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REVIEW ARTICLE

The role of the ward nurse in recognition and response to clinical deterioration: a scoping review

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Background: Nurses play a key role in the recognition and response to clinical deterioration.

Aim: The aim of this scoping review was to explore, map and synthesise existing research related to the ward nurses' role in recognising and responding to clinical deterioration.

Methods: A scoping review was undertaken to identify English only studies focused on the ward nurse's role in recognition and response to clinical deterioration of the hospitalised adult. Search terms included 'clinical deterioration', 'nurses', 'wards', 'general', 'hospital, units' and 'hospitals'. The Cumulative Index to Nursing and Allied Health Literature, EMBASE, Ovid MEDLINE, PubMed, ProQuest and Science Direct databases were searched for eligible studies.

Results: Forty-six studies met the inclusion criteria and three major themes were synthesised: (i) recognition of deterioration; (ii) nursing assessment; and, (iii) challenges responding to patient deterioration.

Conclusion: The review highlighted significant variability in the ward nurses' role, activities, and skills in assessing, monitoring, managing and escalating care for clinical deterioration.

Keywords: Clinical deterioration; hospitals; organisational culture; safety, safety management; patient harm; risk

Impact statement

The review highlighted patient safety risks with non-adherence to Early Warning Systems. There was significant variability in the ward nurses' role, activities, and skills when assessing, monitoring, managing and escalating care for patient deterioration.

Plain language

Nurses spend the most time at the bedside, of all clinicians, and this assists them to know their patients' health status and trajectory. The role, activities, and skills of the nurse influences assessment, monitoring, management and decisions to escalate care when patients' health decline. Nurses valued physical assessment skills and vital sign monitoring, but the frequency, type and documentation of these skills was poor. Understanding the nurse's role and practice during patient deterioration events could improve patient safety.

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Introduction

Assessment, recognition and escalation of clinical deterioration is a primary role of the general ward nurse. A nurse's knowledge, skills and previous experience are crucial factors that interact to support the recognition and timely response to deterioration and drive nursing practice and patient safety (Bingham et al., 2020; Dresser et al., 2023). To support patient safety, nurses develop in-depth understanding and knowledge of patients' health and trajectories, which assists with the recognition of deterioration (Bingham et al., 2020; Considine et al., 2023). Specifically, a nurse's understanding of a patient's pathophysiology, and severity of illness has been shown to positively influence their ability to identify cues in patients at-risk of cardiopulmonary arrest, and make decisions to act and provide interventions to interrupt the cascade of deterioration (Gazarian et al., 2010). Nurses are usually the first to recognise, respond to and manage patient deterioration in a general hospital ward. Early assessment enables timely initiation of nursing interventions and/or escalation of care to medical doctors, thereby improving patient safety and outcomes. The nurse's timely response, knowledge and skills are vital for preventing further deterioration. Therefore, the aim of this scoping review was to explore, map and synthesise existing research related to the general ward nurses' role in recognising and responding to clinical deterioration.

Methods

Design

A scoping review was chosen rather than a systematic review given the knowledge gap, diversity, and heterogeneity of the literature to be explored. The scoping review was conducted using Arksey and O'Malley's (2005) framework to systematically strengthen the rigour of the review. The scoping review was conducted using the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist.

Search

The review search was conducted in October 2023. The date limiter was 1998 to October 2023, following a seminal paper published in 1998 on the concept of clinical deterioration and sub-optimal care. The search was restricted to English language only; no restrictions were placed on study design. The Cumulative Index to Nursing and Allied Health Literature (CINAHL), EMBASE, Ovid MEDLINE, PubMed, ProQuest, and Science Direct databases were searched to identify peer-reviewed research studies focusing on the general ward nurse's role in recognition and response to clinical deterioration of the hospitalised adult. The search strategy included MeSH terms: 'clinical deterioration', 'nurses', 'wards', 'general', 'hospital, units', and 'hospitals' were used to identify potential studies. The search used Boolean logic combinations using 'AND' and 'OR'. The search strategy was piloted to allow for keyword differences. A manual search of reference lists was also undertaken. Table 1 details the eligibility criteria for inclusion and exclusion of studies.

Extraction strategy

Study data characteristics were extracted (author(s), title and abstract, year of publication, country, aim, study design, population, intervention/area of focus, nursing practice behaviours, data collection methods and main findings) and imported into the referencing management software, EndnoteTM (version 20). Duplicate records were identified and removed by a single author

(ND). Two authors screened title and abstract (ND and RE) against the inclusion criteria. For all included studies, full texts articles were retrieved and examined in detail by two authors (ND and RE) independently. A third reviewer (MF or EM) arbitrated when there were divergent views to reach consensus.

Characteristics of studies

A critical appraisal was undertaken of each study (ND and MF) to systematically examine study design and research conduct to determine the credibility, reliability, value and risk of bias (Harrison et al., 2017). Four validated critical appraisal tools were used to support this process: The Critical Appraisal Skills Program (CASP) checklist for qualitative studies; Joanna Briggs Institute (JBI) critical appraisal tool checklists for Analytical Cross-Sectional and Cohort studies; and, the Mixed Methods Appraisal Tool (MMAT) version 2018. The critical appraisal data were transcribed into tables (Supplementary files 1–4) (Peters et al., 2015).

To determine methodological and reporting quality for each study the Joanna Briggs Institute grading system (Level 1 to 5) was applied to rate the importance of studies for translation of evidence and facilitation of clinical recommendations. Level 1 evidence is the highest quality of evidence compared with Level 5 evidence (expert opinion), which is graded low importance (Joanna Briggs Institute, 2014).

Results

Figure 1 illustrates the search findings and eligible study numbers. Forty-six studies met the eligibility criteria, and the quality of evidence was rated as Level 3 (observational – analytic designs) or Level 4 (observational – descriptive designs) (Table 2). There were no randomised controlled trials or quasi-randomised experimental study designs.

Table 2 details that 16 (35%) studies were conducted in Australia (Bingham et al., 2020; Cioffi et al., 2009; Clarke et al., 2010; Considine et al., 2023; Ede et al., 2020; Kitto et al., 2015; Martland et al., 2016; Minyaev et al., 2022; Mohammed et al., 2018; Newman et al., 2023; Osborne et al., 2015; Peet et al., 2019; Rihari-Thomas et al., 2017; Shearer et al., 2012; Sprogis et al., 2023; Tower & Chaboyer, 2014), 10 (22%) in Europe (Andrews & Waterman, 2005; Azimirad et al., 2022; De Meester et al., 2013; Foley & Dowling, 2019; Ludikhuizen, Dongelmans, et al., 2012; Ludikhuizen, Smorenburg, et al., 2012; Mølgaard et al., 2022; Pantazopoulos et al., 2012; Peerboom et al., 2022; Petersen et al., 2017), six (13%) United Kingdom (UK) studies (Dall'Ora et al., 2021; Dalton et al., 2018; Odell, 2015; D. Smith et al., 2021; D. J. Smith & Aitken, 2016; Thompson et al., 2009), eight (17%) in the United States of America (USA) and Canada (17%) (Astroth et al., 2013; Dresser et al., 2023; Fasolino & Verdin, 2015; Gazarian et al., 2010; Hart et al., 2014; Hart et al., 2016; Lavoie et al., 2020a; Prosser et al., 2023), three (7%) in Singapore (Chua et al., 2019; Chua et al., 2020; Chua et al., 2022), one (2%) in South Africa (Keene et al., 2017), Korea (2%) (Jin et al., 2022) and Japan (2%).

Qualitative designed studies ($n = 25$, 60%) (Andrews & Waterman, 2005; Astroth et al., 2013; Bingham et al., 2020; Chua et al., 2019; Chua et al., 2020; Chua et al., 2022; Cioffi et al., 2009; Dalton et al., 2018; Dresser et al., 2023; Ede et al., 2020; Foley & Dowling, 2019; Gazarian et al., 2010; Hart et al., 2016; Kitto et al., 2015; Lavoie et al., 2020a; Martland et al., 2016; Minyaev et al., 2022; Mohammed et al., 2018; Mølgaard et al., 2022; Peerboom et al., 2022; Peet et al., 2019; Petersen et al., 2017; Rihari-Thomas et al., 2017; D. Smith et al., 2021; Tower & Chaboyer, 2014) used semi-structured interviews ($n = 18$, 39%), focus groups ($n = 7$, 15%) or direct observation ($n = 1$, 2%) for data collection.

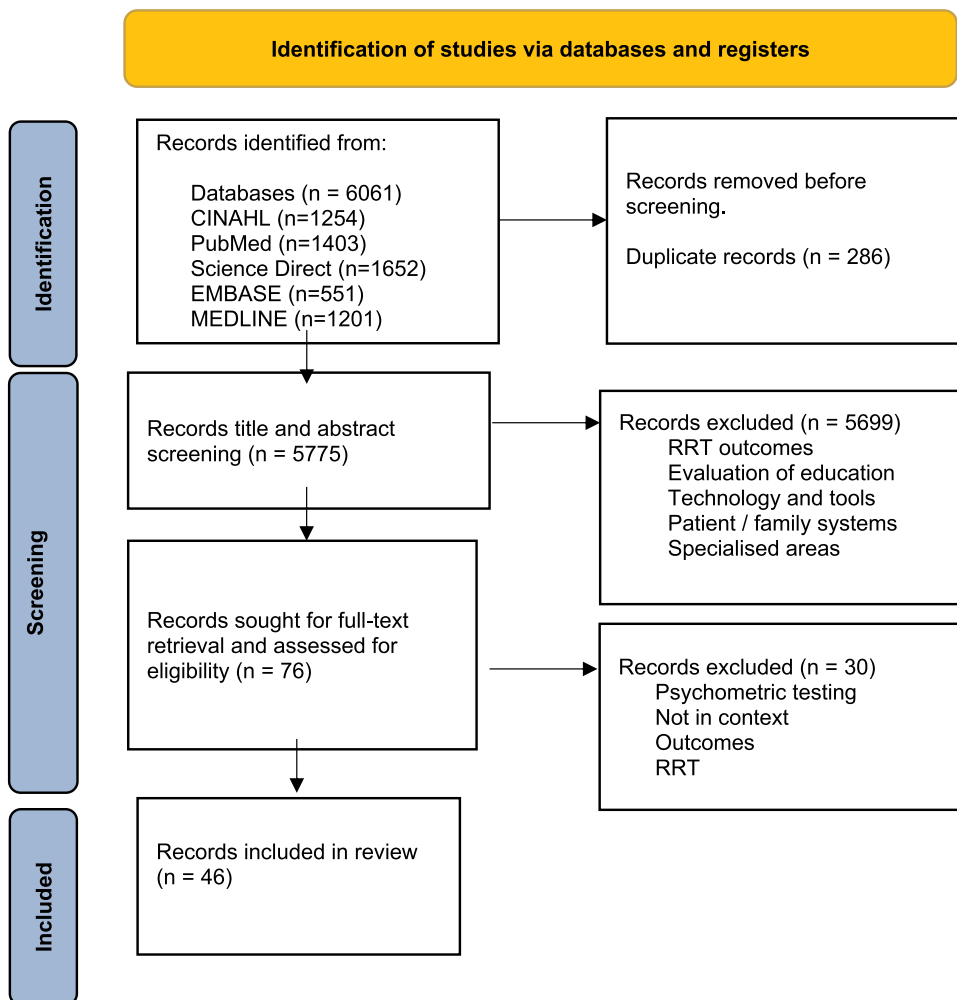


Figure 1. PRISMA extension for scoping reviews (PRISMA-ScR) flowchart.

For the quantitative designed studies, 12 (26%) were cross-sectional design (Azimirad et al., 2022; Dall’Ora et al., 2021; Hart et al., 2014; Jin et al., 2022; Keene et al., 2017; Ludi-khuize, Smorenburg, et al., 2012; Newman et al., 2023; Osborne et al., 2015; Pantazopoulos et al., 2012; Prosser et al., 2023; Takayama et al., 2022); and five (11%) used a retrospective cohort design (Clarke et al., 2010; Considine et al., 2023; Fasolino & Verdin, 2015; Ludi-khuize, Smorenburg, et al., 2012; Odell, 2015). Four (9%) mixed methods studies were included: a retrospective medical record audit and clinician surveys (De Meester et al., 2013; D. J. Smith & Aitken, 2016); a prospective medical record audit and nurse interviews (Shearer et al., 2012); and, semi-structured interviews and non-participant observations (Sprogis et al., 2023).

The studies are presented as a narrative synthesis. Three major themes were synthesised from the literature: (i) recognition of patient deterioration; (ii) nursing assessment; and, (iii) challenges responding to patient deterioration.

Table 1. Eligibility criteria of included studies.

Inclusion Criteria	Exclusion Criteria
Date range 1998 to 2023 All study designs examining nurses' recognition and response to clinical deterioration of the hospitalised adult (all adults over 18 years of age) Studies of nurses with a range of clinical experience were included if they provided direct patient care in general hospital wards. Studies exploring the nursing role, interventions, and practice (i.e. monitoring of vital signs, nursing assessment, decision-making, response, and ongoing management of patient deterioration). Studies exploring nurses' interactions and communication of clinical deterioration with other health professionals (i.e. medical officers, rapid response teams, nursing assistants) were included.	Non English published studies Studies targeting solely undergraduate nursing students, transitional registered nurses, nursing assistants, managerial personnel, allied health, or medical professionals were excluded. Studies conducted in specialised units such as critical care (level 2 high dependency units and level 3 intensive care units), emergency departments, cardiac catheterisation laboratories, operating theatres, and rapid response teams Studies in pre-hospital, community, outpatient, mental health settings, paediatric, obstetric, psychiatric, and palliative care settings were excluded Studies focused on educational programs, outcomes of artificial intelligence, evaluation of track and trigger systems and technology Studies focused on clinical deterioration interventions, care, or treatment of specific disease groups (e.g. Coronavirus disease 2019) Grey literature from organisational and professional associations, including policies and guidelines

Table 2. Sources of evidence for recognising and responding to patient deterioration.

Author, Year, Country	Research Design	Sample/ Population / Context	Data Analysis	Aim	Outcomes/major findings
Azimirad et al. (2022) Country: Finland, Europe Level 4	Quantitative Exploratory descriptive Cross-sectional Survey	179 medical-surgical nurses Context: Medical-surgical wards, two acute hospitals	Descriptive analysis Multi-site	Examine British and Finnish nurses' attitudes as part of clinical competence towards rapid response systems in two acute hospitals	Major themes included rapid response system benefits, barriers, and patient management.
Andrews and Waterman (2005) Country: Ireland, Europe Level 4	Qualitative Grounded theory Interviews and Participant observation	30 medical-surgical nurses 7 medical staff 7 health care support workers Context: A medical-surgical ward, University Teaching Hospital	Descriptive analysis Single site	To present how ward-based staff use vital signs and Early Warning Score to package physiological deterioration effectively to ensure successful referral to doctors.	Two key themes were identified; making credible through intuitive knowing, contextualisation and grabbing attention; and packaging deterioration through convincing referral language and ultimate packaging.
Astroth et al. (2013) Country: Mennonite, USA Level 4	Qualitative Semi-structured interviews Descriptive	15 medical- surgical nurses Context: General wards, Community Hospital	Descriptive and concept analysis Single site	To identify barriers and facilitators to nurses' decision-making regarding activation of rapid response team	Two major themes were identified: facilitators and barriers to calling the rapid response team. Three sub-themes emerged: rapid response team characteristics, unit culture and education.
Bingham et al. (2020) Country: Victoria, Australia Level 4	Qualitative Exploratory, descriptive Semi-structured interviews	30 experienced medical-surgical nurses Context: Nine inpatient wards, major tertiary teaching hospital	Inductive thematic analysis Single site	To describe the decision-making, experiences, and perceptions of escalating deteriorating patients to the treating medical team using urgent clinical review criteria	Four major themes were identified: (i) Detecting deterioration by knowing the patient, sensing something was wrong, using a clinical eye and normalising the abnormal; (ii) Countering the problem, being a first responder, implementing nursing strategies, seeking peer advice for more strategies (iii) Getting a response; working the system, making a case, communication priorities for escalation, tackling medical hierarchies with nursing hierarchies; (iv) Challenges faced in the process, timing, medical response, authority, and communication.

Cioffi et al. (2009) Country: NSW, Australia Level 4	Qualitative Exploratory, descriptive Semi-structured interviews	17 experienced nurses involved in direct patient care. Context: General and specialty ward, four acute care hospitals	Textual analysis Purpose and snowball sampling Multi-site	To identify cues of clinical value for the criterion 'concerned about patient' as used by nurses to recognise potential early clinical deterioration in acute clinical settings with adult patients.	Ten identified changes of concern (cues): noisy breathing, inability to talk in sentences, increasing supplementary oxygen requirements to maintain SaO ₂ , agitation, impaired mentation, impaired cutaneous perfusion, not expected trajectory, new or increasing pain, new symptom, and new observation that nurses used to recognise potential early deterioration. Two mediating factors of cultural and linguistic diversity and impaired cognition.
W. L. Chua et al. (2020) Country: Singapore Level 4	Qualitative Exploratory, descriptive Semi-structured interviews	14 nurses 10 junior doctors with minimum of 6 months clinical experience Context: General wards, acute tertiary hospital	Interpretative thematic analysis Purpose sampling Single site	To explore experiences of junior doctors and nurses escalating care of deteriorating patients	Three major themes emerged: (i) MET activations versus the primary care team doctors' reviews; (ii) challenges in obtaining medical reviews; (iii) unspoken rules of the escalation of care.
W. L. Chua et al. (2019) Country: Singapore Level 4	Qualitative Exploratory, descriptive Semi-structured interviews	14 nurses 8 enrolled nurses with at least 6 months experience Context: General hospital wards, acute general hospital	Thematic analysis Purpose sampling Single site	To gain rich understanding of nurses' experiences and perceptions regarding the recognition of clinically deteriorating patients	Four major themes were identified: (i) having a sense of knowing; the patient and past experiences (ii) patient assessment practices; of vital signs, physical assessment and seeking affirmation (iii) delegation of routine patient care and assessments to enrolled nurses; diminished involvement, over-reliance, and inadequate guidance (iv) missing the big picture due to workload and not seeing the patients' parameters.
W L Chua et al. (2022) Country: Singapore Level 4	Qualitative Exploratory, descriptive Semi-structured interviews	11 nurses 12 enrolled nurses with at least 6 months experience Context: General hospital wards, a tertiary hospital	Descriptive analysis Single site	To explore the collaboration experiences between enrolled nurses and registered nurses in recognising and responding to clinical deterioration	Three major themes emerged: reaching a collective understanding of the patients' condition, role expectations of each other and lacking in shared decision-making.

(Continued)

Table 2. Continued.

Author, Year, Country	Research Design	Sample/ Population / Context	Data Analysis	Aim	Outcomes/major findings
Clarke et al. (2010) Country: NSW Australia Level 3	Quantitative Observational study	Clinical practice audit ($n = 96$) of nursing care plans Context: Acute inpatient ward, metropolitan tertiary hospital	Descriptive analysis Single site	To explore patient assessment and care practices, recognition, and communication of early warning signs of patient deterioration and promote critical thinking in the clinical nursing workplace	Four major findings: nursing care plan, actual care matched planned care, other clinical assessment parameters and dealing with abnormal vital signs. Five nursing care domains: care planning, patient assessment, recognising and articulating changes in the patient condition and communication (written and verbal). Discrepancy between the nursing care that was identified as required and the care the patient received. Underperforming the 'basics' of essential nursing care.
Considine et al. (2023) Country: Victoria Australia Level 3	Quantitative Secondary analysis from a randomised control trial Observational cohort study	10,383 medical record audits Context: 36 medical-surgical wards, four university affiliated metropolitan hospitals	Descriptive analysis Multi-site	To explore vital sign assessment (both complete and incomplete sets of vital signs) and escalation of care per policy and nursing interventions	At the least one vital sign measurement documented every 8 hours in 91.6% of audits and complete set of vital signs was documented every 8 hours in 83.1% of audits. There were pre-medical emergency team, medical emergency team or cardiac arrest team triggers in 25.8% of audits. When triggers were present, a rapid response call occurred in 26.8% of audits.
Dall'Ora et al. (2021) Country: Southampton, UK Level 4	Qualitative Observational study Non-participant observations	715 vital sign measurements were observed. Context: General medical-surgical inpatient wards, four hospitals	Mixed effects models Multi-site	To estimate how much time nursing staff expend measuring and recording a set of vital signs in general hospital wards	Major findings were 680 (95%) were complete sets of vital sign measurements and estimated time per uninterrupted vital signs set of 5 min and 1 second (95% CI = 4:39–5:24). In comparison to interrupted vital signs with estimated time of 6:26 (95% CI = 6:01–6:50). No substantial differences by hospital, ward, nurse characteristics or documentation systems.
Dalton et al. (2018) Country: Liverpool, UK Level 4	Qualitative Exploratory, descriptive Semi-structured interviews	10 medical-surgical nurses with 2 years' experience of caring for deteriorating patients Context: Medical-surgical wards, acute NHS trust	Descriptive analysis Purposeful sampling Single site	To discover what factors, influence how nurses assess patient acuity and their response to acute deterioration.	Main themes: collegial relationships with medical staff; the use of nursing intuition observations and interpretation of modified early warning system. Subthemes: clinical credibility; competence, confidence, expectation, knowledge, communication, leadership, legality, decision-making and organisational culture.

De Meester et al. (2013) Country: Belgium, Europe Level 3	Mixed Methods Observational study Cross-sectional survey Expert review	Retrospective audit of 63 serious adverse events (cardiac arrest, death, or unplanned ICU admission) with subsequent in-hospital mortality 44 medical-surgical nurses were surveyed. Context: One tertiary hospital	Descriptive and thematic analysis Single site	To investigate the circumstances of nursing care eight hours prior to a serious adverse event on medical-surgical wards and to assess the degree of which events were potentially avoidable	Nearly half (49.2%) of the 63 cases were considered potentially preventable by expert reviewers. Reviewers were almost five times most likely to designate a case as potentially preventable when a cardiac arrest team call was a terminal event. Total absence of documentation of respiratory rate in all cases. Surveys revealed that 2 of 3 nurses were often unaware that their patients were deteriorating before the crisis occurred. Nurses reported thresholds levels for concern for abnormal vital signs that suggested they would call for assistance relatively late in the crisis. Eight themes related to clinical judgement emerged: knowing the patient, experience matters, lots of small points where the system call fail, making sense of the data, something doesn't go together, caught in the middle, culture of teamwork and increased nursing workload. An overarching theme was nurses' keen sense of responsibility.
Dresser et al. (2023) Country: Oklahoma City, USA Level 4	Qualitative Semi-structured interviews	20 medical-surgical nurses experienced at least one patient deterioration event. Context: Ten medical-surgical units of acute hospital	Descriptive analysis Single site	To describe medical-surgical nurses' perceptions of factors that influence clinical judgement in situations of patient deterioration	Three main themes identified that influence escalation of care: (i) early warning scores; the sensitivity and specificity and clinical response; (ii) patient and non-patient factors affecting care decisions; fluid and medical management, comorbidities, outliers, and involvement of multiple teams; (iii) chain of communication; tensions, staffing and missed handover.
Ede et al. (2020) Country: Melbourne, Australia Level 4	Qualitative Service Evaluation Grounded Theory Observations and semi-structured interviews	55 hours of observations of escalation of care events Context: Twelve medical-surgical wards, major teaching hospital	Descriptive analysis Iterative and thematic analysis	To map the barriers and facilitators to the escalation of care in the acute ward setting and identify those that are modifiable	Nursing surveillance consists of collecting, analysing, and interpreting vital sign information. Average number of vital signs (00:00–17:00 hours) = 3.67, 16:00 to 09:00am = 5.13, 8:00am – 00:00 = 6.39. More than often every 12 hours. Out of a total of 79 patients, 18 (22.8%) had physiological measurements taken fewer than twice during 24 hours prior to rapid response team activation. Incomplete sets and few entries related to mental status and urinary output.
Fasolino and Verdin (2015) Country: USA Level 3	Quantitative Observational cohort study Retrospective chart review	79 hospitalised patients in medical-surgical units that had rapid response team documented. Context: An acute care hospital	Post-hoc analysis Single site	To investigate trends and documentation of physiological measurements (SBP/DBP, HR, RR, SpO2) in the 24 hours prior to rapid response team activation	

(Continued)

Table 2. Continued.

Author, Year, Country	Research Design	Sample/ Population / Context	Data Analysis	Aim	Outcomes/major findings
Foley and Dowling (2019) Country: Ireland, Europe Level 4	Qualitative Phenomenology Non-participant observations and semi-structured interviews	15 observations of 9 nurses and 2 health care assistants Context: An acute medical short stay ward, regional hospital	Descriptive case study analysis Systematic text condensation Document analysis Single site	To describe how nurses use the early warning scoring system (EWS) in an acute medical ward. To explore the views, experiences, and compliance with EWS	Three major themes identified: (i) protocol adherence versus clinical judgement addresses nurses' knowledge, skill, experience, and patient assessment; (ii) parameter adjustment and escalation of care; (iii) culture being task driven and deficient communication processes.
Gazarian et al. (2010) Country: USA Level 4	Qualitative Interviews	13 nurses experienced in caring for a patient in the pre-arrest period and had been orientated to the rapid response system. Context: Four medical wards with established RRS	Descriptive analysis Cognitive task analysis Purpose sampling Single site	To describe the cues and factors that influence decision-making process used by nurses when identifying and interrupting a cardiopulmonary arrest in the acute care setting	13 decision situations were examined. Two major themes; cues used to identify risk for cardiopulmonary arrest and factors influencing interruption. Organisational resources affecting nurses' decision making to interrupt an adverse event, were identified in three subthemes; equipment, personnel (experience, teamwork, flexibility, and temporal concerns), and knowledge (knowing the patient, knowing the condition, knowledge from experience, knowledge about the organisation).
Hart et al. (2014) Country: USA Level 4	Quantitative Cross-sectional survey	148 medical-surgical nurses that provide direct patient care. Context: Inpatient wards, five-hospital integrated health systems	Descriptive Cross-sectional questionnaire Convenience sampling Multi-site	Explore and understand medical-surgical nurses perceived self-confidence and leadership abilities as first responders in recognition and response to acute patient deterioration (APD)	Nurses felt moderately self-confident in recognising, assessing, and intervening during clinical deterioration. Managing acute deterioration events (mean = 52.38 and SD = 6.75). Over half of nurses felt very confident recognising signs and symptoms of a respiratory (64.29%, $n = 95$), cardiac (58.8%, $n = 87$) or 33.1% ($n = 49$) neurological event. Nurses felt moderately confident with their leadership abilities 26.97 (SD = 5.12) during an acute deterioration event. Age, certification status and experience were significant predictors of nurses' leadership ability.
Hart et al. (2016) Country: USA Level 4	Qualitative Semi-structured interviews	28 medical-surgical nurses who had activated a rapid response team. Context: Inpatient wards, five integrated health systems	Descriptive analysis Purpose sample Multi-site	To explore and understand the experiences of medical-surgical nurses' as first responders during clinical deterioration events.	Three major patterns emerged: (i) recognising and responding to the event; early warning signs, continuity of patient care assignments and intuition; (ii) managing the event; cognitive, technical and behaviour skills; and (iii) challenges encountered during the event; work environment complexity.

Jin et al. (2022) Country: Yangsan, Korea Level 4	Quantitative Cross-sectional design	161 general ward nurses who provide direct care. Context: Two tertiary hospitals	Descriptive analysis Multi-site	To examine nurses' perceived communication and communication practices with physicians in clinical deterioration in general wards	Physician and nurses' perception was highest for timeliness, accuracy, understanding, satisfaction and openness, and their performance highest for preparation, situation, background, assessment, and recommendation.
Keene et al. (2017) Country: South Africa Level 4	Quantitative Cross-sectional survey	Vital signs recorded by nursing staff for all trauma patients ($n = 181$) Context: Acute trauma wards, Regional Hospital	Descriptive analysis Single site	To objectively measure the quality and clinical consequences of vital sign (VS) recording	Quality of vital sign recordings: completion rates for HR (81%) RR (88%) SBP (98%), Temp (92%) and GCS (40%). Positive correlations of recorded HR of 0.76 and uncorrelated for RR of 0.02. In 59% of patients had a RR documented as 20bpm and 27% RR of exactly 15bpm. 7% of patients had GCS scored over 15 the maximum value. Clinical consequence of quality of VS: Average MEWS score of 2 for both recorded and investigated. Analysis showed 59% of MEWS underestimated the physiological derangement. 80% of patients had a MEWS requiring 4 hourly checks, completed only in 2% of cases. 86% of patients had a MEWS recorded of less than 3 not requiring escalation of care, 33% of these showed a MEWS greater than 3 requiring escalations of care. Consistently lower MEWS score in 60% of patients.
Kitto et al. (2015) Country: Australia Level 4	Qualitative Exploratory, descriptive Focus groups.	62 nurses 27 physicians with varying levels of clinical experience Context: Four acute hospitals	Exploratory Case Study Content analysis Criterion and maximum sampling	To explore the reasons why clinical staff do not activate rapid response system. Explore social, cultural, and professional factors.	Two major themes: characteristics of rapid response system and description of missed rapid response call. Two distinct professionally situated ways of activating the rapid response system, a highly hierarchical pathway in nursing and a more autonomous pathway in medicine. Analysis of workaround tool when problematic interprofessional communication.

(Continued)

Table 2. Continued.

Author, Year, Country	Research Design	Sample/ Population / Context	Data Analysis	Aim	Outcomes/major findings
Lavoie et al. (2020b) Country: Montreal, Canada Level 4	Qualitative Part of Sequential explanatory mixed-methods study Focus groups.	62 medical-surgical nurses Context: From one surgical and two medical units at a single Canadian tertiary hospital	Descriptive and thematic analysis Convience sampling	To explore how change-of-shift handoffs relate to nurses' clinical judgements regarding patient risk of deterioration.	Out of 444 handoffs, 125 at least one nurse judged the patient was at risk of deterioration. Nurses agreed in 32 cases (25.6%) and disagreed in 93 (74.4%). Handoff information included abnormal vital signs, breathing problems, chest pain, alteration of mental status or neurological symptoms. The quantity and seriousness of clinical cues, recent transfers from ICU, pain without clear cause, signs of delirium and nurses' knowledge of patient were found to affect nurses' agreement.
Ludikhuize, Dongelmans, et al. (2012) Country: Amsterdam, Europe Level 4	Quantitative Cross-sectional Survey	49 nurses 36 residents 32 medical specialists who provided care in the 12 hours prior to patients ($n=47$) who had experienced a serious adverse event (cardiopulmonary arrest, unplanned intensive care admission) Context: Six inpatient wards, academic medical centre	Descriptive analysis Convience	To describe how nurses and physicians judge their own quality of care for deteriorating patients on medical wards compared with judgement of independent experts	47 serious adverse events and 198 interviews analysed. Means score of knowledge (SD 7.9, 0.8) and skill (SD 7.7, 0.9) in recognition of patient deterioration. Nurses (74%) and residents (76%) coordinated care largely themselves. Medians of communication, cooperation and coordinated were graded in a positive manner (medians between 7.3 and 8).
Ludikhuize, Smorenburg, et al. (2012) Country: Netherlands, Europe Level 3	Quantitative Retrospective observational study	204 patients in the 48 hours prior to a serious adverse event (cardiac arrest, unplanned ICU admission, unexpected death, or emergency surgery) Context: One University Teaching Hospital	Retrospective medical audit Vital Sign Monitoring Single site	To describe current practices in measurement of vital signs To analyse the possible usefulness of Modified Early Warning System (MEWS) in the early recognition of medical surgical patients who died or experienced a serious adverse event.	Total of 2688 measurements of vital signs were undertaken in the 48 hours prior to an event. 81% of patients had a MEWS value of 3 or more at least once in 48 hours prior to the event. Measurements increased in patients with MEWS >3 or more ($n=988$ 37% median time before an event was 13 hours. Recordings of vital signs mostly incomplete with respiratory rate (23%), level of consciousness (6.5%), urine output (16.6%) and temperature (48.5%) being least recorded.
Martland et al. (2016) Country: Adelaide, Australia Level 4	Qualitative Grounded theory Focus groups.	28 nurses 15 medical officers involved in rapid response team activation. Context: All inpatient wards, Australian Tertiary referral hospital	Grounded Theory Purposive sampling Single site	To develop substantial grounded theory related to communication processes between clinicians that preceded rapid response team activation for general concern	Total of 3111 rapid response team callouts, of these 32% ($n=994$) were related to general concern. 322 open codes and 14 thematic concepts were developed during analysis. Five main categories emerged: physiological vital signs and patient plan; decreased resources; workload; communication inability; and lack of confidence in colleagues.

Minyaev et al. (2022) Country: Adelaide, Australia Level 4	Qualitative Semi-structured interviews	10 experienced ward-based nurses involved in direct patient care for acute surgical and medical wards. Context: One large metropolitan hospital	Hermeneutic Phenomenology Single site	To explore experienced ward-based nurses' views on the potential use of standing orders, prior to the escalation protocol, for patient deterioration	Four main themes emerged: (i) ambiguity in perception and the escalation protocol; (ii) observations with acceptable parameters but the patient is deteriorating (iii) paradoxes of escalation well laid out protocol, but hard to escalate (iv) we could intervene with standing orders, but are we permitted?
Mohammed et al. (2018) Country: Victoria, Australia Level 4	Qualitative Exploratory descriptive Focus groups.	14 nurses provide direct patient care for post-operative patients and permanently employed. Context: Surgical inpatient wards of a Metropolitan teaching hospital	Thematic analysis Convenience sample Single site	To explore the views of nurses about their role in response to clinical deterioration in the first three days post-operative Nurses' perceptions of barriers to implementation of early intervention strategies in the early post-operative phase	Two main themes and subthemes: (i) struggling with blood pressure by juggling the patients' fluid balance and taking action to prevent hypotension; and (ii) we know our patients are sick, using clinician concerned criteria as a safety net, medical emergency team call is our last resort.
Mølgaard et al. (2022) Country: Denmark, Europe Level 4	Qualitative Ethnography Participant observations and semi-structured interviews	12 nurses 4 physicians Context: Two wards, Danish University Hospital	Focused Ethnography Exploratory descriptive Single site	To describe and explore the influences in nurses' use of the EWS to support clinical decisions in hospital setting	Two major themes: (i) Ambivalence towards the EWS as decision support, the routine task of using EWS creates a useful space to optimise patient care, nurses give priority to clinical judgement over EWS protocol; (ii) Unspoken expectations in collaboration on the EWS influencing the nurses' workload, collaborators influence the individual nurses workflow about the EWS. Unclear guidance in collaboration on the EWS between nurses' and physicians
Odell (2015) Country: UK Level 3	Quantitative Observational study	120 adult inpatients who suffered a cardiac arrest. Context: 26 general inpatient wards	Descriptive analysis Single site	To audit ward nursing practice in adherence to an early warning score protocol in the detection and initial management of deteriorating ward patient.	91 cases were excluded. Nursing practice: 25 (20.3%) scored maximum for adherence to the protocol. Just over half (50.4%) failed to reach the minimum standard of practice. 103 (83.7%) had EWS completed. Of these a quarter were inaccurate (24.3%) with 16 were scored below trigger of 3 so would not have generated referral. 45 CRA had ineffective recording of EWS – suboptimal referral. Only 1/5 of patients received optimum standard of practice.

(Continued)

Table 2. Continued.

Author, Year, Country	Research Design	Sample/ Population / Context	Data Analysis	Aim	Outcomes/major findings
Osborne et al. (2015) Country: Brisbane, Australia Level 4	Quantitative Cross-sectional design Survey method	434 nurses and Midwives involved in clinical care of patients. Context: Acute inpatient wards, tertiary referral hospital	Descriptive analysis Single site	To determine a minimum data set of core skills used during nursing assessment of hospitalised patients. To identify nurse and workplace predictors of the use of physical assessment to detect patient deterioration	Core skills used by nurses every time they worked included assessment of temperature, oxygen saturation, blood pressure, breathing effort, skin, wound and mental status. Reliance on others and technology ($F = 3.577$, $p < 0.001$), lack of confidence ($F = 5.52$, $p = 0.2$), work area ($F = 3.79$, $p = 0.002$) and clinical role ($F = 44.24$, $p < 0.001$) were significant predictors of physical assessment skill use.
Newman et al. (2023) Country: New South Wales, Australia Level 4	Quantitative Cross-sectional design	677 nurses 43 medical officers 60 allied health 57 health students Context: Regional health district	Descriptive analysis Multi-site	To evaluate clinicians' attitudes towards the escalation and management of the deteriorating patient in an acute setting	Years of experience was significantly associated with more confidence responding to deteriorating patients ($p < .001$) and significantly less fears about escalating care ($p < .001$). Nurses ($M = 4.16$, $SD = .57$) and students ($M = 4.11$, $SD = .55$) in general had significantly greater positive beliefs that the rapid response system would support them to respond to deteriorating patients than allied health ($M = 3.67$, $SD = .64$) and medical ($M = 3.87$, $SD = .54$).
Pantazopoulos et al. (2012) Country: Athens, Europe Level 4	Quantitative Cross-sectional Survey	94 nurses	Descriptive analysis Single site	To evaluate the relationship between nurse demographics and correct identification of clinical situations warranting specific nursing actions, including activation of medical emergency team	50% of nurses were able to accurately identify critical nursing action for patients with respiratory rate < 4 /minute, 72% airway obstruction and 73% with chest pain. Nurses who had graduate from a 4-year educational program identified clinical situations that necessitated medical emergency team activation in a significantly higher rate
Peerboom et al. (2022) Country: Netherlands, Europe Level 4	Qualitative Focus group.	20 nurses Context: Two surgical wards, acute hospital.	Descriptive thematic analysis Single site	To gain an in-depth understanding of the actions nurses on surgical wards undertake to generate an appropriate response to nurses' worry when the 'National Early Warning Score 2' does not indicate deterioration.	Two sequential themes emerged: searching for explanation and confirmation and responding by actively applying nursing interventions.

Petersen et al. (2017) Country: Denmark, Europe Level 4	Qualitative Exploratory, descriptive Focus groups.	18 nurses 11 medical staff with at least three months employment and familiar with early warning system (EWS) protocol Context: Medical-surgical wards, University Hospital with established rapid response system >5 years	Descriptive content analysis Single site	To identify barriers and facilitating factors related to use of the early warning system escalation protocol.	Three major themes: (i) barriers to adhering to frequency of monitoring due to over-monitoring out of concern for the patient; lack of resources as a reason for under-monitoring; concern for sleep deprivation and practical constraints; (ii) barriers to adhering to informing doctors of EWS >3; as EWS range 3–6 considered the norm; the role of interpersonal relations; (iii) barriers and facilitators to initiating medical emergency team calls.
Prosser et al. (2023) Country: USA Level 4	Quantitative Cross-sectional design	31 medical-surgical nurses Context: Three medical-surgical units, acute hospital	Descriptive analysis Single site	To assess nurses' confidence in recognising and responding to clinical deterioration using a Clinical Decision-Making Self Confidence scale	Nurses rated their confidence higher in all parameters of the clinical decision-making self confidence scale in all patient categories at the close of the initiative. Mostly noted in the ability of the nurse to evaluate interventions and greater confidence in use of modified early warning system and increased use of the system.
Peet et al. (2019) Country: Queensland, Australia Level 4	Qualitative Exploratory Descriptive Observations and semi-structured interviews	12 nurses with greater than 2 years' experience involved in direct patient care. Nurses Residents Medical specialists Context: One neurosciences ward, acute hospital setting	Iterative analysis Emancipatory PD Purpose sampling Single site	To explore the context and culture of nursing surveillance on an acute care ward	Nursing surveillance is the fabric that supports hospital nursing practice and keeps patients safe. Two major themes: (i) the fabric of nursing surveillance, revealing the hidden threads, the values of nursing knowledge, value of nursing voice, value of nursing care, value of patient relationships and team membership; (ii) the socio-political process, the unravelling of nursing surveillance.
Rihari-Thomas et al. (2017) Country: NSW, Australia Level 4	Qualitative Exploratory descriptive Focus groups.	13 nurses 21 physicians with current knowledge or actively participated in rapid response team activation. Context: Australian academic health centre	Thematic analysis Single site	To understand the ways in which acute care clinicians (physicians and nurses) experience and negotiate care for deteriorating patients within the rapid response system.	The major themes that reflect systems or organisational level barriers to an effective RRS include: (i) responsibility is inversely proportion to clinical experience; (ii) actions around system flexibility contribute to deviation from protocol; (iii) misdistribution of resources leads to perceptions of inadequate staffing levels inhibiting full optimisation of the RRS; and (iv) poor communication and documentation of RRS increases clinician workload.

(Continued)

Table 2. Continued.

Author, Year, Country	Research Design	Sample/ Population / Context	Data Analysis	Aim	Outcomes/major findings
Shearer et al. (2012) Country: Tasmania, Australia Level 3	Mixed methods Prospective observational study Semi-structured interviews	Point prevalence of 570 inpatient observation charts Prospective audit of all serious adverse events (cardiac arrest, unexpected ICU admission or death) Context: Inpatient wards, four metropolitan teaching hospitals	Descriptive and thematic analysis	To determine the incidence and explore the causes of clinical staff failing to activate the rapid response system.	Point Prevalence: incidence of physiological instability amongst acute adult population was 4.04%. Nearly half of these (42%) did not receive appropriate clinical response from staff, despite 69.2% recognising that their patient met physiological criteria for activating rapid response system and being 'quite' or 'very' concerned about their patient (75.8%). 76 were unaware that their patient had classified as missed rapid response system. Two major themes: i) actions were performed prior to rapid response team activation; ii) explanation of why rapid response team not activated. Ten sociocultural barriers were identified of failure to activate rapid response system.
D. J. Smith and Aitken (2016) Country: London, UK Level 4	Mixed Methods Service Evaluation Observational Cross-sectional	Retrospective audit of 74 patients and use of EWS on involving three physiological parameters 31 nurses, student nurses and health care assistants Context: Four wards	Descriptive analysis Content analysis	To investigate nurses' use of single parameter track and trigger chart to inform implementation of National Early Warning System tool.	Physiological triggers ($n = 263$) and characteristics of triggering patients ($n = 74$) were recorded from medical and surgical inpatient wards. Hypotension was more frequently abnormality ($n = 156$, 59%). There was variability in the time to repeat observations following a trigger, median time 2 at 60 minutes. Major themes for barriers and facilitators to monitoring patients: i) equipment, lack of resource, faulty equipment; ii) workload, lack of staff and availability of senior staff for advice; iii) interactions and expectations of staff, conflicting priorities, trusting colleagues, communication and hierarchy, interactions with patients. 1888 quotes were derived from 184 belief statements. Of these 66 themes inductively synthesised. Nine of the theoretical domains' framework were of high importance; knowledge; social; professional role and identity; beliefs about consequences; reinforcement; intentions; goals; memory, attention, and decision process; environmental, context and resources; social influence.
D. Smith et al. (2021) Country: London, UK Level 4	Qualitative Exploratory descriptive Semi-structured interviews	16 nurses 16 health care assistants Context: Four inpatient wards, metropolitan teaching hospital	Descriptive and thematic analysis Purpose sample Single site	To explore barriers and enablers of recognition and response to signs of patient deterioration by nursing staff in the acute hospital	

Sprogis et al. (2023) Country: Victoria, Australia Level 4	Sequential mixed methods study Non-participant observations and semi-structured interviews	22 nurses 2 enrolled nurses 12 doctors 1 speech pathologist were observed. 16 nurses 2 enrolled nurses 4 physiotherapists 7 doctors were interviewed. Context: One medical and surgical ward of an acute hospital 592 nurses involved in evaluation of vital signs. Context: Nine hospitals	Descriptive and thematic analysis Single site	To explore ward clinicians' use and perceptions of interdisciplinary communication pathways for escalation of care within the pre-medical emergency team tier of rapid response systems.	Escalation practices observed for 13 of the 27 pre-MET events. Leading communication methods for escalating pre-MET events were alphanumeric pagers (61.5%) and in person discussions (30.8%). Only seven pre-MET events led to bedside reviews by doctors. Two themes emerged from interviews: challenges in escalation of care and navigating information gaps. Of the 644 eligible nurses, 592 (92%) completed the questionnaire. The adjusted odds ratios and 95% confidence intervals of the factors of importance 2.24 (1.13–4.45), educational experiences 2.26 (1.20–4.26), shortened count method use 0.61 (0.42–0.91), negative experiences (0.45 (0.29–0.70) and inconvenience 0.41 (0.24–0.65). Five major themes emerged: (i) variation in nurses' risk of judgements; (ii) variation because of information processing; (iii) nurses weighting of clinical information and weightings in real patients to classify if patient at risk and deciding to intervene; (iv) the impact of time pressure and EWS guidance on judgement; (v) achievement, cognitive control, and modes of information processing in risk judgements. Critical care experience was statistically associated with estimates of risk, but not with decision to intervene.
Takayama et al. (2022) Country: Japan Level 4	Quantitative Cross-sectional survey	592 nurses involved in evaluation of vital signs. Context: Nine hospitals	Exploratory, descriptive analysis	To elucidate the factors affecting the frequency of respiratory rate measurement by nurses	
Thompson et al. (2009) Country: York, UK Level 4	Quantitative Case study	245 acute care nurses with 50 computer-presented clinical scenarios Context: UK, Canada, and Australia	Lens model statistics Judgement analysis Multi-site	To explore and explain nurses' use of readily available clinical information when deciding whether a patient is at risk of a critical event	
Tower and Chaboyer (2014) Country: Queensland, Australia Level 4	Qualitative Semi-structured interviews Multi-site descriptive	17 nurses with greater than two years' experience Context: Six medical wards, two public hospitals	Think Aloud Purpose sampling	To report nurses' situational awareness as a precursor to decision-making when recording changes in patients' condition	Complex mental model involves pattern matching information drawing on all three levels of situational awareness. Three themes with changes in the patients' condition emerged: (i) deterioration in condition; (ii) not responding to prescribed treatments as expected; (iii) issues related to professional practice that impacted on the patients' condition.

Theme 1: recognition of patient deterioration

Theme 1 comprises of two sub themes (i) nurse knowledge and expertise; and, (ii) nurse escalation of clinical deterioration. These two sub themes describe the important role of the nurse in recognising deterioration in the ward environment.

Nurse knowledge and expertise

Nurses' knowledge (Bingham et al., 2020; Chua et al., 2019; Gazarian et al., 2010; Peet et al., 2019) and previous experience (Bingham et al., 2020; Chua et al., 2019; Foley & Dowling, 2019; Hart et al., 2016) were crucial factors in the recognition of patient deterioration. Nurses use substantive knowledge and experience to recognise and respond to changes in a patient's condition in the surveillance and recognition of deterioration (Bingham et al., 2020; Chua et al., 2019; Gazarian et al., 2010; Peet et al., 2019).

In Australia, Bingham et al. (2020), reported that nurses (medical-surgical; $n = 30$) perceived an in-depth understanding and knowledge of patients' health and trajectories, which assisted with recognition of clinical deterioration. Experienced nurses expressed safety concern if patients were not following usual recovery trajectories following a procedure, type of illness or operation and would use their clinical judgment to determine a monitoring plan (Cioffi et al., 2009). Similarly, in the USA, Gazarian et al. (2010) conducted a study of nurse first responders ($n = 13$) in the pre-arrest period. The findings suggested that nurse' understanding of the patient's pathophysiological condition, and severity of illness were vital to interrupting the cascade of events that led to cardiopulmonary arrest.

The review identified that nurses develop a sense of 'knowing' when caring for the patient (Chua et al., 2019; Dalton et al., 2018; Hart et al., 2016). The interaction of knowledge, experience and feelings is often defined as intuition and shapes a nurse's action and sense of knowing (REF). In the USA, Hart et al. (2016) conducted interviews with medical-surgical nurses ($n = 28$) and reported that they felt better positioned to detect deterioration if they had previously cared for the patient. Knowing the patient enabled nurses to develop a baseline comparison of a patient's condition to detect changes over time (Hart et al., 2016). While the importance of knowing the patient was evident, in Singapore, nurses and enrolled nurses ($n = 22$) experienced caring for different patients every shift (Chua et al., 2019). In the absence of knowing the patient, nurses said they would gather information to develop their knowledge by reviewing medical records, engaging with family and/or carers and during shift handovers (Chua et al., 2019; Gazarian et al., 2010). In contrast, Lavoie et al. (2020b) found that knowing the patient could negatively influence a nurse's clinical judgement of patients at risk of deterioration and communication during clinical handover. Bingham et al. (2020) also reported that negative patient experiences could hinder decisions to escalate care for deterioration.

Knowing the patient, informs nurse intuition, which has been identified as a significant indicator in the recognition of clinical deterioration (Bingham et al., 2020; Cioffi et al., 2009; Dalton et al., 2018; Hart et al., 2016; Petersen et al., 2017). For example, a study conducted by Dalton et al. (2018) explored general ward nurses' ($n = 10$) assessment of patient acuity and response to deterioration, and reported that intuition would trigger a nursing assessment before abnormalities in physiological signs were evident. Intuition led nurses to increase monitoring rates until abnormalities in physiological parameters were observed. However, there was reluctance to escalate care based on intuition alone (Petersen et al., 2017) as medical teams were unconvinced preferring instead tangible evidence of a patient's condition (Andrews & Waterman, 2005; Cioffi et al., 2009; Dalton et al., 2018). Yet Dalton et al. (2018) and Cioffi et al. (2009) support the notion that nurses rely on intuitive and naturalistic observations to recognise deterioration.

Nurse intuition has been criticised as demonstrating a lack of empirical knowledge and understanding of physiological deviations (Dalton et al., 2018). Ludikhuize, Dongelmans, et al. (2012) found that nurse concern escalation was used infrequently prior to serious adverse events. However, Martland et al. (2016) reported that 33% ($n = 994$) of rapid response team (RRT) activations were based on nurse intuition (nurse concern) rather than abnormal physiological parameters. Nurse intuition provides the capacity for the nurse to escalate care based on tacit personal knowledge and subtle patient changes rather than physiological signs, which are not always evident during early deterioration.

Nurse escalation of clinical deterioration

Early warning systems (EWSs) were developed as a decision support tool to assist in escalating care for clinical deterioration. EWSs are based on vital signs and clinical triggers indicative of patient deterioration (Bingham et al., 2020; Ede et al., 2020; Foley & Dowling, 2019; Ludikhuize, Smorenburg, et al., 2012; Mølgaard et al., 2022; Odell, 2015; Petersen et al., 2017). The review identified that nurses perceived the importance of EWS to determine patient severity (Dalton et al., 2018; Foley & Dowling, 2019) in recognising patient deterioration and escalating nurse concern (Foley & Dowling, 2019; Mølgaard et al., 2022). However, a smaller number of studies reported a lack of clinician knowledge of EWS criteria influenced escalation practices.

Mølgaard et al. (2022) interviewed nurses ($n = 10$) and physicians ($n = 4$) and found a lack of formal organisational EWS training, may have contributed to failure to escalate care for patients with elevated EWS scores. Complicating the interpretation of this study physicians reportedly encouraged nurses' reliance on clinical judgement over acting on EWS scores. Similarly, Foley and Dowling (2019), reported that despite patients triggering EWS for medical review, nurses' ($n = 12$) would delay escalation to instead initiate and evaluate nursing care. Nurses explained that EWS protocols were often too rigid and conflicted with their knowledge, intuition, experience, skills or scope of practice and instead nurses at times were deterred from following EWS escalation protocols (Foley & Dowling, 2019).

Some nurses in the UK reportedly were unconvinced of the sensitivity and specificity of the EWS protocols and criteria (Ede et al., 2020). Instead, nurses (general hospital wards) argued high risk clinical conditions, such as severe bleeding, were often absent in EWS scoring (Petersen et al., 2017). However, EWS protocols were more likely to accurately predict critical events and supported nursing interventions (Petersen et al., 2017). Petersen et al. (2017), in Denmark, identified that EWSs set unrealistic expectations for nurses given the increasing complexity of patients in general hospital wards and explained a lack of adherence to EWS protocols. In the UK, a small study conducted by Smith et al. (2021) also found that nurses' ($n = 16$) disregarded elevated EWS scores and suggested that nurses had a poor understanding of policies pertaining to clinical deterioration and signs requiring escalation. However, in the same study, a mismatch of human resources, time pressures, workload and technology were perceived barriers by nurses in responding to EWS protocols and criteria.

A multi-site study reported that nurses' ($n = 245$) clinical judgement of patients at risk of a deterioration was at times inaccurate. Nurses' clinical reasoning was shown to be non-linear when processing clinical information and that this led to subsequent failure to intervene or mitigate deterioration (Thompson et al., 2009). Yet, nurses with critical care experience were more able to identify deterioration consistently and accurately. While these findings were statistically significant, nurses were reported to often overestimate patient risk; although, nursing intervention decisions did not differ.

Importantly, nurses reported failure by medical staff to adjust EWS parameters to accommodate individual patient conditions and reduce unwarranted escalation. Nurses often faced

challenges from medical staff when seeking to have EWS criteria adjusted (Foley & Dowling, 2019). Nurse knowledge, a lack of organisational EWS policy and education, and failure of medical staff to adjust a patient's EWS criteria influenced nursing escalation practices.

Theme 2: nursing assessment

Theme 2 comprises of two sub themes (i) vital sign measurement; and, (ii) physical assessment. These two sub themes describe the information nurses' gather to inform actions and drive behaviour in the ward environment.

Vital sign measurement

Nursing assessments assist to inform on a patient's risk of deterioration. Nursing assessment often includes vital sign measurements (Andrews & Waterman, 2005; Considine et al., 2023; Dall'Ora et al., 2021; Fasolino & Verdin, 2015; Keene et al., 2017; Ludikhuizen, Dongelmans, et al., 2012) and physical assessment (Chua et al., 2019; Cioffi et al., 2009; Clarke et al., 2010; Osborne et al., 2015) to support the recognition of patient deterioration.

In measuring vital signs (such as blood pressure [BP] and heart rate [HR]), nurses collect physiological information to assist with the recognition of deterioration and inform decisions to escalate care. However, the review (Clarke et al., 2010; Fasolino & Verdin, 2015; Keene et al., 2017; Ludikhuizen, Smorenburg, et al., 2012; Pantazopoulos et al., 2012) identified that monitoring and documenting of vital signs was highly variable. Ludikhuizen, Smorenburg, et al. (2012) conducted a retrospective observational study that explored vital sign measurements ($n = 2,688$; deteriorating patients $n = 204$) in the 24 hours prior to a serious adverse event in hospital wards. In 73% of the serious adverse events, there was inconsistent recording of BP and HR, and that documentation of other vital signs varied significantly: respiratory rate [RR] (23%), level of consciousness (6.5%), urine production (16.6%), body temperature (48.5%) and oxygen saturations (43.7%) prior to all serious adverse events. Similarly, Petersen et al. (2017) found that during acute episodes of patient deterioration, documentation of vital signs into electronic systems were often neglected or frequently recorded on paper, due to cumbersome data entry processes, time pressures and clinical constraints.

Similarly, Pantazopoulos et al. (2012), in Greece, also reported variability in nurse vital sign measurements. Using survey methods, the researchers found that nurses ($n = 94$) most frequently measured and documented BP (92.6%) and temperature (98.9%). In contrast, oxygen saturations (65%), HR (59.6%), and RR were infrequently documented. One reason nurses omitted monitoring of vital signs was their concern that a patient's sleep may be disrupted and thus increase delirium risk (Petersen et al., 2017).

Australian and UK studies have shown nurses' measure and document complete sets of vital signs. Considine et al. (2023) in Australia reported that 83.1% of 10,383 medical record audits had a complete set of vital signs (BP, HR, temperature, oxygen saturation, RR, conscious state) documented every eight hours. However, in the same study, there was evidence (26.8% of audits) that nurses were not acting upon abnormal vital signs or criteria that should trigger escalation of care. Similarly in the UK, Dall'Ora et al. (2021) observed 715 vital sign measurements taken and 95% were complete sets of vital signs. The study estimated that nurses take an average time of 5 minutes and 1 second (95%, CI = 4:39–5:24) per uninterrupted vital sign measurement despite hospital, ward, nurse characteristics or documentation systems.

The review identified that nurses estimated and/ or fabricated vital signs to support decisions to escalate care (Bingham et al., 2020; Keene et al., 2017). Bingham et al. (2020) reported that nurses ($n = 30$) intentionally recorded vital signs incorrectly to escalate care if they believed the

patient needed a higher level of medical intervention. Similarly, vital sign documentation in an acute trauma ward identified 86% ($n = 181$) of patients had a RR recorded between 15 and 20 breaths per minute, suggesting that the values were estimated rather than measured (Keene et al., 2017).

Many studies identified that nurses failed to record RR (Clarke et al., 2010; Fasolino & Verdin, 2015; Ludikhuizen, Smorenburg, et al., 2012; Pantazopoulos et al., 2012; Takayama et al., 2022). Smith et al. (2021) found that knowledge levels varied (nurses ($n = 16$) and health care assistants ($n = 16$)), with evidence of a lack of knowledge to measure RR accurately. Nurses did not perceive the importance of accurately measuring RR or its significance in detecting patient deterioration. Educational experiences, shortened count method use, negative experiences and inconvenience influenced nurses ($n = 592$) capacity for measuring RR (Takayama et al., 2022). Nurses' assessment of respiratory function is not well performed or prioritised (Fasolino & Verdin, 2015; Pantazopoulos et al., 2012). The frequency and type of vital signs (re)assessed by nurses in the ongoing management of patient deterioration remains unclear (Bingham et al., 2020; Clarke et al., 2010; D. Smith et al., 2021).

Delegating vital sign monitoring to enrolled nurses and non-registered staff occurs frequently, particularly with increased nurse workload and staffing shortages. While nurses report awareness of professional accountability despite delegation, inadequate guidance and diminished involvement may result in insufficient measurement and misinterpretation of abnormal findings (Chua et al., 2019; Chua et al., 2022; D. Smith et al., 2021). Delegation of tasks could lead to delayed escalation of care, lack of shared decision-making and unclear scope of practice in response to patient deterioration (Chua et al., 2022).

Physical assessment

The value of physical assessment in the surveillance and recognition of patient deterioration was reported across the literature. Physical assessment informs decisions to escalate patient care and implement nursing strategies to ameliorate deterioration (Chua et al., 2019; Cioffi et al., 2009). Further, subjective changes in a patient's breathing, circulation and neurological status were detected by experienced nurses ($n = 17$) when undertaking a physical assessment.

While physical assessment is a core competency of entry-level nurses, evidence suggests that few nurses use physical assessment to identify patients at risk of deterioration. Nonetheless, nurses ($n = 22$) have reported using few physical assessment skills (e.g. skin colour, behaviour, level of consciousness, and signs of respiratory distress), but often prefer vital sign monitoring instead (Chua et al., 2019). Osborne et al. (2015) reported that 10 of 133 (7.5%) physical assessment skills were used by nurses and midwives ($n = 434$) although abdominal palpation, heart and lung auscultation, and inspection of the jugular venous pulse were considered too complex and were never used. For patients at risk of deterioration mental status, level of consciousness and urine output have also been advocated (Chua et al., 2019; Cioffi et al., 2009; Fasolino & Verdin, 2015; Osborne et al., 2015), although these vital signs were reported to be infrequently assessed, not acted on, or not documented.

The use of a physical assessment framework was rarely reported on in the literature. Only one study reported nurses' ($n = 94$, 68%) assessment of patients using 'ABCD' (airway, breathing, circulation, and disability) framework (Pantazopoulos et al., 2012). Instead, nurses often perceived that physical assessment was a doctor's job or that their assessment findings needed to be validated by a doctor (Chua et al., 2019). A decrease in physical assessment use correlated with increased nursing clinical experience ($F = 9.0$, $p < 0.01$), post-graduate education ($F = 3.6$, $p = 0.07$) and nursing seniority ($F = 31.1$, $p < 0.001$) (Osborne et al., 2015). A lack of clinical

supervision at the bedside when performing more advanced physical assessment skills was also considered a barrier for undertaking the task (Chua et al., 2019).

Nurses working in surgical wards ($M=142$, 95% CI=122, 16.4) were more likely to use physical assessment skills compared to those working in medical wards ($M=121$, 95% CI=10.3, 14.1); oncology wards ($M=110$, 95% CI=8.7, 13.8); and mental health wards ($M=6.3$, 95% CI=4.5, 8.7) (Osborne et al., 2015). Nursing speciality appeared to shape a nurse's practice, skills and activities. While ward culture, shift coordination, care activities, workload, staffing shortages and administration duties appeared to reduce opportunity to conduct physical assessment and led to variability in nursing assessment (Chua et al., 2019; Osborne et al., 2015; Peet et al., 2019).

Theme 3: challenges responding to patient deterioration

Theme 3 comprises of two sub themes (i) working in a team; and (ii) nurse interventions to mitigate deterioration. These two sub themes describe nursing practice, interventions and characteristics that drive behaviour in the ward environment.

Working in a team

Eight studies reported that nurses faced challenges when escalating and communicating deterioration and preferred instead to notify the relevant inpatient medical team (Bingham et al., 2020; Chua et al., 2020; Ede et al., 2020; Mohammed et al., 2018; Rihari-Thomas et al., 2017; Shearer et al., 2012; D. Smith et al., 2021; Sprogis et al., 2023).

Surgical nurses were also more likely to escalate to the treating medical officer than activate rapid response team (RRT) (Mohammed et al., 2018). Similarly, ward nurses ($n=5$) and doctors ($n=10$) favoured inpatient medical team involvement over input from the RRT (Chua et al., 2020). Yet, one study found that in 13 of the 27 pre-Medical Emergency Team (MET) events observed, only seven pre-MET events led to bedside reviews by doctors (Sprogis et al., 2023). Surgical team review delays were attributed to competing priorities, operating room demands, and attendance at outpatient clinics (Bingham et al., 2020).

Nurses also reported challenges when escalating care for patients who were ward outliers or when there were multiple inpatient medical teams involved. This situation led to a lack of clarity about clinical responsibility (Ede et al., 2020). Challenges were also reported by nurses when escalating medical staff or critical care outreach teams, overnight or during weekends (Hart et al., 2016; D. Smith et al., 2021). This led to frequent communication and treatment delays for medical advice and/or orders (Foley & Dowling, 2019).

Instead, the review identified that nurses often sought out more experienced nurses or trusted peers when making management and or escalation decisions (Gazarian et al., 2010). Nurses reported that they felt more comfortable approaching senior nurses for advice or reporting patient problems (Bingham et al., 2020). The review identified that there was also variability in confidence and role of the nurse in charge of the ward in managing patient deterioration (D. Smith et al., 2021). However, nurses who completed a four-year education program were better able to identify deteriorating patients that warranted RRT activation compared with two-year program trained nurses (Pantazopoulos et al., 2012).

Nurses reported that junior medical officers often delayed escalation of care to senior doctors or rapid response system (RRS) activation due to fear of being criticised or deemed incompetent (Chua et al., 2020). The absence of experienced staff with advanced knowledge and critical thinking led to an unnecessary challenge of nurses when activating an RRT (Bingham et al., 2020; Gazarian et al., 2010). For example, two studies (Bingham et al., 2020; Foley &

Dowling, 2019) identified that deferred medical decisions ‘after-hours’, including patients not reviewed, led to repeat escalations by the nurse in the absence of altered calling criteria or documented medical management plans. Chua et al. (2020) found that nurses often escalated for a RRT review when they perceived that the ward medical team’s capacity to manage deterioration was exceeded. Similarly, they escalated to the RRT if the patient’s condition warranted review and expertise of a senior medical staff was needed (Mohammed et al., 2018). Medical-surgical nurses’ activation of an RRT was reported to expedite the transfer to higher level care or encouraged follow-up after the event, improving patient outcomes (Astroth et al., 2013).

Nurses reported frustration and fear of reprisal ‘after hours’ if escalation to the RRT did not occur and for patients reaching the terminal phase of illness if there was unclear documentation of resuscitation status from medical teams (Martland et al., 2016). Similarly, nurses reported fear of criticism from ward medical teams for activating the RRT as a workaround for deterioration (Chua et al., 2020). Nurses experienced tension when they perceived they were unheard when advocating for deteriorating patients (Ede et al., 2020; Peet et al., 2019).

Reports of negative interactions and dismissive feedback when concerns were raised to senior colleagues, ward teams, critical care or RRTs were evident (D. Smith et al., 2021) and could drive behaviour that deterred the escalation of care for the deteriorating patient. Ward characteristics and culture were also reported to influence escalation of deterioration (Astroth et al., 2013). Positive reinforcement from senior nurses, medical colleagues and RRT members influenced nurses’ capability to respond to patient deterioration (D. Smith et al., 2021).

Nursing interventions to mitigate deterioration

Nurse interventions to mitigate deterioration and serious patient adverse events (Bingham et al., 2020; Hart et al., 2014; Hart et al., 2016; Minyaev et al., 2022; Mohammed et al., 2018; Newman et al., 2023; Prosser et al., 2023) have been reported. In Australia, nurses reported using technical skills such as administering oxygen, providing analgesics, deep breathing exercises or airway clearance techniques, reviewing medication charts for interventions that could be initiated to help relieve signs of deterioration or identify medications that potentially could be causing deterioration before escalating care (Bingham et al., 2020).

Surgical nurses reported that they could proactively manage oral intake, but their scope of practice often prevented them from initiating intravenous fluids in the post-operative phase (Mohammed et al., 2018). Consequently, the need for fluid management often resulted in the nurse activating an RRT call (Mohammed et al., 2018). Minyaev et al. (2022) reported surgical nurses ($n = 10$) wanted access to nurse-initiated standing orders to enable early interventions for patient deterioration.

There was a paucity of evidence that has explored how nurses responded to different types of patient deterioration events. Nurses reported moderate confidence in responding and managing patient deterioration, but were less confident in responding to neurological and mental state deterioration (Hart et al., 2014). Pantazopoulos et al. (2012) reported that half the nurses in their study accurately identified critical nursing interventions for chest pain, airway obstruction and respiratory depression. Medical-surgical nurses ($n = 28$) in the USA, described the nursing skills required during resuscitation, such as administering medications, performing cardiopulmonary resuscitation (CPR), ventilation and conducting tests (Hart et al., 2016).

In comparison, Newman et al. (2023) explored nurses ($n = 677$) attitudes towards escalation and management of deteriorating patients and found that only years of experience was significantly associated with confidence levels in responding to deterioration ($p < .001$). However, another study identified that basic and advanced life support training and education increased

the confidence of recognition and management of deterioration for acute inpatient nurses (Hart et al., 2016). Similarly, Hart et al. (2014) identified that nurses lacked confidence in being a team leader (35.1%, $n = 52$) and coordinating the deterioration response. Instead, nurses waited to be directed by the RRT (45.9%, $n = 68$).

Discussion

This scoping review included 46 studies and identified three key themes (i) recognition of patient deterioration; (ii) nursing assessment; and, (iii) challenges responding to patient deterioration, which provided insight into and understanding of the ward nurse's role in recognising and responding to deterioration. Three major findings were synthesised from the review: (1) study designs were largely qualitative and collected data through interviews, focus groups or observation; (2) nursing knowledge, experience and assessment skills supported confidence and capability to recognise, detect and intervene in deterioration; and, (3) challenges for nurses responding to patient deterioration was influenced by ward culture, inpatient medical teams, patient outliers and junior medical officers. The review provides evidence that the role and practice of the ward nurse is variable across countries, specialities and clinical units when recognising and responding to deterioration.

In our review, nurse's knowledge, experience, and assessment skills were fundamental to recognising and responding to patient deterioration. Nurses' knowledge, which was derived from intuition, experience, and theoretical knowledge is a key factor for determining patient risk (Gallione et al., 2022). Education and training programs need to motivate, provide capability and opportunity to optimise interdisciplinary learning and self-confidence, to better promote clinician behaviour change (Michie et al., 2011). To reduce risk and improve patient safety, education and training interventions need to support critical thinking and communication skills for successful collaboration in responding to and managing deteriorating patients (Gallione et al., 2022; Klenke-Borgmann et al., 2023).

There was a paucity of evidence that addressed the value of physical assessment and vital signs undertaken by ward nurses. There was no accepted physical assessment framework for assessing the deteriorating patient (Fennessey & Wittmann-Price, 2011). The evidence was unclear how nurses determine the frequency of vital sign monitoring, conduct advanced physical assessment skills to support patient safety, and or respond to deterioration. While the timeliness of vital signs can mitigate a serious adverse event, the selection and frequency rate in the context of deterioration, on recognition, during and following EWS activation has not been well explored (Leenen et al., 2021; Quinten et al., 2018).

Nurses' use of early warning systems (EWS) as a decision support tool was mixed. Nurses perceived that EWSs had low sensitivity and specificity, conflicted with clinical judgement, intuition, and scope of practice leading to a lack of adherence to EWS criteria (Ede et al., 2020; Foley & Dowling, 2019; Miles et al., 2023; Mølgaard et al., 2022). Importantly, there was reported failure to adhere to organisational EWS policies and guidelines. Individual and organisational factors need to be examined to tailor interventions to optimise patient safety, improve nursing practice and achieve greater adherence to policies and guidelines (Vaismoradi et al., 2020). This finding is important because clinical deterioration in many instances is avoidable through early detection, management, and intervention by nurses.

The review highlighted ward culture, teamwork, interprofessional relationships, and collaboration influenced a nurse's practice and confidence in escalating deterioration. Yet, how clinical task prioritisation, ward communication, staff hierarchies, handover practices influence nursing practice and patient safety principles remains unclear (Peet et al., 2019; Vaismoradi et al., 2020). For example, a task driven ward culture was reported to reduce patient deterioration monitoring

and use of nurse assessment, knowledge, and skills (Chua et al., 2019; Foley & Dowling, 2019). Further research is required to explore the role of teamwork practices, clinical supervision, and debriefing practices on nursing practice.

The scoping review identified that organisational factors such as inadequate staffing, and resourcing, skill-mix, distribution of workloads can have detrimental effects on patient safety, the early detection of patient deterioration and potentially lead to serious adverse events (Gallione et al., 2022; Vaismoradi et al., 2020). This is concerning in the presence of an ever-increasing inexperienced nursing workforce who may lack knowledge, skills, and self-confidence to provide timely interventions to mitigate deterioration (Gallione et al., 2022; Rihari-Thomas et al., 2017).

This is the first review to address the role and practice of the nurse in recognition and response to patient deterioration in general hospital wards. Our review strengthens the findings of a 2017 integrative review that examined factors influencing nurses' recognition of and response to patient deterioration (Massey et al., 2017; Palmer et al., 2023). However, more recent reviews have focused on antecedents (Al-Moteri et al., 2019), nurse preparedness (Mikhail & King, 2023), cognitive capacity of nurses (Klenke-Borgmann et al., 2023), interventions to improve recognition of deterioration (Vincent et al., 2018) and nurses' use of early warning systems (Miles et al., 2023; Wood et al., 2019) but not the nurses' role in recognising and responding to deterioration.

Limitations

There are a number of limitations to consider with this review. Evidence quality was low and so careful consideration is required when drawing conclusive insights. The review was restricted to English language and so may not truly represent all available evidence. No study controlled for confounders increasing the potential of bias, which could have been prevented by randomisation, restriction, or stratification.

Many studies were qualitative, largely single sites and with small samples limiting generalisability. Most studies relied on self-reports and so were open to response, recall and social desirability bias. The inclusion of studies involving other disciplines (such as medical officers, nursing assistants and midwives) raises uncertainty about the extent to which findings accurately reflect nursing practice. The findings may not be relevant to unregistered health workers or nurses working in critical care areas, with advanced nursing assessment skills and readily access to medical staff. The review revealed a disproportionately high number of studies from Australia compared to other regions such as UK, USA and Canada, this may introduce potential bias of the Australian health system, terminology used, RRT models, EWS policies and the role and practice of the general ward nurse, which may affect how the findings are interpreted or applied in international contexts.

Conclusions

The review highlighted significant variability in the ward nurse's role, activities, and skills in assessing, monitoring, managing and escalating care for patient deterioration. Knowledge and practice variability was evident regarding physical assessment, vital sign monitoring and documentation. The review also identified that ward culture, inpatient medical teams, patient outliers, junior medical officers, and organisational resources and education influenced a nurse's response to deterioration.

Further, there was minimal evidence of how nurses intervene before a sentinel patient deterioration event, especially 24 hours prior to and after an EWS escalation event. The research practice gap identified is significant and further understanding of the nurse's role and practice

during this critical period may assist to avert severe clinical deterioration and optimise patient safety. While the evidence was weak, the studies indicated that nurses can and do play a pivotal role in recognising and responding to deterioration.

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