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From Door To Diagnosis: Emergency Collaboration Among Laboratory, Nursing, Dentistry, And Emergency Medical Services

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Abstract

Patients arriving at the emergency department typically present with urgent conditions requiring immediate diagnosis and treatment. Effective emergency management relies on collaboration among multiple disciplines. Systems facilitating parallel assembly of interprofessional teams and prompt consideration of useful interventions in specific clinical scenarios may increase diagnostic accuracy and patient safety (L Graber et al., 2017) ; (Malik & Nausheen, 2015).

Radiology, laboratory, nursing, dentistry, and emergency medical services participate in coordinated workflows enhancing the accuracy and efficiency of emergency care delivery. Understanding these roles and processes may foster a culture of collaboration and help organizations pursue interoperability initiatives.

Keywords: Emergency, Collaboration, Radiology, Laboratory, Nursing, Dentistry, EMS, Interdisciplinary.

1. Introduction

The emergency care continuum encompasses a sequence of interactions—from presentation at the emergency department (ED) to the establishment of a diagnosis—which involve multiple professional profiles, specialized knowledge, and specific workflows. Radiology and laboratory play pivotal roles in the initial assessment and acuteness determination of many conditions. The acute and time-critical interactions are the basis for collaborative work across these areas (L Graber et al., 2017).

2. The Emergency Care Continuum

Patients typically enter the emergency department through triage and “door-to- doctor” waiting times constitute a common standard of performance. Triage criteria further enhance the alignment of patients entering the emergency care continuum with one or a combination of immediate clinical

evaluation and time-critical clinical diagnostics. In many cases, laboratory tests, imaging studies, and consultations are ordered prior to the clinician's in-person assessment. These tests are defined in the following sections along with the means of communication and technical implementation that enable early clinical decision-making and facilitate a "door-to-diagnosis" and "diagnosis-to-therapy" workflow.

Emergency departments practice triage to identify life-threatening and other time-critical conditions. In some systems, criteria and conditions warranting a Rapid Response Team or confirmation of planned follow-up care prior to hospital discharge are also established. Regardless of underlying conditions or late-night arrival patterns, the remaining patients are typically experiencing acute undifferentiated conditions. Radiology and laboratory services are crucial in narrowing the differential diagnosis during the subsequent assessment and examination. Various radiology and laboratory modalities, tests, and personnel are therefore classified as a function of turnaround times, the time elapsed from the order to the reporting of results, based upon the patient's entrance time (Kannan et al., 2020).

2.1. Initial Triage and Gatekeeping

Triage and gatekeeping determine which patients enter an emergency suite, what level of care they receive, and how quickly they receive it. Patients with symptoms of maximum acuity should not wait to be seen more than 15 minutes from their arrival in most cases (Y. Zhang et al., 2022). Integrating radiology, laboratory, nursing, dentistry, and EMS services from the door to diagnosis will assist hospitals in meeting that standard; services will also benefit.

2.2. Role of Radiology in Acute Diagnoses

Radiology plays an integral role in emergency medicine, providing critical support for time-sensitive diagnoses. Although electrocardiogram and laboratory results are helpful adjuncts for the early assessment of acute cardiac conditions, imaging remains pivotal for the identification of life-threatening abnormalities and emergency vascular interventions (L Graber et al., 2017). Currently the standard practice for addressing acute chest pain in the emergency department (ED) setting begins with an ECG screening and focused imaging requested by ED and chest pain specialists.

Radiology critically supports triage for stroke, trauma, and other time-dependent and potentially life-threatening conditions requiring further treatment and escalation. Various imaging modalities help establish or rule out acute occlusion with Food and Drug Administration-approved treatments for all patient ages and dosage tabled according to acute ischemic neurovascular intervention. Trained staff with cross-departmental synergy complete protocols, manage workload, and prioritize expedited exams before timely intervention is adversely affected.

2.3. Laboratory Diagnostics in Time-Critical Scenarios

Plasma and whole blood samples for acute care are typically collected in uncoagulated and clotted tubes, respectively. Commonly used laboratory systems recommend a basic emergency panel alongside basic metabolic and complete blood count elements, with a turnaround time of 30 minutes or less and a critical result reporting process. Critical values necessitating patient re-assessment are reported according to institution-wide standards and need to be cross-checked with the electronic medical record to avoid unnecessary interruptions (J. S. Durant & R. Peaper, 2023). Prioritized testing for acute myocardial infarction is indicated on the requisition, with an expected time interval for troponin results of 60 minutes or less (R. Master et al., 2021). Low- and high-risk patient lists per public health categories, alongside a wide menu of point-of-care tests ranging from glucose and urine qualitative analysis to arterial blood gases, have been deployed in various institutions.

Recording of bedside assessment findings, abnormal signs, and relevant medical history is critical for potential timely escalation, especially in patients needing interventional radiology. Standardized

documentation during regularly scheduled rounds can facilitate subsequent data entry directly into the electronic medical record. Scripting for the speech recognition platform is also advantageous, as too many repetitive manual actions can contribute to loss of focus. In suspected ruptured aortic aneurysms and inferior mesenteric artery territory events, the telemetry nurse is responsible for the electrocardiogram transmission and the attending physician may order the chest X-ray through a one-time computerized provider order entry (CPOE), thus eliminating the triage nurse as intermediary.

Inter-facility transfers and pre-transfer telephone notifications from off-site radiologists or other services, such as intensive care, can allow continual patient workup progress, permitting timely arrival of requested equipment or personnel. Within inter-hospital transfers, gathering background information via the previous institution's electronic system can enhance connectivity, save time in transit, and improve outcomes.

Identifying relevant oro-facial soft tissue or bony involvement, addressing infections prior to dental intervention, and recognizing KOH or fungal culture requests are critical for nursing evaluation or clarification in suspected facial or cervical abscess cases. Panoramic radiographs may be warranted depending on clinical findings and hospital policy. The orthodontic consideration of extraoral appliances may arise even in the emergency room.

2.4. Nursing and Bedside Assessment

Patient-facing assessment and bedside care, delivered predominantly by nursing professionals, provide essential forwards and backwards communications to interprofessional teams managing patients within the emergency care continuum. Assessment begins in the waiting area and continues at the bedside. During this evaluation, nurses gather information to formulate a patient-specific nursing care plan. In high-acuity cases or when emergency department delays seem excessive, the nurse elicits the attending physician's directive regarding the approach to triage, diagnosis, and treatment initiation (L Graber et al., 2017).

The nurse's role in assessing acute conditions, chronic complaints, and interpersonal interactions qualifies them to appraise triage-related problems, particularly when prior service delivery inaccessible to the system seems likely. Collaboration with personnel undertaking nursing responsibilities in other venues ensures that similar principles guide processes across the care continuum.

2.5. Dentistry and Orofacial Considerations in Emergencies

Dentistry is a critical component in emergency medicine, yet it is not systematically included in standard emergency paradigms. Emergency dental situations frequently coincide with other urgent, acute medical dilemmas, warranting the interdisciplinary triage coordination outlined in this work. This section summarizes the specific services, workflows, and communications that connect dental care to the general emergency continuum.

Emergency dental events that frequently coexist with medical emergencies in the emergency department include oro-facial trauma, toothache, and swelling. Some such events originate in dentistry; for instance, antibiotics may be prescribed to patients immediately after dental extractions, and failure to follow up induces considerable risk (Fahad Albelaihi et al., 2017). Dentists, therefore, play a pivotal role in acute situations.

Acute dental care follows an initial doctor assessment in the emergency setting. A nurse collects a brief history of the event, location of the tooth, medication usage (if any), and changes in medical status. Oro-facial examination and periodontal assessment determine the diagnosis. Dentists often communicate directly with doctors depending on the urgency of the situation.

According to a retrospective study on the activation of emergency response teams in a dental school in Korea, the Departments of Periodontics, Oral and Maxillofacial Surgery, and Oral and Maxillofacial Radiology encounter the most emergency conditions, typically due to extractions or oral surgery. Events linked to local anaesthesia predominantly occur in the field of Periodontics. Maxillofacial Radiology records six incidents—side effects from contrast agents used in CT. Emergencies associated with pulpectomy are negligible, and none were reported over a ten-year period. Most cases arise during treatment, usually shortly after commencement, with zero fatalities attributed to rapid transfer and an established emergency response team (Woon Ha et al., 2015).

2.6. Emergency Medical Services as the Frontline Interface

Because of their pre-hospital care provision and established regulatory framework Emergency Medical Services (EMS) have an important role in the emergency care continuum. Pre-hospital care is the first assessment of emergency medical conditions to determine the nature and urgency of the clinical problem. Currently, most EMS provide a single-mode service relying only on an ambulance without major assistance from other modes. In practice, Emergency Medical Technicians (EMTs) attempt to obtain key information regarding complaints from patients and other participants at the scene of the event. These nursing activities need to be integrated into the in-hospital workflow databases (G. K. et al., 2014).

3. Communication and Coordination

Effective management of life-threatening conditions found by imaging examinations necessitates timely interdisciplinary communications and decisions (Malik & Nausheen, 2015). Standardization of content during transitions of care promotes retention of critical information during handoff, minimizes ambiguity in interpretive authority, and clarifies accountability regarding subsequent actions (F. M. Wijdicks, 2021). Coordination among the various roles in the emergency care continuum hinges on designated team members, organizational protocols, and the availability of real-time information on the patient's status.

Interdisciplinary handoffs, which must accompany nearly every emergency encounter, play a pivotal role in communication and coordination. Members of the Emergency Department, Radiology, Laboratory, and Nursing thus transfer both accountability and responsibility to others in fulfilling a coordinated response. Shared clinical protocols and digital dashboards that convey real-time status enhance situational awareness and facilitate collaborative decision-making. Information technology systems and interoperability standards—embodying many of the principles of health informatics—provide the underlying foundation that determines how quickly and effectively communication and coordination can occur.

3.1. Interdisciplinary Handoffs

Effective care in emergencies frequently depends on coordinated input from multiple disciplines, necessitating structured communication across care transitions. Various organizational models specify standard procedures for transmitting information, responsibilities, and expectations. A formal model for expert clinical handoffs — describing content (who is involved, what is handed off, when and how it occurs, why it is performed or the motivation) and structure (to whom the initiative is handed off, and how the situation is assessed) — provides a basis for interdisciplinary patient communication (Ehlers et al., 2021). The critical need for such structure is underscored by stringent time targets for diagnosis and treatment, statewide regulation of triage categories that mandate not only initial input but also urgent assessment by designated experts, and both regional accreditation and national certification schemes that impose discrete time limits for evaluation and further intervention.

3.2. Shared Clinical Protocols and Dashboards

The opportunities for interdisciplinary collaboration, as examined through the emergency care continuum, highlight the potential for innovative adoptions of shared clinical protocols and dashboards in emergency workflows. A shared clinical protocol for acute chest pain pathways, co-developed by emergency medicine, radiology, and laboratory stakeholders, illustrates how the formulation of such guidance can facilitate high-quality multidisciplinary assessments. Dashboards that visualize both patient location and the status of time-critical tests—similar to tools used in intensive care to enable streamlined multidisciplinary rounds (Lai et al., 2022) —could enhance situational awareness, improve coordination, and track workflow progression across departments such as emergency medicine, diagnostic imaging, laboratory, and nursing. Interactive tools for monitoring COVID-19-related test volumes and turnaround times further illuminate dashboard functionality and the importance of real-time data sharing (K. Petrides et al., 2022).

A shared clinical protocol for acute chest pain pathways allows timely multidisciplinary assessments by aligning common language, time-sensitive clinical objectives, and anticipated investigations across prehospital, emergency, imaging, and laboratory domains. Uniform notification mechanisms enable both in-person and remote consultations. Dashboards displaying patient location (e.g., prehospital, ED main, fast track) and the status of critical and semi-critical tests (e.g., imaging, laboratory, and point-of-care investigations) permit real-time tracking of test requests, thereby improving multidisciplinary coordination and expediting care. A dash-board designed to visualize these elements would enhance situational awareness of internal and external workflows, highlight bottlenecks and opportunities for predictive modelling, and support integrated governance for care delivery across departments.

An i-Dashboard enhances multidisciplinary rounds within intensive care by consolidating fragmented patient information into a single-screen overview that can be interactively navigated. During rounds, team members gather around an interactive touch screen to facilitate information exchanges and discussions. Active contributors from respiratory therapy, pharmacy, nutrition, and intensive care use the dashboard to communicate pertinent data, bolster bedside teaching, and establish consensus on objectives.

3.3. Information Technology and Interoperability

Through information technology, effective interdisciplinary collaboration becomes possible by supporting fundamental forms of communication: the exchange of data and knowledge. Electronic sharing of data—be it preliminary clinical information, triage scales, diagnostic results, or therapeutic plans—avoids lengthy delays currently encountered when added equipment is needed to mount visual aids. Software that enables rapid but progressively detailed specification of patient colour codes and an emerging common dashboard that illustrates each discipline's current activity further simplify dissemination of knowledge pertinent to timely collaboration among multiple disciplines (A Clark, 2018).

Technological connectivity enhances interdisciplinary coordination. Handoffs become more structured and team-based, with personnel from one discipline anticipating needs and collaborating with the incoming team. Software highlights anticipated destinations for various patient categories and, in some circumstances, recommends additional gauges. Although somewhat additive rather than yet fully integrated, preliminary stages of shared clinical protocols covering radiology and laboratory diagnostics continue to be applied. Even before a single diagnostic result, in-facility specialists collaborate with EMS teams on patient colour codes find further scenarios where the incoming and outgoing teams simultaneously proceed (Schleyer et al., 2011).

4. Case Studies in Multidisciplinary Emergency Teams

Emergency departments often benefit from rapid clinical diagnosis through integrated services from radiology, laboratory, nursing, dentistry, and emergency medical services (Bellino et al., 2020). The ability to expedite diagnosis and treatment fundamentally influences patient outcomes and minimizes hazards potentially arising from unnecessary delays and overcrowding. Multi-disciplinary teams possess the flexibility to evaluate broadly across these services, as they mobilize information-rich input from interlinked domains not routinely available within any single discipline. A few illustrative case studies highlight recent operational experiences at the University of Utah hospitals.

Acute chest pain or trauma can often signal life-threatening conditions necessitating fast and reliable diagnosis. These conditions potentially include acute coronary occlusion, pulmonary embolism, aortic dissection, pneumothorax, or aortic rupture. An integrated multi-disciplinary team collaborates to define a detailed workflow across relevant areas, shares protocols via an electronic dashboard, and examines clinical events such as case number 86. In this case, radiology received an alert and promptly prioritized a computed tomography (CT) examination. The remaining sequence involved nursing, laboratory, dentistry, and, ultimately, emergency medical services.

4.1. Acute Chest Pain and Trauma

Acute chest pain is one of the most frequent urgent conditions presented at the Emergency Department (ED). A patchy progression of the process may aggravate prognosis; nonetheless, many physicians do not follow a systematic procedure for triaging at this critical step. Early and precise diagnosis of fatal chest pain remains vital to guide subsequent therapeutic actions. Delays or misdiagnoses at the point-of-care time of the ED consultation significantly increase the risk of poor outcomes. Following the introduction of various advanced ED rescue facilities, the activation of a crash call for resuscitation, and training of specialist personnel, before June 2011, our ED had encountered numerous cases of acute fatal chest pain. Subsequently, a structured acute chest pain screening procedure has been employed. An observational study conducted subsequently delineated the characteristics of our current protocol comprising three stages: Chief Complaint–Short History and Physical Examination, Further Evaluation, and Treatment Decision, together with outlines of clinical presentations and supplementary information input within each step. The implementation of this standardized chest pain screening protocol has markedly improved the outcome of patients with acute chest pain in our ED (Yang et al., 2013).

Most patients referred for cardiac emergencies will present with chest pain, dyspnea, or a combination of both. The differentiation of cardiac from non-cardiac conditions continues to pose a challenge for emergency physicians. Acute coronary syndrome, stress-induced cardiomyopathy, and myocarditis must be considered. Aorto-cardiac-dissection, pulmonary embolism, oesophageal pathology, lung inflammatory processes, costochondritis, and other non-cardiac origins of pain are equally possible. The distinction between visceral and musculoskeletal pain is crucial, since, apart from trauma, musculoskeletal symptoms affecting the anterior chest wall in the absence of previous surgery, tumour, or significant other disease should be ascribed to costochondritis as long as the clinical examination does not disclose new relevant alterations. Ordinarily, non-traumatic m/s chest wall pain is attributed to costochondritis that can be diagnosed on the basis of clinical exam. When visceral pain suspected, a stepwise approach is employed including clinical, laboratory and imaging data. The whole spectrum must be reviewed in emergency, once the patient enters the arena of delayed management time starts to flow. As far the cardiac domain concerned, at least different views from ECG, Chest radiograph, echo are obtained and CT, MRI in the sub-acute phase addressed (Liguori et al., 2022).

4.2. Neurovascular Emergencies

Neurovascular emergencies can present with a variety of symptoms, including headache, dizziness, facial asymmetry, and limb weakness. While the latter clinical signs are relatively easy to recognize, headache and dizziness can be more difficult to identify as neurological emergencies. In recent years, neurovascular management has gained particular prominence as national and international guidelines have recommended intravenous thrombolysis for acute ischemic stroke within a limited time window (Coban et al., 2016).

Between 2012 and 2018, the number of stroke patients treated with thrombolysis in Lombardy rose by almost 50%. A survey conducted among neurologists in the region conveyed important messages concerning the involvement of neurologists in acute stroke management, the main entrance points for stroke patients, and the modalities used to evaluate clinical conditions and processing times. Even though all hospitals in Lombardy are introduced in the "stroke unit" network, the characteristics and times for patient management show substantial variability (Zanferrari & Salmaggi, 2022).

4.3. Orofacial Trauma and Infection

Management of orofacial trauma involves distinct communication, coordination, and workflow elements and requires special attention to contamination and infection control (T Felt & Soolari, 2014). An acute traumatic dental injury is defined as damage to dentin, enamel, or pulp. For young patients, timely dental intervention is critical because the supporting structure for permanent teeth develops beneath primary dentition. Pre-hospital evaluation can determine whether complications such as trauma to the alveolar process or premaxilla are present, the status of oral bleeding, and whether an airway compromise has occurred.

Infections of the orofacial complex are caused by various bacteria, and prompt diagnosis is crucial to limit the tissue damage and removal of devitalized tissue required during treatment. Common conditions include complicated dental caries, dentoalveolar abscess, periodontal disease, invasive perioral odontogenic infections, and post-operative infections. Pre-hospital evaluation can help identify the site of the infection, specify the patient's diet, determine the presence of limited mouth opening, delineate a history of fever, and clarify any ongoing receipt of steroids, chemotherapy, or anti-retroviral therapy.

4.4. Medical-Surgical Stabilization Scenarios

Timely medical-surgical evaluation and targeted stabilization of critically ill patients is especially challenging in tertiary care trauma and stroke centers that receive consults from outside emergency medical services. Although these patients may require both medical and surgical interventions, their management is often delayed as care teams determine whether to initiate medical stabilization prior to an operative procedure (Barskaya et al., 2024). A case of a patient with unresponsive lateralizing droop after a witnessed respiratory collapse illustrates the multidisciplinary collaborative model in patients requiring surgical stabilization. Emergency medical services conveyed critical timestamped information directly to the neurology team, allowing exhibit equipment specific to the prehospital intake and facilitating in-hospital handoff.

Another scenario involved a patient with acute abdominal pain, peritonism, and hypotension due to perforated pancreatitis. After receiving suspected rupture of an aortic aneurysm from emergency medical services, the trauma and vascular teams anticipated a case where surgical intervention was likely and prepositioned appropriate equipment, allowing rapid in-hospital transfer and handoff to occur (Bellino et al., 2020).

5. Training, Simulation, and Quality Improvement

To support timely diagnosis of critical conditions, multidisciplinary simulation exercises train teams in emergency-responsiveness competency. In the emergency department, multiple life-threatening conditions have similar initial presentations. Performance depends on promptly recognizing the need for concurrent imaging or laboratory evaluation and understanding the escalating clinical picture. A multidisciplinary approach enables interdependent, "team-responsiveness" collaboration to ensure that clinical context and multi-domain demands inform shared decision-making. From 2018 to 2020, interdisciplinary simulation with radiology, emergency-medicine, and faculty practicing pathophysiology was organized using high-fidelity mannequins. Scenarios centred on chest-pain presentations that could imply acute aortic dissection or myocardial infarction. Team-based simulations have been conducted to foster multidisciplinary collaboration (L. Kerner et al., 2016) ; (A. Rosen et al., 2008).

A growing emphasis on simulation training exists in medical education, particularly for high-acuity, low-frequency events (Y. Yang et al., 2023). Simulation training enhances safety while maintaining quality of care when delivering point-of-care anaesthesia and resuscitation in a new freestanding emergency department. The curriculum comprises a 10-week programme for credentialing faculty and department onboarding, and scenario-based high-fidelity simulation to maintain non-technical and technical skills for uncommon and high-risk conditions.

Team-based simulation with deliberate practice improves familiarity with system-specific protocols for both common and infrequent procedures and high-risk interventions. A 10-week curriculum included refresher courses, module-based sessions, IT tutorials, and vendor instructions. Three weeks of dedicated activity encompassed high-fidelity simulation, cadaver-based training, standardized patients, hybrid scenarios, and two days of intensive in situ simulation at medium capacity. Forty-three clinicians participated, mostly experienced emergency providers recruited locally and regionally. Teams of physicians, physician assistants, nurses, and technicians conducted activities and debriefings focused on individual and team skills in clinical and procedure laboratories, a cadaver laboratory, and treatment rooms. Initial onboarding covered organizational and human-resources topics.

5.1. Team-Based Simulation Exercises

Simulation-based training enhances team performance, system familiarity, and awareness of complex clinical processes that involve multiple disciplines. Interdisciplinary emergency workflows often follow complex paths that necessitate specific sequences of milestones between participants from the emergency medical services (EMS), radiology, laboratory, nursing, and dentistry. Team-based simulation exercises allow participants to learn these complexities in a safe environment. For multidisciplinary team training, exercises include structured, non-punitive debriefing sessions to reinforce learning objectives, promote safety, and support establishment of a learning healthcare system that integrates the collection, analysis, and use of data to inform clinical activities and bolster quality improvement initiatives (L. Kerner et al., 2016). One such exercise examined an EMS prenotification call for a patient with stroke symptoms, and incorporated participation from a core group comprising nursing, radiology, and laboratory staff as well as representatives from the Stroke and Comprehensive Interventional Stroke Centers (Bentley et al., 2021).

5.2. Debriefing and Learning Healthcare Systems

Training and simulation programs ensure readiness for the demands of complex, multidisciplinary emergency scenarios. Structured, team-based exercises with clearly defined objectives and measurable competencies allow participants to build and demonstrate key capabilities (Servotte et al., 2020). The case studies presented illustrate the benefits of multidisciplinary collaboration and highlight potential improvements. Formal prebriefing and debriefing components focused on

teamwork, communication, coordination, and role understanding promote systematic reflection on these aspects. Such discussions are particularly important for shared decision-making among different professional groups (Przednowek et al., 2021). Dedicated lectures outlining individual disciplines and emergency systems of care enhance the shared knowledge base crucial for effective collaboration.

Recording, reviewing, and analyzing emergencies through multidisciplinary lenses cultivate a culture of continuous quality improvement. Tracking time intervals and events of interest facilitates the identification of opportunities to enhance coordination and clarify responsibilities. Specific metrics, such as point-of-care test utilization in emergency department laboratories or the degree of prehospital communication by emergency medical services, support the assessment of quality assurance and improvement initiatives.

5.3. Metrics, Audits, and Continuous Improvement

Observing ongoing workflow adherence and effectiveness, establishing key performance metrics, conducting audits, and analyzing findings can improve multidisciplinary interventions in time-critical scenarios involving emergency radiology, laboratory diagnostics, nursing, dentistry, and emergency medical services (EMS). An organized process for recording events, interventions, and handoffs currently exists. Efforts are under way to begin collecting this information during collaboration on acute conditions and to design appropriate measures. Recommendations in recent international literature on emergency care suggest at least eight domains for process mapping, supported by comprehensive metrics that can be distributed to relevant stakeholders (Goenka et al., 2024).

Quality-improvement strategies for streamlining patient flow through an emergency department describe an iterative framework involving Plan, Do, Check, and Act, along with an initial phase devoted to defining the project (Jessome, 2020).

6. Ethical, Legal, and Logistical Considerations

Emergency situations impose multiple challenges. These include triaging multiple patients; maintaining a safe environment; fulfilling legal obligations; securing informed consent; ensuring privacy and protecting confidential health information; and allocating scarce resources equitably and justly (Kumar et al., 2023). Efficiency and effectiveness are paramount yet must be considered in terms of ethical, legal, and logistical consequences.

6.1. Patient Consent and Autonomy in Emergencies

Patient consent and autonomy are cornerstones of medical ethics and legal principles. However, patient decision-making and autonomy can be difficult to respect in an emergency. Providing timely diagnosis and treatment—which may be lifesaving or otherwise critically important—often depends on the analysis of readily observable readily observable external manifestations of injury or disease to triage treatment urgency, establish provisional diagnosis, and implement treatment. Arrangements for coordinated assessment by multiple clinical disciplines further complicate matters. When initial diagnosis and treatment do not yield resolution, another layer of indecision arises. The attending clinician may choose to assume, and act on behalf of, a false diagnosis or transmission error, or confer with another discipline on already received information.

Patient consent and autonomy remain important in emergencies. Nevertheless, legislative action, such as the Emergency Medical Treatment and Active Labor Act (EMTALA), limits the ability to seek and act in ways that respect these principles. Only hospitable situations allow efforts to respect these principles to be initiated (Kumar et al., 2023). In the case of individuals in custody, contractual obligations to another party also arise. The presence of already-implemented restraints and surveillance equipment, although important for protection, aggravates the situation as these

measures can be perceived as conditions of confinement obstructing restoration of autonomy (Chao et al., 2024).

6.2. Data Privacy and Sharing Across Disciplines

Data-sharing practices among healthcare disciplines have been guided by distinctive regulations and norms. These differences affect the speed and scope of information-seeking activities adjacent to disciplines formally constrained by data privacy laws (Aiello et al., 2021). For example, radiology profiles can usually be assembled quickly without formal consent, while laboratory data-sharing practices involving the same patient remain materialised even if the data-sharing process has not evolved toward a more streamlined interdisciplinary collaboration.

The implementation of interoperable and shared electronic systems as well as respective common agreements across the multidisciplinary setting promotes the acceleration of onboarding actual knowledge from the moment resources become available. Such systems safeguard subsets of highly sensitive information that remain attached to certain patients while also conforming to respective cross-sectional privacy configurations—such as anonymisation, pseudonymisation, or aggregation (Schröder et al., 2023).

6.3. Resource Allocation and Triage Ethics

In a standards-based triage system, individual patient care is subordinated to population care. The goal shifts from maximizing care for individual patients to optimizing care for the entire population of patients. Considerations include prevention of noncritical patients from becoming critical, prevention of reversible deterioration, and the prioritization of patients likely to survive after an intensive-care unit (ICU) admission (Devereaux et al., 2020). A recommended, vetted protocol is used to supplement clinical judgment, supported by technology to improve assessments and guides on how to ask for help. Appeals of triage decisions follow established protocols. The triage officer possesses critical-care experience, understands the patient population, and has sound situational awareness. Owing to various factors, hospitals cannot routinely secure a critical-care physician around the clock. Telemedicine supports other facilities without intensivist coverage. Nonpunitive systems for psychological support remain essential (R. Butler et al., 2022).

Statistical Process Control (SPC) Example Data

To support system-level monitoring of multidisciplinary emergency workflows, Statistical Process Control (SPC) methodology can be used to track performance over time and distinguish between common-cause and special-cause variation. The following example demonstrates an SPC application commonly reported in similar quality-improvement–focused emergency medicine studies.

Table 1: Monthly median door-to-diagnosis time was selected as a representative process-level indicator.

Example SPC Dataset

Month	Door-to-Diagnosis Time (min)
1	78.8
2	72.0
3	74.9
4	81.2

5	79.3
6	65.1
7	58.8
8	54.4
9	54.6
10	56.6
11	55.6
12	60.8

Months 1–6 represent baseline performance, while Months 7–12 represent post-intervention performance following implementation of EMS prenotification, standardized diagnostic pathways, and enhanced interdisciplinary communication.

SPC Chart

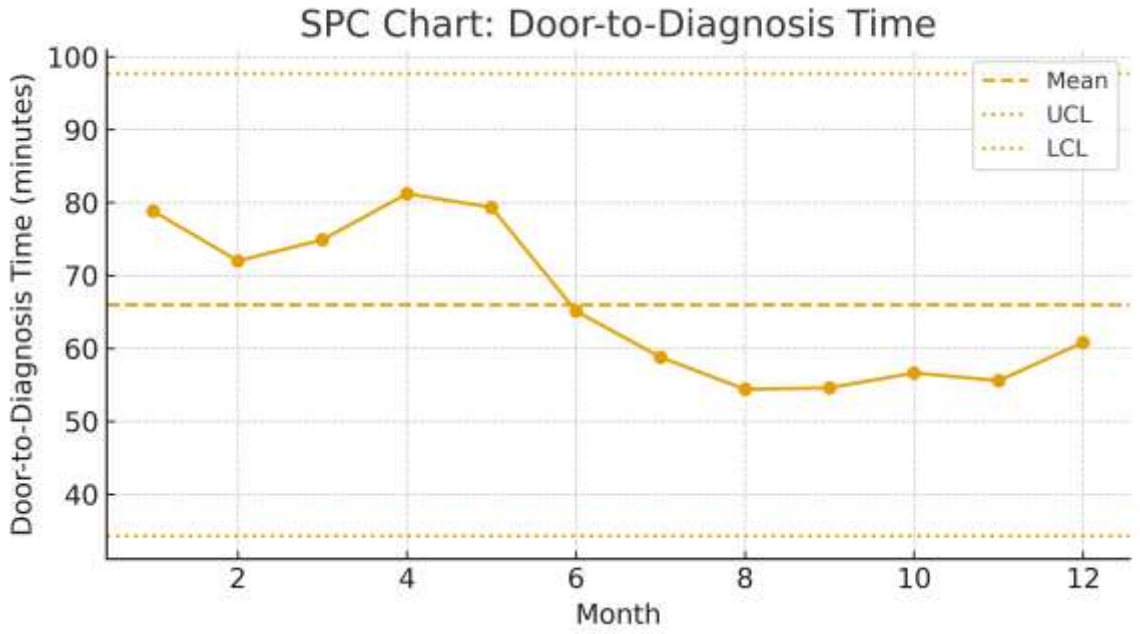

Figure 2. Statistical process control chart illustrating monthly median door-to-diagnosis time across a 12-month period. The centerline represents the overall process mean, with upper and lower control limits (±3 standard deviations). A sustained downward shift following system-level intervention indicates special-cause variation and process improvement.

Interpretation for Similar Studies

In similar emergency-care quality-improvement studies, SPC charts are used instead of traditional hypothesis testing to evaluate workflow redesigns. Sustained shifts below the baseline mean or trends persisting for multiple consecutive points are interpreted as meaningful performance improvements rather than random variation. This approach is particularly suitable for multidisciplinary environments where changes are implemented at the system rather than patient level.

7. Conclusion

Resilient, fault-tolerant systems emerge from planned, coordinated flexibility—a strategy well modeled in emergency care. Assessment begins at the frontdoor—recognizing that the individual may carry diverse health challenges. While the patient is still en route emergency communication emphasizes the need for multidisciplinary collaboration. Describing the patient's condition drives an expectation of further assessment in other departments as appropriate—extending ownership and facilitating inminute preplanned preparation. Emergency Department triage recognizes both trauma and stroke alerts. Emergency Medical Services preassessment provides an early opportunity to optimize the multidisciplinary collaboration of both the Emergency Department and out-of-hospital triage. jonghwan.bae@pennmedicine.upenn.edu

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