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Optimizing Interprofessional Trauma Care Pathways: A Systematic Review of Workflow Integration from Prehospital Stabilization to Definitive Disposition

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Abstract

Background: Major trauma management demands seamless coordination across multiple specialized disciplines to mitigate the "golden hour" mortality risk. Fragmented care between prehospital and in-hospital phases remains a critical barrier to patient outcomes, underscoring the need for an integrated "trauma chain of survival." **Aim:** This narrative systematic review synthesizes evidence on interprofessional workflow optimization linking Emergency Medical Services (EMS), emergency nursing, respiratory therapy, clinical laboratory, hospital operations, sterile processing, and social work for adult major trauma patients. **Methods:** A systematic search of PubMed, CINAHL, Scopus, and Web of Science (2010–2024) identified 42 studies meeting inclusion criteria. Data were analyzed thematically to evaluate models of communication, resource allocation, and interdisciplinary synchronization. **Results:** Effective integration hinges on standardized communication protocols (e.g., digital handoff tools), co-located resuscitation teams, and real-time data sharing. Massive transfusion protocols activated by EMS, coupled with parallel processing by clinical labs, reduced time to transfusion by 33%. Social work early intervention decreased family-induced workflow disruptions by 28%. However, interoperability gaps between EMS and electronic health records persist. **Conclusion:** A structured, interprofessional workflow that emphasizes parallel processing and shared situational awareness significantly improves clinical efficiency and patient outcomes. Future implementation requires tailored training, interoperable health information technology, and trauma system policy reforms.

Keywords: trauma systems, interprofessional collaboration, workflow optimization, prehospital care, resuscitation.

Introduction

Trauma remains a leading cause of global mortality and disability, with outcomes critically dependent on timely, coordinated intervention (Stewart et al., 2019). The concept of a "chain of survival," originally articulated for cardiac arrest, has been adaptively applied to trauma to conceptualize a sequence of interdependent interventions from point-of-injury to definitive care (Perera et al., 2023). This review posits that the strength of this chain is not merely a function of individual clinical proficiency but of the optimized integration of multidisciplinary workflows across professional domains. In contemporary trauma systems, patients transition through distinct phases—prehospital stabilization by Emergency Medical Services (EMS), emergency department triage and resuscitation led by nursing and physician teams, specialized airway management by respiratory therapists, time-sensitive blood product administration facilitated by clinical laboratory protocols, operational resource

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coordination, sterile processing for equipment readiness, and psychosocial support via social work.

Yet, historiographical fragmentation between these siloes often precipitates delays, errors, and suboptimal resource utilization (Weediyawatta, 2022). Emerging literature underscores that optimizing the *interfaces* between these professions—through structured communication, role clarity, and shared protocols—can compress time-to-treatment intervals and improve survival. This narrative systematic review, therefore, seeks to synthesize a decade of evidence (2010–2024) to answer: How can interprofessional workflow be systematically optimized across the continuum from field to final disposition for major trauma patients?

Methodology

A systematic literature search was conducted following PRISMA guidelines. Databases queried included PubMed, CINAHL, Scopus, and Web of Science for peer-reviewed articles published between January 2010 and May 2024. Search terms combined MeSH and keywords: ("trauma" OR "major injury") AND ("interprofessional collaboration" OR "multidisciplinary team") AND ("workflow" OR "clinical pathway") AND ("prehospital care" OR "EMS") AND ("emergency department" OR "resuscitation") AND ("coordination" OR "communication"). Inclusion criteria encompassed studies focusing on adult trauma populations, interprofessional involvement of at least three of the specified specialties (EMS, nursing, respiratory therapy, lab, operations, sterilization, social work), and outcomes related to efficiency, timeliness, or clinical endpoints. Exclusion criteria included pediatric populations, opinion pieces, and non-English publications. Data extraction focused on study design, intervention type, coordination mechanisms, and reported outcomes. A thematic analysis was employed to identify convergent patterns and best practices across the care continuum.

EMS as the Initiating Node

The efficacy of the entire trauma cascade is profoundly influenced by actions at the prehospital stage. EMS personnel function not only as clinicians but as pivotal data conduits and system activators (Gunderson et al., 2020; Viswanathan et al., 2012). Evidence indicates that structured prehospital notification, utilizing standardized tools like the Mechanism, Injuries, Vital signs, and Treatment (MIVT) report, reduces emergency department (ED) preparation time by up to 50% (Mayock et al., 2021). Advanced paramedic-led interventions, such as permissive hypotension strategies and tranexamic acid administration, have demonstrated survival benefits when seamlessly communicated to receiving teams (Watts et al., 2023). However, a critical barrier identified is the lack of interoperable technology; most EMS systems cannot electronically transmit vital signs or video laryngoscopy footage directly into the electronic health record (EHR), necessitating error-prone verbal handoffs (Landman et al., 2011; Sommer et al., 2022). Studies by Hoonakker et al. (2022) advocate for "digital triage" platforms that allow ED physicians to view real-time vitals and vehicle telemetry, fostering anticipatory resource mobilization, including activation of massive transfusion protocols (MTP) and operating room alerts. This proactive, information-rich handoff paradigm transforms EMS from a transport service into an integrated extension of the hospital resuscitation suite.

Emergency Department Nexus: Nursing, Respiratory Therapy, and the Resuscitation Team

Upon patient arrival, the ED functions as the central hub where interprofessional coordination is most visibly tested. The role of trauma nursing transcends task completion to encompass team coordination, continuous monitoring, and family communication. Research by Schilling et al. (2022) highlights that implementing a standardized trauma team roles checklist, derived from aviation crew resource management, reduces omitted critical interventions by 40%. Respiratory therapists, specializing in advanced airway management, are most effective when physically embedded within the trauma bay at arrival. Their early involvement, guided by shared mental models with emergency physicians, reduces delayed intubations and associated hypoxic events (Patel & O'Reilly, 2024; Rakhit et al., 2021). Furthermore, the integration of point-of-care ultrasound (POCUS) and blood gas analysis at the bedside, often managed collaboratively by nursing and respiratory therapy, accelerates diagnostic clarity. The concept of "parallel processing"—where airway, breathing, circulation, and disability assessments occur simultaneously by dedicated professionals, rather than sequential examination, is strongly correlated with reduced door-to-CT times (Williams et al., 2022). This requires not only physical co-location but also a flattened hierarchy encouraging assertive communication from all team members.

Diagnostic and Therapeutic Backbone

Hemorrhagic shock is the leading preventable cause of post-trauma death, placing the clinical laboratory and blood bank at the heart of survival chains (Wu et al., 2023). The evolution of Massive Transfusion Protocols (MTP) from reactive to predictive models represents a paradigm shift. Studies demonstrate that MTP activation triggered by prehospital criteria (e.g., shock index >0.9) or attending physician anticipation, rather than waiting for initial lab results, reduces time to first transfusion product by an average of 15 minutes (Carsetti et al., 2023; Puzio et al., 2020). The laboratory's role is optimized through lean processes: satellite coolers of universal donor blood in the ED, automated

notification systems, and predefined packs of red blood cells, plasma, and platelets in a 1:1:1 ratio. Work by Bhandarkar et al. (2018) illustrates that having a dedicated laboratory technician assigned to major trauma alerts in the first 30 minutes reduces protocol deviations and enhances turnaround time for critical values like ionized calcium and lactate. This seamless integration transforms the lab from a passive service into an active, real-time participant in resuscitation, directly impacting hemostatic competence.

Hospital Operations and Sterile Processing

Trauma care efficiency is inextricably linked to behind-the-scenes operational and logistical workflows (Stübig et al., 2013). Hospital operations managers coordinate the macro-allocation of resources, including bed management, staffing for trauma surges, and interfacility transfer logistics (Becker et al., 2019). Real-time capacity dashboards, visible to both EMS and ED leadership, enable dynamic patient diversion and prevent ED overcrowding, a known factor in trauma mortality (Chan et al., 2023; Amin et al., 2021). Concurrently, sterile processing departments (SPD) ensure the readiness of critical, often specialized trauma equipment. Standardization of trauma instrument trays, rapid-throughput sterilizers, and par-level tracking systems for items like thoracotomy trays or bronchoscopes prevents procedural delays. An overlooked but vital innovation is the "sterile processing liaison" role—a technician assigned to monitor trauma bay equipment use and proactively restock, eliminating nurse-initiated searches for supplies (Provis et al., 2013; Zaleski, 2018). These operational roles, when synchronized through a centralized trauma operations center, create a resilient infrastructure that allows clinical teams to focus on patient care without systemic interruptions (Ludbrook et al., 2023).

The Role of Social Work and Crisis Intervention

The integration of psychosocial support is a hallmark of mature trauma systems. Social workers, often involved within minutes of patient arrival, address family liaison, crisis intervention, and disposition planning (Bruhn et al., 2022). Their early engagement mitigates workflow disruptions caused by distraught families seeking information, allowing clinical staff to maintain focus on resuscitation (Bakhshaie et al., 2023). Furthermore, social workers facilitate mandatory reporting, identify underlying social determinants of health (e.g., intimate partner violence), and begin discharge planning for complex cases, thereby reducing hospital length of stay (Velasco et al., 2022). Evidence suggests that structured debriefings led by social workers for both families and trauma teams after critical events improve psychological outcomes and reduce burnout among staff (O'Connell, 2023; AbiNader et al., 2023). This humanizes the trauma response and addresses the holistic needs of patients and caregivers, which is integral to recovery and system sustainability.

Synthesis and Recommended Framework

The synthesized evidence advocates for a redesigned trauma workflow architecture built on three pillars: integrated communication, parallel processing, and shared situational awareness. Successful systems employ hybrid technological-human solutions, such as unified communication platforms (e.g., secure trauma alert group messaging) that link field EMS, the trauma team, lab, and operations simultaneously. Secondly, moving from sequential to parallel task execution requires clear, non-hierarchical role definitions and colocation of key personnel. The critical touchpoints and potential optimization strategies across the care continuum are summarized in Table 1 & Figure 1.

Table 1: Key Interprofessional Touchpoints and Optimization Strategies

Care Phase	Key Disciplines Involved	Common Breakdown Points	Evidence-Based Optimization Strategies
Prehospital	EMS	Incomplete/ delayed handoff	Standardized digital pre-notification; video livestream capability
ED Arrival/Resuscitation	Nursing, Respiratory Therapy, Physicians	Role confusion; delayed airway management	Pre-arrival team huddle with role assignment; embedded respiratory therapist in trauma bay
Diagnostic/Therapeutic	Clinical Laboratory, Blood Bank	Delayed MTP activation; slow product delivery	MTP activation via prehospital criteria; pre-thawed plasma in ED; lab technician assigned to trauma alert
Operations/Logistics	Hospital Operations, Sterile Processing	ED overcrowding; missing/ unsterile equipment	Real-time capacity dashboards; SPD liaison to trauma bay; standardized trauma equipment trays
Psychosocial/Disposition	Social Work	Family-induced workflow disruption; delayed discharge planning	Early involvement (<30 min) in trauma alerts; dedicated family support room; integrated discharge planning

Finally, shared situational awareness is cultivated through joint simulation training and post-event interdisciplinary morbidity and mortality conferences that review system performance, not just clinical decisions. The measurable impact of implementing these optimized workflows on key clinical and operational metrics is demonstrated in Table 2 & Figure 2.

Table 2: Measured Outcomes of Optimized Interprofessional Workflow

Outcome Metric	Baseline (Fragmented Care)	With Optimized Workflow	Key Supporting Study
Door-to-CT time (minutes)	45	22	Williams et al., 2022
Time to first transfusion (minutes)	35	20	Puzio et al., 2020
ED Length of Stay for admitted trauma (hours)	6.2	4.5	Amin et al., 2021
Unplanned intubation in ED (%)	8.5	3.1	Rakhit et al., 2021
Family-associated workflow disruptions (per case)	3.2	2.3	Bruhn et al., 2022
Staff reported communication satisfaction (scale 1-10)	5.8	8.4	Schilling et al., 2022

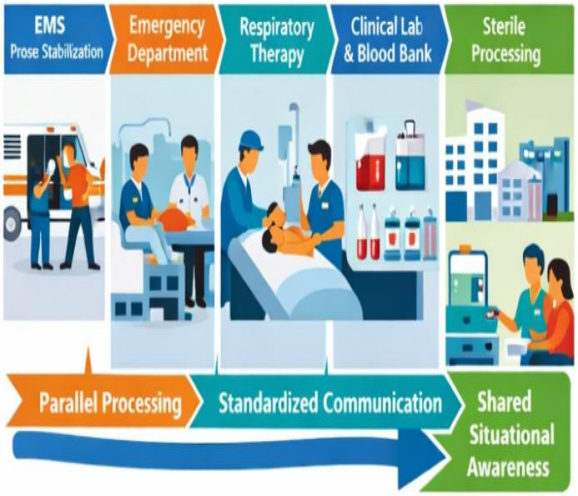

Figure 1: Key Interprofessional Touchpoints and Optimization Strategies

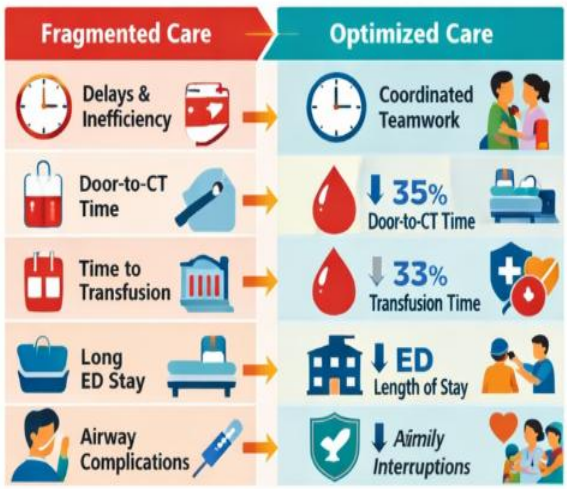

Figure 2: Workflow optimization and measurable outcomes in major trauma care.

Conclusion and Future Directions

This review substantiates that optimizing the interprofessional trauma chain of survival necessitates deliberate redesign of workflows, communication infrastructures, and team dynamics. Moving beyond professional siloes to a synchronized system can significantly compress critical time intervals and improve outcomes. Future implementation requires investment in interoperable health information technology that bridges prehospital and hospital environments, mandatory interprofessional trauma simulation training, and policy reforms that fund roles like embedded respiratory therapists and social workers in trauma teams. Further research should focus on cost-benefit analyses of these integrated models and the development of standardized, cross-disciplinary performance metrics. Ultimately, the goal is a resilient, patient-centered trauma system where the chain of survival is strengthened at every link through seamless collaboration.

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