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ORIGINAL RESEARCH

Mapping Global Research in Emergency Medicine; a Bibliometric Analysis of Documents Indexed in the Web of Science Database

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Abstract: **Introduction:** Emergency medicine is a relatively new and rapidly growing specialty, and its research monitoring is important for future policies. This study aimed to analyze the published literature related to emergency medicine, to create a documented research perspective for this field. **Methods:** This research is a bibliometric study that analyzes the research outputs of the subject area of emergency medicine indexed in the Web of Science database from the beginning to 2023. VOSviewer software was used to visualize and predict the trends in research on the topic. **Results:** The findings showed that the University of California, The Journal of Neurotrauma and Brain Injury, Elsevier, and the USA were the most prolific units in the cycle of scientific productions in the field of emergency medicine. Results showed that most scientific productions in this field fall into 6 clusters: psychological impressions, injuries caused by traumatic events and the effects of traumas on children, pathophysiology and nervous system issues and related diseases, complications of traumatic events and injuries, biomechanics and complications caused by sports injuries, and consciousness. **Conclusion:** In addition to interventions and clinical complications, research in the field of emergency medicine has also focused on psychological structures. So, based on various measurement indicators, the subjects of this field have been the focus of researchers' attention.

Keywords: Emergency Medicine; Bibliographic network; Scientometric; Science in literature

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1. Introduction

Emergency medicine is a relatively new and rapidly growing specialty focused on improving the science and practice of emergency care globally. This subject area covers a wide range of topics including the development of emergency medicine expertise and emergency care systems in areas with low access to medical services, as well as humanitarian clinical care in emergencies; For example, traumatic injuries, acute manifestations of infectious and non-infectious diseases, and presentation of other types of diseases are covered by this specialty (1-3).

In recent years, significant growth in the field of biomedical research, including medical emergencies, has been observed along with the progress of other branches of science and technology (4) and there has been great interest in us-

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ing bibliographic information to evaluate research activities. The evaluation of research activities is considered one of the most important tools for achieving the standards of research performance in scientific centers (5). Among the reasons for the expansion of research in the fields of bibliometrics are the possibility of knowing the current situation, comparing subject areas and universities with each other, and trying to improve the scientific situation (6).

Drawing a scientific map as one of the scientometric methods can make people aware of the state of research published in different scientific fields and show the most influential subject areas. Presenting a big picture of the state of research and how different fields are related and knowing how these fields grow and develop over time is one of the goals of scientific maps (7, 8). Drawing a scientific map is one of the powerful bibliographic methods for analyzing scientific outputs. This method provides a situational representation of how scientific disciplines, subject areas, and scientific texts are related. Drawing a scientific map focuses on observing a scientific subject area and determining research boundaries to define the structure and interaction of that area. The purpose of drawing a scientific map is to show the structural and dynamic aspects of research (9-11).

Therefore, with the aim of analysis and visualization of research on medicine using the science mapping approach, this study analyzes global scientific productions in the field of emergency medicine.

2. Methods

2.1. Study design

In this study, we recruited all the documents indexed in the Web of Science database with the topic of emergency medicine and related topics. To achieve maximum comprehensiveness, SCI-EXPANDED and SSCI collections were selected. The search for the documents took place on February 15, 2023. To illustrate the thematic process, all the documents available on the Web of Science database in the search field, which were published until the beginning of 2023, were examined.

2.2. Search strategy

Searching for resources on the topic was done with the following strategy: Trauma* OR Injur* OR Wound* OR "Emergency Medic*" OR "Critical care medic*" OR "Emergency Care*" OR Emergicenter* OR "Emergency Health Service*". Then, to filter the results and retrieve related results, in Citation Topics Meso, the results were limited to Trauma & Emergency Surgery. Citation Topics are algorithmically-derived citation clusters (using an algorithm developed by CWTS, Leiden). For Meso-topics, the documents' stability is higher than 90% (12). After searching with the mentioned formula, finally, 65,265 records related to the field of emergency medicine were retrieved and included in the study.

2.3. Data analysis

To analyze the results, VOSviewer-v1.6.14 software was used. VOSviewer is a software tool for creating and visualizing bibliographic networks (13-17).

To extract bibliographic and citation information from documents in a readable format by the software used, the data was exported in the form of full records (covering author and author units, source journal titles, titles, keywords, and abstracts) and cited references.The minimum number of occurrences for keywords to enter the study was 300 repetitions.

One of the problems of this stage was the existence of different forms of writing or singular and plurals and synonyms of concepts for drawing lexical maps. Therefore, to unify the concepts and prevent the dispersion of the same concepts, the researchers first designed a specialized thesaurus to be used in the analysis by VOSviewer. This is one of the specialized advantages of VOSviewer software analysis.

3. Results

3.1. Baseline characteristics of studied documents

The findings showed that 65,265 documents have been published in the Web of Science database so far. The publication process of these documents shows that the scientific productions of this field have increased with an almost constant growth rate every year (Figure 1). Table 1 shows the top ten authors, affiliations, journals, publishers, funding agencies, and conutries in the field of emergency medicine.

Kochanek PM with 278 articles, Menon DK with 269 articles and Iverson GL with 241 articles were, respectively, the 3 most prolific and best authors in the field of emergency medicine.

Also, the University Of California System, Harvard University, and Pennsylvania Commonwealth System of Higher Education Pcshe universities/institutions have been the most productive organizations in this field with more than three percent of scientific productions in the field of emergency medicine.

The Journal of Neurotrauma and Brain Injury, was the most productive, publishing more than two percent of all articles in this field.

Elsevier has been the most active international publisher by publishing more than 14% of articles in this field. In the next ranks, Lippincott Williams & Wilkins with 9%, and Springer Nature with 7.7% are the top 3 publishers in the field of publishing scientific products of emergency medicine.

Also, two American organizations, the United States Department of Health and Human Services and the National Institutes of Health NIH USA, each with more than 6000 financial

support for all scientific productions published in the field of emergency medicine, have played a very prominent role in the development of research in this field. In the same way, the United States of America is at the top of the countries, with 29,778 documents, equivalent to 45,626% of the total scientific outputs of emergency medicine. Meanwhile, the closest pursuers of America are England, Canada, and Australia with a little more than 4% of emergency medicine scientific production.

3.2. Map of scientific productions

The map of scientific productions in the field of emergency medicine based on the co-occurrence analysis of words is presented in Figure 2 and table 2. In this map, as can be seen, the topics of published documents are placed in 6 topic clusters. It is reminded that the placement of topics in clusters was based on their co-occurrence with each other and creates thematic themes. Accordingly, cluster 1 with 30 nodes was the largest, and cluster 6 with 4 nodes was the smallest. Cluster 2 with 28 nodes, cluster 3 with 26 nodes, cluster 4 with 18 nodes, and cluster 5 with 11 nodes are the cluters in between. It should be noted that considering the minimum number of occurrence conditions of 300 repetitions in the research method, the documents of the most recent years are not included in this collection due to the lack of a sufficient repetition threshold. In the coming years, we will naturally see changes in the research landscape of this field.

3.3. Frequent published topic

Overall, in emergency medicine research, traumatic brain injury with 18,152 repetitions, was the most frequent topic among published documents. Also, this subject with 121 links and total link strength (TLS) amounting to 47846, is the main focus of research in the field of emergency medicine.

3.4. The most cited subject

In terms of citations, the recurrent concussion has been the most cited node with an average of 45.1 citations. After that, the subjects of recurrent concussion, Alzheimer's disease, football players, microglia, axonal injury, closed-head injury, diffuse axonal injury, chronic traumatic encephalopathy, white-matter, cerebrospinal-fluid, encephalopathy, controlled cortical impact have been the most cited topics with an average of more than 30 citations.

In terms of avgerage normal citation, topics of microglia, neuroinflammation, Alzheimer's disease, recurrent concussion, neurodegeneration, cerebrospinal-fluid, chronic traumatic encephalopathy, football players, white matter, axonal injury, and controlled cortical impact were the most important subjects in emergency medicine researches with an average of more than 2 normalized citations. Thematic map of emergency medicine research based on average citations is presented in Figure 3.

3.5. The most up-to-date topics

Based on the year of publication, neuroinflammation, rib fractures, dementia, education, neurodegeneration, biomarker, pain, Mild Traumatic Brain Injury (mTBI), anxiety, microglia, and sex differences, with an average publication year of 2018, were the most up-to-date topics among the most frequent and important research nodes in the field of emergency medicine. The thematic map of research in the field of emergency medicine based on the year of publication is presented in Figure 4.

3.6. Characteristics of 6 topic clusters

Cluster 1

In the first cluster, mainly psychological issues are placed, and psychological impressions after emergency incidents are placed as one of the main themes in emergency medicine research. In this cluster, based on the number of links, the subject of traumatic brain injury has the most communication link and co-occurrence with 121 links with other topics of this cluster. Also, based on TLS, this subject has the highest communication power with TLS at the rate of 47846. For a given item, the links and total link strength attributes indicate the number of links of an item with other items and the total strength of the links of an item with other items, respectively (18). Based on the frequency of occurrence, the same topic is at the top of the topics of this cluster with the frequency of 18,152. In terms of average citations, the postconcussion syndrome was the most cited subject in cluster 1, with an average of more than 26 citations. In terms of the average normalized number of citations index, the postconcussion syndrome has the highest value of this index with 1.84. The average normalized number of citations received by the documents in which a keyword or a term occurs or the average normalized number of citations received by the documents published by a source, an author, an organization, or a country . In terms of the novelty index (Avgrage publication year), the findings showed that the documents published on the subject of mTBI were mostly published in 2018, and the most up-to-date topics of interest to researchers were in this cluster.

Cluster 2

In cluster 2, the thematic theme of the research is presented mainly around the injuries caused by traumatic events and also the effects of traumas on children. According to the findings, the topics of children, diagnosis, and injuries are at the center of the thematic links of this cluster with more than 120 links. In terms of TLS, children and injuries are at the top of cluster 2 topics with a communication power of 12999 and 11067, respectively. Injuries, trauma, and children with 5,923, 4,839, and 4,230 occurrences, respectively, are the

most important subjects in emergency medicine in cluster 2. In terms of average citations, severity was the most cited topic in this cluster with an average of 17.66 citations. But according to Average Normal Citation, hemorrhage was the most cited subject in cluster 2 with 1.2685 citations. In terms of the novelty index (average publication year), the findings showed that the documents published on the subject of rib fractures were mostly published in 2018, and the most up-to-date topics of interest to researchers were in this cluster.

Cluster 3

Cluster 3 mainly focuses on the pathophysiology and nervous system issues and related diseases. In this cluster, mechanisms with 118 links, the most co-occurring links, and biomarkers with 3282 have the highest communication power. In this cluster, biomarker has the highest topic frequency with 984 repetitions. But in terms of citations, the findings show that Alzheimer's disease is the most cited subject with an average of 36.7277, followed by the concepts of microglia, axonal injury, and closed-head injury with approximately 33 citations. In terms of normalized citation average, microglia, neuroinflammation, Alzheimer's disease, neurodegeneration, cerebrospinal-fluid, whitematter, axonal injury, and controlled cortical impact were the most cited topics with an average of almost 2 citations. Based on the findings, the topics of neuroinflammation, dementia, neurodegeneration, biomarker, and microglia had the most scientific productions in 2018 and are the most updated topics of cluster 3 of emergency medicine.

Cluster 4

Cluster 4 has the thematic theme of complications of traumatic events and injuries. In this cluster, head trauma has the most communication links with 121 links, and with a TLS of 19425, it has the most communication power with other topics. It also has the highest frequency of occurrences with 6430 cases. In terms of the number of citations, cerebral perfusion pressure has been the most cited subject of this cluster with more than 25 citations. Also with average normal citations equal to 1.79, it has been the most important subject of this cluster. All topics of this cluster were published in 2016 and 2017 on average, which can be said to indicate less attention to the topics of that cluster in recent years.

Cluster 5

Cluster 5 is dedicated to biomechanics and complications caused by sports injuries. In this cluster, concussion with 113 links, and TLS with 3949, have the most links and communication power with other topics and are the focus of research. A recurrent concussion is the most cited subject of this cluster with an average of 45 citations and a normalized citation average of 2.40. Education and sex differences in sports injuries have been the most up-to-date issues raised in the research of this cluster.

Cluster 6

Cluster 6 is the smallest cluster with only 4 nodes, and it may not be possible to assign a precise topic to it, but consciousness is the most likely option for the research of this cluster. In this cluster, recovery with the number of 116 links and TLS amounting to 7856, and the occurrence frequency of 2143, is the focus of the topics. In terms of citation index, the subject's minimally conscious state, recovery, with an average of 20 citations, and average normal citations with 1.4 citations are the most cited subjects of this cluster.

4. Discussion

This study is the first bibliometric analysis of publications from emergency medicine research networks that collaborate globally. Of course, studies have been conducted in fields close to emergency medicine like Pediatric Emergency, pre-hospital emergency, Spinal Cord Injury, Triage, Ultrasound in Emergency Medicine, and Sacral Fracture Surgery (19-24), but none of these studies have reviewed all the documents available in the Web of Science in a comprehensive manner in this field. Highlighting the thematic areas of emergency medicine, and drawing its maps, is one of the most important tools for predicting ground research based on the past path, and this study was carried out to draw the perspectives of research policies needed by researchers in this field. Our results indicate an upward trend in the growth of scientific productions in the field of emergency medicine. In a similar research, Xu et al. reached the same conclusion in 2021 and stated that scientific productions in the field of prehospital emergency have a generally upward trend and developed countries have the largest share in these productions (20).

Our results showed that the United States of America is at the top of the countries in this field by publishing 45.626% of the total scientific productions of emergency medicine. Meanwhile, the closest pursuers of America are England, Canada, and Australia with a little more than 4%. These results are completely consistent with Qiang et al.'s 2011 research. They showed that the United States published the most articles from 2006 to 2010 (4523/9775, or 46.3%), followed by the United Kingdom, Australia, China, and Canada (4). Yuh-Shan et al. (2021) and Xu et al. (2021) also obtained a similar result (20, 25).

Analysis of information based on the central research concept in this field shows that most scientific productions in this field fall into 6 categories: psychological impressions, injuries caused by traumatic events and the effects of traumas on children, pathophysiology and nervous system issues and related diseases, complications of traumatic events and injuries, biomechanics and complications caused by sports injuries, and consciousness. As mentioned, the biggest subject cluster was the psychological impressions cluster, and

this subject has been the focus of research attention, and this situation indicates the researchers' focus on reducing or alleviating psychological complications caused by traumatic events, both for patients and for emergency personnel (26-32).

The result showed that traumatic brain injury is the most frequent topic among published documents and is the main focus of research in the field of emergency medicine. But in terms of citations, the recurrent concussion has been the most cited node. In terms of average normal citation, topics of microglia, neuroinflammation, Alzheimer's disease, recurrent concussion, neurodegeneration, cerebrospinal-fluid, chronic traumatic encephalopathy, football players, white matter, axonal injury, and controlled cortical impact were the most important subjects in emergency medicine researches. Based on the year of publication, neuroinflammation, rib fractures, dementia, education, neurodegeneration, biomarker, pain, mTBI, anxiety, microglia, and sex differences are the most up-to-date topics among the most frequent and important research nodes in the field of emergency medicine. As mentioned, this study is unique, and the comparison of other results with this study is not possible. But in the review of the closest studies, it has been determined that in a similar research, Xu et al. also stated in 2021 that "Complications" is a hot research field in intensive care. In the identification research cluster, "acute ischemic stroke" was determined to be the hotspot, while "secondary outcome" was the new trend in the first-aid cluster (20). In their research on pre-hospital emergency research, Xu et al. determined that out of 118 keywords, defined as terms that occurred more than 45 times within titles and abstracts in all papers during the analysis process, were identified and classified into four clusters namely, management, first-aid, identification, intensive care. Within the cluster of management, the following keywords were frequently mentioned: service 5573 times, management 288, review 236, pre-hospital care 149, and process 123 times. Within the cluster of identification, diagnosis 195 times, confidence interval 241, and survival 348 times. Within the cluster of first aid, cardiac arrest 249 times, resuscitation 236, odds ratio 184, hospital cardiac arrest 330, and spontaneous circulation 188 times. Within the cluster of intensive care, intubation 192 times, airway management 125, and airway 123 times (20). One of the reasons for this difference is that the research is limited to the pre-hospital emergency. Therefore, in a wider horizon, it is obvious that there are differences in the topics presented.

The interpretation of the findings of this research has limitations that should be considered. First of all, this analysis was based on documents indexed in only one database, and a very detailed generalization of the data requires research in other reliable international databases and considering them. It should also be noted that these analyzes were performed on indexed documents without language restrictions. It thus provides a global perspective that may not be entirely consistent with the prevailing trend of English-only journals.

5. Conclusion

In addition to interventions and clinical complications, research in the field of emergency medicine has also focused on psychological structures. So, based on various measurement indicators, the subjects of this field have been the focus of researchers' attention.

Paying attention to the evolution of various scientific fields is one of the most important prerequisites for research policy-making and predicting the scientific needs of researchers. The results of this research, which was conducted with a large amount of data, provide a suitable perspective for discovering future research patterns for researchers, journals, and emergency medicine specialists. Further research is essential to generalize the data.

6. Declarations

6.1. Acknowledgments

Not applicable.

6.2. Conflict of interest

The authors declare that they have no competing interests.

6.3. Funding and support

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6.4. Authors' contribution

Conceptualization: M.Mohammadi and S.G; Data curation: F.Sh. M.N., F.F., N, R, and M.Mhaboubi; Formal analysis: M.Mohammadi and M. N, F.F. and N.R.Methodology: M.Mohammadi and F.Sh. Project administration: M.Mohammadi and S.G; Writing – original draft:
M.Mohammadi, S.G., and M.N.; Writing – review & editing: All authors

6.5. Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

6.6. Ethical Approval

The study was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. Ethical approval was also obtained from the Research Ethics Clearance Committee of Gadarif Teaching Hospital. Consents were obtained from all participants before starting to

fill out the online survey.

6.7. Consent for publication

Not applicable.

6.8. Competing interests

The authors declare that they have no competing interests.

6.9. Ethics approval and consent to participate

This research was approved by ethics in research of Golestan University of Medical Sciences (IR.GOUMS.REC.1400.225).

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Table 1: Top ten authors, affiliations, journals, publishers, funding agencies, and conutries in the field of emergency medicine based on the documents indexed in the Web of Science database

Variable	N (%)	Variable	N (%)
Authors		**Affiliations**	
Kochanek PM	278 (0.43)	University Of California System	2,587 (3.96)
Menon DK	269 (0.41)	Harvard University	2,492 (3.81)
Iverson GL	241 (0.36)	Pennsylvania Common wealth System Of Higher Education Pcshe	2,056 (3.15)
Yeates KO	221 (0.34)	University Of Texas System	1,710 (2.62)
Lefering R	211 (0.32)	University Of Pittsburgh	1,641 (2.51)
Maas AIR	186 (0.29)	Us Department Of Veterans Affairs	1,564 (2.40)
Inaba K	173 (0.27)	University Of Toronto	1,548 (2.37)
Ponsford J	173 (0.27)	Veterans Health Administration Vha	1,524 (2.3)
Hutchinson PJ	172 (0.26)	United States Department Of Defense	1,519 (2.33)
Diaz-arrastia R	170 (0.26)	Harvard Medical School	1,472 (2.56)
Publishers		Journal titles	
Elsevier	14,052 (21.53)	Journal Of Neurotrauma	2,508 (3.84)
Lippincott Williams	9,074 (13.90)	Brain Injury	2,349 (3.60)
Springer Nature	7,723 (11.83)	Journal Of Trauma Injury Infection And Critical Care	1,401 (2.15)
Taylor & Francis	5,363 (8.22)	Journal Of Trauma And Acute Care Surgery	1,307 (2.00)
Wiley	3,448 (5.28)	Injury International Journal of The Care of The Injured	1,220 (1.86)
Mary Ann Liebert	2,359 (3.61)	Journal Of Head Trauma Rehabilitation	938 (1.43)
Sage	1,765 (2.70)	Resuscitation	925 (1.42)
BMJ	1,700 (2.60)	World Neurosurgery	675 (1.03)
Oxford Univ Press	1,573 (2.41)	Military Medicine	658 (1.01)
Cambridge	1,185 (1.82)	Frontiers In Neurology	623 (0.96)
Conutries		Funding Agencies	
USA	29,778 (45.6)	United States Department Of Health Human Services	6,727 (10.31)
England	4,755 (7.29)	National Institutes Of Health Nih Usa	6,080 (9.32)
Canada	4,722 (7.24)	Nih National Institute Of Neurological Disorders Stroke Ninds	1,902 (2.91)
Australia	4,105 (6.29)	United States Department Of Defense	1,451 (2.22)
Germany	3,795 (5.81)	National Natural Science Foundation Of China Nsfc	1,262 (1.93)
China	3,772 (5.78)	Canadian Institutes Of Health Research Cihr	857 (1.13)
Italy	2,109 (3.23)	Us Department Of Veterans Affairs	805 (1.23)
France	1,774 (2.72)	Nih Eunice Kennedy Shriver National Institute Of Child Health	726 (1.11)
Netherlands	1,658 (2.54)	Uk Research Innovation Ukri	648 (0.99)
Japan	1,574 (2.41)	National Health And Medical Research Council Nhmrc Of Australia	596 (0.91)

Data are presented as number (%).

Table 2: Thematic clusters of emergency medicine and detailed information on nodes based on the documents indexed in the Web of Science database

Cluster	Node (concept)	Weight			Score (average)		
		Links	TLS*	Occurrences	Year**	Citations	Citations#
1	Acquired brain injury	71	1119	434	2017.865	8.7972	0.8316
1	Adolescents	107	3398	845	2017.336	16.4757	1.1713
1	Adults	113	2585	885	2017.208	16.3797	1.1828
1	Anxiety	98	1655	409	2018.129	15.4132	1.2781
1	Behavior	106	1877	588	2017.555	17.1548	1.2887
1	Blast	87	1154	369	2017.171	17.7236	1.205
1	Childhood	92	1479	422	2016.696	14.5071	0.9524
1	Cognition	107	2519	634	2017.942	14.7776	1.1376
1	Cognitive rehabilitation	76	1250	381	2016.757	15.3543	1.0908
1	Deficits	98	2597	751	2017.164	16.4008	1.1208
1	Depression	108	4642	1240	2017.665	17.1081	1.3138
1	Disability	109	2421	801	2017.558	15.2047	1.1398
1	Executive function	81	1526	401	2017.374	16.8354	1.168
1	Impairment	97	1760	487	2017.24	19.0267	1.2854
1	Intervention	102	1369	412	2017.776	17.2112	1.311
1	Memory	99	2042	563	2017.081	15.389	1.1048
1	Military	99	1432	491	2017.626	17.3503	1.2754
1	mTBI	83	1288	348	2018.186	21.3333	1.5394
1	Postconcussion syndrome	93	3369	776	2017.418	26.8003	1.8409
1	Posttraumatic stress disorder	100	3000	860	2017.054	22.7128	1.5173
1	Predictors	118	4267	1192	2017.728	15.406	1.2101
1	Quality of life	114	3897	1227	2017.485	15.621	1.2298
1	Randomized controlled trial	103	990	320	2017.047	19.9281	1.3546
1	Rehabilitation	116	7590	2617	2017.211	14.0111	1.0214
1	Stress	100	1003	324	2017.293	15.9784	1.1942
1	Stroke	105	2440	825	2017.354	12.2267	0.9638
1	Symptoms	95	5970	1549	2017.959	17.3138	1.3568
1	Traumatic brain injury	121	47846	18152	2017.404	16.7134	1.2404
1	Veterans	81	1864	553	2017.546	16.4268	1.213
1	Working-memory	87	1329	349	2016.959	20.106	1.2997
2	Abusive head trauma	76	1405	436	2017.641	10.8372	0.851
2	Autopsy	59	602	342	2017.611	7.2398	0.5856
2	Blunt trauma	60	600	341	2016.711	10.7478	0.7303
2	Child abuse	60	1308	468	2017.615	8.2585	0.7431
2	Children	121	12999	4230	2017.399	12.4307	0.9293
2	Computed tomography	117	3826	1594	2017.303	12.8388	0.9463
2	Death	111	2262	1054	2017.419	13.3121	0.9746
2	Diagnosis	120	2779	973	2017.628	14.4687	1.2171
2	Emergency medical services	46	668	392	2017.69	11.8878	0.9248
2	Emergency department	90	880	320	2017.764	16.8219	1.2198
2	Fractures	75	1102	511	2017.262	10.3112	0.6806
2	Hemorrhage	93	1629	796	2017.797	13.6985	1.2685
2	Infants	94	1938	597	2017.271	11.3166	0.8329
2	Injuries	120	11067	5923	2017.518	10.8837	0.8222
2	Injury severity score	55	678	374	2017.373	10.4519	0.8078
2	Intracranial hemorrhage	73	937	329	2017.626	16.4103	1.2574
2	Major trauma	68	1246	566	2017.478	12.9028	0.9722
2	Morbidity	73	960	379	2017.81	12.7177	1.0712
2	Mortality	119	8132	3864	2017.597	13.8967	1.0199
2	Ocular trauma	40	254	333	2017.638	6.2763	0.5337
2	Pain	97	1176	416	2018.197	12.1995	1.1261
2	Pediatrics	117	3899	1084	2017.728	13.4779	1.0017
2	Polytrauma	85	786	330	2017.364	10.8394	0.7596
2	Rib fractures	46	788	381	2018.598	11.2047	1.0724
2	Severity	117	2300	696	2017.089	17.6652	1.1975
2	Shaken baby syndrome	74	1042	307	2017.203	10.7557	0.8965
2	Survival	96	3182	1379	2017.545	14.8658	1.1034

Table 2: Thematic clusters of emergency medicine and detailed information on nodes based on the documents indexed in the Web of Science database

Cluster	Node (concept)	Weight			Score (average)		
		Links	TLS*	Occurrences	Year**	Citations	Citations#
2	Trauma	119	8442	4839	2017.585	9.9423	0.7775
2	Wounds	50	351	314	2016.074	12.2134	0.6362
3	Activation	103	2083	590	2017.73	18.5525	1.5416
3	Alzheimer' disease	102	2605	705	2017.431	36.7277	2.5234
3	Apoptosis	75	1126	343	2017.255	15.8251	1.2381
3	Axonal injury	104	2462	654	2016.783	33.2324	2.0307
3	Biomarker	115	3282	984	2018.198	20.1372	1.7843
3	Cerebrospinal fluid	106	1852	519	2016.99	30.7553	2.1868
3	Closed head injury	101	1103	314	2016.16	33.1178	1.9703
3	Cognitive impairment	103	1841	459	2017.532	28.6688	1.9801
3	Controlled cortical impact	91	1857	584	2016.847	30.5993	2.025
3	Damage	109	2284	673	2017.067	18.3418	1.2981
3	Dementia	90	1344	370	2018.462	19.7892	1.8362
3	Diffuse axonal injury	108	2784	783	2016.535	31.3678	1.8086
3	Diffusion tensor imaging	94	1589	385	2017.068	25.0779	1.6263
3	Dysfunction	111	2007	558	2017.534	17.5502	1.3033
3	Encephalopathy	100	1257	311	2017.081	30.7106	1.9781
3	Expression	104	2142	714	2017.524	18.9398	1.487
3	Inflammation	108	2922	893	2017.996	22.5733	1.9167
3	Mechanisms	118	1936	580	2017.237	16.5672	1.1872
3	Microglia	89	1294	313	2018.051	33.7827	2.7668
3	MRI	116	3269	942	2017.413	17.9119	1.2789
3	Neurodegeneration	94	1534	368	2018.23	26.0462	2.234
3	Neuroinflammation	97	1933	501	2018.62	27.6487	2.537
3	Neuron-specific enolase	96	1368	398	2016.902	25.8568	1.8326
3	Neuroprotection	96	1808	524	2017.222	20.3855	1.4933
3	Oxidative stress	91	1954	586	2017.732	21.5205	1.7421
3	Pathophysiology	110	1719	471	2017.698	16.2314	1.3002
3	White-matter	101	1421	367	2017.284	31.1962	2.0528
4	Blood-flow	95	1053	330	2016.693	20.403	1.3639
4	Cardiac arrest	98	3896	1372	2017.421	14.4468	1.1416
4	Cardiopulmonary resuscitation	87	3038	1243	2017.436	15.436	1.1462
4	Cerebral perfusion-pressure	65	1009	306	2016.567	25.049	1.7925
4	Cerebral blood flow	103	1773	496	2017.193	22.3206	1.6113
4	Complications	93	1594	673	2017.499	14.1516	1.0493
4	Cranioplasty	58	990	435	2017.408	15.531	1.1145
4	Decompressive craniectomy	86	2826	1019	2017.386	13.8234	1.0422
4	Head trauma	121	19425	6430	2016.803	20.724	1.3576
4	Hospital cardiac arrest	68	1003	373	2017.424	13.2976	1.0498
4	Hypothermia	90	2206	699	2016.745	15.8298	1.0173
4	Intracranial hypertension	72	1183	350	2016.849	16.38	1.1395
4	Intracranial pressure	108	3271	1117	2016.777	18.7323	1.2605
4	Ischemia	77	1078	337	2016.53	14.8427	0.9676
4	Pressure	97	1119	411	2016.998	14.6886	1.0272
4	Prognosis	111	2410	776	2017.697	14.7564	1.206
4	Resuscitation	100	2894	1151	2017.45	14.4422	1.0818
4	Subarachnoid hemorrhage	99	1194	396	2016.67	17.3258	1.207
4	Therapeutic hypothermia	90	2138	679	2016.825	17.0692	1.1581
5	Biomechanics	85	1625	554	2017.097	17.0181	1.1691
5	Chronic traumatic encephalopathy	88	2522	661	2017.596	31.3162	2.1176
5	Concussion	113	13979	3949	2017.896	18.5961	1.41
5	Education	88	1155	462	2018.246	12.4913	0.9772
5	Football	88	2111	558	2017.622	22.0896	1.4897
5	Football players	84	2491	623	2016.681	35.7223	2.0729
5	High school	90	3532	824	2017.599	26.4769	1.6912
5	Mild traumatic brain injury	100	6153	1743	2017.874	18.3391	1.3682

Table 2: Thematic clusters of emergency medicine and detailed information on nodes based on the documents indexed in the Web of Science database

Cluster	Node (concept)	Weight			Score (average)		
		Links	TLS*	Occurrences	Year**	Citations	Citations#
5	Players	76	1374	401	2017.566	20.4813	1.5252
5	Recurrent concussion	83	1414	320	2016.269	45.1	2.4063
5	Sex differences	89	1267	340	2018.006	21.9176	1.6729
5	Sport-related concussion	102	6895	1810	2017.741	20.884	1.5023
5	Sports	92	2148	587	2017.898	19.293	1.3857
6	Consciousness	93	1238	468	2017.553	15.4103	1.3648
6	Minimally conscious state	62	972	344	2016.598	20.1802	1.3461
6	Recovery	116	7856	2143	2017.569	20.0187	1.426
6	Vegetative state	78	1524	567	2017.055	19.612	1.432

* Total link strength; **: Publication year; #: normal citation. mTBI: Mild Traumatic Brain Injury; MRI: magnetic resonance imaging.

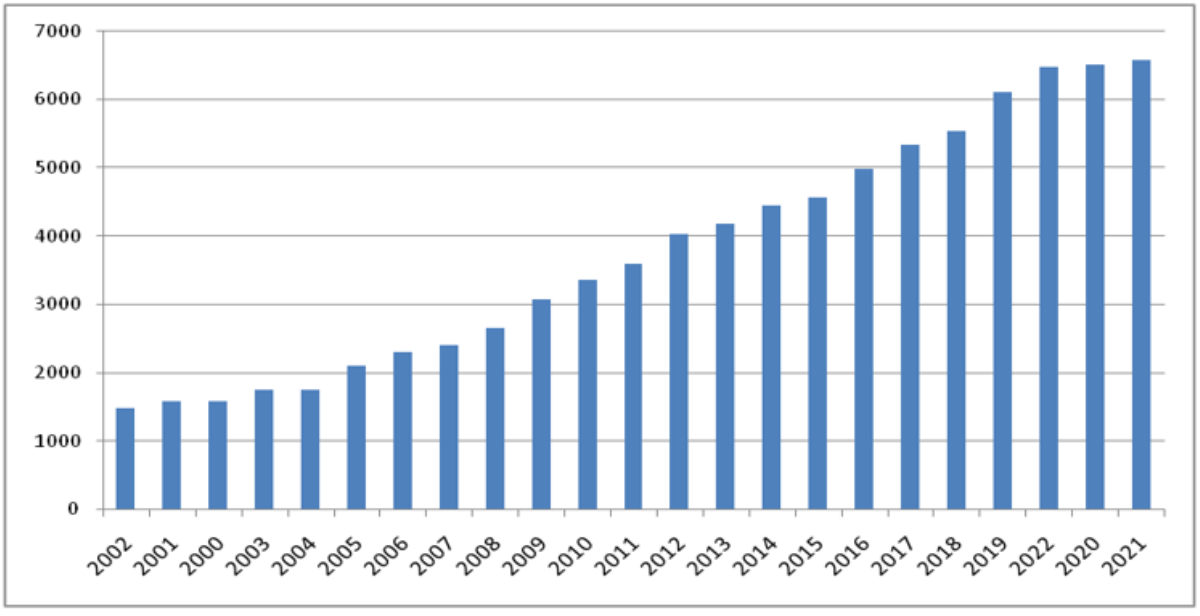

Figure 1: The annual growth trend of scientific productions in the field of emergency medicine based on the documents indexed in the Web of Science database.

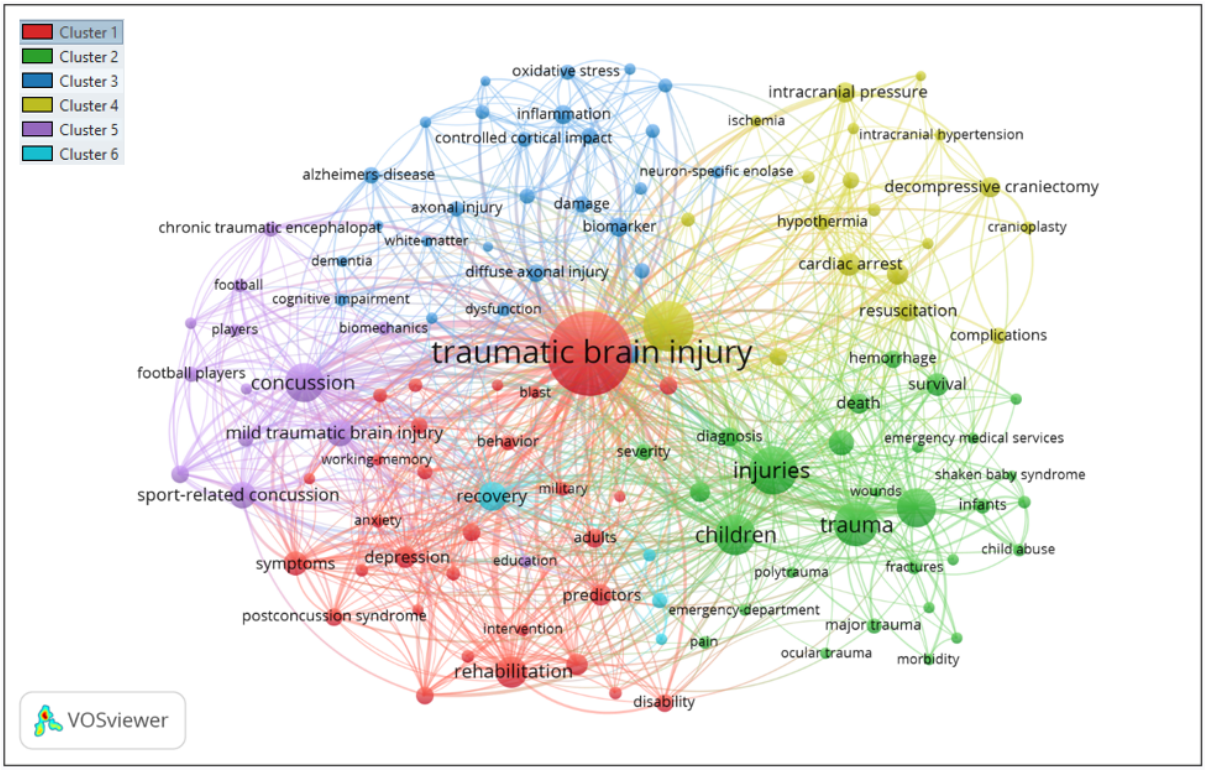

Figure 2: Visualization of the thematic map of research in the field of emergency medicine based on the documents indexed in the Web of Science database.

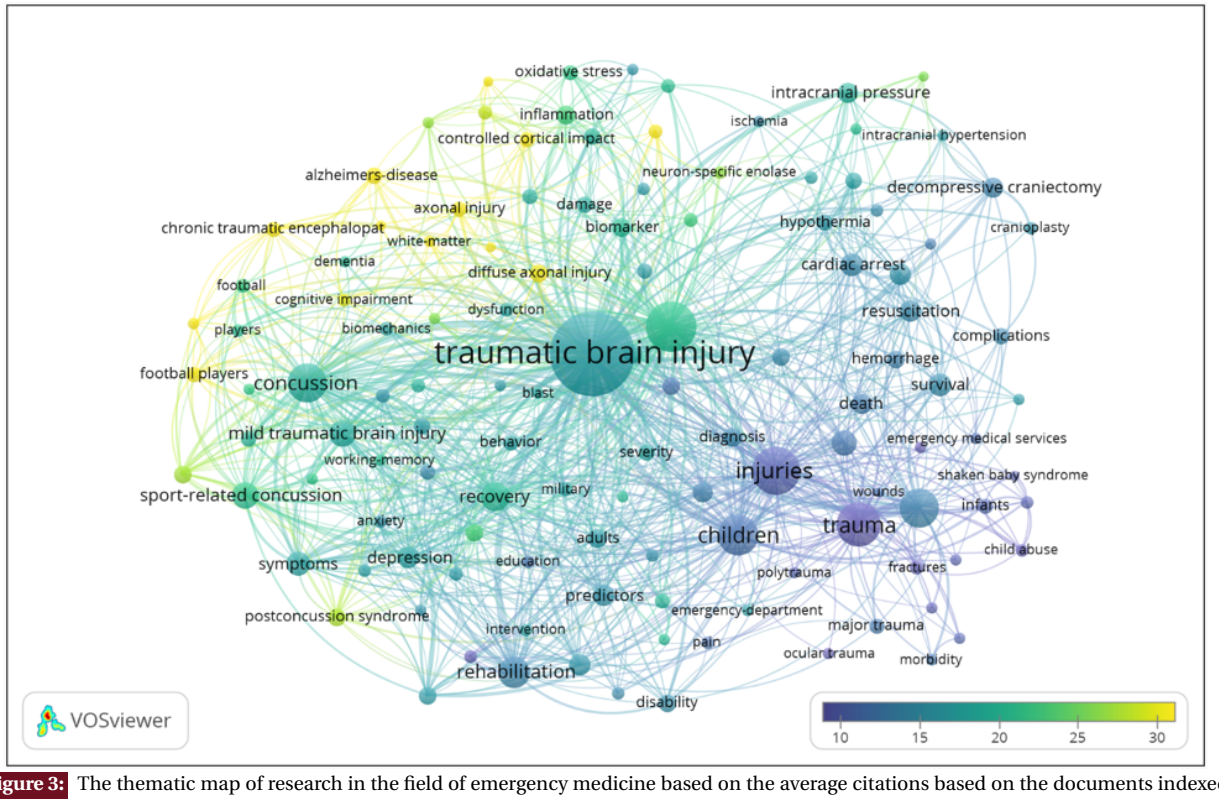

Figure 3: The thematic map of research in the field of emergency medicine based on the average citations based on the documents indexed in the Web of Science database.

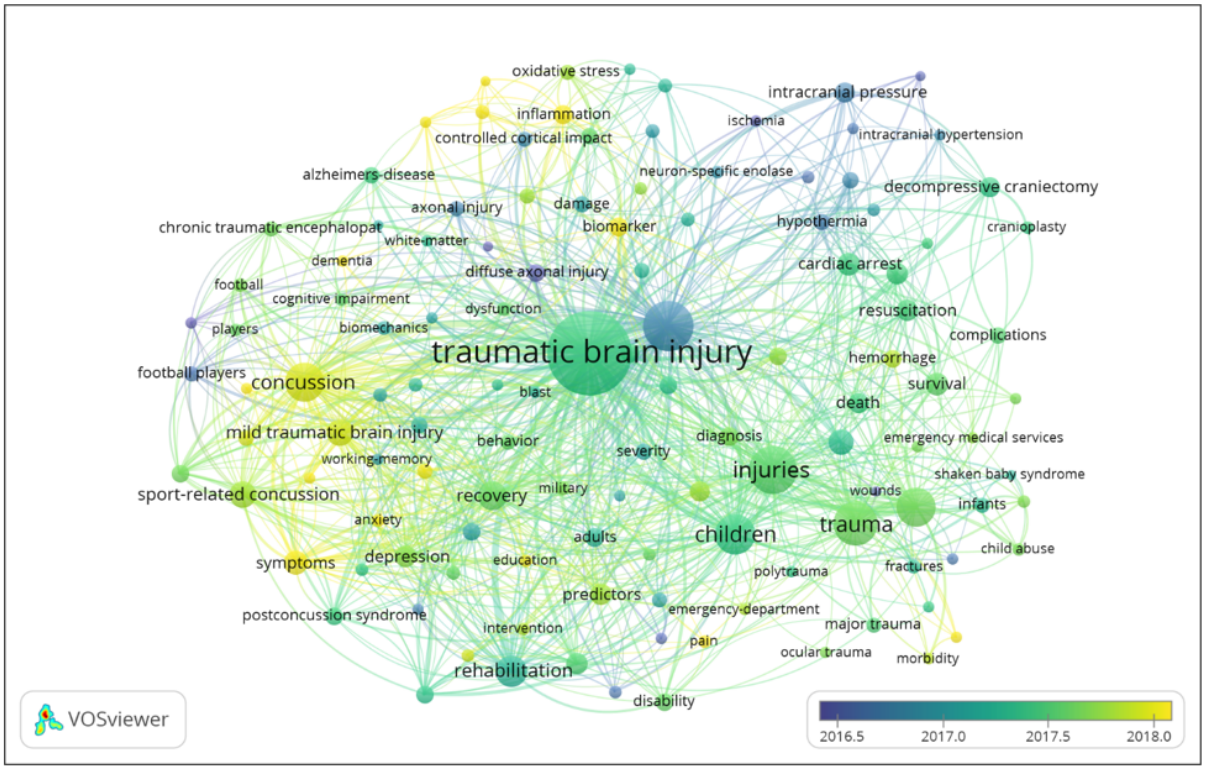

Figure 4: The thematic map of research in the field of emergency medicine based on the year of publication based on the documents indexed in the Web of Science database.