MCBU SBED
MANİSA CELAL BAYAR ÜNİVERSİTESİ SAĞLIK BİLİMLERİ ENSTİTÜSÜ DERGİSİ
MANISA CELAL BAYAR UNIVERSITY JOURNAL OF INSTITUTE OF HEALTH SCIENCE
ISSN: 2147-9607

ARAŞTIRMA MAKALESİ
RESEARCH ARTICLE
CBU-SBED, 2025, 12 (1):92-101

Acil Tıp Literatüründe Son 30 Yıl Perspektifinden Hastane Dışı Kardiyak Arrestlerde İlk Yardımcı Tarafından Uygulanan Kardiyopulmoner Resüsitasyon ve Otomatik Eksternal Defibrilatörün Değerlendirilmesi: Bir Bibliyografik Araştırma

Evaluation Of Bystander Cardiopulmonary Resuscitation and Automatic External Defibrillator in Out-Of-Hospital Cardiac Arrests from A 30-Year Perspective in Emergency Medicine Literature: A Bibliographic Study

Gülbin Aydoğdu Umaç[1], Sarper Yılmaz[2*]

[1]İzmir City Hospital, Department of Emergency Medicine, İzmir/Türkiye
[2] Kartal Dr. Lutfi Kirdar City Hospital, Department of Emergency Medicine, İstanbul /Türkiye

E-mail: dr.gulbinaydogdu@gmail.com, sarperyilmaz08@gmail.com
ORCID: 0000-0002-9874-0343
ORCID: 0000-0001-8166-659X

*Sorumlu Yazar / Corresponding Author: Sarper Yılmaz
Gönderim Tarihi / Received:18.11.2024
Kabul Tarihi / Accepted: 26.12.2024
DOI: 10.34087/cbusbed.1587575.

Öz

Giriş ve Amaç: Hastane dışı kardiyak arrestlerde (HDKA), temel yaşam desteği (TYD) ve ileri yaşam desteği (İYD) zincirinde, arrestin başlangıcından spontan dolaşımın geri dönüşüne (ROSC) kadar müdahaleler gerçekleştirilir. Bu zincirde, sonuçlar üzerinde en büyük etkiye sahip ve en kritik, hassas noktalar, bir ilk yardımcının varlığı ve Otomatik Eksternal Defibrilatör'ün (OED) bulunmasıdır. Bu zincir başarılı bir şekilde yönetildiğinde, HDKA yaşayan hastalar hastaneye ulaştırılabilir ve ilk temas acil serviste (AS) gerçekleşir. AS literatüründe bu zincirin en zayıf halkalarının değerlendirilmesi bu nedenle büyük önem taşımaktadır. Bu çalışma, AS literatüründe son 30 yıl boyunca HDKA ile ilgili retrospektif araştırmalarda ilk yardımcı tarafından uygulanan kardiyopulmoner resüsitasyon (KPR) ve OED kavramlarını incelemeyi amaçlamaktadır.

Gereç ve Yöntemler: Bu çalışmada, 1 Ocak 1994 ile 31 Aralık 2023 tarihleri arasında AS ortamlarında İlk Yardımcı KPR ve OED konularında yapılmış araştırmaların bibliyometrik analizi gerçekleştirilmiştir. Bibliyografik veriler, Web of Science (WoS) Core Collection veritabanından elde edilmiş ve çalışma PRISMA 2020 rehberine uygun olarak hazırlanmıştır.

Bulgular: AS'lerde HDKA konusunda son 30 yılda yapılan çalışmalarda İlk Yardımcı KPR terimi arama terimi olarak kullanılmış ve analiz için 764 kaynak elde edilmiştir. OED konusunda ise Otomatik Eksternal Defibrilatör tüm alanlarda aranmış ve analiz için 93 kaynak elde edilmiştir. İlk Yardımcı KPR ile ilgili makale sayısı 2007 yılına kadar dalgalı bir seyir izlerken genel bir artış eğilimi gözlemlenmiştir. Makale sayısı 2007 yılında 28'e ulaşmış ve düzenli bir şekilde artmaya devam ederek 2023'te 63'e çıkmıştır. Buna karşın, OED ile ilgili makale sayısı düşük kalmış, 2007 yılında yalnızca iki makale yayımlanmış ve zamanla belirgin bir artış göstermemiş, 2023 yılında yalnızca dört yayına ulaşmıştır. Vosviewer analizlerinde hem İlk Yardımcı KPR hem de OED için en az beş kez tekrar eden anahtar kelimeler dâhil edilmiştir. İlk Yardımcı KPR için 989 anahtar kelimeden 82'si bu eşiği karşılamış, OED için ise 195 anahtar kelimeden 13'ü karşılamıştır. İlk Yardımcı KPR, 843 bağlantı ve 8 küme ile temsil edilirken, OED 49 bağlantı ve 3 küme ile temsil edilmiştir. İlk Yardımcı KPR ile en sık ilişkilendirilen anahtar kelimeler "kardiyak arrest" (76 bağlantı), "KPR" (72 bağlantı) ve "ilk yardımcı KPR" (63 bağlantı) olmuştur. OED için ise öne çıkan anahtar kelimeler "kardiyak arrest" (11 bağlantı), "KPR" (11 bağlantı) ve "OED" (9 bağlantı) olmuştur.

Sonuç: AS'lerde gerçekleştirilen HDKA çalışmalarının İlk Yardımcı KPR ve OED kavramları üzerinden analizi, bu kavramların "kardiyak arrest", "KPR" ve "OED" gibi terimlerle güçlü bir ilişkiye sahip olduğunu göstermektedir. Bu bulgular, HDKA sonrası hayatta kalma için topluluk tarafından başlatılan temel ve ileri yaşam desteği zincirlerini değerlendirmek açısından AS araştırmalarının değerli bir araç olabileceğini düşündürmektedir.

Anahtar kelimeler: Acil Servis, Hastane Dışı Kardiyak Arrest, İlk Yardımcı, Kardiyopulmoner Resüsitasyon, Otomatik Eksternal Defibrilatör

Abstract

Aim; In out-of-hospital cardiac arrests (OCHA), interventions are carried out from the onset of arrest to the Return of Spontaneous Circulation (ROSC) through a chain of basic and advanced life support (BLS-ALS) measures. The most critical and fragile points in this chain, with the highest impact on outcomes, are the presence of a bystander and an Automatic External Defibrillator (AED). If this chain is managed successfully, patients experiencing OCHA can be brought to the hospital, where initial contact occurs in the emergency department (ED). Evaluating the most vulnerable links in this chain within ED literature is therefore crucial. This study aims to examine the concepts of bystander cardiopulmonary resuscitation (CPR) and AED in 30 years of retrospective OCHA research in ED literature.

Method; This study performed a bibliometric analysis of research on Bystander CPR and AED in ED settings from January 1, 1994, to December 31, 2023. Bibliographic data were obtained from the Web of Science (WoS) Core Collection database, and the study was prepared following PRISMA 2020 guidelines.

Results; Under the topic of OCHA in EDs over the last 30 years, the term Bystander CPR was used as a search term, yielding 764 sources for analysis. For the AED topic, Automatic External Defibrillator was searched across all fields, resulting in 93 sources analyzed. While the number of Bystander CPR articles fluctuated until 2007, a general upward trend was observed. The article count reached 28 in 2007 and continued to increase steadily, reaching 63 in 2023. In contrast, articles on AEDs remained low, with only two published in 2007 and showing no significant growth over time, peaking at only four publications in 2023. Vosviewer analyses included keywords with a minimum of five occurrences for both Bystander CPR and AED. For Bystander CPR, 82 out of 989 keywords met this threshold, while for AED, 13 out of 195 did. Bystander CPR showed 843 connections and 8 clusters, while AED had 49 connections and 3 clusters. The most frequently associated keywords for Bystander CPR were cardiac arrest (76 links), CPR (72 links), and bystander CPR (63 links). For AED, the prominent keywords were cardiac arrest (11 links), CPR (11 links), and AED (9 links).

Conclusion; Analyzing OCHA studies conducted in EDs based on the concepts of Bystander CPR and AED highlights the strong association with terms like cardiac arrest, CPR, and AED. These findings suggest that ED research can be a valuable tool for evaluating the essential BLS and ALS chains initiated by the community for post-OCHA survival.

Keywords: Emergency Department, Out-of-Hospital Cardiac Arrest, Bystander, Cardiopulmonary Resuscitation, Automatic External Defibrillator

1. Introduction

Even though the hearts of 95.9 out of every 100,000 adults stop suddenly outside the hospital (Out-of-Hospital Cardiac Arrests, OHCA) each year, the survival rate in this patient group remains below 10% [1]. Consequently, OHCAs continue to be a leading cause of death and remain a significant global health issue today[2]. According to the International Liaison Committee on Resuscitation, initiating chest compressions and using a defibrillator by a bystander before emergency departmants (ED) arrive could save an additional 200,000 lives each year in cases of OHCA [3].

For a patient who experiences sudden cardiac arrest outside the hospital to have a chance of survival, the first essential factor is that someone witnesses the arrest. This is because the chain of basic and advanced life support needed to revive the patient always begins with one or more bystanders[4,5]. When bystanders perform CPR on a person experiencing OHCA while emergency personnel are on their way, the chance of survival nearly doubles [6]. When witnessing an OHCA, there are four primary expectations from a bystander: 1) recognizing the OHCA, 2) activating emergency services by calling 911/112, 3) starting CPR, and 4) using an AED. Basic life support algorithms are also based on these four key actions and are illustrated to be easily learned at the community level. In this way, the chain of survival following an OHCA begins with the bystander and continues through basic and advanced life support, highlighting two of the most critical and fragile components in this chain: the bystander CPR and the AED. Despite awareness of these two critical points, current epidemiological data report that the percentage of Bystander CPR remains only between 35% and 45%. Additionally, the rate of training for non-professional responders in Bystander CPR and AED use remains below 20% annually in the United States [7].

In its 2030 Impact Goals for Emergency Cardiovascular Care and Call to Action for Improving Cardiac Arrest Outcomes, the American Heart Association (AHA) aims to increase the rate of Bystander CPR among individuals over 18 to over

50%. Additionally, it seeks to raise the proportion of OHCA cases in public settings where an AED is applied before EMS arrival to over 20% [8]. Interestingly, EDs are not included among the stakeholders identified for this goal. In cases of OHCA, high-quality CPR initiated by a bystander and timely access to an AED are crucial to maintaining the chain of survival and enhancing outcomes that can be observed in the ED. Although the first professional contact with OHCA patients typically occurs through pre-hospital healthcare providers, the initial in-hospital contact is made in the ED. Therefore, research conducted in EDs on OHCA can provide valuable insights and a broader projection of out-of-hospital cardiac arrest scenarios.

The aim of this study was to examine the bibliographic landscape of OHCA research conducted in EDs, focusing on the keywords Bystander CPR and AED.

2. Methods

This bibliographic study was designed in accordance with The Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) 2020 guidelines.

2.1. Inclusion and exclusion criteria:

In this study, a bibliometric analysis was conducted on research related to *Bystander CPR* and *Automatic External Defibrillator (AED)* in the ED from January 1, 1994, to December 31, 2023. Bibliographic data were obtained from the Web of Science (WoS) Core Collection database.

In this study, the following exclusion criteria were applied:

1. **Out-of-Scope Topics:** Studies involving cardiac arrest cases other than OHCA, studies on basic life support that do not include Bystander CPR or AED, and studies on pediatric or neonatal cardiac arrest cases that do not address Bystander CPR or AED.
2. **Studies in Different Healthcare Settings:** Research focused on in-hospital cardiac arrest cases and cases of cardiac arrest where the first intervention did not occur outside the emergency department (e.g., those occurring in a hospital setting).
3. **Studies Lacking Specific Data:** Research that does not provide detailed data on Bystander CPR or AED use but only general cardiac arrest data, and studies focusing solely on primary intervention types outside emergency medicine without discussing Bystander CPR or AED.
4. **Language Criterion:** Studies published in languages other than English, without available translations, provided the database being used supports this criterion.
5. **Non-Research Documents:** Documents other than articles, reports, or peer-reviewed publications that are deemed unreliable data sources (e.g., conference abstracts or meeting presentations) were excluded from the study.

2.2. Information Source / Web of Science (WoS) Core Collection:

The WoS Core Collection is a widely used and reliable database for bibliometric analyses, encompassing over 20,000 peer-reviewed, high-quality journals across various fields. Documents obtained from the WoS database were analyzed based on trends such as publication years, citation counts, the journals in which they were published, and the most frequently cited authors. The analyses included keyword co-occurrence networks, bibliographic coupling of publications, citation networks (for references, journals, and authors), and co-authorship networks examining collaborations among countries and institutions.

2.3. Search Strategy:

The primary research question was defined as follows: What is the quantitative and qualitative distribution of academic studies conducted on ***Bystander CPR*** and ***Automatic External Defibrillator (AED)*** from 1994 to 2023, and how have academic interest and research trends evolved for these two topics? Sub-questions related to this main question are as follows: 1) How has the number of published articles on **Bystander CPR** and ***AED*** changed over the years? 2) Which journals have published the most studies on these two topics, and how are articles distributed across these journals? 3) Which are the most frequently cited articles, and in which journals, years, and by which authors were they published? 4) What are the most frequently used keywords related to these two topics, and what is the relationship between these keywords? 5) Which academic institutions have the highest citation counts and publication output on these topics?

2.4. Data Collection Process:

In this bibliometric analysis, data such as article titles, abstracts, publication years, journal names and impact factors, authors, institutions, countries, WoS subject categories, keywords, and citation counts were collected. For both topics, annual publication growth in the medical literature and the related research interest (RRI) were also determined.

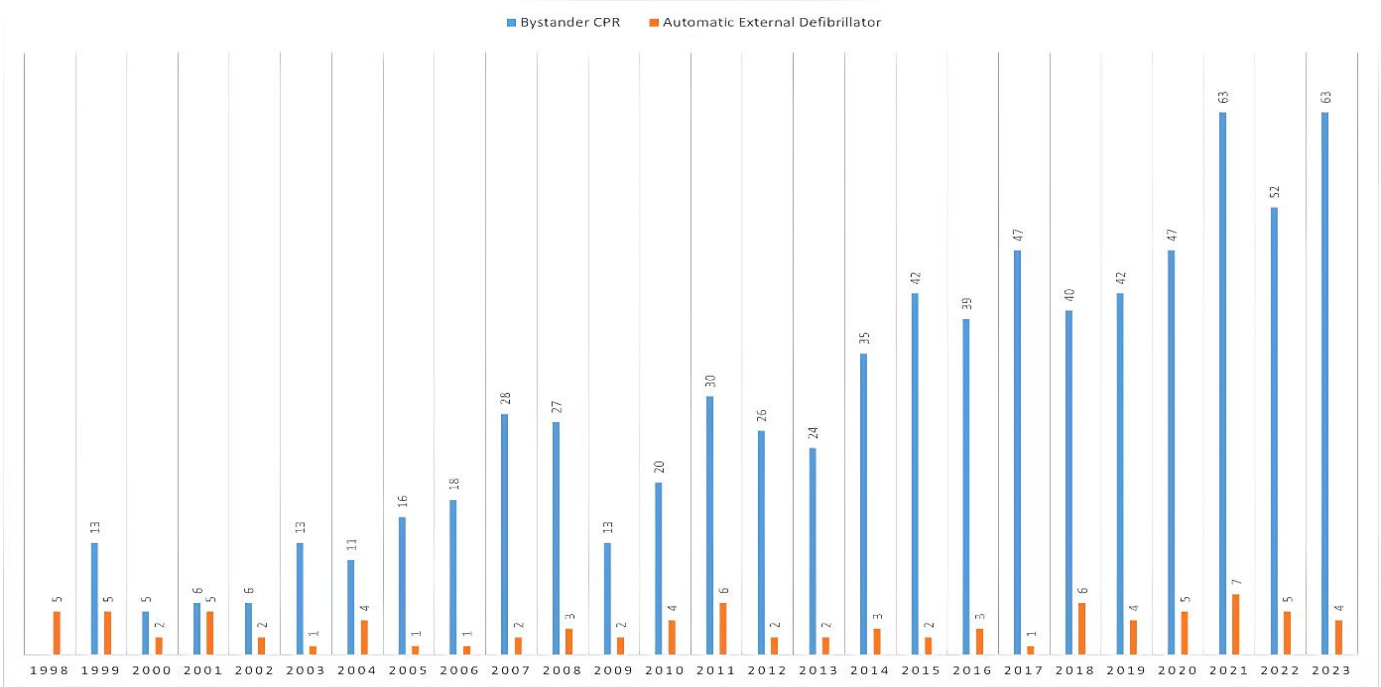

Figure 1. The number of articles published annually on "Bystander CPR" and "Automatic External Defibrillator" (AED) from 1998 to 2023

2.5. Data Items:

Keyword co-occurrence networks measure the most frequently used keywords within documents. Bibliographic coupling occurs when two documents cite the same third document, while citation networks analyze instances where two documents reference the same source. Co-authorship networks examine the volume of publications and how they are interconnected. Choosing the correct keywords is critical in research, as it enhances the academic visibility and impact of a study. Inaccurate keyword selection can hinder the discovery and citation of the study. Bibliometric analyses of frequently used keywords provide insights into popular topics within the research field and reveal potential directions for future studies [9,10].

2.6. Visualization:

Network visualization maps were generated using VOSviewer software (Leiden University, Netherlands; version 1.6.11) to identify the most frequently cited articles. The software forms clusters using circles to show how often elements co-occur. The size of a circle reflects the frequency of an element's co-occurrence, while colors represent the cluster to which an element belongs. The proximity between elements indicates the strength of their relationship; a larger distance suggests limited similarity or weak association, whereas the absence of connection lines indicates no direct relationship between elements.

3. Results and Discussion

3.1. Results

Between January 1, 1994, and December 31, 2023, under the topic of OCHA in EDs, the search term Bystander CPR was searched in the Emergency Department section, and a total of 764 sources were included for analysis. For the topic of AED, the term Automatic External Defibrillator was searched in the all-fields option, resulting in 93 sources analyzed.

3.1.1. Analysis of Articles by Year

The number of articles published annually on the topics of bystander CPR and AED between 1998 and 2023 within the WoS database is presented in Figure 1. This analysis provides essential data for examining the academic interest in both concepts and their trends over the years. In 1998, 13 articles were published on Bystander CPR, while 5 articles addressed the topic of AED. Although the number of articles on Bystander CPR fluctuated until 2007, a general upward trend was observed. By 2007, the number of articles reached 28, and it continued to increase steadily, reaching 63 by 2023. This trend indicates a growing academic interest in the topic of Bystander CPR. In contrast, articles on AED remained relatively low throughout the 2000s, with only 2 articles published in 2007. Academic interest in this topic did not show a significant increase over the years, with the publication count fluctuating and reaching only 4 articles in 2023

3.1.2. Analysis of Articles by Journal

The comparison of article counts by journal for the topics of *Bystander CPR* and AED within the WoS database is presented in **Table 1**. For both topics, the majority of articles were published in the journal Resuscitation. Specifically, 440 articles (57.59%) on *Bystander CPR* and 42 articles (45.16%) on *AED* were published in this journal. In other journals, article counts were considerably lower. Resuscitation Plus ranked second for *Bystander CPR* with 45 articles (5.89%), while the American Journal of Emergency Medicine held second place for *AED* with 8 articles (8.60%). Under the *Other* category, 12.04% of articles on *Bystander CPR* and 17.20% on *AED* were published in various other journals.

3.1.3. Authors, Article Titles, Journals, Publication Years, and Citation Counts of the Most Cited Articles

The citation counts, author names, article titles, journal names, and publication years for articles on *Bystander CPR* and *AED* within the WoS database are presented in detail in **Table 2**. The most cited article in the field of *Bystander CPR* is the "EuReCa TWO" study by Gräsner JT, published in Resuscitation in 2020, which has received 490 citations [11]. This article represents a large-scale study examining survival rates in out-of-hospital cardiac arrests across Europe. Other notable articles include the study by Jacobs IG, published in 2011, which investigated the effects of adrenaline administration in cardiac arrests and has garnered 355 citations [12].

Table 1. Distribution of Articles on "Bystander CPR" and "Automatic External Defibrillator" by Journal in the Web of Science Database

	Bystander CPR		**AED**	
No	**Journal**	**Research Counts (%)**	**Journal**	**Research Counts (%)**
1	Resuscitation	440 (57,59)	Resuscitation	42 (45,16)
2	Resuscitation Plus	45 (5,89)	American Journal of Emergency Medicine	8 (8,60)
3	Prehospital Emergency Care	42 (5,50)	Annals of Emergency Medicine	6 (6,45)
4	American Journal of Emergency Medicine	39 (5,11)	Emergencias	4 (4,30)
5	Annals of Emergency Medicine	27 (3,53)	Prehospital Emergency Care	4 (4,30
6	Scandinavian Journal of Trauma Resuscitation Emergency Medicine	20 (2,62)	Notarzt	3 (3,23)
7	Emergency Medicine Journal	18 (2,36)	Pediatric Emergency Care	3 (3,23)
8	Academic Emergency Medicine	15 (1,96)	Resuscitation Plus	3 (3,23)
9	International Journal of Emergency Medicine	14 (1,83)	Academic Emergency Medicine	2 (2,15)
10	Bmc Emergency Medicine	12 (1,57)	Annales Francaises De Medecine D Urgence	2 (2,15)
11	***Diğer***	***92 (12,04)***	***Diğer***	***16 (17,20)***

AED: Automatic External Defibrillator; **CPR:** Cardiopulmonary Resuscitation

Table 2. Authors, Article Titles, Journal Names, Publication Years, and Citation Counts of the Most Cited Studies on the Articles

Keyword	**No**	**First Author**	**Title of Research**	**Journal**	**Publication Year**	**Citation Counts**
Bystander CPR	1	Gräsner JT., et al.	Survival after out-of-hospital cardiac arrest in Europe - Results of the EuReCa TWO study	*Resuscitation*	2020	490
	2	Jacobs IG., et al.	Effect of adrenaline on survival in out-of-hospital cardiac arrest: A randomised	*Resuscitation*	2011	355

			double-blind placebo-controlled trial			
	3	Wik L., et al.	Quality of Bystander Cardiopulmonary-Resuscitation Influences Outcome After Prehospital Cardiac-Arrest	*Resuscitation*	1994	295
	4	Ong MEH., et al.	Outcomes for out-of-hospital cardiac arrests across 7 countries in Asia: The Pan Asian Resuscitation Outcomes Study (PAROS)	*Resuscitation*	2015	284
	5	Stiell IG., et al.	Modifiable factors associated with improved cardiac arrest survival in a multicenter basic life support/defibrillation system: OPALS study phase I results	*Annals of Emergency Medicine*	1999	244
Automatic External Defibrillator	1	Eberle B., et al.	Checking the carotid pulse check: Diagnostic accuracy of first responders in patients with and without a pulse	*Resuscitation*	1996	268
	2	Stiell IG., et al.	Modifiable factors associated with improved cardiac arrest survival in a multicenter basic life support/defibrillation system: OPALS study phase I results	*Annals of Emergency Medicine*	1999	244
	3	Nichol G., et al.	A cumulative meta-analysis of the effectiveness of defibrillator-capable emergency medical services for victims of out-of-hospital cardiac arrest	*Annals of Emergency Medicine*	1999	239
	4	Eisenburger P., et al.	Life supporting first aid training of the public - review and recommendations	*Resuscitation*	1999	152
	5	De Maio VJ. et al.	Optimal defibrillation response intervals for maximum out-of-hospital cardiac arrest survival rates	*Annals of Emergency Medicine*	2003	137

CPR: Cardiopulmonary Resuscitation

In the topic of *AED*, the most cited article is the study by Eberle B, published in Resuscitation in 1996, which examined the diagnostic accuracy of first responders in pulse checks, receiving 268 citations[13]. Additionally, studies on AED efficacy by Stiell IG and Nichol G have also gained attention, with 244 and 239 citations, respectively[14].

3.1.4. Keywords Analysis

Commonly used keywords and their frequencies for the topics *Bystander CPR* and *AED* within the WoS database are presented in **Figure 2 and Figure 3**. In the Vosviewer analyses, keywords with a minimum of 5 occurrences were included for both *Bystander CPR* and *AED*. For *Bystander CPR*, 82 out of 989 keywords exceeded this threshold, while for *AED*, 13 out of 195 keywords met this criterion. A total of

843 links and 8 clusters were identified for *Bystander CPR*, whereas *AED* showed 49 links and 3 clusters. The analyses highlight the most common and associated keywords. In the field of *Bystander CPR*, the most frequently used keywords include *cardiac arrest* (76 links), *CPR* (72 links), and *bystander CPR* (63 links). For *AED*, prominent keywords are *cardiac arrest* (11 links), *CPR* (11 links), and *AED* (9 links).

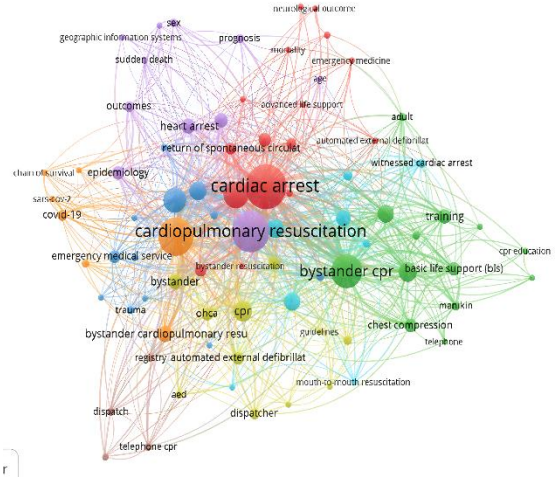

Figure 2. Commonly Used Keywords and Their Frequency of Use

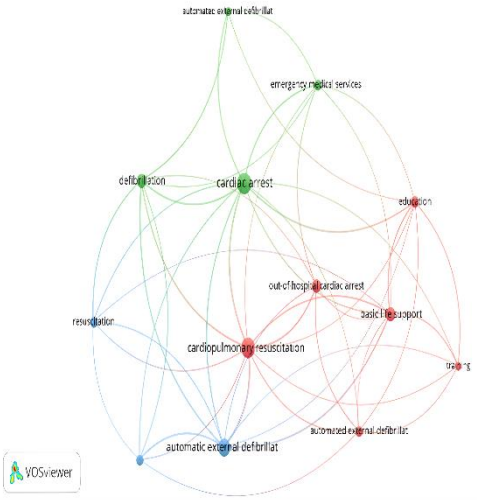

Figure 3. Commonly Used Keywords and Their Frequency of Use-Wos

3.1.5. Affiliated Institutions of Research Authors

The affiliated institutions, publication counts, and citation numbers for authors of articles on *Bystander CPR* and *AED* within the WoS database are detailed in **Table 3**. In the topic of *Bystander CPR*, the University of Washington is the most cited institution, with 37 publications and a total of 2,105 citations, reflecting its significant academic impact in *Bystander CPR research*. It is followed by the University of Ottawa, with 24 publications and 1,809 citations, and Sahlgrenska University Hospital, with 27 publications and 1,714 citations, indicating the leading role of these universities in *Bystander CPR research*. For *AED*, the University of Ottawa is the most cited institution, with 3 publications and 437 citations, followed by the University of Pittsburgh (2 publications, 157 citations) and Fondazione Ticino Cuore (3 publications, 152 citations).

3.2. Discussion

In the context of OCHA, both *Bystander CPR* and *AED* are considered critical components of the emergency response chain. From the perspective of ED research, *Bystander CPR* requires broader public awareness and community engagement, whereas *AED* usage remains limited to technical device knowledge and accessibility. The lower publication volume on *AED* suggests that it is a more technically focused and narrow research area. While *Bystander CPR* studies attract broader academic interest, *AED* research is more specialized and conducted primarily by specific institutions. Nonetheless, both topics contribute significantly to cardiac arrest intervention, with academic activity concentrated in certain centers. These distinctions are also reflected in academic interest and research orientations; *Bystander CPR* research is based on a more community-centered intervention strategy, while *AED* studies highlight a device-focused, technically specialized area of expertise.

In ED studies on OHCA for *Bystander CPR* and *AED*, the number of *Bystander CPR* studies has shown a more pronounced increase over a 30-year projection. Many recent OHCA studies argue that *Bystander CPR* can increase survival rates by 50% to 500% for OCHA, highlighting its significant impact on patient outcomes.[15,16]. These statistics inspire public health initiatives, and it is increasingly evident that Bystander intervention has become the most critical focus for achieving ROSC in OHCA.

Table 3. In the Web of Science database, the institutions with the highest number of citations and their corresponding publication counts

	Bystander CPR			AED		
No	**Institution**	**Citation Counts**	**Counts of Publications**	**Institution**	**Citation Counts**	**Counts of Publications**
1	University of Washington	2105	37	University of Ottawa	437	3
2	University of Ottawa	1809	24	University of Pittsburgh	157	2
3	Sahlgrenska University Hospital	1714	27	Fondazione Ticino Cuore	152	3
4	University of Arizona	1640	28	The University of North Carolina	145	2
5	Seoul National University	1276	30	Policlinico San Matteo Pavia Fondazione	123	2
6	Singapore General Hospital	1246	35	Federaz Cantonale Ticinenese	123	2
7	University of Toronto	1104	29	University of Warwick	117	3
8	The University of British Columbia	1005	21	Monash University	113	7
9	Monash University	973	31	University of Washington	101	2
10	Emory University	966	28	National Taiwan University Hospital	75	3

AED: Automatic External Defibrillator; **CPR:** Cardiopulmonary Resuscitation

Consequently, in recent years, some countries have implemented legal regulations for Bystanders, providing a legal basis to empower community members to perform CPR, with positive impacts observed. This shift underscores the importance of *Bystander CPR* as a life-saving intervention and supports efforts to enhance community readiness in emergency response [16]. Correlation analysis between the two concepts reveals no significant relationship between the number of studies on *Bystander CPR* and *AED*. The article counts do not show parallel increases over time, indicating that academic interest in these topics has developed in divergent directions.

In emergency medicine literature, most research on OHCA related to both *Bystander CPR* and AED is published in Resuscitation, a monthly journal by the European Resuscitation Council [17]. This journal is fully dedicated to cardiac arrest and CPR, catering to healthcare professionals working in intensive care, emergency medicine, acute medicine, anesthesiology, cardiology, pediatrics, and neonatology. Additionally, numerous emergency medicine journals frequently publish studies on these topics, with *Bystander CPR* research being predominant among the published articles.

Among these studies, the research titled "Survival after out-of-hospital cardiac arrest in Europe - Results of the EuReCa TWO study" by Gräsner JT and colleagues, published in Resuscitation in 2020, holds the highest citation count in the Web of Science database, with 490 citations [15]. This study utilized data from the EuReCaONE registry, an international European project established to collect and analyze resuscitation events from October 2014. Aimed at further investigating the incidence and outcomes of OHCA in Europe and enhancing understanding of the role of bystanders, this research has distinguished itself with a higher citation count than many other studies in the field [18]. Additionally, over the past 30 years, the top four most-cited studies conducted with the "Bystander CPR" keyword have all been published in Resuscitation, while in AED research, three of the top five articles were published in Annals of Emergency Medicine. Overall, Resuscitation and Annals of Emergency Medicine emerge as prominent journals for both topics, hosting the most-cited studies and contributing to their impact within the scientific community. This distribution highlights that significant research on CPR and AED often centers on life-saving interventions and cardiac arrest management.

Examining the citations of studies reveals that research on *Bystander CPR* is strongly linked to the fields of cardiac arrest, CPR, and bystander CPR itself. These strong connections underscore the central role of cardiac arrest and CPR in these studies, highlighting the critical importance of bystander CPR, especially in cardiac arrest cases. The close association of the *bystander CPR* keyword reflects its primary focus within the research, suggesting that studies in this area broadly concentrate on cardiac arrest and initial intervention practices.

In the analysis of *AED* studies, strong associations with cardiac arrest and CPR are also evident, indicating that *AED* research is similarly related to cardiac arrest and CPR but with fewer connections overall. Given its focus on specific intervention devices, *AED* emerges as a more technically specialized topic, with studies addressing questions regarding the use of this device. While both *Bystander CPR* and *AED* research revolve around cardiac arrest and CPR, *Bystander CPR* studies draw broader academic interest, whereas *AED* research represents a more niche area. This distinction clearly highlights the different focal points and respective significance of each field within academic literature.

In OHCA research trends related *to Bystander CPR* and *AED* use, there are notable differences among research institutions. The University of Washington leads in the field of *Bystander CPR*, with 37 publications and 2,105 citations, demonstrating its substantial academic influence in this area. An examination of this institution reveals that it conducts numerous studies related to both basic and advanced life support, as well as community-centered training programs [19,20]. This focus underscores its commitment to advancing both clinical research and public education in lifesaving interventions[21].

The research efforts of this institution, along with other leading institutions such as the University of Ottawa and Sahlgrenska University Hospital, indicate a pioneering role in community-based intervention strategies aimed at improving survival rates in cardiac arrest cases[22]. This highlights the broad academic interest in *Bystander CPR* research and the growing emphasis in academia on the importance of early intervention within communities.

In contrast, *AED* research stands out as a narrower, more technical field with relatively fewer publications. The University of Ottawa, the most-cited institution in *AED* research, has achieved 437 citations from only three publications, followed by institutions such as the University of Pittsburgh and Fondazione Ticino Cuore, which have similarly published fewer studies. The lower publication count in *AED* research suggests that this field is more specialized, focusing on specific devices and technical applications. Unlike *Bystander CPR*, *AED* studies are directed at specific questions and technological advancements, attracting a more niche academic interest. Overall, while *Bystander CPR* research continues to draw broad and sustained academic attention, *AED* research is more concentrated within a select group of institutions. Both areas, however, are critically important in the response to cardiac arrest, offering valuable contributions to distinct components of the emergency response chain.

In summary, expanding *Bystander CPR* training in emergency and public health settings stands out as the most effective approach to increasing survival rates in cardiac arrest cases. Future studies could make significant contributions to improving survival rates and global public health by developing new strategies that integrate these two critical intervention areas. This perspective clearly highlights the need to further enhance emergency response to cardiac arrest cases and to support it with effective community-based initiatives.

4. Conclusion:

Research on *Bystander CPR* and *AED* in OHCA cases within EDs is steadily increasing. The 30-year rise in studies on *Bystander CPR* reflects the success of public awareness campaigns and public health efforts aimed at improving out-of-hospital interventions for OHCA. The investigation of *Bystander CPR* and *AED* use in patients brought to EDs after OHCA serves as an indicator of successful pre-hospital interventions, highlighting that these patients have reached the hospital due to prompt bystander action. Research conducted on this patient group provides increasingly valuable data that can inform public health strategies, positively or negatively, over the years. In this respect, this research serves as a projection of public health interventions through the lens of ED and hospital-based studies across three decades.

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