



Clinical Deterioration Among Emergency Department Boarders: From Hallway Monitoring to a Structured Rescue System

Mohammed Alkhanafsa¹, Jamil Wafi¹, Soud Deek¹

ABSTRACT

BACKGROUND

Emergency department (ED) boarding places admitted patients in an environment designed for rapid episodic assessment rather than longitudinal inpatient surveillance. The resulting mismatch in ownership, monitoring, medication delivery, fundamental nursing care, and rescue capability creates a clinically important interval of vulnerability.

OBJECTIVE

To critically synthesize recent PubMed-indexed evidence on deterioration among adult ED boarders and translate it into a practical rescue framework.

METHODS

This narrative review followed the Scale for the Assessment of Narrative Review Articles (SANRA) recommendations. PubMed was searched for English-language publications from 1 January 2020 through 11 July 2026 using predefined terms for ED boarding and corridor care together with deterioration, monitoring, treatment continuity, fundamental care, and rescue. The lead author screened titles and abstracts, assessed potentially eligible full texts, and mapped included studies to the review questions; reference lists of key reviews and cohorts were hand-searched. Direct studies of adult ED boarders were prioritized, and supporting studies were retained only when they informed a BOARD component. Meta-analysis was not attempted because boarding definitions and time zero, populations and acuity, outcome definitions and time windows, and adjusted effect measures differed substantially, while comparative intervention studies were sparse.

FINDINGS

Recent observational cohorts associate longer boarding with early clinical deterioration, longer subsequent hospitalization, and mortality, but residual confounding limits causal interpretation. In a five-hospital cohort of 173,168 floor-level adult boarders, early deterioration occurred in 3.6%, with risk increasing as boarding time lengthened. Recurrent hazards include diagnostic closure, ambiguous ownership, surveillance decay, delayed or omitted treatment, unmet frailty-related needs, and unsafe temporary care environments. Evidence is strongest for the existence of a high-risk care state and weakest for prospectively tested integrated rescue bundles.

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PROPOSED FRAMEWORK

The BOARD framework comprises: Begin the boarding clock and dynamic risk stratification; One accountable clinical team; Acuity-matched observation and reassessment; Rescue triggers with immediate rapid-response access; and Delivery of essential inpatient care, dignity, and hospital-wide flow escalation.

CONCLUSION

Boarding should be treated as an active clinical exposure and risk marker rather than passive waiting. Hospitals should simultaneously reduce boarding and protect patients who remain in the ED through explicit ownership, risk-based monitoring, uninterrupted treatment, and reliable rescue. The BOARD framework is an evidence-informed implementation model that requires prospective multicenter validation.

INTRODUCTION

Emergency department boarding is the period after a decision to admit has been made while the patient remains physically in the ED awaiting an inpatient bed or another definitive destination. Crowding is a system-level mismatch between demand and available clinical capacity, whereas corridor care (or hallway care) describes treatment in a non-designated clinical space and may involve admitted boarders or patients still undergoing ED assessment. A department may therefore be crowded without every patient boarding, and a boarder may be located in a standard bay or a corridor. Although a four-hour threshold is often used for policy or measurement, boarding begins at the admission decision. Risk exposure starts when the patient enters a transition state in which diagnostic uncertainty, active treatment, and the possibility of deterioration persist: a "transition without transfer" in which responsibility may change before the environment and care infrastructure do.

Boarding is now a common and prolonged exposure. In a national United States analysis of 46.2 million hospitalizations from 2017 through 2024, the proportion of admitted patients boarding for more than four hours peaked at 40.1%, while 6.3% boarded for more than 24 hours [1]. A 2026 systematic review linked boarding with morbidity, mortality, longer hospitalization, treatment delay, error, compromised experience, and adverse staff outcomes [2]. These findings challenge the operational assumption that admission orders make patients safe.

The most clinically important consequence is deterioration before physical transfer. In a five-hospital cohort of 173,168 adult floor-level boarders, 3.6% experienced early clinical deterioration, with greater risk as boarding duration lengthened [3]. This review asks four questions: What is the current evidence of

deterioration? Through which pathways does harm occur? Which patients require enhanced surveillance? What minimum rescue system can operate while hospitals address access block? The proposed BOARD framework is presented as a testable implementation model rather than a validated clinical rule.

METHODS

This narrative review was prepared in accordance with the Scale for the Assessment of Narrative Review Articles (SANRA) recommendations. PubMed was searched for English-language publications dated from 1 January 2020 through 11 July 2026. The core strategy combined setting and exposure terms ("emergency department," "emergency service, hospital," "boarding," "access block," "hallway care," and "corridor care") with outcome and safeguard terms ("clinical deterioration," "mortality," "monitoring," "reassessment," "rapid response," "early warning score," "medication reconciliation," "older adults," and "patient safety"). Focused searches addressed critical-care boarding, behavioral-health boarding, geriatric hallway care, medication continuity, and hospital-wide mitigation; reference lists of key reviews and cohorts were hand-searched.

Eligible direct evidence involved adults for whom an admission decision had been made and who remained in the ED, and reported outcomes or processes relevant to deterioration, mortality, monitoring, treatment continuity, fundamental care, or rescue. Pediatric-only studies, reports limited to ambulance off-load delay, non-indexed news or policy reports, and crowding studies without a boarding-specific analysis were excluded from the direct synthesis. Supporting evidence outside the direct boarding population was retained only when it addressed a prespecified framework domain. Systematic reviews, multicenter cohorts, and large recent observational studies were prioritized; qualitative studies, quality-improvement reports, and commentaries were used when they clarified mechanisms or implementation gaps not addressed by comparative research.

The lead author screened titles and abstracts, assessed the full text of potentially eligible reports against these criteria, and mapped each included source by design, population, exposure, outcome, principal finding, limitations, and relevant BOARD domain. The coauthors reviewed the resulting synthesis and interpretation. Selection was purposive and iterative, consistent with a narrative review; no protocol was registered, and dual independent screening or PRISMA-compatible record accounting was not performed. The final synthesis comprised the 23 publications listed in the reference section.

Evidence was appraised narratively according to directness, design, sample size, consistency,

adjustment for confounding, and applicability across health systems. Meta-analysis was not undertaken because studies used different definitions and start points for boarding, duration thresholds, populations and intended destinations, deterioration outcomes and follow-up windows, and effect measures or adjustment sets. Comparative studies of integrated rescue interventions were also too sparse for a meaningful pooled estimate. Combining these non-equivalent estimands would imply false precision; this manuscript is therefore a transparent narrative and implementation synthesis rather than a systematic review, pooled effectiveness estimate, or clinical guideline.

THE CONTEMPORARY BURDEN OF BOARDING-RELATED HARM

Boarding is best interpreted as a patient-level, time-varying exposure within the wider system state of crowding; corridor placement may add environmental risk but is not required for boarding. In a large United Kingdom analysis, each additional four hours of boarding was associated with an 8.6-hour increase in subsequent inpatient length of stay and an 8.4% increase in the adjusted odds of 30-day mortality; the reported number needed to harm for boarding beyond four hours was 69 [4]. In 160 Brazilian hospitals, boarding showed a stronger association with early in-hospital mortality than overall ED occupancy [5]. These findings support displaying boarding duration in real

time and using it for clinical and operational escalation, but not treating it as a proven causal threshold.

The risk is particularly consequential among critically ill patients. A multidisciplinary review identified delayed intensive care unit admission, treatment delay, suboptimal monitoring, and increased mortality as central hazards of critical-care boarding [6]. More recent mitigation evidence emphasizes that solutions must extend beyond the ED because the dominant determinants include inpatient bed availability, discharge processes, staffing, diagnostic turnaround, and hospital-wide demand-capacity mismatch [7]. A bedside rescue pathway is therefore necessary but cannot be the definitive solution.

Boarding also degrades the care environment. A rapid review of staff and patient experiences found recurring concerns involving privacy, dignity, communication, workload, and safety during corridor care [8]. Emergency nurses and technicians caring for older adults described difficulty providing toileting, nutrition, repositioning, delirium prevention, and routine reassessment in waiting rooms and hallways [9]. Older boarders themselves have described corridor care as disorienting, exposing, and dehumanizing [10]. National data further show that prolonged ED stays disproportionately affect older adults, who have less physiological reserve and greater vulnerability to delirium, falls, pressure injury, missed medications, and functional decline [11]. The principal recent studies and their implications for rescue-system design are summarized in Table 1.

TABLE 1 - Recent PubMed-indexed evidence relevant to clinical deterioration among ED boarders

Study	Design and Population	Principal finding	Practice interpretation and limitation
<i>Janke et al., 2025 [1]</i>	National cohort; 46.2 million US hospitalizations, 2017–2024	Boarding >4 hours became common; a measurable subgroup remained >24 hours	Make elapsed time visible and escalate prolonged exposure. Limitation: administrative data cannot define bedside mechanisms or preventability.
<i>Rizer et al., 2026 [3]</i>	Five-hospital retrospective cohort; 173,168 floor-level adult boarders	Early deterioration occurred in 3.6%; risk increased with longer boarding	Begin risk stratification and repeat reassessment at the admission decision. Limitation: retrospective design and residual confounding
<i>Howlett et al., 2026 [4]</i>	Large observational study of admitted medical patients	Each additional 4 hours was associated with longer inpatient stay and higher 30-day mortality	Use elapsed time to strengthen clinical and operational escalation, not as a causal threshold. Limitation: association may reflect severity and system strain
<i>Nicolaidis et al., 2026 [5]</i>	Multicenter cohort across 160 hospitals	Boarding showed a stronger association with early mortality than ED occupancy	Use boarding-specific safeguards even when aggregate occupancy is acceptable. Limitation: cross-system variation and residual confounding.
<i>Kim et al., 2025 [12]</i>	Clinical commentary on physiologic monitoring	Boarders may enter a monitoring gap after admission decisions	Monitoring should follow physiology and treatment needs, not location. Limitation: commentary rather than comparative outcomes research.
<i>Tran et al., 2025 [13]</i>	Tertiary ED study of emergency calls for admitted patients	Emergency calls identified boarders with prolonged ED exposure and acute rescue needs	Rapid-response capability must explicitly include ED boarders. Limitation: single-center design and local call practices
<i>Nessen et al., 2025 [9]</i>	Qualitative interviews with nurses and technicians caring for older adults	Hallway and waiting-room care compromised routine nursing care and surveillance	Include mobility, toileting, delirium, nutrition, and skin-care safeguards. Limitation: qualitative, context-dependent findings

ASSOCIATION, CAUSALITY, AND COMPETING EXPLANATIONS

Across cohorts, longer boarding is associated with worse outcomes, and the duration-response pattern is compatible with harm accumulating over time [3-5]. Qualitative and process studies identify plausible mechanisms, including surveillance gaps, delayed treatment, fragmented ownership, and environmental hazards [8-14]. Consistency and biological plausibility strengthen concern, but they do not establish that boarding itself caused the observed outcomes.

Confounding may operate at both patient and hospital levels. Greater illness severity can increase deterioration risk and simultaneously delay placement when a patient requires an ICU, isolation, telemetry, or specialty bed. Case complexity, diagnostic uncertainty, behavioral-health needs, and limited destination options may also prolong boarding. Hospital strain—including high occupancy, staffing shortages, concurrent demand, delayed diagnostics, and night or weekend presentation—can both extend boarding and reduce surveillance or treatment reliability. Administrative and electronic health record adjustment may not fully capture these factors, and time-dependent selection may persist.

Reported effect sizes should therefore not be interpreted as a causal increase per hour, a universally safe duration, or proof that shortening time alone prevents deterioration. Boarding duration is best viewed as both a plausible modifiable exposure and a marker of patient and system risk. Stronger causal inference requires prospective studies that define time zero, model duration and illness severity over time, measure hospital strain, and test structured interventions across multiple sites.

WHY BOARDED PATIENTS DETERIORATE: A FIVE-PATHWAY MODEL

Deterioration usually arises from five interacting pathways: diagnostic closure, ambiguous ownership, monitoring mismatch, treatment discontinuity, and environmental or fundamental-care failure. Each pathway maps to a responsible owner, immediate safeguard, and measurable process.

DIAGNOSTIC CLOSURE AFTER THE ADMISSION DECISION

The admission decision can falsely signal diagnostic completion even as pneumonia, heart failure, intoxication, or apparently stable bleeding evolves into sepsis, respiratory failure, withdrawal, or occult hemorrhage. Pending tests and consultant recommendations may return after handover. The care plan must retain unresolved differentials and name who will review every pending result.

AMBIGUOUS CLINICAL OWNERSHIP

Boarders often sit between ED and inpatient teams: medical responsibility may have transferred while nursing care and location remain in the ED. This ambiguity delays response to new symptoms, abnormal trends, and critical results. One accountable medical team and one bedside nurse must be explicitly identifiable at all times.

MONITORING MISMATCH

Monitoring may reflect location or device availability rather than physiology and treatment. A patient can lose monitoring despite ongoing oxygen, high-risk medication, arrhythmia risk, or active bleeding, while alarms without adequate staffing create fatigue. Monitoring should follow acuity and connect to a staffed response pathway [12].

DELAYED OR OMITTED INPATIENT CARE

Boarding may interrupt antibiotics, insulin, anticonvulsants, steroids, analgesia, fluids, nutrition, mobility, pressure care, and sleep. Pharmacist-led reconciliation has reduced medication discrepancies among behavioral-health boarders [14]. Time-critical medication and essential inpatient care must begin in the ED rather than wait for a ward bed.

ENVIRONMENTAL AND HUMAN-FACTOR HAZARDS

Corridor locations reduce privacy, examination quality, infection control, equipment access, sleep, and observation. Frail adults are especially vulnerable to delirium, falls, poor intake, and immobility, while staff divide attention between new emergencies and boarders. These pressures can conceal subtle deterioration and normalize unsafe delays. Table 2 summarizes the principal warning signs, care gaps, and immediate safeguards.

IDENTIFYING THE BOARDER AT HIGHEST RISK

Every boarded patient requires ongoing care, but surveillance intensity should reflect both the probability and consequence of deterioration. High-risk features include unstable or recently stabilized physiology, escalating oxygen needs, active bleeding, sepsis, acute coronary syndrome, stroke, metabolic emergencies, intoxication or withdrawal, recurrent hypoglycemia, high-risk intravenous therapy, and any anticipated need for intensive or intermediate care. Frailty, cognitive impairment, immunosuppression, pregnancy, limited communication, and multiple comorbidities lower the threshold for enhanced observation because deterioration may be less visible or more consequential.

TABLE 2 - Common deterioration risks and immediate safeguards

<i>Risk Domain</i>	<i>Warning signs</i>	<i>Common gap</i>	<i>Immediate safeguard</i>
<i>Respiratory</i>	Rising oxygen need; tachypnea; hypercapnia; recurrent desaturation	Monitoring does not match respiratory trajectory	Continuous oximetry when indicated; repeat examination/blood gas; respiratory or critical-care review
<i>Circulatory</i>	Hypotension; rising lactate; oliguria; active bleeding; persistent tachycardia	A single stable value obscures a worsening trend	Use trend-based triggers; reassess perfusion; activate hemorrhage or sepsis pathway
<i>Neurologic</i>	New confusion; reduced consciousness; seizure; agitation; focal deficit	Change attributed to environment, intoxication, or dementia	Check glucose; perform neurologic and medication review; activate time-critical pathway
<i>Infection</i>	Persistent fever; rigors; delayed antimicrobials; immunosuppression	Sepsis reassessment stops after admission	Record antibiotic time; reassess source/perfusion; review cultures and imaging
<i>Medication</i>	Omitted insulin, anticonvulsant, steroid, Parkinson medication, anticoagulation decision, or analgesia	Reconciliation or ED administration is incomplete	Reconcile medication; flag time-critical drugs; involve pharmacy where available
<i>Frailty/function</i>	Older age; delirium risk; falls; immobility; incontinence; poor intake	Fundamental care deferred until ward transfer	Delirium bundle; assisted toileting/mobility; nutrition/hydration; pressure care
<i>System</i>	Prolonged boarding; repeated handovers; corridor placement; unclear team	Responsibility diffuses as time passes	Visible boarding clock; named team; standardized handover; operational escalation

Risk is dynamic. A patient who was low risk at the admission decision may become high risk after a new fever, increasing pain, reduced urine output, delayed medication, abnormal laboratory result, or a prolonged stay with repeated handovers. Time itself should therefore modify the risk tier. The association between longer boarding and deterioration [3-5] supports reassessment at predefined elapsed-time thresholds rather than waiting for a dramatic event.

Early-warning scores can standardize recognition of abnormal physiology and trends, but systematic reviews show variable performance, population dependence, and important methodological limitations [15,16]. Scores are also vulnerable when observations are delayed or deterioration is non-physiological, such as delirium, medication omission, occult bleeding, or diagnostic error. A score must never veto escalation. Objective thresholds and concern expressed by a nurse, physician, patient, or family member should have equal authority to trigger review.

POPULATIONS REQUIRING A LOWER ESCALATION THRESHOLD

Critically ill boarders require the same surveillance, staffing, equipment, and specialist access as patients physically located in an intensive care unit. The label "admitted" must not delay airway management, vasoactive support, source control, or destination upgrade. When an ICU bed is unavailable, an ED-based critical-care model or direct intensivist co-management may reduce gaps, but it must be adequately staffed and governed [6].

Older adults need proactive protection from non-physiological deterioration. Delirium, falls, dehydration,

urinary retention, pain, sleep disruption, and functional decline may emerge before vital signs become abnormal. Hallway care compounds these risks by limiting orientation, toileting, mobility, and family participation [9-11]. A frailty or delirium risk flag should therefore increase observation intensity and trigger a basic-needs bundle.

Behavioral-health boarders and patients with intoxication or withdrawal may deteriorate through medication interruption, over-sedation, agitation, self-harm, or occult medical illness. Reassessment must remain medical as well as behavioral. Medication reconciliation, glucose testing, withdrawal surveillance, safe observation, and renewed diagnostic review are essential when the clinical course changes [14].

THE PROPOSED BOARD RESCUE SYSTEM

The BOARD framework is a minimum safety architecture for admitted adults who remain in the ED. It does not normalize boarding, replace local rapid-response or critical-care protocols, or substitute for hospital-wide flow reform. Its purpose is to make bedside responsibilities explicit during a period in which accountability is otherwise easily diluted. Each component is operational: it can be assigned to an owner, linked to a trigger, and audited. The integrated framework has not yet been prospectively validated.

B – Begin the boarding clock and dynamic risk stratification

The boarding clock starts at the documented admission decision, not at an arbitrary later administrative step. The electronic tracking system should display

elapsed time, intended destination, current location, and risk tier. At time zero, the responsible clinician should document the working diagnosis, unresolved differential diagnoses, physiological risks, pending tests, time-critical medications and treatments, escalation limits, and expected destination. Risk should be updated after any meaningful change and at locally defined elapsed-time thresholds. The Quality at Risk instrument illustrates growing interest in structured prioritization of boarding-related threats [17].

O – One accountable clinical team

A named team must retain responsibility throughout boarding. Acceptable local models include the admitting service, a dedicated hospitalist or boarding team, or a formally governed shared-care model; ambiguity is unsafe. The accountable clinician must be reachable, review critical results, respond to deterioration, and provide scheduled reassessment. Nursing ownership must also be explicit, with workload and ratios based on acuity rather than assuming admitted patients are low demand. Closed-loop acceptance is required at every shift, service, and location handover. Structured documentation initiatives show that explicit reassessment records are feasible [18].

A – Acuity-matched observation and reassessment

Observation should be based on physiology, treatment, and trajectory. Patients requiring continuous electrocardiography or pulse oximetry should retain it regardless of ED location. Vital signs, mental status, pain, urine output, oxygen requirement, and treatment response should be trended rather than documented as isolated values. A complete clinician reassessment should occur after a meaningful change and at scheduled intervals. The exact interval must follow local policy and staffing; Table 3 provides a pragmatic

starting point rather than a validated standard.

R – Rescue triggers and immediate rapid-response access

Boarders must have access to the same rescue capability available on inpatient wards. Triggers should include severe abnormal vital signs, a worsening early-warning score, new oxygen need, altered mental status, recurrent hypoglycemia, active bleeding, oliguria, delayed critical treatment, an unexpected diagnostic result, or any staff, patient, or family concern. The response must include immediate bedside assessment, stabilization, diagnostic reopening, senior decision-making, and transfer to an appropriate monitored or critical-care location. Ward-based evidence supports early-warning-score-linked rapid-response systems, but direct validation in ED boarders remains limited [19].

D – Deliver essential inpatient care, dignity, and flow escalation

Medication administration, nutrition, hydration, analgesia, venous-thromboembolism assessment, glycemic management, mobility, toileting, pressure-injury prevention, delirium prevention, sleep, communication, and goals-of-care review should begin during boarding. Hallway placement should never imply a reduced standard. The rescue system must also connect to hospital-wide escalation, including discharge acceleration, flexible staffing, clinically governed surge areas, senior bed management, elective-capacity decisions, and executive review of prolonged boarders. Boarding restriction and corridor-reduction initiatives have improved occupancy or reduced prolonged corridor care in individual systems [20,21], while hospitalist-led commentary emphasizes cross-departmental alignment [22]. Table 3 translates BOARD into minimum standards, triggers, actions, and measures; Figure 1 presents the pathway visually.

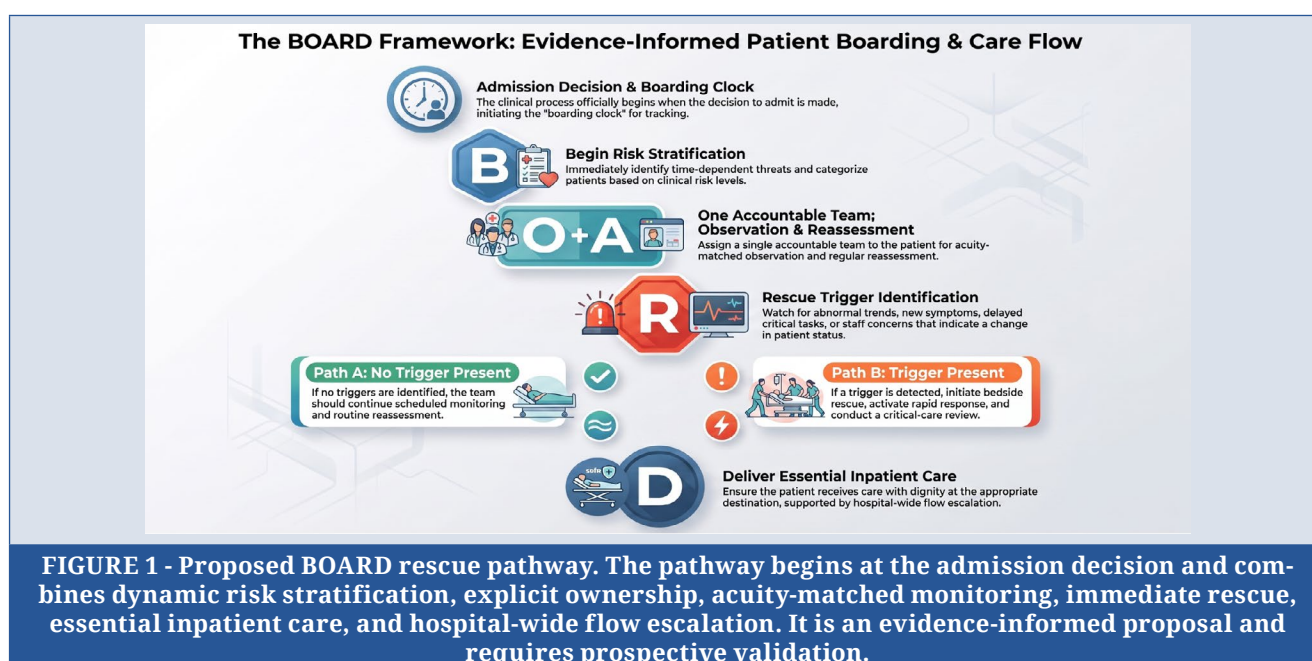


TABLE 3 - BOARD framework: minimum standards and measures

BOARD Step	Minimum standard	Trigger	Action	Metric
B - Begin	Show admission-decision time; record risk tier, unresolved differential, pending tests, and time-critical tasks	Admission decision; risk change; elapsed-time threshold	Update risk tier and care plan; escalate flow priority	% with visible start time and completed risk assessment
O - One team	Name the accountable medical team and bedside nurse; use a standardized handover	Shift, service, or location handover	Closed-loop transfer with explicit acceptance	% with named team; missed-result rate
A - Acuity	Match observations, monitoring, and clinician review to physiology, treatment, and trajectory	Abnormal trend; new symptom; treatment change; prolonged stay	Reassess; increase monitoring or upgrade destination as needed	Observation/reassessment compliance; unplanned ICU transfer
R - Rescue	Include boarders in the rapid-response system; concern alone may activate review	Severe abnormal physiology; rising score; critical delay; any concern	Stabilize; reopen diagnosis; obtain senior/critical-care review; upgrade destination	Response time; arrest; deterioration-to-ICU interval
D - Deliver	Provide time-critical medication, inpatient essentials, dignity, and communication	Medication omission; poor intake; immobility; delirium; prolonged corridor care	Correct gap; mobilize nursing, pharmacy, or allied health; escalate flow	Medication omission; falls/delirium; pressure injury; corridor hours

SUGGESTED MONITORING AND REASSESSMENT TIERS

The following tiers are intended as an adaptable operational example. They are not evidence-validated intervals and should not override national standards, local policies, or clinician judgement. **Table 4** presents an example risk-based monitoring and reassessment structure for local adaptation.

IMPLEMENTATION: FROM POLICY TO RELIABLE PRACTICE

Implementation should begin with a local failure analysis rather than importing a generic protocol. Hospitals should map when boarding starts, who receives abnormal results, how medications are released and administered, which patients retain monitoring, how rapid-response calls are activated in temporary spaces, and what happens when no staffed destination exists. Frontline nurses, ED clinicians, hospitalists, critical-care clinicians, pharmacists, bed managers, information-technology teams, and patient representatives should co-design the pathway.

A minimum electronic boarding record should display seven items: admission-decision time, current location, intended destination, risk tier, accountable team, last complete observations and reassessment, and unresolved tasks or pending results. Useful automation includes overdue-observation alerts, time-critical medication alerts, a prominent escalation function, and automatic operational notification for extreme duration or high-risk hallway placement. Documentation must be concise enough to remain

usable during crowding [17,18].

Training should use deterioration scenarios outside traditional resuscitation rooms: escalating oxygen need in a corridor, delirium and a fall, recurrent hypoglycemia, delayed anticonvulsant therapy, occult bleeding, or a critical result returned after handover. Simulation should test not only clinical management but whether staff can identify the accountable team, access equipment, summon assistance, and obtain an appropriate destination.

Implementation can proceed in phases: first establish the boarding clock, ownership, handover, and rescue access; then introduce risk tiers, medication continuity, and a fundamental-care bundle; next integrate electronic alerts and dashboards; and finally link bedside triggers to hospital-wide capacity actions. Each phase should be tested with small-cycle improvement before scale-up.

Measurement must balance outcomes, processes, and unintended consequences. Cardiac arrest, unplanned intensive care transfer, mortality, and time from deterioration to definitive care are important but may be uncommon and case-mix dependent. More sensitive process measures include risk-assessment completion, observation timeliness, medication omissions, pending-result review, and documented ownership. Balancing measures should assess alarm burden, duplicated work, nurse workload, and whether enhanced boarder surveillance delays care for new arrivals. Boarding can lengthen ED stay even for patients who are not personally boarding, reinforcing the need for department-wide and hospital-wide evaluation [23]. A practical set of outcome, process, balancing, and equity measures is provided in **Table 5**.

TABLE 4 - Example risk-based monitoring and reassessment tiers for adult ED boarders

<i>Tier</i>	<i>Illustrative criteria</i>	<i>Monitoring and nursing reassessment</i>	<i>Clinician reassessment / destination</i>
High risk	Unstable or recently stabilized physiology; rising oxygen; active bleeding; severe sepsis; altered consciousness; high-risk infusion; anticipated ICU/intermediate care	Continuous monitoring when indicated; frequent observations according to critical-care protocol; direct visibility whenever possible	Immediate senior review; critical-care involvement; prioritize transfer to resuscitation, monitored unit, or ICU
Moderate risk	Persistent abnormal trends; oxygen therapy; frailty/delirium risk; complex comorbidity; repeated parenteral treatment; diagnostic uncertainty	At least every 1-2 hours as locally feasible, plus targeted measures such as urine output, glucose, pain, or neurologic checks	Scheduled review at least every 4 hours and after any change; upgrade promptly if trajectory worsens
Standard Risk	Physiologically stable, predictable treatment plan, no high-risk therapy, reliable communication	At least every 4 hours or per local inpatient standard; basic-needs and medication checks	Review at least every 8 hours, after new results, and at every handover; reassess tier as boarding time accumulates

TABLE 5 - Recommended measurement framework for BOARD implementation

<i>Domain</i>	<i>Example measures</i>	<i>Interpretive notes</i>
Clinical outcomes	Cardiac arrest; rapid-response activation; unplanned ICU transfer; mortality; deterioration-to-definitive-care interval	Risk-adjust and report by duration, location, and intended level of care
Process reliability	Risk tier completed; named owner; observations and clinician review on time; pending results reviewed; critical medication administered	Use run charts and stratify by shift, service, hallway location, and boarding duration
Fundamental care	Falls; delirium; pressure injury; missed meals; toileting delay; pain reassessment; medication omission	Include older adults, disability, and limited-language groups as predefined equity strata
Operational exposure	Median and 90th-percentile boarding time; hallway hours; ICU-boarder hours; number of handovers	Treat duration as a time-varying exposure, not only a binary >4-hour measure
Patient/staff experience	Privacy; communication; perceived safety; workload; moral distress; alarm burden	Use brief repeated measures and qualitative feedback to identify unintended harm

PROSPECTIVE VALIDATION ROADMAP

The BOARD framework should be validated as a care bundle rather than as a prediction score. A multicenter feasibility phase should first define the non-negotiable core of each component, permit limited local adaptation, and establish baseline event rates, fidelity, acceptability, and data completeness. Consecutive adults should be followed from the admission decision until ED departure, with results stratified by intended level of care, location, frailty, and boarding duration.

A subsequent stepped-wedge cluster-randomized or cluster-controlled pragmatic trial across EDs would reduce contamination between individual patients. Primary implementation endpoints could include timely risk assessment, named ownership, observation and reassessment reliability, time-critical medication delivery, and time from a rescue trigger to bedside review or definitive monitored care. Clinical endpoints should include cardiac arrest, unplanned ICU transfer, delirium or falls, mortality, and length of stay; balancing measures should include alarm burden, duplicated work, staff workload, and delays for new arrivals.

Analyses should adjust for case mix and hospital strain and model boarding duration and illness severity over time rather than as fixed binary variables.

Validation should include a process evaluation of adherence, mechanisms, and local adaptation, together with prespecified equity analyses by age, disability, language, behavioral-health status, and corridor versus standard-bay location. Sustained benefit should be reassessed after implementation support is withdrawn.

PRACTICAL BARRIERS TO IMPLEMENTATION

Implementation faces predictable barriers: inadequate staffing or monitored space, disputed ownership between services, electronic record integration costs, alert fatigue, equipment and privacy limitations in corridors, variable local policies, and additional documentation burden. A rescue bundle could also unintentionally legitimize prolonged boarding. These barriers favor a small non-negotiable core, co-designed workflows, phased pilots, minimal data entry, human-factors testing of alerts, explicit executive governance, and predefined escalation

when the required standard cannot be met. Resource use and equity should be reported so implementation does not preferentially protect patients already located in monitored bays.

HOSPITAL-WIDE PREVENTION REMAINS THE DEFINITIVE INTERVENTION

A rescue system may reduce preventable harm but cannot make prolonged boarding acceptable. The definitive intervention is timely movement to the correct care environment. Earlier discharge planning, discharge lounges, smoothing elective admissions, extended diagnostic and pharmacy services, improved bed turnaround, flexible staffed surge capacity, and senior review of avoidable inpatient days may reduce access block. Strategies must be judged by whether they create staffed, monitored, clinically governed capacity; moving patients to an unstaffed ward corridor merely relocates risk.

Governance should therefore place boarding on the hospital safety dashboard, not solely the ED performance dashboard. Senior operational leaders should receive real-time notification of extreme boarding duration, ICU boarders, high-risk hallway patients, and deterioration events. Every serious event during boarding should undergo multidisciplinary review that asks both “Was deterioration recognized and rescued?” and “Why was this patient still in the ED?”

RESEARCH PRIORITIES

Beyond bundle validation, research should refine dynamic risk models that combine physiology, treatment intensity, frailty, unresolved diagnosis, location, elapsed time, and hospital strain; compare fixed with risk-based reassessment; evaluate continuous or wearable monitoring; and test alternative ownership models. Studies should report boarding as a time-varying exposure and distinguish floor-level, intermediate-care, and intensive-care boarders.

Patient-centered outcomes require greater attention, including delirium, functional decline, sleep, privacy, pain, medication continuity, communication, and trust. Equity analyses should examine whether rescue systems preferentially protect patients in monitored spaces while leaving older adults, people with disability, behavioral-health patients, and those with limited language proficiency less visible.

Economic and implementation studies should determine whether improved recognition and rescue change downstream ICU use, length of stay, mortality, cost, staff workload, and sustainability.

LIMITATIONS

This review was designed as a clinically usable narrative synthesis rather than a systematic review. It used a targeted PubMed search restricted to English-language publications; selection was led by one reviewer, no protocol was registered, and dual independent screening, PRISMA-compatible record accounting, and formal study-level risk-of-bias tools were not used. Relevant studies in other databases or languages may therefore have been missed, and purposive inclusion of complementary evidence introduces selection and publication bias.

Definitions of boarding, exposure start times, care locations, outcomes, and health-system contexts were too heterogeneous for a defensible pooled estimate. Most direct studies were observational; illness severity, case complexity, destination constraints, time of presentation, and hospital strain may confound reported associations. Evidence for individual components—monitoring, medication reconciliation, fundamental care, rapid response, and flow mitigation—is stronger than evidence for an integrated bundle. BOARD is therefore a structured, testable synthesis, not a validated prediction tool, clinical guideline, or universal staffing standard.

CONCLUSION

Emergency department boarding creates a predictable interval of clinical vulnerability. Recent observational evidence consistently associates longer boarding with greater deterioration risk, but it does not prove an independent causal effect. The safest response remains dual: eliminate avoidable boarding through hospital-wide flow reform, and protect patients who remain in the ED through explicit ownership, dynamic risk stratification, acuity-matched monitoring, uninterrupted treatment, fundamental nursing care, and immediate rescue access. The BOARD framework specifies when risk begins, who owns the patient, how observation is matched to need, what triggers rescue, and which inpatient essentials cannot wait. Prospective multicenter evaluation is required before it can be considered a definitive standard.

KEYWORDS

EMERGENCY DEPARTMENT; BOARDING; ACCESS BLOCK; CLINICAL DETERIORATION; HALLWAY CARE; RAPID RESPONSE SYSTEM; PATIENT SAFETY

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AUTHOR CONTRIBUTIONS

Mohammed Alkhanafsa conceived the review, designed the manuscript, performed the literature search, synthesized the evidence, and drafted the manuscript. Jamil Wafi and Soud Deek critically reviewed the manuscript for important intellectual content and contributed to manuscript revision. All authors read and approved the final manuscript.

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DECLARATIONS

CONFLICTS OF INTERESTS

The Authors declare that there is no conflict of interest.

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REGISTRATION

No registration applicable.

DATA AVAILABILITY STATEMENT

No new datasets were generated or analyzed during the preparation of this review. Data sharing is therefore not applicable.

ETHICAL APPROVAL

Ethical approval for this study was not required.

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