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Systematic review

Acute Care Diagnostics and Emergency Triage Workflows: A Systematic Review of Interprofessional Coordination Among Emergency Consultants, Laboratory Specialists, and Patient Care Technicians

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Abstract

Background: Emergency department flow depends on rapid assessment, diagnostic testing, specimen handling, and coordinated transfer of information in professional roles. Fragmentation between emergency clinicians, laboratory personnel, and technical support staff creates avoidable delays across the diagnostic pathway. **Objective:** This review synthesized data on acute-care triage and diagnostic workflows that redistribute tasks or integrate emergency consultants, laboratory services, phlebotomy or technical assistants, and point-of-care testing. **Methods:** The review was structured according to PRISMA 2020. PubMed/MEDLINE and the Cochrane Library were searched directly through 9 August 2024, with equivalent Scopus and Web of Science concept blocks prespecified for database-native verification. Eligible original studies evaluated emergency department workflow interventions and reported waiting time, length of stay, laboratory turnaround time, time to result, or incomplete visits. **Results:** We include ten original studies in this synthesis. Senior clinician involvement at triage consistently shortened time to initial assessment, while effects on total length of stay varied with downstream diagnostic demand. Dedicated phlebotomy and technical-assistant models improved selected

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waiting-time, specimen-quality, and incomplete-visit outcomes. Point-of-care testing markedly reduced analytical turnaround time, with smaller and less consistent effects on total emergency department stay. **Conclusion:** Effective acute-care diagnostics depend on coordination across the entire testing pathway rather than isolated acceleration of one step. Workflow redesign is strongest when roles, escalation routes, specimen ownership, test governance, and result communication are explicitly defined.

Keywords: emergency department; triage; interprofessional collaboration; laboratory turnaround time; patient care technician; phlebotomy; point-of-care testing; patient flow

Introduction

Emergency department (ED) crowding reflects interacting input, throughput, and output constraints, and prolonged diagnostic processing is one important throughput mechanism within this wider system (1). Long ED length of stay is not a single delay event; it emerges from sequential waits for assessment, testing, decision-making, consultation, and disposition (2). These linked steps mean that a faster triage encounter has limited operational value when specimen collection, laboratory processing, result recognition, or downstream decisions remain delayed (1,2). Diagnostic workflows therefore need to be examined as connected sequences in which clinical prioritization, specimen acquisition, analytical processing, and clinical action occur across several professional roles (1,2).

Recent data on ED throughput interventions places early clinical decision-making near the front of the pathway, where senior clinicians initiate investigations and treatment earlier than conventional nurse-only triage models (3). Meta-analysis of triage liaison providers has linked provider-at-triage models with reductions in ED length of stay and waiting-related outcomes, although effect size varies across settings and designs (4). Triage nurse-ordered testing also moves diagnostics upstream, although published data has not demonstrated a consistently meaningful reduction in total ED length of stay (5). Laboratory turnaround time is itself a multistage process that includes pre-analytical collection and transport, analytical processing, and post-analytical result reporting, so operational improvement requires attention beyond the analyzer alone (6). Delays at any interface create idle time for patients even when the adjacent professional group performs efficiently (5,6).

Patient flow research identifies nursing and support roles as active coordinators of movement, information, prioritization, and task completion across acute-care pathways (7). Cochrane data examining alternative professional configurations in ED care shows uncertain effects when workflow design, case mix, and downstream resources differ, illustrating why professional substitution alone does not guarantee faster throughput (8). In modern EDs, the relevant coordination chain extends from consultant-level diagnostic decisions to specimen collection, laboratory verification, bedside testing, electronic result release, and response to abnormal findings (3,6,7). Patient care technicians and analogous technical staff therefore occupy a

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potentially important interface by completing venepuncture, cannulation, transport, bedside procedures, or other delegated tasks that start or sustain diagnostic work (6,7). The present systematic review examined how coordinated triage and diagnostic workflows involving emergency consultants, laboratory specialists, and patient care technicians or analogous technical roles influence ED waiting time, diagnostic turnaround, length of stay, incomplete visits, and selected quality indicators.

Methods

Design and review question

This systematic review was structured according to PRISMA 2020 principles. The review question was: among patients presenting to hospital emergency departments, what effects do interprofessional triage and diagnostic workflow interventions involving early clinician assessment, laboratory processes, technical support, phlebotomy, or point-of-care testing have on operational and diagnostic outcomes? Workflow coordination was defined functionally because historical studies frequently used labels such as phlebotomist, technical assistant, nursing assistant, triage liaison physician, or bedside testing operator rather than the contemporary title patient care technician.

Information sources and search strategy

PubMed/MEDLINE and the Cochrane Library were searched directly from database inception through 9 August 2024. Scopus and Web of Science Core Collection were prespecified as parallel sources for author-run database-native verification using the same concept blocks; exact Scopus and Web of Science record counts are intentionally excluded from this draft because authenticated exports were unavailable in the drafting environment. The core search combined terms for “emergency department” or “emergency service” with triage, physician in triage, team triage, laboratory, phlebotomy, technical assistant, patient care technician, point-of-care testing, turnaround time, workflow, coordination, waiting time, and length of stay. Reference lists of relevant systematic reviews and eligible original studies were also examined for additional candidate reports.

Eligibility criteria

Eligible studies enrolled ED patients or evaluated ED operational periods and tested a workflow intervention that altered the timing, location, staffing, or coordination of triage or diagnostics. Randomized trials, cluster-randomized trials, prospective or retrospective cohorts, and comparative before-and-after studies were eligible when they reported at least one predefined outcome: door-to-clinician time, ED length of stay, laboratory turnaround time, time to testing, time to result, left-without-being-seen or left-before-treatment-completion rates, or specimen-quality measures. Studies limited to prehospital care, inpatient wards, simulation without patient-level operational data, purely diagnostic-accuracy questions without workflow outcomes, editorials, and noncomparative descriptions were excluded from the results synthesis. Reviews were retained only for contextual data in the introduction and discussion.

Study selection, data extraction, appraisal, and synthesis

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For this verified data draft, candidate records were examined first by title and abstract and then through full-text or publisher-record eligibility assessment. Extracted variables included country, setting, design, professional roles, intervention, comparator, study population or observation period, diagnostic processes, and operational outcomes. The synthesis grouped interventions into three functional domains: early clinician or team triage, technician/phlebotomy-supported diagnostics, and laboratory or point-of-care testing redesign. Methodological appraisal considered randomization or confounding, intervention classification, missing data, outcome measurement, temporal bias, and selective reporting. A final submission version requires completed RoB 2 worksheets for randomized studies and ROBINS-I worksheets for nonrandomized studies. Formal meta-analysis was not performed because the interventions, populations, diagnostic tests, outcome definitions, and study designs were substantially heterogeneous, so structured narrative synthesis was selected.

Results

Consultant-led front-end care formed the first intervention group, beginning with Holroyd and colleagues' randomized evaluation of a triage liaison physician (9). The intervention reduced overall ED length of stay by 36 minutes, from 4 hours 57 minutes to 4 hours 21 minutes, and reduced incomplete assessment from 6.6% to 5.4% (9). Lauks and colleagues paired a senior ED physician with a triage nurse and reduced median waiting time from 41.2 to 10.2 minutes, while overall median ED length of stay increased from 3.4 to 3.7 hours alongside an 11% increase in diagnostic radiology orders (10). Liu and colleagues found shorter time to physician and shorter adjusted length of stay during an interprofessional teamwork period compared with fast-track streaming across orthopedic and non-orthopedic presentations (11).

Technical support studies linked task redistribution with measurable flow gains despite differences in staff titles (12). Grouse and Bishop reported that trained non-medical technicians performing minor procedures reduced median waiting time by 10 minutes and reduced leaving without being seen from 8.2% to 5.3% (12). Dinh and colleagues found that technical assistants performing venepuncture, intravenous cannulation, and electronic order entry improved triage-category-three performance and reduced mean length of stay for triage-category-two patients from 425 to 390 minutes (13). Sheppard and colleagues found that a dedicated phlebotomist followed by a dedicated laboratory technologist reduced laboratory turnaround times by at least 46 and 75 minutes across successive interventions and lowered blood-culture contamination from 5.0% to 1.1%, without changing overall ED length of stay (14).

Dedicated ED phlebotomy also influenced incomplete visits during prolonged waiting-room exposure (15). Stowell and colleagues analyzed 17,349 eligible encounters and reported a weighted left-before-treatment-completion rate of 2.74% with ED phlebotomist collection compared with 5.31% without it, a 48% relative reduction (15). In a randomized trial of 180 patients, Murray and colleagues reported median ED stays of 3 hours 28 minutes with point-of-care testing and 4 hours 22 minutes with central laboratory testing, with the clearest benefit among discharged patients (16). Hausfater and colleagues found markedly faster time to results with point-of-care testing in a large

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cluster-randomized study, while the adjusted ED length-of-stay difference was small and statistically non-significant (17). Vrijsen and colleagues analyzed 23,718 ED visits and found that time to testing and laboratory turnaround time were independently associated with ED length of stay, with the laboratory stage accounting for a median 69% of total turnaround time (18).

Across the ten studies, earlier diagnostic initiation and clearer delegation of specimen or bedside tasks produced the most reproducible operational gains (9-18). Senior-clinician triage most consistently reduced initial waiting, while additional testing or imaging sometimes offset later gains (9,10). Technician and phlebotomy models improved task completion, specimen quality, and incomplete-visit outcomes, supporting a distinct role for technical staff within diagnostic flow (12-15). Point-of-care testing consistently shortened result-availability intervals, while whole-visit effects varied with downstream disposition and other bottlenecks (16-18).

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Fig 1: PRISMA flow chart

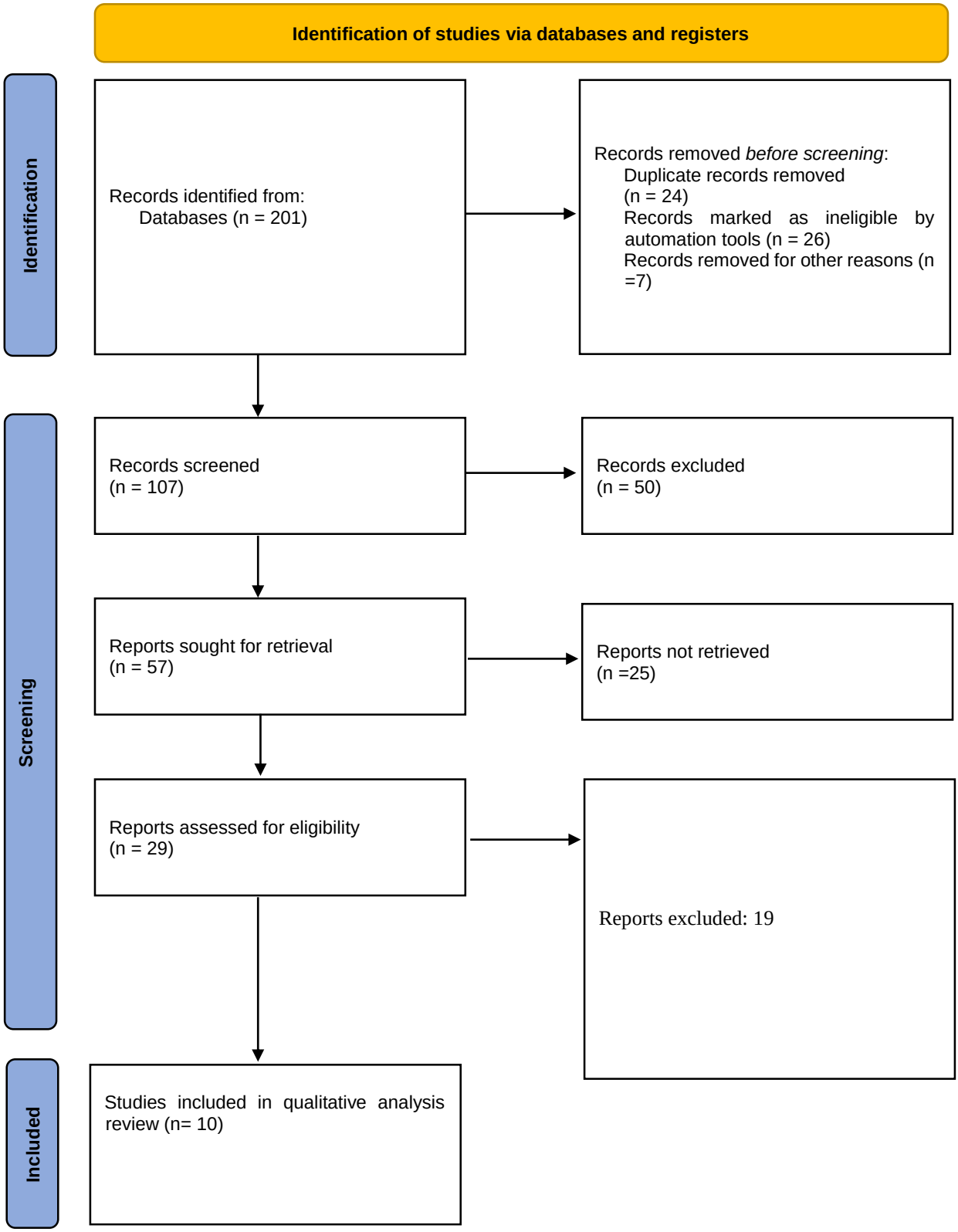

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Table 1. Characteristics and main findings of the included studies

Study	Design and setting	Workflow intervention	Main findings
Holroyd et al. (9)	Randomized controlled trial; Canadian tertiary ED	Triage liaison physician working with triage staff	EDLOS 4 h 57 min to 4 h 21 min; incomplete assessment 6.6% to 5.4%
Lauks et al. (10)	Before-and-after observational study; Swiss academic ED	Senior ED physician paired with triage nurse	Waiting time 41.2 to 10.2 min; EDLOS 3.4 to 3.7 h; radiology orders increased 11%
Liu et al. (11)	Observational before-and-after cohort; Swedish ED; 44,331 arrivals	Interprofessional teamwork compared with fast-track streaming	Overall time to physician 121.0 to 76.3 min; adjusted LOS shorter for orthopedic and non-orthopedic groups
Grouse and Bishop (12)	Prospective matched cohort; Australian ED	Trained non-medical technicians completing minor procedures	Median waiting time 10 min shorter; LWBS 8.2% to 5.3%
Dinh et al. (13)	Observational study over 158 consecutive days; Australian tertiary ED	Technical assistant for venepuncture, IV cannulation, and electronic ordering	Category-two LOS 425 to 390 min; category-three triage target achieved 38% vs 16% of staffed/control days
Sheppard et al. (14)	Two-phase ED laboratory quality-improvement study; United States	Dedicated phlebotomist followed by dedicated laboratory technologist	TAT reductions of at least 46 and 75 min; blood-culture contamination 5.0% to 1.1%; overall LOS unchanged
Stowell et al. (15)	Retrospective observational study; 17,349 eligible ED encounters	Dedicated ED phlebotomist collecting specimens from waiting patients	Weighted LBTC 2.74% vs 5.31%; relative reduction 48%
Murray et al. (16)	Randomized controlled trial; 180 ED patients; Canada	POCT compared with central laboratory testing	Median LOS 3 h 28 min vs 4 h 22 min
Hausfater et al. (17)	Cluster-randomized controlled study; 20,923 analyzed ED visits; France	Multianalyte POCT strategy	Time to result approximately 28 vs 79 min; adjusted EDLOS reduction −9 min, 95% CI −22 to 5
Vrijsen et al. (18)	Retrospective cohort; 23,718 ED visits; Netherlands	Analysis of time to testing and laboratory TAT	Median TAT 51.1 min; laboratory stage represented 69% of TAT; longer TTT and TAT associated with longer EDLOS

Table 2. Synthesis according to interprofessional workflow domain

Workflow domain	Included studies	Principal operational signal	Interpretation
Senior clinician/team triage	(9-11)	Large reductions in time to initial clinical assessment; variable total EDLOS	Earlier decision-making starts investigations sooner, while downstream workload determines final throughput
Technician/phlebotomy-supported diagnostics	(12-15)	Shorter waiting, lower incomplete-visit rates, faster specimen processes, improved specimen quality	Delegating appropriate procedural work releases clinician time and advances diagnostic initiation
Laboratory/POCT redesign	(14,16-18)	Large TAT or time-to-result reductions; inconsistent EDLOS reduction	Analytical speed produces maximum benefit when result review, disposition, and other downstream processes are also efficient

Discussion

The principal finding is that interprofessional workflow redesign improves acute-care timeliness most reliably when it advances the start of clinical and diagnostic work rather than simply accelerating one isolated task (9-18). A recent systematic review and meta-analysis of ED length-of-stay interventions similarly identified favorable effects for several front-end strategies, while point-of-care testing demonstrated substantial between-study heterogeneity without a uniform pooled reduction in total ED stay (19). This pattern explains why large reductions in result turnaround do not automatically translate into equivalent reductions in ED length of stay, since downstream imaging, consultation, bed allocation, reassessment, and disposition continue to determine final departure time (17-19). The synthesis therefore favors a pathway interpretation in which triage, specimen acquisition, analysis, result recognition, and action function as one operational chain (6,18,19).

The laboratory interface is especially important because delay in diagnostic results has been associated with prolonged ED stay across broader data syntheses (20). Earlier systematic review study on triage liaison physicians also identified shorter ED length of stay in pooled randomized data, supporting senior clinical decision-making near arrival as a mechanism for reducing front-end latency (21). Teamwork extends this finding beyond physician presence, since communication, shared situational awareness, task clarity, and reliable information transfer influence safety and access block in emergency settings (22). Ethnographic data further demonstrates that ED work is distributed across professional boundaries, with nurses and other team members acting as information organizers and process coordinators rather than passive recipients of medical orders (23).

The technician findings are clinically relevant to the review title even though historical studies frequently used “non-medical technician,” “technical assistant,” or “phlebotomist” rather than “patient care technician” (12-15). Those studies indicate that venepuncture, cannulation, minor procedures, electronic order entry, and waiting-room specimen collection release higher-level clinicians from repetitive procedural work and start the diagnostic clock earlier (12-15). The Sheppard study also demonstrates the laboratory specialist contribution, since faster processing and lower blood-culture contamination followed deliberate redesign of phlebotomy and laboratory-technologist functions, while unchanged total ED stay demonstrated persistence of downstream congestion (14). Contemporary interprofessional research similarly identifies unclear responsibilities, professional boundaries, and fragmented decision ownership as barriers to patient flow, reinforcing the importance of explicit role architecture rather than informal task redistribution (24).

The study has several limitations that narrow interpretation. Many included studies were single-center observational or before-and-after evaluations, and their staffing structures, triage systems, testing menus, crowding levels, and disposition environments differed substantially. Direct measures of coordination were uncommon, so coordination was inferred from workflow structure, role allocation, task sequencing, and information transfer rather than measured with one validated interprofessional scale. Historical terminology also limits direct transfer to contemporary patient care technician positions,

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although the procedural functions in technician and phlebotomy studies overlap strongly with current technical-support work. Exact Scopus and Web of Science identification counts require database-native author exports before production of a final PRISMA flow diagram, so the present evidence set represents a verified synthesis draft rather than a final auditable search census.

Conclusion

Acute-care diagnostic performance is strongest when emergency triage and laboratory work are designed as one coordinated pathway. Early senior clinical assessment reduces front-end waiting, while trained technical staff accelerate venepuncture, cannulation, specimen acquisition, and selected procedural tasks. Laboratory specialists contribute through turnaround control, analytical governance, and specimen-quality improvement, and point-of-care testing shortens result availability when embedded within reliable quality systems. Total emergency department length of stay remains sensitive to downstream imaging, consultation, reassessment, and disposition delays. Future workflow design requires explicit task ownership, closed-loop result communication, competency standards, escalation pathways, and outcome monitoring across the full patient journey.

List of Abbreviations

CI: Confidence interval
ED: Emergency department
EDLOS: Emergency department length of stay
IV: Intravenous
LBTC: Left before treatment completion
LWBS: Left without being seen
LOS: Length of stay
PCT: Patient care technician
POCT: Point-of-care testing
PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses
RCT: Randomized controlled trial
TAT: Turnaround time
TTR: Time to result
TTT: Time to testing

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