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Recognising and responding to in-hospital clinical deterioration: an integrative review of interprofessional practice issues

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ABSTRACT

Aims and Objectives

To identify, appraise and synthesise current evidence regarding organisation-wide interprofessional practice issues that facilitate or inhibit effective recognition and response to clinical deterioration, using a theoretical Rapid Response System (RRS) model.

Background

Recognition and response to clinical deterioration, in adult general medical-surgical ward patients, is embedded as a routine interprofessional practice in acute healthcare organisations worldwide. The process of care escalation is complex and sometimes involves multiple health professionals from different disciplines with varying levels of expertise. While a theoretical RRS model offers a formalised structured approach to escalate patient care, it is unclear how the implementation of this model, or similar, influences RRS-wide interprofessional practices to effectively recognise and respond to clinical deterioration.

Design

An integrative review

Methods

This review was conducted using key words to systematically search four electronic bibliographic databases (PubMed, CINAHL, ProQuest Central, Cochrane Library). Twenty-nine eligible full text papers were identified. Quality appraisal of methods was performed using recommended guidelines. Study findings were narratively coded, themed and conceptualized in the context of an organisation-wide RRS using an interprofessional collaborative practice (ICP) framework.

Results

Five main themes aligned with the four ICP competency domains and a learning continuum of professional development: Organisational culture, Role perceptions and professional accountability, Communication of clinical needs, Team-based practices, and Interprofessional learning opportunities in recognising and responding to clinical deterioration. Within these themes three notable interprofessional practice issues were highlighted: professional reporting hierarchies (inhibiting), critical care outreach services (facilitating), and interprofessional relationships (facilitating).

Conclusions

A unique approach for exploring organisation-wide interprofessional practice issues has been presented using an ICP framework. Further interpretive organisation-wide research is necessary to develop a more in-depth and meaningful understanding of ICP issues that facilitate or inhibit effective recognition and response to clinical deterioration.

Keywords

Clinical deterioration, communication, interprofessional collaborative practice, patient safety, healthcare standards, rapid response system

What does this paper add to the wider global clinical community?

- The effects of RRS implementation, within busy complex acute care environments, on organisation-wide ICP in recognising and responding to clinical deterioration are poorly understood.
- A system-wide approach for exploring effective ICP in recognition and response to clinical deterioration has been presented, and may be used to guide future research methods or development of local patient safety improvement strategies.
- Further in-depth, RRS-wide investigation into ICP would help clinicians, researchers and policy makers to better understand, and prepare for, future implications of recommended healthcare standards that are to be implemented and applied in routine practice.

INTRODUCTION

Early recognition and response to clinical deterioration in adult general medical-surgical ward patients has become an accepted accreditation benchmark for quality and safety standards in acute care hospitals worldwide (National Patient Safety Agency 2007; Joint Commission on Accreditation of Healthcare Organisations 2008). To achieve these standards, in Australia for example, acute care hospitals are required to provide evidence of a formally established organisation-wide system that supports and promotes early recognition and response to clinical deterioration, and facilitates health professionals to escalate care and take appropriate actions; while keeping patients, families, and carers informed and engaged in decision-making processes (Australian Commission on Safety and Quality in Healthcare 2012). Various organisation-wide systems have been implemented in practice (Jones *et al.* 2015), yet only one theoretical organisation-wide model, known as a 'Rapid Response System (RRS) structure' (DeVita *et al.* 2006) has been found to date. This model identifies four key elements in an organisation-wide system: the afferent limb, the efferent limb, administration, and quality.

Origins of RRS and the efferent limb element can be found in the 'Medical Emergency Team (MET)' concept (Lee *et al.* 1995), which was implemented over 20 years ago as a standardised proactive patient safety strategy to promote early recognition and timely response to clinical deterioration. Based on principles of 'early recognition' and 'timely response', predetermined clinical parameters (e.g. respiration rate, blood pressure, fluid balance) provided set trigger criteria for ward staff to activate a MET (Lee *et al.* 1995). A MET comprises a group of clinicians

with critical care expertise who provide the necessary skills at the bedside to stabilise a patients' clinical condition and prevent further deterioration by limiting unnecessary (potentially invasive) interventions; preventing unplanned transfers to intensive care units (ICU); and the necessity for cardiopulmonary resuscitation.

Even though emergency response teams (RT), similar to the MET concept or RRS efferent limb, have been adopted worldwide by acute care hospitals there is still need for high-level evidence to support implementation as a reliable, sustainable or cost-effective patient safety improvement strategy (McNeill & Bryden 2013). Although, a recent meta-analysis suggested that RT could significantly reduce in-hospital mortality (RR 0.87, 95 %CI 0.81-0.95, $p<0.001$) and cardiopulmonary arrests (RR 0.65, 95 %CI 0.61-0.70, $p<0.001$) (Maharaj *et al.* 2015). Interestingly, both of these reviews examined similar patient outcomes, yet the former identified 42 eligible studies (McNeill & Bryden 2013), and the latter only 29 (Maharaj *et al.* 2015). While this may be due to slight variations in eligibility and selection criteria, it also highlights challenges in comparing RT patient outcome studies that have used inconsistent methodological approaches (Maharaj *et al.* 2015). While outcome studies can provide important large-scale data sets, 'quantitative targets…should never displace the primary goal of better care' (National Advisory group on the Safety of Patients in England 2013, p. 4), i.e. to effectively recognise and respond to clinical deterioration in a timely and appropriate manner.

Efferent limb RT are also commonly termed Rapid Response Teams (RRT) or Critical Care Outreach Teams (CCOT) (DeVita *et al.* 2006) and often vary in staff composition (ANZICS-CORE MET dose Investigators 2010), depending on local policy and resources available to individual organisations. There is currently little evidence to guide recommendations regarding RT staffing composition, except that responses to deterioration are more likely to be effective when a clinician with critical care skills is leading the RT event (McNeill & Bryden 2013). Whether RT should be medical specialist-led (Al-Qahtani *et al.* 2013), primary care team-led (Moldenhauer *et al.* 2009; Howell *et al.* 2012), or nurse specialist-led (Mitchell *et al.* 2014; Pirret *et al.* 2015) is unclear. Other variations in RT composition occur between organisations according to 'individualised' predetermined clinical parameters and recommended responses (Psirides *et al.* 2013) which again, are adapted locally to align with relevant policies protocols and resources (Australian Commission on Safety and Quality in Healthcare 2012).

Importantly, the efferent limb provides a critical response for the afferent limb, where clinical deterioration and routine practice of bedside patient care occurs (e.g. intermittent monitoring, documentation of practices, recognition of deterioration, care escalation). Like the efferent limb, afferent limb practices have also received widespread scrutiny. These studies tend to be nursing focused (Jones *et al.* 2009; Odell *et al.* 2009) or identify failures in patient management, which lead to suboptimal care (McQuillan *et al.* 1998). For example, when health professionals delay decision-making or advice seeking (Boniatti *et al.* 2014), or inadequately communicate a patients' clinical needs (Endacott *et al.* 2007); and when there is a lack of underlying knowledge and supervisory support (Jones *et al.* 2009). Other afferent limb studies used predetermined clinical parameters and patient outcome data to describe practice phenomena of 'afferent limb failure' or 'failure to rescue' (Trinkle & Flabouris 2011). These system failures can increase the chance of further clinical deterioration, subsequent invasive interventions and unplanned transfers to ICU with worse patient outcomes (McQuillan *et al.* 1998).

In contrast to afferent and efferent limb studies exploration of administrative and quality elements of RRS has been stark. Administration has a governance responsibility to support sustainability of the RRS and to ensure the necessary resources are available; while quality improvement processes collect and provide ongoing data for system-wide feedback to optimise use of the RRS (DeVita *et al.* 2006).

How these two elements of an organisation-wide RRS interrelate with afferent and efferent limb elements however remains unclear. Overall, evidence regarding administration and quality elements is sparse, and afferent and efferent limb evidence is growing but remains disparate. In view of such variable practices, RRS and RT composition, and differing needs for service improvement between acute healthcare organisations, there is a need for more in-depth 'whole system' investigations (McCallin 2001; McNeill & Bryden 2013) into effective interprofessional practices of recognising and responding to clinical deterioration.

It has been proposed that effective interprofessional collaborative practices (ICP) are likely to mitigate professional silos and fragmented healthcare processes to strengthen organisational safety cultures and provide optimal patient-focused care (World Health Organisation 2010; Interprofessional Education Collaborative Expert Panel 2011 (IECEP)). Effective ICP are more likely to occur where there is an organisation-wide learning culture that promotes and supports ongoing professional development in four key competency domains: values and ethics, roles and responsibilities, communication, and team-based patient care (IECEP 2011). These four competency domains, overarched by a learning continuum, provided a conceptual framework to explore ICP issues that facilitated or inhibited effective recognition and response to clinical deterioration.

AIMS

An integrative review was undertaken (Whittemore & Knafl 2005) to explore current literature for organisation-wide interprofessional practice issues that facilitate or inhibit effective recognition and response to clinical deterioration. A theoretical RRS model (DeVita *et al.* 2006) provided the context for developing a unique holistic understanding of these diverse issues. Three key objectives were to: 1) identify and appraise the quality, depth and breadth of current evidence, 2) explore and synthesise unique and recurrent practice issues using an ICP framework, and 3) determine gaps in existing evidence to inform future research.

SEARCH METHOD

The search strategy (in Table 1) was used to retrieve peer-reviewed articles with evidence of interprofessional practice issues in recognising and responding to clinical deterioration. An initial search did not identify any specifically relevant studies or systematic reviews that explored these issues in the context of an organisation-wide RRS model (DeVita *et al.* 2006). Therefore, articles were selected if interprofessional practice issues were described within or between any of the four elements of a RRS. Figure 1 illustrates the search and selection process used to identify eligible full-text articles based on PRISMA statement recommendations (Moher *et al.* 2009). The procedure for confirming accuracy and relevance of selected articles followed an iterative process between all authors to reach a consensus for inclusion.

A search of four bibliographic databases revealed 637 papers of interest. After removal of duplicate titles and screening of abstracts, 67 full-text articles were retrieved and assessed for eligibility according to context (i.e. organisation-wide RRS in adult general-medical surgical ward settings); population (i.e. health professionals); and outcomes (i.e. interprofessional practice issues that facilitate or inhibit effective recognition and response to clinical deterioration). A further seven relevant papers were identified by hand searching references of eligible full-text papers retrieved from the database search. In total, 29 papers were included in this review: 18 qualitative, eight survey-based, and three mixed-methods studies (Table 2). Two papers were based on findings from a larger scale study, which offered both unique and recurrent insights into the phenomena of interest (Mackintosh *et al.* 2012; Mackintosh *et al.* 2014).

QUALITY APPRAISAL OF STUDY METHODS

Due to diverse sources often used in an integrative review, and a lack of recommended standards, quality appraisal of methods usually depends on the sampling frame (Whittemore & Knafl 2005). In this review, 21 papers used a qualitative approach, nine papers were survey-based, one mixed-method paper used both approaches (Beebe *et al.* 2012) and was therefore included in both appraisals. The Critical Assessment Skills Program (CASP 2014) checklist provided recommended appraisal criteria for qualitative methods (see Table 3 *); and a 37-item checklist (shown in Table 4) was used to appraise survey-based papers (Bennett *et al.* 2011). Papers deemed of poor quality during the appraisal process were omitted from the review.

Findings of Qualitative Appraisal

All CASP criteria were either met or partially met by each of the 21 qualitative papers (92%), although only four sufficiently met all criteria (Athifa *et al.* 2011; Williams *et al.* 2011; Bunkenborg *et al.* 2013; Leach & Mayo 2013). Importantly, details of strategies used to address researcher bias and influences on participant relationships were lacking in over two-thirds of the papers (15/21; 71%), which is necessary for transparency and reader interpretation of qualitative findings (Lincoln & Guba 1985, 1986; Sandelowski 1986; Houghton *et al.* 2013). Detail was also lacking in two papers on the ethical approaches used (Donohue & Endacott 2010; Shapiro *et al.* 2010), one study design did not clearly address study aims (Astroth *et al.* 2013), and another the data analysis process (Wood *et al.* 2009).

While most CASP criteria were addressed, further in-depth analyses of trustworthiness revealed additional strengths and weaknesses (Table 3). Using four key criteria: credibility (n=total number of strategies, n=5), transferability (n=3), dependability (n=3), and confirmability (n=4) (Lincoln & Guba 1985; Sandelowski 1986; Houghton *et al.* 2013), details of relevant strategies for each criterion were extracted and coded similarly to above, with the addition of a fourth level, unclear (U). The number of strategies 'met' or 'partially met' were combined and presented as a total trustworthiness score of 15.

None of the 21 qualitative papers provided sufficient details to address all 15 strategies. Only four papers provided information on 10 strategies or more (Mackintosh *et al.* 2012; Astroth *et al.* 2013; Mackintosh *et al.* 2014; Massey *et al.* 2014), while the remaining scored eight or less. Most studies incorporated strategies to address the 'transferability' criterion (86%), although

only five addressed all strategies (Williams *et al.* 2011; Mackintosh *et al.* 2012; Astroth *et al.* 2013; Leach & Mayo 2013; Mackintosh *et al.* 2014). Over half of the credibility strategies were addressed across all qualitative papers (53/105), while only 27% addressed both the dependability and confirmability criteria. Important details on strategies used to address overall trustworthiness were therefore lacking.

Furthermore, this trustworthiness analyses supported CASP appraisal findings where there was insufficient information on strategies used to address researcher bias. In addition, no papers explicitly described how researcher reflexivity was conducted as part of the research process. While one study mentioned 'bracketing of own beliefs' (Astroth *et al.* 2013), and another recognised the importance of identifying personal values, assumptions and biases at the outset (Massey *et al.* 2014), neither explained how these were captured nor applied in context of data collection, interpretation or study findings (Mays & Pope 2000; Silverman 2011).

Seven papers described the use of member checking as a strategy to address confirmability and credibility criteria. Four confirmed study findings were shared with participants to further refine and identify contextual issues (Endacott *et al.* 2007; Mackintosh *et al.* 2012; Mackintosh *et al.* 2014); one conducted further interviews (Chellel *et al.* 2006). While others described sharing findings with participants (Leach *et al.* 2010; Shapiro *et al.* 2010; Leach & Mayo 2013), it was unclear if this was a strategy to validate findings or inform further analysis.

Only two papers commented on audit trails for tracking decision-making and data coding (Astroth *et al.* 2013; Massey *et al.* 2014). Transparent audit trails are an important strategy for addressing dependability and confirmability criteria, by maintaining accurate records of the entire research process (Lincoln & Guba 1985; Houghton *et al.* 2013). No papers considered an external audit.

Findings of Survey-Based Appraisal

All nine papers provided a description of the survey instrument, and how they were developed, although three provided very limited information (Plowright *et al.* 2006; Salamonson *et al.* 2006; Sarani *et al.* 2009) and two of those did not include individual survey items (Plowright *et al.* 2006; Salamonson *et al.* 2006) (Table 4). Each study developed a new local survey tool to address specific study aims except one, which used a locally modified version of a previously developed tool (Beebe *et al.* 2012). Only four referenced other work to inform the development or administration of the instrument (Pusateri *et al.* 2011; McIntyre *et al.* 2012; Rotella *et al.* 2014; Stevens *et al.* 2014). While all studies reported that the newly developed surveys had pre-testing prior to distribution, none provided any convincing evidence of instrument reliability or validity.

Three studies provided clear justification for sample size calculations (Plowright *et al.* 2006; Sarani *et al.* 2009; Stevens *et al.* 2014), four described representativeness of the sample (Jones *et al.* 2006; Sarani *et al.* 2009; Pusateri *et al.* 2011; Stevens *et al.* 2014), and the population sampling frame (Jones *et al.* 2006; Sarani *et al.* 2009; Rotella *et al.* 2014; Stevens *et al.* 2014). Ethics approval was noted in every study, with three exempted as local quality improvement surveys (Plowright *et al.* 2006; Salamonson *et al.* 2006; Stevens *et al.* 2014). Of note, five did not explicitly comment on participant consenting procedures (Jones *et al.* 2006; Plowright *et al.* 2006; Sarani *et al.* 2009; Pusateri *et al.* 2011; Stevens *et al.* 2014).

Importantly, no papers provided sufficient information for replication of data analysis methods. Only three noted steps for handling missing data (Jones *et al.* 2006; Pusateri *et al.* 2011; McIntyre *et al.* 2012; Rotella *et al.* 2014), two described how data entry was verified (Jones *et al.* 2006; Pusateri *et al.* 2011), and one explained response rate calculations (Rotella *et al.* 2014). None explained approaches for analysis of non-response error, or provided definitions for complete versus partially completed surveys.

Summary of Quality Appraisal and Study Eligibility

Most CASP criteria were met in qualitative methods and in-depth analyses of trustworthiness highlighted further strengths and weaknesses. Due to the nature of qualitative research rigour can be challenging to achieve, although careful consideration of recommended trustworthiness strategies can help to improve this issue (Lincoln & Guba 1986; Mays & Pope 2000; Houghton *et al.* 2013). Despite some of the limitations identified from quality appraisal of study methods, these varied and diverse qualitative approaches are essential for exploring the sociocultural phenomena of interprofessional practices in recognising and responding to clinical deterioration, and were therefore considered appropriate for inclusion.

Similar to qualitative studies, survey-based enquiry has inherent limitations in the context of achieving rigour e.g. participant bias and interpretation (Bennett *et al.* 2011). While few surveys demonstrated validity or reliability, the uniqueness of survey questions revealed some important health professional perceptions of practices in recognising and responding to clinical deterioration and were therefore, also considered appropriate for inclusion.

ANALYSIS AND INTERPRETATION OF STUDY FINDINGS

Study findings were extracted (Table 5) and analysed using the four competency domains of ICP: values and ethics, roles and responsibilities, communication, team-based practices; bridged by an overarching professional development continuum (IECEP 2011). Unique and recurrent facilitating or inhibiting ICP issues were coded, grouped and themed within each competency domain (Table 6). Findings were synthesised and conceptualised in the context of an organisation-wide RRS model (DeVita *et al.* 2006) (Figure 2) to determine the depth, breadth and distribution of evidence regarding interprofessional practice issues within, and between, all four elements.

RESULTS

Four main themes aligned with each ICP competency domain: 1) Organisational culture, 2) Role perceptions and professional accountability, 3) Communication of clinical needs and, 4) Team-based practices in recognising and responding to clinical deterioration. These four themes were bridged by an overarching theme of 'Interprofessional learning opportunities' (Table 6). Figure 2 conceptualises resulting ICP issues in the context of a theoretical organisation-wide RRS model. Paragraph codes noted in parentheses (e.g. (V1)) refer to codes in Tables 5 and 6, and Figure 2.

Organisational culture

Eight review papers (27%) identified RRS-wide ICP issues concerning organisational culture or professional practice values, which facilitated or inhibited effective recognition and response to clinical deterioration.

Facilitating

A facilitating organisational culture was described as having shared values of a collegial teaching environment with patient- and problem-focused care, while having a shared understanding of the core value of vital signs to effectively recognise and respond to clinical deterioration. A shared organisation-wide understanding was further facilitated through open discussions of roles, responsibilities, efferent limb activation criteria and success stories at hospital orientation (V1).

Inhibiting

Inhibiting organisational cultures were reflected where there was limited understanding of the RRS concept; a perceived lack of ongoing improvement; and a lack of formal response strategies, which caused variable practices and delays in care escalation. A practice culture of normalising protocol breaches was also reported where nursing or medical staff prioritised other duties over responding to abnormal vital signs. This practice aligned with a perception that local organisational policy and hierarchical issues sometimes conflicted with existing practice and inhibited effective recognition and response to clinical deterioration (V2).

Role perceptions and professional accountability

Twenty-five papers (86%) described key characteristics of RRS roles and, professional accountability issues, which were considered to facilitate or inhibit effective recognition and response to clinical deterioration.

Facilitating

Senior level commitment and clear leadership, from administration and quality elements, were key role characteristics required to facilitate effective recognition and response to clinical deterioration (R1).

Importantly, outreach service roles appeared to provide the most value in terms of facilitating effective care escalation throughout afferent and efferent limb elements. These roles provided important critical care knowledge and clinical expertise, which accelerated clinical decision-making, prevented unnecessary delays, and addressed deficiencies in ward practices to prevent minor events from becoming major. Outreach services also provided a safety net for patients with ongoing complex care needs when discharged from critical care back to general wards; and an afferent limb response instead of, or prior to, efferent limb activation (R2).

Efferent limb RT services were, similarly, considered an invaluable expert resource for providing patient safety advocacy, while preventing minor events from becoming major adverse events. Clarity of RT role and staff composition was important for effective care escalation and utilisation of services by afferent limb staff (R3).

Ward nurses were recognised for providing a pivotal role in initiating and facilitating afferent limb care escalation. They perceived the efferent limb RT as a supportive resource for enabling redistribution of nursing workload and easing burden of responsibility when caring for acutely unwell ward patients. Unqualified nursing assistants also supported ward nurses as 'backup' observers for recognising clinical deterioration (R4).

Inhibiting

Inhibiting issues for administration and quality elements occurred when support and funding for resources were not available and system feedback curtailed with changes in managerial priorities. As a result there was a perceived increase in workload when clinicians were given additional data collection and clinical responsibilities. Increased workload demands and division of care between medical teams were considered to create a 'pass the buck' culture with resistance to accept responsibility for patients with complex care needs. Professional responsibilities and appropriate patient management were also influenced by ongoing variations in staff and skill mix (R5).

Efferent limb RT staff felt a sense of burden from increased workload demands and additional responsibility to attend RT events when already managing a heavy patient caseload; while (afferent limb) ward nurses felt efferent limb RT staff had unrealistic expectations of them to provide ongoing support during an event. Demands of increasing patient acuity was described as overwhelming for nurses, bedside crowding during RT responses was perceived as intimidating, and uncertainty of role responsibilities caused reluctance for ward nurses to fully participate. These may be reasons why nurses were observed to disengage and leave the patient's bedside during RT events (R6).

With a lack of role clarity and blurred professional boundaries there was interprofessional tension and uncertainty regarding individual responsibilities. Shared (medical and nursing) leadership roles during RT events were described, with mixed perceptions of who the main clinical leader was. Medical staff would also sometimes disengage from leading patient care when outreach staff became involved patient management, which may have been perceived as interfering or taking over patient care. Another inhibiting role perception was described where one staff member did not escalate patient care to the efferent limb because they considered themselves 'too junior' to activate the RT (R7).

An inhibiting efferent limb influence for (afferent limb) medical staff was a perceived challenge to assume accountability for patient management with limited clinical autonomy once the RT was activated, which caused further concerns of fragmented and compartmentalised patient care. Use of efferent limb RT services was also considered a failure by (afferent limb) medical staff to manage a patient's increasing clinical needs, potentially inhibiting or delaying care escalation if the patient was not considered sick enough, or the current management plan was considered appropriate (R8).

Other potential delays in care escalation occurred when a patient's clinical needs were within a specific clinical specialty (e.g. neurology) and ward staff felt confident enough in their own roles to address the issue, without activating efferent limb services. This may be reinforced by the autonomy and accountability issues previously described, with reluctance from medical staff to engage in RT utilisation (R9).

When interprofessional support was not immediately available for making collaborative decisions, delays occurred while ward staff awaited clinical reviews, or when registrars or consultants could not be contacted. In these circumstances medical staff hold overriding responsibility to alter escalation criteria, although after-hours or on-call doctors had limited authority and lacked familiarity with patient's clinical issues, which caused further delays in care escalation while seeking support elsewhere (R10).

Communication of clinical needs

The most widely supported theme across all papers comprised professional practices, attitudes and methods that facilitated or inhibited effective communication of patients' clinical needs, escalation of care and, recognition and response to clinical deterioration.

Facilitating

From an organisation-wide perspective the RRS concept was viewed as a formal model to facilitate timely care escalation, which importantly circumvented time-intensive traditional hierarchical communication processes and improved interprofessional collaboration. Electronic records were also considered to facilitate system-wide interprofessional communication. They provided staff with easily accessible patient information and real-time alerts of clinical deterioration, as well as formative performance feedback data (C1).

Constructive feedback from efferent limb leaders, following a RT event, facilitated interprofessional communication and a shared understanding of what worked well, and what could be improved to address patient's needs in the future. Of note, nurses found feedback from an efferent limb leader more useful and beneficial for improving patient care than doctors (C2).

Formal structured clinical practice tools were also considered to facilitate RRS-wide communication of a patient's increasing needs. Examples included the Early Warning Scoring (EWS) system for vital sign measurements; and the Situation, Background, Assessment, Recommendation (SBAR) handover technique used to guide verbal delivery of a patient's immediate clinical needs (C3).

Another key characteristic of outreach roles, which facilitated care escalation, was clarity in communicating and prioritising patients' clinical needs using their critical care knowledge and expertise. This level of communication was considered to limit interprofessional conflict between ward staff (i.e. nursing and medical) and clinical areas (e.g. wards and critical care units), accelerate medical review processes, and expedite more timely referrals and transfers to critical care units (C4).

There were unique intra- and inter-professional communication practices identified between nursing and medical staff that facilitated afferent limb care escalation. Nurses placed importance on conveying a patient's clinical urgency to increase the likelihood of obtaining a medical response when escalating care. Objective data (e.g. vital signs) was also considered important for reinforcing any subjective or intuitive concerns (e.g. knowing something is wrong but unable to specify or articulate). Nurses appreciated having their concerns acknowledged or supported when escalating patient care although, senior nurses were considered more likely to

elicit an appropriate medical response, than junior nurses, by addressing a doctors' clarifying questions more clearly. Medical staff were, however, more likely to activate and utilise efferent limb RT with increasing acceptance and ongoing exposure to the RRS concept in practice, or when uncertain about a patient's clinical diagnosis, issue or management plan (C5, C6).

Inhibiting

While electronic records were considered to facilitate system-wide access to patient information there was a perceived risk of inhibiting important verbal communication between staff when patient data were entered electronically. Restricted access to important clinical information, usually kept at a patient's bedside, also occurred when computer terminals were in demand (C7).

Ambiguous or circuitous communication of a patient's clinical needs was also an inhibiting interprofessional practice issue. For example, when medical staff ordered tests or prescribed medications and did not directly inform a nurse of changes in a patient's clinical priorities; or when ward doctors provided sub-optimal handover of a patient's clinical needs to on-call doctors lacking familiarity (C8).

Despite perceived benefits of formal structured clinical practice tools, EWS and SBAR were inconsistently used for their primary purpose to recognise deterioration and communicate a patient's increasing clinical needs. EWS were sometimes used to confirm deterioration rather than assess it, which may be due to perceived limitations of escalation criteria not formalising certain clinical markers, such as blood results. Professional responsibilities to address recommended actions, according to specific EWS escalation criteria, were also blurred (C9).

Another frequently cited inhibiting practice issue concerned breaching traditional medical or nursing reporting hierarchies. With a sense of professional duty to comply with embedded practice over protocol, ward clinicians were more likely to seek advice from other ward staff before, or instead of, the RT critical care experts. Hierarchies were also described to have unique intra-disciplinary decision-making processes to escalate patient care. Nurse decision-making was described as 'highly hierarchical and protocol-based', and medical as 'autonomous … medicine based on clinical judgement' (Kitto *et al.* 2014, p. 342), with a perception that nurses tended to over-activate according to escalation criteria and doctors tended to under-activate efferent limb responses (C10).

Negative implications for breaching traditional reporting hierarchies were also widely reported. When nurses escalated patient care according to protocol, and medical staff or efferent limb responders considered the activation call inappropriate, negative feedback, reprimand or hostility were described. A breach of embedded hierarchies was sometimes necessary when nurses were unable to contact medical ward staff or when they were discouraged to escalate care and remained concerned. Having concerns ignored or disrespected caused nurses to feel undervalued, nervous, or anxious and, hesitant to escalate patient care in the future with self-doubt of the appropriateness to utilise efferent limb RT services (C11).

A unique intra-hierarchical practice issue occurred between ward nurses and unqualified nursing assistants. When patient monitoring responsibilities were divided between roles, there was a perceived risk of vital sign changes going unrecognised or miscommunicated (C12).

Team-based practices

Team-based ICP issues, from 20 review papers (69%), were closely aligned with relationship building values and principles of team dynamics.

Facilitating

A shared organisation-wide understanding of a formal structured RRS, facilitated by open discussions noted previously, was considered to promote ICP in recognising and responding to clinical deterioration (T1).

As well as providing essential clinical expertise, efferent limb RT and outreach services were also widely appreciated for their collegial and collaborative support. When a professional rapport existed between efferent and afferent limb clinicians, escalation practices were more likely to be collaborative; along with shared problem solving and clinical decision-making to prevent further deterioration (T2).

Outreach services further facilitated collaborative practices by fostering familiarity and trust with ward staff. They offered educational and empathic support for ward nurses and collaborated with junior ward doctors, which occasionally prevented the need for further care escalation or efferent limb activation. Outreach nurses also supported each other to manage an existing workload if one of them was required to provide efferent limb support away from their clinical area (T3).

Examples of interprofessional relationship and team-building values were described as: polite, friendly, encouraging, enabling, non-interfering, willing to have dialogue, and patient-focused, without concern of negative criticism (T4).

Inhibiting

When administrative decisions were made to plan and implement practice changes without consultation of key stakeholders (e.g. senior clinical ward staff) there were challenges to effectively engage staff in ICP. Poor recognition of individual professional performance and lack of support were also likely to inhibit engagement, and lead to interprofessional conflict. Interprofessional collaboration was considered more likely to occur as a reactive approach, when a patient was acutely unwell, rather than preventing a patient from becoming acutely unwell (T5).

There was a perceived expectation of junior (afferent limb) ward doctors to occasionally manage patients without support from a senior medical decision-maker, despite lacking critical care expertise. This was a particular concern for after-hours staff when junior doctors cared for a larger cohort of patients they were less familiar with and additional support services were not available (T6).

Frequent changes in efferent limb RT members and ward staff posed inhibiting challenges for team-based practices, and for building and developing ICP competency skills (T7).

Interprofessional learning opportunities

Opportunities for collaborative interprofessional learning, identified in thirteen review papers (45%), were distinctly clinical or practice-based.

Facilitating

Multidisciplinary meetings were considered to facilitate interprofessional learning opportunities for key stakeholders by enabling discussion and feedback of performance data, which motivated ongoing engagement in the RRS concept. Other, more informal learning opportunities occurred during afferent limb clinical deterioration, and efferent limb responses, which were widely perceived to teach less experienced health professionals how to manage acutely unwell patients, and further develop acute care clinical skills in ward staff (L1, L2).

Inhibiting

An inhibiting interprofessional learning issue for efferent limb RT and outreach services was the perception that they deskilled junior medical ward staff by taking over difficult clinical decision-making, and removing traditional experiential learning opportunities. Although, outreach services often lacked resources to sustain education of frequently changing ward staff, which created challenges to improve acute care skills outside of critical care areas. In addition, constructive feedback from efferent limb leaders was not consistently provided during RT responses (L3).

DISCUSSION

While no studies were found to specifically examine organisation-wide relationships of RRS elements or ICP issues in recognising and responding to clinical deterioration, evidence was identified in more focused studies. These studies tended to focus on afferent limb practices (e.g. patient monitoring), perceptions of the efferent limb element, or the effectiveness of efferent limb RT on patient outcomes.

Four ICP themes were grouped under one overarching theme (Table 6). Within these themes a broad range of recurrent and unique interrelated sociocultural practice issues were identified across the four elements of a RRS (Figure 2). Three notable interprofessional practice issues emerged: intra- and inter-professional reporting hierarchies (inhibiting), critical care outreach services (enabling), and interprofessional relationships (enabling). These practice issues are discussed below. Codes listed in parentheses identify themes and ICP issues shown in Tables 5 and 6 and Figure 2.

Traditional, or embedded, medical and nursing reporting hierarchies were most widely recognised as an inhibiting ICP issue for communicating and escalating patients increasing clinical needs according to protocol (C10, C11). A breach of traditional hierarchy reporting with negative feedback was more likely to lead to future hesitation or delay in care escalation to the efferent limb RT, while seeking advice from other ward clinicians. Importantly, delays in care escalation, efferent limb RT activation, and poor communication are likely to lead to unsatisfactory patient outcomes (Tirkkonen *et al.* 2014), including catastrophic adverse events in cases of preventable clinical deterioration (*Inquest into the death of Vanessa Anderson* 2008).

This issue reinforces the significance of research priorities in healthcare communication (World Health Organisation 2009), and highlights a level of urgency for identifying effective system-wide strategies that reduce or minimise opportunity for miscommunication between health professionals.

A particularly noteworthy RRS role, provided by outreach services, bridged three ICP competency domains (R2, C4, T3) and was widely perceived to overcome embedded reporting hierarchies, while facilitating interprofessional communication and timely care escalation throughout the afferent and efferent limb elements. When compared to efferent limb RT services, outreach services provided a more proactive interprofessional collaborative system-wide approach when responding to concerns of clinical deterioration in ward patients, which was consistent with their intended purpose of extending critical care expertise outside of critical care areas (Marsh & Pittard 2012). While there appears to be benefits in proactive (afferent limb) assessment teams, such as outreach services, with early identification of patients at risk of deterioration (Wood *et al.* 2009; Pirret *et al.* 2015), there is still a lack of evidence from a system-wide perspective to support their effectiveness on improving in-hospital patient outcomes. While various types of uniquely structured proactive patient safety teams continue to be implemented in acute healthcare organisations, future large-scale system-wide research would be beneficial but perhaps not feasible or ethical. Alternatively, it is proposed that more in-depth inquiry into the implications of patient safety teams on embedded practice cultures, combined with patient outcome data, would provide more meaningful insights into ICP that promote effective recognition and response to clinical deterioration. Organisations or recommended practice standards should also consider that a lack of role clarity or boundaries can inhibit ICP (Firth-Cozens 2001)(R7), and when staff feel burdened with excessive workloads (R6).

Positive interprofessional relationships were also highlighted as an important facilitator of effective practice (T2, T4). Shared team-based practice values and clinician rapport were widely reported. Examples were provided by outreach roles, again, where they fostered familiarity and trust with ward staff, and promoted collaborative interprofessional relationships throughout RRS. This reflected the fundamental relationship-centred, process-oriented properties of ICP competencies (IECEP 2011), which promote effective decision-making (Eljiz *et al.* 2010). Current evidence to recommend successful strategies that improve interprofessional collaboration is considerably lacking and warrants further investigation (Zwarenstein *et al.* 2009).

This review identified various ICP issues in recognising and responding to clinical deterioration, some facilitative, some inhibitive. There may also be some that have not yet been discovered. An ICP framework can be used to guide further in-depth system-wide research into the interprofessional relationships of organisation-wide practices, using both quantitative and qualitative approaches; and to identify facilitating practices that promote safe patient care, which are prevalent in high reliability organisations with low incident rates (Firth-Cozens 2001). An analytic lens of system-wide ICP also aligns with recent quality and safety recommendations to build organisational resilience in constantly changing healthcare environments (Hollnagel *et al.* 2015) where non-technical skills are increasingly promoted to improve leadership, communication, situational awareness and decision-making skills (Chalwin & Flabouris 2013).

Review strengths and limitations

A methodological strength of this integrative review was the unique application of an ICP framework as an analytic lens for exploring the essential human elements of a RRS, i.e. health professionals with roles and responsibilities to implement and apply recommended standards for effective recognition and response to clinical deterioration. This approach has provided some early foundations for building a more in-depth understanding of organisation-wide interprofessional practice issues, rather than focusing on specific RRS elements or issues within clinical disciplines. In addition, the use of a clear review strategy and established appraisal tools has enabled transparency in reviewing the literature for this topic.

Specifically relevant studies were not identified, which limited strength of evidence for this review. It is also possible that interprofessional practice issues have been reported in other papers not identified by the literature search strategy used in Table 1. While limitations in trustworthiness were identified following quality appraisal, study rigour can be challenging to achieve in qualitative research (Sandelowski 1986), and recommended strategies to enhance rigour should be carefully considered (Mays & Pope 2000). Even though synthesis of evidence from multiple qualitative studies is a complex process (Whittemore & Knafl 2005), each study included in this review was considered to report important interprofessional practice issues and was therefore, retained for further analysis.

RECOMMENDATIONS

Research

Organisation-wide research in complex and constantly changing busy clinical environments is challenging (Firth-Cozens 2001). Despite this, it is necessary to better understand how healthcare professionals can collectively and effectively adapt and align healthcare practice cultures towards better and safer patient care (Tsasis *et al.* 2012). Current knowledge of organisation-wide ICP in recognition and response to clinical deterioration is fragmented and limited. While patient outcome data provides a more positivist, tangible view of RRS effectiveness, an interpretive approach could reveal the less tangible multiple realities of interprofessional practice issues (Lincoln & Guba 1986). It would therefore seem appropriate for researchers, clinicians and administrators to develop a shared organisation-wide understanding of positive ICP cultures that promote optimal patient care to effectively recognise and respond clinical deterioration.

Education and Relevance to Clinical Practice

Interprofessional learning and collaborative clinical practices should occur mutually between health professionals to facilitate effective recognition and response to clinical deterioration (IECEP 2011). Examples of existing interprofessional learning opportunities were identified in this review such as multidisciplinary meetings, episodes of clinical deterioration, and RT activation. Although, how these opportunities are utilised in routine clinical practice to facilitate interprofessional learning is unclear. Studies have described benefits of applying the concept of ICP to simulated learning contexts (Miller *et al.* 2013), and in health professional

undergraduate programs (Darlow *et al.* 2015), but much less so in the clinical environment. A recent four-year action research intervention aimed at improving ICP across a state-wide health system in Australia found significant differences in attitudes, between medical, nursing, allied health and administrative staff, towards perceived benefits (Braithwaite *et al.* 2013); administration indicated a more favourable attitude towards the intervention and medical the least. These differences in professional perceptions and attitudes are likely to perpetuate healthcare silos and poor collaborative practice cultures, which is why it is essential for clinicians to find common ground and shared values to enable ICP. Organisation-wide application of an ICP framework could be used to facilitate effective practices in organisations with RRS models.

CONCLUSION

This review has presented a unique approach for exploring the relationships of RRS-wide interprofessional practice issues using an ICP framework. Various ICP issues were identified but the evidence lacks strength, depth and quality. Future research should consider exploring the effectiveness of RRS implementation using an organisation-wide interpretive approach to build a more in-depth understanding of ICP issues for effective recognition and response to clinical deterioration. An improved understanding of organisation-wide ICP issues could also help clinicians, researchers and policy makers to develop more effective quality and safety improvement strategies.

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Table 1 Literature Search Strategy

Item	Details
Electronic sources	PubMed, CINAHL (Cumulative Index for Nursing and Allied Health), ProQuest Central, Cochrane Library
Year range	1995 (Medical Emergency Team concept) to Dec 2014
Inclusion criteria	Peer reviewed articles of studies of adult medical/surgical inpatients in acute care hospital wards that described: Interprofessional relations within or between elements of a RRS, Interprofessional practice behaviours associated with care and management of ward patients at risk of deterioration, or Roles and responsibilities of health professionals within or between one or more element of a Rapid Response System
Exclusion criteria	Studies examining response teams or rapid response systems in specific clinical specialties e.g. sepsis, stroke, oncology, cardiology, pharmacy, mental health Emergency departments, trauma settings, emergency retrieval services End of life or palliative care Studies reporting patient outcomes only e.g. in-hospital cardiopulmonary arrest/mortality, unplanned critical care admissions e.g. ICU Commentaries, editorials, conference abstracts without publications
MeSH terms	Professional role, nurses role, doctors role, interprofessional relations, nurse-physician relations, communication, interdisciplinary communication
Additional search terms	Interdisciplinary, multidisciplinary, multiprofessional, interprofessional, interpersonal Practice culture, safety culture, organisational culture, workplace culture Rapid response system, rapid response team, medical emergency team, critical care outreach Deteriorating patient, acutely ill patient, acute patient, patient rescue, adult patient
Restrictions	English language, humans

Table 2 Summary of Study Methods

First Author Year	Design	Study population Setting	Study focus
Astroth *et al.* 2013	Qualitative; semi-structured interviews	15 ward nurses 1 community hospital, USA	Barriers/facilitators to nurses decisions to activate RRT
Athifa *et al.* 2011	Qualitative; before-after focus groups	66 nurses pre intervention, 65 nurses post intervention 3 teaching hospitals, Australia	Nurses perceptions of CCO services pre and post implementation
Baker McClearn *et al.* 2008	Qualitative; semi-structured interviews	56 nurses, 3 students, 27 doctors, 8 allied health, 6 managers 8 hospitals, UK	Impact of CCO services on delivery and organisation of care
Beebe *et al.* 2012	Mixed method; structured and unstructured observations, RRT member survey	5 RRT doctors, 3 ward nurses, 10 RRT nurses, 2 respiratory practitioners, 1 assistant manager, 3 nurse supervisors, 3 unknown 1 teaching medical centre, USA	Observed and self-perceived teamwork of RRT members
Benin *et al.* 2012	Qualitative; open-ended interviews	18 nurses, 12 home team physicians, 8 administrators, 4 RRT physicians, 4 RRT nurses, 3 RRT respiratory technicians 1 university hospital, USA	Impact and value of a RRT - staff experiences and attitudes
Bunkenborg *et al.* 2013	Qualitative; structured observations and semi-structured interviews	13 nurses 1 university hospital, Denmark	Nursing practices of bedside monitoring in-hospital patients
Chaboyer *et al.* 2005	Qualitative; semi-structured interviews	10 ward nurses 1 university hospital, Australia	Ward nurses perceptions of the ICU liaison nurse
Chellel *et al.* 2006	Qualitative; semi-structured interviews, further in-depth interviews	20 outreach nurses, 60 other (dieticians, physiotherapists, nurses, doctors, anaesthetists) 2 acute and 5 general hospitals, UK	Outreach contribution to managing critically ill ward patients
Cioffi 2000	Qualitative; unstructured interviews	32 registered nurses 2 hospitals, Australia	Experiences of nurses calling emergency assistance
Donohue & Endacott 2010	Qualitative; semi-structured interviews	11 ward nurses, 3 CCO staff 1 district hospital, UK	Ward nurse and CCO staff perceptions of

First Author Year	Design	Study population Setting	Study focus
			caring for deteriorating ward patients
Endacott *et al.* 2007	Mixed methods; document audit, semi-structured interviews, focus group	11 nurses, 14 doctors, 17 patient cases 1 regional hospital, Australia	Cues used to identify, assess and communicate patient deterioration
Jones *et al.* 2006	Survey; Likert-type agreement scale	351 ward nurses (RR 100%) 1 teaching hospital, Australia	Value of MET and barriers to activation
Kitto *et al.* 2014	Multiple case study; focus groups	27 doctors, 62 nurses 4 hospitals, Australia	Reasons why staff members do not activate the RRS
Leach *et al.* 2010	Qualitative; semi structured interviews	14 bedside nurses, 16 RRT nurses, 2 respiratory therapists, 18 nurse supervisors 6 acute hospitals, USA	How nurses rescue patients in hospitals with RRT
Leach *et al.* 2013	Qualitative; semi-structured interviews and observations	17 staff (ward nurses RRT nurses, ward doctors, administrators, department heads) 1 tertiary university hospital, USA	Perceived and observed effectiveness of RRT
Mackintosh *et al.* 2012	Ethnographic comparative case study; observations and interviews	35 doctors, 11 ward nurses, 4 health care assistants, 6 safety leads and managers 2 tertiary hospitals, UK	Process of patient rescue trajectories and safety strategies within the care pathway
Mackintosh *et al.* 2014	See Mackintosh 2012	See Mackintosh 2012	Rules of rescue - collective norms and practice behaviours in RRS
2014 Massey *et al.*	Qualitative; in-depth semi-structured interviews	15 ward nurses 1 public teaching hospital, Australia	Experiences and perceptions of accessing and utilising a MET
2012 McIntyre *et al.*	Survey design; Likert-type agreement scale	208 nurses (RR 97%) 1 university hospital, Australia	Nurse perceptions of ICU nurse consultant
Plowright *et al.* 2006	Survey; closed questions with free-text answers	400 nurses, 120 medical staff, 158 other (RR 52%) 7 hospitals, UK	Views of outreach services and care escalation
Pusateri *et al.* 2011	Survey design; Likert-type	131 ward nurses (RR 34%)	Perceptions of MET and actions during a

First Author Year	Design	Study population Setting	Study focus
	agreement scale	661 bed academic medical centre, USA	MET call
Rotella *et al.* 2014	Survey; Likert-type agreement scale	50 junior medical officers (RR 100%) 1 teaching hospital, Australia	Self-reported factors influencing care escalation
Salamonson *et al.* 2006	Survey	92 ward nurses (RR 73%) 1 regional hospital, Australia	Satisfaction and perceived benefits of MET
Sarani *et al.* 2009	Survey; web-based	414 ward nurses (RR 83%), 103 ward doctors (RR 67%) 1 university hospital, USA	Perceived effect of MET on patient safety
Shapiro *et al.* 2010	Qualitative part of larger mixed-methods study; semi-structured focus groups	56 nurses 18 hospitals, 13 US states	Nurses experiences of activating an RRT
Shearer *et al.* 2012	Mixed method; point prevalence, prospective audit, structured interviews	44 ward nurses, 29 ward doctors, 10 other e.g. ICU outreach 4 tertiary hospitals, Australia	Delayed or non-activated RRS calls and sociological factors
Stevens *et al.* 2014	Cross-sectional survey; Likert-type agreement scale	At 2 months: 60 doctors (RR 38%) At 5 months: 111 doctors (RR 70%) 1 university hospital, USA	Self-reported behaviours 2 months and 5 years post RRS implementation
Williams *et al.* 2011	Qualitative; semi-structured focus groups	13 ward nurses 1 community hospital, USA	Nurses shared experiences of RRT use
Wood *et al.* 2009	Qualitative; structured telephone interviews	15 department directors from ICU, emergency, patient safety 15 academic medical centres, USA	Practices, characteristics and structures of RRS

CCO – critical care outreach, ICU – intensive care, MET – medical emergency team, RR – response rate, RRT – rapid response team, RRS – rapid response system

Table 3 Summary of Qualitative Appraisal

Appraisal Question*	1	2	3	4	5	6	7	8	9	10	11	12
First Author												
Astroth *et al.* 2013	Y	Y	Y	N	Y	Y	P	Y	Y	Y	P	11
Athifa *et al.* 2011	Y	Y	Y	P	Y	P	P	Y	Y	Y	P	5
Baker-McClearn *et al.* 2008	Y	Y	Y	P	Y	Y	N	Y	P	Y	P	4
Beebe *et al.* 2010	Y	Y	Y	P	P	P	N	Y	P	P	P	2
Benin *et al.* 2012	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	P	6
Bunkenborg *et al.* 2013	Y	Y	Y	P	Y	Y	P	Y	P	Y	Y	7
Chaboyer *et al.* 2005	Y	Y	Y	P	Y	Y	N	Y	Y	Y	Y	5
Chellel *et al.* 2006	Y	Y	Y	Y	Y	Y	N	P	Y	P	P	7
Cioffi 2000	Y	Y	Y	P	Y	Y	N	Y	Y	Y	Y	5
Donohue *et al.* 2010	Y	Y	Y	P	P	P	N	N	P	Y	Y	5
Endacott *et al.* 2007	Y	Y	Y	P	P	Y	N	P	P	P	P	8
Kitto *et al.* 2014	Y	Y	Y	P	Y	P	N	P	P	Y	Y	4
Leach *et al.* 2010	Y	Y	Y	P	P	P	N	Y	P	P	P	6
Leach *et al.* 2013	Y	Y	Y	Y	Y	Y	P	Y	P	Y	Y	7
Mackintosh *et al.* 2012	Y	Y	Y	P	P	Y	N	Y	Y	Y	Y	12
Mackintosh *et al.* 2014	Y	Y	Y	Y	P	P	N	Y	Y	Y	Y	12
Massey *et al.* 2014	Y	Y	Y	P	Y	Y	Y	Y	Y	Y	P	10
Shapiro *et al.* 2010	Y	Y	Y	P	Y	Y	N	N	P	Y	Y	7
Shearer *et al.* 2012	Y	Y	Y	Y	P	P	N	P	P	P	P	4

Williams *et al.* 2011	Y	Y	Y	P	P	Y	P	P	P	Y	P	7
Wood *et al.* 2009	Y	Y	Y	Y	Y	P	N	Y	N	P	P	5

***CASP Appraisal Questions** (Table 3)

1	Was there a clear statement of the aims of the research?
2	Was qualitative methodology appropriate?
3	Is it worth continuing?
4	Was the design appropriate to address the aims of the research?
5	Was the recruitment strategy appropriate?
6	Was the data collected in a way that addressed the research issue?
7	Has the relationship between researcher and participants been addressed?
8	Have ethical issues been taken into consideration?
9	Was the analysis sufficiently rigorous?
10	Is there a clear statement of findings?
11	How valuable is the research?
12	**Additional to CASP questions**: How many trustworthiness strategies were addressed? (Total of 15)

Ref: Critical Appraisal Skills Programme, 2014

Table 4 Summary of Survey-based Appraisal

First Author/Year	Beebe 2012	Jones 2006	McIntyre 2012	Plowright 2006	Pusateri 2013	Rotella 2014	Salamonson 2006	Sarani 2009	Stevens 2014
TITLE, ABSTRACT, INTRODUCTION									
Survey design; explicit purpose/aim; background	P	P	Y	Y	Y	P	Y	Y	Y
METHODS									
Methods sufficiently described for replication	P	P	N	N	P	N	N	N	P
Location of data collection	Y	Y	Y	Y	Y	Y	Y	Y	Y
Dates of data collection	Y	Y	N	N	Y	Y	N	Y	Y
Use of a codebook	ND	ND	ND	ND	ND	ND	ND	ND	ND
DATA ANALYSIS									
Description of methods used for data analysis	Y	Y	N	N	Y	Y	Y	Y	Y
Methods for verifying data entry	N	Y	N	N	Y	N	N	N	N
Method for analysis of nonresponse error provided	N	N	N	N	N	N	N	N	P
Method for calculating response rate provided	N	N	N	N	N	Y	N	N	N
Definitions for complete vs partial completions provided	N	N	N	N	N	N	N	N	N
Methods for handling item missing data provided	N	Y	Y	N	Y	Y	N	N	N
SAMPLE SELECTION									
Sample size calculation rationale/justification	N	N	N	Y	N	N	N	Y	Y
Description of representativeness of sample	N	Y	N	N	Y	N	N	Y	Y
Description of population and sample frame	N	Y	N	N	N	P	N	Y	P
RESEARCH TOOL DEVELOPMENT									
Sample size calculation rationale/justification	N	N	N	Y	N	N	N	Y	Y
Description of representativeness of sample	N	Y	N	N	Y	N	N	Y	Y
Description of population and sample frame	N	Y	N	N	N	P	N	Y	P
Sample size calculation rationale/justification	N	N	N	Y	N	N	N	Y	Y
Description of representativeness of sample	N	Y	N	N	Y	N	N	Y	Y
Description of population and sample frame	N	Y	N	N	N	P	N	Y	P
Sample size calculation rationale/justification	N	N	N	Y	N	N	N	Y	Y
Description of representativeness of sample	N	Y	N	N	Y	N	N	Y	Y
ADMINISTRATION OF TOOL									
Who approached potential participants	P	Y	Y	Y	Y	Y	Y	Y	Y
Mode of administration	Y	Y	Y	P	P	Y	P	Y	Y
Type and number of contacts provided	N	Y	Y	Y	Y	Y/N	N	Y	Y
Financial incentives offered/provided	ND	ND	ND	ND	ND	ND	ND	ND	ND
ETHICAL QUALITY									
HREC approval	Y	Y	Y	N	Y	Y	N	Y	Y
Subject consent procedures reported	Y	N	Y	N	N	Y	Y	N	N
Funding reported	ND	ND	ND	ND	Y	ND	ND	Y	Y
RESULTS									
Response rate reported / clearly defined	N	P	P	P	P	P	P	P	P
All respondents accounted for	N	N	N	N	N	N	N	N	N

(complete and partial according to eligibility)									
Information on how non-respondents differ from respondents provided	N	N	N	Y	Y	N	N	N	N
Results clearly presented	Y	Y	Y	Y	N	Y	Y	Y	N
Results address objectives	Y	Y	Y	P	P	Y	Y	P	Y
DISCUSSION									
Results summarised referencing study objectives	Y	Y	N	N	P	Y	Y	Y	Y
Strengths of the study stated	N	Y	Y	N	N	Y	N	N	N
Limitations of the study stated (bias)	Y	Y	Y	Y	Y	Y	Y	Y	Y
Generalisability of results discussed	Y	Y	Y	N	Y	Y	Y	Y	Y

Ref: Bennett *et al,* 2011

Table 5 Summary of Study Findings

Ref No.	Year First Author	Professions RRS Element	Key Findings: Facilitating	Key Findings: Inhibiting
1	2014 Stevens *et al.*	Medical Afferent limb	RRS considered a necessity for improving patient care (R3) Familiarity and acceptance increases utilisation (C6)	RRS not considered to improve ability to manage deteriorating patient (R8)
2	2014 Rotella *et al.*	Medical Afferent limb	Uncertainty about diagnosis or management plan; unfamiliarity with patients' clinical problem; no patient response to initial treatment (C6) Unconcern of criticism (T4)	Patient not sick enough or clearly dying and management plan considered appropriate (R8) Over confidence to manage patient without support (R9) Difficulty escalating care when registrar or consultant unavailable (R10) Suboptimal handover from the home team to on-call doctors (C8) Reluctance to wake a senior to escalate care (C11)
3	2014 Massey *et al.*	Nursing Efferent Limb	Leadership and support for appropriate activation (R1)	Lack of role clarity (R7) Nurses report along the traditional hierarchy (C10) Previous negative experiences (C11) MET not recognised as early intervention strategy (V2)
4	2014 Mackintosh *et al.*	Medical, nursing, HCAs, managers Afferent limb	Understanding of core value in vital signs monitoring for clinical deterioration (V1) EWS mediated between nursing and medical boundaries (C3) HCA provided backup for ward RN in detecting deterioration (R4) CCOT perceived as supportive by junior doctors (T3)	Normalisation of protocol breaches (V2) Intraprofessional jurisdictional disputes of accountability/responsibility caused fragmentation of care (R8) Specific clinical concerns not implicitly supported by EWS; EWS blurred professional responsibilities (C9) Junior doctors reprimanded without legitimate reason for escalation (C11) Hierarchical division of labour/selective vital sign monitoring (C12) Poor engagement of key stakeholders (T5) Senior doctors concerned about CCOT increased

			Key Findings	
Ref No.	**Year First Author**	**Professions RRS Element**	**Facilitating**	**Inhibiting**
				professional power in medical domain (L3)
5	2014 Kitto *et al.*	Medical, nursing Efferent limb	Improved communication and collaboration across hierarchical boundaries (C1) Nurses felt empowered to communicate concerns and initiate a response for help (C5) RRS used as formal tool by nursing and junior medical to obtain expertise to address patient needs (T1)	Medical responsibility to alter escalation criteria (R10) Non-activation of RRS caused by breakdown in communication (C8) Utilisation of (nursing and medical) traditional reporting hierarchies; discipline specific decision-making pathways (C10) Previous negative experiences and stories of reprimand (C11) RRS escalation criteria deskilled junior doctors with less exposure to difficult decision making experiences (L3)
6	2013 Leach *et al.*	Medical, nursing, management Efferent limb	Shared mission to innovate and pursue safety and quality improvement with a collegial teaching environment (V1, T1) Administrative leadership to organise and manage change (R1) RRT nurse resources/skills/expertise (R2) Clarity of RRT role/structure (R3) Collaborative teamwork (T2) RRT members non-intimidating and 'willing to have dialogue' around patient needs (T3, T4)	Ambiguous leadership during efferent limb response (R7) Medical staff conveyed a sense of failure if an RRT had to be called (R8) Poor communication, not patient focused (C8) Negative experiences/reprimand (C11) Frequently changing RRT members (T6)
7	2013 Bunkenborg *et al.*	Nursing Afferent limb	Nurses placed importance on clear communication; obtained vital signs before contacting doctor; likely to escalate care when concerns acknowledged by doctor (C5) Collaborative decision-making (T2)	Lack of clarity in communicating patients needs (C8) Patients' condition needed to be severe to get a response (C9) Nurses concerns not taken seriously (C11) Collaborative communication more likely to occur when vital signs abnormal (T5)
8	2013 Astroth *et al.*	Nursing Afferent limb	Support and encouragement from nursing unit colleagues and leaders (C5) Unit cultures of teamwork and willingness (T2, T4)	Poor knowledge of policy (V2) Uncertainty of expectations during event (R6) Calling home team doctor first (C10)

Ref No.	Year First Author	Professions RRS Element	Key Findings: Facilitating	Key Findings: Inhibiting
			Ward staff appreciated RRT members' guidance, education and follow-up (L2)	Communication style of RRT members, fear of appearing dumb or being reprimanded (C11)
9	2012 Shearer *et al.*	Medical, nursing Efferent Limb	Collegial support with chosen approach of care escalation; no concern of hostile response (C5, T2)	Staff considered themselves too junior to activate RRS (R7) Escalation delayed when issue is within clinical discipline of home team, or ward staff felt the situation was under control (R9) Medical staff delay review patient on ward (R10) Poor communication of prioritisation by medical to nursing (C8) Concern of negative or hostile response (medical and nursing) for efferent limb activation (C11) Junior staff without clinical expertise expected to manage patient (T7)
10	2012 McIntyre *et al.*	Nursing Outreach services	Helped prioritise patients' clinical issues after MET/ICU discharge (82%); prevented a minor problem becoming major (90%); reduced serious adverse events (83%) (R2) Accelerated medical review (71%) (C4) Teach how to manage (69%) and identify (56%) sick patients on ward (T2)	Utilisation of outreach services instead of MET (C10)
11	2012 Mackintosh *et al.*	Medical, nursing, HCAs, managers Afferent limb	Senior level commitment/leadership (R1) CCOT mediated between ward staff and critical care, prevented delays, and safety net for patients discharged from ICU (R2, C4) Electronic systems provided access to timely patient data, inbuilt prompts and formative feedback data (C1) Audit and feedback for staff engagement (C2) EWS facilitated escalation of care across hierarchical and occupational boundaries (C3)	Lack of formalised response strategy (V2) CCOT introduced compartmentalisation and fragmentation of care (R8) Lack of administrative support with shifting managerial priorities (R5) Challenges to escalate care without objective signs (C5) Electronic systems – restricted access, replaced face to face communication, not available at patient bedside (C7)

Ref No.	Year First Author	Professions RRS Element	Key Findings: Facilitating	Key Findings: Inhibiting
			CCOT provided education, support and IP training (L2)	EWS inconsistently used to request help; poor adherence with use of SBAR as a handover tool; signs of deterioration not formalised by EWS (C9) Medical and nurse reporting hierarchies (C10)
12	2012 Benin *et al.*	Medical, nursing Efferent limb	Enabled redistribution of workload for ward nurses and on-call doctors (R4) Improved model to facilitate timely escalation of care (C1) Empowerment of nurses and increased morale (C5) Responses facilitated interprofessional learning (L2)	RRT members felt burdened with additional workload (R6) Tensions between nurses, doctors and RRT (R7) Reduced autonomy for trainee doctors (R8) RRS model negated traditional teaching approaches (L3)
13	2012 Beebe *et al.*	Efferent limb RRT members Efferent limb	Field Observations: Use of situation, background, assessment, recommendation (SBAR) (C3) Collegial support between ward and RRT nurses (T2) RRT Member Survey: Effective leadership (67%); familiarity with each other's job responsibilities (78%) (R1) RRT perceived as a patient safety net (93%) (R3) Members use effective decision-making and problem-solving skills (83%) (T2)	Field Observations: Inconsistent engagement, or disengagement, by bedside nurses (R6) Ambiguous leadership during RRT events (R7) Fragmented interprofessional communication (C8) RRT Member Survey: Perceived lack of continuous improvement (52%) (V2) Poor recognition of individual performance (37%); unresolved IP conflicts (33%) (T5) Lack of constructive feedback (33%), and coaching from RT leader (30%) (L3)
14	2011 Williams *et al.*	Nursing Efferent limb	RRT nurse support and expertise (R2, T2) Perceived role of RT as advocates for patients safety (R3) RRT eliminated time intensive process of reporting along traditional hierarchy (C1) Collaborative teamwork and decision-making (T2)	Ward doctors unavailable or reluctance to activate RRT; negative responses to ward nurses from RRT members (C11)
15	2011 Pusateri *et al.*	Nursing Efferent limb		Not feeling valued as a member of the MET (29%); uncertain (22%) or uncomfortable (20%) with role in MET; feeling intimidated during MET (18%) caused reluctance to participate fully (11%) (R6)

Ref No.	Year First Author	Professions RRS Element	Key Findings: Facilitating	Key Findings: Inhibiting
				Physician discouragement caused hesitation to activate (20%) (C12)
16	2011 Athifa *et al.*	Nursing Outreach services	Improved communication processes between multi-disciplinary team members, ward staff and ICU (C4) Friendly, non-intrusive or interfering attributes (T2, T4) An important resource to educate staff on complex procedures uncommon to general wards for post-ICU patients (L2)	No CCOS available after-hours (services discontinued post-intervention study) (T7)
17	2010 Shapiro *et al.*	Nursing Efferent limb	RRT perceived as an invaluable expert resource (R3) Positive feedback (C2) Supportive working relationships with RRT members (T2) RRT nurse collegial support, autonomy and expertise (T3)	Uncertainty when to activate RRT or call code blue (R7) RRT nurse concerns of leaving own patient caseload (R6) Concerns of reprimand for activating efferent limb RRT (C11)
18	2010 Leach *et al.*	Nursing Afferent limb, efferent limb	RRT nurse provided critical care skills and knowledge Nurse decision-making facilitated by protocol and consultation (C10) RRT nurse augmented, reinforced and supported the bedside nurse (T2)	Lack of clarity in articulating care escalation requirements (C8) Decision-making occurred within nursing hierarchy before call (C10) Nurses felt their voices were not heard, respected or accepted by doctors (C11) Collaboration more likely when the patient is acutely unwell (T5)
19	2010 Donohue *et al.*	Nursing Afferent limb	CCO considered an important resource for initiating clear action plans (R2) Use of objective data/EWS to communicate and reinforce concerns, intuition, visual observation (C2, C5) CCO provided calm and reassurance for ward staff (T2)	Disengagement of medical staff when CCO become involved (R7) Medical staff sometimes delayed escalation to manage patient themselves (R9) EWS infrequently used to look for trends in data; EWS used to confirm deterioration rather than assess it (C9)
20	2009 Wood *et al.*	Management Efferent limb	Open discussions of roles, activation criteria and success stories (V1) Nurse role pivotal to care escalation (R4) Feedback of outcome data, follow-up surveys (C2)	Lack of administrative support/funding for resources and positions (R5) Bedside crowding perceived as intimidating (R6) Reluctance from medical staff to activate RRT; negative

Ref No.	Year First Author	Professions RRS Element	Key Findings: Facilitating	Key Findings: Inhibiting
			Utilisation improved with medical acceptance (C6) Ward staff rapport with RRS members (T2) Multidisciplinary team meetings – opportunity for learning and feedback (L1)	feedback for inappropriate activation (C11)
21	2009 Sarani *et al.*	Medical, nursing Efferent limb	Feedback from MET – (RN 3.5, Dr 2.7) (C2) Positive perceptions of MET (RN 4.4:Dr 3.9) (T2) (Mean Likert-score: 1 strongly disagree to 5 strongly agree)	Negative perception of MET on educational experiences (RN 2.5, Dr 3) and resuscitation skills (RN 2.1, Dr 2.6) (L3)
22	2008 Baker McClearn *et al.*	Medical, nursing, allied health Outreach services	Reduced ICU referrals and instilled confidence in ICU staff to transfer patients back to ward (R2) Improved relationships and communication between nurses and doctors (C4) Provided encouragement to make timely and appropriate decisions (T4) Imparted critical care expertise and developed confidence in ward staff (L2)	Challenged to improve and sustain skills in context of ongoing staff rotations and turnover; perceived deskilling of junior doctors (L3)
23	2007 Endacott *et al.*	Medical, nursing Afferent limb	Clear communication of situational urgency for patient (C5)	Local policy and hierarchical issues prevented appropriate responses (V2) On-call doctors lack familiarity with patients and authority to change management (R10) Delays in treatment created interprofessional friction (T5) Division of patient care between medical teams; staffing issues (casual/locum/part-time, shortages, multiple demands, skill mix, medical rotations, inexperienced staff) (R5)
24	2006 Salamonson *et al.*	Nursing Efferent limb	Provided immediate attention - 41%RR; early interventions - 34%RR; backup support - 33%RR; access to medical experts - 18% (R3)	Negative perceptions of the MET attitude (11%) (C11)
25	2006 Plowright *et*	Medical, nursing	Positive effects of services on patient care and facilitation of critical care referrals (85%) (R2)	

			Key Findings	
Ref No.	**Year First Author**	**Professions RRS Element**	**Facilitating**	**Inhibiting**
	al.	Outreach services	Improved timeliness of responses (98%) and transfer to critical care (93%) (C4) High-level awareness of RRS services (98%) (T1) Polite attitude of service (97%) (T4)	
26	2006 Jones *et al.*	Nursing Efferent limb	Prevented a minor event becoming major (90%) (R3) MET allowed nurses to seek help when worried (97%) (C5) MET considered to teach how to better manage sick patients (71%); MET not perceived as deskilling (95%) (L2)	Nurses would call ward doctor before MET (72%) although, would activate MET if ward doctor not available (81%) (C10) Fear of criticism for activating MET (10%) (C11)
27	2006 Chellel *et al.*	Medical, nursing, allied health Outreach services	Facilitated timely escalation processes and decision-making to address patient needs; provided clinical expertise and critical care skills for ward patients (R2) Communicated effectively and were listened to by doctors; developed action plans; initiated additional investigations; liaised, coordinated and relieved work pressures (C4, T4)	Covered up deficiencies in nursing and medical practices on ward (R2) Medical resistance to ownership, responsibility and accountability (R5) Extra demands of increasing patient acuity overwhelmed ward staff (R6) Ward staff felt unsupported by senior clinical decision-makers (T7)
28	2005 Chaboyer *et al.*	Nursing Outreach services	Advocated for ward staff - acted as advisor, counsellor, mediator, and negotiator of teams; considered a change agent, promoter of good will and diplomacy (R2) Improved communication and transfers between ward and ICU (C4) Supported ward staff when advanced critical care skills required for ward patient (T3, L2)	Lack of role clarity; interference/taking over patient care (R7)
29	2000 Cioffi	Nursing Efferent limb	Debriefing post MET call (C2) Primary use of subjective data/use of intuition was supported by objective data/vital signs (C5)	Collaboration with other ward staff before calling MET (C10) Feelings of nervousness or anxiety, self-doubt/questioning whether MET call was appropriate (C11)

CCO(T) – critical care outreach (team), EWS – early warning score, HCA – unqualified healthcare assistant, ICU – intensive care unit, IP – interprofessional, MET – medical emergency team, RN – registered nurse, RRS – rapid response system, RRT – rapid response team

Table 6 Interprofessional Collaborative Practice Themes: Recognising and Responding to Clinical Deterioration

ICP Domain	Values and Ethics	Roles and Responsibilities	Communication	Teamwork
Theme	***Organisational Culture***	***Role Perceptions and Professional Accountability***	***Communication of Clinical Needs***	***Team-based Practices***
Subthemes	**ENABLING** V1 – Shared practice values [4, 6, 20]	**ENABLING** R1 – Senior level commitment with clear leadership [3, 6, 11, 13] R2 – Outreach service roles [4, 6, 10, 11, 14, 18, 19, 22, 25, 27, 28] R3 – Efferent limb teams [1, 6, 13, 14, 17, 24, 26] R4 – Ward nurses [4, 12, 20]	**ENABLING** C1 – Formal conceptual model with electronic records [5, 11, 12, 14] C2 – Constructive feedback from efferent limb leaders [10, 11, 17, 20, 21, 29] C3 – Formal structured clinical practice tools [4, 11, 13, 19] C4 – Outreach professional expertise [4, 10, 11, 16, 22, 25, 27, 28] C5 – Nursing specific practice issues [5, 7-9, 11, 12, 19, 23, 26, 29] C6 – Medical specific practice issues [1, 2, 20]	**ENABLING** T1 – Shared organisation-wide understanding of Rapid Response System concept [5, 6, 25] T2 – Professional rapport [6-9, 13, 14, 16-21] T3 – Outreach services support [4, 6, 17, 28] T4 – Positive professional team values [2, 6, 8,16, 22, 23, 25, 27]
	INHIBITING V2 – Variable or noncompliant practices [3, 4, 8, 11, 13, 23]	**INHIBITING** R5 – Lack of organisational support and resources [11, 20, 23, 27] R6 – Increasing clinical acuity and heavy patient caseloads [8, 12, 13, 15, 17, 20, 27] R7 – Lack of role clarity and blurred professional boundaries [3, 6, 12, 13, 17, 19, 28] R8 – Limited benefits of efferent limb services [1, 2, 4, 6, 11, 12] R9 – Patients needs within ward clinical specialty [2, 9, 19] R10 – Unsupported clinical decision-making [2, 5, 9, 23]	**INHIBITING** C7 – Restrictions of electronic records [11] C8 – Ambiguous/circuitous IP communication [2, 5, 6, 7, 9, 13, 18] C9 – Inconsistent application of Early Warning Scoring system [4, 7, 11, 19] C10 – Concerns of breaching traditional reporting hierarchies [3, 5, 8, 10, 11, 18, 26, 29] C11 – Negative experiences when embedded hierarchies breached [2-9, 14, 15, 17, 18, 20, 23, 24, 26, 29] C12 – Division of patient monitoring responsibilities [4]	**INHIBITING** T5 – Poor administrative engagement and support [4, 7, 13, 18, 23] T6 – Frequently changing efferent limb staff [6] T7 – Lack of support for clinical decision-making [9, 16, 27]
Overarching Theme	***Interprofessional Learning Opportunities***			
Overarching	**ENABLING**			

ICP Domain	Values and Ethics	Roles and Responsibilities	Communication	Teamwork
Subthemes		L1 – Multidisciplinary meetings [20] L2 – Clinical deterioration and efferent limb events [8, 10-12, 16, 22, 26, 28] **INHIBITING** L3 – Efferent limb and outreach services [4, 5, 12, 21, 22]		

Figure 1 Literature Eligibility Search Flow

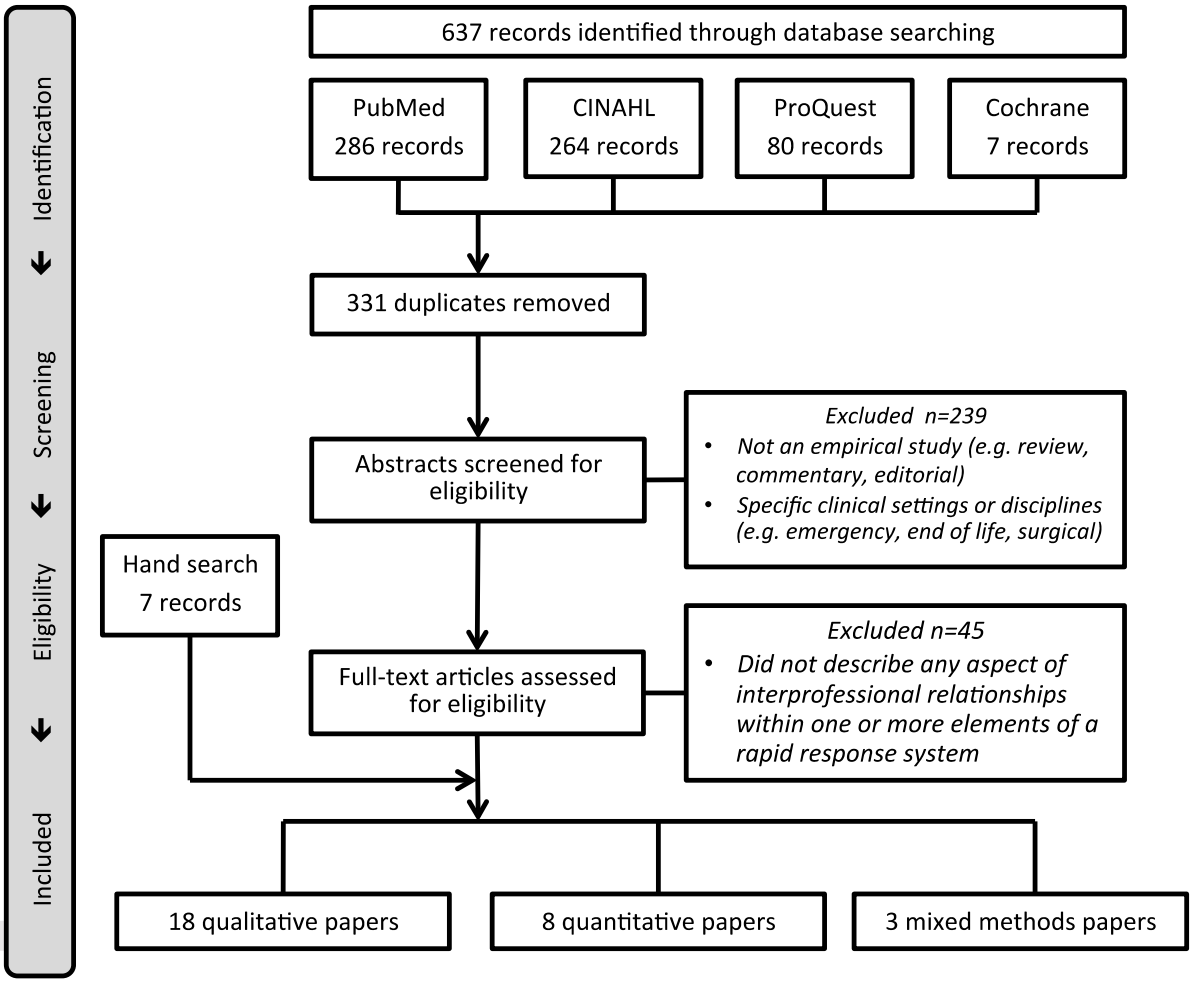


Figure 2 Rapid Response System-wide Interprofessional Collaborative Practice Issues

AFFERENT LIMB ISSUES

Facilitating

R4 – Ward nurses [4, 12, 20]
C5 – Nursing specific practice issues [5, 7-9, 11, 12, 19, 23, 26, 29]
C6 – Medical specific practice issues [1, 2, 20]
T3 – Outreach services support [4, 6, 17, 28]
T4 – Positive professional team values [2, 6-8,16, 22, 23, 25, 27]

Inhibiting

R8 – Limited benefits of efferent limb services [1, 2, 4, 6, 11, 12]
R9 – Patients' needs within ward clinical specialty [2, 9, 19]
R10 – Unsupported clinical decision-making [2, 5, 9, 23]
C10 – Concerns of breaching traditional reporting hierarchies [3, 5, 8, 10, 11, 18, 26, 29]
C11 – Negative experiences when embedded hierarchies breached [2-9, 14, 15, 17, 18, 20, 23, 24, 26, 29]
C12 – Division of patient monitoring responsibilities [4]
T7 – Lack of support for clinical decision-making [9, 16, 27]

AFFERENT – EFFERENT LIMB ISSUES

Facilitating

R2 – Outreach service roles [4, 6, 10, 11, 14, 18, 19, 22, 25, 27, 28]
C2 – Constructive feedback from efferent limb leaders [10, 11, 17, 20, 21, 29]
C3 – Formal structured clinical practice tools [4, 11, 13, 19]
C4 – Outreach clinical expertise [4, 10, 11, 16, 22, 25, 27, 28]
T2 – Professional rapport [6-9, 13, 14, 16-21]
L2 – Clinical deterioration and efferent limb events [8, 10-12, 16, 22, 26, 28]

Inhibiting

R6 – Increasing clinical acuity and patient caseloads [8, 12, 13, 16, 17, 20, 27]
R7 – Lack of role clarity and blurred professional boundaries [3, 6, 12, 13, 17, 19, 28]
C8 – Ambiguous/circuitous IP communication [2, 5, 6, 7, 9, 13, 18]
C9 – Inconsistent application of Early Warning Scoring system [4, 7, 11, 19]
L3 – Efferent limb and outreach services [4, 5, 12, 21, 22]

ADMINISTRATION AND QUALITY ISSUES

Facilitating

R1 – Senior level commitment with clear leadership [3, 6, 11, 13]

Inhibiting

R5 – Lack of support and resources [11, 20, 23, 27]

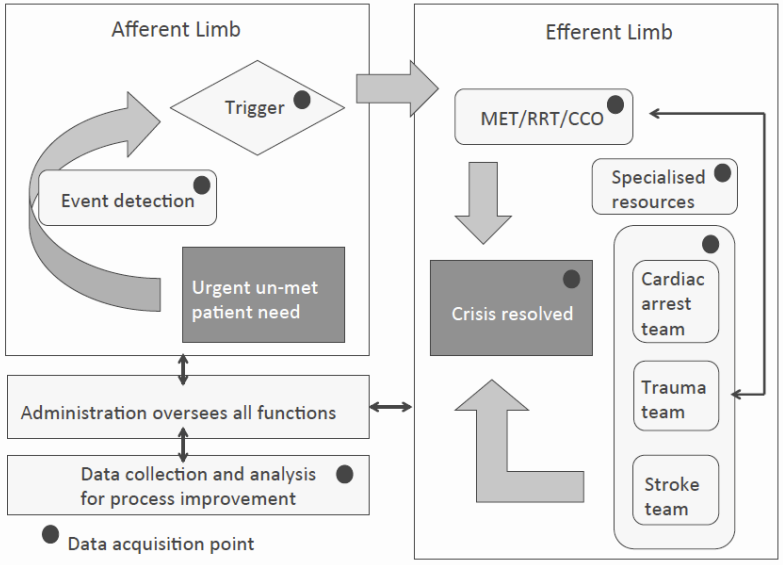
RAPID RESPONSE SYSTEM-WIDE ISSUES

Facilitating

V1 – Shared practice values [4, 6, 20]
C1 – Formal conceptual model with electronic records [5, 11, 12, 14]
T1 – Shared organisation-wide understanding of RRS concept [5, 6, 25]
L1 – Multidisciplinary meetings [20]

Inhibiting

V2 – Variable/noncompliant practices [3, 4, 8, 11, 13, 23]
C7 – Restrictions of electronic records [11]
T5 – Poor administrative engagement and support [4, 7, 13, 18, 23]



Rapid Response System structure (DeVita *et al,* 2006)

EFFERENT LIMB ISSUES

Facilitating

R3 – Efferent limb teams [1, 6, 13, 14, 17, 24, 26]

Inhibiting

T6 – Lack of continuity in efferent limb staff [6]

Coding

V – values and ethics
R – Roles and responsibilities
C – Communication
T – Teamwork and team-based care
L – Interprofessional learning

References correspond with Table 5 and 6