiveness of Early Warning Scores and Rapid Response Teams.

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