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The Role of Healthcare Professionals in Early Detection and Prevention of Clinical Deterioration Across Hospital Settings

Healthcare Professionals and Clinical Deterioration

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ABSTRACT:

Background. Most in-hospital cardiac arrests, unplanned intensive care admissions and unexpected deaths are preceded by hours of detectable physiological decline. Whether this window is used depends less on technology than on the healthcare professionals who observe, interpret, escalate and respond. Variation in their performance explains much of the variation in failure-to-rescue between hospitals.

Objective. To synthesize evidence on the roles of nurses, physicians, rapid response teams and allied health professionals in the early detection and prevention of clinical deterioration; to examine how these roles differ across hospital settings; to identify the human, team and organizational factors that enable or impede rescue; and to propose an integrated framework for practice and policy.

Methods. Narrative review informed by the SANRA criteria, drawing on MEDLINE, CINAHL, Embase and Scopus, with priority given to systematic reviews, multicenter studies and controlled evaluations of early warning scores, rapid response systems, escalation and digital surveillance.

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Results. Aggregate early warning scores such as NEWS discriminate patients at risk of death and unplanned ICU admission well, and rapid response systems are associated with fewer cardiac arrests outside the ICU, with smaller and less consistent effects on mortality. Automated predictive surveillance coupled with structured clinical response has been associated with lower mortality. Benefits, however, depend on the afferent limb: complete observations, nurse concern, timely escalation across hierarchies and an effective response. Staffing, education, psychological safety and interprofessional communication are consistently implicated in failure-to-rescue.

Conclusions. Recognition and rescue of deteriorating patients is an interprofessional competency rather than a tool. The proposed WATCH framework (Watch, Assess and act on concern, Trigger and escalate, Coordinated response, Hardwired learning) aligns roles, processes and system supports across settings, and is applicable to health systems undergoing transformation, including those under Saudi Vision 2030.

KEY POINTS

- Clinical deterioration is usually preceded by hours of abnormal physiology; the opportunity to rescue is lost mainly through missed observation, misinterpretation and delayed escalation.
- Nurses are the principal detectors of deterioration; physicians, rapid response teams and allied professionals determine whether detection leads to timely, effective treatment.
- Early warning scores and rapid response systems reduce cardiac arrests, but outcome benefits depend on staffing, escalation culture and the quality of response.
- The WATCH framework integrates monitoring, clinical concern, escalation, coordinated response and continuous learning across hospital settings.

1. INTRODUCTION

Hospitalized patients do not usually deteriorate without warning. Studies of in-hospital cardiac arrest, unplanned admission to intensive care and unexpected death have repeatedly found that abnormal vital signs and clinical signs are present in the hours before these events (Buist et al., 2002; Kause et al., 2004; Andersen et al., 2019). This observation underpins the concept of "preventable deterioration": a proportion of serious adverse events could be averted if deterioration were recognized and treated earlier.

The importance of this concept is illustrated by research on failure to rescue, defined as death following a complication. Silber et al. (1992) proposed that hospital quality is reflected less in whether complications occur than in whether patients survive them. Ghaferi et al. (2009), analyzing patients in the American College of Surgeons National Surgical Quality Improvement Program, found that complication rates were broadly similar across hospitals with high and low mortality, but patients in poorly performing hospitals were almost twice as likely to die after a major complication. The difference between good and poor hospitals, in other words, lies substantially in the recognition and management of deterioration.

Over the past two decades, health systems have responded with structural solutions: aggregate early warning scores such as the National Early Warning Score (NEWS and NEWS2), rapid response teams and medical emergency teams, critical care outreach services and, more recently, electronic surveillance and machine-learning alerts. Yet the evidence for these solutions is mixed, and their effects depend heavily on how professionals use them (Jones et al., 2011). A score that is calculated but not acted upon, an alert that is overridden, or a rapid response team that is called too late provides little protection.

This review places healthcare professionals at the center of the analysis. It examines how nurses, physicians, rapid response clinicians and allied health professionals contribute to each stage of the rescue process, how these contributions vary across hospital settings, and which human, team and organizational factors determine success. It concludes with an integrated framework, WATCH, designed to align professional roles with system supports and to guide implementation, including within the Saudi health system's Vision 2030 transformation.

2. REVIEW METHODOLOGY

This structured narrative review followed the Scale for the Assessment of Narrative Review Articles (SANRA). MEDLINE/PubMed, CINAHL, Embase and Scopus were searched from January 2000 to September 2026 using terms related to deterioration ("clinical deterioration", "deteriorating patient", "failure to rescue", "in-hospital cardiac arrest"), detection tools ("early warning score", "NEWS", "track and trigger", "predictive analytics"), response systems ("rapid response team", "medical emergency team", "critical care outreach") and professional factors ("nurse", "escalation", "clinical judgment", "communication", "staffing"). Reference lists of key reviews and national guidance documents were hand-searched.

Studies were eligible if they examined adult, pediatric or obstetric inpatients in acute hospital settings and addressed recognition, escalation or response to deterioration. Priority was given to systematic reviews and meta-analyses, multicenter cohort studies, randomized and stepped-wedge trials, and national consensus documents. Qualitative studies were included to illuminate professional experiences and barriers. Findings were synthesized thematically using the afferent–efferent model of rapid response systems (DeVita et al., 2006) and Donabedian's structure–process–outcome framework.

3. CONCEPTUAL FOUNDATIONS

3.1 THE CHAIN OF PREVENTION

Smith (2010) proposed an in-hospital "chain of prevention", analogous to the chain of survival for cardiac arrest, consisting of five rings: staff education, monitoring, recognition, the call for help, and the response. The chain is only as strong as its weakest link. An excellent rapid response team cannot compensate for infrequent observations, and frequent observations are useless if abnormal values are not recognized or escalated. Each ring is fundamentally a human activity, supported but not replaced by tools.

3.2 AFFERENT AND EFFERENT LIMBS

The international consensus on rapid response systems distinguishes an afferent limb, which detects deterioration and triggers a response, from an efferent limb, which delivers the response, supported by administrative and quality-improvement components (DeVita et al., 2006). Most failures occur in the afferent limb: observations are incomplete, scores miscalculated, concerns unspoken or calls delayed. This places ward nurses, junior physicians and the systems that support them at the center of prevention.

3.3 CLINICAL DETERIORATION AS A PATIENT-SAFETY PROBLEM

Viewed through Reason's systems model, failure to rescue rarely results from a single error. It reflects the alignment of latent conditions, such as inadequate staffing, poor handover, hierarchical culture and fragmented information systems, with active failures such as a missed observation or a delayed call. Prevention therefore requires layered defenses distributed across professions and organizational levels.

Table 1. The chain of prevention mapped to professional roles and failure modes

Link	Principal professionals	Common failure mode	System support
Education	All clinical staff; educators	Inadequate knowledge of physiology and escalation	Mandatory, simulation-based training
Monitoring	Nurses; nursing assistants	Incomplete or infrequent observations	Observation policies; electronic charting
Recognition	Nurses; junior physicians	Abnormal values normalized or misinterpreted	Aggregate EWS; decision support
Call for help	Nurses; junior physicians	Delayed or unclear escalation	Graded escalation; SBAR; psychological safety

Link	Principal professionals	Common failure mode	System support
Response	Physicians; RRT/outreach; ICU	Delayed attendance; inadequate plan	Response standards; RRT availability

4. TOOLS FOR DETECTION

4.1 EARLY WARNING SCORES

Aggregate weighted early warning scores combine routinely measured physiological parameters into a single number that triggers graded responses. The Modified Early Warning Score was an early example (Subbe et al., 2001). The National Early Warning Score was developed in the United Kingdom to standardize assessment across hospitals. In a comparison against 33 other scores, NEWS discriminated patients at risk of death within 24 hours (area under the receiver operating characteristic curve 0.894), unanticipated ICU admission (0.857) and cardiac arrest (0.722) better than all alternatives (Smith et al., 2013). NEWS2, published in 2017, added a separate oxygen-saturation scale for patients with hypercapnic respiratory failure and gave new confusion a weighting equal to other severe abnormalities (Royal College of Physicians, 2017).

Evidence that implementing early warning scores improves patient outcomes is less robust than evidence of their predictive accuracy. A systematic review found that early warning scores could identify patients at risk but that evidence of improved outcomes after implementation was limited and of low quality (Alam et al., 2014). In a large pre–post evaluation in the United States, an electronic early warning score with a best-practice alert had minimal impact on outcomes, in part because the alerts were frequently not acted upon (Bedoya et al., 2019). These findings indicate that the score is necessary but not sufficient: it must be embedded in a reliable process of response.

A distinctive strength of NEWS2 is that it links each score band to a defined clinical response, monitoring frequency and level of competence required of the responder, thereby translating a number into professional action (Royal College of Physicians, 2017). Table 2 summarizes this graded response, which many hospitals adapt to local resources.

Table 2. NEWS2 aggregate score bands and the associated graded clinical response

NEWS2 score	Clinical risk	Minimum observation frequency	Clinical response
0	Low	Every 12 hours	Continue routine monitoring
1–4	Low	Every 4–6 hours	Registered nurse assesses; decides on frequency and escalation
3 in a single parameter	Low–medium	At least hourly	Urgent ward-based review by a clinician
5–6	Medium	At least hourly	Urgent review by a clinician competent in acute illness; consider critical care
7 or more	High	Continuous monitoring	Emergency assessment by critical care–competent team; usually transfer to higher level of care

4.2 SPECIALTY-SPECIFIC SCORES

Physiological norms differ in children and pregnant women, and specific tools have been developed for these populations. Pediatric early warning systems are widely used, but in the EPOCH cluster-randomized trial across 21 hospitals, implementation of the Bedside Pediatric Early Warning System did not significantly reduce all-cause hospital mortality, although it was

associated with fewer clinical deterioration events (Parshuram et al., 2018). Modified obstetric early warning charts have been shown to predict maternal morbidity, supporting their use in maternity settings (Singh et al., 2012). For sepsis, the quick Sequential Organ Failure Assessment was proposed as a bedside prompt (Seymour et al., 2016), though current guidance recommends against using it as a single screening tool in place of NEWS or similar scores (Evans et al., 2021).

4.3 AUTOMATED AND PREDICTIVE SURVEILLANCE

Electronic health records enable continuous calculation of scores and the use of predictive models that combine vital signs with laboratory data, diagnoses and trends. At Kaiser Permanente Northern California, an automated model that identified ward patients at high risk of deterioration, coupled with a remote nurse-led review and a standardized bedside response, was deployed in a staggered fashion across 19 hospitals and was associated with lower 30-day mortality, corresponding to an estimated several hundred deaths prevented annually (Escobar et al., 2020). The success of this program is instructive: the model triggered a structured human response, including review by experienced nurses, assessment by the rapid response team and consideration of goals of care, rather than a stand-alone alert.

4.4 CLINICAL JUDGMENT AND NURSE CONCERN

Structured scores do not capture everything that experienced clinicians notice. Changes in behavior, color, breathing pattern, mobility or engagement may precede measurable physiological change. A systematic review found that nurses' "worry" or concern, often expressed before vital signs become abnormal, is a meaningful predictor of deterioration and should be incorporated into escalation criteria (Douw et al., 2015). Many rapid response systems therefore include "staff concern" as an independent calling criterion, and some extend this right to patients and families.

Table 3. Detection tools: strengths, limitations and dependence on professionals

Tool	Evidence base	Key limitation	Professional dependency
NEWS/NEWS2	Strong discrimination for death and ICU admission	Outcome benefit of implementation uncertain	Complete, accurate observations; action on trigger
MEWS and local scores	Variable validation	Heterogeneous thresholds	Same as above
Pediatric EWS	Cluster RCT: fewer deterioration events, no mortality change	Age-specific norms complex	Pediatric nursing expertise
Obstetric EWS (MEOWS)	Predicts maternal morbidity	High false-positive rate	Midwifery and obstetric response
Automated predictive models	Associated with reduced mortality when coupled with response	Alert fatigue; validation	Remote review; structured bedside response
Staff and family concern	Predictive of deterioration	Subjective; under-used	Psychological safety to call

5. PROFESSIONAL ROLES IN DETECTION AND PREVENTION

5.1 NURSES

Nurses are present at the bedside around the clock and are therefore the principal detectors of deterioration. Their role spans measurement of vital signs, interpretation of trends, synthesis of subtle clinical cues, calculation and documentation of early warning scores, initiation of first-line interventions within protocols, and escalation. A systematic review of the nursing role in detecting deterioration on wards found that nurses draw on both objective measurements and intuitive knowledge, but that

recognition is impeded by workload, incomplete observations and lack of confidence in escalating to medical staff (Odell et al., 2009).

The capacity of nurses to fulfil this role is strongly influenced by staffing and education. In a study of 300 hospitals in nine European countries, each additional patient per nurse was associated with an increase in the odds of inpatient death within 30 days of admission, while each 10% increase in nurses with a bachelor's degree was associated with a decrease (Aiken et al., 2014). A longitudinal study in English hospitals similarly associated lower registered nurse staffing with higher mortality and found that vital-sign observations were more likely to be missed when staffing was low (Griffiths et al., 2019). Nurse staffing is therefore not merely a workforce issue but a direct determinant of rescue.

5.2 PHYSICIANS

Physicians, particularly junior doctors covering wards out of hours, receive escalations, perform diagnostic assessment, initiate treatment, decide whether senior or critical care review is needed and establish ceilings of care. Delays in medical review after escalation are a recurrent finding in reviews of deterioration incidents. Contributing factors include high workload across multiple wards at night, inexperience, reluctance to seek senior help, and diagnostic momentum. A study of responses to NEWS in a British hospital found that a substantial proportion of patients with high scores did not receive a timely medical review, highlighting the efferent gap (Kolic et al., 2015).

Senior physicians shape outcomes through supervision, accessibility and culture. Explicit expectations that juniors escalate to seniors at defined thresholds, and that seniors respond without censure, reduce the hierarchy gradient that delays care. Physicians also hold primary responsibility for discussing treatment limitations and goals of care, which is critical because a proportion of deteriorating patients are approaching the end of life and benefit most from timely palliative rather than escalated care.

5.3 RAPID RESPONSE TEAMS AND CRITICAL CARE OUTREACH

Rapid response teams (RRTs), medical emergency teams and critical care outreach services bring critical care expertise to the ward. In the cluster-randomized MERIT trial in 23 Australian hospitals, introduction of medical emergency teams did not significantly reduce the composite of cardiac arrest, unplanned ICU admission and unexpected death, a result attributed partly to low calling rates and contamination of control hospitals (Hillman et al., 2005). Subsequent meta-analyses found that rapid response systems were associated with reductions in cardiac arrest outside the ICU, with less consistent effects on hospital mortality (Chan et al., 2010; Maharaj et al., 2015).

The value of RRTs extends beyond resuscitation. They provide education at the bedside, support ward staff in managing complex patients, facilitate ICU admission or avoid it when ward management suffices, and frequently initiate goals-of-care discussions. Their effectiveness depends on being called early, which in turn depends on the afferent limb and on a culture in which calling is encouraged rather than criticized.

5.4 ALLIED HEALTH PROFESSIONALS

Allied health professionals contribute distinct and often under-recognized safeguards. Respiratory therapists detect evolving respiratory failure through blood gas interpretation and ventilatory assessment. Clinical pharmacists identify medication-related causes of deterioration, such as opioid toxicity, hypoglycemia, anticoagulant-associated bleeding and nephrotoxicity, and optimize antimicrobial therapy in sepsis. Medical laboratory professionals provide the first signal of deterioration through critical-value reporting of lactate, potassium, troponin and blood cultures; the reliability and speed of this communication is itself a rescue process. Radiology professionals detect and communicate unexpected critical findings. Physiotherapists observe changes in exercise tolerance and respiratory function during mobilization. Each of these professions holds information that is incomplete in isolation but decisive when integrated into the team's situational awareness.

5.5 HEALTH INFORMATICS PROFESSIONALS AND MANAGERS

Health informatics professionals design the electronic charting, score calculation, alerting and dashboards that support recognition. Poorly designed alerts generate fatigue and are ignored; well-designed systems present trends and contextual information that support clinical judgment. Managers and executives create the structural conditions for rescue: safe staffing, availability of senior medical cover and RRTs, protected training time, and governance that reviews deterioration events and learns from them.

5.6 PATIENTS AND FAMILIES

Patients and families often notice changes before professionals, especially in children, older adults and patients with cognitive impairment. Family-activated rapid response mechanisms allow relatives to escalate directly when they feel concerns are not being addressed. Such schemes have generally been used appropriately and have not overwhelmed response teams, and they reflect a patient-centered model in which families are partners in safety.

Table 4. Interprofessional contributions to the detection and prevention of deterioration

Profession	Key contributions	Enablers
Registered nurses	Observation, trend interpretation, clinical concern, first-line actions, escalation	Safe staffing; education; escalation autonomy
Physicians	Timely review, diagnosis, treatment, senior escalation, goals of care	Response standards; accessible seniors; supervision
RRT / outreach	Expert assessment, stabilization, triage to ICU, bedside education	24/7 availability; low threshold for calling
Respiratory therapists	Respiratory assessment, blood gases, oxygen and ventilation support	Integration into RRT
Clinical pharmacists	Detection of drug-related deterioration; sepsis and anticoagulation optimization	Ward-based pharmacy; EHR access
Laboratory professionals	Critical-value detection and rapid communication	Closed-loop notification protocols
Radiology professionals	Communication of unexpected critical findings	Critical results policies
Informatics specialists	Score automation, alert design, dashboards	Clinician co-design; evaluation
Managers and leaders	Staffing, governance, culture, learning systems	Board-level oversight of deterioration metrics
Patients and families	Recognition of subtle change; escalation	Family-activated response; clear information

6. DETECTION ACROSS HOSPITAL SETTINGS

Deterioration manifests differently, and is detected by different professionals, in different parts of the hospital. Table 5 summarizes the setting-specific considerations.

6.1 EMERGENCY DEPARTMENT

In the emergency department, undifferentiated and often crowded patients may deteriorate while awaiting assessment, investigations or an inpatient bed. Triage nurses perform the first risk stratification; repeated reassessment of waiting and boarded patients is essential but is compromized by crowding. Applying an early warning score at triage and during the ED stay helps identify sepsis and other time-critical conditions, and supports prioritization.

6.2 GENERAL MEDICAL AND SURGICAL WARDS

Wards have the lowest staff-to-patient ratios and the least frequent monitoring, yet carry a large share of preventable deterioration. Postoperative patients are vulnerable to bleeding, sepsis, respiratory depression and anastomotic leak; failure-to-rescue research highlights the surgical ward as a key determinant of hospital mortality (Ghaferi et al., 2009). Night and weekend periods, when medical cover is thinner, require particular vigilance.

6.3 POST-ANESTHESIA AND STEP-DOWN UNITS

Recovery units and high-dependency areas provide closer monitoring, but transitions out of them, to the ward, are moments of risk. Patients discharged from the ICU to wards are at elevated risk of readmission and death; outreach follow-up of recently discharged ICU patients is a recognized preventive strategy.

6.4 MATERNITY AND PEDIATRIC UNITS

Pregnant women and children compensate physiologically until late, so that obvious abnormalities may appear only shortly before collapse. Specialty-specific early warning charts, staff trained to recognize population-specific signs, and response teams with obstetric or pediatric expertise are required.

6.5 MENTAL HEALTH AND LONG-STAY AREAS

Patients in mental health, rehabilitation and long-stay settings may have physical deterioration overlooked because staff focus on other needs, monitoring is less frequent, or symptoms are attributed to underlying conditions. Physical health monitoring and access to medical response should be explicit in these settings.

Table 5. Setting-specific considerations in detecting deterioration

Setting	Principal risks	Key professional and system responses
Emergency department	Deterioration while waiting or boarding; sepsis	Triage EWS; scheduled reassessment; boarding protocols
Medical wards	Sepsis, respiratory failure, delirium	NEWS2; nurse concern criteria; RRT
Surgical wards	Bleeding, anastomotic leak, opioid toxicity	Postoperative observation plans; failure-to-rescue audit
Post-ICU wards	Readmission and death after ICU discharge	Outreach follow-up; structured ICU discharge handover
Maternity	Hemorrhage, preeclampsia, sepsis	Obstetric EWS; obstetric emergency drills
Pediatrics	Late decompensation	Pediatric EWS; family concern escalation
Mental health / long-stay	Overlooked physical illness	Physical observation protocols; medical access

7. HUMAN, TEAM AND ORGANIZATIONAL DETERMINANTS

7.1 ESCALATION AND HIERARCHY

Even when deterioration is recognized, escalation is frequently delayed. Nurses describe uncertainty about whether concerns are sufficient to call, fear of being perceived as incompetent, previous negative responses from physicians, and the need to "build a case" with objective data before calling. Junior physicians report similar reluctance to call seniors or ICU. These behaviors reflect steep hierarchies and low psychological safety. Structured communication tools, especially SBAR (Situation,

Background, Assessment, Recommendation), give callers a shared language and legitimate the request for help, while explicit escalation policies that mandate responses at specified thresholds remove discretion and the associated social risk.

7.2 TEAMWORK AND COMMUNICATION

Deterioration often crosses shift boundaries, and information about subtle changes is easily lost at handover. Structured handovers that explicitly identify "watcher" patients, safety huddles at shift change, and team-training programs such as TeamSTEPPS, which emphasize situational awareness, mutual support and closed-loop communication, strengthen collective vigilance (Agency for Healthcare Research and Quality [AHRQ], 2023).

7.3 WORKLOAD AND STAFFING

Missed observations and delayed responses are strongly associated with workload. When nurses care for more patients, observation frequency falls, and subtle changes are less likely to be noticed (Griffiths et al., 2019). Medical cover at night is often stretched across many wards. Safe staffing is therefore a precondition for any detection strategy.

7.4 EDUCATION AND SIMULATION

Courses that teach structured assessment of the acutely ill patient, such as the ABCDE approach, interpretation of early warning scores and escalation communication, improve knowledge and confidence. Interprofessional simulation, in which nurses, physicians and allied staff rehearse deterioration scenarios together, builds shared mental models and is particularly valuable for rehearsing escalation across hierarchies. Education should be repeated, since skills decay, and embedded in orientation for new staff.

7.5 ALERT FATIGUE AND TECHNOLOGY DESIGN

Electronic alerts that are too frequent, insufficiently specific or poorly integrated into workflow are overridden. Bedoya et al. (2019) showed that an electronic early warning score with best-practice alerts had minimal impact, whereas the successful program described by Escobar et al. (2020) used remote expert review to filter alerts before they reached bedside teams. Technology works best when it reduces rather than adds to cognitive load and when clinicians are involved in its design.

7.6 SEPSIS AS AN EXEMPLAR OF INTERPROFESSIONAL RESCUE

Sepsis illustrates how rescue depends on the integration of multiple professions. Early recognition typically begins with a nurse noting fever, tachycardia, tachypnea, hypotension or new confusion, often reflected in a rising NEWS2. A laboratory professional may report an elevated lactate or a positive blood culture; a pharmacist ensures that appropriate antimicrobials are prescribed, dosed for renal function and administered promptly; a physician confirms the diagnosis, identifies the source and directs resuscitation; and the rapid response or critical care team supports patients who fail to respond. International guidelines recommend that hospitals implement performance-improvement programs for sepsis, including screening of acutely ill high-risk patients, and that antimicrobials be administered within one hour for patients with probable sepsis and shock (Evans et al., 2021).

Each hand-off in this sequence is a potential point of delay: an abnormal observation not escalated, a laboratory result not communicated, a prescription not dispensed, an antibiotic dose delayed by intravenous access problems. Hospitals that achieve reliable sepsis care typically use protocol-driven pathways that empower nurses to initiate investigations and fluids, automated alerts that notify both clinicians and pharmacists, and audit with feedback. Sepsis therefore serves as a model for the broader principle that rescue is a team performance rather than an individual act.

7.7 CEILINGS OF CARE AND ETHICAL DIMENSIONS

Not every deteriorating patient benefits from escalation to intensive care. Patients with advanced frailty, progressive malignancy or end-stage organ failure may prefer comfort-focused care, and aggressive intervention may prolong suffering without meaningful benefit. Rapid response teams frequently attend patients for whom limitations of treatment have not been discussed, and such calls often result in new do-not-attempt-resuscitation decisions. Proactive, documented discussions about goals of care at admission, involving patients and families in a culturally sensitive manner, allow early warning triggers to prompt the right response, which may be symptom control and family support rather than transfer to intensive care.

Professionals also face ethical tension when escalation is constrained by resources, such as limited ICU beds. Transparent triage criteria, senior involvement and clear documentation protect both patients and staff. In societies where family involvement in

decision-making is central, including Saudi Arabia, communication skills training for these conversations should be integral to deterioration education programs.

> ◆ **KEY MESSAGE**
>
> The same early warning score can save lives in one hospital and achieve nothing in another. The difference lies in whether observations are complete, whether concern is voiced, whether calls are answered promptly and whether the hospital learns from every case of failed rescue.

8. THE WATCH FRAMEWORK

Synthesizing the evidence, we propose the WATCH framework for interprofessional detection and prevention of clinical deterioration. It integrates Smith's chain of prevention with the afferent–efferent model of rapid response systems and Donabedian's structure–process–outcome logic. Each component specifies professional actions and the organizational supports that make them reliable.

Table 6. The WATCH framework: components, professional actions, system supports and indicators

Component	Professional actions	System supports	Indicators
W – Watch	Complete observations at prescribed frequency; NEWS2 or specialty score; trend review	Safe staffing; electronic charting; observation plans by acuity	% complete observation sets; missed observations
A – Assess and act on concern	Holistic assessment (ABCDE); nurse, allied and family concern recognized as trigger	Concern criterion in policy; family-activated escalation	Concern-triggered calls; time to assessment
T – Trigger and escalate	Graded escalation with SBAR; senior and RRT involvement at defined thresholds	Mandatory escalation pathway; psychological safety; no-blame calling	Time from trigger to review; delayed escalation incidents
C – Coordinated response	Timely review; treatment plan; ICU referral or ceiling-of-care decision; interprofessional input	24/7 RRT/outreach; pharmacist, respiratory therapist integration	RRT response time; cardiac arrests outside ICU
H – Hardwired learning	Case review of failed rescue; simulation; feedback to teams	Governance committee; dashboards; predictive analytics with evaluation	Failure-to-rescue rate; unplanned ICU admissions; learning actions closed

The framework is setting-adaptable. In the emergency department, the Watch component emphasizes scheduled reassessment of waiting patients; in maternity, it uses obstetric scores; in pediatrics, it gives particular weight to family concern. It is also level-adaptable: individual clinicians use it to structure their practice, units use it to organize workflows, and hospitals use its indicators for governance.

"No Tool Detects Deterioration. People Do — When Systems Give Them The Time, The Knowledge And The Permission To Act."

8.1 MEASURING PERFORMANCE

Measurement should combine process indicators (observation completeness, time from trigger to medical review, RRT response time), outcome indicators (cardiac arrests outside the ICU, unplanned ICU admissions, failure-to-rescue rates,

mortality in low-risk groups) and balancing measures (RRT call volume, alert override rates, staff workload). Every cardiac arrest and unexpected death outside the ICU should be reviewed for missed opportunities using a structured, non-punitive methodology, and lessons should be fed back to frontline teams.

8.2 PHASED IMPLEMENTATION

Table 7. Phased roadmap for implementing the WATCH framework

Phase	Indicative timing	Key activities	Milestone
1. Readiness	0–6 months	Governance committee; baseline audit of observations, escalation and arrests; staffing review	Approved deterioration policy
2. Standardization	6–12 months	Single hospital-wide EWS with specialty variants; SBAR escalation; concern criterion; RRT standards	Score and escalation in use on all wards
3. Capability	6–18 months	Interprofessional simulation; ABCDE training; family-activated response	>80% staff trained
4. Digital integration	12–36 months	Electronic score calculation; trend dashboards; validated predictive alerts with remote review	Automated surveillance with response protocol
5. Sustainment	Ongoing	Failure-to-rescue reviews; indicator reporting; accreditation alignment	Sustained reduction in ward arrests

9. IMPLICATIONS FOR SAUDI ARABIA AND VISION 2030

The Saudi health system is undergoing rapid reorganization under the Health Sector Transformation Program of Vision 2030, which prioritizes patient safety, quality, workforce development and digital health, and is restructuring Ministry of Health services into regional health clusters (Saudi Vision 2030, 2021). This context offers several opportunities to strengthen recognition and rescue.

First, national standardization of early warning tools, for example adoption of NEWS2 with validated pediatric and obstetric variants across clusters, would improve consistency for staff who move between hospitals and support national benchmarking. Second, accreditation standards of the Saudi Central Board for Accreditation of Healthcare Institutions (CBAHI) already address patient assessment, resuscitation and quality indicators; incorporating explicit deterioration metrics, such as ward cardiac arrest rates and escalation response times, would align incentives. Third, the Saudi Commission for Health Specialties (SCFHS) could embed recognition and escalation competencies, including interprofessional simulation, in residency, nursing and allied health training and continuing professional development. Fourth, the large and diverse international nursing workforce in Saudi hospitals makes standardized escalation language and culturally sensitive team training especially important for overcoming hierarchy and communication barriers. Fifth, the expansion of national electronic health records and virtual care creates the infrastructure for automated surveillance and remote nurse review models, provided these are coupled with structured bedside response and rigorous evaluation.

Published Saudi evidence on early warning score performance and rapid response outcomes remains limited. Multicenter registries of in-hospital cardiac arrest and unplanned ICU admission, and evaluation of national implementation, would allow the Kingdom to measure progress and contribute to the international evidence base.

10. DISCUSSION

This review emphasizes that the detection and prevention of clinical deterioration is fundamentally a professional and interprofessional activity. Tools such as NEWS2, rapid response teams and predictive analytics provide structure, but their impact is mediated by the people who use them. The most consistent finding across the literature is the gap between recognition

and response: abnormal observations are recorded but not acted upon, triggers are reached but escalation is delayed, and calls are made but review is slow.

The mixed evidence for outcome benefits from early warning scores and rapid response systems should be interpreted in this light. Trials such as MERIT and EPOCH evaluated complex interventions in settings where implementation fidelity varied, control hospitals adopted similar practices, and mortality was an insensitive endpoint for preventable deterioration. Positive programs, such as that reported by Escobar et al. (2020), share the characteristic of tightly coupling detection to a defined, resourced human response.

Two further themes deserve emphasis. First, staffing is not a background condition but an active determinant of rescue; strategies that add monitoring tasks without adequate staff are unlikely to succeed. Second, a significant proportion of deterioration occurs in patients nearing the end of life, and timely recognition should prompt not only escalation but also honest discussion of goals of care. Rescue, properly understood, includes rescuing patients from unwanted and futile interventions.

11. RESEARCH GAPS AND FUTURE DIRECTIONS

- **Implementation science:** rigorous evaluations of how escalation culture, staffing and training modify the effect of early warning systems are needed, using stepped-wedge and hybrid effectiveness–implementation designs.
- **Predictive analytics:** externally validated, transparent models evaluated for patient outcomes, alert burden and equity, and coupled with defined human response.
- **Continuous monitoring:** wearable and wireless ward monitoring may improve detection between intermittent observations but requires evaluation of false alarms and workload.
- **Allied health roles:** the contributions of pharmacists, respiratory therapists and laboratory professionals to rescue are under-studied.
- **Family engagement:** the effectiveness and acceptability of family-activated escalation in diverse cultural contexts, including the Gulf region.
- **Regional evidence:** Saudi and Gulf data on deterioration, rapid response performance and failure to rescue are needed for context-specific policy.

12. LIMITATIONS

As a narrative review, this work may be affected by selection and interpretive bias despite a structured search. Much of the evidence derives from high-income countries and from observational or before–after studies, limiting causal inference. Definitions of deterioration, escalation and failure to rescue vary between studies. The WATCH framework is a synthesis to guide practice and has not yet been prospectively validated.

13. CONCLUSIONS

Clinical deterioration in hospital is common, usually signaled in advance and frequently preventable. Healthcare professionals are the decisive element in converting warning signs into timely action: nurses through vigilant observation and voiced concern, physicians through prompt review and decision-making, rapid response teams through expert intervention, allied professionals through specialized surveillance, and leaders through the staffing, culture and learning systems they create. Early warning scores, rapid response systems and predictive technologies are valuable when embedded in reliable interprofessional processes. The WATCH framework offers a practical structure for this integration, and health systems undergoing transformation, such as Saudi Arabia under Vision 2030, are well positioned to adopt it at scale.

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Data availability. No new data were generated or analyzed in this study.

Author contributions. [To be completed according to the CRediT taxonomy before submission.]

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