ORIGINAL ARTICLE

Most cited cardiac arrest and emergency cardiovascular care studies: a bibliometric analysis of trends, impact, and global research gaps

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ABSTRACT

Background: Cardiac arrest contributes significantly to global mortality and imposes substantial public health and economic burdens. This bibliometric examined the most highly cited studies on cardiac arrest.

Methodology: To identify the most-cited articles on cardiac arrest, data were retrieved from the Web of Science Core Collection database using an adapted process based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. Eligible studies included peer-reviewed articles published in English that focused on cardiac arrest and involved human participants. Extracted data included article titles, authors' names, citations count, average annual citations, publication year, country, journal, funding source, study design, level of evidence, and primary outcomes.

Results: The United States (56%) and United Kingdom (6%) were among the leading contributor to highly cited cardiac arrest research. The included studies generally focused on providing high levels of evidence. Publication rates reached their highest level in the early 2000s, and the most productive author was Michael Holzer (USA), whose work received the most citations (143.57 annually; 3302 total). The most impactful research was published in *The New England Journal of Medicine* and *Circulation*.

Conclusions: This analysis of the most-cited articles on cardiac arrest provides valuable insights into this crucial field, guiding future research directions and helping to build evidence-based methods for improving clinical outcomes globally.

Keywords: Cardiac arrest, cardiopulmonary resuscitation, heart attack, Preferred reporting items for systematic reviews and meta-analyses, bibliometric analysis.

Introduction

Cardiac arrest, defined as a sudden cessation of effective cardiac pumping, is a major global health concern [1]. It may affect individuals with or without a prior diagnosis of cardiovascular disease [1]. Cardiac arrest differs from cardiac death, myocardial infarction (MI; "heart attack"), myocarditis, and pericarditis [2]. In-hospital cardiac arrest (IHCA) also differs from out-of-hospital cardiac arrest (OHCA) in its underlying causes, presenting arrhythmias, and patient characteristics. IHCA is often caused by underlying cardiac conditions in patients with more severe illnesses or comorbidities, whereas OHCA is more commonly associated with cardiac etiology and occurs suddenly [3]. Globally, approximately 90% of OHCAs result in fatal outcomes [4]. OHCA accounts for nearly 15%-20% of all deaths in developed countries, representing a substantial burden on patient safety and public health systems [5,6]. Despite the growing volume of work in this field, the research landscape has received little synthesis, particularly regarding the quality, impact, and evolution of the most influential studies.

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Bibliometric analyses systematically evaluate the structure of scientific literature using mathematical and statistical methods to identify leading contributors, influential journals, citation networks, and emerging research themes [6-8]. Bibliometric studies provide valuable insights into emerging research area, helping guide future investigations and inform healthcare priorities [9]. Tools such as CiteSpace further enhance this process by enabling visualization of knowledge networks and thematic trends [10].

Understanding the trajectory and concentration of high-impact cardiac arrest research is essential for identifying public health disparities, guiding resource allocation, and informing global research priorities. Therefore, this bibliometric study evaluated the methodological rigor, research designs, and relevance of the most cited publications in cardiac arrest. It also mapped the emerging trends, identified research gaps and inconsistencies, and examined the contributions of these studies to field. This paper provides a comprehensive overview of the intellectual structure of cardiac arrest research and offers direction for future investigations aimed at improving clinical outcomes and public health strategies.

Methods

This bibliometric analysis examined the methodological quality and research trends in cardiac arrest by examining the 50 most cited publications. This study focused on publications involving human subjects who had suffered from cardiac arrest and characterized the existing research landscape rather than assessing specific clinical outcomes or interventions. Although the included studies covered a range of interventions (e.g., defibrillation, cardiopulmonary resuscitation [CPR], postarrest care), these were considered only in terms of their representation within the most highly cited research. The analysis was conducted in three main stages: (1) a database search and item identification using an adapted Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) process; (2) screening and eligibility assessment using Rayyan software; and (3) statistical and bibliometric analysis.

Literature search

On October 5, 2024, a comprehensive literature search was conducted using the Web of Science Core Collection database. The following search terms were applied: "cardiac arrest" OR "heart arrest" OR "cardiopulmonary arrest" OR "asystole" OR "cardiopulmonary resuscitation (CPR)." A total of 100,424 records were retrieved.

Records were sorted by citations (highest first) as of the search date, and the 300 most-cited records were exported to Rayyan for title and abstract screening against the eligibility criteria. Twenty articles were eliminated as duplicates and 158 as irrelevant, leaving 122 articles after screening. The 50 most-cited relevant studies were then selected for inclusion in the bibliometric analysis. Data from the final 50 articles were then extracted into a structured Excel sheet. The inclusion criteria were: (1) peer-reviewed articles published in English; (2) studies focusing primarily on cardiac arrest; (3) studies involving individual human subjects or patient populations affected by cardiac arrest; and (4) articles with measurable citation impact. No time restrictions were applied. Studies were excluded if they were published in languages other than English, did not primarily address cardiac arrest, or were not published in peer-reviewed sources. The adapted PRISMA process is illustrated in Figure 1.

Eligibility screening

Rayyan software was used to manage the screening process of the retrieved articles. Titles and abstracts were independently reviewed by seven investigators to assess eligibility according to the above inclusion and exclusion criteria. Discrepancies were resolved through discussion to ensure consistency and consensus.

After the final set of 50 articles was selected for data extraction, key information was systematically extracted and recorded in a structured Microsoft Excel sheet. The extracted variables included article title, authors' names, publication year, journal name, total citation (TC) count, average citations (AC) per year, study setting, funding status, study design, level of evidence, primary research topic, and the use of patient-reported outcome measures.

Statistical analysis

Following data extraction, the dataset of the 50 most cited articles was organized and prepared for bibliometric analysis. The data were imported into RStudio (R Foundation for Statistical Computing, Vienna, Austria) using the read.csv function. Bibliometric analyses were conducted using the R package Bibliometrix and its web interface, BiblioShiny. Additional analyses were performed using the metapackage.

Descriptive and exploratory analyses were conducted to evaluate publication trends over time and identify

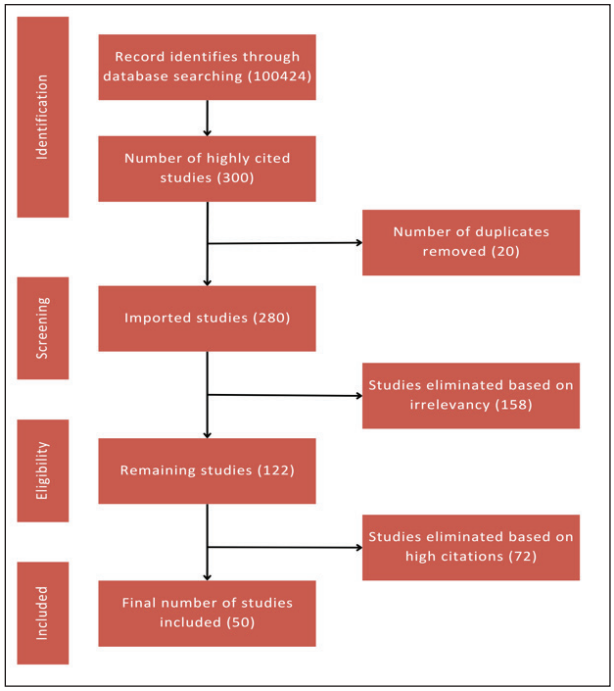


Figure 1. *Adapted PRISMA flow diagram.*<AQ3>

the most productive authors, countries, institutions, and journals. Citation metrics, including TC and AC per year, were calculated to assess the impact of the included studies. Thematic analysis was also performed to identify frequently occurring keywords and explore the field's conceptual structure. This included an evaluation of keyword co-occurrence patterns and the identification of the major research themes.

Results

Annual scientific production

Annual publication counts for the 50 most-cited cardiac arrest publications are shown in Figure 2. The earliest article in the sample appeared in 1978, after which output remained very low through the 1980s, with only 1982 seeing a highly cited article. There was a gradual rise in annual production from the early 1990s, and a sustained increase began in the late 1990s. The period from 2000 to 2010 represented the peak in annual production, with multiple years reaching the highest observed annual counts (up to five highly cited articles in a single year). After 2010, annual counts became more variable and, on average, lower than during the peak decade. Some years had no articles on the top-50 list, and others had only one or two articles.

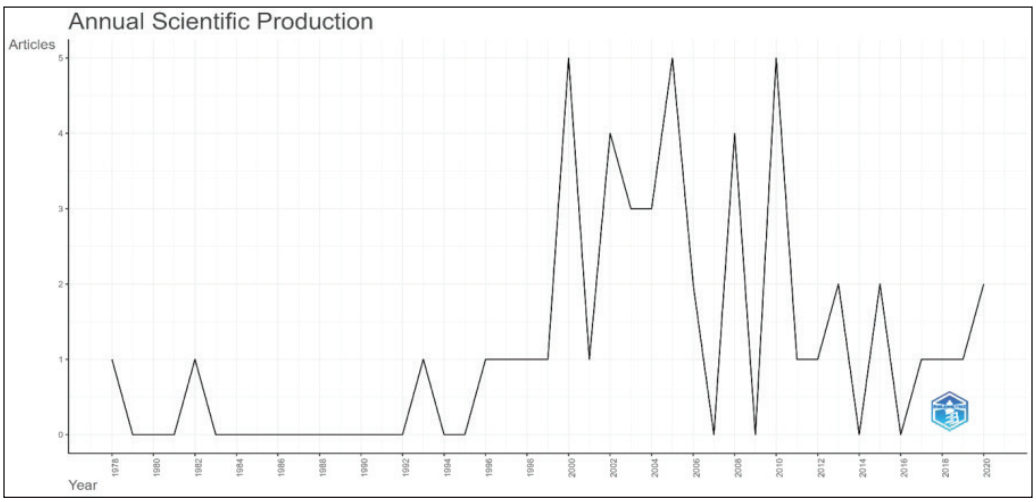


Figure 2. *Publication growth trends of highly cited studies, 1978-2020.*

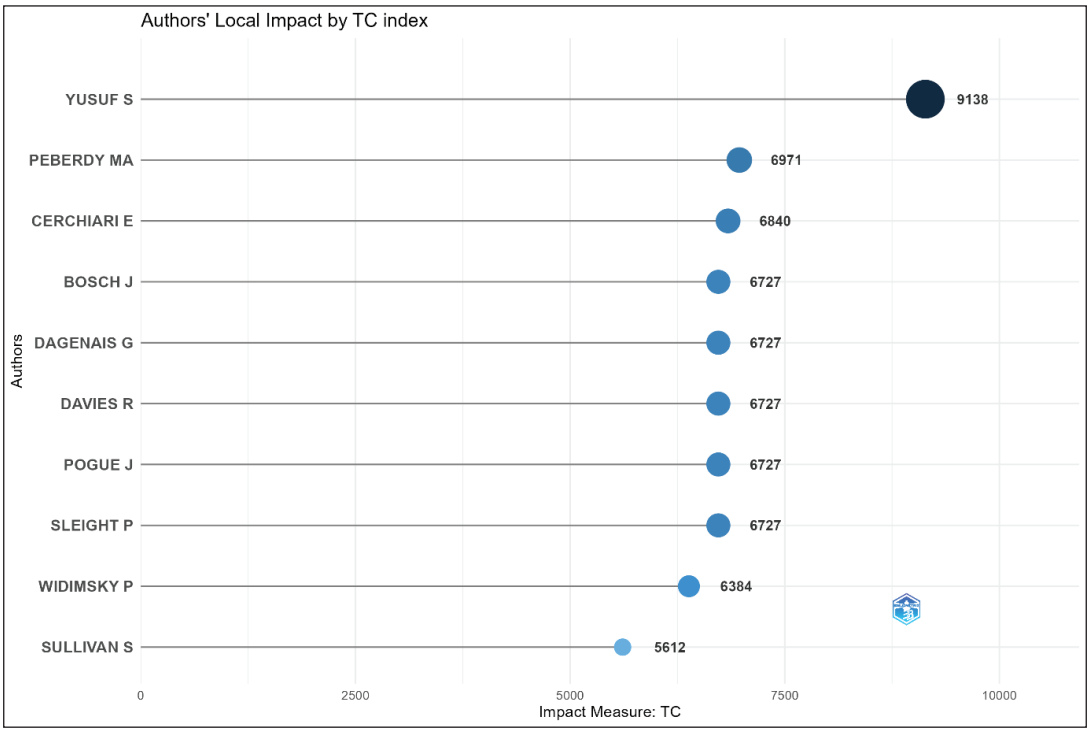
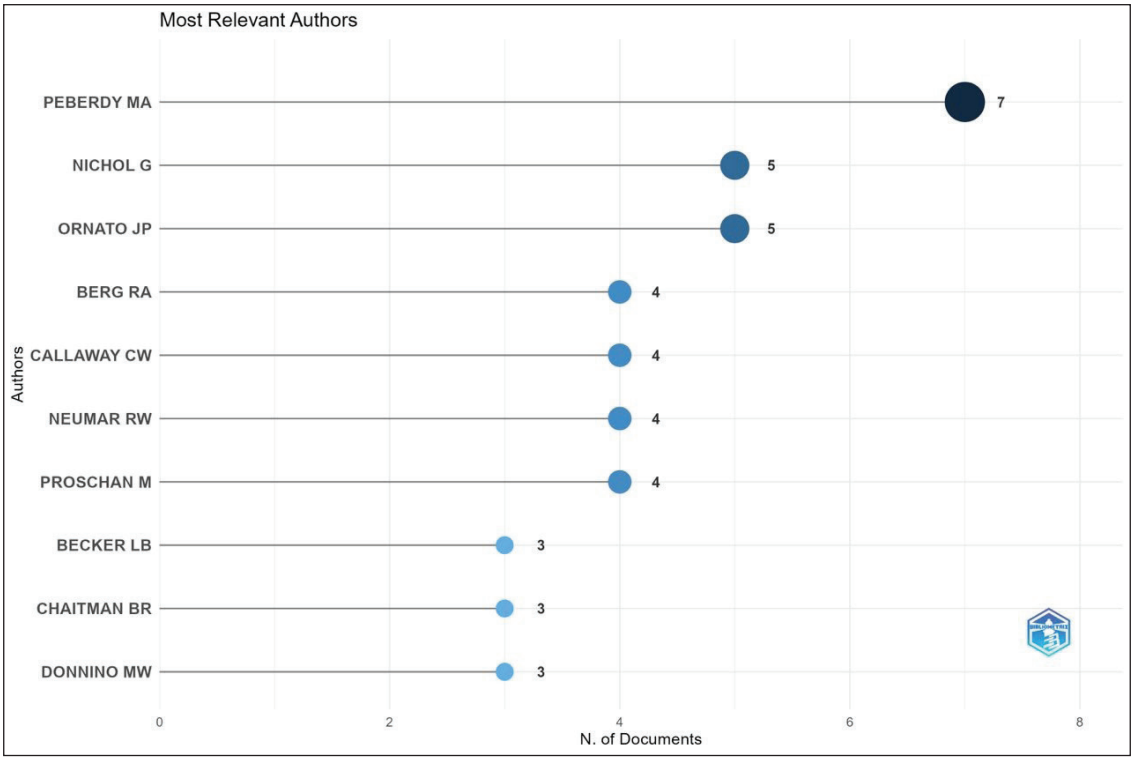
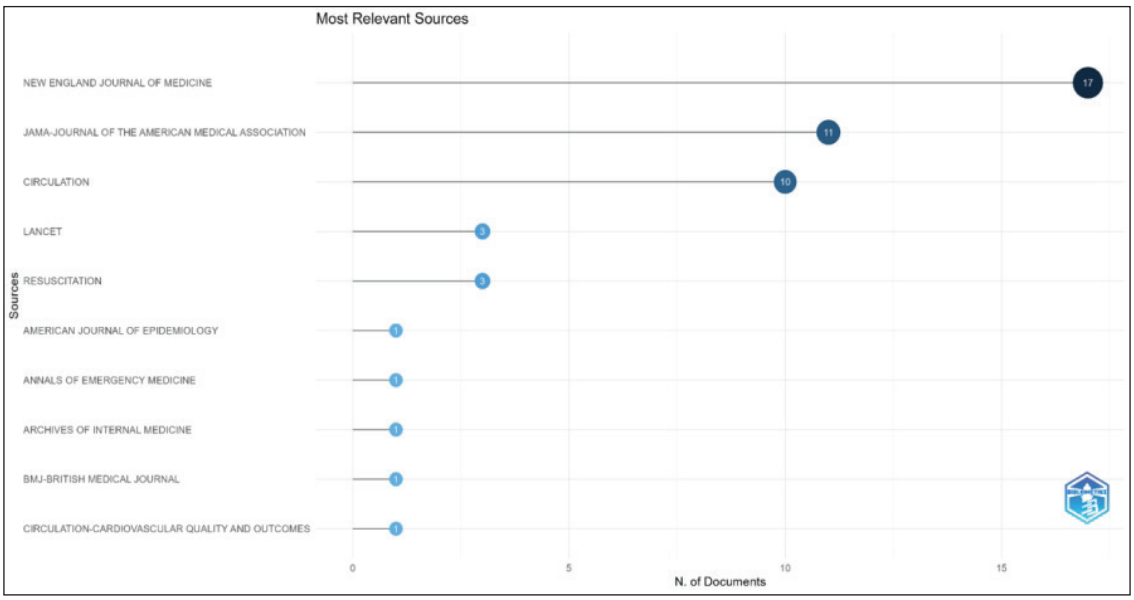


Figure 3. *Author impact (total citations).*



170 ***Figure 4.*** *Most relevant authors (number of publications).*



171 ***Figure 5.*** *Publication trends for the most productive journals (number of items).*

172 ## *Most relevant authors and production over time*

173 Figure 3 presents each lead author's local impact by TC.
174 It demonstrates a clear skew in citation impact.

175 Figure 4 displays author productivity (number of
176 publications): Peberdy contributed seven publications,
177 Nichol and Ornato contributed five each, and five
178 additional authors (Berg, Callaway, Neumar, and
179 Proschan) contributed four each. These eight authors
180 together accounted for most of the article documents in
181 the sample, demonstrating that the top-cited literature
182 in this field was concentrated in a relatively small core
183 of highly productive scientists. The two figures indicate
184 some alignment between productivity and citation impact
185 as Peberdy was also among both the most productive and
186 the most highly cited authors.

187 ## *Most relevant and cited scientific journals*

188 As demonstrated in Figure 5, *The New England Journal*
189 *of Medicine* (*NEJM*) published the largest share with 17
190 of the 50 items, followed by *JAMA* [11] and *Circulation*
191 [10]. These three journals published 76% of the most
192 cited papers in the sample. The remaining 12 items were

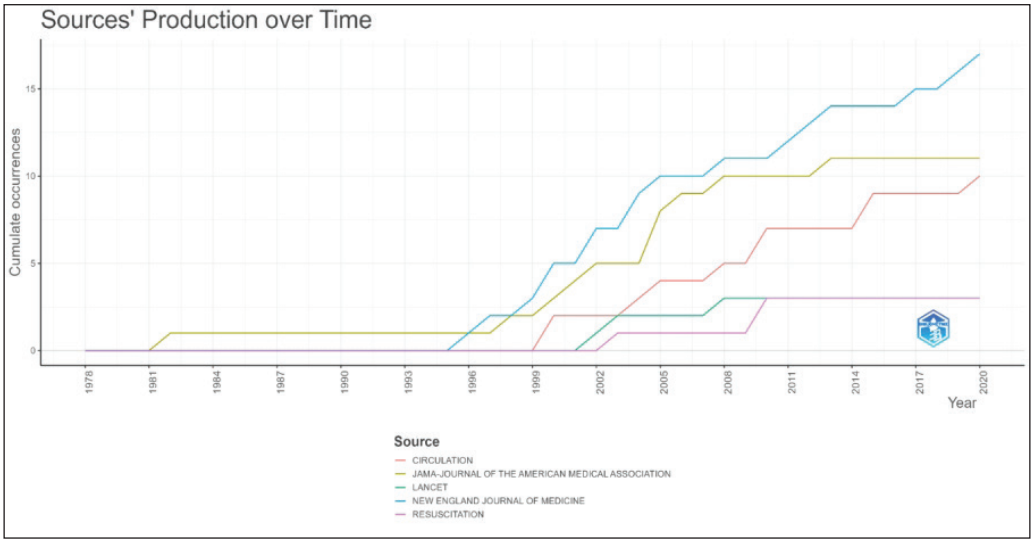


Figure 6. *Publication trends for the most productive journals by year (1978-2020).*

distributed across a mixture of general and specialty journals, including *Lancet* [3], *Resuscitation* [3], and a handful of others that published only one highly cited item each. This concentration indicates that the most highly cited cardiac arrest/MI research has been published preferentially in a few high-impact journals.

The temporal dynamics of source contributions (Figure 6) demonstrate that *NEJM*'s contribution increased steadily from the late 1990s into the 2010s. *JAMA* accumulated most of its highly cited articles earlier (plateauing at 11 in the first decade of the 2000s), while *Circulation* experienced a continuing rise across the 2000s and 2010s to reach 10 occurrences by 2020. *Lancet* and *Resuscitation* contributed more intermittently. The source-level time series demonstrates that the early 2000s were a formative period in which many of the most highly cited articles appeared in major general medical journals. Table 1 presents the TCs and citations per year for the top 50 publications included in the analysis. The most highly cited article, by Yusuf et al., published in *NEJM*, accumulated 6727 TCs as of the writing of this article, with an AC rate of 258.73 per year.

Co-citation analysis revealed a compact intellectual structure dominated by three main clusters of highly co-cited works. In Figure 7, node size reflects citation frequency (larger nodes = more citations) and link thickness reflects co-citation strength. The largest/most central nodes act as intellectual hubs or "bridge" documents that connect subfields. The network shows a dense, red cluster of tightly interlinked papers from the late 1990s that forms one core of the field (the largest nodes in this cluster include "Spaulding" and its neighboring highly co-cited items). A blue cluster (centered on nodes like "Aufderheide" and "Valenzuela") sits adjacent to the red and contains many cross-links with it, indicating substantial conceptual and citation overlap between these two cores. Two smaller, more isolated nodes (green: "Cox 1972"; purple: "Pedersen 1994") fall at the periphery of the map and appear only weakly connected to the main clusters. The map reveals a field organized around a concentrated set of seminal papers from the late 1990s to the early 2000s, with a high degree of internal cohesion and a small number of peripheral or methodologic antecedents.

Most relevant affiliations and primary research-producing countries

Figure 8 shows the most productive affiliations. The most frequent institutional addresses were the University of Texas [8] and the University of Washington [8], followed by Ullevaal University Hospital [7], Brigham and Women's Hospital [6], University of Pennsylvania [6], and the University of Toronto [6]. Several additional institutions contributed multiple highly cited articles (Duke University, National Taiwan University Hospital, University of Amsterdam, Columbia University). Nevertheless, the high concentration of output from six institutions confirms that a relatively small group of centers produced a disproportionate share of the field's most influential papers. These institutional results largely reflected the author- and journal-level concentration reported above. Most of the top affiliations were US-based academic hospitals and universities (University of Texas, University of Washington, Brigham and Women's, Columbia, Duke), with important contributions from Canada (University of Toronto), northern Europe (Ullevaal University Hospital, University of Amsterdam), and Taiwan (National Taiwan University Hospital).

Figure 9 plots the cumulative longitudinal production for the five most prominent nations. The United States dominated the field, with a steep rise beginning in the late 1990s and reaching its largest cumulative contribution by 2020. The USA was followed by Canada, the UK, France, and Sweden, each of which experienced a modest but steady accumulation of top-cited articles across the 2000s and 2010s. The temporal curves indicate that the formative surge in highly cited outputs occurred from 2000 onward and was largely led by US institutions, with other high-income countries contributing steadily thereafter. The world map (Figure 10) illustrates the overall geographic spread of the sample. A geographical

Table 1. Citation parameters of the 50 most cited studies in cardiac arrest research.

1st Author, Year, Journal	TC	AC/Year	Normalized TC
Yusuf, 2000, *NEJM*	6727	258.73	3.06
Hulley, 1998, *JAMA*	4822	172.21	1.00
Ibanez, 2018, *Kardiol Pol*	4686	585.75	1.00
Bernard, 2002, *NEJM*	3993	166.38	1.54
Holzer, 2002, *NEJM*	3420	142.50	1.32
Moss, 1996, *NEJM*	3039	101.30	1.00
LaRosa, 2005, *NEJM*	2718	129.43	1.92
Stone, 2011, *NEJM*	2628	175.20	1.00
McAnulty, 1997, *NEJM*	2411	83.14	1.00
Nielsen, 2013, *NEJM*	2178	167.54	1.40
Tardif, 2019, *NEJM*	2162	308.86	1.00
Furberg, 2002, *JAMA*	2094	87.25	0.81
Schwartz, 2001, *JAMA*	1978	79.12	1.00
Maron, 2020, *NEJM*	1828	304.67	1.27
Granger, 2003, *Arch Intern Med*	1815	78.91	1.23
Buxton, 1999, *NEJM*	1807	66.93	1.00
Sasson, 2010, *Circ Cardiovasc Qual Outcomes*	1718	107.38	1.39
Fox, 2003, *Lancet*	1698	73.83	1.15
Schwartz, 2012, *NEJM*	1629	116.36	1.00
Anavekar, 2004, *NEJM*	1619	73.59	1.28
Paffenbarger, 1978, *Am J Epidemiol*	1605	33.44	1.00
Berdowski, 2010, *Resuscitation*	1586	99.13	1.28
Nichol, 2008, *JAMA*	1581	87.83	1.40
Friedman, 1982, *JAMA*	1400	31.82	1.00
Jacobs, 2004, *Circulation*	1330	60.45	1.05
Pedersen, 2005, *JAMA*	1270	60.48	0.90
Fox, 2006, *BMJ*	1174	58.70	1.14
Callaway, 2015, *Circulation*	1172	106.55	1.13
Anonymous, 2005, *Circulation*	1120	53.33	0.79
Connolly, 2000, *Circulation*	1117	42.96	0.51
Furberg, 2000, *JAMA*	1107	42.58	0.50
Neumar, 2008, *Circulation*	1081	60.06	0.96
Panchal, 2020, *Circulation*	1049	174.83	0.73
Peberdy, 2010, *Circulation*	1026	64.13	0.83
Kuck, 2000, *Circulation*	1023	39.35	0.47
Valenzuela, 2000, *NEJM*	1022	39.31	0.46
Wik, 2005, *JAMA*	1011	48.14	0.71
Neumar, 2010, *Circulation*	990	61.88	0.80
Haïssaguerre, 2008, *NEJM*	961	53.39	0.85
Abella, 2005, *JAMA*	954	45.43	0.67
Wissenberg, 2013, *JAMA*	944	72.62	0.60
Peberdy, 2003, *Resuscitation*	919	39.96	0.62
Link, 2015, *Circulation*	908	82.55	0.87
Nadkarni, 2006, *JAMA*	886	44.30	0.86
Chen, 2008, *Lancet*	883	49.06	0.78
Nolan, 2010, *Resuscitation*	878	54.88	0.71
Dickstein, 2002, *Lancet*	863	35.96	0.33
Larsen, 1993, *Ann Emerg Med*	841	25.48	1.00
Hallstrom, 2004, *NEJM*	838	38.09	0.66
Anderson, 2017, *NEJM*	835	92.78	1.00

Note: AC = average citations; ***Am J Epidemiol*** = ***American Journal of Epidemiology***; ***Ann Emerg Med*** = ***Annals of Emergency Medicine***; ***Arch Intern Med*** = ***Archives of Internal Medicine***; ***BMJ*** = ***British Medical Journal***; ***Circ Cardiovasc Qual Outcomes*** = ***Circulation: Cardiovascular Quality and Outcomes***; ***JAMA*** = ***Journal of the American Medical Association***; ***Kardiol Pol*** = ***Polish Heart Journal***; ***NEJM*** = ***New England Journal of Medicine***; TC = total citations.

map of the most productive countries is presented in Supplementary Figure 2.

Keyword analysis

Keyword-level analyses demonstrated that the most-cited literature cardiac arrest and myocardial infraction was organized around closely related, clinically important themes. These were chiefly acute coronary syndromes, resuscitation, and survival outcomes, with a mixture of well-established and more peripheral topics.

The thematic map (Figure 11) organizes terms by centrality (relevance) and density (development). Motor themes (upper-right quadrant) included "survival," "myocardial infarction," "ventricular fibrillation," "therapeutic hypothermia," and "percutaneous coronary intervention." These topics are central to the field and relatively well developed. More basic themes (lower-right) were highly relevant but less internally developed and included "mortality," "hospital cardiac arrest," and "acute myocardial infarction." Niche themes (upper-left) like "ischemia" and "moderate hypothermia" were well developed but more specialized. Emerging or declining themes (lower-left) included items related to "prevention" and "high-risk" populations; these achieved lower centrality and density in the sample.

The timeline plotting of frequent terms demonstrated temporal shifts in emphasis, as shown in Figure 12. Early peaks include "mortality" and "myocardial infarction"

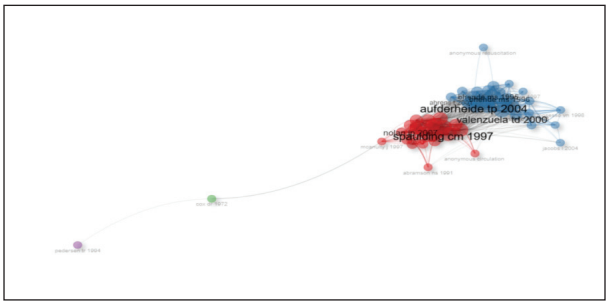


Figure 7. *Co-citation network of the 50 most-cited articles.*

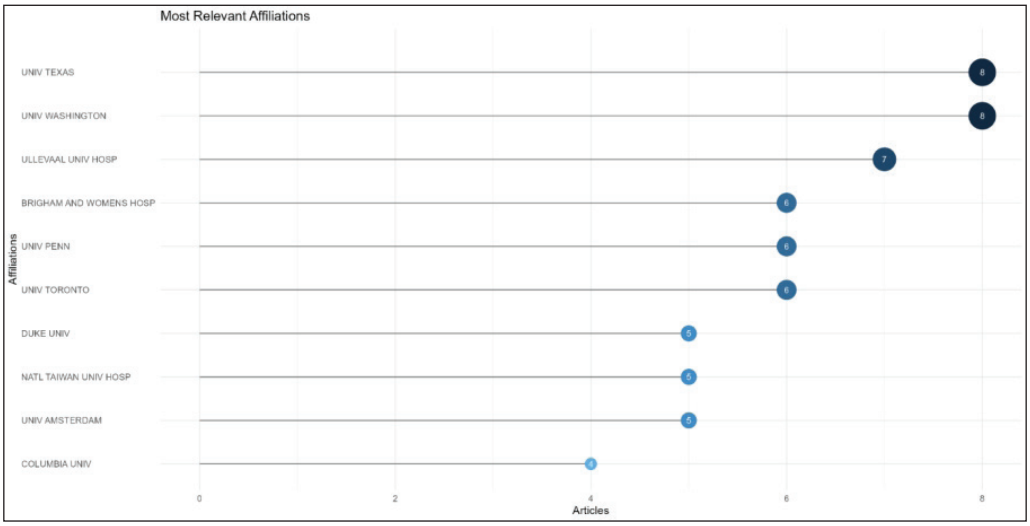


Figure 8. *Main affiliations for the 50 most-cited studies in cardiac arrest research.*

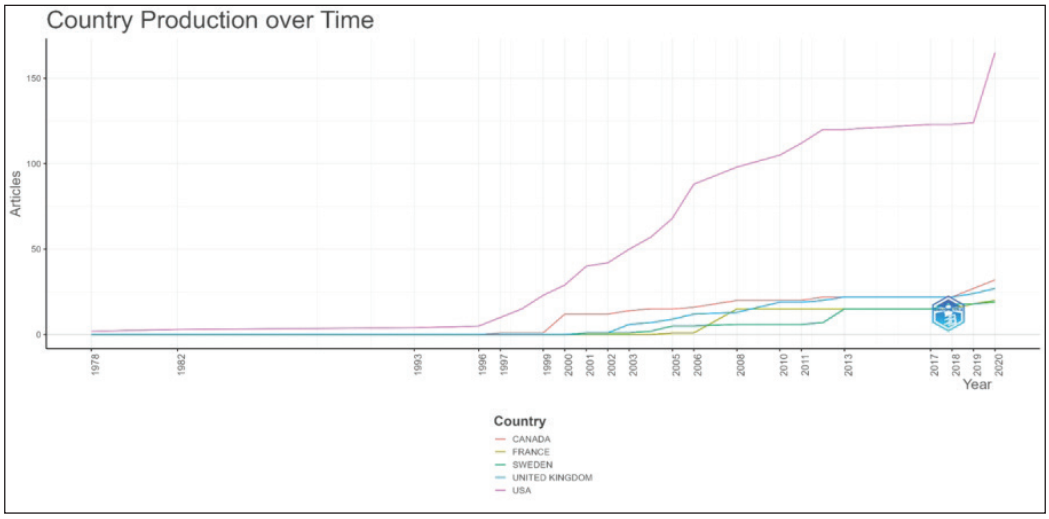


Figure 9. *Production in top five most prolific countries (1978-2020).*

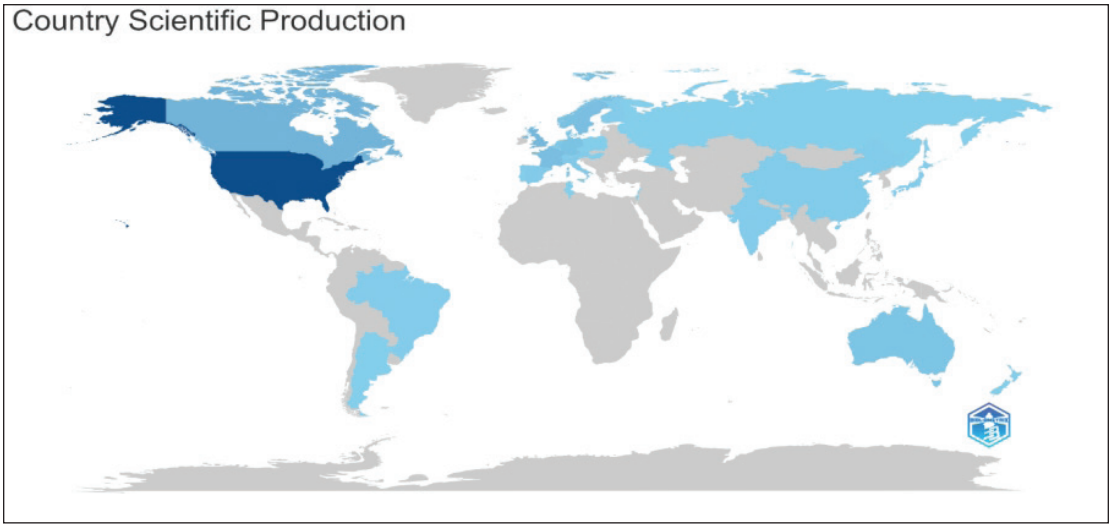


Figure 10. *Geographic distribution of the most cited cardiac research.*

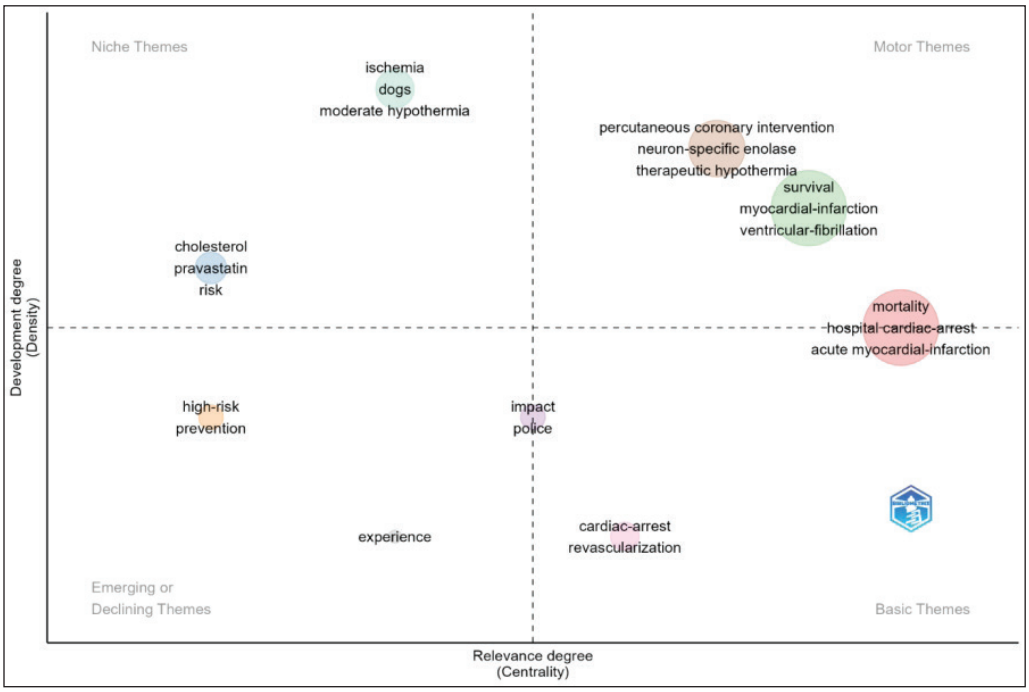
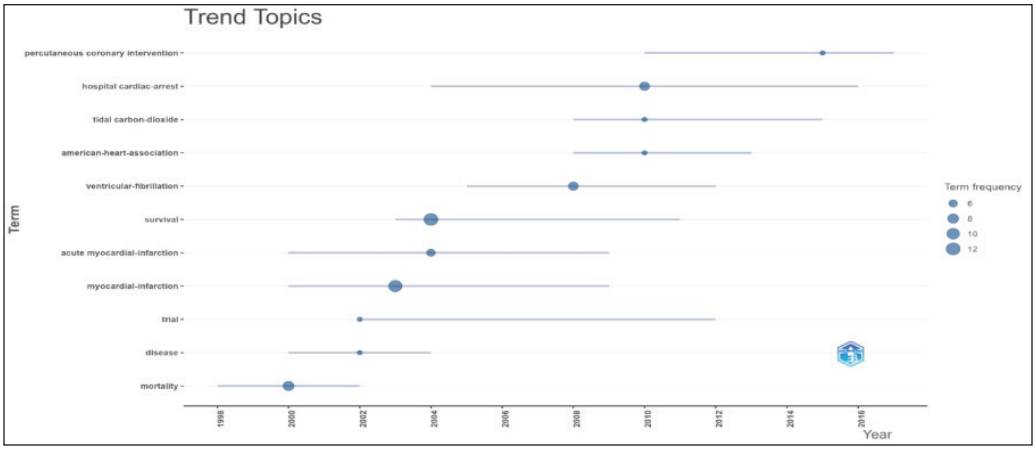


Figure 11. *Distribution of research themes based on centrality and density.*

around the late 1990s–early 2000s, while "survival" and "ventricular fibrillation" became prominent in the 2000s. More intervention-focused terms, most notably "percutaneous coronary intervention," emerged later and extended into the 2010s. Terms describing measurement/physiology (e.g., "tidal carbon-dioxide") and organizational actors (e.g., "American Heart Association") appeared in specific time windows, reflecting waves of methodological, guideline-driven research.

The word cloud (Figure 13) visually illustrates term frequency patterns. The most frequent keywords were "myocardial infarction," "survival," "hospital cardiac arrest," "acute myocardial infarction," "ventricular fibrillation," "mortality," and intervention/technology terms like "percutaneous coronary intervention," "therapeutic hypothermia," "automated external defibrillators," and "cardiopulmonary resuscitation." This reinforces the observation that the highly cited literature emphasized clinical outcomes and therapeutic approaches.

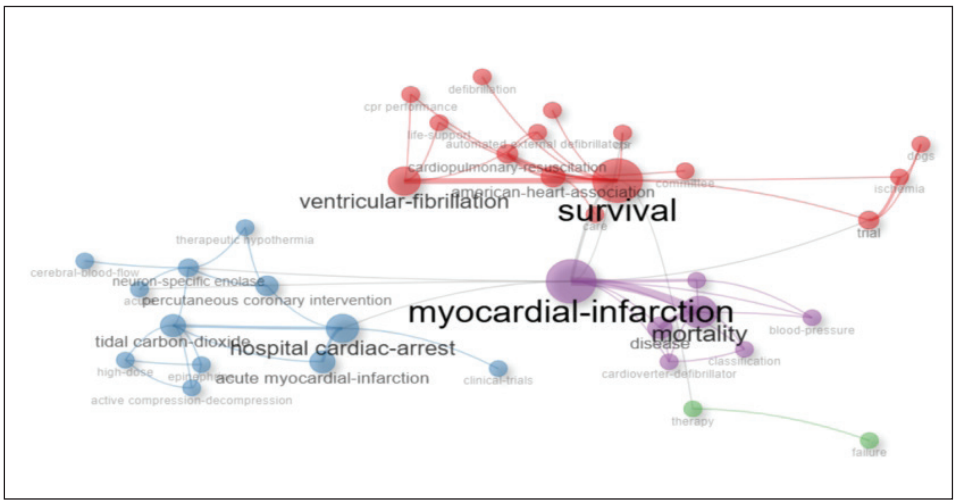
The term co-occurrence network reveals multiple topical clusters and their connections, as shown in Figure 14. Two large hubs ("myocardial infarction," "survival") acted as central connectors linking clusters about acute coronary syndromes and revascularization, resuscitation methods and defibrillation, and neurologic outcome/biomarkers (e.g., "neuron-specific enolase") and hypothermia. The edge thicknesses and node sizes indicate that a handful of keyword pairs co-occurred frequently, demonstrating



342 ***Figure 12.*** *Trending topics in cardiac arrest research (1998-2016).*



343 ***Figure 13.*** *Word cloud of most frequently occurring keywords.*



344 ***Figure 14.*** *Thematic clusters and interconnections based on frequency and co-occurrence.*

345 strong conceptual coupling between outcomes (survival/
346 mortality), arrhythmia (ventricular fibrillation), and
347 interventions (percutaneous coronary intervention,
348 defibrillation, and hypothermia).

Discussion

349

350 The purpose of the present bibliometric analysis was to
351 identify the intellectual structure and the main research
352 trends represented by the 50 most cited publications

on cardiac arrest and emergency cardiovascular care. The included studies were published between 1978 and 2020, with the highest number of publications occurring between 2000 and 2010. The most cited paper was Yusuf et al. with a total of 6727 citations and 258.73 citations per year at the time of analysis. The results also revealed a highly skewed distribution of citations, with a small number of publications accounting for a large portion of the field's visibility.

The concentration of highly cited publications in the 2000–2010 period may reflect a formative period in cardiac arrest research. Influential publications from this period addressed CPR quality, early defibrillation, public-access AED programs, temperature management, coronary reperfusion, and predictors of survival. This temporal pattern indicates the citation prominence of these topics but does not by itself establish their clinical effectiveness or the extent of their implementation.

The production of research was concentrated on a relatively small number of authors and institutions. Peberdy had seven publications, while Nichol and Ornato had five publications each. The most frequent institutional affiliations were the University of Texas and the University of Washington, each with eight publications. The United States was the largest contributing country, accounting for 56% of the publications analyzed, followed by the United Kingdom and other high-income countries. This pattern suggests that the most visible cardiac arrest research has come from largely established academic and clinical networks.

This geographic concentration may reflect differences in research capacity, including access to registries, emergency medical systems, intensive-care facilities, funding, established collaborations, and high-visibility journals. It should not be interpreted as evidence that cardiac-arrest problems or innovations in less-represented settings are less important.

The concentration of highly cited publications also raises questions about the representation of global research needs. The underrepresentation of low- and middle-income settings in this top-cited sample supports further investigation of geographic differences in research visibility and collaboration; it does not measure the underlying burden of cardiac arrest or the quality of care in those settings.

The distribution of publications across journals was also highly concentrated. Of the 50 articles, 17 were published in the New England Journal of Medicine, 11 in JAMA, and 10 in Circulation. Hence, these three journals comprised 76% of the sample. The co-citation network showed a compact intellectual structure, with a central cluster of publications from the late 1990s and early 2000s and a few methodological or historical contributions in the periphery.

The broad readership of general medical journals such as NEJM and JAMA may contribute to the citation visibility of articles published in them. Conversely, citation-based selection may underrepresent clinically relevant work in specialist or regional journals. Citation prominence therefore reflects scholarly visibility and patterns of dissemination, rather than clinical quality alone [11,12].

The major topics derived from the keyword analysis were survival, myocardial infarction, ventricular fibrillation, mortality, hospital cardiac arrest, therapeutic hypothermia, cardiopulmonary resuscitation, automated external defibrillators, and percutaneous coronary intervention. The thematic map showed survival, myocardial infarction, ventricular fibrillation, therapeutic hypothermia, and percutaneous coronary intervention as the most central and developed themes. Prevention and high-risk populations, in contrast, were less central and less developed. In general, the citation classics were weighted more toward acute treatment and short-term clinical outcomes than toward prevention, survivorship, rehabilitation, equity, or implementation science.

The prominence of therapeutic hypothermia and targeted temperature management reflects sustained scholarly attention to postarrest temperature control. Early randomized trials reported improved neurologic outcomes in selected comatose survivors [9,13], while subsequent research compared temperature targets of 33°C and 36°C [10]. Their central position in the citation network indicates their influence on the research literature, not a determination by this bibliometric analysis of the optimal temperature-management strategy.

The representation of myocardial infarction and percutaneous coronary intervention indicates a substantial overlap between highly cited cardiac arrest research and acute coronary syndrome research. This bibliometric association demonstrates the visibility of coronary intervention within the literature, but does not independently establish which patients benefit from angiography or revascularization. Clinical decisions must instead be based on current evidence and guidance [14].

The compact co-citation network suggests that landmark research on CPR, defibrillation, survival prediction, temperature management, and coronary intervention is intellectually interconnected. The peripheral position of prevention and high-risk populations indicates lower integration or citation visibility within this selected literature, rather than lesser clinical importance.

Our findings are consistent with Yan et al. [3], who analyzed 28,312 cardiac-arrest publications from 2000 to 2020 and identified United States leadership and prominent themes including CPR, ECMO, survival, and targeted temperature management. Unlike their broader productivity analysis, the present top-50 design maps the most cited intellectual core rather than the full research output.

Similarly, Turan et al. [1] examined the 100 most-cited CPR articles in Scopus and found prominent representation of NEJM, JAMA, and North American institutions. Differences in rankings and citation counts are expected given differences in databases, search terms, sample sizes, and eligibility criteria.

Dippenaar et al. [15] also reported concentrated citation activity among landmark CPR articles, while Danış and Kudu [2] documented growth in CPR publications and

identified Resuscitation as a major publication venue. These studies provide context for the distinction between overall research productivity and citation concentration in the present sample.

Jia et al. [7] likewise identified CPR, therapeutic hypothermia, AEDs, survival, and neurologic outcomes as prominent topics in their 2010–2019 bibliometric analysis. The overlap across datasets supports the persistence of these themes in the literature, although differences in search strategies and citation windows limit direct comparison. In our selected top-50 sample, newer topics such as ECMO, prevention, survivorship, and implementation were less visible.

Bibliometric analysis maps scholarly production, influence, collaboration, and conceptual relationships, but citation counts are affected by publication age, journal visibility, field size, self-citation, collaboration, and citing behavior [11,12,16]. Consequently, the present results describe scholarly attention and uptake, not the comparative clinical effectiveness, validity, equity, or applicability of interventions.

Strengths and limitations

A strength of this study is its combined assessment of highly cited publications and their intellectual structure, including connections among authors, institutions, journals, countries, and themes. This approach can help researchers identify foundational literature and areas with lower citation visibility.

Several limitations exist in the interpretation of this analysis. The search was conducted using the Web of Science Core Collection, a major citation database whose coverage differs from that of Scopus, PubMed, Dimensions, and Google Scholar. The 2025 CPR bibliometric study revealed that rankings and citation counts may differ among databases even if the most influential articles overlap [1]). Future studies should use multi-database searches and report the level of overlap and disagreement between databases.

Second, we restricted our analysis to peer reviewed publications in English and involving human participants. This may have precluded relevant evidence published in other languages or in regional journals. Thus, the geographic concentration may be partly a reflection of language and indexing bias. Future work should include multi-lingual searches, regional databases and explicit assessment of representation from low- and middle-income countries.

Third, the time dependence of citation counts. Older papers have simply had more time to collect citations whereas recently published influential studies are possibly underrepresented. The draft partially addresses this issue with ACs per year and normalized citation measures, but these measures do not eliminate all age, field, or journal effects. Future updates should include percentile-based indicators, citation impact normalized by field and year, citation-context analysis and alternative indicators [11,12,16].

Fourth, the analysis screened the 300 most-cited records and then included 50 eligible studies. This method is suitable for identification of citation classics but may miss clinically important studies below the citation threshold. Also, guidelines, reviews, methods papers, and large multicenter studies tend to be cited more often, thus citation selection also favors them. Future studies should use a top-cited design and a complementary systematic map of all eligible publications.

Fifth, and besides cardiac arrest, CPR, asystole, and related expressions were included in the search terms. This broad strategy increases sensitivity but may also introduce heterogeneity in the epidemiology of cardiac arrest, CPR interventions, myocardial infarction, and postarrest care. Future studies should report separate analyzes for OHCA, IHCA, CPR education, defibrillation, acute coronary syndromes, post arrest neurologic care, and ECMO. Standardized Utstein variables should be used for comparison of clinical research outputs [17].

Sixth, an adapted PRISMA procedure was followed although PRISMA 2020 was mainly developed for transparent reporting of systematic reviews and not for citation-ranking studies [18]. In the next version, detailed search string, coverage of database fields, date of last search, procedures for deduplication, inter-rater agreement, reasons for excluding full-text articles, and a reproducible data file should be included. Reporting should also specify whether citation counts were obtained once or refreshed, how multiple affiliations were computed, and how self-citations or group authorship were treated.

Implications for clinical practice

These findings should not be used to rank treatments or replace current guidelines and local protocols. Instead, the citation map may serve as an educational overview of historically influential research across recognition, CPR, defibrillation, postarrest care, coronary evaluation, neurologic prognostication, and survivorship. Decisions about clinical training and care should be based on up-to-date clinical evidence.

The prominence of survival, ventricular fibrillation, CPR, and AEDs indicates sustained research attention to early resuscitation. It does not, by itself, establish the effectiveness of specific investments in community CPR training, dispatcher-assisted CPR, public-access defibrillation, or emergency medical systems. The 2024 Utstein update provides a framework for standardized reporting and comparison of resuscitation outcomes [17].

The visibility of temperature-management studies in this analysis should be distinguished from clinical recommendations. The cited AHA guidance addresses purposeful temperature management in selected comatose adults after ROSC, including a target range of 32°C to 37.5°C for at least 36 hours, and discusses oxygenation, ventilation, and hemodynamic targets [14]. These recommendations arise from clinical evidence appraisal and guideline processes, not from the citation rankings reported here.

The results also have implications for planning research. The dominance of survival and acute treatment themes

suggests that the field has generated a substantial body of evidence on resuscitation and post-arrest interventions. The lower prominence of prevention, high-risk populations, and implementation-related themes suggests opportunities for research addressing the full continuum of care. This encompasses arrest prevention and early deterioration recognition, lay rescuer CPR, dispatch-assisted CPR, AED access, rural and resource-limited emergency systems, rehabilitation, psychological recovery, and long-term quality of life.

Finally, the limited representation of patient-reported outcomes in the analyzed publications points to an opportunity to examine outcomes beyond survival, including neurologic function, cognition, independence, mental health, caregiver burden, and quality of life. Future studies could involve patients and families in selecting relevant outcomes.

Implications for future research

The dominance of survival and acute-treatment themes in this top-cited sample, alongside the lower visibility of prevention, high-risk populations, and implementation, suggests opportunities for further bibliometric and clinical research across the continuum of care. Potential areas include early deterioration recognition, lay-rescuer and dispatcher-assisted CPR, AED access, resource-limited emergency systems, rehabilitation, psychological recovery, and long-term quality of life.

Therefore, future studies should progress beyond static lists of citations to longitudinal reproducible science maps. Annual updates might be used to monitor whether prevention, equity, rehabilitation, AI-assisted dispatch, ECPR, and patient-centered outcomes are moving to the center stage. Analyzes of collaboration should explore whether international collaboration enhances the relevance and uptake of evidence in different health systems. Finally, bibliometric findings should be linked to guideline citations, trial results, implementation outcomes, and patient priorities, so that research impact is evaluated in combination with clinical utility and equity.

Conclusions

This analysis demonstrates that a small number of authors, institutions, countries, journals and landmark clinical themes dominate the most cited literature in cardiac arrest and emergency cardiovascular care. The intellectual core of the field was largely developed between 2000 and 2010 and concentrated on survival, CPR, ventricular fibrillation, myocardial infarction, temperature management, defibrillation, and coronary intervention. The results are consistent with previous bibliometric studies, while the more focused top 50 approach highlights the concentration of the citation impact within high-resource research networks and general medical journals.

The analysis identifies influential literature but does not assess clinical quality or global applicability. Future research may broaden attention to prevention, health-system implementation, equity, rehabilitation, survivorship, and patient-centered outcomes. Analyses incorporating multi-database, multilingual, citation-normalized, and regularly updated analyses could provide a more complete picture of the field.

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List of Abbreviations

AC	Average citations
AED	Automated external defibrillator
CPR	Cardiopulmonary resuscitation
ECMO	Extracorporeal membrane oxygenation
IHCA	In-hospital cardiac arrest
MI	Myocardial infarction
OHCA	Out-of-hospital cardiac arrest
PRISMA	Preferred reporting items for systematic reviews and meta-analyses
TC	Total citations
UK	United Kingdom
US	United States
USA	United States of America

Conflicts of interest

The authors declare no conflicts of interest.

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Consent to participate

Not applicable.

Ethical approval

Ethical approval was obtained from the King Abdullah International Medical Research Center (KAIMRC), under protocol number NRR24/009/12 (Reference No. 00000120924), on 12 May 2024.

Data availability statement

The research data are available upon special request from the authors of this article.

Institutional review board

The study was conducted following the Declaration of Helsinki and approved by the Ethics Committee of King Abdullah International Medical Research Center protocol code NRR24/009/12 (reference: 00000120924).

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Supplementary content (If any) is available online.

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