Bibliometric Analysis for Researches On Emergency Care: 30-Year Thematic Development Mapping with SciMAT

Acil Bakım Konulu Araştırmalar İçin Bibliyometrik Analiz: SciMAT İle 30 Yıllık Tematik Gelişim Haritalaması

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ABSTRACT

Aim: This study aims to reveal the change in trends of the themes discussed in the scientific studies conducted in the field of Emergency Medicine by years.

Material and Methods: In this study, 2112 articles published in the Web of Science Core Collection database covering the last 30 years (1990-2019) and containing the term "emergency care" in the title tab in the Web of Science Core Collection database, which is the most accepted in the academic world, were examined using bibliometric scientific mapping method. In these analyses conducted with SciMAT software, which is one of modern science mapping techniques, articles were evaluated in the periods of 1990-1999, 2000-2009 and 2010-2019 years. The findings were examined with the number of articles, total citations, strategic diagrams, cluster networks, thematic development maps and comparative analyzes.

Results: It was observed that the studies carried out in the field of emergency medicine since 1990 have increased in quantity over time, the thematic change is significant in terms of periods and new themes have been evaluated in studies while some themes have declined over time. In emergency medicine, "medicine", "departments" and "emergency medicine" in 1990-1999, "management", "satisfaction" and "diabetic ketoacidosis" in 2000-2009 and "practitioner", "risk" and "geriatrics" in 2010-2019 were found as motor themes.

Conclusion: When the cluster networks and thematic development maps on emergency care are examined, it can be said that the general subject fields and definitions have evolved towards more specific and specific subject fields over the years.

Keywords: Emergency medicine, bibliometric, scientific mapping, thematic development, SciMAT

ÖZ

Amaç: Acil Tıp alanında yapılan bilimsel çalışmalarda ele alınan temaların yıllara göre değişim eğilimlerini ortaya koymaktır.

Gereç ve Yöntemler: Bu çalışmada akademik dünyada en fazla kabul gören Web of Science Core Collection veri tabanında son 30 yılı kapsayacak şekilde (1990-2019) yayımlanan ve başlık sekmesinde "emergency care" terimini içeren 2112 makale bibliyometrik bilimsel haritalama yöntemi kullanılarak incelemiştir. Modern bilim haritalama tekniklerinden SciMAT yazılımı ile yapılan analizlerde makaleler 1990-1999, 2000-2009 ve 2010-2019 dönemleri halinde ele alınmıştır. Bulgular makale sayısı, toplam atıf sayısı, stratejik diyagramlar, küme ağları, tematik gelişim haritaları ve karşılaştırmalı analizler ile incelenmiştir.

Bulgular: Acil Tıp alanında 1990 yılından itibaren gerçekleştirilen çalışmaların zaman içerisinde nicelik olarak artış gösterdiği, dönemler bazında ele alındığında tematik değişimin belirgin olduğu, zaman içerisinde bazı temalar gerileme gösterirken yeni temalarında araştırmalarda ele alındığı görülmüştür. Acil Tıp alanında 1990-1999 döneminde "medicine", "departments" ve "emergency medicine", 2000-2009 döneminde "management", "satisfaction" ve "diabetic ketoacidosis", 2010-2019 döneminde "practitioner", "risk" ve "geriatrics" temalarının motor temalar olduğu belirlenmiştir. Temalara ait h-index ve toplam atıf sayıları gibi veriler tablolarda sunulmuştur.

Sonuç: Acil bakım konusundaki otuz yıllık yayın küme ağları ve tematik gelişim haritaları incelendiğinde genel konu alanları ve tanımlamalarının, yıllar geçtikçe daha spesifik ve özel konu alanlarına doğru evrildiği söylenebilir.

Anahtar Kelimeler: Acil tıp, bibliyometri, bilimsel haritalama, tematik gelişim, SciMAT

Introduction

In recent years, tremendous change and growth have been seen in the healthcare industry including the field of emergency medicine along with the progress of other branches of science and technology.

Themes addressed in scientific studies are also among those affected by this change. Studies that increased quantifiably in the field of Emergency Medicine were examined using the bibliometric scientific mapping method in this study to see changing themes.

Emergency medicine refers to a medical specialty in which physicians care for patients with acute illnesses or injuries that require immediate medical attention (1).

The goal of emergency medicine is to improve health while preventing and treating disease and illness in patients seeking emergency medical care. Improvements in emergency medical care and the delivery of this care can be achieved through credible and meaningful research efforts. Improved delivery of emergency medical care through research requires careful planning and the wise use of limited resources (2).

Emergency medicine research's goal is to extend knowledge and advance technology in ways that will ultimately improve the health of patients through enhancing the emergency medical care they receive. Emergency medical care is both an important community responsibility and a vital community resource. It is the only medical care resource that offers both immediacy and universality of service (2).

Despite a consensus on the need for more research, little is known about the current state of research in EM. Although anecdotal information suggests that the volume of EM publications is increasing, data to support this conclusion are scarce (3).

To the best of our knowledge, no investigation has characterized the type and quantity of worldwide EM research publications (1).

This study is the first analysis conducted in Emergency Medicine with SciMAT software (A free java-based scientific mapping program that builds network analysis at a longitudinal level), one of which is modern bibliometric science mapping technique.

Bibliometric measures and indicators can be employed to carry out a performance analysis of the generated maps (4). This kind of analysis allows us to quantify and measure the performance, quality, and impact of the generated maps and their components, as shown in (5).

Science mapping, or bibliometric mapping, is an important research topic in the field of bibliometrics (6). It is focused on monitoring a scientific field and delimiting research areas to determine its cognitive structure and its evolution (7).

Science mapping aims at displaying the structural and dynamic aspects of scientific research (8).

In this article, we used an open-source science mapping software tool called SciMAT (Science Mapping Analysis Software Tool) which incorporates methods, algorithms, and measures for all the steps in the general science mapping workflow, from preprocessing to the visualization of the results.

SciMAT allows the user to carry out studies based on several bibliometric networks (co-word, cocitation, author cocitation, journal cocitation, coauthor, bibliographic coupling, journal bibliographic coupling, and author biblio-graphic coupling). Different normalization and similarity measures can be used over the data (association strength, Equivalence Index, Inclusion Index, Jaccard Index, and Salton's cosine). Several clustering algorithms can be chosen to cut up the data. In the visualization module, three representations (strategic diagrams, cluster networks, and evolution areas) are jointly used, which allows the user to better understand the results (9).

SciMAT also uses advanced bibliometric indexes such as the h-index (10-14).

Material and Methods

The bibliometric scientific mapping method was used in this study whose aim is to reveal the tendency of change of the themes discussed in the scientific studies conducted in the field of emergency medicine. The data obtained from the Wos (Web of Science) database were analyzed with SciMAT software, which allows the evaluation of bibliometric sources (5). This study examines 30 years of research in the field of emergency medicine. For this reason the ethics committee approval was not obtained.

Data Analysis

Web of Science Core Collection database covering the last 30 years (1990-2019) and containing the term "emergency care" in the title tab in the Web of Science Core Collection database. The data related to 2658 articles from 1980-2019 period which were obtained from WoS database were uploaded to SciMAT program for analysis and necessary arrangements were made. Of the 2658 articles uploaded to the SciMAT program, 546 articles belonging to the period 1980-1989 were excluded from the analysis due to lack of data. It was determined that the publication year data of 3 of the 2112 articles to be used in the analysis were missing and the missing data were introduced to the program manually. The data were divided into 10-year periods as "1990-1999", "2000-2009" and "2010-2019" in order to see thematic change. "Words" were used as an analysis unit, groups of similar and synonyms were made, very general meaningful words were excluded from the analysis, and threshold values were determined for data reduction by taking into account the word frequencies for each period. Accordingly, the threshold values of 2 for the "1990-1999" period, 3 for the "2000-2009" period, and 8 for the "2010-

2019" period were used in the data reduction. "Co-occurrence" for network inference, "Equality index" for network normalization, "simple centers algorithm" for clustering algorithm, "core mapper" for mapping, "h-index" and "sum citations" for the quality measure, "inclusion index" for development map and overlap map were used in the analyses.

Overlap map, strategic diagrams, thematic networks, and thematic development map were used in the evaluation of SciMAT analysis findings. The overlap map shows the number of themes in the relevant period, the number and percentage of themes from the previous period and the next period. Strategic diagrams were examined in four areas based on the concepts of centrality and density (15). The concept of centrality shows the degree of strength of the relationship of a theme with other themes and this relationship increases with the right approach in the diagram. The concept of density shows the working density of a theme, i.e. the number of publications, and this density increases with the upward approach in the diagram. According to this; The themes in the upper right area of the diagram are motor themes with high centrality and density, the themes in the lower right area are essential and transformational themes that are important for the research area but not studied enough, the themes in the upper left area are highly developed and isolated themes that are very studied but have a weak relationship with other themes, the themes in the lower left area refers to themes that have just emerged or begun to disappear (4,16).

Thematic network maps show the degree of strength of the relationship between the themes in the map and the thickness of the lines shows that the relationship is strong. The thematic development map shows the periodic development of the themes, with straight lines expressing coexistence in the same publication, and dashed lines expressing the frequency of sharing common words, and the thickness of the lines indicating that the relationship is strong (16).

The aim of this study is to provide a scientific and macroscopic perspective to those who are interested in the subject by making bibliometric analysis of articles on emergency care with science mapping method.

Results

The number of articles for the periods examined has increased significantly over time. Findings related to the ten most frequently mentioned keywords in publications in the period of 1990-2019 are Emergency-care, Management, Mortality, Children Services, Emergency-medical-services, Health-care, Emergency-department, Medicine and Health respectively. The most frequently used keywords are "Emergency-care" (n: 127), "Management" (n: 111) and "Mortality" (n: 103).

The use of keywords used in the research publications in the periods "1990-1999", "2000-2009" and "2010-2019" are as follows,

114 (39%) of the 292 words used in the period 1990-1999 continued to be used in the period 2000-2009 and 1003 new words began to be used.

512 (46%) of the 1117 words used in the period 2000-2009 continued to be used in the period 2010-2019 and 2792 new words began to be used.

The strategic diagram for the 1990-1999 period is shown in Figure 1. The findings related to the themes are given in Table 1. During the period 11 themes emerged. The themes of "Medicine", "Departments" and "Emergency-medicine" are motor themes whose relation to other themes in the field is high and intensively studied. The themes of "Medicine" and "Departments" were the main themes of this period, while the theme of "Emergency-medicine" was more numerous in publication.
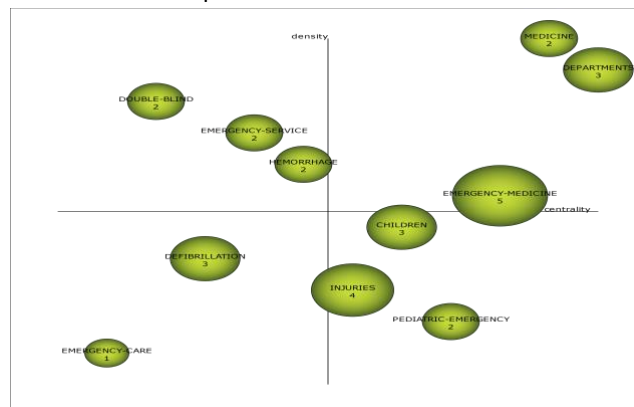

Figure 1: Strategic Diagram of the Period 1990-1999

The themes "Children", "Injuries" and "Pediatric-emergency" are fundamental and transformational themes that have a high relation to other themes in the field but a lower intensity of study. The themes "double-blind", "Emergency-service" and "Hemorrhage" are highly developed and isolated themes with low relation to other themes in the field but with high intensity of work. The themes of "Defibrillation" and "Emergency-care" are newly emerging or beginning to disappear, with a low intensity of study and relationship to other themes in the field. The h-index values and total citation numbers of the articles are as shown in Table 1.

According to the thematic network map for the theme "Medicine", which is one of the prominent themes in terms of centrality and intensity in the period 1990-1999, and the thematic network map weight values the themes to which the "Medicine" theme is highly associated with "Predictive-instrument", "Public-hospital-emergency" and "Visits" themes.

The strategic diagram for the "2000-2009" period is shown in Figure 2, the findings related to the themes are given in Table 1. During the period 2000-2009, 15 themes emerged.
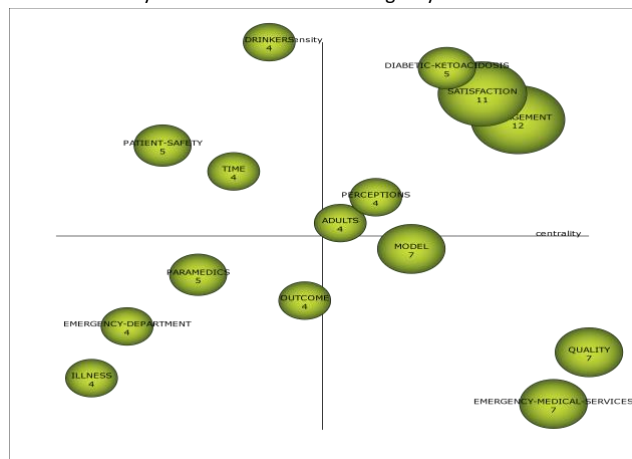
Figure 2: Strategic Diagram For The Period 2000-2009

The themes of "Management", "Satisfaction" and "Diabetic-ketoacidosis" are the leading motor themes whose relation to other themes in the field is high and intensively studied. "Diabetic-ketoacidosis" theme has a high intensity, "Management" and "Satisfaction" themes have a higher number of publications. "Quality", "Emergency-medical-services" and "Model" themes are fundamental and transformational themes that have a high relation to other themes in the field but a lower intensity of work. The themes of "Drinkers", "Patient-safety" and "Time" are highly developed and isolated themes with low relation to other themes in the field but with high intensity of study. The themes of "Illness", "Emergency-department", "Paramedics" and "Outcome" are newly emerging or beginning to disappear, with low relation to other themes in the field and intensity of work. The h-index values and total citation numbers of the articles are as shown in Table 1.

According to the thematic network map for the theme "Management", which is one of the prominent themes in terms of centrality and intensity in the period 2000-2009, the "Management" theme is most highly associated with "Guidelines", "Head-injury", "Relief" and "Acute-abdominal-pain" themes.

The strategic diagram for the "2010-2019" period is shown in Figure 3, the findings related to the themes are given in Table 1. During the period 23 themes appeared. The themes of "practicer", "Risk" and "Geriatrics " are high in relation to other themes in the field and are the leading motor themes studied extensively. Of these themes, the intensity of the "Geriatrics" theme, the centrality of the "practicer" theme is high, while the number of publications of the "Risk" theme is higher. Besides, "Mortality", "Emergency-medical-services" and "Death" themes are also included as motor themes during this period, and "mortality" and "Emergency-medical-services" themes are seen to have a high number of publications.

The "Departments" and "Management" themes are fundamental and transformational themes that have a high relation to other themes in the field but a lower intensity of

study. The themes of "Department-visits", "Performance", "Patient" and "Burden" are also included as fundamental
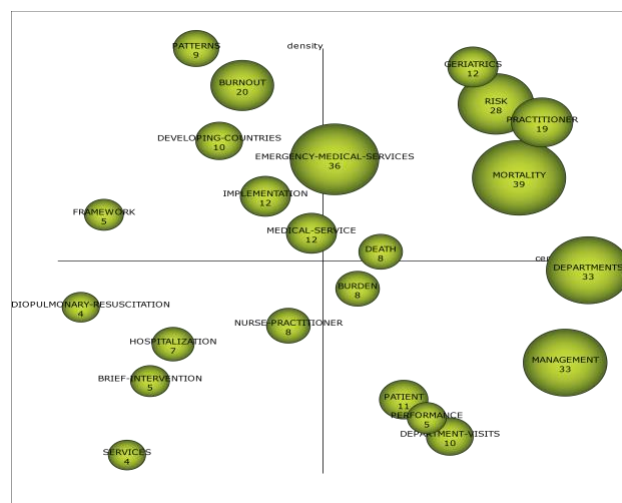

Figure 3: Strategic Diagram For The 2010-2019 Period

and transformational themes in this period. The themes of "Patterns", "Burnout" and "Developing-countries" are highly developed and isolated themes that are not related to other themes in the field but have a high intensity of work. The themes of" Services", "Brief-intervention", and" Hospitalization " are newly emerging or beginning to disappear, with a low intensity of study and relationship to other themes in the field. The h-index values and total citation numbers of the articles are as shown in Table 1. According to the thematic network map for the theme "practicer", which is one of the prominent themes in terms of centrality and intensity in the period 2010-2019İ; practicer theme is most highly associated with "Community", "Impact" and "Quality-of-care" themes. The highest level relationship between the other themes in the thematic network map is between the themes "Accident" and "Impact".

The thematic development map, which shows the conceptual and structural development of the themes that stand out in the period of 1990-2019, is shown in Figure 4.

When the straight lines showing coexistence between the themes of the "1990-1999" period and the themes of the "2000-2009" period are examined in the same publication, the highest relationship is between "Emergency-care" and "Satisfaction" and similar relations "Department" and "Quality", "Injuries" and "emergency-medical-service" is observed. When the dashed lines showing the frequency of sharing common words between "1990-1999 theme and 2000-2009 themes" are examined, it is seen that there are high levels of relationships between "Medicine" and "Time", "Hemorrhage" and "Management", "hemorrhage" and "Illness".

When the straight lines showing the coexistence between the themes "2000-2009" and "2010-2019" are examined, the highest relationship is between "Emergency-
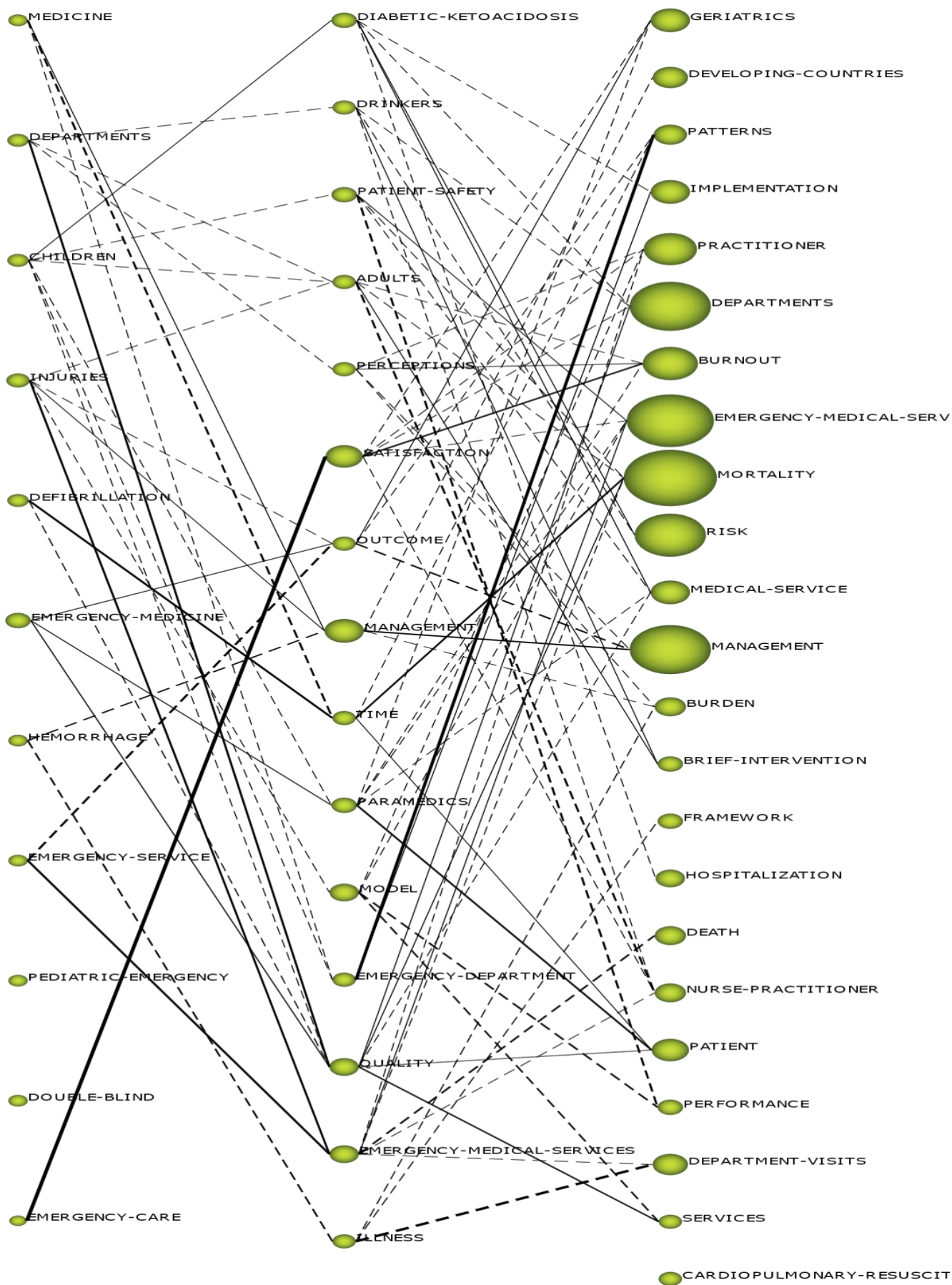
Figure 4: Thematic Development Map (1990-2019)

1990-1999

Name	Centrality	Centrality range	Density	Density range	h-index	Sum Citiations
Departments	55.00	1.00	71.43	0.91	3	71
Medicine	47.89	0.91	144.05	1.00	2	41
Emergency medicine	46.78	0.82	39.03	0.55	2	39
Pediatric-emergency	36.94	0.73	11.11	0.18	2	41
Children	29.72	0.64	36.11	0.45	3	72

2000-2009

Name	Centrality	Centrality range	Density	Density range	h-index	Sum Citiations
Emergency-medical-services	38.75	0.93	1.29	0.07	5	148
Management	36.86	0.87	26.74	0.80	7	176
Satisfaction	36.58	0.80	28.28	0.87	8	198
Diabetic-ketoacidosis	35.03	0.73	44.62	0.93	5	150
Model	32.76	0.67	9.66	0.47	6	180

2010-2020

Name	Centrality	Centrality range	Density	Density range	h-index	Sum Citiations
Departments	25.36	1.00	2.55	0.48	11	331
Practitioner	21.07	0.91	4.20	0.83	7	120
Mortality	20.74	0.87	3.23	0.70	11	382
Risk	20.01	0.83	4.24	0.87	7	171
Geriatrics	19.33	0.78	5.82	0.96	6	98

Table 1: Themes of the Periods 1990-1999, 2000-2009 and 2010-2020 (First five themes)

department" and "Pattern" similar relationships are found at high levels between "Satisfaction" and "Burnout", "Management" and "Management". When the dashed lines showing the frequency of sharing common words between "2000-2009" themes and "2010-2019 "themes are examined, it is seen that there are high levels of relationships between "Patient safety" and "performance", "Adults" and "Nurse-practitioner", "Outcome" and "Management".

Although "children" and "Pediatric-emergency" themes were found in "1990-1999" period," "adults" in "2000-2009" period, "Geriatrics" themes appeared in "2010-2019" period, the theme "Management" in the period "2000-2009" takes place in the next period and its intensity increases (Figure 4).

Discussion

The increase in the number of articles in the years determined in our research is thought to be an expected result. The speed of publishing academic articles in the world and the volume of the literature from different disciplines are increasing. Among the disciplines with the highest number of publications in recent years academic publication statistics, there is no emergency medicine discipline. Nevertheless, the fact that emergency medicine is a relatively new discipline within the medical disciplines and the continuing research on emergency medicine issues are thought to be a factor that supports the increase in the number of articles. (17).

In this research, articles on emergency care were examined. Naturally, the most frequently used keywords are such as emergency-care, mortality, emergency medical services, health care, and emergency department. Management is one of the most used keywords. There is also "management" in emergency services. Examples such as airway management and difficult patient management can be given. Emergency medicine is a new discipline among the disciplines of medicine. Emergency Medicine was accepted as a branch of science in 1979 with the effect of wars in the past century. In the following years, legal regulations related to Emergency Health Services, Administrative/administrative application principles, training programs for personnel, and similar regulations were implemented within the authorized institutions and organizations of countries. In this context, research, examination, analysis, and evaluations on issues related to Emergency Health Services have been carried out over the past years and continue. Therefore, there are numerous articles in the literature containing the word "management" (18).

Keywords increased at a similar rate in the periods 1990-1999, 2000-2009, and 2010-2019. It is close to each other in the proportions of the numbers of words that have been abandoned and newly used. These increases give clues about the necessity of bibliometric methods which are the subject of our research. Continuity in scientific development has brought a striking increase in the number of scientific publications. With this increase, the follow-up, examination, and control of academic and scientific progress have become difficult. It is important to be able to follow the developments in various disciplines and the changes in

existing practices. Scientists demand constant updates and access to scientific data at any time to stay integrated with their worldwide counterparts. All these needs increased the need for bibliometric methods and the use of the methods, which are also the subject of this article (18,19).

The themes "Medicine", "Departments" and "Emergency-medicine" are motor themes between 1990-1999 that have a high relationship with other themes. "Departments" stand out among themes. In this period, there are many articles in the literature with the title "emergency department". In these articles, topics such as the effectiveness of the emergency services, frequency of use, and quality level were examined. The reason for the research to focus on this issue may be to identify possible disruptions and possible contributions to the operation of the emergency services, which were recently implemented and are still under development at that time. The fact that "Departments" is one of the most cited themes among the themes in the same period supports this.

Epidemiologists are evaluating evidence to determine whether exposure is responsible for a direct outcome. Studies follow a hierarchy in terms of the quality of the evidence they can provide, and randomized double-blind studies are considered the "gold standard" of epidemiological studies. Randomized double-blind studies started to be used by scientists in the 60s, these studies became much more valuable in the 90s. It is thought that this situation will explain the determination of the "Double-blind" theme as a highly developed and isolated theme with high working intensity (20).

Among themes from the same period, the most cited theme is "Defibrillation". The reason why this theme stands out in terms of attribution compared to other themes is the periodical intensity in the scientific debate on the use of Automatic External Defibrillators (OED) and its reflection in academic papers. In the early 90s, it was reported that OEDs were used successfully by first aid teams. In the same period, the use of OED of non-healthcare personnel was approved, the legal legislation on the subject was soon written and OED training was included in the basic CPR course. Increasing the number of researches in which academic circles examine this new device led to an increase in the number of articles on the OED. This increase, together with the citation increase, caused this theme to stand out among others (21).

"Management" and "Satisfaction" are the motor themes that stand out in 2000-2009 period. This is likely to be since emergency medicine, as stated in the paragraphs above, is a new discipline among the disciplines of Medicine. Legal arrangements, administrative/administrative implementation principles, training programs for personnel, and similar arrangements regarding Emergency Health Services were implemented in the 80s and 90s. The research and analysis of the results obtained from these regulations

and practices were carried out during the same period and continues. As an expected result, the data obtained from these researches and studies have been shared with the scientific world in academic articles, and many articles have been published titled "Management of emergency health services and satisfaction with these services" (22).

"Drinkers", which is one of the themes in the strategic diagram of the same period, attracts attention as the most cited theme. This may be since when applying to the emergency room with a trauma complaint, it is quite common for the applicant to be drunk. This situation is frequently encountered especially in adolescent applications in the USA. There are numerous articles on "drinkers" from the period studied in the literature (23).

Patterns, practicer, Departments Mortality, Management themes are some of the themes that emerged during 2010-2019. These indicate that research and investigations into Emergency Health Services continued during this period as well. The fact that Departments and Management themes have the highest citation level among other themes supports this.

The themes of "Practitioner" and "Nurse-practitioner" which appeared in the same period indicate that, unlike previous periods, the issue of examining the results of education related to emergency health services gained weight in this period, and the articles related to it came to the fore. Following the establishment of the Emergency Medicine Departments, training programs for the personnel who would work in this field in the 80s and 90s and training topics related to the Emergency Health Services were determined and documents related to this were written. Afterward, the results obtained from these trainings were analyzed and examined. This may explain the issues related to education to come to the fore. Besides, the recent increase in various disasters, immigration, epidemics, and conflicts in the world has accelerated the work of developing training programs. This issue is also thought to contribute to highlighting educational issues.

In the thematic development map of the 1990-2019 period obtained in our study, the themes of the period of 1990-1999 and the themes of 2000-2009 period, "Emergency-care" and "Satisfaction", "Department" and "Quality" and "Injuries" and "Emergency -Medical-Service are found in many articles together. The intensity of the articles that share the results of the researches examining the emergency and emergency health services in a way to support the issues stated in the paragraphs above can be accepted as the reason for this cooperation.

There is a strong relationship between the "Emergency-department" and "Pattern" between the themes of the period 2000-2009 and 2010-2019, as discussed in the above paragraph. In the literature, there are articles examining the numerous features of emergency departments: patient and

admission patterns, bleeding, and diurnal patterns of treatments. This situation is thought to explain the strong relationship between "Emergency-department" and "Pattern".

The strong relationship "Emergency-department" and "Pattern" is similar to that between "Satisfaction" and "Burnout". Burnout refers to a state of emotional, mental, and physical exhaustion caused by extreme and long-term stress. Emergency physicians have a higher level of burnout compared to other physicians. This situation arises from the characteristics of the medical discipline they belong to, such as working hours, need for intensive professional development, and non-clinical tasks. Satisfaction is used in relation to job satisfaction and has been investigated with burnout in emergency physicians. This explains the strong relationship between themes (24,25).

Conflict of Interest: The author declares no any conflict of interest regarding this study.

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Authors' Contribution: The manuscript was written by one author.

Ethical Statement: This study examines 30 years of research in the field of emergency care. For this reason, it is declared that the ethics committee approval was not obtained by the author. Author declared that he follows the rules of Research and Publication Ethics.

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