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The Effect Of Interprofessional Communication Between Nurses, Laboratory Technicians, And Radiology Staff On Diagnostic Accuracy

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Abstract

Diagnostic accuracy is a cornerstone of patient safety and effective treatment, yet it remains vulnerable to errors, many of which originate in communication breakdowns. This research paper investigates the critical impact of interprofessional communication (IPC) among three pivotal groups in the diagnostic pathway: nurses, laboratory technicians, and radiology staff. Through a comprehensive literature review and analysis, the study delineates the interdependent roles of these professionals in a "diagnostic relay," where the baton of information and specimens is passed. It identifies and examines the common barriers that fracture these communication channels, including hierarchical silos, systemic pressures, technological fragmentation, and a lack of psychological safety. The paper directly links specific communication failures—such as mislabeled specimens, vague clinical histories, and passive critical result alerts—to tangible diagnostic inaccuracies and harmful delays. In response, the research evaluates structured frameworks for improvement, including SBAR protocols, standardized requisitions, and critical result policies, while arguing that technological solutions must be paired with a foundational cultural shift. Ultimately, the study concludes that optimizing IPC within this triad is not merely an administrative goal but a clinical imperative. Enhancing diagnostic accuracy requires a synergistic, multi-faceted strategy that integrates standardized tools, thoughtfully designed health information technology, and, most crucially, the cultivation of a collaborative culture characterized by psychological safety and shared responsibility.

Keywords Interprofessional Communication; Diagnostic Accuracy; Nursing; Laboratory Technicians; Radiology Staff.

Introduction:

In the intricate and high-stakes environment of modern healthcare, diagnostic accuracy stands as the fundamental cornerstone upon which effective treatment, patient safety, and positive clinical outcomes are built. An accurate diagnosis is the essential first step in the clinical reasoning process, guiding all subsequent therapeutic interventions. Conversely, diagnostic error—a failure to establish an accurate and timely

explanation of a patient's health problem or to communicate that explanation to the patient—represents a significant and persistent threat to global health systems. The Institute of Medicine's seminal report, "Improving Diagnosis in Health Care" (2015), starkly highlighted that most people will experience at least one diagnostic error in their lifetime, sometimes with devastating consequences [1]. These errors contribute to an estimated 10% of patient deaths and account for 6-17% of all hospital adverse events, underscoring a critical vulnerability within the care continuum [2]. While the causes of diagnostic inaccuracy are multifactorial, a growing body of evidence points to systemic and interpersonal communication failures as a predominant, and often modifiable, root cause.

This research focuses specifically on the triadic communication interface between three pivotal groups within the diagnostic pathway: nurses, laboratory technicians, and radiology staff. The diagnostic journey for a patient is rarely linear or confined to a single department; it is a collaborative relay race where critical information is passed between these key players. Nurses, as the primary patient caregivers and coordinators, are responsible for initial assessment, clinical observation, specimen collection, and conveying the clinical context. Laboratory technicians process and analyze these specimens, transforming biological samples into quantitative and qualitative data that form the basis of many diagnoses. Radiology staff, including technologists and radiographers, acquire medical images, while radiologists interpret them, providing visual evidence of pathology or its absence. The diagnostic "truth" is not discovered in isolation by any one profession but is constructed through the synthesis of information flowing between them. Consequently, the quality of interprofessional communication (IPC) within this triad directly and profoundly influences the integrity of the diagnostic process.

Interprofessional communication in this context is defined as the effective, respectful, and timely exchange of information, opinions, and expertise between nurses, laboratory technicians, and radiology staff to enable collaborative decision-making. Effective IPC transcends mere information transfer; it involves shared mental models, mutual respect for each profession's unique expertise, and a common commitment to the patient's diagnostic journey. It is the lubricant that ensures the gears of the diagnostic machine turn smoothly. When IPC is robust, it facilitates clarity in test orders, ensures proper specimen collection and handling, provides vital clinical context for interpretation, and enables the rapid clarification of ambiguous or critical findings. When it fractures, the consequences are severe: mislabeled specimens, inappropriate test orders, lost samples, misinterpreted results due to lack of clinical history, and delays in reporting critical values—all of which are direct pathways to diagnostic error [3, 4].

The roles and communication needs of each group within this triad are distinct yet interdependent. Nurses initiate the process by ordering tests based on clinical suspicion. The clarity and completeness of the requisition—including relevant patient history, current medications, specific clinical questions, and details of specimen collection (e.g., time, site)—are paramount for the laboratory and radiology [5]. A vague or incomplete requisition forces laboratory technicians and radiologists to interpret results in an informational vacuum, increasing the risk of misinterpretation. For instance, knowing a patient has a history of prostate cancer is crucial for a radiologist interpreting a bone scan, just as knowing a blood sample was drawn from a line receiving intravenous fluids is critical for a laboratory technician assessing electrolyte levels.

Laboratory technicians and radiologists, in turn, generate the objective data (numerical results and images) that validate or refute clinical hypotheses. Their communication responsibility lies not only in reporting accurate results but also in flagging abnormalities, suggesting confirmatory tests when results are incongruent, and, most critically, communicating "panic" or critical values directly and promptly to the responsible nurse or clinician [6]. The failure of a critical alert system—where a life-threatening laboratory result is documented but not communicated—is a classic and tragically common communication breakdown with dire diagnostic and therapeutic delays.

Radiology staff, particularly technologists, also play an often-overlooked communicative role. They are the last professionals to interact with the patient before an image is created and can provide crucial contextual notes to the radiologist (e.g., "patient unable to fully inspire due to pain," "poor positioning due to obesity").

Furthermore, direct communication between the radiologist and the nursing team regarding preliminary findings, especially in emergency settings, can drastically alter immediate patient management [7]. The traditional model of a finalized written report traveling through an electronic system hours later is increasingly seen as inadequate for time-sensitive diagnoses.

Barriers to effective IPC among these groups are deeply embedded in healthcare culture and structure. Hierarchical structures often silo professions, leading to unidirectional communication (orders given, orders followed) rather than collaborative dialogue [8]. Physical and temporal separation—with laboratories and radiology departments often located far from nursing units—reduces opportunities for informal, face-to-face clarification. High workloads, shift changes, and constant interruptions create an environment prone to information loss and task-oriented, rather than patient-oriented, communication [9]. Professional stereotypes and a lack of understanding of each other's roles, scopes of practice, and challenges can breed mistrust and reluctance to seek clarification. Additionally, incompatible or fragmented information technology systems can create digital silos, where data exists but does not flow seamlessly or intuitively between departments [10].

Strategies to enhance IPC and, by extension, diagnostic accuracy are multifaceted. Structured communication tools, such as SBAR (Situation, Background, Assessment, Recommendation), originally developed for nursing-physician communication, can be adapted for nurse-to-lab and nurse-to-radiology handoffs, providing a standardized framework for conveying requests and results [11]. Implementing joint interprofessional education (IPE) sessions, where nurses, technicians, and radiology staff train together on simulated diagnostic error scenarios, can break down stereotypes and build shared understanding [12]. Co-designing and optimizing shared electronic health record (EHR) interfaces to include mandatory contextual fields for test requisitions and to streamline critical result alert pathways is a systemic technological intervention. Finally, fostering a culture of psychological safety, where any team member feels empowered to speak up, ask questions, or challenge assumptions without fear of reprisal, is the foundational cultural shift required for sustained improvement [13].

The Diagnostic Relay: Defining the Interdependent Roles of Nurses, Laboratory, and Radiology in the Care Pathway

The pursuit of diagnostic accuracy is not a solitary endeavor performed by a single clinician in isolation. Rather, it is a complex, sequential, yet deeply collaborative process that resembles a meticulously orchestrated relay race. In this critical relay, the baton of patient information and biological material is passed between specialized professionals, each adding their unique expertise to advance the diagnostic journey. The seamless transfer of this baton between nurses, laboratory technicians, and radiology staff constitutes the operational backbone of modern diagnosis. A fumble at any handoff point can delay, distort, or derail the entire process, ultimately compromising patient outcomes. This section delineates the distinct yet inextricably interdependent roles of these three key groups, charting the patient's path through the diagnostic care pathway and highlighting the points of contact where communication is paramount.

The diagnostic relay begins at the patient's bedside with the nurse, who acts as the primary initiator, clinical sensor, and coordinator. Nurses are the first to detect subtle clinical changes—a slight fever, new onset confusion, localized pain—that trigger the need for diagnostic investigation. Their role transcends mere test ordering; it involves constructing the initial clinical narrative. When a nurse draws a blood culture, performs a wound swab, or prepares a patient for a computed tomography (CT) scan, they are not executing a mechanical task. They are capturing a biological snapshot at a specific moment in the patient's illness trajectory. The nurse's critical responsibilities include ensuring correct patient identification, selecting the appropriate specimen container, adhering to proper collection techniques (e.g., avoiding hemolysis, ensuring sterility), and documenting the exact time of collection [14]. Most importantly, they provide the indispensable clinical context. This context, conveyed via the test requisition, includes the patient's presenting symptoms, recent antibiotic administration, suspected diagnosis, and specific clinical questions. For instance, a lactate level drawn for suspected sepsis carries a different interpretive urgency than one

drawn for routine monitoring. The nurse, therefore, launches the diagnostic baton with a package consisting of both a physical sample and a narrative framework without which the subsequent data may be meaningless or misleading [15].

Upon receipt of this baton, the laboratory technician enters the relay as the analytical scientist and guardian of pre-analytical and analytical quality. Their domain is the world of molecules, cells, and numerical data. The interdependence here is immediate and absolute: the quality of the analysis is fundamentally constrained by the quality of the sample and the information provided. The laboratory technician's role begins with the pre-analytical phase, where they verify specimen integrity, check for clots or hemolysis, and ensure proper labeling—a direct quality check on the nurse's initial handoff [16]. Any discrepancy, such as an unlabeled tube or a mismatched requisition, forces a communicative loop back to the nursing unit to rectify the error, a process that inherently causes delay. Analytically, technicians operate complex instrumentation to generate quantitative results (e.g., sodium levels, white blood cell counts) or qualitative findings (e.g., positive blood culture, pathogenic organisms on a Gram stain). Their expertise lies in ensuring the precision and accuracy of these machines and procedures. However, their role is not purely mechanical. When a result is critically abnormal, exhibits an improbable delta check from a previous value, or presents an analytical interference, the technician must interpret the analytical validity and initiate a critical communication loop. They transform raw data into a reported result, but that result's clinical validity—its meaning for the specific patient—remains partially dependent on the context the nurse provided [17]. The baton they pass on is a data point, which gains its true significance only when re-integrated into the clinical story.

Concurrently, on a parallel track of the diagnostic pathway, the radiology staff, comprising radiographers/technologists and radiologists, manage the visual dimension of diagnosis. The radiographer is the frontline professional who receives the patient and the imaging order. Their interdependence with nursing is crucial for patient safety and image quality. They rely on the nurse to ensure the patient is properly prepared (e.g., NPO for contrast studies, pre-medicated for allergies) and to provide a brief report on the patient's condition (e.g., "patient is unstable, cannot lie flat," "has left-sided weakness") which may affect positioning and protocol selection [18]. During the imaging procedure, the technologist makes real-time technical adjustments and observes the patient, information that is vital for the next handoff. The radiologist then assumes the baton, interpreting the images to generate a diagnostic report. This interpretation is profoundly context-dependent. A lung nodule on a CT scan has a different differential diagnosis in a patient with a history of smoking and weight loss than in an asymptomatic young adult. The radiologist's report, therefore, is not created in a vacuum but is a synthesis of visual patterns and the clinical history supplied initially by the nursing team [19]. In urgent cases, the radiologist may directly communicate a critical finding (e.g., a large pulmonary embolism, an intracranial hemorrhage) back to the nursing station, initiating an immediate therapeutic relay and closing the communicative loop.

The interdependence of this triad is perhaps most vividly illustrated in scenarios involving sequential or correlative testing. Consider a patient presenting with fever and hypotension. The nurse's suspicion of sepsis leads to blood culture collection and lactate measurement (handoff to lab). The same clinical picture warrants a chest X-ray to rule out pneumonia (handoff to radiology). The laboratory technician reports a positive Gram stain for Gram-negative rods and a soaring lactate. Simultaneously, the radiologist reports bilateral pulmonary infiltrates. The nurse at the bedside now receives two crucial pieces of the diagnostic puzzle from two different professional silos. The accuracy of the final diagnosis—septic shock likely from pneumonia—hinges not only on each result being accurate in itself but on the nurse's ability to synthesize them in real-time, a synthesis made possible only if both the lab and radiology provided clear, timely, and contextually linked information [20]. The pathway is also riddled with potential failure points born from poor handoffs: a mislabeled specimen (nurse-lab interface) leads to a wrong result; an unclear clinical question on an imaging requisition (nurse-radiology interface) leads to an inappropriate scan or a missed finding; a critical radiology report filed without verbal alert (radiology-nurse interface) leads to a dangerous delay in treatment [21].

Fractured Channels: Common Barriers to Effective Interprofessional Communication in Diagnostic Settings

While the ideal diagnostic pathway envisions a seamless flow of information, the reality within healthcare institutions is often characterized by fractured communication channels. These fractures are not mere inconveniences; they are systemic points of vulnerability where diagnostic information can be distorted, delayed, or lost entirely. The interprofessional triad of nurses, laboratory technicians, and radiology staff operates within a complex ecosystem fraught with deeply embedded barriers that impede the clear, timely, and respectful exchange of information necessary for diagnostic accuracy. These obstacles are multifaceted, arising from entrenched hierarchies, logistical and physical constraints, overwhelming systemic pressures, and flawed technological interfaces. Understanding these barriers is the essential first step toward designing targeted interventions to mend the fractured channels that jeopardize patient safety.

A primary and pervasive barrier is the existence of hierarchical structures and professional silos that inhibit open dialogue. Healthcare has traditionally operated within a rigid hierarchy, often placing physicians at the apex, with other professions like nursing, laboratory science, and radiology technology perceived as ancillary "support services" rather than as co-equal diagnostic partners. This ingrained hierarchy can manifest in communication between the triad itself. For instance, a laboratory technician or radiologist may be hesitant to question an unclear test order from a nursing unit due to perceived chain-of-command protocols or fear of overstepping, leading to the execution of an inappropriate test rather than a clarifying conversation [22]. Conversely, critical findings communicated from the lab or radiology back to nursing may not be acted upon with appropriate urgency if the message is not delivered by or through a physician, a phenomenon known as the "authority gradient" effect. These silos foster unidirectional, transactional communication (e.g., "order" and "result") rather than collaborative, bidirectional dialogue aimed at shared problem-solving. The lack of shared physical spaces for interaction—with labs and radiology departments often located in separate wings or floors—further reinforces these silos, minimizing the opportunity for the informal, face-to-face conversations that build rapport and mutual understanding [23].

Compounding the issue of silos are acute systemic pressures and workflow mismatches that create an environment hostile to careful communication. Nurses, laboratory technicians, and radiology staff universally operate under conditions of high workload, staffing shortages, and constant interruption. For a nurse managing multiple acutely ill patients, the act of filling out a detailed clinical history on a lab requisition or calling the radiology department to provide context can be deprioritized in favor of more immediate, hands-on tasks. This results in terse, incomplete orders that lack the clinical "why," forcing laboratory and radiology professionals to work in an informational vacuum [24]. Similarly, in the laboratory, high-throughput pressures during peak hours can lead to a focus on processing speed over communication, potentially causing subtle specimen irregularities to be overlooked or critical value calls to be delayed. Shift work and handovers introduce another critical fracture point: diagnostic information is vulnerable to loss during the transfer of responsibility between shifts in nursing, lab, and radiology. An important nuance about a patient's condition or a pending test result can easily fall through the cracks if not meticulously documented and verbally communicated, a process often rushed during busy changeovers [25].

The very technology designed to facilitate communication often becomes a significant barrier itself. Fragmented, non-intuitive, or incompatible information systems can create digital silos that mirror physical ones. It is common for laboratory information systems (LIS), radiology information systems (RIS), and nursing electronic health records (EHR) to be poorly integrated or to function as separate "islands of information." A nurse may have to log into three different systems to view a lab result, a radiology report, and the patient's chart, with no unified view to correlate data. Critical alerts from the lab or radiology may appear as passive pop-ups in an already cluttered EHR interface, easily missed by an overwhelmed nurse [26]. Furthermore, the design of digital requisition forms can incentivize poor communication by relying on dropdown menus and checkboxes that fail to capture nuanced clinical context. The replacement of rich,

narrative communication with fragmented, templated data points can strip away the essential story of the patient, reducing them to a list of ordered tests and reported values [27]. This technological friction discourages the very interprofessional dialogue it should enable.

At a psychosocial level, interprofessional stereotypes, role ambiguity, and a lack of shared language erode the foundation of effective teamwork. Persistent stereotypes—such as viewing nurses as task-oriented rather than diagnostically critical, or perceiving laboratory staff as isolated "bench workers" disconnected from patient care—breed misunderstanding and diminish mutual respect. These stereotypes can lead to dismissive attitudes when communication is attempted [28]. Additionally, each profession possesses its own distinct jargon and conceptual frameworks. What a nurse terms "dizziness" could be vertigo to a neurologist, hypotension to a cardiologist, or a medication side effect to a pharmacist; this ambiguity is magnified when communicated to a radiologist deciding on a scan protocol or a lab technician interpreting a metabolic panel. The absence of a standardized, shared communication protocol for inter-departmental exchanges (unlike the increasing adoption of tools like SBAR for nurse-physician communication) means that vital information is structured and conveyed inconsistently, increasing the risk of misinterpretation [29].

Finally, a pervasive culture that lacks psychological safety serves as the ultimate barrier, cementing all others in place. In environments where blame is assigned for errors, individuals are less likely to speak up, ask clarifying questions, or report near-misses. A laboratory technician who spots a mislabeled specimen may fear reprimand for delaying results and thus might not call to verify, opting instead to process it with a disclaimer. A radiology technologist aware that a patient's condition has worsened during a scan may not feel empowered to immediately interrupt the radiologist. A nurse receiving a complex, abnormal result may hesitate to call the lab or radiology for clarification, worried about being perceived as incompetent [30]. This culture of fear suppresses the proactive communication required to catch errors before they harm patients. It transforms potential cross-checks into silent, individual burdens[30].

From Error to Event: Linking Communication Failures to Specific Diagnostic Inaccuracies and Delays

The theoretical risks posed by poor interprofessional communication manifest in the clinical realm as concrete, often preventable, diagnostic errors and harmful delays. These are not abstract concepts but specific event chains where a lapse in the transfer of information between nurses, laboratory staff, and radiology initiates a cascade that culminates in patient harm. By tracing the trajectory of these failures from the initial communication error to the final adverse event, we can move beyond generalities and pinpoint critical vulnerabilities in the diagnostic relay. This analysis reveals that communication breakdowns directly cause inaccuracies and delays across the entire diagnostic spectrum—from the pre-analytical phase of test ordering and specimen collection, through the analytical phase of interpretation, to the post-analytical phase of result reporting and integration.

Pre-Analytical Pitfalls: The Foundation of Error. The diagnostic process is most vulnerable at its inception, where communication failures between nursing and diagnostic departments set the stage for irreversible error. A primary and catastrophic example is specimen misidentification. A nurse under intense time pressure may label a blood tube at a central station away from the patient’s bedside, increasing the risk of applying the wrong label. If this mislabeled specimen reaches the laboratory, the technician, having no direct patient contact, is entirely reliant on the label’s accuracy. Despite procedural checks, the specimen is processed and results are generated for the wrong patient. This direct failure in the nurse-to-laboratory handoff can lead to a healthy patient undergoing unnecessary treatment for critical results, while the actual sick patient remains undiagnosed, a grave diagnostic inaccuracy rooted in a single communication (labeling) act [31]. Similarly, an incomplete or absent clinical history on a radiology requisition forces the radiologist into a pattern-matching exercise devoid of context. A nurse may order a chest X-ray for “cough” without specifying a history of recent breast cancer surgery and worsening shortness of breath. The radiologist, lacking this history, may report vague interstitial changes, missing the high probability of

lymphangitic carcinomatosis. The diagnostic delay in identifying metastatic disease stems directly from the failure to communicate a critical piece of clinical narrative from the nursing domain to the radiology domain [32].

Analytical Ambiguity: Interpreting Without a Map. Even with a correctly identified specimen or image, the interpretation of data is profoundly sensitive to the quality of interprofessional communication. In the laboratory, certain analytical results are inherently ambiguous without clinical context. Consider an elevated D-dimer level, a test for blood clot degradation products. In a patient with a high pre-test probability for pulmonary embolism (PE), it is a useful indicator. However, if ordered for an elderly patient with multiple comorbidities without a clear clinical question from the nursing team, the elevated result is non-specific. It could indicate a PE, but also disseminated intravascular coagulation, recent surgery, or even normal aging. The laboratory reports the number accurately, but its diagnostic meaning is unclear. Without a proactive communication loop where the lab scientist calls to understand the clinical picture or the nurse provides better context upfront, the result may trigger an unnecessary, costly, and potentially risky CT angiogram—a diagnostic detour caused by an information gap [33]. In radiology, the same principle applies. A small pulmonary nodule on a CT scan is a common finding. Its significance hinges on context: is the patient a 20-year-old non-smoker or a 60-year-old with a 40-pack-year smoking history? Without this communicated history, the radiologist must issue a generic report recommending follow-up, which may be deprioritized by the clinical team. The failure to communicate risk factors from nursing to radiology can lead to a delayed diagnosis of lung cancer, a tragic consequence of informational siloing [34].

Post-Analytical Breakdowns: The Silence of Critical Results. The communication pathway does not end with the generation of a result; it is arguably most critical at the point of result reporting. Here, failures in the laboratory-to-nurse and radiology-to-nurse channels directly cause dangerous delays. Critical value reporting protocols exist for life-threatening results like severe hyperkalemia or a new large intracranial hemorrhage. The barrier lies in execution. A laboratory technician may document a critical potassium level of 6.8 mEq/L in the system but, assuming an automated alert will suffice, may not make a direct phone call. That automated alert may be lost in a flood of other EHR notifications for the nurse. The resultant delay in administering life-saving treatment (e.g., calcium gluconate, insulin/dextrose) is a direct function of a failed active communication handoff [35]. Similarly, a “wet read” or preliminary finding from radiology may not be communicated actively. A radiologist identifying free air under the diaphragm—a sign of a perforated viscus requiring emergency surgery—may finalize the report in the system. If this finding is not directly called to the surgical team or the covering nurse, the report may not be seen for hours, leading to a catastrophic delay in surgical intervention. This represents a critical failure in the “closing of the loop,” where vital information is transmitted but not verified as received and understood by the responsible caregiver [36].

The Cascade Effect: Compounding Delays and Conflicting Data. Often, a single communication failure triggers a cascade of diagnostic delays. For example, an inappropriate test order due to unclear interprofessional guidelines (e.g., a nurse ordering a “routine” MRI for lower back pain without appropriate red flag screening) sets off a chain reaction. The radiology department, following protocol, may cancel the order, but the communication of the cancellation and the reason may be slow or unclear. Days are lost while the nursing team believes the test is pending. When the confusion is finally resolved and the correct test (e.g., an X-ray followed by physical therapy) is ordered, the patient’s condition may have worsened, and diagnostic momentum is lost [37]. Furthermore, when results from the lab and radiology arrive in conflict and are not reconciled through communication, diagnostic paralysis ensues. A patient with abdominal pain might have a normal white blood cell count (from the lab) but a CT scan showing appendiceal wall thickening (from radiology). If the nurse receiving these results does not engage both departments to discuss the discrepancy—the lab to rule out lab error or immunosuppression, radiology to clarify the certainty of the finding—the diagnosis of early appendicitis can be missed, leading to rupture [38].

Frameworks for Fidelity: Structured Tools and Protocols to Standardize Critical Communication

The chaotic and high-stakes environment of diagnostic medicine, with its inherent barriers and proven links to error, demands more than goodwill and ad-hoc communication. To mend fractured channels and ensure the faithful transmission of critical information, healthcare systems must implement structured, evidence-based frameworks. These tools are designed to combat ambiguity, enforce completeness, and create predictable, reliable pathways for interaction between nurses, laboratory technicians, and radiology staff. By standardizing the "how" and "when" of communication, these frameworks aim to reduce cognitive load, minimize reliance on fallible human memory, and create a safety net that catches errors before they compromise diagnosis. The adoption of such protocols represents a move from variable, personality-dependent exchanges to a system engineered for fidelity and resilience.

One of the most pivotal and adaptable frameworks is the SBAR (Situation, Background, Assessment, Recommendation) technique. Originally developed for nurse-physician communication, its structured format is powerfully applicable to the diagnostic triad. When a nurse calls the laboratory about a pending critical result or contacts radiology to clarify an imaging protocol, using SBAR organizes the conversation efficiently and comprehensively. For instance: Situation: "This is Nurse Jones on 4 West, I'm calling about patient John Smith, DOB 05/10/1955." Background: "He was admitted with GI bleeding, hemoglobin this morning was 7.2 g/dL. A stat repeat hemoglobin was drawn 30 minutes ago." Assessment: "I am concerned he may be having ongoing hemorrhage and need the result urgently to determine if transfusion is needed." Recommendation: "Can you provide the pending hemoglobin result and ensure it is called to me directly at extension 4321?" This structure prevents rambling, ensures key identifiers and context are delivered first, and ends with a clear, actionable request. Conversely, when a laboratory technician calls a critical potassium result, using SBAR ensures the gravity is communicated: Situation: "This is the core lab calling a critical value for patient Jane Doe." Background: "A potassium level was ordered stat." Assessment: "The result is 6.8 mEq/L, which is critically high and requires immediate intervention." Recommendation: "Please read back the result and state the actions you will take." This closed-loop communication verifies understanding and is proven to reduce transmission errors [39, 40].

Complementing verbal tools are structured documentation and requisition protocols that target the pre-analytical phase. Standardized, smart-form electronic requisitions for laboratory tests and imaging studies can mandate the entry of key clinical data before submission. Instead of an open, often blank, "clinical notes" field, these forms can require drop-down selections or forced entries for specific elements: "Reason for test: (e.g., Suspected infection, Monitoring of therapy, Pre-operative)." "Relevant History: (e.g., Immunosuppressed, Diabetic, Known malignancy)." "Specific Clinical Question: (e.g., 'Rule out pulmonary embolism,' 'Source of fever?')." For radiology, fields like "Time of onset of symptoms" or "Relevant surgical history (e.g., date of mastectomy)" guide appropriate protocol selection and interpretation [41]. This standardization compels the ordering nurse to provide the context that laboratory and radiology professionals desperately need, transforming vague orders into clinically meaningful requests. It also creates an audit trail, making it clear when inadequate information was provided at the source.

For the handoff of critical findings, formalized Critical Test Result Reporting (CTRR) policies are non-negotiable safety protocols. These policies must move beyond institutional folklore to explicit, written procedures that define what constitutes a critical result (e.g., a positive blood culture, a CT scan showing a new large stroke), who is responsible for reporting it, to whom it must be reported (e.g., the licensed nurse caring for the patient, not just the unit clerk), by what method (e.g., direct telephone call followed by an electronic alert), and within what timeframe (e.g., within 30 minutes of verification) [42]. Crucially, these policies must mandate "read-back" verification, where the receiver repeats the result and patient identifiers back to the sender. For the radiology-nurse interface, this includes policies for communicating urgent incidental findings discovered on studies ordered for other reasons (e.g., a newly discovered mass on a routine chest X-ray for pre-op clearance). Standardizing this process ensures that panic values are never left

to languish in an inbox and that the responsibility for acknowledgment is clear, protecting both the patient and the professionals involved [43].

In complex diagnostic scenarios, especially those involving sequential or multi-modal testing, shared mental models and checklists can enhance team-based communication. A pre-procedure checklist for an image-guided biopsy, for instance, can be co-verified by the nurse (confirming patient consent, allergies, and lab values like INR), the radiologist (confirming the correct site and procedure plan), and the radiology technician (confirming equipment and specimens containers are ready). This brief, structured pause (a "time-out") ensures all three parties have a shared understanding of the plan and can voice concerns. Similarly, for complex lab testing panels, a shared understanding of test limitations and turn-around times, perhaps facilitated by joint in-services, helps nurses set realistic expectations and choose the most appropriate diagnostic pathway in consultation with lab staff [44]. These tools formalize the "brief, huddle, and debrief" model, fostering situational awareness across professions.

The ultimate framework for standardizing communication is interprofessional education (IPE) and simulation training. While tools like SBAR provide the script, IPE provides the shared language and mutual respect necessary to use them effectively. When nurses, lab technicians, and radiology staff train together in simulated scenarios—such as a deteriorating patient requiring stat labs and imaging—they practice using these structured tools in real-time. They experience firsthand the consequences of an incomplete SBAR or a missed critical value call. This shared experiential learning breaks down stereotypes, clarifies roles, and builds the psychological safety required for a laboratory technician to confidently call a nurse using a structured format or for a nurse to comfortably ask a radiologist for a clarification using a standard protocol [45]. Simulation embeds the frameworks into muscle memory, transforming them from administrative mandates into intuitive components of professional practice [45].

Beyond Technology: Cultivating a Culture of Psychological Safety and Shared Responsibility

While structured tools and integrated technologies provide the essential scaffolding for improved interprofessional communication, they are ultimately insufficient if deployed within a dysfunctional cultural ecosystem. Protocols like SBAR can be ignored, and critical alert systems can be overridden if the individuals within the system—nurses, laboratory technicians, and radiology staff—do not feel empowered or obligated to use them effectively. The final, and perhaps most profound, determinant of success in safeguarding diagnostic accuracy is the cultivation of an organizational culture characterized by psychological safety and a profound sense of shared responsibility. This cultural dimension moves beyond checklists and software to address the human factors of fear, hierarchy, and identity that so often stifle the open dialogue necessary to catch errors. In a high-stakes diagnostic environment, the courage to speak up about a concern, the humility to acknowledge a knowledge gap, and the collective ownership of the diagnostic outcome are the ultimate safeguards against communication breakdowns.

Psychological safety, defined as a shared belief that the team is safe for interpersonal risk-taking, is the bedrock upon which effective interprofessional communication is built. In the context of the diagnostic triad, it means that a laboratory technician feels confident calling a nurse at 3 a.m. to question a potentially mislabeled specimen without fear of reprimand for delaying results. It allows a radiology technologist to alert a radiologist that a patient's clinical condition has worsened during a scan, prompting a review for additional findings. It enables a nurse to contact a radiologist to clarify an ambiguous report, not worrying about being perceived as incompetent [46]. Without this safety, concerns remain unvoiced. A lab scientist might process a poorly labeled sample with a disclaimer, a technologist might not mention a patient's unrecorded pregnancy before an X-ray, and a nurse might not call to confirm a surprising normal result when the patient appears critically ill. These silent failures, born from fear of embarrassment, blame, or retribution, directly enable diagnostic error. Amy Edmondson's seminal work demonstrates that in psychologically safe environments, teams are more likely to report errors, discuss mistakes openly, and innovate processes—all behaviors critical to diagnosing complex cases [47].

Cultivating this safety requires actively dismantling the barriers of hierarchy and blame. The traditional, physician-centric hierarchy often implicitly extends to create sub-hierarchies between other professions, silencing voices deemed "lower" in the peche order. A culture of blame, where errors are met with punishment rather than systemic inquiry, is the antithesis of psychological safety. When a miscommunication leads to a diagnostic delay, if the response is to identify and sanction an individual (e.g., the nurse who wrote an unclear order, the technician who didn't call), it guarantees that future errors will be hidden, not reported. The solution is a deliberate shift towards a "just culture" that distinguishes between human error (unintentional slips), at-risk behavior (cutting corners due to system design), and reckless behavior (conscious disregard of risk) [48]. In a just culture, the focus following a diagnostic error stemming from communication is not "Who is to blame?" but "What in our system allowed this to happen?" and "How do we, as a team of nurses, technicians, and radiologists, prevent it together?" This shift is fundamental to encouraging the transparent reporting of near-misses, which are invaluable learning opportunities to fortify communication handoffs before catastrophe strikes.

Leadership at all levels plays a decisive role in modeling and mandating this cultural shift. Departmental leaders in nursing, laboratory medicine, and radiology must visibly champion interprofessional collaboration. This involves more than verbal support; it requires concrete actions such as participating in joint rounds, publicly praising examples of effective cross-disciplinary communication that caught an error, and—most importantly—responding with curiosity and gratitude, not defensiveness, when concerns are raised about their own domain [49]. A laboratory manager who thanks a nurse for calling to provide additional clinical context for an abnormal result, or a director of radiology who encourages technologists to speak up about protocol suitability, sends a powerful message. Frontline supervisors must coach their staff on how to voice concerns respectfully and how to receive them constructively, using the structured tools not as rigid scripts but as frameworks for safe dialogue. Leadership must also resource and protect time for the activities that build psychological safety, such as interprofessional case reviews and team training.

The companion to psychological safety is the active fostering of a shared mental model and collective responsibility for diagnosis. The prevailing model often frames diagnosis as the ultimate responsibility of the ordering physician, with nurses, lab, and radiology in supporting roles. This fragmented mental model fosters a "handoff and forget" mentality. Cultivating a shared model means instilling the understanding that the diagnostic process is a single, integrated system, and each professional is a co-steward of its accuracy. A laboratory scientist is not just producing a number; they are a partner in validating or refuting a clinical hypothesis. A radiologist is not just interpreting pixels on a screen; they are a consultant adding a critical piece to a collaborative puzzle. This mindset is nurtured through interprofessional education (IPE), where nurses, technicians, and radiology staff learn with, from, and about each other [50]. Simulated scenarios where a diagnostic error unfolds due to sequential communication failures can powerfully demonstrate each profession's vital role in the chain and the catastrophic consequences of its breakage. These experiences build empathy, dismantle stereotypes, and make abstract concepts like "shared responsibility" a tangible reality.

Ultimately, the culture of psychological safety and shared responsibility manifests in daily, observable behaviors. It is the habit of curiosity—where a radiologist, unsure of the clinical context, picks up the phone to speak to the nurse rather than issuing a vague report. It is the practice of acknowledgment—where a nurse thanks a lab technician for a careful call about a critical value. It is the ritual of collective review—where teams from all three departments periodically analyze a diagnostic delay, not to assign fault, but to map the communication pathway and identify points for reinforcement [51].

Integrating the Digital Nexus: The Role and Limitations of Health Information Technology in Facilitating Communication

The contemporary diagnostic landscape is inextricably interwoven with Health Information Technology (HIT), a digital nexus intended to connect the interprofessional triad of nurses, laboratory technicians, and

radiology staff. Electronic Health Records (EHRs), Laboratory Information Systems (LIS), Radiology Information Systems (RIS), and middleware platforms promise a revolution in communication: seamless data flow, instant access to results, and automated alerts designed to transcend physical and temporal barriers. In theory, this digital infrastructure should be the ultimate facilitator, creating a unified source of truth that enhances diagnostic accuracy. In practice, however, the role of HIT is profoundly paradoxical. While it possesses immense potential to integrate and streamline, its current implementation often introduces new forms of fragmentation, cognitive burden, and communicative failure. The efficacy of the digital nexus in supporting the diagnostic relay hinges not on its mere presence, but on its thoughtful, human-centered design and its alignment with, rather than replacement of, vital interpersonal communication rituals.

The primary promise of HIT lies in its capacity to integrate and democratize information access. A well-designed, interoperable system provides a shared digital workspace where a nurse can view real-time lab results alongside the most recent radiology report, a laboratory technician can see the patient's latest antibiotic administration to interpret a microbial susceptibility profile, and a radiologist can access a patient's full clinical history and prior imaging studies at the point of interpretation. This integration aims to close the contextual gaps that plague manual systems. Computerized Physician Order Entry (CPOE), when paired with clinical decision support (CDS), can guide nurses toward appropriate test selection by flagging duplicate orders or suggesting necessary correlative studies, thereby improving the quality of the initial diagnostic request [52]. Furthermore, automated critical result notification systems are designed to eliminate the perilous delay of a life-threatening finding sitting in an inbox. By pushing alerts directly to the nurse's mobile device or workstation, HIT can theoretically ensure time-critical information reaches the caregiver promptly, creating a reliable post-analytical safety net [53]. This integrated, alert-driven environment represents the ideal of a cohesive diagnostic ecosystem.

However, this ideal is frequently undermined by the reality of digital fragmentation and poorly designed interfaces. It is common for the LIS, RIS, and core EHR to be separate systems from different vendors, connected by unstable or non-intuitive interfaces. This forces users into a burdensome practice of "swivel-chair integration," logging in and out of multiple systems, each with its own password, layout, and logic. For a nurse trying to correlate a rising white blood cell count (in the LIS viewer) with a new lung infiltrate (in the RIS viewer), this fragmentation adds time and cognitive effort, hindering synthesis rather than enabling it [54]. The communication breakdown here is technological: data exists but does not flow in a coherent, user-friendly narrative. Moreover, the proliferation of passive, non-urgent alerts—a phenomenon known as "alert fatigue"—poses a severe limitation. When a system generates hundreds of pop-up notifications daily for routine results, medication reminders, and administrative tasks, the one critical alert for a precipitously dropping hemoglobin can be lost in the noise. Nurses, overwhelmed by auditory and visual clutter, may instinctively click through or silence alerts, a rational response to a poorly prioritized system that inadvertently recreates the very communication failure it was meant to solve [55].

A more subtle but pernicious limitation of HIT is its tendency to constrain and de-contextualize professional communication. The structured data fields and dropdown menus of digital requisition forms, while promoting standardization, can stifle the nuanced clinical narrative. A nurse ordering a complex test may be forced to choose from limited, generic indications, unable to convey the specific, atypical suspicion that is crucial for the pathologist or radiologist. The rich "story" of the patient is reduced to a series of clicks, stripping away the very information that guides expert interpretation [56]. Similarly, the asynchronous, text-based communication tools within EHRs (e.g., secure messaging) can become a black hole. A radiologist may send an electronic query about a study, but without a protocol for urgent follow-up, that query can languish unanswered for hours, unlike a direct phone call which demands immediate engagement. HIT can thus incentivize impersonal, low-fidelity communication that is efficient for the sender but ineffective for collaborative problem-solving.

Furthermore, HIT systems often fail to support, and can even erode, the relational foundations of teamwork. The convenience of ordering a test or checking a result from a workstation can reduce the frequency of direct, face-to-face or telephone conversations between departments. These informal interactions are not social luxuries; they are the mechanisms through which relationships are built, trust is established, and subtle uncertainties are quickly resolved. Over-reliance on digital channels can lead to the "siloing" of professionals within their digital domains, weakening the interpersonal networks that are essential for navigating complex, ambiguous diagnostic cases [57]. The technology becomes a barrier to, rather than a conduit for, the development of shared mental models.

Ultimately, the limitations of HIT are not inherent to technology itself but to its implementation as a standalone technical fix, disconnected from workflow and human factors. To become a true facilitator, the digital nexus must be re-engineered around principles of human-centered design and interoperability. This requires moving beyond basic data display to intelligent synthesis. For example, systems could generate integrated diagnostic timelines that visually align lab trends with imaging events and medication administration. Alert systems must be radically refined using intelligent algorithms that suppress non-urgent notifications and escalate critical ones through multiple, fail-safe channels (e.g., SMS after an unacknowledged EHR alert) [58]. Interoperability standards like HL7 FHIR (Fast Healthcare Interoperability Resources) must be fully leveraged to create seamless data exchange, not just between departments within a hospital, but across care settings, providing a continuous diagnostic narrative [59].

Most importantly, HIT must be recognized as a tool to augment, not replace, human judgment and dialogue. The most effective systems will include features that prompt and facilitate interprofessional communication, not assume to eliminate it. This could be a "contextual communication button" within a lab or radiology result that initiates a pre-populated secure call or message to the ordering nurse, or a shared digital whiteboard for complex cases involving the triad [60]. Technology should close the loop by tracking not just the delivery of information, but its acknowledgment and the action taken [60].

Conclusion

The diagnostic journey is a complex, collaborative endeavor whose accuracy is profoundly dependent on the quality of interaction between key stakeholders. This research has established that the interprofessional communication between nurses, laboratory technicians, and radiology staff forms the central nervous system of this process. The evidence demonstrates that fractures in this system—whether from hierarchical barriers, workflow mismatches, or technological silos—are not mere inefficiencies but direct precursors to diagnostic error, leading to mislabeled results, misinterpreted findings, and dangerous delays in treatment. While the implementation of structured tools like SBAR and robust critical reporting protocols provides a necessary framework to standardize exchanges, and while integrated health information technology holds promise for data synthesis, these solutions are insufficient in isolation. True and sustainable improvement requires moving beyond protocols and platforms to address the human and cultural core of healthcare work. The final, and most critical, determinant of success is the deliberate cultivation of a culture marked by psychological safety, a just approach to error, and a genuine sense of shared responsibility for diagnostic outcomes. When nurses, technicians, and radiology professionals feel empowered to speak up, inquire, and collaborate without fear, the entire diagnostic system becomes more resilient. Therefore, safeguarding patients through improved diagnostic accuracy demands an unwavering commitment to this triad, investing simultaneously in the tools that guide their communication, the technology that connects their data, and the trust-based culture that motivates their collaboration. The path forward is integrative, recognizing that the fidelity of the diagnostic relay depends as much on the human connections between professions as it does on the information they convey.

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