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ORIGINAL RESEARCH

Basic life support research trends in Korea

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Abstract

Background: Basic life support (BLS) is a critical emergency procedure that significantly increases survival rates during cardiac emergencies. Despite its importance, research trends remain largely underexplored. **Methods**: We analyzed 121 peer-reviewed Korean research articles (2014–2023) using latent Dirichlet allocation topic modeling. Relevant articles were retrieved from five major Korean academic databases (Database Periodical Information Academic, Korean Studies Information Service System, Research Information Sharing Systems, Korea Citation Index and Science Online) ensuring a comprehensive analysis of domestic research trends. Keywords from the abstracts and titles were extracted and processed for topic modeling and network text analysis. **Results**: Three primary topics were identified: BLS Education and Training, Emergency Treatment and Life-Sustaining Measures, and Emergency Situations and Experience. The focus on "Emergency Situations and Experience" declined from 65.79% (2014–2016) to 55.88% (2020–2023), while studies on "BLS Education and Training" increased from 21.05% to 32.35% over the same period. **Conclusions**: We identified a shift in research priorities from experience-based studies to structured education and training programs. This trend demonstrates the growing emphasis on standardized BLS training methodologies to improve the effectiveness of emergency response efforts.

Keywords

Basic life support; Topic modeling; Research trends; Cardiopulmonary resuscitation; Training programs; Emergency response

1. Background

Basic life support (BLS) is a fundamental emergency procedure that plays a crucial role in increasing the survival rate of patients with cardiac arrest [1]. The importance of BLS lies in its ability to maintain blood circulation and breathing in patients experiencing cardiac emergencies until advanced medical help arrives [2]. Therefore, research on BLS is essential to ensure effective responses during emergency situations, and understanding the trends in this research within the Korean healthcare system is of significant academic and practical importance. However, despite global advancements in BLS education and implementation, research trends specific to Korea remain underexplored, necessitating a systematic review of evolving themes and priorities in this field.

Topic modeling is an advanced analytical technique that allows the extraction of latent themes from large-scale textual data [3], making it an ideal method for analyzing research trends in BLS. Unlike traditional systematic reviews, topic modeling enables the identification of recurring themes and keyword associations across a vast dataset, offering a more objective and data-driven approach to understanding the research focus. By employing topic modeling, frequent keywords and recurring themes within the literature can be identified, facilitating the analysis of the flow and changes in research focus over time [4]. Such an analysis is not only academically interesting but also practically valuable, as it can inform training program development, policy decisions, and clinical guidelines for BLS education and practice.

The necessity of this study is underlined by the pivotal role that BLS plays in emergency medical care. BLS procedures, including chest compressions and rescue breaths, are crucial for maintaining vital blood flow to the heart and brain during cardiac arrest [5]. Continuous improvements and adaptations of these techniques are necessary to align them with advancements in medical knowledge and technology [6]. By identifying research gaps and emerging trends, this study aimed to provide a foundation for optimizing BLS protocols and enhancing educational methodologies in Korea. Moreover, a systematic review of BLS research can reveal gaps in the existing literature, highlighting areas that require more attention and resources [7]. For example, previous studies have primarily focused on professional healthcare providers, whereas research on layperson training, community-based BLS education, and the impact of digital learning tools in Korea remains limited. If certain aspects of BLS, such as pediatric resuscitation or community training programs, are underrepresented, targeted

research initiatives can be developed to address these gaps. This, in turn, can lead to more comprehensive and effective BLS training and implementation strategies, ultimately improving patient outcomes.

The academic community and healthcare practitioners can benefit from this study. Academics provide a detailed map of the research landscape, showing areas that have been thoroughly explored or neglected [8]. For healthcare educators and policymakers, these findings can guide the development of evidence-based curricula and national training standards that reflect current research priorities. Understanding these trends can aid the development of training programs and protocols based on the latest research findings, ensuring that the most effective [8] and up-to-date practices are employed in real-life emergency situations.

Therefore, the primary purpose of this study was to analyze the research trends in BLS in Korea using topic modeling techniques. This approach will help identify the main interests and trends in BLS research and provide insights into future research directions.

2. Methods

2.1 Research design

This bibliometric and topic modeling study analyzed the knowledge structure and research trends of BLS in Korea over the past decade. This study employed latent Dirichlet allocation (LDA) topic modeling to identify and classify major themes in BLS research.

2.2 Study subjects

This study targeted peer-reviewed research literature related to BLS across multiple disciplines in Korea, including medicine, health sciences, nursing, and social sciences. Relevant studies were initially identified using predefined search terms from major academic databases. The study selection process involved keyword-based extraction of potentially relevant studies and a review of abstracts and keywords to determine their alignment with the research focus. To ensure consistency and reliability, we included only peer-reviewed journal articles published between January 2014 and December 2023. Conference papers, presentation posters, books, and gray literature such as master's and doctoral theses were excluded, as they did not undergo a standardized peer-review process. Studies focusing primarily on advanced life support (ALS) or do-not-resuscitate decisions were also excluded because they were outside the scope of this research.

2.3 Data collection

To analyze research trends in BLS in Korea, this study utilized five major Korean academic databases: Database Periodical Information Academic (Korean academic journal database), Research Information Sharing Systems, Korean Studies Information Service System, Korea Citation Index and Science Online (Korean science and technology database). The selection of these databases ensures comprehensive coverage of BLS research published in Korea. Literature was retrieved using the following search terms: English—("Basic Life Support" OR "Basic life support" OR "basic life support") and Korean—("Basic Life Support" OR "Basic life support" OR "basic life support"). The search period was set between 08 and 14 July 2024, and articles containing these terms in their titles or abstracts were included in the initial dataset. To refine the dataset, we filtered the retrieved articles based on the following criteria. Only studies written in Korean or English were included, and the document type was restricted to peer-reviewed journal articles. To ensure the reliability of the dataset, we excluded duplicate papers, conference proceedings, thesis/dissertations, and papers without abstracts. After 413 duplicate records were removed and studies that did not meet the eligibility criteria were excluded, 121 articles were selected for the final analysis (Fig. 1).

2.4 Data analysis

The abstracts of the 121 selected papers were compiled into a dataset, and NetMiner 4.5.1.c (Cyram Inc., Seongnam-si, Gyeonggi-do, South Korea) was used for natural language processing and topic modeling. A total of 794 nouns were extracted after automatically removing stop words such as pronouns, adverbs, and numerical values (*e.g.*, p0001, INnc, *et al.*). To refine keyword consistency, a dictionary of excluded terms and synonyms was created. The excluded words included statistical terms deemed inappropriate for selection as main topics, such as Statistical Package for the Social Sciences (SPSS), Analysis of Variance (ANOVA), Pearson correlation coefficient, and Student's *t*-test. In addition, synonym processing was performed to standardize the variations in key terms. Multiple expressions of "basic life support" (*e.g.*, basic CPR, basic cpr, basic cardiopulmonary resuscitation) were unified under "BLS". Similarly, CPR-related terms such as "cardiopulmonary resuscitation" were standardized to "CPR". After preprocessing, a final keyword dataset consisting of 638 unique words was constructed.

To identify hidden topics within the literature, we employed LDA topic modeling. LDA is a probabilistic text analysis technique that estimates the probability distribution of topics within a document corpus based on a document-term matrix [3]. The LDA model parameters were optimized based on previous research, with settings including Markov chain Monte Carlo sampling, alpha = 0.001, beta = 0.001 and 1000 iterations. To ensure the robustness of the topic modeling results, we computed coherence scores for different numbers of topics and selected a three-topic model for its interpretability and coherence. Additionally, expert validation was conducted by three senior researchers specializing in BLS education and emergency medicine to confirm the significance of the extracted topics. The final analysis identified three major topic groups that best represented research trends in BLS over the study period.

3. Results

This study analyzed 121 research articles related to BLS in Korea published between January 2014 and December 2023. The key findings are as follows.

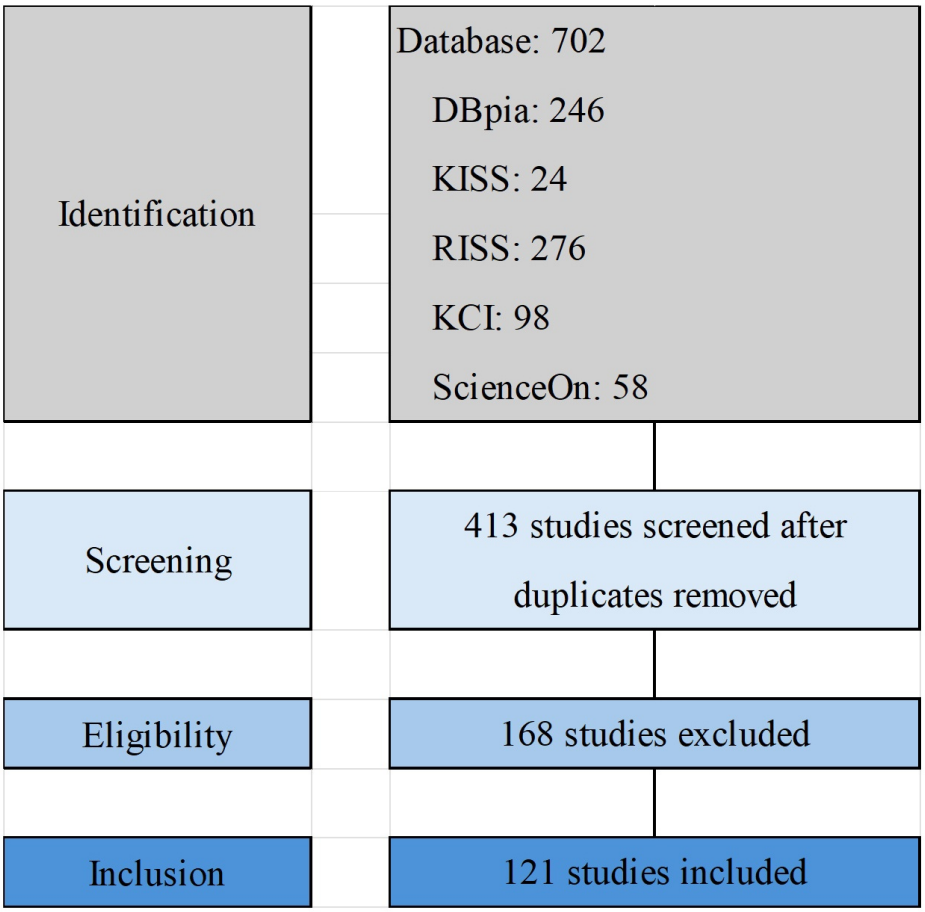

FIGURE 1. Literature selection process. Abbreviations: DBpia, Database Periodical Information Academic; KISS, Korean Studies Information Service System; RISS, Research Information Sharing Systems; KCI, Korea Citation Index; ScienceOn, Science Online.

3.1 Annual research trends in BLS

Fig. 2 presents the annual distribution of BLS research publications in Korea from 2014 to 2023, illustrating notable fluctuations in research activities over the past decade. The data indicate a gradual increase in research output from 9 publications in 2014 to 17 in 2015, reflecting the growing academic interest in BLS. However, in 2016, the number of studies declined slightly to 12, possibly owing to shifts in research funding or academic focus. From 2017 to 2019, the research output remained relatively stable, with an average of 18 publications per year, peaking at 22 studies in 2019, which was the highest number recorded during the study period. This trend aligns with increased national and international efforts to enhance BLS training and certification programs. However, from 2020 onward, a noticeable decline in research output was observed, with publications decreasing to 13 in 2020 and dropping further to only six in 2023. This downturn coincides with the COVID-19 pandemic, which may have diverted research priorities toward infectious disease control and public health emergencies, reducing academic focus on BLS. The overall trend, as shown in Fig. 2, highlights an initial rise in research activity, a peak in 2019, and a subsequent decline in recent years. This pattern suggests that, while interest in BLS research has been strong, external factors such as the pandemic and evolving academic priorities have influenced publication trends. Future studies should examine whether this decline is temporary or indicative of a broader shift in emergency medical research.

3.2 Keyword frequency analysis of domestic BLS research

A frequency analysis was conducted on the final dataset of 638 unique words related to BLS research in Korea. The top 30 most frequently occurring keywords are listed in Table 1. The most frequently appearing keyword was “CPR” (93 times), followed by “BLS” (53 times), “education” (43 times), “patient” (42 times) and “knowledge” (29 times). Other commonly occurring keywords included “emergency” (27 times), “training” (26 times), “time” (26 times), “nursing student” (26 times) and “experience” (22 times). Terms such as “treatment” (21 times), “attitude” (21 times), “safety” (20 times), “performance” (20 times) and “student” (18 times) also appeared frequently. Additionally, keywords associated with clinical practice and emergency interventions, such as “ALS” (16 times), “practice” (14 times), “arrest” (14 times), “life” (13 times), “AED” (13 times) and “life sustaining” (12 times), were identified.

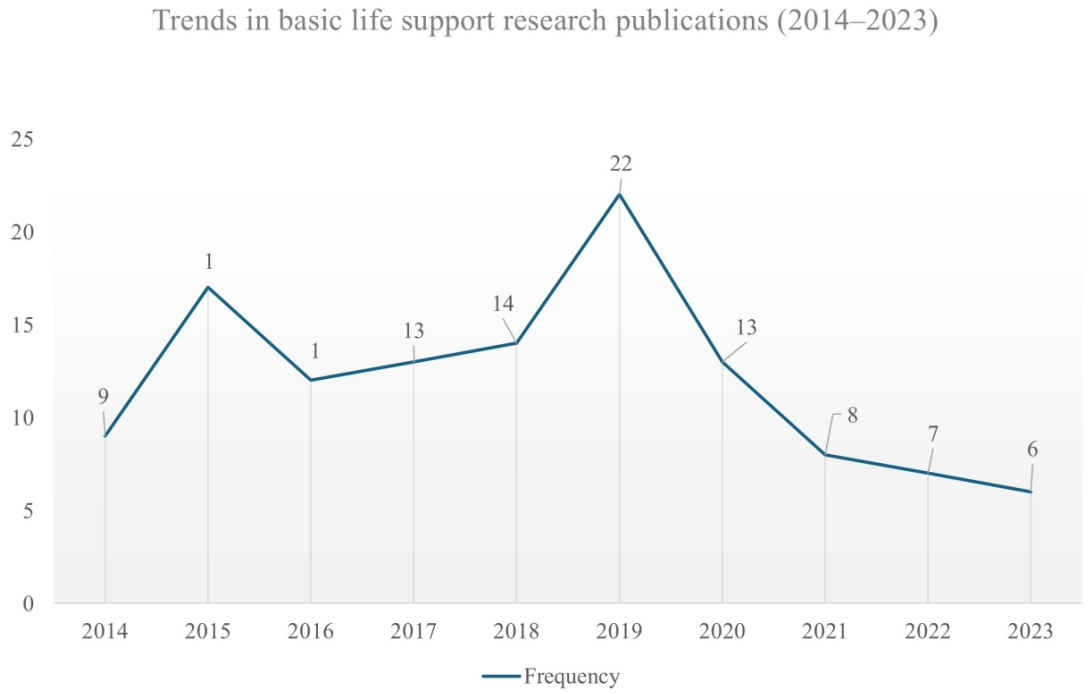

FIGURE 2. Annual frequency of BLS research publications in Korea (2014–2023). Note: This figure illustrates the annual trends in the number of published research articles on basic life support (BLS) in Korea from 2014 to 2023. The number of publications fluctuated over the years, peaking in 2019 with 22 articles. A steady increase in publications was observed from 2014 to 2019, followed by a sharp decline in 2020. After 2020, the number of published articles continued to decrease, reaching 6 publications in 2023. The decline in recent years may indicate a shift in research focus or publication trends in the field of BLS.

TABLE 1. Top 30 most frequent keywords in BLS research in Korea (2014–2023).

Rank	Word	Frequency (N)
1	CPR	93
2	BLS	53
3	Education	43
4	Patient	42
5	Knowledge	29
6	Emergency	27
7	Training	26
8	Time	26
9	Nursing student	26
10	Experience	22
11	Treatment	21
12	Attitude	21
13	Safety	20
14	Performance	20
15	Work	18
16	Student	18
17	Sport	18
18	Self-efficacy	17
19	Response	17
20	Family	16
21	ALS	16
22	Practice	14

TABLE 1. Continued.

Rank	Word	Frequency (N)
23	Arrest	14
24	Life	13
25	AED	13
26	Video	12
27	Situation	12
28	Satisfaction	12
29	Life sustaining	12
30	Guideline	12

Abbreviations: CPR, cardiopulmonary resuscitation; BLS, basic life support; ALS, advanced life support; AED, automated external defibrillator.

3.3 Keyword centrality analysis

Degree centrality analysis was conducted to identify the most significant keywords in BLS research (Fig. 3). The results showed that "CPR", "education", "BLS", "student", "training" and "knowledge" had the highest centrality values, indicating that these terms are closely interconnected with other keywords within the research network. The keyword "CPR" had the highest centrality, suggesting that it is the most frequently referenced concept in BLS-related studies. "Education" and "training" also showed high centrality, reflecting a strong emphasis on instructional methods and skill development in BLS research. Additionally, "student" and "knowledge" appeared as central terms, indicating a research focus on BLS education, particularly in academic and training environments.

3.4 Topic modeling analysis results

Topic modeling analysis identified three main research topics in BLS studies (Table 2). Each topic was classified based on frequently occurring keywords, representing distinct focus areas in BLS research.

The first topic, "BLS Education and Training", includes key terms such as "CPR", "BLS", "education", "knowledge" and "nursing student". Studies in this category have focused on BLS training programs, instructional strategies, and curriculum development. Research has also examined the effectiveness of different teaching approaches for improving CPR skills and assessing knowledge retention and competency among healthcare professionals and students.

The second topic, "Emergency Treatment and Life-Sustaining Measures", includes key terms such as "patient", "CPR", "treatment", "BLS" and "life sustaining". This topic covers the clinical applications of BLS, emergency interventions, and resuscitation outcomes in prehospital and hospital settings. Previous studies have explored the effectiveness of CPR techniques and life-sustaining measures during various emergencies.

The third topic, "Experience and Practice", includes key terms such as "experience", "practice", "performance", "self-efficacy" and "situation". Research in this category has focused on hands-on applications, CPR performance, and skill retention. Previous studies have assessed the impact of simulation-based training and real-world emergency situations on CPR execution and self-efficacy.

These topics represent the primary research areas in BLS studies in Korea, including education, emergency treatment, and hands-on, practice. The distribution of these topics over time highlights shifts in research focus and emerging trends in BLS-related studies.

3.5 Changes in topic proportions over time

The analysis of topic proportions over different periods showed changes in the research focus of BLS studies in Korea (Fig. 4). From 2014 to 2016, Topic 3 (Experience and Practice) accounted for 65.79%, followed by Topic 2 (Emergency Treatment and Life-Sustaining Measures) at 13.16% and Topic 1 (BLS Education and Training) at 21.05%. Between 2017 and 2019, the proportion of Topic 3 decreased to 61.22%, Topic 2 increased to 16.33% and Topic 1 increased to 22.45%. From 2020 to 2023, Topic 3 further declined to 55.88%, whereas Topic 1 increased to 32.35%. In contrast, Topic 2 decreased to 11.76%. These results show a variation in topic proportions over time, with Topic 3 decreasing and Topic 1 increasing, whereas Topic 2 remained relatively stable, with minor fluctuations.

4. Discussion

4.1 Research trends in BLS

The analysis of research trends in BLS studies in Korea revealed significant changes in research focus over the past decade. The study identified three primary topics: "BLS Education and Training", "Emergency Treatment and Life-Sustaining Measures" and "Emergency Situations and Experience". These topics represent different aspects of BLS research, including education, clinical intervention, and practical experience [1]. From 2014 to 2016, "Emergency Situations and Experience" accounted for 65.79% of the research, making it the dominant topic. During this period, studies primarily focused on the real-world applications of BLS, including hands-on experience and emergency response strategies. The high proportion of studies in this area indicates an empha-

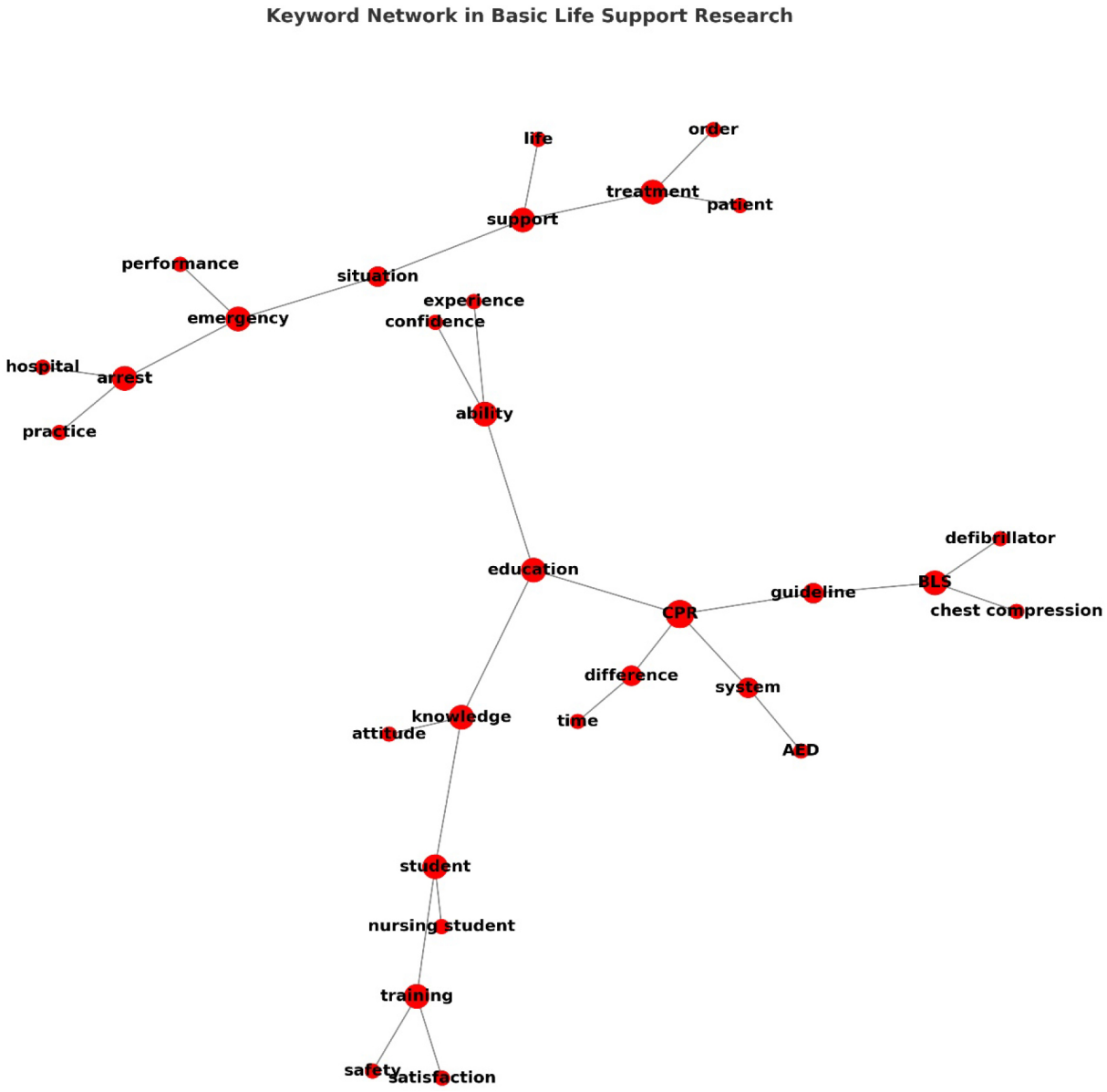

FIGURE 3. Network visualization of keyword connections and degree centrality in BLS research. Note: This figure illustrates the network visualization of keyword connections in basic life support (BLS) research, highlighting the relationships between key terms. The size of each node represents the degree centrality, indicating the relative importance of a keyword within the network. Larger nodes, such as CPR, education, and ability, signify higher connectivity and greater influence in the research landscape. The connections (edges) between nodes indicate co-occurrence and thematic relevance. This visualization provides insights into the key focus areas and trends in BLS research. CPR, cardiopulmonary resuscitation; BLS, basic life support; AED, automated external defibrillator.

TABLE 2. Topic groups and their top five keywords in BLS research.

Topic Name	1st Keyword	2nd Keyword	3rd Keyword	4th Keyword	5th Keyword
Topic 1: BLS Education and Training	CPR	BLS	Education	Knowledge	Nursing Student
Topic 2: Emergency Treatment and Life-Sustaining Measures	Patient	CPR	Treatment	BLS	Life Sustaining
Topic 3: Experience and Practice	Experience	Practice	Performance	Self-efficacy	Situation

Abbreviations: BLS, basic life support; CPR, cardiopulmonary resuscitation.

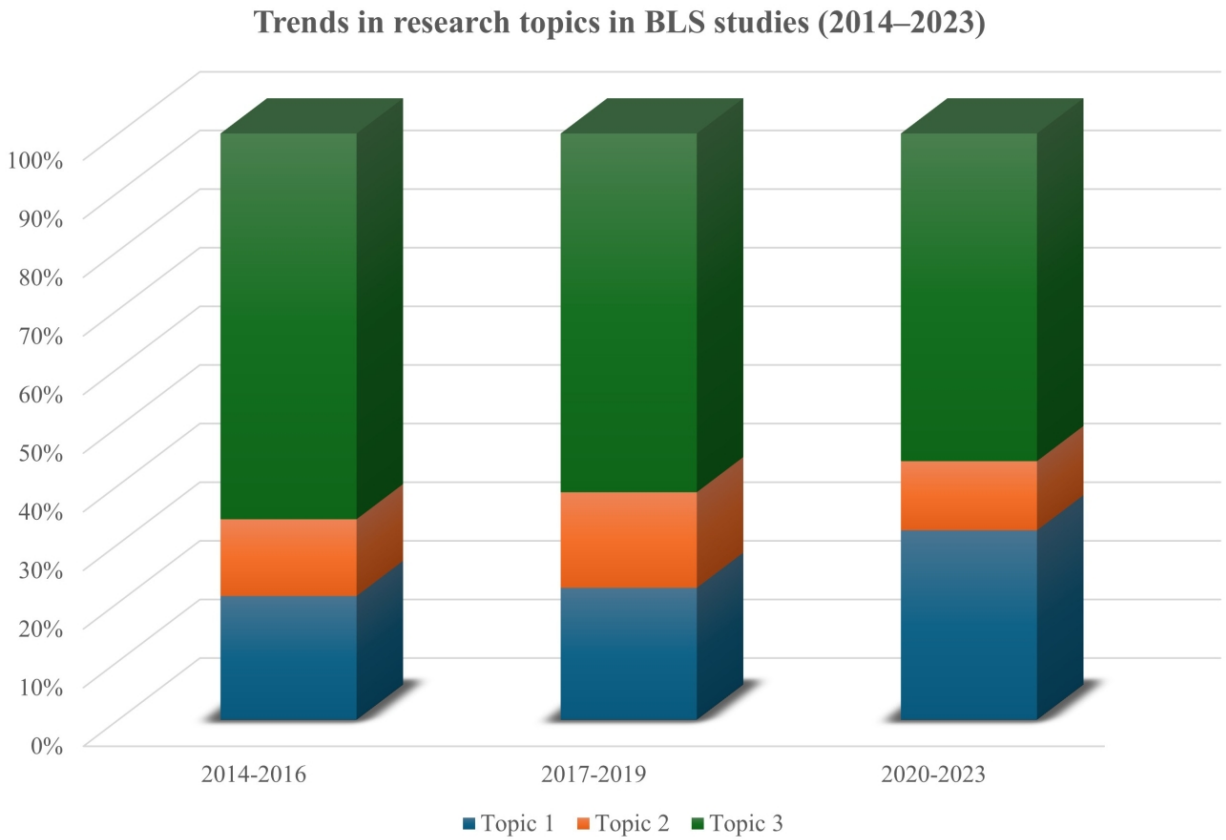

FIGURE 4. Proportional changes in research topics in BLS studies by period (2014–2023). Note. Fig. 4 illustrates the changes in the distribution of research topics in BLS studies over three time periods (2014–2016, 2017–2019 and 2020–2023). Topic 1 (BLS Education and Training) exhibited a steady increase from 21.05% in 2014–2016 to 32.35% in 2020–2023, indicating a growing research focus in this area. In contrast, Topic 3 (Experience and Practice) showed a gradual decline from 65.79% to 55.88% over the same period. Topic 2 (Emergency Treatment and Life-Sustaining Measures) experienced relatively minor fluctuations, decreasing slightly from 13.16% to 11.76%. These trends suggest a shift in research priorities toward education and training in BLS studies. BLS, Basic life support.

sis on immediate practical applications during emergencies [9]. Over time, the proportion of studies related to "Emergency Situations and Experience" declined to 55.88% from 2020 to 2023. In contrast, research on "BLS Education and Training" increased, reaching 32.35% during the same period. These findings indicate a shift from experience-based research toward a structured and systematic focus on education and training programs [10]. The increasing number of studies on education and training suggests a growing research interest in developing standardized instructional methods and enhancing CPR training effectiveness. This shift in research priorities corresponds with advancements in simulation-based training, standardized certification programs, and increased accessibility to digital learning tools for CPR education [11]. Furthermore, the evolution of BLS guidelines and recommendations by international organizations may have contributed to this change, influencing the direction of research and education.

4.2 Increasing emphasis on education and training

The proportion of research focused on "BLS Education and Training" increased from 21.05% in 2014–2016 to 32.35% in 2020–2023. This trend indicates a growing emphasis on education and training programs in BLS research, with an increasing number of studies exploring methods to improve knowledge acquisition, skill proficiency and retention of BLS techniques [12, 13]. This shift suggests that the development of structured and effective training programs has become a key area of interest in BLS. This increased focus on education and training is supported by research indicating that structured instructional programs lead to better retention and application of BLS skills [14]. Studies have shown that simulation-based training, repetitive practice sessions, and feedback-driven learning methods enhance BLS competency among healthcare professionals and laypersons [15, 16]. Simulation-based education has been widely adopted because of its effectiveness in providing realistic hands-on training that improves technical and decision-making skills [17].

Moreover, as the healthcare landscape evolves, the demand for standardized and evidence-based training programs has increased. The development of universal BLS guidelines and structured certification programs ensures that individuals receive consistent and high-quality training across clinical and non-clinical settings [18]. Recent studies have also explored the integration of digital learning platforms, virtual simulations, and mobile applications into BLS education, which

have been shown to enhance accessibility and engagement in training programs [19]. Artificial intelligence (AI)-driven learning modules and adaptive training systems have also been introduced to personalize instructions and provide real-time feedback on CPR performance [17].

Furthermore, research has highlighted the importance of retraining intervals and skill retention strategies to ensure long-term competency in BLS. Studies have suggested that frequent refresher courses, spaced learning techniques, and periodic assessments contribute to better skill retention than traditional one-time training sessions [20, 21]. The implementation of short and high-frequency training modules has been evaluated as an effective approach to reinforce critical BLS skills and improve overall performance in emergency situations [22].

Collectively, these findings indicate that BLS education and training have evolved to incorporate more structured, technology-enhanced, and competency-based approaches, ensuring that healthcare providers and the general public are better equipped to respond effectively to emergencies.

4.3 Evolution of emergency treatment and life-sustaining research

The topic "Emergency Treatment and Life-Sustaining Measures" remained relatively stable over the study period, with its proportion fluctuating slightly from 13.16% in 2014–2016 to 11.76% in 2020–2023. This stability indicates that research on immediate life-sustaining measures and emergency treatments has consistently been an area of interest. Studies in this category focus on improving techniques and protocols for BLS, including the effectiveness of different chest compression methods, use of automated external defibrillators (AEDs), and integration of ALS measures. The continued interest in emergency treatment and life-sustaining research reflects the ongoing need to enhance immediate care during cardiac emergencies [23]. As medical technology advances, research in this area is critical in validating new treatment methods and ensuring their effective incorporation into BLS protocols [24]. Studies have examined the factors influencing CPR success rates, the impact of high-quality chest compressions, and post-resuscitation care strategies. Additionally, the focus on optimizing prehospital interventions, including the role of AED accessibility and emergency response system efficiency, has been increasing.

4.4 Limitations

This study has several limitations. First, the analysis was limited to research published in Korea, which may restrict the generalizability of the findings to other countries. Future research should include international comparisons to assess global trends in BLS research. Second, the study employed topic modeling, which relies on automated text processing. While this approach provides objective insights into research trends, it may overlook nuanced interpretations that qualitative systematic reviews could offer. Lastly, the study focused on peer-reviewed journal articles, excluding conference papers and gray literature. Including a broader range of literature in future analyses could provide a more comprehensive understanding of BLS research trends.

4.5 Implications for future research

The trends identified in this study suggest several areas for future research on BLS in Korea. The increasing emphasis on education and training highlights the need for continuous development and evaluation of BLS training programs. Future research should explore innovative training methods, such as virtual reality simulations and online learning platforms, which provide flexible and accessible training options for a wide range of learners [25]. Further research on the long-term outcomes of BLS education and training is required. Studies have shown that testing BLS skills three months after initial training is more effective for skill retention than testing immediately after the course [26]. Other studies have found that for students aged 8–12 years, annual 50-minute refresher sessions help maintain BLS performance, but brief rolling refreshers every four months are even more effective [27]. Future studies should focus on optimizing training intervals, refresher course content, and skill retention strategies to ensure that individuals maintain BLS proficiency over time.

Although the proportion of research on "Emergency Situations and Experience" has decreased, this area remains critical for the practical application of BLS. Future studies should continue to explore real-world emergency scenarios to identify the common challenges and barriers to effectively performing BLS. This information can inform the development of targeted interventions to improve the overall effectiveness of emergency response.

An important emerging area of research is the integration of advanced technologies into BLS training and practice. The use of AI-powered training tools, wearable devices for real-time feedback, and augmented reality can significantly enhance the learning experience and provide more accurate assessments of CPR performance [28, 29]. Research on these technologies can help develop more engaging and effective BLS training programs that better prepare individuals for real-life emergencies. In addition, machine learning algorithms are being explored to analyze CPR quality and optimize resuscitation techniques, further advancing BLS training methods [30]. These future research directions could help improve BLS training, emergency response efficiency, and overall survival outcomes in patients with cardiac arrest.

5. Conclusions

The analysis of BLS research trends in Korea using topic modeling highlights the shift from experience-based studies to a greater focus on structured education and training programs. This reflects broader advancements in medical education and emergency preparedness, emphasizing the role of systematic training in improving BLS competency.

By identifying key research themes and their changes over time, this study provides a comprehensive overview of BLS research in Korea and suggests directions for future research. These findings indicate that education and training will remain central, whereas research on emergency treatment and life-sustaining measures will continue to be relevant.

A balanced approach that integrates experiential and structured education is essential for advancing BLS training. Fur-

ther research on training methodologies, skill retention, and technology integration will contribute to more effective and accessible BLS education programs.

AVAILABILITY OF DATA AND MATERIALS

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

AUTHOR CONTRIBUTIONS

HY—Contributed to the conceptualization and design of the study, data collection, and drafting of the initial manuscript. Provided critical feedback and revisions and approved the final version for submission. KJ—Led the conceptualization and design of the study, data analysis, and interpretation. Took primary responsibility for writing, revising, and finalizing the manuscript and approved the final version for submission.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study analyzed publicly available literature and did not involve human participants. Therefore, based on relevant regulatory and ethical requirements, the Institutional Review Board (IRB) of Daejin University confirmed that ethical approval and informed consent were not required for this study (Approval Number: 1040656-202412-HR-01-09).

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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