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Enhancing Patient Safety and Continuity across the Emergency-to-Rehabilitation Continuum: Collaborative Roles of Paramedics, General Nursing, Radiology, Medical Secretaries, Epidemiology, and Physical Therapy/Rehabilitation.

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Abstract

Patient safety risks cluster at the transitions between care settings, yet the disciplines that manage those transitions are rarely studied together. This narrative review synthesises literature published between 2017 and 2025 on how paramedics, general nurses, radiology professionals, medical secretaries, epidemiologists, and physical therapists/rehabilitation specialists contribute to safe, continuous care from the emergency scene to rehabilitation. Evidence indicates that structured handover, closed-loop communication of diagnostic results, accurate and timely information management, surveillance-informed feedback, and early, goal-directed rehabilitation each reduce preventable harm, but benefits depend on how well roles interlock rather than on any single discipline. We propose an integrated framework, a role-by-stage matrix, and a failure-point analysis, and we identify gaps, notably the scarce evidence on medical secretaries and on shared outcome measures. Practical implications for interprofessional protocols, training, and data governance are outlined.

Keywords: patient safety; continuity of care; interprofessional collaboration; emergency care; rehabilitation.

Introduction

Patient harm remains one of the largest preventable burdens on health systems. A systematic review and meta-analysis estimated that about 6% of patients experience preventable harm across care settings, and roughly one in eight of those events is severe or fatal (Panagioti et al., 2019). The financial consequences are also considerable: harm has been estimated to account for up to 15% of hospital expenditure and activity in high-income countries (Slawomirski et al., 2017). More than two decades after the landmark report *To Err Is Human*, progress has been uneven, and priorities have shifted towards diagnostic safety, ambulatory and transitional care, and the systematic use of data to detect harm (Bates & Singh, 2018). The World Health Organization's Global Patient Safety Action Plan 2021–2030 reflects this shift by calling for safety to be designed into every point of care, including the transitions between services (World Health Organization [WHO], 2021).

Transitions are where safety is most fragile. A patient with major trauma, stroke, sepsis, or hip fracture may pass through the hands of paramedics, emergency and ward nurses, radiographers and radiologists, administrative staff, infection prevention and public health teams, and physical therapists within days. Each discipline holds a fragment of the patient's story, and each depends on the others to complete it. Information that is lost, delayed, or distorted at any interface can propagate downstream as a missed diagnosis, a duplicated test, a hospital-acquired infection, a fall, or a failed rehabilitation plan. Yet the literature is organised mostly by profession or by setting, so the cumulative nature of risk along the whole pathway is seldom examined.

This review addresses that gap. It focuses on six disciplines that together span the emergency-to-rehabilitation continuum: paramedics, general nursing, radiology, medical secretaries, epidemiology, and physical therapy/rehabilitation. The first three are conventionally visible in acute pathways. Medical

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secretaries are largely invisible in safety research despite controlling appointments, documentation, and communication flows. Epidemiology supplies the surveillance and feedback functions that allow systems to learn, and rehabilitation determines whether survival translates into function. Interprofessional collaboration is associated with improved processes and some outcomes, although the evidence is heterogeneous (Reeves, 2018), and teamwork quality is positively associated with performance in healthcare teams (Schmutz et al., 2019). The guiding question is therefore how these six roles can be coordinated so that safety and continuity are maintained from first contact to the later stages of recovery.

The review makes three contributions. First, it brings together prehospital, hospital, imaging, administrative, public health, and rehabilitation literatures that are rarely read together. Second, it proposes a continuum framework, a role-by-stage matrix, and a map of recurrent failure points. Third, it identifies priorities for practice, education, and research, including shared metrics and information governance. Because safety emerges from interactions rather than from isolated actions, the review adopts a systems perspective consistent with work on complexity and implementation science (Braithwaite et al., 2018).

2. Review Approach

This is a narrative review. That design was chosen because the aim was interpretive synthesis across six disciplines whose studies differ in design, outcome measures, and setting, which makes statistical pooling inappropriate. The scope covered the pathway from first emergency contact through prehospital care, the emergency department, inpatient and diagnostic services, discharge, and rehabilitation.

Sources were purposively selected rather than retrieved through a registered search protocol. Priority was given to systematic reviews, meta-analyses, clinical practice guidelines, international policy documents, and large cohort or trial evidence published between 2017 and 2025 in English. Items were included when they addressed safety, communication, diagnostic accuracy, infection control, mobilisation, or continuity of care within at least one of the six disciplines, or when they described cross-disciplinary teamwork and information flow. Where evidence on a discipline was thin, adjacent evidence was used and its indirect nature is stated in the text.

Findings were organised in three steps. Evidence was first grouped by discipline, then mapped to the stage of the pathway at which each discipline exerts most influence, and finally compared across disciplines to identify recurring mechanisms such as structured handover, closed-loop communication, and feedback. No formal risk-of-bias appraisal was applied, so conclusions are presented as an interpretive synthesis rather than as graded recommendations. The consequences of this choice are discussed in the limitations.

3. Conceptual Framework: A Safety Continuum with Six Interlocking Roles

The framework used in this review treats the patient pathway as five consecutive stages: prehospital care, emergency department assessment, inpatient and diagnostic care, discharge and transition, and rehabilitation and community follow-up. Safety is not located in any one stage. It is the product of how well the output of one stage becomes the input of the next, which is why the framework gives equal attention to the interfaces between stages and to the stages themselves.

The six disciplines map onto this pathway with different weights. Paramedics dominate the first stage but also initiate the information record on which later teams rely. General nurses provide the only continuous presence across the emergency department, ward, and discharge stages. Radiology contributes at the diagnostic core of the emergency and inpatient stages and again when follow-up imaging is needed. Medical secretaries sit at the interfaces, handling registration, documentation, referrals, appointments, and the circulation of reports. Epidemiology works above the individual patient, converting aggregated data into surveillance signals and system-level learning. Physical therapy and rehabilitation begin earlier than is often assumed, in the acute stage, and carry responsibility for functional recovery in the final stage.

Two principles follow from this arrangement. The first is that each discipline should be understood both as a provider of direct care and as a producer and consumer of information. The second is that safety depends on closed loops: a message, a result, or a recommendation is complete only when its receipt and action are confirmed. Teamwork research supports the view that effective coordination, shared mental models, and communication are the mechanisms through which individual competence becomes safe team performance (Rosen et al., 2018). Figure 1 summarises the framework.

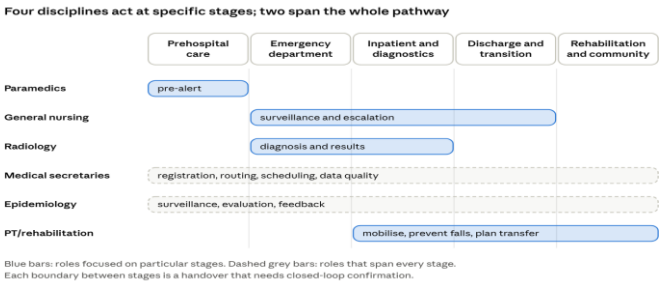


Figure 1. Conceptual framework of the emergency-to-rehabilitation continuum, showing the stages of the pathway and the disciplines active at each.

4. Paramedics: Prehospital Care and the First Handover

Paramedics make the earliest clinical judgments in the pathway and create the first record of the patient's condition, mechanism of injury, treatments given, and time course. Their safety contribution has three components: recognition of time-critical conditions, adherence to protocols, and handover.

Recognition and pre-notification matter most where minutes translate into outcome. For acute ischaemic stroke, current guidelines emphasise rapid prehospital recognition, severity assessment, and advance notification of the receiving hospital so that imaging and treatment teams are ready on arrival (Powers et al., 2019). For sepsis, the Surviving Sepsis Campaign recommends that hospitals and health systems implement screening and performance-improvement programmes (Evans et al., 2021), which implies that prehospital observations and early warning information should be carried into the emergency department rather than collected again. In both conditions the paramedic's contribution is less the treatment delivered than the information transferred ahead of the patient.

Protocol adherence is the second component. A systematic review of implementation strategies in emergency care found that approaches such as education, reminders, and audit with feedback can improve adherence to guidelines and protocols, although the quality of evidence was modest and effects varied by context (Ebben et al., 2018). The scope of paramedic practice is also widening. A systematic review of paramedics in primary and urgent care suggested that paramedic-led assessment can be safe and may reduce unnecessary conveyance to hospital, while noting that the evidence was heterogeneous and limited (Eaton et al., 2020). Expanded roles heighten the importance of decision support, supervision, and clear referral pathways, because a safe decision not to convey depends on follow-up that someone has to arrange and communicate.

Handover is the third and most fragile component. It occurs in a noisy, time-pressured setting, often while the receiving department is crowded. Emergency department crowding is associated with delays, longer stays, and worse outcomes, and its causes lie in access block and downstream capacity as well as in the number of arrivals (Morley et al., 2018). Paramedics may therefore wait with patients in corridors and hand over to staff who cannot give them full attention. Structured tools can reduce this risk. A systematic review of the SBAR communication tool concluded that it was associated with improvements in patient safety outcomes, although most studies used uncontrolled before-and-after designs (Müller et al., 2018). Teaching programmes built around ISBAR, which adds an identification step to SBAR, have been described as a practical way to standardise how clinicians structure handover (Burgess et al., 2020).

Handover should be read as a two-way process. The receiving team needs concise, ordered, verified information, and the paramedic needs confirmation that the information has been received. Where electronic patient care records can be viewed by the receiving department, the verbal handover can concentrate on priorities rather than on reconstructing the story. A further gap concerns the return of information to paramedics: outcome feedback on diagnoses and subsequent course is often limited, even though it is a principal route by which prehospital clinicians refine their recognition of time-critical conditions. Building it in would link the paramedic role to the epidemiological feedback loops described later in this review.

5. General Nursing: Continuity at the Bedside and at Discharge

General nurses are the only profession present at every stage from the emergency department to discharge. They triage, monitor, administer medicines, coordinate with other disciplines, educate patients, and prepare transitions. Because of this breadth, nursing capacity and wellbeing function as system-level safety variables.

Staffing and skill mix provide the clearest evidence. A cross-sectional study of European hospitals found that a richer nurse skill mix, meaning a higher proportion of professional nurses among nursing staff, was associated with lower mortality and better patient ratings of care (Aiken et al., 2017). A retrospective longitudinal cohort study in English hospitals similarly linked lower registered nurse staffing, and the substitution of nursing assistants for registered nurses, to higher hospital mortality (Griffiths et al., 2019). These studies are observational and cannot prove causation, but they consistently indicate that the capacity to observe, recognise deterioration, and escalate depends on adequate numbers of appropriately qualified staff.

Workload and wellbeing are linked to safety through burnout. A meta-analysis found that professional burnout among healthcare workers was associated with poorer quality and safety (Salyers et al., 2017). In the emergency department, crowding intensifies these pressures. Reviews describe how boarding of admitted patients, limited inpatient capacity, and high demand produce delays, patient dissatisfaction, and avoidable harm (Morley et al., 2018; Sartini et al., 2022). Nurses working in this environment carry out tasks that are invisible in outcome statistics but critical to safety, including reassessing waiting patients, noticing changes in condition, and negotiating priorities with colleagues.

Nursing also anchors communication. Within the emergency department, nurses receive the paramedic handover, and on the ward they receive the emergency

team's. Structured communication tools such as SBAR can strengthen these exchanges (Müller et al., 2018), but tools work only when embedded in routines and supported by culture. The same nurses later pass information to radiology (requests and patient preparation), to secretaries (bed status, transfer and discharge details), and to physical therapists (mobility status, pressure injury risk, and the patient's baseline function). Each exchange is a potential point of loss; each is also an opportunity for a closed loop.

Discharge is the final nursing-led transition and one of the most studied. A systematic review of information transfer at hospital discharge identified recurring problems with the timeliness and completeness of information passed to community clinicians (Kattel et al., 2020). A systematic review and meta-analysis of interventions to improve communication at discharge examined their relationship with readmission and noted considerable variation in intervention content and results (Becker et al., 2021). Taken together, these findings suggest that nursing contributions to discharge are most useful when they combine clear patient-facing teaching with a timely, structured summary to the next provider and a defined route for questions.

Within the continuum, general nursing therefore contributes three safety functions: surveillance, translation of information between disciplines, and preparation of the patient and the next service for transition. The first requires staffing and workload control, the second requires standard formats and shared records, and the third requires time and administrative support, which links nursing directly to the role of the medical secretary.

6. Radiology: Diagnostic Safety and Closed-Loop Results Communication

Imaging sits at the diagnostic core of emergency care, and its safety depends on two linked processes: accurate interpretation and reliable communication of what has been found. Diagnostic error is a major source of harm. Analyses of the "Big Three" categories of vascular events, infections, and cancers indicate that these conditions account for a substantial share of serious misdiagnosis-related harm (Newman-Toker et al., 2021), and imaging is central to the diagnosis of all three.

Radiological error has been studied for decades, and the recent literature is consistent in its message. Discrepancies between reports and later findings occur in a small but non-trivial proportion of examinations in daily practice, and most arise from perceptual and cognitive factors rather than from lack of knowledge (Brady, 2017). A review of interpretive error classified these causes into perceptual errors, in which an abnormality is not seen, and cognitive errors, in which it is seen but misinterpreted, and described contributors such as satisfaction of search and faulty reasoning under time pressure (Waite et al., 2017). The implication is that safety depends on conditions of work as much as on individual skill. Alexander et al. (2022) argued for limits on workload, duty hours, and reporting speed in radiology, because pressure to read more studies faster increases the opportunity for error.

Learning systems form the second pillar. Peer feedback and structured learning programmes have been proposed as a constructive alternative to punitive peer review, giving radiologists information about their discrepancies and a route to improve (Larson et al., 2017). These programmes depend on the availability of outcome data, which in turn depend on the work of epidemiologists and secretaries who link imaging with later diagnoses and follow-up.

The third pillar is the safe participation of radiographers and other imaging staff. A joint paper of the European Society of Radiology and the European Federation of Radiographer Societies set out a patient safety agenda covering correct patient identification, appropriate justification of examinations, radiation protection, medication safety for contrast media, and a culture in which incidents are reported and discussed (European Society of Radiology & European Federation of Radiographer Societies, 2019). These tasks are performed before the radiologist ever sees an image, and each depends on accurate requests from nurses and clinicians, which links radiology back to the earlier stages of the pathway.

Communication of results is the interface at which many imaging errors become patient harm. A correct report that fails to reach the responsible clinician, or whose recommendation for follow-up imaging is never actioned, is functionally equivalent to a missed diagnosis. Closed-loop communication therefore requires that critical and unexpected findings are communicated directly, that receipt is acknowledged, and that follow-up recommendations are tracked to completion. Medical secretaries and administrative staff frequently manage these steps, as discussed below.

Artificial intelligence offers a possible supplement. A recent review of AI in medical image interpretation described considerable potential for triage and decision support, together with the need for rigorous validation, monitoring in clinical use, and attention to how clinicians interact with algorithmic output (Rajpurkar & Lungren, 2023). For emergency pathways, the safest framing is that AI may help prioritise worklists and flag urgent findings, while accountability for the final report and for communication remains with the radiology team. In summary, radiology contributes to safety along the continuum through accurate and justified imaging, reliable reporting under manageable workloads, learning from discrepancies, and closed-loop communication of findings.

7. Medical Secretaries: Information Stewardship at the Interfaces

Medical secretaries, ward clerks, and administrative coordinators are the least studied of the six disciplines

in the safety literature, yet their work touches every transition. They register patients and verify identity, assemble and route documentation, schedule imaging and rehabilitation, send referrals and discharge summaries, manage appointments, and act as the contact point for patients and families. A patient who is correctly diagnosed and treated can still be harmed when a report is filed to the wrong record, an appointment is lost, or a referral is never sent. The direct evidence on secretarial roles is limited, so this section relies on related evidence about clerical and documentation work and states clearly where inferences are being drawn.

Documentation burden is the best-documented issue. Time-and-motion and event-log data from primary care showed that physicians spent about half of their working day on electronic health record tasks (Arndt et al., 2017). Documentation that consumes clinicians' time reduces the time available for patients and increases the likelihood of rushed or incomplete entries. A randomised trial of medical scribes found improvements in charting efficiency and physician satisfaction (Gidwani et al., 2017). Although scribes are not identical to medical secretaries, the findings support a broader principle: delegating suitable documentation and coordination work to trained administrative staff can free clinical time and improve the quality of records.

Information transfer is the second area of influence. Problems with the timeliness and completeness of discharge information are well described (Kattel et al., 2020), and interventions to improve communication at discharge have varied in effect (Becker et al., 2021). Secretaries often control the mechanics that determine whether these interventions work, such as whether a summary is dispatched on the day of discharge, to the correct recipient, in an agreed format. They also manage follow-up appointments, which is where the continuity from hospital to rehabilitation and community care is made real.

Third, secretaries contribute to data quality. Electronic health records can support population health management and surveillance when data are accurate, standardised, and complete (Kruse et al., 2018). Registration errors, duplicate records, and inconsistent coding undermine these uses and create silent safety risks, for instance when a patient's infection status or allergy is not visible to the next team. Secretaries who are trained in data standards and who have a clear route to correct errors act as stewards of the information on which epidemiology, radiology, and nursing all depend.

Because the evidence base is thin, four recommendations are offered as hypotheses for implementation and research rather than as established findings. First, secretarial tasks that affect safety, such as result routing and discharge dispatch, should be defined as explicit steps in pathways, with named owners. Second, secretaries should receive training in patient identification, confidentiality, and escalation of concerns. Third, they should be included in incident review and quality meetings. Fourth, studies should measure the safety effect of administrative interventions such as result-tracking worklists and appointment reminders. Recognising this workforce as part of the safety system is a low-cost way to strengthen continuity.

8. Epidemiology: Surveillance, Infection Prevention, and System Learning

Epidemiology contributes to the continuum at the level of populations rather than individuals. Its safety functions are to detect patterns of harm, quantify risk, evaluate interventions, and return the findings to frontline teams. Without this function, each discipline sees only its own cases and the system cannot learn.

Surveillance is the core method. Public health surveillance systems have advanced through electronic data sources, automated detection, and more systematic evaluation, although timeliness, data quality, and integration across sources remain challenges (Groseclose & Buckeridge, 2017). In hospital settings, surveillance is closely tied to infection prevention, because healthcare-associated infections are among the most common adverse events. Two European point prevalence surveys conducted in 2016 and 2017 estimated the prevalence of patients with at least one healthcare-associated infection in acute care hospitals at about 5.5% (Suetens et al., 2018). Overviews describe how these infections arise across care settings from invasive devices, procedures, and transmission between patients and staff, and how prevention depends on hand hygiene, device management, environmental cleaning, and antimicrobial stewardship (Haque et al., 2018).

Antimicrobial resistance magnifies the stakes. Modelling for the European Union and European Economic Area estimated roughly 33,000 deaths in 2015 attributable to infections with antibiotic-resistant bacteria (Cassini et al., 2019). Global analysis estimated that bacterial antimicrobial resistance was directly responsible for 1.27 million deaths in 2019 and associated with 4.95 million (Murray et al., 2022). For a patient moving from the scene of an emergency to a ward and then to a rehabilitation unit, resistant organisms travel with the patient, which makes the timely communication of colonisation and infection status across settings a continuity issue as well as an infection control issue.

Epidemiology also connects the disciplines through shared data. Linkage of prehospital records, emergency department data, imaging reports, inpatient records, and rehabilitation outcomes allows the system to answer questions that no single team can answer. Examples include whether prehospital pre-notification shortens time to treatment, whether discrepancies in

imaging reports are associated with later harm, and which patients are at highest risk of falls or readmission after discharge. Electronic health records can support these analyses when data are well structured (Kruse et al., 2018), which again places weight on the data stewardship role of medical secretaries and on common coding.

A closed learning loop requires four elements: defined indicators agreed across disciplines, reliable data capture, analysis with appropriate adjustment for case mix, and timely feedback in a form that frontline teams can act on. Epidemiologists should also advise on evaluation design, because many safety interventions are introduced without a comparison group and their effects are overestimated or unclear. Complexity-informed approaches to implementation emphasise that interventions interact with local context and that monitoring and adaptation are necessary parts of change (Braithwaite et al., 2018). Epidemiology is therefore best viewed as the learning engine of the continuum, converting the experience of thousands of transitions into improvements for the next patient.

9. Physical Therapy and Rehabilitation: From Early Mobilisation to Community Reintegration

Rehabilitation is often seen as the end of the pathway, but its safety and continuity contributions begin in the acute phase. The scale of need is large. The Global Burden of Disease analysis estimated that about 2.41 billion people worldwide were living with a health condition that would benefit from rehabilitation in 2019 (Cieza et al., 2020). The World Health Organization's Rehabilitation 2030 initiative called for rehabilitation to be integrated into health systems and delivered across the care pathway, from acute services to the community (Gimigliano & Negrini, 2017).

Early mobilisation is the clearest acute-phase contribution. In intensive care, strategies to optimise early mobilisation and rehabilitation include assessing safety criteria, setting daily goals, engaging interprofessional teams, and addressing barriers such as sedation and equipment (Hodgson et al., 2021). After surgery, enhanced recovery pathways include early mobilisation as one of several elements associated with fewer complications and shorter recovery (Ljungqvist et al., 2017). In neurological conditions, the timing of rehabilitation is increasingly defined. The Stroke Recovery and Rehabilitation Roundtable proposed agreed time-based phases of recovery, from hyperacute through chronic, to standardise how timing is reported and studied (Bernhardt et al., 2017). Such definitions help teams coordinate when therapy should begin, intensify, and transfer to the next setting.

Physical therapists also protect against secondary harm. Falls are a leading hazard in hospital and community. International guidelines for older adults recommend a multidomain approach with risk stratification, exercise, and attention to medications and environment (Montero-Odasso et al., 2022). A Cochrane review concluded that exercise reduces the rate of falls among older people living in the community by about 23% (Sherrington et al., 2019). Physical therapists assess balance, strength, and mobility; recommend safe transfer and walking plans; and advise nursing staff on handling and aids. Those recommendations need to be communicated at the bedside and recorded in a way that every shift can follow, or the benefit is lost.

Transition to rehabilitation is itself a vulnerable interface. Receiving therapists need to know the diagnosis, precautions, weight-bearing status, cognitive state, baseline function, and goals; community services need to know what has been achieved and what remains. The evidence on discharge communication (Becker et al., 2021; Kattel et al., 2020) applies directly: complete, timely information passed in a standard format supports continuity, and gaps lead to repeated assessment, delayed therapy, or unsafe activity. Patients and families also need clear, consistent instructions, so that exercises and precautions continue at home.

Rehabilitation outcomes, finally, close the loop for the entire continuum. Functional measures such as mobility, independence in daily activities, and return to participation provide the best indicator of whether early decisions in the prehospital, emergency, and inpatient stages translated into recovery. Sharing these outcomes with paramedics, nurses, radiology teams, and epidemiologists would allow every discipline to see the downstream effect of its work. Physical therapy and rehabilitation thus provide both a direct safety function, through early mobilisation and prevention of secondary harm, and an evaluative function, through functional outcomes.

10. Integration: Roles, Failure Points, and Shared Mechanisms

The discipline-specific evidence reviewed above converges on a small number of shared mechanisms. Table 1 summarises the principal safety functions, key interfaces, and closed-loop indicators for each discipline across the continuum.

Table 1. Role-by-stage matrix of the six disciplines

Discipline	Main stage(s)	Principal safety functions	Key interfaces	Closed-loop indicator
Paramedics	Prehospital; emergency department entry	Recognition of time-critical conditions; protocol adherence; structured handover	Emergency nurses; radiology (pre-alert); registration	Handover confirmed and outcome feedback returned

General nursing	Emergency department; ward; discharge	Surveillance and escalation; medication safety; translation of information; discharge preparation	All disciplines	Handover and discharge summary received and acted on
Radiology	Emergency and inpatient diagnostics; follow-up imaging	Justified imaging; accurate reporting; communication of critical findings	Requesting clinicians; nurses; secretaries	Critical result acknowledged; follow-up recommendation completed
Medical secretaries	All interfaces	Identification and registration; document routing; scheduling; data quality	Nurses; radiology; rehabilitation; community services	Documents delivered to correct recipient; appointments attended
Epidemiology	System level, all stages	Surveillance; infection prevention intelligence; evaluation; feedback	Data stewards; infection control; all frontline teams	Findings fed back and followed by documented change
Physical therapy/rehabilitation	Acute ward to community	Early mobilisation; falls prevention; functional assessment; transition planning	Nurses; secretaries; community services	Mobility plan visible every shift; functional outcome reported

The matrix shows that every discipline both produces and consumes information, and that nursing and secretarial roles connect with every other discipline. Figure 2 depicts the resulting information flows as a set of closed loops around a shared record.

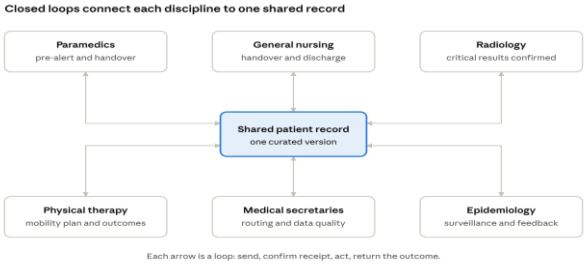


Figure 2. Closed-loop information flows between the six disciplines and a shared patient record.

Several failure points recur in the literature. They concentrate at interfaces, where responsibility passes from one team to another. Table 2 lists the principal failure points, the stages at which they arise, and countermeasures supported by the evidence reviewed above.

Table 2. Recurrent failure points and evidence-informed countermeasures

Failure point	Stage	Disciplines involved	Potential consequence	Countermeasure (supporting evidence)
Unstructured or interrupted handover	Prehospital to emergency department; ward to ward	Paramedics; nursing	Omitted history or treatments; delayed care	SBAR/ISBAR formats with read-back (Burgess et al., 2020; Müller et al., 2018)
Crowding and access block	Emergency department	Nursing; paramedics; secretaries	Delays; missed deterioration	Flow management and capacity planning (Morley et al., 2018; Sartini et al., 2022)
Diagnostic error or delay	Emergency and inpatient	Radiology; nursing; clinicians	Missed vascular event, infection, or cancer	Workload limits; peer learning; decision support (Alexander et al., 2022; Larson et al., 2017; Newman-Toker et al., 2021)
Result or follow-up not actioned	Diagnostic to discharge	Radiology; secretaries; clinicians	Delayed treatment or cancer diagnosis	Direct communication of critical findings; tracked follow-up worklists (European Society of Radiology & European Federation of Radiographer Societies, 2019)

Incomplete discharge information	Discharge	Nursing; secretaries; rehabilitation	Readmission; duplicated assessment	Structured, timely discharge summary (Becker et al., 2021; Kattel et al., 2020)
Healthcare-associated infection and resistant organisms	Inpatient; transfer	Epidemiology; nursing; secretaries	Infection; transmission across settings	Surveillance, prevention bundles, status flagged on transfer (Haque et al., 2018; Suetens et al., 2018)
Immobility and falls	Acute ward to community	Rehabilitation; nursing	Deconditioning; injury	Early mobilisation; falls prevention programmes (Hodgson et al., 2021; Montero-Odasso et al., 2022; Sherrington et al., 2019)
No outcome feedback	System level	Epidemiology; all disciplines	Missed learning	Linked data and routine feedback (Groseclose & Buckeridge, 2017; Kruse et al., 2018)

Three cross-cutting mechanisms explain most of the countermeasures in Table 2. The first is standardisation: shared formats for handover, requests, reports, and discharge summaries reduce variation and the cognitive load on both sender and receiver. The second is closure: a message is complete only when receipt and action are confirmed. The third is feedback: disciplines learn when outcomes are returned to them. These mechanisms depend on working conditions, particularly staffing and workload (Aiken et al., 2017; Griffiths et al., 2019) and on the wellbeing of the workforce (Salyers et al., 2017). Interprofessional training and shared protocols can reinforce them, although the evidence for interprofessional interventions remains heterogeneous (Reeves, 2018).

Figure 3 shows how these mechanisms combine at the system level. Frontline teams generate data through care and documentation; secretaries and information systems curate those data; epidemiologists analyse them and identify signals; and findings return to every discipline as feedback, protocol change, and training. This loop is the means by which the continuum improves rather than merely repeats itself.

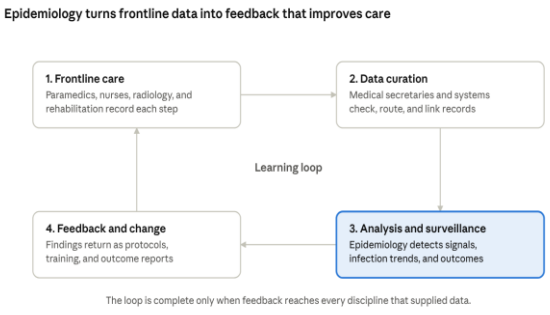


Figure 3. System-level learning loop linking frontline care, data curation, epidemiological analysis, and feedback.

11. Implementation, Limitations, and Conclusion

11.1 Implications for practice, education, and policy

Several implications follow from the synthesis. For practice, organisations should define the continuum as a single pathway with named owners for each interface, and should adopt shared handover and discharge formats across paramedic, nursing, radiology, administrative, and rehabilitation services. Result-tracking and follow-up systems should be treated as safety-critical, with secretaries and radiology teams jointly responsible for confirming that critical findings and recommendations reach and are actioned by the responsible clinician. Rehabilitation should be integrated early, with mobility plans visible to every shift and a standard transfer summary for post-acute and community services, in line with the broader call to embed rehabilitation across health systems (Gimigliano & Negrini, 2017).

For education, interprofessional training should bring the six disciplines together around realistic transition scenarios, including handovers from the ambulance to the emergency department, escalation of a critical imaging result, and a complex discharge. Simulation can rehearse structured communication and closed-loop confirmation, and the training should include administrative staff, whose omission from safety curricula reflects their invisibility in research. For policy, safety plans should explicitly address transitions, as the global action plan envisages (WHO, 2021), and should support safe staffing, workload limits, and data governance that allows linkage across settings while protecting confidentiality.

Implementation itself should be treated as a complex process. Interventions that work in one setting may fail in another, and local adaptation, monitoring, and iterative learning are essential (Braithwaite et al., 2018). Epidemiological support for evaluation, including comparison groups where feasible and consistent indicators, can prevent the common

situation in which a new tool is introduced without any means of knowing whether it helped.

11.2 Research priorities

The review identified four priorities. First, studies of medical secretaries and administrative staff are needed, because current evidence is indirect. Second, shared outcome sets that span prehospital, hospital, and rehabilitation stages would allow comparison of pathways and evaluation of interprofessional interventions. Third, linked-data studies should test whether specific interface interventions, such as pre-notification, closed-loop result tracking, and standard discharge summaries, change patient-level outcomes. Fourth, research should evaluate how artificial intelligence and decision support are integrated into workflows without creating new communication gaps (Rajpurkar & Lungren, 2023).

11.3 Limitations

This review has limitations. It is a narrative synthesis with purposively selected sources, not a systematic review, and no registered protocol, exhaustive database search, or formal appraisal of study quality was undertaken. Selection bias is therefore possible, and relevant studies may be missing. Much of the supporting evidence comes from observational designs, before-and-after studies, and reviews with heterogeneous methods, which limits causal inference. Evidence for medical secretaries is largely indirect, and the framework proposed here is conceptual and has not been empirically validated. Findings come predominantly from high-income settings, so transferability to low-resource systems should be assessed locally. A future systematic review of each interface would strengthen the conclusions.

11.4 Conclusion

Safe and continuous care from the emergency scene to rehabilitation is a collective achievement. Paramedics create the first record and pre-alert receiving teams. General nurses provide surveillance and carry information across stages. Radiology supplies accurate and communicated diagnoses. Medical secretaries steward the documents, appointments, and data that make continuity possible. Epidemiology converts experience into learning and protects against infection and resistance. Physical therapy and rehabilitation turn survival into function and measure the result. The evidence reviewed here indicates that the greatest gains are likely to come from strengthening the interfaces between these roles through standard formats, closed-loop communication, adequate staffing, shared data, and routine feedback. Health systems that recognise all six disciplines as members of one safety system, and that design pathways, training, and measurement accordingly, are better placed to reduce preventable harm and to sustain recovery.

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