Saudi Journal of Medicine and Public Health

https://saudijmph.com/index.php/pub

https://doi.org/10.64483/202412566

The Fragile Chain: A Narrative Review of Communication Breakdown in Time-Sensitive Diagnoses Across the ED-Radiology-Inpatient Continuum

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Abstract

Background: In time-sensitive medical conditions such as acute stroke, aortic dissection, and major trauma, diagnostic delays of minutes can drastically alter patient outcomes. The diagnostic pathway is a high-stakes relay involving multiple handoffs: from emergency department (ED) nursing and physicians, to radiographers, to radiologists, and finally to inpatient or interventional teams. Failures in communication at any point in this chain are a major source of preventable diagnostic error and patient harm. **Aim:** This narrative review aims to synthesize evidence on the critical communication pathways, vulnerabilities, and enabling strategies for handoffs from the ED through radiology to definitive inpatient care for time-sensitive diagnoses. **Methods:** A comprehensive literature search was conducted in PubMed, CINAHL, Scopus, and Web of Science (2010-2024). **Results:** The review identifies systemic vulnerabilities at each handoff: incomplete clinical information provided with imaging orders, ambiguous verbal communication, inefficient report dissemination, and failures in critical result notification. It highlights the pivotal but often overlooked roles of the radiographer as a situational communicator and the medical secretary as an information flow expediter. While health information systems like critical result alerts offer solutions, they often generate alert fatigue and can be circumvented. **Conclusion:** Safeguarding time-sensitive diagnoses requires a systems-engineering approach that hardwires communication protocols, formally recognizes the communicative roles of all team members (including radiographers and secretaries), and optimizes health information technology to support, not hinder, the cognitive and collaborative work of diagnosis.

Keywords: Patient Handoff; Diagnostic Errors; Communication; Radiology Information Systems; Continuity of Patient Care

Introduction

In the high-velocity environment of acute care, time is tissue. For conditions like acute ischemic stroke, thoracic aortic dissection, hemorrhagic shock from trauma, or septic shock, the window for effective intervention is narrow, and diagnostic speed is inextricably linked to survival and functional recovery (Krumholz, 2020). The journey from patient arrival to definitive diagnosis and treatment is not a linear process but a complex, multi-step relay race involving a series of critical handoffs between specialized teams (Bucholz et al., 2015). This relay begins with emergency department (ED) clinicians who suspect a time-sensitive condition and activate imaging protocols. It passes to radiographers who acquire the crucial images, then to radiologists who interpret them, and finally to the inpatient or interventional teams (e.g., stroke neurology, trauma surgery,

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Receive Date: 22 December 2024, Revise Date: 30 December 2024, Accept Date: 31 December 2024

vascular surgery) who act on the findings (Singh et al., 2013).

Each handoff in this chain represents a potential "switch point" for error, where information can be lost, distorted, or delayed. Communication failures are consistently cited among the top root causes of sentinel events in healthcare, and diagnostic delays in acute settings are a prevalent and harmful subset (Zaboli et al., 2018). These failures are rarely due to individual negligence but are more often symptoms of systemic flaws: poorly designed workflows, ambiguous protocols, inadequate technology support, and a culture that undervalues the communicative contributions of all team members (Graber et al., 2012). Figure 1 presents a systems-level overview of the diagnostic communication pathway for time-sensitive medical conditions, including acute stroke, major trauma, and aortic dissection.

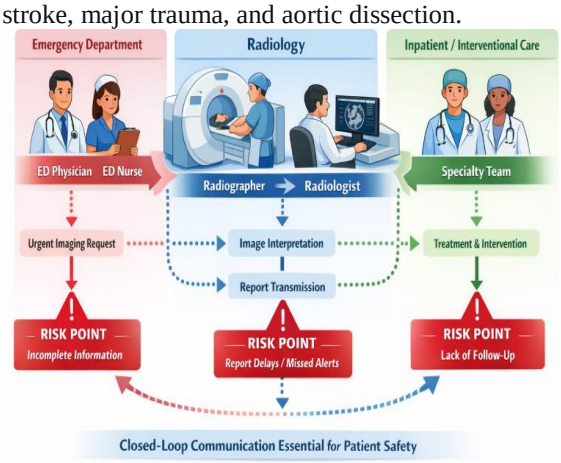

Figure 1. The Diagnostic Communication Chain for Time-Sensitive Conditions

This review focuses on the often-invisible infrastructure of communication that underlies time-sensitive diagnosis. It moves beyond a physician-centric view to examine the essential roles of nursing in initial assessment and protocol activation; radiographers as the frontline operators who must understand the clinical question and adapt exams in real-time; radiologists as diagnostic consultants who must communicate urgency and uncertainty effectively; medical secretaries or communication coordinators who manage the logistics of report dissemination and specialist notification; and health information systems (HIS) like Radiology Information Systems (RIS), Picture Archiving and Communication Systems (PACS), and electronic health records (EHRs) that can either facilitate seamless information flow or create formidable digital barriers.

By synthesizing literature from 2010 to 2024, this narrative review aims to map the communication pathway for time-sensitive diagnoses, identify evidence-based vulnerabilities and best practices at each handoff, and propose an integrated model for a more reliable, resilient diagnostic communication chain. The goal is to shift the paradigm from viewing communication as a series of informal conversations to recognizing it as a core, structured clinical process that must be designed, measured, and optimized with the same rigor as a surgical procedure.

Clinical Suspicion and the Imaging Order Handoff

The diagnostic cascade begins with clinical suspicion in the ED. The quality of information transmitted at this initial stage sets the trajectory for all subsequent steps.

Nursing Assessment and Protocol Activation

For standardized time-sensitive conditions like stroke or major trauma, nurses are frequently the first to recognize key symptoms and initiate standardized screening and protocol activation. In stroke care, nurses use tools like the Cincinnati Prehospital Stroke Scale or the Face-Arm-Speech-Time (FAST) assessment, triggering a "Code Stroke" that pre-emptively mobilizes the radiology and neurology teams (Fonarow et al., 2011). This role requires not only clinical skill but also clear, structured communication to the attending physician and, subsequently, to the radiology department. The handoff from nursing to the ordering physician must include a precise timeline of symptom onset—a critical piece of data for interpreting brain imaging (Powers et al., 2019).

The Imaging Order as a Foundational Communication Tool

The electronic imaging order is the primary formal handoff from ED to Radiology. A poorly constructed order is a primary source of downstream error. Common failures include: (1) Vague clinical history (e.g., "pain," "rule out pathology"), which deprives the radiologist of context needed to prioritize the study and focus the search pattern; (2) Incorrect study selection due to order set complexity or knowledge gaps; and (3) Missing critical data, such as time of symptom onset for stroke, mechanism of injury for trauma, or renal function for contrast administration (Royuela et al., 2019). Studies show that providing a specific, pertinent clinical history significantly increases the diagnostic accuracy and usefulness of radiology reports (Larson et al., 2014; Pierre et al., 2023). The handoff here is not just digital; it often requires verbal confirmation, especially for unstable trauma patients, where the radiographer may need immediate guidance on patient handling and sequencing (Rockall et al., 2022).

Acquisition, Interpretation, and the Internal Handoff

Once the order is received, the responsibility shifts to the radiology team. The handoff from order to image acquisition and then to interpretation is fraught with potential gaps.

The Radiographer as a Communicator and Adaptive Agent

Radiographers are far more than technical operators. They are the first point of contact in radiology and serve as crucial situational communicators (Calvo et al., 2020). Upon receiving a

trauma or stroke patient, the radiographer must quickly assess the patient's stability, clarify the clinical question with the transporting ED staff if it's unclear, and make real-time decisions about imaging parameters (e.g., scan range for a dissection) or the need for additional views (Zygmont et al., 2017). A breakdown here—such as failing to communicate that a trauma patient is becoming hypotensive during the CT scan—can have dire consequences. Furthermore, the radiographer's communication with the radiologist about technical limitations or patient factors affecting image quality is essential for accurate interpretation (Moore et al., 2022).

Radiologist Interpretation and the "Currency of Urgency"

The radiologist's task is to transform images into a meaningful narrative. In time-sensitive cases, the interpretation must be both rapid and accurate. Key communication challenges include: (1) Cognitive bias, where premature closure is risked if the provided history is misleading or absent; (2) "Satisfaction of search," where finding one major injury (e.g., a liver laceration) leads to overlooking a second (e.g., a diaphragmatic rupture) (Bruno et al., 2015); and (3) Communicating uncertainty. In acute settings, a radiologist may need to issue a preliminary read with a degree of uncertainty (e.g., "possible early ischemic change") to guide immediate therapy while seeking confirmatory opinions. The handoff of this interpretation to the treating team is the most critical juncture in the entire chain.

Disseminating Results to the Definitive Care Team

The act of communicating a critical finding is where many systems fail catastrophically. A diagnosis trapped in a PACS or an unreported finding is of no clinical value (Table 1).

The Fallible Process of Critical Result Notification

Traditionally, critical results were communicated via phone. This process is vulnerable to multiple failures: the radiologist cannot reach the ordering provider, the message is left with an uninformed covering person, the content is misheard or not recorded, or there is no closed-loop verification that the message was received and understood (Callen et al., 2013). In response, The Joint Commission established a National Patient Safety Goal requiring timely reporting of critical results with a read-back verification process. However, implementation remains inconsistent.

The Role of the Medical Secretary/Communication Coordinator

In many departments, the logistical burden of tracking down providers falls to radiology secretaries or communication coordinators (Nobel et al., 2022). This role is critical but often under-supported. They must manage multiple parallel communication attempts, navigate complex hospital directories, document every contact attempt and its outcome, and ensure final verification—all while managing routine workflow (Powell & Silberzweig, 2015). Without clear protocols and authority, secretaries can be caught between insisting on speaking directly to a busy clinician and letting a critical finding wait.

Health Information Systems: Promise and Peril of Automation

Modern HIS have introduced electronic critical result alerts (CRAs) within EHRs. In theory, these provide an auditable, immediate handoff. In practice, they suffer from alert fatigue due to poor specificity and over-alerting, leading clinicians to ignore or disable them (Hussain et al., 2019). Furthermore, workflow misalignment occurs when the alert pops up for a covering physician unfamiliar with the patient, or when the ED physician has already transferred care to an inpatient team. The system must ensure the alert follows the patient's care team in real-time, a significant technical and operational challenge (Malik et al., 2022).

Table 1: Communication Handoffs, Vulnerabilities, and Best Practices in Time-Sensitive Diagnosis

Handoff Point	Primary Actors	Key Information Exchanged	Common Vulnerabilities	Evidence-Based Best Practices
ED Clinical → Radiology (Order)	ED Physician/Nurse, Radiology Scheduler	Clinical history, suspected diagnosis, urgency, patient stability, lab values (e.g., creatinine).	Vague/absent clinical history; incorrect exam ordered; missing time-critical data (e.g., stroke onset).	Structured order entry with forced fields for key data (e.g., "Time last known well"); use of protocolized order sets (Code Stroke, Trauma Pan-Scan).
Order → Radiographer	Radiology Scheduler, Radiographer	Exam specifics, patient location, clinical question, special instructions (e.g., trauma alert).	Order "dumped" into queue without context; radiographer unaware of patient acuity or	Verbal handoff for high-acuity cases; use of standardized acuity flags in RIS; dedicated trauma/stroke radiographer teams.

			specific clinical concern.	
Radiographer → Radiologist	Radiographer, Radiologist	Patient condition during scan; technical limitations; need for protocol modification; preliminary observation.	Failure to communicate patient deterioration; assumption radiologist will "see everything."	Standardized "wet read" communication for unstable patients; structured technologist notes in PACS; shared situational awareness.
Radiologist → Treating Team (Result)	Radiologist, ED/Inpatient Physician, Medical Secretary	Findings, impression, urgency level, recommendations, degree of certainty.	Phone tag; message left with wrong person; no read-back/verification; ambiguous verbal report.	Closed-loop communication protocol (e.g., SBAR + read-back); tiered notification levels; use of trained communication coordinators.
Result → Inpatient/Consultant Team	ED Physician, Inpatient/Consultant, Medical Secretary	Full diagnostic picture, pending studies, planned interventions, and handoff of ongoing care.	Assumption consultant has seen the report; incomplete sign-out; loss of information during care transitions.	Structured sign-out tools integrated with EHR; mandatory consultant acceptance/acknowledgment of referral; shared digital care plans.

4. The Role of Health Information Technology: Bridging and Dividing

Health Information Systems are the backbone of modern diagnostic communication, but their design profoundly influences safety.

Radiology Information Systems (RIS) & PACS Integration

The seamless flow of information between the RIS (scheduling, tracking) and PACS (images) is fundamental. Poor integration can lead to studies being "lost" or mismatched with the wrong patient record. Advanced PACS now offer hanging protocols that automatically display relevant prior studies for comparison—a crucial feature for detecting interval change in stroke or dissection (Kohli et al., 20157). Furthermore, speech recognition software for reporting has sped up report turnaround time but can introduce errors if not carefully edited, and can depersonalize the communication process (Coyner et al., 2022).

Electronic Health Records (EHRs) and Interoperability

The EHR is meant to be the unifying record. However, for radiologists, accessing a complete patient history often requires tabbing through multiple fragmented modules. Health Information Exchange (HIE) is theoretically the solution for accessing outside records, but technical, proprietary, and privacy barriers often render it ineffective in acute time-pressured scenarios (Han et al., 2019). Within the hospital, a major failure point is the lack of a unified communication platform that integrates secure messaging, alerts, and task management, forcing clinicians to use a chaotic mix of pagers, phones, EHR alerts, and separate messaging apps (Aluvalu et al., 2023).

Strategies for Building a Resilient Communication Chain

Improving reliability requires a multi-pronged approach that addresses technology, process, and culture.

Adopting standardized tools like SBAR (Situation-Background-Assessment-Recommendation) for verbal handoffs and critical calls ensures completeness and clarity (Müller et al., 2018). Read-back verification must be a non-negotiable step. For radiology reports themselves, initiatives like structured reporting with standardized templates for common emergencies (e.g., stroke, trauma) improve clarity, completeness, and ease of information extraction for referring physicians (Weber et al., 2020).

Interventions like TeamSTEPPS (Team Strategies and Tools to Enhance Performance and Patient Safety), adapted for ED-Radiology teams, can improve mutual respect, shared mental models, and communication behaviors (Adjei, 2022). Interdisciplinary simulation involving ED nurses, physicians, radiographers, and radiologists in scenarios like a deteriorating trauma patient in the CT scanner can reveal system flaws and build teamwork.

Technology optimization involves moving beyond basic alerting to intelligent, workflow-aware systems (de Souza Leite et al., 2022). This could mean: (1) Routing alerts based on real-time care team assignment from the EHR. (2) Integrating diagnostic

"dashboards" that track the progress of time-sensitive patients (e.g., "door-to-needle" for stroke) across departments, providing transparency and accountability (Kamal et al., 2022). (3) Developing peer comparison feedback for clinicians on the quality of the clinical history provided in imaging orders (Man et al., 2023; Table 2).

Table 2: Systemic Interventions to Fortify the Diagnostic Communication Chain

Intervention Category	Specific Strategy	Targeted Handoff/Vulnerability	Potential Outcomes
Process Standardization	Mandated structured clinical history fields in imaging order sets.	ED → Radiology (Incomplete context).	Improved radiologist diagnostic accuracy & efficiency; reduced follow-up imaging.
	Closed-loop communication protocol with read-back for all critical results.	Radiologist → Treating Team (Unverified notification).	Eliminated "assumption errors"; auditable safety trail; improved reliability.
Role Clarification & Support	Formalize and train the "Radiology Communication Coordinator" role (for secretaries).	Result Dissemination (Logistical failure).	Reduced radiologist burden; professionalized tracking; guaranteed follow-through.
	Define and empower radiographers' role in situational communication and protocol adaptation.	Radiographer ↔ Radiologist/ED (Real-time data gap).	Safer patient handling in scanner; more appropriate imaging; earlier detection of patient decline.
Health IT & System Design	Implement intelligent alert routing tied to dynamic EHR care team assignment.	Health IT (Alert fatigue, misrouting).	Alerts reach the responsible clinician; reduced noise for others.
	Create integrated, real-time diagnostic pathway dashboards (e.g., Stroke Tracker).	All Handoffs (Lack of system awareness).	Enhanced situational awareness across departments; data-driven process improvement.
Culture & Team Development	Conduct interdisciplinary TeamSTEPPS training for ED & Radiology staff.	All Handoffs (Siloed culture, hierarchy).	Improved psychological safety, mutual respect, and collaborative communication.
	Establish regular interdepartmental morbidity & mortality conferences on diagnostic delay.	System-Wide (Latent systemic flaws).	Shared learning; identification and correction of recurring system failures.

Future Directions and Conclusion

The future of diagnostic communication in acute care lies in smarter integration, predictive analytics, and human-centered design. Artificial Intelligence (AI) holds promise as a "co-pilot," not to replace radiologists, but to prioritize worklists by acuity, provide automated preliminary detection of critical findings (e.g., intracranial hemorrhage, large vessel occlusion), and flag discrepancies between preliminary and final reads (Langlotz et al., 2019). However, this introduces new handoff complexities—how does the AI finding get communicated and validated? Natural Language Processing (NLP) could be used to mine the EHR at the time of order entry to auto-populate a more complete clinical history for the radiologist (Pons et al., 2016). Standardized APIs and true interoperability mandated by regulations like the 21st Century Cures Act may finally break down information silos, allowing outside imaging and records to flow into the ED in real time (Dreizin et al., 2023).

In conclusion, diagnosing time-sensitive conditions is a team sport played on a field of complex systems and profound time pressure. The communication chain from ED to radiology to inpatient care is fragile, with breakpoints at every human and digital interface. Protecting patients requires moving from a reliance on heroic individual vigilance to the deliberate design of a resilient system. This system must hardwire best practices (like closed-loop communication), formally recognize and support the critical communicative functions of all team members—especially radiographers and medical secretaries—and leverage health information technology as a designed support for clinical cognition and collaboration, not a distracting or obstructive force. By viewing the diagnostic pathway as a coherent, cross-departmental process worthy of systematic measurement and optimization, healthcare

institutions can transform a fragile chain of handoffs into a robust, reliable conduit for lifesaving information.

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