CHAPTER FIVE

# Recognizing and Managing the Deteriorating Patient: the Role of Rapid Response Systems, Critical Care Outreach Nurse and Medical Emergency Team

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## LEARNING OUTCOMES

After completing this chapter you will be able to:

1. Identify the characteristics and early warning signs of the deteriorating patient outside the intensive care unit
2. Explain the role of early warning systems for activation of rapid response in the hospital setting
3. Identity characteristics of a rapid response system
4. Understand the role, activities and operation of the critical care outreach nurse
5. Identify the skills, attributes, education and training requirements of the critical care outreach nurse
6. Understand the evidence supporting the effectiveness of outreach services
7. Identify future directions for organizing an outreach service
8. Describe the administrative and governance structures necessary for establishing, implementing, monitoring and improving rapid response systemperformance
9. Identify future directions of the rapid response system.

## ABBREVIATIONS

- CCOT - critical care outreach team
- CCON - critical care outreach nurse
- EWS - early warning system/score
- ICU - intensive care unit
- MET - medical emergency team
- MOEWS - maternity/obstetric early warning system/score
- PEWS - paediatric early warning system/score
- RRS - rapid response system
- RRT - rapid response team

## CHAPTER OVERVIEW

The last decades have witnessed the emergence of a new strategy to identify and respond to clinical deterioration in acute care hospitals, the RRS)/MET (Jones et al., 2009; Jones et al., 2015). This concern emerged due to the increased acuity of ward patients [Armitage et al., 2007; Australian Commission on Safety and Quality in Health Care (ACSQHC), 2012], the limited beds in ICU and limited critical care resources in ward services. Critical care outreach nurses have played a pivotal role in the development, operation and management of the RRS (Niven et al., 2014; Stelfox et al., 2014) whether they are medical- or nurse-led (Devita et al., 2006). The MET has become an accreditation requirement in some countries and is a highly recommended strategy for recognising and responding to clinical deterioration in acute care hospitals (ACSQHC, 2012).

Critical care nurses' contribution to the management of clinical deterioration is noteworthy. Outreach nurses in the UK, liaison nurses in Australia or ICU liaison nurses “enfermeros de vinculación con la UCI” in Argentina are clinical experts, who use advanced assessment, technical, teaching and communication skills to both assist in the care of complex patients and support nurses who are providing care to these patients (Alberto et al., 2014; Chaboyer et al., 2004; Green & Edmonds, 2004; Williams et al., 2012). Patients discharged from ICU are also vulnerable to clinical deterioration as they are recovering from a critical illness (Stelfox et al., 2014) requiring clinical expert surveillance to identify early signs of clinical deterioration and trigger a response mechanism (Eliott et al., 2012; Priestley et al., 2004).

This chapter introduces the RRS/MET systems and the use of CCONs, how to organize and implement a hospital wide response, and how to monitor and improve early recognition and management of the deteriorating patient. It also describes the role of CCON, the competences required, and the variation in current practice across settings and countries. A case study is developed across the chapter to illustrate how different the roles and rapid response procedures described can be implemented.

### *Introduction: chapter case*

*A 59-year-old obese male has been on the medical ward for 12 hours. One week earlier he presented to the emergency department (ED) with a 7-day history of mucous diarrhea and abdominal pain and was treated symptomatically and with antibiotics. However, symptoms worsened and in the 48 hours prior to admission he reported repeated episodes of bleeding stools and fever. Current treatment plan is for intravenous (IV) fluids, mild analgesic/anti-inflamatory and fecal specimen including clostridium difficile screen along with other lab testing, abdominal ultrasound and colonoscopy. He has a history of anemia and is on medications for hypertension and diabetes, as described by the patient’s wife.*

*Abdominal ultrasound shows inflammation of the bowel, colonoscopy results are not available. The patient is awake and responsive but restless and uncomfortable with slight diaphoresis. Initial physical examination reveals pale skin, slow/sluggish capillary refill, and he is anxious in appearance.*

*Current vital signs: blood pressure (BP): 110/60 mmHg, heart rate (HR): 130/min., temperature: 37.8 ºC, respiratory rate (RR): 22/min.*

*The patient’s wife requests to see the nurse in charge because her husband seems confused, and she hasn’t seen yet the parental unit doctors since she arrived 2 hours ago.*

## RECOGNITION AND MANAGEMENT OF THE DETERIORATING PATIENT

Risk to patient harm and death is lowered when complications and deterioration are recognized quickly and treated aggressively. This is an intuitively obvious premise, that is, the earlier the complication is recognized and acted upon, the less likely a negative patient outcome will occur… a stitch in time saves nine! However numerous studies have

shown that patient harm has been and remains an endemic iatrogenic consequence of the life and death of a patient in the hospital setting.

The 1992 Quality in Australian Healthcare Study examined a random sample of 14,179 admissions across 28 hospitals in two states of Australia and identified 112 deaths (0.79%). Nearly 70% of the deaths, and 58% of the cases of significant disability were considered to have a high degree of preventability (Wilson et al., 1995). In the UK, 100 sequential admissions to the ICU from ward areas across 2 hospitals found that 54 had sub-optimal care on the ward prior to transfer. This group of patients had a mortality rate of 56%. Some of the sub optimal treatment factors included failure to seek advice, lack of knowledge, failure to appreciate clinical urgency and lack of supervision (McQuillan et al., 1998). In a Melbourne (Australia) teaching hospital it was found that the median period of time that clinical instability was documented was 6.5 hours (range 0-432 hours) prior to either cardiac arrest call or intensive care unit referral among 122 in-hospital patients. Yet many of these patients were reviewed, on average, twice by junior medical staff during the intervening period (Buist et al., 1999).

Finally, others have found that patients who have just one episode of single-parameter vital-sign abnormality during hospitalization had a higher 30-day mortality rate (25%) as compared to patients who did not (3.5%) (Bell et al., 2006). Despite many studies examining the antecedents of patient deterioration and death in the hospital setting, it remains difficult to determine which vital-sign parameters and which threshold values can reliably predict dangerous deterioration before it happens.

Kause et al. (2004) studied "primary events" across 68 hospitals over 4 days in the UK, Australia and New Zealand. A primary event was defined as a cardiac arrest, death or ICU admission. Of the 638 primary events, 383 (60%) had antecedent factors of systolic blood pressure less than 90 mmHg (148), Glasgow coma score drop > 2 points (118), threatened airway (75), RR > 36 (54), HR > 140 (45) (Kause et al., 2004). While Buist and others, showed in a study of 6,303 patients 1,598 experienced abnormal observations and 146 died. The two most common abnormal observations were hypoxia < 90% (51%) and hypotension (17%). Significant predictors of death were: respiratory rate < 6 or > 30/min., oxygen saturation < 90%, hypotension, decreased or loss of consciousness. Anyone one of these 6 events resulted in a six-fold increase in mortality (Buist et al., 2004). Objective written parameters appear to be favoured over open-ended clinician judgment call alone and DeVita et al. (2006; 2010) recommend predefined numeric trigger thresholds for HR, RR, BP and blood oxygen saturation ($SpO_2$).

***Case study***

*The nurse in charge reviews the patient, noticed the Glasgow Coma Scale (GCS) has declined, although other vital sings remain unchanged. She calls the treating doctor, but the doctor is currently performing a procedure and is unavailable to see the patient. The junior resident medical officer is available but is not confident to initiate treatment until the treating doctor arrives. The patient is presenting an antecedent factor of clinical deterioration.*

### The rapid response system closed feedback loop model

Figure 1 provides a flow diagram of the common sequence of events that ought to track and trigger a rapid response to a deteriorating patient. There are two key systems in most closed loop models such as this: afferent limb (receiving pathway) and efferent limb (action pathway). The diagram shows a continuous feedback loop with 4 linked and critical components in each.

The afferent limb describes:

1. Patient assessment and monitoring of vital parameters
2. Tracking of vital parameters to detect abnormality or deterioration
3. Early warning score and alert flags deterioration and indicates the need for action
4. Trigger, being a prescribed action response to the detection of deterioration.

The efferent limb describes:

1. Rapid response person/team is mobilised to attend the patient bedside
2. Intervention; the RRT is sufficiently skilled to intervene in an emergency and to engage whatever other expertise is required to correct the deterioration
3. Stabilise and plan; the whole team reviews the goals of care and specific follow up actions required
4. Monitor; continue to monitor closely to avert any relapse of deterioration.

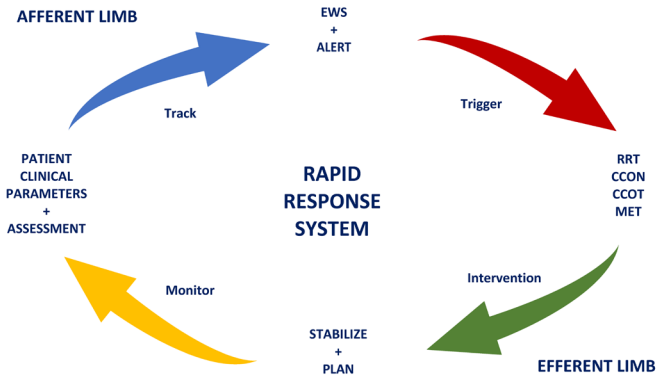


**Figure 1. The rapid response system closed feedback loop model**

## THE AFFERENT LIMB OF THE RAPID RESPONSE SYSTEM

The afferent limb commences with regular vital sign and other patient parameter observations and assessment at the bedside. Such observations need to be purposeful, thorough and made by a health professional suitably trained and cognisant of the significance of any subtle deterioration in the patient's condition and the approved protocol driven response required should an aberrant finding or deterioration be detected. This is sometimes known as "tracking". "Tracking" is the process of monitoring and recording patient clinical status over time and looking for abnormalities and signs of deterioration. The most common vital signs "tracked" in early warning systems are HR, RR, BP, $SpO_2$, Temperature, conscious level and "worried" (see Table 1).

| | MET call parameters = Call 555 |
|---|---|
| Airway | Threatened |
| Breathing | RR < 8 and > 30<br>$SpO_2$ < 92% (on or off oxygen) |
| Circulation | HR < 50 and > 120/min.<br>Systolic BP < 90 and > 180 mmHg |
| Neurological | Seizure or fall in GCS > 2 points |
| Other | Worried about patient<br>Parent unit cannot attend<br>Urine output < 30 mL/hour (for 2 hours) or > 500 mL/hour (for 2 hours)<br>Blood glucose Level < 3.0 and > 20 mmol/L<br>Temperature < 35 and > 39.5 $^{O}C$<br>Metabolic derangement |

**Table 1: Single parameter track and trigger chart to alert MET.** From Maroondah Hospital, Australia, 2006.

### Early warning systems

Early warning systems and alerts have been in place for over two decades and were designed to inform when a MET should be summoned (Lee et al., 1995). The earliest published EWS identified the specific vital signs

to be "tracked" (observed/recorded) and the parameters considered to be abnormal and therefore requiring a "trigger" (response/action) were clearly identified (Daffurn et al., 1994).

There are essentially 3 types of EWS methods used to alert clinicians to a notifiable level of concern requiring action in hospital settings:

- Single parameter thresholds: These are a set of specific parameters that, if the identified threshold is exceeded, will stimulate a trigger (see Table 1). The trigger is usually the escalation and summonsing of more experienced or knowledgeable assistance to the bedside.
- Multi-parameter score: This method provides an attribution of points for each abnormal parameter and a cumulative score is attained commonly known as an EWS. An EWS above a prescribed threshold will provide an alert that then requires an action by the patient's nurse to "trigger" a set of similar escalations and help as above (see Figure 2) (Royal College of Physicians, 2012).
- Mixed method trigger: Over time single and multi-parameter methods have become merged into scoring systems that accommodate a trigger for either a single aberrant measure or a total score that exceeds the acceptable "safe" zone (Figure 3) (Royal College of Physicians, 2012).

National Early Warning Score (NEWS)*

| PHYSIOLOGICAL PARAMETERS | 3 | 2 | 1 | 0 | 1 | 2 | 3 |
|---|---|---|---|---|---|---|---|
| Respiration Rate | ≤8 | | 9 - 11 | 12 - 20 | | 21 - 24 | ≥25 |
| Oxygen Saturations | ≤91 | 92 - 93 | 94 - 95 | ≥96 | | | |
| Any Supplemental Oxygen | | Yes | | No | | | |
| Temperature | ≤35.0 | | 35.1 - 36.0 | 36.1 - 38.0 | 38.1 - 39.0 | ≥39.1 | |
| Systolic BP | ≤90 | 91 - 100 | 101 - 110 | 111 - 219 | | | ≥220 |
| Heart Rate | ≤40 | | 41 - 50 | 51 - 90 | 91 - 110 | 111 - 130 | ≥131 |
| Level of Consciousness | | | | A | | | V, P, or U |

*The NEWS initiative flowed from the Royal College of Physicians' NHSU Development and Implementation Group (NEWSDIG) report, and was jointly developed and funded in collaboration with the Royal College of Physicians, Royal College of Nursing, National Outreach Forum and NHS Training for Innovation

Please see next page for explanatory text about this chart.

Royal College of Physicians

NHS Training for Innovation

**Figure 2: Early warning scoring system – aligning aberrant parameter readings with a numeric score.** © National Early Warning Score (NEWS) (Royal College of Physicians, 2012).

| NEW scores | Clinical risk |
|---|---|
| 0 | Low |
| Aggregate 1–4 | |
| RED score* (Individual parameter scoring 3) | Medium |
| Aggregate 5–6 | |
| Aggregate 7 or more | High |

**Figure 3. Early warning scoring system – NEWS thresholds and triggers.**

**Notes:** i) The National Early Warning Score (NEWS) trigger system aligned to the scale of the clinical risk; ii) A low score (NEW score 1-4) should prompt assessment by a competent registered nurse who should decide if a change of frequency of clinical monitoring or an escalation of clinical risk is indicated; iii) A medium score (NEW score 5-6 or a RED score) should prompt an urgent review by a clinician skilled in the assessment of acute illness, who will consider if there should be an escalation of care; iv) A high score (NEW score of 7 or more) should prompt emergency referral to secondary care; v) *RED score refers to an extreme variation in a single physiological parameter (i.e. a score of 3 on the NEWS chart, coloured RED to aid identification and represents an extreme variation in a single physiological parameter).

### *Case study*

*The charge nurse repeats the vital sign measures with the junior medical officer present and finds: GCS 13, HR 132/min., BP 105/60 mmHg, RR 28/min.*

Paper-based observation charts such as the Adult Deterioration and Detection System (ADDS) (Elliott et al., 2014) are colour-coded to track the patient's vital signs and provide visual alert that the measured parameter is in a "coloured zone". In the development of ADDS colour-coded charts, heuristic evaluation and human factors principles were used to maximise the track and trigger response of clinicians using the tool. The coloured zones provide a visual alert cue to the clinician that the patient's measured clinical parameter is now in a zone that requires special consideration or a specific clinical response. The response required can be related to a single significant vital sign entering the red zone or if the cumulative score of more than one aberrant vital signs exceed the threshold of normality (see Figure 4) (Royal College of Physicians, 2012). More contemporary EWS systems are now fully automated and embedded into the electronic medical record (described below - see Future Directions).

### Clinical staff education and training in track and trigger EWS procedures

Critical to the effective utilisation of the above track and trigger systems is the education, training, auditing and confidence of the nurses at the ward level to use and respond appropriately to the tool and the escalation protocol. Historically this has been a significant issue stimulating the development and need for MET and other RRS (Daffurn et al., 1994).

In a descriptive study of 32 ward nurses, Cioffi (2000) identified that many nurses lacked the confidence to summons help for their patients when required. The summons for help was delayed because the nurses feared they would "feel like an idiot if they called unnecessarily", or they would consult a colleague first before making the call. They also noted that often the junior doctors were just as unsure of themselves in these situations as the nurses. Similar findings have been described by Jones et al. (2006) who described how nurses would follow traditional hierarchical reporting lines to the parent medical service rather than be subjected to criticism by their medical colleagues. Buist et al. (1999) have also discussed similar behaviour by junior doctors.

The first step in establishing an appropriate track and trigger process is to educate the staff in the use of the tools and protocols and to be confidence to activate the response. The hospital management also needs to provide education and training for the response team and to give them capacity to spend time with the patient and staff so that thorough assessment, intervention and follow up education and documentation activities can be accomplished. Education and counselling of the ward staff is critical, and careful use of language is also important so that the "trigger" nurse is NOT left to "feel like an idiot" – public praise and acknowledgement for having the courage to escalate the issue is critical to encourage others to do likewise. However if the trigger has been delayed or was unnecessarily premature, the response team need to use this as a "teachable moment", to help the ward staff understand and "fill" the knowledge gaps they may have.

In addition to educating the staff in this process it is also important that the organisation sanctions the response mechanism and audits the system to ensure that the trigger is escalated in an appropriate and timely manner and that outcome measures are monitored to ensure the effectiveness of the RRS and the staff teams involved.

### Output and outcome measures

The ideal measures to have in place to monitor the efficiency and effectiveness of the RRS will encompass demographic, process, output and outcome measures. All of which are necessary to ensure the system is functioning to achieve best possible outcomes and to ensure continuous improvement over time (see Table 2).

The ideal measurement system will be contained within an electronic system, ideally an electronic medical record. It will have data populated automatically from the patient echart and will calculate measurement

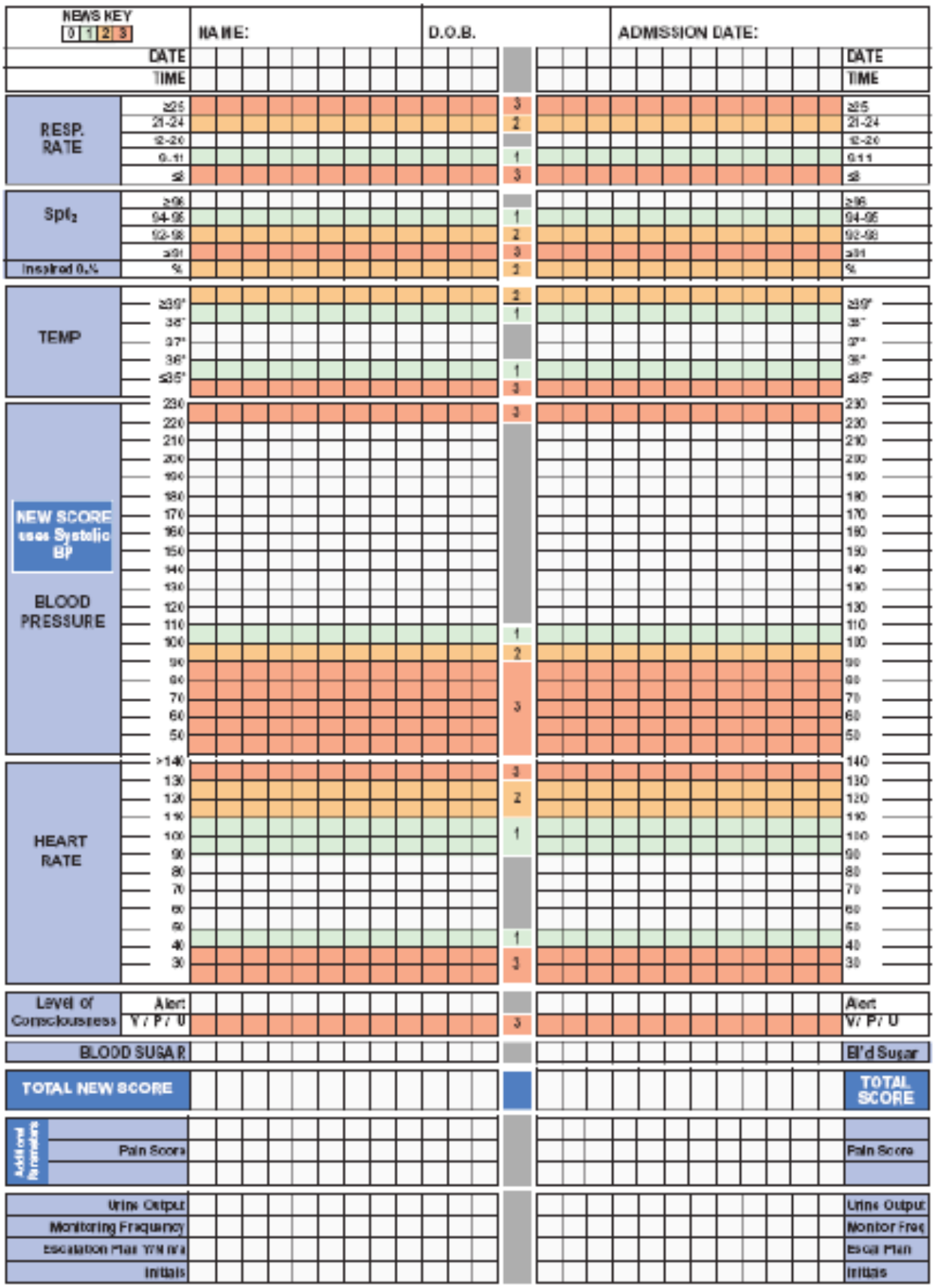


**Figure 4: Example of an adult deterioration detection chart.** © Royal College of Physicians (2012).

scores automatically. It will also have tick boxes and menu lists to ensure standardisation of language and data collation and to reduce unnecessary clinician documentation time or research interpretation error.

Beadle (personal communication, August 2015) surveyed and interviewed 124 nurses following the introduction of an electronic patient record system that contain an automated EWS and alert function. Of the nurses that responded 92% preferred the electronic EWS system over the previous paper-based version, 75% believed the electronic score were more accurate than written scores and 85% felt more empowered to follow the cascade call based on the electronic alerts than those that were on paper. Preliminary results are published online (2015).

| Parameters | Measures |
|---|---|
| Demographics | Patient age, gender, location, admission diagnosis<br>Event day, time, location<br>Composition of response team |
| Process measures | Rescue response time<br>Time of trigger to time of call<br>Rapid response time<br>Time of call to time of RRT arrival<br>RRT time on ward |
| Output measures | Reason for call - Types of interventions rendered - Frequency of calls - Staff education/training - Ward staff evaluation of response team actions - Response team evaluation of ward staff response |
| Outcome measures | Admission to ICU or other higher acuity area - NFR order - Death |

**Table 2: Minimum data set used to evaluate RRS**. NRF, Not For Resuscitation.

| Parameters | Measures | |
|---|---|---|
| Core scope of the CCON role | Actively coordinates code blues (MET) or EWS trigger as first responder | |
| Extended potential scope of the CCON role | Clinical assessment | :Continuously monitors patients at risk<br>Aids with patient flow activity<br>Informs prioritization of clinical workloads of teams |
| | Technical intervention | Aids with other hospital codes (violence, evacuation, etc.)<br>Assists staff to manage difficult tasks e.g. IV cannulation<br>Advanced problem solving and troubleshooting of clinical issues<br>Guidance on resource needs and management, e.g. borrowing scarce resources and equipment from other departments |
| | Communication/ interpersonal | Facilitates dispute resolution<br>Provides multidisciplinary leadership<br>Formal report at the end of shift of those patients reviewed |
| | Clinical Teaching | Nursing and medical staff<br>Impromptu teaching and support<br>Competency training and assessment<br>Uses every moment as a *teachable moment* |

**Table 3: Core and extended potential scope of the CCON role**

## THE EFFERENT LIMB OF RAPID RESPONSE SYSTEMS

Once a patient's vital signs have reached a prescribed parameter in the EWS, the bedside nurse is then alerted to action, triggering a sequence of prescribed responses along the efferent limb of the RRS closed loop feedback system (Figure 1). Nursing roles in Rapid Response systems The rapid response nurse (RRN) has many different names and slightly differing roles depending on the context and emphasis of the role and outcomes the position is designed to achieve. Some of the titles for this role in the literature include but are not limited to rapid response nurse, ICU liaison nurse, nurse-at-night, clinical team coordinator (CTC), Medical emergency team nurse (MET nurse) or critical care outreach nurse (CCON) to name a few. For ease of discussion we refer to all these as CCON, acknowledging that some variance does occur between some roles.

### Characteristics of the CCON role

The CCON role may do more than simply respond to MET codes or the deteriorating patient, in fact it is recommended that if the role of the CCON is available for very early intervention they can help to improve the assessment and management skills of ward nurses (Alberto et al., 2014; Eliott et al., 2012), intervene in a patient's care long before deterioration in the EWS occurs and potentially prevent unnecessary codes and death throughout the hospital. Williams et al. (2012) describe a much broader range of potential tasks and activities for the CCON role in their study that have been summarised in Table 3. Critical to the success of these RRS programs is that the CCON demonstrates excellence in the following attributes:

- Clinical assessment
- Technical intervention
- Communication
- Teaching.

In addition, the CCON needs to be familiar with the clinical and practice policies, procedures and protocols across many areas of the facility and have a reputation for being approachable, patient and responsive to the needs of both medical and nursing staff (Williams et al., 2012).

### *Case study*

*The CCON was rounding in the medical ward and she sees a woman approaching to nurses' station. No nurses were present. The CCON asks the woman if she needs something. The woman answers her husband became sleepy, suddenly less responsive; the nurse in charge is assessing him. The woman says she thinks her husband is dying... The CCON approaches the patient, she realises the patient maybe bleeding internally and is now semi-unconscious. She pages the intensivist to attend and initiates oxygen therapy, increases IV fluid rate while she was requesting information from medical history from the patient's wife, the nurses in charge and the resident. She orders arterial blood gases, Foley catheter and nasogastric tube insertion.*

### Critical care outreach team (CCOT) composition and role

As with the CCON, we also find many differing terms and scope of the CCOT. Also known as the Medical Emergency Team (MET), Rapid Response Team (RRT) and Patient-at-Risk Team (PART), to name a few, the overriding common function of all is that it is a team of 2 or more individuals from the multidisciplinary team with complimentary advanced clinical skills.

The CCOT works collaboratively and cooperatively to assess, stabilise and plan the care of a patient at risk of further deterioration in the general ward setting. Generally the skill sets expected of the CCOT are summarised as follows:

- Management of Airway/breathing – medical officer with advanced airway management skills, usually an anaesthetist
- Management of physiological deterioration – medical officer with broad critical care knowledge and skills, usually an intensivist
- Advanced clinical nursing skills – CCON - Additional support and assistance – ward medical and nursing staff.

There remains debate regarding the appropriate composition of the CCOT. There are essential 2 models of CCOT/RRT/MET response, a "two tier" of "single tier" system.

***Two tier system*** - The first tier in the two tier system is a small team with either a CCON only and/or a medical physician that respond to a consultation request for guidance or advice: The threshold EWS or other parameters to engage the first tier team is generally much lower than the

code blue-type call and generally requires a response within 15 minutes. The second tier is a larger multidisciplinary team similar to that described above and can fully respond to all codes including complex "code blue" scenarios.

***Single tier CCOT System*** - Some facilities consider that any call for assistance should have the same level of urgency and composition of RRT as the second tier team described above even if the requirement is for a situation less intense than a cardio-pulmonary arrest.

Proponents for the single tier model argue that the first tier in a two-tier system may be under staffed or under-skilled to respond to a rapidly deteriorating patient. However proponents of the two-tier system suggest that many situations picked up early will only require consultation, advice and guidance, therefore:

1. The CCON and/or physician alone is accessible and sufficient in most instances
2. A small response team is less intimidating to the ward staff (and especially ward nurses) to call for advice and evaluation
3. It is less costly and disruptive to the system.

Each organisation will need to assess and determine which system it will adopt and provide clear evidence and guidance to staff to inform the rationale for each choice.

Critical to the effectiveness of the CCOT are clear written protocols and algorithms that all members of the team are familiar with and competent in performing. Each member knows their specific component and can implement their contribution competently, efficiently and effectively. In addition, each member is familiar with and knows the role, contribution and sequencing of the inputs of all other members of the team.... Similar to a well studied and rehearsed orchestra.

The other key element to the "orchestra" is the conductor! The lead, usually the intensivist, will only be as good as the musicians (other doctors and nurses) and if they all play well together the audience (patient) will applaud their performance... but hopefully not come back for an encore!

***Case study***

*When the intensivist arrives (15 min. after CCON call), the CCON and the resident had already informed the family about the current clinical situation and future actions. The intensivist reinforced this communication with patient's wife. The intensivist had already managed ICU bed availability for a potential admission. They meet the parental unit doctors and organize patient transferred to ICU. In this case, the CCOT has two respondents, a CCON and an intensivist. Good communication with the parental unit staff is vital. In a further dialogue with the nurse on charge, she said she has recently started to work at this hospital, and that she was not familiar with the CCOT activities and activation criteria. CCON takes that opportunity to let the staff know about the criteria for triggering the CCOT.*

## SPECIFIC VARIATIONS TO THE STANDARD RAPID RESPONSE SYSTEMS

### Paediatrics

Like adults, many Paediatric EWS (PEWS) have a degree of variability suggesting a limitation of evidence and confidence to be precise as to the right track and trigger scores and systems to use for this population group. Many more sophisticated PEWS tools provide age-specific parameters for children 0-1year, 1-4, 5-11, 12+. As with adult systems the key measures include threatened airway, hypoxemia, tachypnea, tachy/bradycardia, hypotension, acute changes in neurological condition, cardiac and respiratory arrest and of course "worried" (Monaghan, 2005; Tibballs & Kinney, 2009). However, a relatively new trend in paediatric medicine, which is also being adopted in some countries, is the ability for the parents/family to be able activate the response team directly or via a central call number. This model is particularly strong in Australia (Queensland Health, 2014) and is receiving international media and health and parenting advocacy elsewhere (Bedo, 2015).

Paediatric EWS and paediatric RRS show similar benefits to those published regarding adult RRS. Tibbals & Kinney (2009) study the impact of a paediatric MET system over 4 years and found a 55% reduction preventable cardiac arrest, and that 53% of 809 calls did not result in an ICU admission. Whilst one interpretation of this result is that the MET was being over utilised, the authors also acknowledge that high levels of suspicion and early intervention may result in a situation where it is better to be sure than sorry! The major and obvious difference between adult and paediatric RRS is the skill and expertise of the paediatric RRT, who must be experts in paediatric acute care assessment and treatment.

### Obstetrics

Obstetric RRS are essentially similar to adult RRS with two major exceptions:

1. Blood pressure parameters of a MOEWS (Modified Obstetric Early Warning Score) are more conservative: Normal acceptable systolic BP = 110-149 and diastolic BP < 90 mmHg
2. The CCOT generally adds or substitutes an intensivist with an Obstetrician. The CCON is often a nurse with midwifery qualifications and skills, although if they are a "purest ICU nurse" then it is expected that the midwives on the floor will provide the additional midwifery specific knowledge and skills required in most scenarios.

As with adult RRS programs, MOEWS rely heavily on team training and competency development in advanced life support obstetric (ALSO) emergencies. Draycott et al. (2006) have shown that training in obstetric emergencies can lead to substantial improvements hypoxic ischemic encephalopathy, 5-min APGAR scores <7 and shoulder dystocia.

## THE "ADMINISTRATIVE LIMB" – RAPID RESPONSE GOVERNANCE

An often forgotten yet vital component to the introduction and maintenance of RRSs is the governance and management of such an intervention. The RRS is a hospital-wide, multi-disciplinary clinical and system improvement policy direction designed to impact the overall capacity to save and rescue patients in most clinical settings. Contemporary hospitals are measured on their performance against important patient safety and outcome measures such as standardised mortality ratios, unplanned admission to ICU, unexpected death, sepsis and the like and RRS can help to improve such outcomes. Furthermore, the RRS is an expensive investment and therefore requires senior oversight and attention to ensure the investment actually meets the goals expected of it.

Our experience suggests that the RRS steering committee ought to be a high-level clinical quality and safety committee that reports directly to the executive or through the morbidity and mortality committee or resuscitation committee.

At least in the initial years of establishing the RRS program the following key members ought to be on this committee:

- Chief Medical Officer
- Chief Nursing officer
- ICU medical lead
- ICU nursing lead
- CCON representative
- General medicine lead
- Charge nurse representative
- Data analyst.

The role of the committee is to enable successful change and improvement in clinical systems by ensuring the four key elements of empowerment are provided: Direction, Knowledge, Resources and Support. The need for high-level executive representation and commitment cannot be overstated. Our experience suggests that one of the key differences between those

hospitals who can successfully implement RRS and those that cannot, is that the unsuccessful teams have not been able to engage or recruit the commitment of the senior executive to invest in the program.

***Case study***

*The CCON informs CCOT administration board about the case. They decide to review the procedures and policies for providing education/information to new admitted staff.*

## FUTURE DIRECTIONS

As mentioned earlier, the use of electronic medical records to auto-calculate EWS, provide immediate alerts and protocol driven guidance to the bedside clinicians as well as a directly alert the RRT electronically are the newer technological improvements we are now experiencing in the journey towards continual improvement of the RRS. Cable less monitoring and automation, continuous surveillance may become the focus of future research (Subbe et al., 2017; Taenzer & Spence, 2018). On the human side, RRS responders are now becoming "super-specialist", designated senior clinical nurses are recruited into seemingly prestigious and recognised CCON roles (various titles!). With greater specialisation it is foreseeable that these nurses will lead further research and refinement of methods and practices with expanding skill expectations and scope of clinical practice, which will inevitably lead to further education, training and potentially clinical privileging requirements to ensure optimal practice and safety. Further, identifying the core measures of impact on patients' outcomes at local and national level may provide additional metrics of system performance and benchmarking (Lyons, et al., 2018) to further improve education and practice of RRT.

The movement towards patient and family advocacy and empowerment in health care will ensure stronger representation of patients, carers and family members on to health care safety and quality governing committees and groups. They are likely to demand greater immediate access to RRS and the ability to initiate such responses directly as we have already seen in countries such as Australia.

Finally, the world witnessed the formation of the International Society of Rapid Response Systems in May 2014 (see http://rapidresponsesystems.org/?page_id=33). A truly global and multidisciplinary organisation with membership categories for doctors, nurses, allied health practitioners, managers and administrators and lay persons. It is envisaged that national and regional RRS organisations will form or will increasing be represented through subcommittees of existing national critical care associations.

## CONCLUSION

CCONs are a clinical resource and support for at risk or deteriorating patients, their families and staff. They are a key component of rapid response systems. RRS is a systematic approach for responding and managing clinical deterioration hospital wide. Indeed, it is a strategy that contributes to all patients having access to the care they need in a timely manner. Providing safe and timely care to every patient is not only an ethical but also an equity mandate. Hippocrates instructed us: *primum nil nocere* (First, do no harm). Unfortunately, Hippocrates naively thought we would all follow his doctrine. Wrong! What Hippocrates failed to say was: "*Should you do harm, then put in place a rapid response system to correct your error*"…some 2500 years later we can only hope Hippocrates is happy with our progress so far!

## QUESTIONS

***1. Name the eight of most common signs used to track and trigger a rapid response to a deteriorating patient?***

A. Threatened airway

B. Respiratory rate change

C. Oxygen saturation level change

D. Heart rate change

E. Blood pressure change

F. Temperature change

G. Neurological/conscious level change

H. "worried".

***2. According to Bell et. al. (2006), what is the 30-day mortality rate of hospitalized patients who had single-parameter vital sign change?***

A. 3%

B. 10%

C. 20%

D. 25%.

***3. Describe the key components of the afferent and efferent arm of the RRS.***

***4. What is meant by "Tracking"?***

***5. There are essentially three types of EWS methods used to alert clinicians to a notifiable level of concern requiring action in hospital settings, which of the following is NOT one of them?***

A. Single parameter thresholds

B. Multi-parameter score

C. Mixed method trigger

D. Closed feedback loop model.

***6. Cioffi's (2000) study of 32 nurses, one of the significant reasons nurses did NOT call for help in a timely manner was because:***

A. They could not tell the time

B. They were too busy and could not manage any greater workload

C. They would "feel like an idiot if they called unnecessarily"

D. Doctors are not capable of responding in time.

***7. Identify three process measures that may be used to evaluate the effectiveness of the RRS.***

***8. Beadle et al. (2015) surveyed and interviewed 124 nurses following the introduction of an electronic patient record system that contain an automated EWS and alert function. Of the nurses that responded what percentage preferred the electronic EWS system over the previous paper based version?***

A. Only experienced nurses

B. 92%

C. 62%

D. Only novice nurses.

***9. Which of the following is NOT normally considered a clinical assessment role of the CCON:***

A. Continuously monitors patients at risk

B. Aids with patient flow activity

C. Informs prioritization of clinical workloads of teams

D. Prescribes a Do Not Resuscitate order after consultation with the patient.

***10. Generally, the skill sets expected of the Critical Care Outreach Team are summarised as follows, EXCEPT:***

A. Airway/breathing management – medical officer with advanced airway management skills, usually an anaesthetist

B. Management of physiological deterioration – medical officer with broad critical care knowledge and skills, usually and intensivist

C. Advanced clinical nursing skills – CCON

D. Chief finance officer or delegate.

***11. In the Tibbals and Kinney study the impact of a paediatric MET system over 4 years, they found preventable cardiac arrest reduced by:***

A. 25%

B. 55%

C. 75%

D. 90%

***12. Name two significant differences found in an Obstetric RRS (MOEWS) and a regular adult RRS.***

***13. The role of the RRS governance committee is to enable successful change and improvement in clinical systems by ensuring the four key elements of empowerment are provided. These elements are:***

A. Election, influence, resources and sustainability

B. Direction, knowledge, political savvy and resilience

C. Direction, knowledge, resources and support

D. Direction, kindness, reason and support.

## ANSWERS

1. *A, B, C, D, E, F, H*
2. *D.*
3. *The afferent limb describes patient assessment, tracking of vital parameters, early warning score and alert, trigger; the efferent limb describes rapid response person/team, intervention, stabilise and plan, monitor.*
4. *Tracking is the process of monitoring and recording patient clinical status over time and looking for abnormalities and signs of deterioration.*
5. *D.*
6. *C.*
7. *Process measures: rescue response time, time of trigger to time of call, rapid response time, time of call to time of RRT arrival, RRT time on ward.*
8. *B.*
9. *D.*
10. *D.*
11. *B.*
12. *The blood pressure parameters of a MOEWS (Modified Obstetric Early Warning Score) are more conservative: normal acceptable systolic BP = 110-149 and diastolic BP < 90 mmHg, and the CCOT generally adds or substitutes an intensivist with an obstetrician.*
13. *C.*

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