

Recognition and response systems: A summary

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Introduction

In recent work, the Health Quality & Safety Commission (the Commission) has identified significant opportunities to improve the quality and safety of systems for recognising and responding to signs of deterioration among adult patients in New Zealand hospitals (Health Safety & Quality Commission 2016a, 2016b). It has funded a five-year programme to help New Zealand hospitals to implement three workstreams to improve the care of adult patients (excluding maternity) who acutely deteriorate while in hospital. The workstreams are:

1. A recognition and response system (including a standardised national vital signs chart and New Zealand early warning score (NZEWS); localised clinical escalation and response processes; and structures for clinical governance, measurement and ongoing improvement).
2. A patient, family and whānau escalation system (developed locally using a co-design approach).
3. Processes for determining and documenting shared goals for patient care.

This summary sheet provides information about the first workstream: the recognition and response system. For additional information, go to the Commission's website; this information will grow as further work gets under way.

Recognition and response systems: the problem

It is well established that observable physiological and clinical abnormalities often come before serious adverse events such as unexpected death and cardiac arrest (Schein et al 1990; McQuillan et al 1998; Buist et al 2004). Failures to recognise and respond to such abnormalities are preventable errors that can have devastating consequences for patients, families, whānau and clinicians. A significant body of evidence demonstrates that recognition and response systems can help to prevent harm associated with in-hospital clinical deterioration (Drower et al 2013; Winters et al 2013; Ludikhuizen et al 2015).

Recognition and response systems in New Zealand have evolved locally, so they now vary considerably in the vital sign triggers they use to prompt escalation of care, as well as in their models of clinical response and the organisational approach to managing the care of deteriorating patients (Psirides et al 2013, 2016; Pedersen et al 2014). Analysis of adverse events related to patient deterioration reveals common problems with aspects of recognition and response systems such as escalation of care, engagement with patients, family and whānau, and access to training and education for clinicians (Health Quality & Safety Commission 2015). If all hospitals take a standardised approach to recognising and responding to clinical deterioration, patients, clinicians and the system as a whole benefit (Royal College of Physicians 2012; Green 2013).

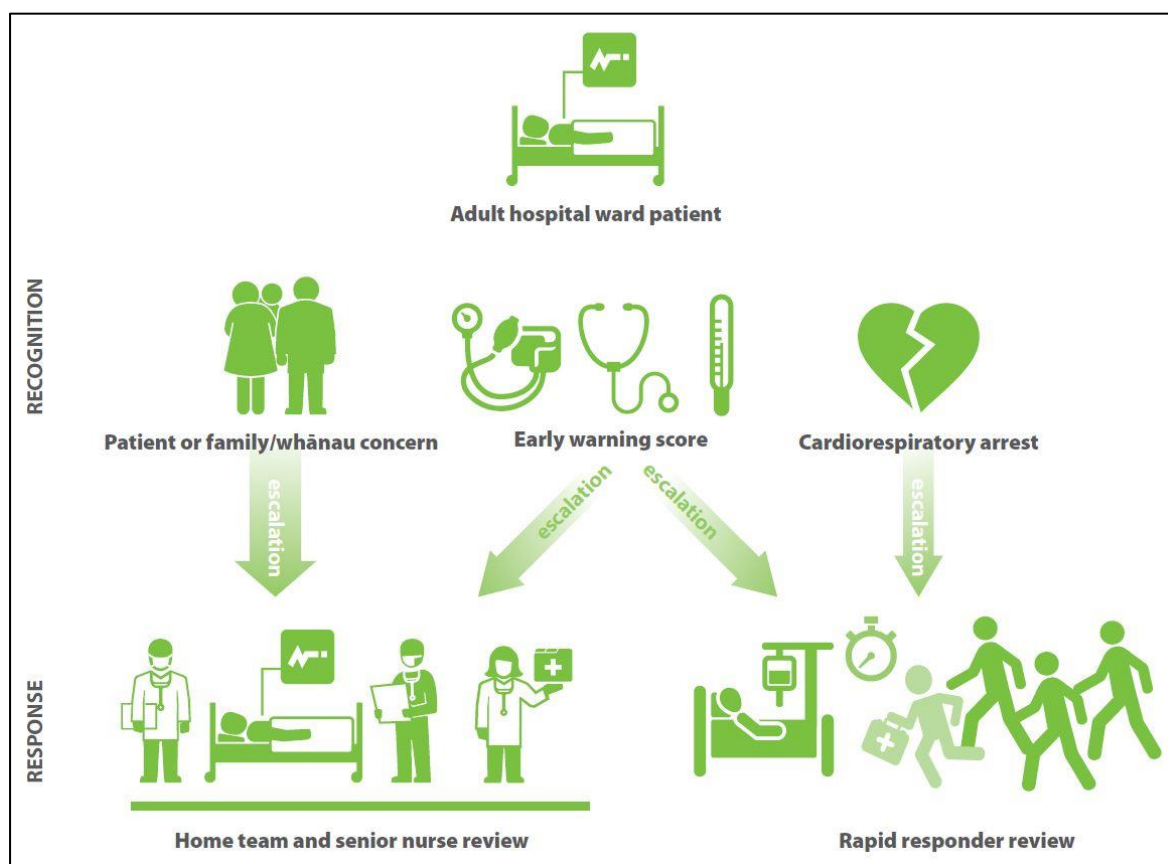
There are continuing reports of failures to identify or act on warning signs that hospital inpatients are clinically deteriorating, and significant data describing the poor outcomes for patients that result (Cioffi et al 2006; Leuvan and Mitchell 2008; Barwise et al 2016; Chan et

al 2016). A range of complex and overlapping organisational, social and clinical factors contributes to such failures. These include a lack of formalised systems and processes; inadequate clinical governance; a siloed and super-specialised hospital workforce; problems associated with inadequate clinical knowledge and skills; suboptimal handover, communication and teamwork; and inconsistent engagement with patients and families (Endacott et al 2007; DeVita et al 2011).

What makes an effective recognition and response system?

There is broad agreement about the components necessary for effective recognition and response systems and these have been mandated as policy in some jurisdictions (NICE 2007; Santiano et al 2009; ACSQHC 2012). To be effective and sustainable, recognition and response systems must have underpinning structures for clinical leadership and governance, clinical and administrative resource, education and training, teamwork and communication, and measurement and evaluation. Figure 1 illustrates how the clinical components of an evidence-based recognition and response system fit together.

Figure 1: Model of a recognition and response system



The ‘recognition’ components

Recognition of clinical deterioration relies on accurately and regularly measuring vital signs to detect physiological abnormalities (DeVita et al 2011). The NZEWS is an aggregate score that staff calculate from a matrix built into the patient’s vital signs chart and use to identify deterioration. The NZEWS increases as a patient’s vital signs deviate further from normality and triggers staff to act when certain thresholds are reached.

The recognition components of the system (or the ‘afferent arm’) are designed to provide objective criteria for escalating care, a clinical safety net for detecting acute deterioration, and agreed processes for escalating care to appropriately skilled responding clinicians. They do not remove the need for clinicians to use their clinical judgement. International evidence indicates clinical concern is one of the most common reasons for calls to rapid response teams (Jones et al 2006; Santiano et al 2009). For this reason, a criterion for escalating care based solely on clinician ‘worry’ is part of the escalation pathway.

Patients, family and whānau must be supported to escalate concerns and be involved in making shared decisions about appropriate responses to acute deterioration. These are important components of successful recognition and response systems. It is possible to achieve them by implementing patient, family and whānau escalation pathways, discussing the patient’s preferences for care early, and sharing decision-making about curative, restorative or palliative goals of care (You et al 2014; Carey et al 2015; Gill et al 2016). Such activities can improve communication, provide better experiences for patients, families, whānau and clinicians, and ensure staff respond appropriately to acute deterioration (Downey et al 2013; Berger et al 2014; Brady et al 2015).

See the [New Zealand vital signs chart and NZEWS](#).

The ‘response’ components

With the response components of the system (or the ‘efferent arm’), different responders with appropriate skills treat different levels of severity of illness (DeVita et al 2011). For example, a junior doctor from the primary team might respond to marginally deranged vital signs, while an intensive-care-based rapid response team might respond to severely abnormal vital signs. The response arm of the system will vary according to the local context of the hospital. For example, a small rural facility may rely on expert senior nurses to fulfil the role a multidisciplinary rapid response team would perform in a large tertiary hospital.

See the [escalation mapping tool](#) for assistance with the process of agreeing local escalation pathways.

Non-clinical components

Recognition and response systems require a whole-of-hospital approach if they are to work successfully and achieve sustained improvement (ACSQHC 2010; DeVita et al 2011). They must be part of the organisation’s strategic plan to improve patient safety. If recognition and

response systems are to have adequate support and function successfully, they must have visible and ongoing executive, clinical and operational leadership and clear clinical governance structures.

Those who are accountable for the performance of the recognition and response system must oversee a range of activities such as policy and process development; ongoing measurement, evaluation and quality improvement; resourcing and equipment; education and training; and patient and family engagement. A collaborative model of executive, clinical and operational leadership is required.

Routine monitoring and measurement of the recognition and response system helps evaluate the impact of the system and to identify areas for improvement. The Commission is developing a measurement framework which will help standardise the data being collected across the country. This will include the collection of local audit data to monitor how well the system is operating, as well as local and national outcome measures to monitor impact.

Early implementation work

The Commission worked with six early implementer sites to test and refine the tools and guidance provided to support implementation of the recognition and response system. See the [evaluation report](#) for detail on their experiences, and the barriers and enablers encountered during implementation at each site.

Guidance and support from the Commission

The Commission has developed a range of tools and guidance to support organisations to prepare and implement their recognition and response systems (see Table 1). These are available at <https://www.hqsc.govt.nz/our-programmes/patient-deterioration/recognition-and-response-systems/guidance/> Additional factsheets have been developed on topics including frequently asked questions, sepsis, oxygen, and capabilities for responders.

Table 1: Tools and guidance materials	
Preparation	Implementation
<ul style="list-style-type: none"> • Preparation and implementation guide 	<ul style="list-style-type: none"> • Vital signs chart with New Zealand early warning score
<ul style="list-style-type: none"> • Project charter template 	<ul style="list-style-type: none"> • Measurement guidance
<ul style="list-style-type: none"> • Example policy 	<ul style="list-style-type: none"> • Ward level audit guidance and data collection tool
<ul style="list-style-type: none"> • Clinical governance recommendations 	<ul style="list-style-type: none"> • Hospital level audit data collection tool
<ul style="list-style-type: none"> • Escalation mapping tool 	<ul style="list-style-type: none"> • Post event case review tool
<ul style="list-style-type: none"> • Vital signs chart eLearning module 	<ul style="list-style-type: none"> • Escalation sticker
<ul style="list-style-type: none"> • Count down to launch posters 	<ul style="list-style-type: none"> • Rapid response call sticker

Frequently asked questions from clinical staff

Q: Why are children and obstetric patients not included in the programme?

A: The scope of the programme is limited to adult inpatients. The strongest current evidence for predicting deterioration is based on studies of the adult (non-pregnant) population. Because physiology changes with age and pregnancy, vital signs that are abnormal in non-pregnant adults may be normal for children or pregnant women.

Q: How does the programme address sepsis?

A: Evidence shows up to 30 percent of patients who have a rapid response call while in hospital have sepsis (Cross et al 2015). The recently updated consensus definitions for sepsis use the quick Sepsis-related Organ Failure Assessment (qSOFA) tool to identify patients with suspected infection who are at a greater risk for a poor outcome (Singer et al 2016). The qSOFA tool uses fast respiratory rate, low blood pressure and altered level of consciousness – three parameters that are already scored in the proposed New Zealand Early Warning Score (NZEWS). A recent study of 30,000 patients has shown the British national EWS (on which the proposed NZEWS score is based) is more accurate than qSOFA for predicting death and transfer to an intensive care unit (ICU) in non-ICU patients. The authors conclude that qSOFA scores should not replace early warning scores when identifying the level of risk for patients with suspected infection (Churpek et al 2016).

Q: Why does the proposed NZEWS use 'AVPU' to assess level of consciousness?

A: Changes in level of consciousness may be overt (unconscious) or subtle (personality change) and may reflect a variety of causes. AVPU (Alert / responds to Voice only / responds to Pain only / Unresponsive) is simple to use. Evidence also shows it is better at identifying early deterioration in consciousness level in critically ill ward patients (McNarry and Goldhill 2004).

Some systems have used other ways to assess and document changes in level of consciousness linked with specific conditions or interventions. For example, research shows sedation scores are an effective way of detecting the impact of sedative medicines like opioids but not for detecting changes in level of consciousness from other causes (such as infection, hypotension or hypercapnia) (Nisbet and Mooney-Cotter 2009).

Similarly, the Glasgow Coma Scale (GCS) was developed as a tool for assessing patients with neurological injury. As a relatively complex scoring system, it has significant interrater variability (Gill et al 2007). For patients with specific neurological injury, clinicians must use the individual components of the GCS. Tertiary hospitals usually manage such patients in specific neurosurgical or neurology wards where clinicians are more familiar with the complexity of the GCS.

Q: How is level of consciousness scored if the patient is asleep?

A: You need to wake patients to do a full set of vital signs. If the patient does not wake normally from sleep, then score that. If you think a patient has low clinical risk and does not need to be woken to record a full set of vital signs at night, then document this in their monitoring plan.

Q: Why aren't pain scores part of the proposed NZEWS?

A: Some, particularly specialist pain teams, have proposed pain as a vital sign for a number of years (Lynch 2001; Purser et al 2014). To date, no research has validated pain scores as a component of early warning scores. However, it is important to record pain on the vital signs chart to help interpret abnormal vital signs and effectively manage patients' pain.

Q: What about deterioration from opioids?

A: The proposed NZEWS will detect both early and late signs of opioid toxicity by scoring abnormal respiratory rate, heart rate, systolic blood pressure and, subsequently, altered conscious state or hypoxaemia. Such abnormalities will prompt escalation to those with the skills needed to assess and manage opioid toxicity.

Q: Why isn't urine output part of NZEWS?

A: Although it can be useful to identify end-organ perfusion, urine output is difficult to measure in certain circumstances and can be affected by a variety of factors. Ambulant patients without a urinary catheter who are able to walk to the toilet will be difficult to assess, as will patients with chronic renal failure who may normally produce little or no urine. Some medicines may either increase or decrease the volume of urine output. Another influence can be normal post-operative states where there is an appropriate release of antidiuretic hormone to conserve volume in the face of (elective surgical) trauma. For these reasons, urine output is not part of the proposed NZEWS.

Q: Why do we not record fluid balance on the vital signs chart?

A: Fluid balance is measured over a 24-hour period. Vital signs charts may cover much longer periods depending on how frequently the patient develops vital signs, which varies with the degree of illness. For this reason, the vital signs chart does not include fluid balance.

Q: Where should we record bowel function and weight?

A: Bowel function and weight are not vital signs and therefore you should not document them on a vital signs chart. Weight is mainly used to calculate medication and you have space on the national medication chart to record that. If you need to weigh a patient daily, record the measurement on a daily weight chart so you can see the trend over time. Record bowel function on a bowel chart if there are particular concerns, or in the clinical record.

Q: Why do we score oxygen?

A: Oxygen is a medicine and should be prescribed and titrated to a target oxygen saturation (usually measured with a pulse oximeter) (Beasley et al 2015). Any patient who develops a new need for supplemental oxygen to maintain normoxia is at higher risk of deterioration. This is recognised in both the score weighting (2). Patients who receive oxygen at home or require it for other reasons (eg, carbon monoxide poisoning, decompression sickness) should have their NZEWS modified if it is clinically appropriate.

Patients who are hypoxaemic despite receiving additional oxygen will score twice (once for their hypoxaemia and once for the supplemental oxygen). Such patients are at greater risk of adverse outcomes so require more senior review. Other methods of oxygen delivery, such as high-flow devices or non-invasive ventilation, may be required.

In situations where oxygen is routinely administered regardless of oxygen saturation (such as in a post-anaesthetic care unit), a time-limited modification for supplemental oxygen may be required.

In some hospitals, patients leaving a post-anaesthetic care unit with oxygen have their supplemental oxygen score modified to 0, which expires 4 hours after returning to the ward. Patients who still require supplemental oxygen after this time should be medically reviewed for atelectasis or aspiration events.

Glossary of terms

Term	Definition
Advance care directive (ACSQHC 2010; Ministry of Health 2011)	A set of documents giving instructions that consent to, or refuse, specified medical treatments and that state care and lifestyle preferences in possible future events or scenarios. An advance care directive instructs what medical care or treatment a person does or does not want in specific future circumstances. Any treatment refusals are legally binding on the health care team treating the person who can no longer communicate the refusal.
Advance care plan (Ministry of Health 2011)	Instructions for the future (which sometimes include advance care directives) that a person gives while they are still able to make decisions. The plan describes what kind of care the person would want (or not want) if they were unable to speak for themselves. It cannot be made on behalf of someone else or compel clinicians to provide treatment that is not medically indicated.
Advance care planning (ACSQHC 2015)	The process of discussing and developing an advance care plan or directive. People and their families may do this independently of the health care and/or legal professions. People may return to and build on their advance care planning over time.
Advanced life support (ACSQHC 2010)	The method of preserving or restoring life by establishing and/or maintaining airway, breathing and circulation using invasive techniques such as defibrillation, advanced airway management, dialysis, intravenous access or certain medicine therapies.
Clinical governance	<p>Definitions of clinical governance have continued to evolve over time as different health jurisdictions have put the concept into practice and new initiatives and practices have emerged.</p> <p>One widely used definition from the English national health system states that clinical governance is ‘a system through which healthcare organisations are accountable for continuously improving the quality of their services and safeguarding high standards of care creating an environment in which excellence in clinical care will flourish’ (Scally and Donaldson 1998).</p> <p>Many health systems have adopted the definition from the Australian Council on Healthcare Standards (2004), which strongly emphasises consumers are at the centre of continuous improvement of health care. It states that clinical governance is ‘the system by which the governing body, managers, clinicians and staff share responsibility and accountability for the quality of care, continuously improving, minimizing risks, and fostering an environment of excellence in care for consumers/patients/residents’.</p>

	The Commission's Clinical Governance document sets out a high-level framework for clinical governance in health and disability services in New Zealand
Core vital sign set	The core observations required to identify acute physiological deterioration using the NZEWS (respiratory rate, oxygen saturation, supplementary oxygen, temperature, blood pressure, heart rate and level of consciousness).
Early warning score (EWS)	A score calculated from the core vital sign set, which increases as vital signs become increasingly abnormal. The aggregate (total) NZEWS triggers an escalating clinical response so clinicians with the right skills can intervene and manage patient deterioration.
Enduring power of attorney (Community Law 2016)	An authority that a person gives to someone else to act on their behalf in the event of an enduring loss of capacity. It is a way of making sure that someone trusted will make decisions if the person becomes unable to make those decisions alone – for example, if they suffer an ongoing loss of cognitive function. An enduring power of attorney for personal care and welfare can only come into effect when the person loses mental capacity (as determined by a relevant health practitioner or court) and has become incapable of managing their own affairs. In circumstances where enduring loss of capacity has not been determined but the person is currently not able to speak for themselves, then the enduring power of attorney can provide useful indication of the person's preferred substitute decision maker.
Escalation pathway (ACSQHC 2010)	A document that describes the actions required for different levels of abnormal physiological measurements or other observed deterioration. An escalation pathway provides details of a hospital's track and trigger system and is linked to the escalation policy.
Escalation policy (ACSQHC 2010)	A document outlining the principles, processes and expectations for staff escalating care for patients whose condition is deteriorating.
Escalation threshold or trigger	The point where abnormality in an aggregate early warning score or single vital sign parameter indicates that care should escalate.
Evaluation (Trochim 1998)	A systematic analysis of the merit, worth or significance of an object, system or programme.
Goals of care (ACSQHC 2015)	The aims for a patient's care and medical treatment, as agreed between the patient, family, carers and health care team. Goals of care will change over time, particularly as a patient nears the end of life. Medical goals of care may include to try to cure a reversible condition, to trial a treatment to assess reversibility of a

	<p>condition or to treat deteriorating symptoms, or the primary aim may be to make the patient comfortable.</p> <p>The patient's goals of care may also include non-medical goals – for example, to return home or reach a particular milestone, such as participating in a family event.</p>
Human factors (WHO 2016)	The environmental, organisational and job factors that affect how humans interact with systems, as well as the physiological and psychological characteristics that influence behaviour at work.
ISBAR	A structured communication tool used to hand over critical information (Identify, Situation, Background, Assessment, Recommendations or Request).
Limitations of medical treatment (ACSQHC 2015)	<p>Medical decisions to limit treatments that could be provided but are unlikely to benefit the patient. One example is a decision to not try cardiopulmonary resuscitation if a patient suffers a cardiopulmonary arrest.</p> <p>Similar terms include withdrawal or withholding of medical treatment.</p> <p>Decisions to limit medical treatment may avoid prolonging dying but will not cause a patient's death. This is different from the practice of euthanasia, which involves deliberately and purposefully hastening death.</p>
Monitoring plan (ACSQHC 2010)	A plan outlining the minimum observation and assessment requirements for a patient in an acute care setting. It may be an individualised plan documented in the patient record or a standardised policy or pathway applying to a group of patients. This includes the frequency (times per day) and duration (number of days) of physiological observation monitoring.
National vital signs chart	A document on which clinical staff record patient vital signs. It also provides triggers indicating abnormality and states the actions to take when a patient deteriorates from the norm. Its purpose is to support staff in recognising clinical deterioration in an accurate and timely way, and prompt them to take action when they observe deterioration.
Rapid response system (ACSQHC 2010)	The system for providing emergency help to patients whose condition is acutely deteriorating.
Rapid response team (ACSQHC 2010)	<p>The clinical team or individual responsible for providing emergency help to patients whose condition is deteriorating.</p> <p>Similar terms are the tertiary responder or the medical emergency team (MET).</p>

Recognition and response system (ACSQHC 2010)	<p>System designed to provide clinicians with an objective decision-making process for recognising and responding to changes in physiological observations.</p> <p>A similar term is a track and trigger system.</p>
Responder (primary, secondary, tertiary)	<p>The clinical team or individual responsible for helping patients whose condition is deteriorating. Those who help patients with increasingly abnormal vital signs are:</p> <ul style="list-style-type: none"> • primary responders, who may include ward-based nurses and junior doctors • secondary responders, who may include ward-based registrars and experienced senior nurses • tertiary responders, who may include specialist acute care doctors (such as intensive care, acute medical, or emergency department registrars or senior doctors), senior nurses with advanced training and capability in acute care, or external providers such as the ambulance service.
Single parameter trigger	A trigger for escalation of care based on a single vital sign that is abnormal.
Aggregate score trigger	A trigger for escalation of care based on a calculated early warning score derived from a number of different vital sign measurements.
Triggers	Predetermined thresholds of abnormality in aggregated early warning scores, single vital sign parameters, or other clinical assessments that require an escalation of care according to the escalation pathway.

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