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Emergency medicine literature in the Web of Science category “emergency medicine”: A bibliometric analysis (1980–2024)

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Abstract:

OBJECTIVES: The objective is to describe long-term trends in emergency medicine (EM) research output from 1980 to 2024 and to map study designs, conceptual domains, and collaboration structures within the Web of Science (WoS) Category “EM.”

METHODS: We conducted a retrospective bibliometric analysis of records indexed in the WoS Core Collection from January 1, 1980, to December 31, 2024, using the WoS Categories filter “EM.” The search was performed on October 3, 2025. Only records with WoS document type “Article” were included. Bibliographic data, including publication year, journal, country, institutions, citations, and indexed keywords/metadata, were extracted. A rule-based text-mining algorithm classified study designs and conceptual domains and was internally validated against a manually reviewed sample of 240 records, showing 75.8% agreement ($\kappa = 0.638$) for study design and 86.3% agreement ($\kappa = 0.828$) for conceptual domain. Descriptive statistics and VOSviewer-based co-authorship, co-citation, and keyword co-occurrence analyses were performed.

RESULTS: Of 161,842 records initially identified, 102,561 articles met eligibility criteria. Annual EM publication counts increased after 2000. Health services and systems research and observational clinical studies predominated, whereas randomized controlled trials and qualitative or mixed-methods studies remained uncommon. Trauma, resuscitation, cardiovascular emergencies, and sepsis were longstanding core domains, while digital health, artificial intelligence, point-of-care ultrasound, disaster medicine, and global EM gained prominence after 2010. Collaboration expanded over time, but multinational co-authorship remained limited, and affiliations from low- and middle-income countries were underrepresented.

CONCLUSIONS: EM has evolved into a high-volume, thematically diverse field, but its evidence base remains predominantly observational and geographically imbalanced.

Keywords:

Artificial intelligence, bibliometrics, emergency medicine, health services research, publications

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Introduction

Emergency departments (EDs) are a critical interface between communities and health systems, functioning

simultaneously as portals for time-sensitive conditions, safety-net access points, and barometers of system performance. Over recent decades, rising ED attendance, increasing case complexity, and persistent crowding have been documented in many countries, with consistent associations between crowding, delays in care, and

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Box-ED section**What is already known about the study topic?**

- Emergency medicine (EM) research output has increased substantially over recent decades, but most prior bibliometric studies are limited to single journals, short time windows, or specific subtopics
- Science-mapping approaches (co-citation, co-authorship, keyword networks) can clarify the intellectual structure of a field and identify emerging themes.

What is the conflict on the issue? Has it importance for readers?

- It remains unclear whether the expanding EM literature has diversified in study designs and conceptual domains in parallel with volume growth
- Readers and stakeholders need an evidence-based overview to identify underrepresented methods (e.g., trials, qualitative research) and to prioritize future research agendas.

How is this study structured?

- Retrospective bibliometric analysis of Web of Science Core Collection-indexed EM journals covering 1980–2024
- Article-level extraction of bibliographic metadata with rule-based classification of study designs and conceptual domains, complemented by network analyses.

What does this study tell us?

- EM scholarship has grown markedly and broadened thematically, with increasing prominence of systems/health services research and newer domains such as digital health and artificial intelligence
- The evidence base remains dominated by observational designs, and international collaboration is relatively limited, highlighting opportunities for more interventional, implementation, qualitative, and globally inclusive research.

adverse outcomes.^[1-3] These epidemiological pressures have reinforced emergency medicine (EM) as a distinct academic discipline with its own research priorities, methods, and journals, particularly around time-critical conditions such as trauma, cardiac arrest, sepsis, and acute coronary syndromes.

In parallel, the scientific literature on EM has expanded rapidly and diversified. Several bibliometric studies have examined specific elements of this growth, including highly cited EM articles in the Web of Science (WoS) category, 10-year trends in EM research output and topics, national EM publication patterns such as those from Türkiye, and focused domains including

COVID-19-related emergency care research.^[4-7] More recently, global analyses have mapped EM research networks and highlighted substantial geographic and income-related imbalances in authorship and collaboration, particularly between high-income and low- and middle-income countries.^[8] Collectively, these studies show that EM research activity is increasing and thematically heterogeneous, but they are typically constrained to single journals, limited time windows, specific subtopics, or particular regions.

To date, there has been no comprehensive, article-level bibliometric synthesis of EM research spanning the modern history of the specialty within the WoS Category “EM.” Such a synthesis is needed not only to characterize long-term trends in publication volume, study designs, conceptual domains, and collaboration structures but also to identify persistent methodological, thematic, and geographic gaps. By mapping these intellectual structures, bibliometric analysis may help researchers, academic leaders, journal editors, and funding bodies identify underdeveloped areas and better inform future research prioritization in EM. Therefore, the objective of this study was to provide a four-decade overview (1980–2024) of EM literature indexed in the WoS Category “EM,” describing temporal trends in publication output, the distribution of study designs and major conceptual domains, and the co-citation, co-authorship, and keyword networks that delineate the intellectual structure of the field.

Methods

Study design

This was a retrospective, descriptive bibliometric analysis of publications indexed in the WoS Category “EM” within the WoS Core Collection. The analysis was conducted at the article level and followed established guidance for bibliometric reviews, with structured reporting of data sources, search strategy, eligibility criteria, classification procedures, and quantitative synthesis of publication patterns, citation structures, and conceptual domains.

Data sources, search strategy, and eligibility

All data were retrieved from the WoS Core Collection (Clarivate Analytics) using the advanced search interface on October 3, 2025. The dataset was defined by selecting the WoS categories field and applying the category “EM,” with the publication period restricted to January 1, 1980, through December 31, 2024. No additional filtering was applied by individual WoS Core Collection indexes/components; all records returned under this category definition were considered for screening. No explicit language restrictions were applied, although the WoS Core Collection is predominantly English-language.

Records were eligible if they were indexed in the WoS Category “EM,” had a publication year within the predefined time frame, and were classified as “Article” according to the WoS document type. All nonarticle document types, including editorials, letters, meeting abstracts, notes, and corrections, were excluded from the analytic dataset.

Records were exported in WoS format using Full Record and Cited References. Exported fields included title, authors, source title, publication year, author affiliations, document type, abstract, author keywords, Keywords Plus, citation counts, and cited references. For transparency, the list of journals indexed under the EM category at the time of search is provided in Supplementary Table 1.

Data refinement and selection procedure

The initial WoS retrieval yielded 161,842 records across all document types within the WoS Category “EM.” After restricting the dataset to records with WoS document type “Article,” 102,561 articles remained for the final analyses. This selection flow is summarized in Figure 1.

Within the retained article set, some records also carried overlapping WoS labels such as book chapter or proceedings paper; these were flagged and reported descriptively but were not excluded because the primary inclusion criterion was the WoS document type “Article.” Records flagged as retracted publications were also identified and counted separately, but were retained in the dataset. Because only a single bibliographic database was used, no cross-database de-duplication was required.

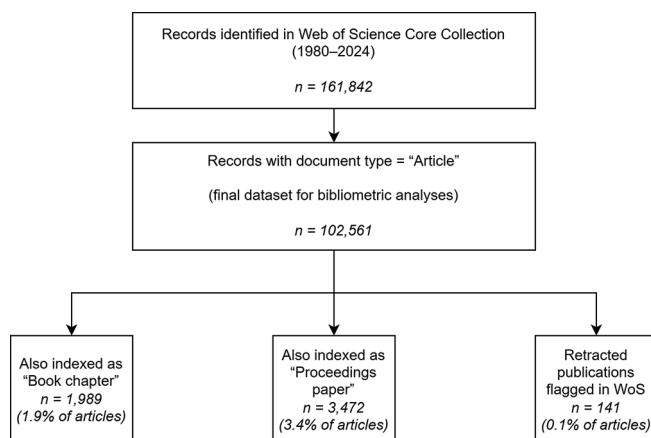


Figure 1: Flow diagram of record identification and selection for the bibliometric analysis. The initial dataset comprised all WoS records indexed in the emergency medicine category between 1980 and 2024 ($n = 161,842$). The final analytic dataset retained only records classified as “Article” ($n = 102,561$); nonarticle document types were excluded from the main analyses, while overlapping WoS tags (e.g. book chapter, proceedings paper, and retracted publication) were flagged descriptively within the retained set

Data extraction and classification

From each eligible record, we extracted publication year, source title (journal), country/region and institutional affiliations, author names, document type, abstract, author keywords, Keywords Plus, total citation count in WoS, and cited references.

Study designs were classified using a rule-based text-mining algorithm applied to concatenated title, abstract, and keyword fields. Articles were assigned hierarchically to one mutually exclusive category: randomized controlled trials; diagnostic/prognostic accuracy studies; health services and systems research; educational and simulation studies; methodological/validation/scores; qualitative or mixed-methods studies; observational clinical studies (cohort or cross-sectional); and other/not classified. If an article matched more than one study-design category, it was assigned to the highest-priority category in the predefined hierarchy. The full keyword dictionary used for study-design classification is provided in Supplementary Table 2.

Conceptual domains were assigned using a similar rule-based approach applied to the same combined text field. Articles were classified into one dominant domain: trauma and injury; cardiovascular and chest pain; resuscitation and cardiac arrest; infectious disease and sepsis; respiratory emergencies and chronic obstructive pulmonary disease (COPD)/asthma; pediatric EM; imaging and point-of-care ultrasound (POCUS); digital health and artificial intelligence (AI); disaster, prehospital and emergency medical services (EMS); and other/miscellaneous. The detailed term lists are provided in Supplementary Table 3.

To strengthen confidence in the rule-based classification, we performed an internal validation on a manually reviewed sample drawn from the final dataset. A computer-generated validation sample was selected using decade-stratified random sampling, with additional oversampling from records initially assigned to “other/not classified” categories. Two independent reviewers manually assigned study-design and conceptual-domain labels based on title, abstract, author keywords, and Keywords Plus using the same operational framework as in the main analysis. Inter-rater agreement was assessed using percentage agreement and Cohen’s kappa, and discordant cases were resolved by consensus. The final consensus labels were then used as the manual reference standard for comparison with the rule-based algorithm.

Quality assessment

Because this was a bibliometric analysis of published records rather than a systematic review of primary clinical studies, we did not perform article-level methodological quality or risk-of-bias assessments.

The focus was on describing the structure, volume, distribution, and thematic content of the literature indexed in the WoS Category “EM.”

Data synthesis and analysis

Descriptive statistics were used to summarize publication counts by year, decade, study-design category, conceptual domain, country or region, institution, journal, and author. Categorical variables were described using frequencies and percentages, and time trends in annual publication output were visualized with bar charts.

Bibliometric network analyses were performed in VOSviewer (version 1.6.20; Centre for Science and Technology Studies, Leiden University, Leiden, the Netherlands) using full counting. Journal co-citation networks were analyzed at the source level, author co-authorship networks at the author level, and keyword co-occurrence networks at the author keyword level. Lower bounds on citation counts, document counts, or keyword occurrences were applied to improve map interpretability, and overlay visualization based on average publication year was used for the keyword map.

For transparency and reproducibility, the main VOSviewer preprocessing decisions and parameter settings are summarized in Supplementary Table 4. Default VOSviewer normalization and clustering settings were retained. Journal co-citation analysis used a minimum threshold of 200 citations per source, after which the top 90 sources were selected. Author co-authorship analysis used minimum thresholds of 15 documents and 100 citations per author, with the top 100 authors selected. Keyword co-occurrence analysis used author keywords with a minimum threshold of 20 occurrences, after which the top 100 keywords were selected for the overlay map. No external thesaurus file or manual term-merging procedure was applied for keyword cleaning, and author names were analyzed as indexed in WoS/VOSviewer without additional external author-disambiguation procedures. All preprocessing, rule-based classification, and tabulation were performed using Python (version 3.13; Python Software Foundation, Wilmington, Delaware, USA) and Microsoft Excel (Microsoft Corporation, Redmond, Washington, USA). Network maps were exported as high-resolution images for inclusion in the manuscript.

Results

Search, selection, and descriptive characteristics

The search of the WoS Core Collection using the WoS Category “EM” for the period January 1, 1980–December 31, 2024 identified 161,842 records. After restricting the document type to “Article,” 102,561 articles remained and constituted the final dataset for all analyses [Figure 1].

Within this set, 1989 records were also indexed as book chapters, 3472 as proceedings papers, and 141 were flagged as retracted publications in WoS.

Annual publication counts increased gradually during the 1980s and 1990s, followed by steep growth after 2000 and further acceleration in the 2010–2019 and 2020–2024 periods [Figure 2]. The ten most cited articles were predominantly influential methodological or clinical works in trauma, pain measurement, fracture healing, resuscitation, appendicitis scoring, and burn severity assessment, published mainly in *Injury*, *Annals of EM*, *Resuscitation*, and *Academic EM* [Table 1].

Across the full dataset, health services and systems research accounted for the largest share of publications (36.6%), followed by diagnostic/prognostic accuracy studies (8.0%), educational and simulation studies (7.1%), randomized controlled trials (6.6%), observational clinical studies (6.4%), methodological/validation work (5.5%), and qualitative or mixed-methods studies (0.4%). Nearly one-third of articles (29.4%) remained in an “other/not classified” category [Table 2].

Internal validation of the rule-based classification

In the validation sample ($n = 240$), inter-rater agreement between the two manual reviewers was 67.9% ($\kappa = 0.474$) for study-design classification and 72.1% ($\kappa = 0.648$) for conceptual-domain assignment. Agreement between the rule-based algorithm and the final manual reference standard after consensus adjudication was 75.8% ($\kappa = 0.638$) for study design and 86.3% ($\kappa = 0.828$) for the conceptual domain. Most discordant cases reflected ambiguous study-design wording, overlap between adjacent conceptual domains, or sparse metadata in earlier records. A detailed summary is provided in Supplementary Table 5.

Schematic maps and temporal trends

The journal co-citation network revealed a concentrated core of sources, with general EM and trauma journals forming a central cluster, flanked by resuscitation/critical

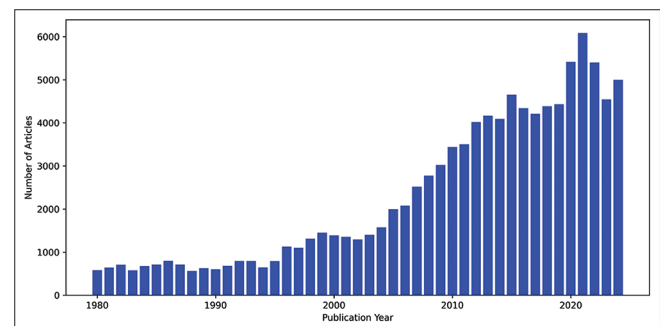


Figure 2: Annual number of emergency medicine-related publications indexed in Web of Science (1980–2024). Bars represent the yearly number of articles included in the final dataset ($N = 102,561$)

Table 1: Ten most cited articles in the final analytic dataset indexed in the Web of Science category “emergency medicine”

Rank	First author (year)	Article title	Journal	Times cited (WoS Core)
1	Giannoudis, PV (2005)	Bone substitutes: An update	<i>Injury-International Journal of the Care of the Injured</i>	1564
2	Bijur, PE (2001)	Reliability of the visual analog scale for measurement of acute pain	<i>Academic Emergency Medicine</i>	1444
3	Marsell, R (2011)	The biology of fracture healing	<i>Injury-International Journal of the Care of the Injured</i>	1252
4	Soar, J (2015)	European resuscitation council guidelines for resuscitation 2015: Section 3. Adult advanced life support	<i>Resuscitation</i>	1146
5	Gilbert, EH (1996)	Chart reviews in emergency medicine research: Where are the methods?	<i>Annals of Emergency Medicine</i>	1031
6	Alvarado, A (1986)	A practical score for the early diagnosis of acute appendicitis	<i>Annals of Emergency Medicine</i>	986
7	Todd, KH (1996)	Clinical significance of reported changes in pain severity	<i>Annals of Emergency Medicine</i>	896
8	Soar, J (2021)	European resuscitation council guidelines 2021: Adult advanced life support	<i>Resuscitation</i>	743
9	Gräsner, JT (2020)	Survival after out-of-hospital cardiac arrest in Europe - Results of the EuReCa TWO study	<i>Resuscitation</i>	655
10	Tobiasen, J (1982)	The abbreviated burn severity index	<i>Annals of Emergency Medicine</i>	359

The table presents the ten most cited articles in the final analytic dataset, showing rank, first author, publication year, article title, source journal, and total citation count in the Web of Science Core Collection

Table 2: Distribution of study designs and main study types by decade (1980–2024)

Study Type	1980–1989, n (%)	1990–1999, n (%)	2000–2009, n (%)	2010–2019, n (%)	2020–2024, n (%)	Total, n (%)
Observational clinical (cohort/cross-sec)	118 (1.8)	622 (6.7)	1158 (6.0)	2555 (6.2)	2146 (8.2)	6599 (6.4)
Randomised controlled trials	98 (1.5)	537 (5.8)	1433 (7.4)	2994 (7.3)	1714 (6.5)	6776 (6.6)
Diagnostic/prognostic accuracy	83 (1.3)	448 (4.8)	1142 (5.9)	3494 (8.5)	3032 (11.6)	8199 (8.0)
Health services and systems research	673 (10.2)	2603 (28.0)	6729 (34.7)	16,098 (39.2)	11,416 (43.6)	37,519 (36.6)
Educational and simulation studies	159 (2.4)	630 (6.8)	1449 (7.5)	3045 (7.4)	1996 (7.6)	7279 (7.1)
Methodological/validation/scores	81 (1.2)	355 (3.8)	934 (4.8)	2373 (5.8)	1874 (7.2)	5617 (5.5)
Qualitative/mixed-methods	6 (0.1)	42 (0.5)	80 (0.4)	162 (0.4)	108 (0.4)	398 (0.4)
Other/not classified	5386 (81.6)	4066 (43.7)	6485 (33.4)	10321 (25.1)	3916 (14.9)	30174 (29.4)

The table summarises the distribution of articles across major study design categories - observational clinical studies, randomized controlled trials, diagnostic/prognostic accuracy studies, health services and systems research, educational and simulation studies, methodological/validation work, qualitative/mixed-methods designs and other/not classified - stratified by decade (1980–1989, 1990–1999, 2000–2009, 2010–2019, 2020–2024) and for the overall period

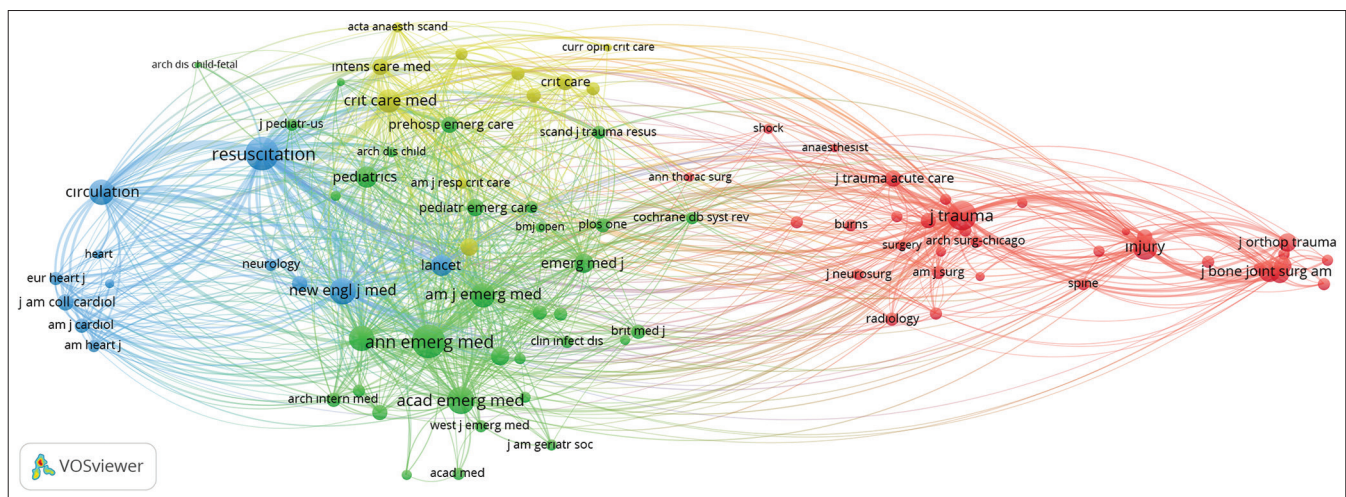


Figure 3: Journal co-citation network of emergency medicine-related literature. Nodes represent journals and edges represent co-citation links between journals. Node size is proportional to the total number of citations, and colors indicate clusters of closely related journals identified by the VOSviewer clustering algorithm

care and pediatric emergency care clusters [Figure 3]. The author co-authorship map showed several large

multicenter collaboration networks with highly productive researchers occupying central positions

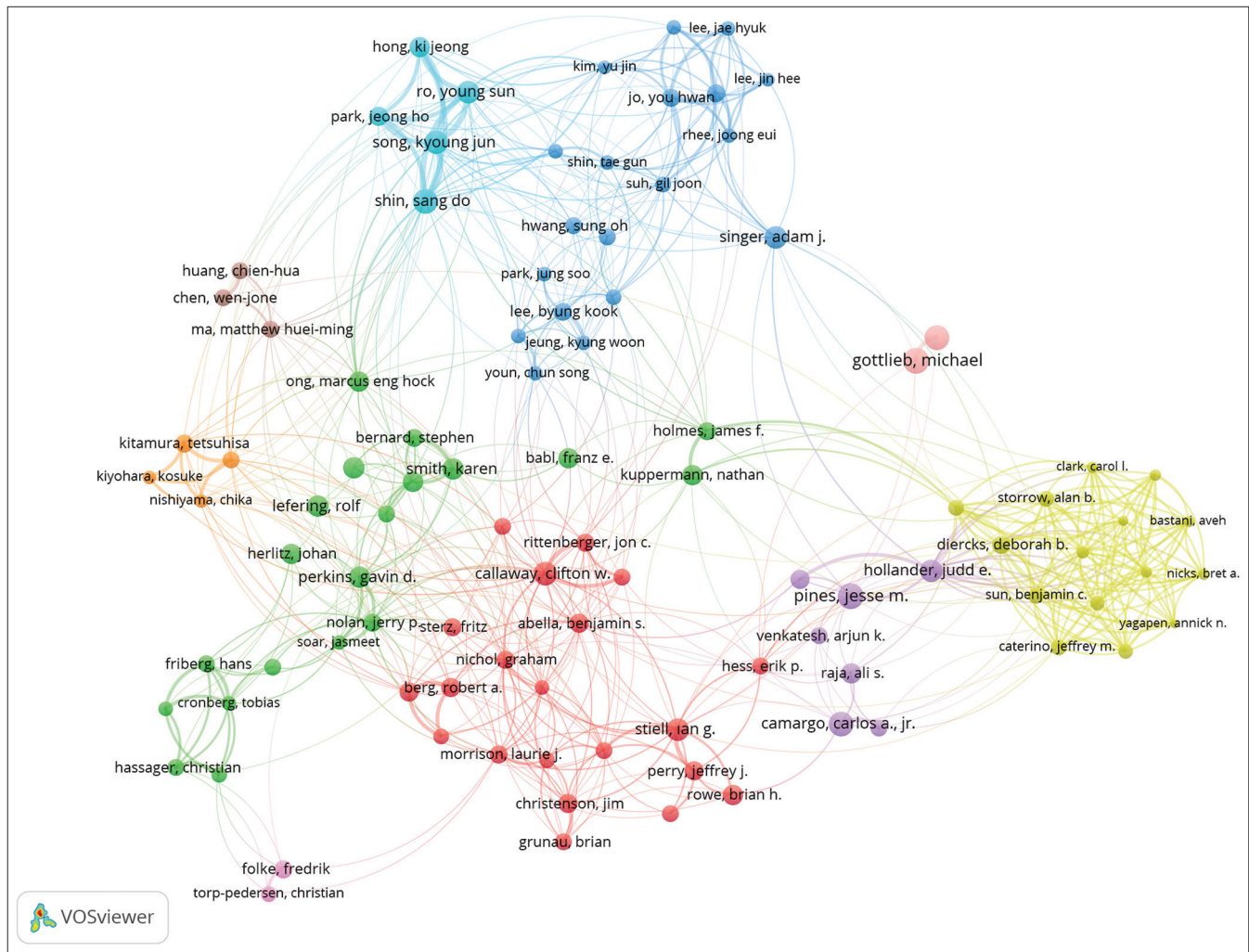


Figure 4: Author co-authorship network in emergency medicine research. Nodes represent authors and edges represent co-authorship links. Node size reflects the number of publications attributed to each author, and colors indicate collaboration clusters identified by the VOSviewer clustering algorithm

within dense clusters [Figure 4]. The author keyword co-occurrence overlay map demonstrated a temporal shift in research focus: older topics such as trauma, resuscitation, prehospital care, and traditional cardiovascular emergencies appeared as blue–green nodes, whereas more recent terms related to POCUS, COVID-19, and selected digital-health-related topics appeared as yellow nodes [Figure 5].

Tabulated summary of study designs and conceptual domains

When stratified by decade, the contribution of study designs changed substantially over time [Table 2]. In the 1980s and 1990s, a large proportion of publications fell into the “other/not classified” category, reflecting heterogeneous early work together with limited metadata completeness and methodological standardization. From 2000 onward, health services and systems research increased steadily, accounting for 34.7% of articles in 2000–2009, 39.2% in 2010–2019, and 43.6% in 2020–2024. Diagnostic/prognostic

accuracy studies also increased from 5.9% to 11.6% over the same period, while qualitative and mixed-methods studies remained rare across all decades.

Conceptually, the literature clustered into a limited number of dominant domains [Table 3]. Trauma and injury (23.6%), pediatric EM (16.0%), resuscitation and cardiac arrest (14.4%), and cardiovascular and chest pain research (12.8%) together accounted for more than half of all articles. Smaller domains included infectious disease and sepsis (4.5%), respiratory emergencies and COPD/asthma (2.8%), disaster/prehospital/EMS (2.6%), imaging and POCUS (2.5%), and digital health and AI (0.4%). The “other/miscellaneous” domain (20.2%) comprised diverse low-frequency topics.

Synthesis of findings and conceptual model

Overall, the results depict a rapidly growing but structurally layered research field, dominated by observationally clinical studies and health services and

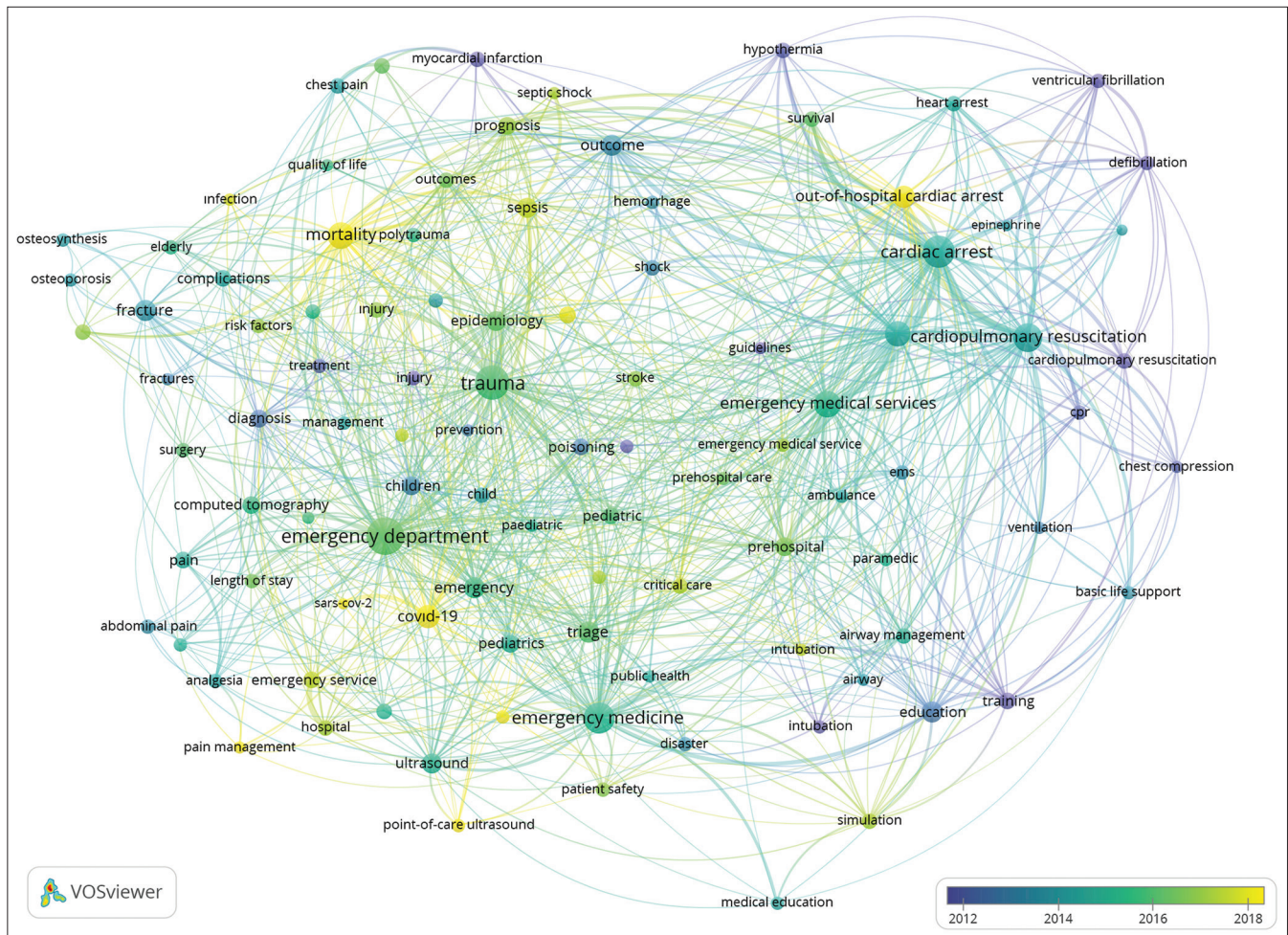


Figure 5: Keyword co-occurrence overlay map showing established and emerging topics. Nodes represent author keywords and Keywords Plus terms, and edges represent co-occurrence links between terms. Node size is proportional to the frequency of occurrence, and node color indicates the average publication year, with blue-green nodes corresponding to older, established topics and yellow nodes representing more recent, emerging topics

systems research, particularly in trauma, resuscitation, pediatric care, and cardiovascular emergencies. Randomized trials, diagnostic/prognostic accuracy studies, educational interventions, methodological work, and digital-health-related research expanded after 2000, but still represented a relatively small proportion of the overall literature.

Discussion

This bibliometric analysis of 102,561 articles indexed in the WoS Category “EM” between 1980 and 2024 provides a broad overview of how the field has evolved over 45 years. Overall, EM research output increased markedly, with annual publication counts accelerating particularly after 2000, in line with previous journal- and country-specific bibliometric studies.^[6,9,10] This quantitative expansion was accompanied by a progressive diversification of study designs and topics.

Across the dataset, health services and systems research constituted the single largest study-type category, reflecting sustained interest in emergency care delivery, quality improvement, crowding, and health policy in acute care settings.^[6,11] Classic conceptual work on ED crowding and input-throughput-output models appears to have provided a durable framework for much of this literature.^[9,12] In contrast, randomized controlled trials (RCTs) accounted for only a small minority of publications, and qualitative research remained rare despite a modest increase in recent decades, consistent with earlier reports that RCTs represent roughly 5% of global EM studies and that qualitative methods are still emerging in this field.^[8,13] Thus, the overall evidence base in EM is dominated by observational and health services and systems research, with comparatively fewer experimental or in-depth qualitative investigations.

In terms of subject matter, trauma and resuscitation have historically been the most prominent domains, with cardiac arrest, cardiopulmonary resuscitation and trauma systems repeatedly appearing among the most cited and

Table 3: Conceptual domains and topic clusters of emergency medicine research (meso- and micro-level)

Conceptual domain (meso-level)	Number of articles	Percentage of total	Representative micro-topics (examples)	Representative keywords (examples)
Trauma and injury	24218	23.6	Polytrauma, traumatic brain injury, fracture management, burns	"Trauma", "injury", "fracture", "hip fracture", "TBI", "burns"
Cardiovascular and chest pain	13,148	12.8	Acute coronary syndrome, myocardial infarction, arrhythmias, heart failure, venous thromboembolism	"Chest pain", "ACS", "STEMI", "NSTEMI", "heart failure", "pulmonary embolism"
Resuscitation and cardiac arrest	14,803	14.4	Out-of-hospital cardiac arrest, in-hospital cardiac arrest, CPR quality, post-ROSC care, advanced life support	"Cardiac arrest", "CPR", "ROSC", "advanced life support", "OHCA"
Infectious disease and sepsis	4641	4.5	Sepsis bundles, septic shock management, pneumonia in the emergency department, biomarker-guided therapy (e.g. procalcitonin)	"Sepsis", "septic shock", "infection", "pneumonia", "antibiotics"
Respiratory emergencies and COPD/asthma	2905	2.8	Acute respiratory failure, COPD exacerbation, asthma attacks, non-invasive ventilation, intubation strategies	"COPD", "asthma", "respiratory failure", "NIV", "mechanical ventilation"
Pediatric emergency medicine	16,399	16.0	Pediatric trauma, pediatric fever, respiratory infections, pediatric pain management, neonatal and infant emergencies	"Pediatric", "child", "children", "infant", "neonate"
Imaging and POCUS	2610	2.5	Bedside ultrasound, FAST examinations, echocardiography in the ED, CT imaging pathways, radiography utilization	"Ultrasound", "POCUS", "FAST", "echocardiography", "CT", "imaging"
Digital health and artificial intelligence	397	0.4	Triage algorithms, machine-learning risk scores, clinical decision support systems, tele-emergency care, EHR-based alerts	"Artificial intelligence", "machine learning", "telemedicine", "decision support", "EHR"
Disaster, prehospital and EMS	2699	2.6	Prehospital triage, EMS dispatch and response, ambulance outcomes, disaster and mass-casualty incidents, earthquake-related emergencies	"Prehospital", "EMS", "ambulance", "disaster", "mass casualty"
Other/miscellaneous	20741	20.2	Diverse low-frequency topics including toxicology, environmental exposures, rare presentations and miscellaneous ED conditions	"Toxicity", "overdose", "environmental", "poisoning", "miscellaneous"

The table reports the number and percentage of articles assigned to each conceptual domain (trauma and injury; cardiovascular and chest pain; resuscitation and cardiac arrest; infectious disease and sepsis; respiratory emergencies and COPD/asthma; pediatric emergency medicine; imaging and POCUS; digital health and artificial intelligence; disaster, prehospital and EMS; other/miscellaneous). For each domain, representative micro-topics and keywords are provided to illustrate the thematic content of the cluster. ACS: Acute coronary syndrome, COPD: Chronic obstructive pulmonary disease, CPR: Cardiopulmonary resuscitation, CT: Computed tomography, ED: Emergency department, EHR: Electronic health record, EMS: Emergency medical services, NIV: Noninvasive ventilation, NSTEMI: Non-ST-segment elevation myocardial infarction, POCUS: Point-of-care ultrasound, STEMI: ST-segment elevation myocardial infarction, TBI: Traumatic brain injury

co-occurring topics.^[8,10,14] Other major clinical themes included acute cardiovascular care, sepsis, and pediatric emergencies. More recently, newer domains such as digital health, POCUS, COVID-19-related topics, and AI have gained visibility in EM literature, particularly in the last decade, while disaster, humanitarian, and global EM research also suggest a widening geographical and thematic scope of the specialty.^[15,16]

Several factors help explain the observed expansion and shifting profile of EM research over the past four decades. The sustained increase in publication output parallels the formal establishment and growth of EM as an academic specialty, with the proliferation of dedicated departments, journals and funding streams in many countries.^[6,8,10] As EM matured, research agendas broadened from primarily descriptive clinical reports to encompass systems, policy, and methodological questions, which is reflected in the rising share of health services and systems research in our dataset.^[6,11] In this context, influential conceptual models of ED crowding and input–throughput–output dynamics appear to have

anchored much of the subsequent work on access block, patient flow, and quality improvement.^[9,12]

The relatively large "other/not classified" category in the earlier decades should be interpreted cautiously. Based on re-examination of the dataset, this pattern appears to reflect a combination of historical metadata sparsity, evolving terminology, and genuine heterogeneity in early EM research. In the 1980–1989 subset, only 24.0% of records contained an abstract, while author keywords and keywords plus were essentially absent, meaning that most records from this period could be classified only from the title text. By contrast, records from recent years were far more information-rich, with abstracts and keyword fields available for the great majority of articles. Accordingly, the high residual category in the earlier period likely reflects not only the limitations inherent to rule-based text classification when metadata are sparse but also the fact that early EM scholarship was more formative, descriptive, and methodologically heterogeneous, and therefore less easily mapped onto later, more standardized categories.

The relative scarcity of RCTs and qualitative studies in EM likely reflects ethical, logistical, and structural constraints. Emergency care often involves time-critical decisions, unstable patients, and limited opportunity for conventional consent processes, which complicates the conduct of RCTs and favors observational designs that can leverage routinely collected data.^[8,17,18] Similarly, qualitative approaches have historically been underused in a specialty that has prioritized biomedical and quantitative paradigms, despite growing recognition that questions related to communication, equity, and clinician cognition may be better addressed with qualitative or mixed-methods designs.^[13,19] Recent increases in both RCTs and qualitative work suggest gradual methodological diversification, but our findings indicate that the field's evidence base remains heavily skewed towards observational and health services and systems research. Internal validation of the rule-based classification further suggested that discordant cases were concentrated in borderline distinctions between adjacent study-design and conceptual-domain categories, rather than being randomly distributed across the dataset.

The emergence of digital health and AI as visible themes in EM research reflects a broader technological shift. Telemedicine and remote-care models, particularly highlighted during and after the COVID-19 period, have been adopted to improve access and throughput in EDs.^[15,20] In parallel, AI and machine-learning applications are being explored for triage, diagnostic support, and operational forecasting, aligning well with the data-intensive, time-pressured nature of emergency care.^[15,16,21,22] However, many of these studies are still in early development or validation phases, and their real-world impact on patient outcomes and system performance remains to be established. Finally, our co-authorship and co-citation patterns suggest that EM research is structured into partially siloed subfields (e.g., trauma/resuscitation vs. health policy/health services and systems research), with limited but growing international and cross-disciplinary collaboration, particularly between high-income and low- and middle-income settings.^[8,10] This imbalance was also evident in the affiliation profile of the dataset: among 177,549 classifiable country/region address occurrences, 154,227 (86.9%) originated from high-income economies, whereas only 23,322 (13.1%) came from low- and middle-income economies overall, including just 821 (0.5%) from low-income economies. From a regional perspective, Türkiye contributed a modest but increasingly visible share of the literature in our dataset. Articles with at least one Türkiye-affiliated address accounted for approximately 5.7% of all records overall, with the annual proportion rising to around 7%–8% in more recent years, suggesting growing integration of Türkiye into the global EM research landscape.

Limitations

Several limitations should be acknowledged. Restricting the analysis to WoS means that some emergency-relevant articles indexed only in other databases (e.g., Scopus, regional indexes) may have been missed, and the predominance of English-language journals in WoS introduces a language and publication-type bias that likely underrepresents research from non-English-speaking regions.^[8] In addition, because the dataset was defined using the WoS Category “EM,” the findings should be interpreted as reflecting the literature indexed within this category rather than a manually curated set of core EM journals. Our focus on articles also excluded other influential document types such as conference abstracts, editorials, and grey literature. The text-mining approach used to classify study designs and conceptual domains, although systematically applied and internally validated, remains imperfect and may have misclassified some borderline articles, particularly in records with sparse metadata or overlapping terminology. As with all citation-based bibliometrics, our indicators reflect patterns of visibility and influence rather than methodological quality, and are sensitive to article age and field-specific citation norms. Nevertheless, these constraints are typical of large-scale bibliometric work, and the convergent patterns observed across multiple analytic approaches suggest that our main conclusions about the trajectory and structure of EM research are robust.

Conclusions

Over the past 45 years, EM has evolved into a mature academic discipline with a rapidly expanding and increasingly diversified research portfolio. Our analysis shows that publication volume has risen sharply, especially since 2000, with health services and systems research emerging as the dominant study type and trauma, resuscitation, acute cardiovascular care, and pediatric emergencies remaining core thematic pillars.^[6,9-12] At the same time, newer domains such as digital health, POCUS, COVID-19-related topics, and AI have gained visibility only in the last decade, indicating a gradual but still nascent technological shift in the field.^[15,16,21,22] Overall, the evidence base in EM is substantial but methodologically imbalanced, with observational and health services and systems research far outnumbering randomized trials and qualitative or mixed-methods work.^[8,13,17-19]

These findings have several implications for future research agendas. To support more robust, practice-changing guidance, greater investment is needed in interventional, implementation, and qualitative studies, particularly in underrepresented areas such as mental health emergencies, injury prevention, geriatric

emergency care, and care in low-resource settings.^[6,8,10] Strengthening international and cross-disciplinary collaborations will also be essential to ensure that emerging tools – especially AI-driven decision support and digital care models – are rigorously evaluated, equitably implemented and aligned with the needs of diverse patient populations.^[8,15,16,21,22] In parallel, EM journals may help reduce geographic imbalance by broadening editorial board and peer-review representation, adopting more context-sensitive evaluation of research from resource-constrained settings, and creating mentorship or developmental review pathways for authors from underrepresented regions. By addressing these gaps, the EM community can build a more methodologically diverse, globally inclusive, and clinically impactful research ecosystem.

Author contributions statement

AA: Conceptualization (lead); Methodology (lead); Formal analysis (lead); Data curation (lead); Writing – original draft (lead); Visualization (lead).

EG: Supervision (lead); Validation (lead); Writing – review and editing (equal); Project administration (lead).

CY: Methodology (supporting); Data curation (supporting); Writing – review and editing (equal).

MVÖ: Visualization (supporting); Writing – review and editing (equal).

Conflicts of interest

None Declared.

Ethical approval

Not applicable. This study used only publicly available and anonymized bibliographic data; therefore, ethics committee approval was not required according to institutional policies.

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References

- Hoot NR, Aronsky D. Systematic review of emergency department crowding: Causes, effects, and solutions. *Ann Emerg Med* 2008;52:126-36.
- Morley C, Unwin M, Peterson GM, Stankovich J, Kinsman L. Emergency department crowding: A systematic review of causes, consequences and solutions. *PLoS One* 2018;13:e0203316.
- Johnson KD, Winkelman C. The effect of emergency department crowding on patient outcomes: A literature review. *Adv Emerg Nurs J* 2011;33:39-54.
- Cetin M, Long B, Gottlieb M. A 10-year bibliometric analysis of publications in emergency medicine. *Am J Emerg Med* 2022;58:215-22.
- Ho YS. A bibliometric analysis of highly cited publications in Web of Science category of emergency medicine. *Signa Vitae* 2021;17:11-9.
- Güzelce MC, Orhan E, Özgür S. A bibliometric analysis of publications on emergency medicine in Türkiye. *Turk J Emerg Med* 2024;24:145-50.
- Dogan M, Bulbul E. Bibliometric analysis of research on “emergency medicine and COVID-19” using web of Science, Carrot² and biblioshiny. *Med Sci* 2025;14:329.
- Garbern SC, Hyuha G, González Marqués C, Baig N, Chan JL, Dutta S, et al. Authorship representation in global emergency medicine: A bibliometric analysis from 2016 to 2020. *BMJ Glob Health* 2022;7:e009538.
- Goldberg SA, Chadwick E, Makam S, Shah HJ, Bass MB, Hasdianda MA, et al. Twenty years after the EMS research agenda: Trends in emergency medical services publications and research funding. *Ann Emerg Med* 2023;82:94-100.
- Kılıç M, Rohat AK. Four decades of emergency medicine research: Bibliometric trends and citation dynamics in the American Journal of Emergency Medicine (1984-2024). *Am J Emerg Med* 2025;95:159-66.
- Clancy CM, Eisenberg JM. Emergency medicine in population-based systems of care. *Ann Emerg Med* 1997;30:800-3.
- Asplin BR, Magid DJ, Rhodes KV, Solberg LI, Lurie N, Camargo CA Jr. A conceptual model of emergency department crowding. *Ann Emerg Med* 2003;42:173-80.
- Cooper S, Endacott R. Generic qualitative research: A design for qualitative research in emergency care? *Emerg Med J* 2007;24:816-9.
- Bülbül E, Tabur A. Trend topics in emergency medicine: A comprehensive bibliometric analysis of CPR research. *Front Emerg Med* 2025;9:e15.
- Amiot F, Potier B. Artificial intelligence (AI) and emergency medicine: Balancing opportunities and challenges. *JMIR Med Inform* 2025;13:e70903.
- Alimiri Dehbaghi H, Khoshgard K. Revolutionizing emergency care: An overview of the transformative role of artificial intelligence in diagnosis, triage, and patient management. *Int J Emerg Med* 2025;18:242.
- Bosdriesz JR, Stel VS, van Diepen M, Meuleman Y, Dekker FW, Zoccali C, et al. Evidence-based medicine-when observational studies are better than randomized controlled trials. *Nephrology (Carlton)* 2020;25:737-43.
- Paneth N, Joyner M. The use of observational research to inform clinical practice. *J Clin Invest* 2021;131:146392.
- Choo EK, Garro AC, Ranney ML, Meisel ZF, Morrow Guthrie K. Qualitative research in emergency care part I: Research principles and common applications. *Acad Emerg Med* 2015;22:1096-102.
- Hollander JE, Carr BG. Virtually perfect? Telemedicine for COVID-19. *N Engl J Med* 2020;382:1679-81.
- Chenais G, Lagarde E, Gil-Jardiné C. Artificial intelligence in emergency medicine: Viewpoint of current applications and foreseeable opportunities and challenges. *J Med Internet Res* 2023;25:e40031.
- Limon Ö, Bayram B, Çetin M, Limon G, Dirican N. A bibliometric analysis of clinical studies on artificial intelligence in emergency medicine. *Medicine (Baltimore)* 2025;104:e43282.

Supplementary Table 1: Journals indexed in the web of science category “emergency medicine” at the time of search, with publication counts in the study dataset

Publication titles	Count
<i>Annals of Emergency Medicine</i>	24,514
<i>American Journal of Emergency Medicine</i>	16,031
<i>Injury International Journal of the Care of the Injured</i>	14,624
<i>Resuscitation</i>	10,237
<i>Journal of emERgency Medicine</i>	7946
<i>Pediatric Emergency Care</i>	7216
<i>Academic Emergency Medicine</i>	7139
<i>Emergency Medicine Journal</i>	7061
<i>Unfallchirurg</i>	5537
<i>European Journal of Trauma and Emergency Surgery</i>	3416
<i>Journal of Emergency Nursing</i>	3239
<i>Emergency Medicine Australasia</i>	3032
<i>Western Journal of Emergency Medicine</i>	2967
<i>Canadian Journal of Emergency Medicine</i>	2532
<i>Notfall Rettungsmedizin</i>	2530
<i>Emergency Medicine</i>	2465
<i>Prehospital and Disaster Medicine</i>	2415
<i>Ulusal Travma Ve Acil Cerrahi Dergisi Turkish Journal of Trauma Emergency Surgery</i>	2361
<i>European Journal of Emergency Medicine</i>	2288
<i>Emergencias</i>	2217
<i>Prehospital Emergency Care</i>	2143
<i>Scandinavian Journal of Trauma Resuscitation Emergency Medicine</i>	1962
<i>Trauma Und Berufskrankheit</i>	1716
<i>Emergency Medicine Clinics of North America</i>	1708
<i>Bmc emergency Medicine</i>	1673
<i>Annales Francaises De Medecine D Urgence</i>	1641
<i>Journal of the American College of Emergency Physicians Open</i>	1551
<i>International Journal of Emergency Medicine</i>	1509
<i>Signa Vitae</i>	1314
<i>Resuscitation Plus</i>	1210
<i>Hong Kong Journal of Emergency Medicine</i>	1169
<i>Journal of Accident Emergency Medicine</i>	1158
<i>Notarzt</i>	1150
<i>World Journal of Emergency Medicine</i>	1076
<i>Aem Education and Training</i>	972
<i>Eurasian Journal of Emergency Medicine</i>	967
<i>World Journal of Emergency Surgery</i>	950
<i>Trauma England</i>	910
<i>African Journal of Emergency Medicine</i>	902
<i>Emergency Medicine International</i>	901
<i>Journal of Burn Care Rehabilitation</i>	801
<i>Turkish Journal of Emergency Medicine</i>	781
<i>Emergency Care Journal</i>	762
<i>Trauma Monthly</i>	741
<i>Journal of Emergency Medicine Case Reports</i>	654
<i>Burns Trauma</i>	625
<i>Clinical and Experimental Emergency Medicine</i>	615
<i>Unfallchirurgie</i>	551
<i>Archives of Academic Emergency Medicine</i>	550
<i>Archives of Emergency Medicine</i>	549

Contd..

Supplementary Table 1: Contd...

Publication titles	Count
<i>Open Access Emergency Medicine</i>	487
<i>Journal of Emergencies Trauma and Shock</i>	465
<i>Journal of Acute Medicine</i>	394
<i>Australasian Emergency Care</i>	353
<i>International Journal of Burns and Trauma</i>	352
<i>Current Emergency and Hospital Medicine Reports</i>	332
<i>8th European Congress of Intensive Care Medicine I and II</i>	324
<i>Trauma Spain</i>	315
<i>Emergency</i>	285
<i>Journal of Trauma and Injury</i>	242
<i>Journal of Cardiovascular Emergencies</i>	237
<i>Emergency Medical Services</i>	222
<i>Journal of Endovascular Resuscitation and Trauma Management</i>	219
<i>Frontiers in Emergency Medicine</i>	212
<i>Advanced Journal of Emergency Medicine</i>	206
<i>7th European Congress on Intensive Care Medicine</i>	205
<i>4th International Congress on the Immune Consequences of Trauma Shock and Sepsis</i>	180
<i>Journal of Pediatric Emergency and Intensive Care Medicine</i>	164
<i>Emergency and Critical Care Medicine</i>	161
<i>Journal of Public Health and Emergency</i>	154
<i>5th World Congress on Trauma Shock Inflammation and Sepsis</i>	149
<i>9th European Congress on Intensive Care Medicine</i>	149
<i>New Horizons the Science and Practice of Acute Medicine</i>	122
<i>Clinical Emergency Medicine Casebook</i>	114
<i>Update in Intensive Care and Emergency Medicine</i>	111
<i>Recent Advances in Neurotraumatology</i>	108
<i>Intracranial Pressure and Neuromonitoring in Brain Injury</i>	107
<i>Acta Neurochirurgica Supplementa</i>	105
<i>Acute Care and Emergency Gynecology A Case Based Approach</i>	99
<i>Anaesthesia Pain Intensive Care and Emergency Medicine A P I C E Vol 1 and 2</i>	91
<i>International Congress Series</i>	85
<i>Proceedings of the 7th European Trauma Congress</i>	83
<i>Emergency Management of Infectious Diseases 2nd Edition</i>	80
<i>Proceedings Annual Conference of the Association for the Advancement of Automotive Medicine</i>	79
<i>Anaesthesia Pain Intensive Care and Emergency Medicine</i>	76
<i>Hot Topics in Acute Care Surgery and Trauma</i>	76
<i>Annual Update in Intensive Care and Emergency Medicine</i>	72
<i>Annual Update in Intensive Care and Emergency Medicine 2011</i>	72
<i>Acute Medicine A Symptom Based Approach</i>	70
<i>Enjeux Ethiques En Reanimation</i>	69
<i>Ethical Issues In Reanimation</i>	69
<i>Trauma Critical Care and Surgical Emergencies A Case and Evidence Based Textbook</i>	67
<i>Urgent Interventional Therapies</i>	63
<i>Emergency Department Analgesia an Evidence Based Guide</i>	61
<i>Major Incidents Pandemics and Mental Health</i>	59
<i>Intensive Care Medicine Annual Update 2010</i>	56
<i>Proceedings of the 6th World Congress on Trauma Shock Inflammation and Sepsis Pathophysiology Immune Consequences and Therapy</i>	55

Contd..

Supplementary Table 1: Contd...

Publication titles	Count
<i>Updates in Surgery Series</i>	53
<i>Emergency Cross Sectional Radiology</i>	52
<i>Acute Respiratory Distress Syndrome</i>	51
<i>Nato Advanced Science Institutes Series Series A Life Sciences</i>	51
<i>Ryan s Ballistic Trauma A Practical Guide Third Edition</i>	46
<i>43rd Annual Proceedings Association For The Advancement Of Automotive Medicine</i>	45
<i>Clinical Emergency Radiology 2nd Edition</i>	44
<i>Sops in Der Orthopadie Und Unfallchirurgie</i>	44
<i>Sops in Orthopedics and Trauma Surgery</i>	44
<i>State of the Art Technology in Anesthesia and intensive Care</i>	43
<i>Resuscitation 98</i>	42
<i>Shock</i>	42
<i>Hemodynamic Monitoring</i>	40
<i>Lessons from the ICU</i>	40
<i>Managing the Critically Ill Child A Guide for Anaesthetists and Emergency Physicians</i>	40
<i>Neurosurgical Emergencies 3rd Edition</i>	40
<i>First European Congress on Emergency Medicine</i>	39
<i>Doing Research in Emergency and Acute Care Making Order Out Of Chaos</i>	38
<i>2nd European Congress of Trauma and Emergency Surgery</i>	37
<i>Occupational Electrical Injury an International Symposium</i>	37
<i>Emergency Department Leadership and Management Best Principles and Practice</i>	35
<i>Field Hospitals A Comprehensive Guide to Preparation and Operation</i>	35
<i>loc Manual of Emergency Sports Medicine</i>	35
<i>42nd Annual Proceedings Association For The Advancement of Automotive Medicine</i>	34
<i>Alcohol and Injuries Emergency Department Studies in An International Perspective</i>	33
<i>Anaesthesia Pain Intensive Care and Emergency a P i C E</i>	33
<i>Vascular Emergencies Expert Management for the Emergency Physician</i>	31
<i>Acute Lung Injury</i>	30
<i>Cases in Emergency Airway Management</i>	30
<i>Emergency Surgical Management of Colorectal Cancer</i>	30
<i>Proceedings of the 7th World Congress on Trauma Shock Inflammation and Sepsis</i>	30
<i>Emergency Surgery in Obese Patients</i>	29
<i>Value and Quality Innovations in Acute and Emergency Care</i>	29
<i>Annals of the New York Academy of Sciences</i>	28
<i>Journal of Academic Emergency Medicine cAse Reports</i>	28
<i>Orthopaedic and Trauma Nursing an Evidence Based Approach to Musculoskeletal Care</i>	27
<i>Telemedicine for Trauma Emergencies and Disaster Management</i>	27
<i>Clinical Trials for the Treatment of Sepsis</i>	26
<i>12th European Congress on Trauma Emergency Surgery</i>	25
<i>Neonatal and Infant Emergencies</i>	25
<i>Advances in Critical Care Testing</i>	24
<i>Essentials of Trauma Anesthesia</i>	24
<i>Essentials of Trauma Anesthesia 2nd Edition</i>	24
<i>Textbook of Disaster Psychiatry 2nd Edition</i>	24

Contd..

Supplementary Table 1: Contd...

Publication titles	Count
<i>Trauma Centers and Acute Care Surgery</i>	24
<i>Endovascular Resuscitation and Trauma Management Bleeding and Haemodynamic Control</i>	23
<i>Intensive Care for Emergency Surgeons</i>	23
<i>Brain Hypothermia Pathology Pharmacology and Treatment of Severe Brain Injury</i>	22
<i>European Manual of Medicine</i>	22
<i>General Trauma Care and Related Aspects Trauma Surgery ii</i>	22
<i>In Clinical Practice</i>	22
<i>Trauma and Combat Critical Care in Clinical Practice</i>	22
<i>Cerebral Blood Flow</i>	21
<i>Emergency Psychiatry</i>	21
<i>Geriatric Emergencies</i>	21
<i>Neurotraumatology biomechanic aspects cytologic and molecular mechanisms</i>	21
<i>Research in Legal Medicine</i>	21
<i>Emergency Neurology</i>	20
<i>Expecting Trouble Early Warnings and Rapid Responses in Maternal Medical Care</i>	20
<i>Neurotrauma and Vascular Neurosurgery Joint Eans Annual Meeting 4th World Ich Conference 2011</i>	20
<i>Gis in Hospital and Healthcare Emergency Management</i>	19
<i>Sports Emergency Care A Team Approach Third Edition</i>	19
<i>Updates in Emergency Medicine</i>	19
<i>Stroke</i>	18
<i>Challenging and emerging conditions in emergency medicine</i>	17
<i>Global cases in best and worst practice in crisis and emergency management</i>	17
<i>Tic and intelligent systems as support tools for trauma management education and prevention</i>	17
<i>Tic y sistemas inteligentes como herramientas de soporte para el manejo educacion y prevencion del trauma</i>	17
<i>Clinical manual of emergency psychiatry 2nd ed..ition</i>	16
<i>Contemporary Cardiology</i>	16
<i>Emergency Airway Management</i>	16
<i>Emergency Care and the Publics Health</i>	16
<i>Proceedings of The 3rd European Congress On Emergency Medicine</i>	16
<i>Short Stay Management of Chest Pain</i>	16
<i>Splanchnic Circulation</i>	16
<i>Sports Emergency Care A Team Approach Second Edition</i>	16
<i>Urban Emergency Management Planning And Response For The 21st Century</i>	16
<i>Emergency Care Of Children and Young People</i>	15
<i>Hazardous Materials Chemistry For Emergency Responders 3rd Edition</i>	15
<i>Manual of Emergency and Critical Care Ultrasound</i>	15
<i>Shock Sepsis and Organ Failure</i>	15
<i>Burns a Practical Approach to Immediate Treatment and Long Term Care</i>	14
<i>Exertional Heat Illness A Clinical and Evidence Based Guide</i>	14
<i>Reanimation Urgences vol 4 no 1 1995</i>	14
<i>Battlefield Biomedical Technologies</i>	13
<i>Dialyse 1995</i>	13

Contd..

Supplementary Table 1: Contd...

Publication titles	Count
<i>Leveraging Lean In The Emergency Department Creating A Cost Effective Standardized High Quality Patient Focused Operation</i>	13
<i>Primary Management Of Polytrauma</i>	13
<i>Pulmonary Embolism</i>	13
<i>Medical Response to Terror Threats</i>	12
<i>Nato Science for Peace and Security Series E Human and Societal Dynamics</i>	12
<i>Reanimation Urgences Vol 4 No 4 1995</i>	12
<i>Essential us for Trauma E Fast</i>	11
<i>Proceedings of the Society of Photo Optical Instrumentation Engineers Spie</i>	11
<i>Trauma Surgery Handbooks in General Surgery</i>	11
<i>Ultrasound for Acute Care Surgeons</i>	11
<i>Diabetic Emergencies Diagnosis and Clinical Management</i>	10
<i>Emergency Care of the Abused</i>	10
<i>Moderate Sedation and Emergency Medicine for Periodontists</i>	10
<i>Practical Assessment and Treatment of the Patient with Headaches in the Emergency Department and Urgent Care Clinic</i>	10
<i>Annals of the New York Academy of Sciences Series</i>	9
<i>Cardiology Research and Clinical Developments</i>	9
<i>Prehospital Care of Neurologic Emergencies</i>	9

ICU: Intensive care unit

Supplementary Table 2: Keyword dictionary for study design classification

Category	Indicative terms/phrases (examples)	Notes/typical contexts
Randomized controlled trials	"Randomized," "randomised," "randomly assigned," "randomised controlled," "RCT"; "double-blind," "placebo-controlled," "cluster randomised," "crossover trial," "intervention group" + "control group"	Trials with explicit randomization terminology; simulation studies using "random" only for scenario order were not included here
Diagnostic/prognostic accuracy studies	"Diagnostic accuracy," "prognostic accuracy," "validation study" (test/score); "sensitivity," "specificity," "PPV," "NPV," "ROC curve," "AUC," "c-statistic," "cut-off value," "threshold value," "diagnostic performance"	Index test versus reference standard, biomarker or risk score performance in ED populations
Health services and systems research	"Health services research," "health system," "organizational," "emergency department crowding," "overcrowding," "access block," "boarding," "length of stay," "waiting time," "patient flow," "resource utilisation," "quality improvement," "policy," "care pathway," "cost-effectiveness"	Studies focused on organization, delivery, efficiency, quality or financing of emergency/acute care
Educational and simulation studies	"Education," "educational intervention," "curriculum," "training programme," "workshop," "simulation," "high-fidelity simulation," "simulated patient," "OSCE," "assessment," "competency," "skills training," "knowledge retention"	Primarily concerned with training, teaching methods or learner assessment, including simulation-based education
Methodological/ validation/scores	"Score," "scoring system," "risk score," "prediction score," "severity score," "derivation," "instrument validation," "scale validation," "psychometric properties," "reliability," "inter-rater reliability," "kappa," "intraclass correlation coefficient"	Development and methodological evaluation of scales, scoring systems, questionnaires or measurement tools
Qualitative/ mixed-methods	"Qualitative study," "grounded theory," "ethnography," "phenomenological," "interview," "focus group," "thematic analysis," "content analysis," "mixed-methods," "mixed methods," "convergent design," "sequential explanatory"	Studies using qualitative or explicit mixed-methods designs to explore experiences, perceptions or processes
Observational clinical studies (cohort/ cross-sectional)	"Prospective cohort," "retrospective cohort," "cohort study," "cross-sectional study," "chart review," "registry study," "case-control," "case series"	Clinical epidemiology or outcome studies without randomization, not primarily about systems/ education/methods
Other/not classified	No matching terms from the above categories	Narrative or conceptual papers, ambiguous clinical reports and other items not clearly classifiable

This table lists the main study design categories and the indicative keyword/phrase sets used in the rule-based classification algorithm. Matching was performed on concatenated title, abstract and keyword fields. Categories were applied in the hierarchical order shown below; once a higher-priority category was matched, subsequent categories were not evaluated for that record. PPV: Positive predictive values, NPV: Negative predictive values, ROC: Receiver operating characteristic, AUC: Area under the curve, RCT: Randomized controlled trial, OSCE: Objective structured clinical examinations, ED: Emergency department

Supplementary Table 3: Keyword dictionary for conceptual domain assignment

Domain	Core terms (examples)	Priority rule/notes
Trauma and injury	"Trauma," "injury," "polytrauma," "fracture," "TBI," "head injury," "blunt trauma," "penetrating trauma," "road traffic injury," "burn," "burns"	Assigned when trauma or injury is the primary clinical focus; overrides other domains if clearly dominant
Cardiovascular and chest pain	"Chest pain," "acute coronary syndrome," "ACS," "NSTEMI," "STEMI," "myocardial infarction," "heart failure," "pulmonary embolism," "venous thromboembolism"	Applied when nonarrest cardiovascular emergencies or chest pain are central and trauma/resuscitation terms do not dominate
Resuscitation and cardiac arrest	"Cardiac arrest," "out-of-hospital cardiac arrest," "OHCA," "in-hospital cardiac arrest," "CPR," "cardiopulmonary resuscitation," "BLS," "ALS," "ROSC," "defibrillation"	Takes precedence over cardiovascular/chest pain when the main focus is cardiac arrest, CPR or resuscitation processes
Infectious disease and sepsis	"Sepsis," "septic shock," "infection," "pneumonia," "meningitis," "cellulitis," "COVID-19," "SARS-CoV-2," "coronavirus"	Used when infection or sepsis is the central theme and not secondary to another primary domain (e.g. trauma)
Respiratory emergencies and COPD/asthma	"Respiratory failure," "respiratory distress," "dyspnea," "COPD exacerbation," "asthma," "status asthmaticus," "NIV," "mechanical ventilation"	Applied when acute respiratory pathology is primary, and articles are not primarily about cardiac arrest, trauma or infection
Pediatric emergency medicine	"Pediatric," "paediatric," "child," "children," "adolescent," "infant," "neonate," "newborn," "pediatric emergency department"	Overrides other domains when the study population is clearly pediatric, unless the article focuses mainly on a nonclinical theme (e.g. AI tools)
Imaging and POCUS	"Ultrasound," "POCUS," "bedside ultrasound," "FAST," "echocardiography," "CT scan," "MRI," "radiography"	Used when the primary focus is the use, performance or impact of imaging/POCUS rather than the clinical disease alone
Digital health and artificial intelligence	"AI," "machine learning," "deep learning," "neural network," "telemedicine," "telehealth," "EHR," "mHealth," "mobile app"	Overrides other domains when the main contribution is a digital or AI tool/platform, even if targeted at a specific clinical condition
Disaster, prehospital and EMS	"Prehospital," "EMS," "paramedic," "ambulance," "disaster," "MCI," "earthquake," "flood," "disaster preparedness"	Applied when the care setting is prehospital/EMS or when disaster/humanitarian emergency medicine is the primary focus
Other/miscellaneous	Topics not clearly fitting the above domains, e.g., "poisoning," "overdose," "intoxication," "envenomation," "environmental exposure," rare syndromes	Used for heterogeneous or low-frequency topics without a dominant term pattern

This table summarizes the conceptual domains used to classify articles and the corresponding domain-specific term sets. Matching was performed on concatenated title, abstract and keyword fields. A fixed priority order was applied so that each article was assigned to a single dominant domain when multiple domains matched. AI: Artificial intelligence, ALS: advanced life support, BLS: Basic life support, COPD: Chronic obstructive pulmonary disease, COVID: Corona Virus Disease, CPR: Cardiopulmonary resuscitation, CT: Computed tomography, EHR: Electronic health record, EMS: Emergency medical services, MCI: Mass casualty incident, NIV: Noninvasive ventilation, NSTEMI: Non-ST-segment elevation myocardial infarction, POCUS: Point-of-care ultrasound, SARS-CoV-2: Severe acute respiratory syndrome corona virus, STEMI: ST-segment elevation myocardial infarction, TBI: Traumatic brain injury

Supplementary Table 4: VOSviewer preprocessing and parameter settings for network visualizations

Figure	Network type	Unit of analysis	Counting method	Minimum threshold (s)	Final selected items	Normalization/ clustering	Cleaning/disambiguation notes
Figure 3	Journal co-citation	Sources	Full counting	Minimum 200 citations/ source	Top 90 sources	Default VOSviewer settings	No additional source-name cleaning beyond indexed form
Figure 4	Author co-authorship	Authors	Full counting	Minimum 15 documents/ author; minimum 100 citations/author	Top 100 authors	Default VOSviewer settings	No external author disambiguation beyond WoS/ VOSviewer indexed names
Figure 5	Keyword co-occurrence overlay	Author keywords	Full counting	Minimum 20 occurrences/keyword	Top 100 keywords	Default VOSviewer settings	No external thesaurus file or manual synonym merging

VOSviewer: Visualization of Similarities Viewer

Supplementary Table 5: Internal validation of the rule-based classification algorithm

Panel A. Validation sample design				
Item	<i>n</i>	%	Notes	
Total validation sample	240	100.0	Decade-stratified random sample with oversampling of difficult categories	
Main stratified random	180	75.0	Primary random sample	
Oversample: Study type other	30	12.5	Borderline records initially assigned to study-design Other	
Oversample: Conceptual domain Other	30	12.5	Borderline records initially assigned to conceptual-domain Other	
Panel B. Decade distribution of validation sample				
Decade	<i>n</i>	%		
1980–1989	27	11.3		
1990–1999	39	16.3		
2000–2009	57	23.8		
2010–2019	66	27.5		
2020–2024	51	21.3		
Panel C. Agreement metrics				
Comparison	<i>n</i>	Agreement (%)	Cohen’s kappa	Interpretation
Reviewer 1 versus reviewer 2 (study type)	240	67.9	0.474	Inter-rater agreement before adjudication
Algorithm versus final consensus (study type)	240	75.8	0.638	Rule-based classification versus manual reference standard
Reviewer 1 versus reviewer 2 (concept domain)	240	72.1	0.648	Inter-rater agreement before adjudication
Algorithm versus final consensus (concept domain)	240	86.3	0.828	Rule-based classification versus manual reference standard
Panel D. Discordance reasons among discordant records				
Reason code	<i>n</i>	Percentage of discordant records		Meaning
M1	21	8.8	Insufficient metadata	
M2	0	0.0	Historical/ambiguous terminology	
M3	33	13.8	Multiple study-design signals	
M4	9	3.8	Overlapping conceptual domains	
M5	7	2.9	Dictionary gap/borderline term	
M6	3	1.3	Priority-order difference	
M7	45	18.8	Reviewer interpretation difference	
M8	1	0.4	Other	

Agreement percentages are calculated from the 240-record validation sample. Cohen’s kappa values were calculated from the same sample and entered as fixed values. Final manual reference labels correspond to the adjudicated consensus labels recorded in the consensus workbook. Percentages in panels A-D are formatted as proportions of total sample or discordant records, as indicated