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Scientific productivity and Collaborative network analysis on Aerospace Medicine from Scopus database in Scientometric method during 2014 to 2023

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Abstract
Objective: To assessment the scientific productivity and collaborative network analysis on aerospace medicine literature required bibliographic data have been extracted from the Scopus database with the utilization of all field search strategies. The keyword “Aerospace Medicine” was used as a topic search with the objectives of the study. **Methods:** The scientometric method has been used in this research from 2014 to 2023. The bibliographic data was exported in plain text format for this research. Bibexcel, VOSviewer, Microsoft Excel and Word were employed for data analysis and visualization functions. **Results:** Totally 11630 bibliographic records have been extracted in the study. The productivity of aerospace medicine publications has an upward trend from 2014(708) 6.08% to 2023(1564) 13.76%. The annual growth rate has shown spikes in the years 2021 and 2016 with the count of 18.46 and 16.77 respectively. Wang X and Wang Y are notable collaborative authors in aerospace medicine publications; they collaboratively published 4 publications with 0.03%. The United States has published 4122(35.44%) publications with 71533 citations. **Conclusions**: Overall, the aerospace medicine publications are increased, and it shows the growth trend from 2014 to 2023. The results of the study will be useful for aerospace professionals to find out the hotspots and collaboration networks in the aerospace medicine domain.
Keywords: Aerospace Medicine. Scientific Productivity. Scopus. Scientometrics. Bibliometrics.

Productividad científica y análisis de redes colaborativas en Medicina Aeroespacial a partir de la base de datos Scopus en método Cienciométrico durante 2014 a 2023

Resumen
Objetivo: Para evaluar la productividad científica y el análisis de redes colaborativas sobre la literatura de medicina aeroespacial, los datos bibliográficos requeridos se han extraído de la base de datos Scopus con la utilización de todas las estrategias de búsqueda de campo. Se utilizó la palabra clave “Medicina Aeroespacial” como tema de búsqueda con los objetivos del estudio. **Método:** En esta investigación se ha

utilizado el método cienciométrico desde 2014 hasta 2023. Los datos bibliográficos se exportaron en formato de texto plano para esta investigación. Se utilizaron Bibexcel, VOSviewer, Microsoft Excel y Word para las funciones de análisis y visualización de datos. **Resultado:** En el estudio se han extraído un total de 11.630 registros bibliográficos. La productividad de las publicaciones de medicina aeroespacial tiene una tendencia ascendente desde 2014 (708) 6,08% hasta 2023 (1564) 13,76%. La tasa de crecimiento anual ha mostrado picos en los años 2021 y 2016 con un recuento de 18,46 y 16,77 respectivamente. Wang X y Wang Y son autores colaborativos notables en publicaciones de medicina aeroespacial; publicaron de forma colaborativa 4 publicaciones con un 0,03%. Estados Unidos ha publicado 4122 (35,44%) publicaciones con 71533 citas. **Conclusiones:** En general, las publicaciones sobre medicina aeroespacial aumentan y muestra la tendencia de crecimiento de 2014 a 2023. Los resultados del estudio serán útiles para que los profesionales aeroespaciales descubran los puntos críticos y las redes de colaboración en el dominio de la medicina aeroespacial.
Palabras clave: Medicina Aeroespacial. Productividad científica. Scopus. Cienciometría. Bibliometría.

Produtividade científica e análise de redes colaborativas em Medicina Aeroespacial a partir da base de dados Scopus no método Cientométrico durante 2014 a 2023

Resumo

Objetivo: Para avaliar a produtividade científica e a análise colaborativa de redes na literatura de medicina aeroespacial, os dados bibliográficos necessários foram extraídos da base de dados Scopus com a utilização de todas as estratégias de pesquisa de campo. A palavra-chave "Medicina Aeroespacial" foi utilizada como busca por tópico com os objetivos do estudo. **Método:** O método cienciométrico foi utilizado nesta pesquisa de 2014 a 2023. Os dados bibliográficos foram exportados em formato de texto simples para esta pesquisa. Bibexcel, VOSviewer, Microsoft Excel e Word foram empregados para análise de dados e funções de visualização. **Resultado:** No total foram extraídos 11.630 registros bibliográficos no estudo. A produtividade das publicações de medicina aeroespacial apresenta tendência ascendente de 2014(708) 6,08% a 2023(1564) 13,76%. A taxa de crescimento anual apresentou picos nos anos de 2021 e 2016 com a contagem de 18,46 e 16,77 respectivamente. Wang X e Wang Y são autores colaboradores notáveis em publicações de medicina aeroespacial; publicaram colaborativamente 4 publicações com 0,03%. Os Estados Unidos publicaram 4.122 (35,44%) publicações com 71.533 citações. **Conclusões:** No geral, as publicações sobre medicina aeroespacial aumentaram e mostram a tendência de crescimento de 2014 a 2023. Os resultados do estudo serão úteis para os profissionais aeroespaciais descobrirem os hotspots e redes de colaboração no domínio da medicina aeroespacial.
Palavras-chave: Medicina Aeroespacial. Produtividade Científica. Scopus. Cientometria. Bibliometria.

1 Introduction

One of the specializations under preventive medicine is aerospace medicine, which is concerned with the operational support, clinical care, and research related to the health, safety, and performance of air and space crew members and passengers. It has grown constantly year by year (Lim, 2012). Aerospace medicine is concentrated on the health and physiology of humans in high altitudes in space, moreover, it focuses on how to overcome the difficulties of human body tolerance while travelling in such an environment. Aerospace medicine operates at the convergence of exploration, science, technology, and medicine. It is global, multicultural, and multidisciplinary (Hodkinson *et al*., 2017). Space medicine as the practice of all aspects of preventive medicine including screening, health care delivery, and maintaining human performance in the extreme environment of space and preserving the long-term health of space travellers (Pool; Davit, 2007). A specialized field of preventive medicine called aerospace medicine, investigates the physiological and psychological strains that airplane travel places on

the human body (Shariati; Zareiy, 2009). The "Father of Space Medicine" Dr. Hubertus Strughold (1898 - 1986), he was the first and only Professor of Space Medicine in the U.S. Air Force. He first used the term "Space Medicine" in 1948. Aerospace Medicine School In 1950, he participated in the founding of the Aerospace Medical Association's Space Medicine Branch. The annual "Hubertus Strughold Award," established in 1963 by the Space Medicine Branch, is given in recognition of the finest accomplishment in space medicine (Campbell *et al*., 2007, p. 716). Furthermore, the Aerospace Medicine and Human Performance journal, published by the Aerospace Medical Association, caters to people interested in aircraft medicine and human performance. The organization aims to serve individuals who work, travel, or live in dangerous settings, from the sea to space. The Aerospace Medical Association is dedicated to humanitarian, educational, and scientific reasons. The Association was created in response to the growing demand for physicians with expertise in aviation. The Association now includes individuals from other areas and countries who share a concern for the health and safety of those working in hazardous environments, in addition to physicians (Aerospace Medical Association, 2024).

Scientometrics is one of the emerging fields in Library and Information Science, it is used for quantitatively measuring scientific publications. It has mainly focused on measuring the scientific literature outputs such as annual growth rate, authors productivity and collaborations, various disciplines, types of published documents, journal publications, frequently used keywords, affiliations contributions, funding sponsors, countries contributions, and language publications. The authors states that scientometrics is the application of that quantitative method which deals with the analysis of science viewer as an information process (Nalimov; Mulchenko, 1969). Therefore, the authors have employed the scientometrics analysis technique with the study purpose of scientific productivity and collaboration network on aerospace medicine through Scopus database from 2014 to 2023.

The review of the previous literature focused on four types of reviews such as scientometric, bibliometric, collaboration network analysis and research productivity related to aerospace medicine. In this study, the authors have adapted a scientometric analysis. Bibliometric analysis was also similar to scientometric analysis. Hence, bibliometric analyses are considered for collecting related literature on aerospace medicine. Scientometric literature is scarce on aerospace medicine. Therefore, the authors have selected to conduct the research in the scientometric method. First, the scientometric approach was applied by (Hancerliogullari, 2022) who examined a scientometric assessment of space medicine research productivity through Web of Science database from 1970 to 2021 fifty-one years of analysis. The author analyzed 746 publications productivity of yearly output, countries contribution, document

types, languages, affiliations, publishers and research areas. The keyword “Aerospace Medicine” was searched in the database to collect the required data. This article is known as the first scientometric study in aerospace medicine literature. The findings of their study show that a huge number of documents were published in 2020, and these publications have increased from 2010 to 2021. Articles are the most preferred document type in this study and China has been identified as the most productive country in the study. Moreover, English is the most used language in the study. Similarly, (Shugart, 2009) researched the development of space medicine professional literature with the utilization of qualitative methods in China. The Space Medicine and Medical Engineering Journal; China’s eminent space medicine journal has been used for collecting the required data for the study. Furthermore, the TiROS sequential analytical paradigm was also used for collecting the datasets. A total of 2000 data were analyzed by descriptive statistical methods to assess China’s space medicine development. Likewise, (Zhang *et al*., 2017) explored ten years 2007 to 2016 of bibliometric analysis on military health and medicine publications based on a Web of science database with the analysis of knowledge mapping and visualization. For this analysis, 7921 published literatures were collected. Moreover, the data used for analyzing the co-citation analysis. For the co-citation analysis, CiteSpace III java-based software was employed. Furthermore, cluster analysis has been performed to evaluate the author's networks and institutions' collaborative networks. The authors found that the annual publication trend has increased constantly. The Uniformed Services University of the Health Science, the United States Army has found that the top in the institution’s publications. Likewise, (Eito-Brun; Ledesma Rodriguez, 2016) carried out bibliometric exploration on space research in the Europe Space Agency’s scientific production. The necessary data for the study has been collected from the Scopus database from 1964-2014. For the bibliographic data analysis, BibExcel and VOSviewer bibliographic software were used for identifying the co-citation, bibliographic coupling cluster analysis and visualization. Additionally, (Rangoli; Laxminarsaiah, 2015) investigated the collaboration and authorship pattern on aerospace technology publications in scientometric method. The main objectives of the study were testing Lotka’s law of authors productivity, and degree of collaboration and identifying the eminent authors in the field of aerospace technology. There are three print versions of spacecraft journals selected for the collection of required data from 2001 to 2011. 1907 publication has been published in 154 volumes. The results of the study reveal that the 1907 publication was contributed by 4344 authors and the Journal of Spacecraft and Rockets has published the majority of publications. The *Journal of Spacecraft Technology* has identified a high degree of collaboration. Loka’s author's productivity was tested partially. In addition, (Taskın; Aydinoglu, 2015) scrutinized a bibliometric assessment of NASA Astrobiology Institute’s

(NAI) collaboration research in astrobiology from 2008 to 2012. Furthermore, the study has focused on co-authorship patterns, journal contributions, international institutions collaborations, and scholarly citation counts. Based on the NAI annual report, a total of 1210 peer-reviewed publications were analyzed in the study. The authors have concluded that from the findings of the study are researchers mostly interested in publishing their work in high-impact multidisciplinary journals. Astronomy and astrophysics disciplines are mostly preferred for publications and researchers Insist that astrobiology disciplines be considered for further research. Furthermore, (Restrepo-Arango, 2024) used Scopus database indexed literature on the theme of the choco department of choco (Colombia) research. The main keywords Choco and Colombia have been applied to search for collecting data. All data were retrieved in the endnote format with the inclusion of bibliographic details of the documents. RStudio software has been used for the analysis of the data. 668 records were extracted. Especially, Colombia, and Choco are the main and frequently appeared keywords of the study. In conclusion, the frequently used keywords such as mining, biodiversity, climate change, tropical forest, and the Pacific Ocean need further concerns in this theme for conducting research. (Penkova; Carlos, 2023) conducted a study on scientific productivity in library and information science in Puerto Rico from 1961 to 2020. The authors adopted the bibliometric technique for this study. There authors have analyzed the scientific productivity of authors, literature dissemination and dispersion, languages and areas of research. Scientific productivity results show ECOSUR fluctuation with low productivity. The findings of the study reveal that Puerto Rico's scientific production has followed notable trends in Latin American and Caribbean religions. Also, (De Jesus-Navarrete *et al*., 2023) examined the visibility and research productivity of El Colegio de la Frontera sur: 26 years of multidisciplinary research in Southeastern Mexico. This study has evaluated ECOSUR's institutional scientific productivity based on the Web of Science database from 1995 to 2020. Totally 3753 articles were identified, and it has been calculated as a growth trend. Moreover, in the year 2018, published a large number of articles 336 and the English language has contributed high range of publications. Journal articles were published 60% with an impact factor of one. (Martinez-Comeche; Juan-Antonio, 2023) analyzed the Twenty-five years of (1997-2021) social network evolution research based on the latent Dirichlet allocation. The Scopus database was used in the study for data collection. Totally seven themes are selected for the analysis. Finally, the study results show that the social media and social networks online themes have taken with some intensity in the previous studies. Eventually, (Sema *et al*., 2023) tested the Lotka's model on the scientific productivity of National University of Asuncion (UNA) researchers. 2015 to 2020 was the selected period in Paraguayan journals, where 627 documents have been collected from 15 journal titles. It has been collected in SciELO in the

disciplines of social sciences, medical and health sciences, veterinary and agricultural sciences. In the four disciplines, the authors tested Lotka's model for authors' productivity. The field of aerospace medicine is a novel and emerging topic in the field of aerospace and there is limited literature published in this field. Hence the authors have conducted a scientometric study in the field of aerospace medicine to find out the scientific productivity and its collaboration networks from 2014 to 2023 through Scopus database.

2 Methodology

This scientometric study has utilized the Scopus database to obtain the required data for the study analysis. In the document search field, the authors selected all field's search strategies. The "Aerospace Medicine" keyword has been used for collecting data from 2014 to 2023. The data collection process was carried out on 10th March 2024. A Total of 11630 documents were found in the study. It has 7976 research articles, 1425 review articles, 989 conference papers, 525 book chapters, 214 notes, 174 letters, 124 editorials, 115 books, 43 errata, retracted 8 and data papers 3. In the document search, authors exported bibliographic details in plain text format. In this study data analysis functions are employed by Bibexcel software (Persson *et al*., 2009). Moreover, visualization functions are employed by VOSviewer software (Van Eck; Waltman, 2017). Thereafter, Microsoft Word and Excel were used for further mathematical and statistical analysis.

3 Results and discussions

Year-wise publications and annual growth rate

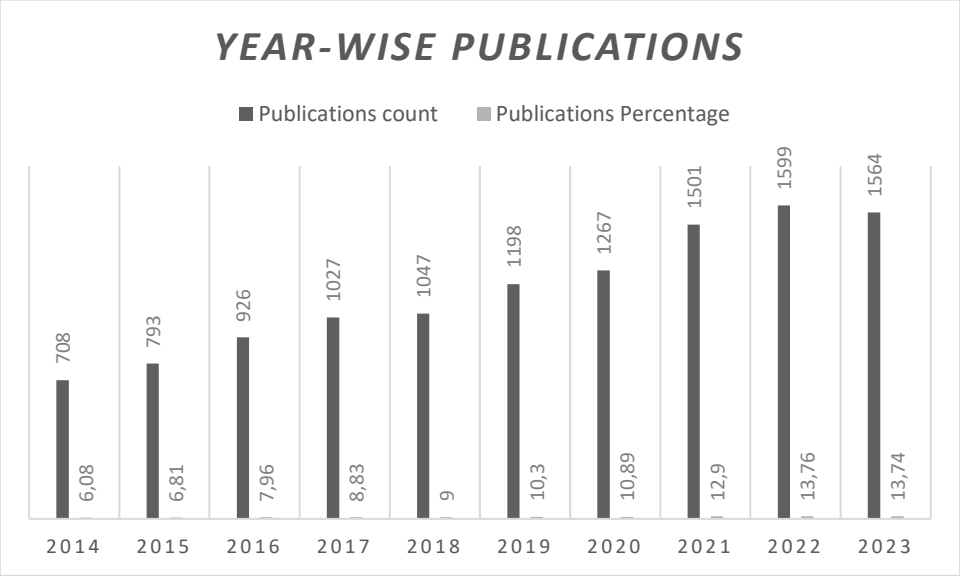
Table 1 - Year-wise publications and annual growth rate

S. No	Year	Publications count	Cumulative	Publications percentage	Cumulative percentage	Annual growth rate
1	2014	708	708	6.08	6.087	0
2	2015	793	1501	6.81	12.90	12.00
3	2016	926	2427	7.96	20.86	16.77
4	2017	1027	3454	8.83	29.69	10.90
5	2018	1047	4501	9.00	38.70	1.94
6	2019	1198	5699	10.30	48.65	14.42
7	2020	1267	6966	10.89	59.89	5.75
8	2021	1501	8467	12.90	72.80	18.46
9	2022	1599	10066	13.76	86.55	6.52
10	2023	1564	11630	13.74	100	-2.18
	Total	11630		100		

Table 1andFigure 1 represent the year-wise publications and annual growth rate over ten years from 2014 to 2023. The computed data reveals a consistent upward trend in

publications count, cumulative count and percentage from 2014(708) 6.08% to 2023(1564) 13.76%. The annual growth rate shows spikes in the years 2021 and 2016 with the count of 18.46 and 16.77 respectively. However, it is important to note that in 2023, there is a negative growth rate (-2.18%), indicating a slight decline in publication output compared to the previous years. This could be due to various factors such as shifts in research priorities, funding constraints, or other external influences. Overall, the data reveals a steady growth and occasional fluctuations in publications output.

Figure 1. Year-wise publications



Most eminent author's publications

Table 2 - Most eminent author's publications

S. No	Author	Publications	Percentage	Author's country
1	Rittweger, J.	168	1.44	German
2	Jordan, J.	143	1.22	German
3	Murad. M.H.	115	0.98	United States
4	Moeller, R.	98	0.84	United States
5	Tank, J.	81	0.69	United States
6	Rettberg, P.	78	0.67	German
7	Tang, Y.	61	0.52	South Australia
8	Jiang, S.	61	0.52	China
9	Hemmersbach, R.	57	0.49	China
10	Zhang, X.	55	0.47	Hong Kong
11	Other authors	10713	92.11	
	Total	11630	100	

Table 2 depicts the most eminent author's publications along with the percentage and their respective countries. The author Rittwegar, J. from Germany is the leading author in aerospace medicine publications with 168 publications, contributing 1.44%. Following Jordan, J. from Germany who has published 143 publications with 1.22% in second position. Furthermore, Murad, M.H, Moeller, R. and Tank, J from the United States were published in 115, 98, and 81 publications with third, fourth and fifth positions respectively. The rest of the authors have published less than 78 publications with 0.67%.

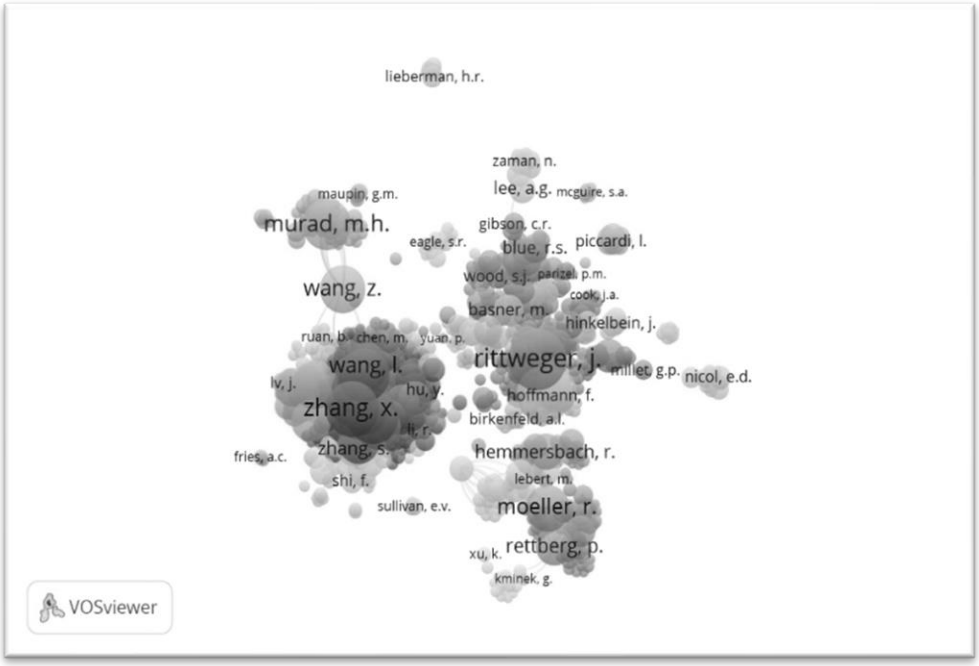
Collaborate author's network

Table 3 - Collaborate author's network

S. No	Author	Collaborate with	Publications	Percentage
1	Wang X	Wang Y	4	0.03
2	Wang J	Wang Y	3	0.02
3	Wang Y	Zhang J	3	0.02
4	Liu J	Wang J	3	0.02
5	Liu J	Zhang J	3	0.02
6	Wang Y	Zhang Y	3	0.02
7	Wang J	Wang X	3	0.02
8	Wang Y	Zhang L	3	0.02
9	Liu J	Zhang Y	3	0.02
10	Li J	Zhang J	3	0.02

Table 3 and Figure 2 indicate the collaborative authorship relationships and associated publication statistics in aerospace medicine literature. The data represented the multiple author's contributions predominantly, three authors contributed huge numbers of publications. Several authors emerge as central figures within the collaborative network, including Wang X, Wang J, Wang Y, Liu J, Zhang J, Zhang Y, and Zhang L. These authors have contributed to multiple collaborations. Collaboration between Wang, Liu, and Zhang demonstrates a diverse exchange of expertise and perspective. Wang X and Wang Y are notable collaborative authors in aerospace medicine publications they; collaboratively published 4 publications with 0.03%. Other authors collaboratively published 3 publications with 0.02%.

Figure 2**.** Collaborate author's network



Document type-wise publications

Table 4 - Document type-wise publications

S. No	Document Type	Publications	Percentage
1	Article	7976	68.58
2	Review	1425	12.25
3	Conference paper	989	8.50
4	Book chapter	525	4.51
5	Note	214	1.84
6	Letter	174	1.49
7	Editorial	124	1.06
8	Book	115	0.98
9	Erratum	43	0.36
10	Short survey	34	0.29
11	Retracted	8	0.06
12	Data paper	3	0.02
	Total	11630	100

Table 4 Implies the document type-wise publications of aerospace medicine literature. Articles are the predominant document type, comprising 68.58% of the total publications. Followed by reviews and conference papers also constitute substantial proportions of the total publications, accounting for 12.25% and 8.50% respectively. Furthermore, other document types such as book chapters, notes, letters, editorials, books, errata, short surveys, data papers, and retractions collectively contributed to a smaller percentage. Overall, the document type-

wise publications reflect the diverse forms of scholarly communications and the dynamic nature of academic publishing within aerospace medicine publications.

Source title type-wise publications

Table 5 - Source title type-wise publications

S. No	Source Title	Publications	Percentage	CS (2022)	JIF (2022)
1	*Aerospace Medicine and Human Performance*	1554	13.36	1.1	0.23
2	*Frontiers in physiology*	222	1.90	6.1	1.00
3	*Proceedings of the International Astronautical Congress Iac*	145	1.24	0.5	0.20
4	*Military medicine*	141	0.12	2.4	0.37
5	*PLoS ONE*	134	1.15	6.0	0.91
6	*Scientific Reports*	127	1.09	7.5	1.06
7	*Aviation Space and Environmental Medicine*	107	0.92	0.889	0.21
8	*International Journal of Environmental Research and Public Health*	106	0.91	5.4	0.66
9	*Aviakosmicheskaya I Ekologicheskaya Meditsina*	98	0.84	1.23	0.56
10	*Journal of Applied Physiology*	92	0.79	6.1	1.12
	Other Sources	8904	76.56		
	Total	11630	100		

Table 5 presents the source title type-wise aerospace medicine publications, corresponding percentages, Cite score (CS), and Journal impact factors (JIF) for the year 2022. The productive journal, Aerospace Medicine and Human Performance has published 1554 publications with 13.56% and 1.1 Cite score, 0.23 Journal impact factor. Frontiers in Physiology journal has published 222 publications with 11.90% and a 6.1 Cite score 1.00 Journal impact factor. Moreover, the scientific report journal had a 7.5 Cite score, the highest Cite score obtained, and 1.06 Journal impact factor; it has published 127 publications with 1.09%. In

Journal impact factor measurements, the Journal of Applied Physiology has obtained a 1.12 Journal impact factor than other source titles in aerospace medicine publications.

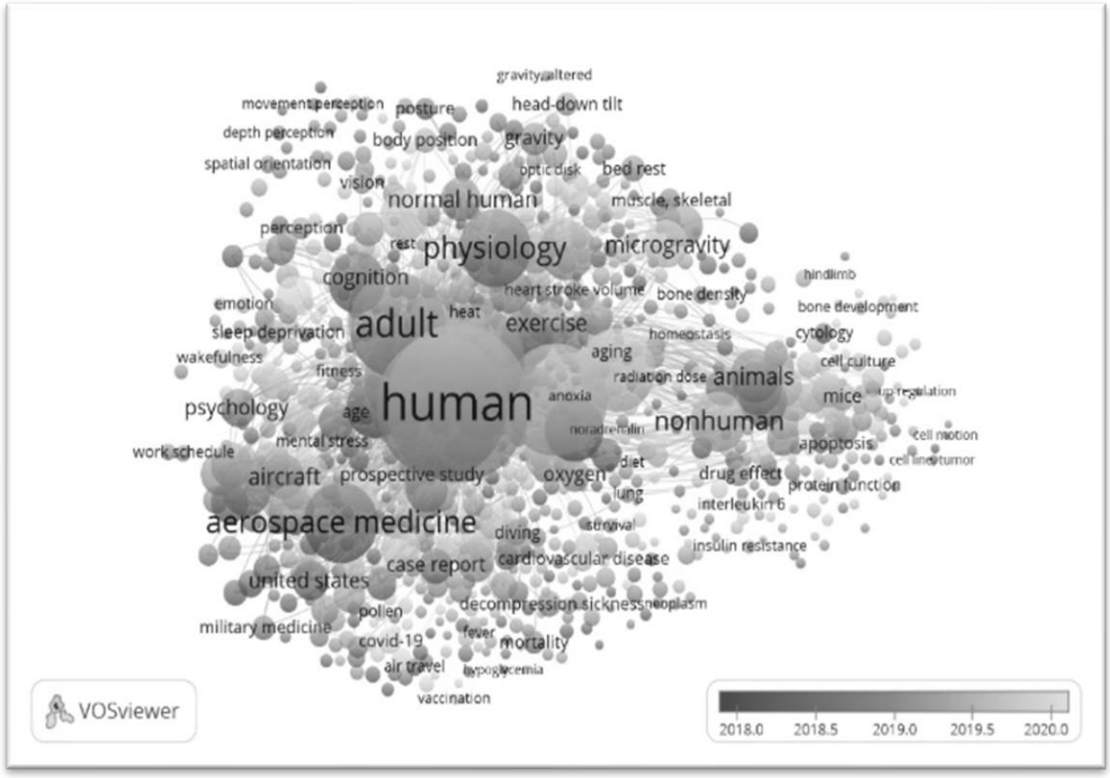
Frequently used keywords

Table 6 - Frequently used keywords

S. No	Keyword	Used Count
1	Human	6663
2	Humans	5438
3	Male	3503
4	Adult	3387
5	Female	2951
6	Controlled study	2328
7	Aerospace medicine	1874
8	Physiology	1757
9	Priority journal	1627
10	Middle age	1112

Table 6 and Figure 3 represent the frequently used keywords and their counts. The human keyword has been used 6663 times and Humans 5438 times; these two keywords were used frequently in aerospace medicine publications. It indicates a strong emphasis on human-centric research. Followed by the keywords Male 3503 times and Female 2951 times were used, which implies investigations into gender-specific phenomena or the consideration of gender as a variable in aerospace medicine publications. Especially, the Aerospace medicine keyword was used 1874 times in aerospace medicine publications, it focuses on medical issues or research pertinent to the aerospace environment. It could encompass studies related to the physiological effect of space travel, astronaut health, or aviation medicine. Overall, the findings of the frequency distribution of these keywords provide valuable insights into the thematic priorities in aerospace medicine publications. Also, it provides concrete ideas to investigate new disciplines or strengthen existing disciplines.

Figure 3. Frequently used keywords



Affiliations-wise publications

Table 7 - Affiliations-wise publications

S. No	Affiliation	Publications	Percentage	Affiliation located county
1	Deutsches Zenturum Fur Luft-Und Raumfahrt (DLR)	954	8.20	Federal Republic of Germany
2	The Fourth Military Medical University	520	4.47	China
3	NASA Johnson Space Center	303	2.60	United States
4	Universitat Zukoln	250	2.14	Germany
5	Ministry of Education of the People's Republic of China	247	2.12	China
6	U.S. Air Force School of Aerospace Medicine	239	2.05	United States
7	Mayo Clinic	237	2.03	United States
8	Wright-Patterson Air Force Base	237	2.03	United States
9	Institute for Biomedical Problems, Russian Academy of Sciences	190	1.63	Russia
10	Harvard Medical School	177	1.52	United States
	Other Affiliations	8276	71.16	
	Total	11630	100	

Table 7 shows the affiliations-wise publications in the field of aerospace medicine publications, their percentage, and the country where each country is located. Deutsches Zentrum Fur Luft-Und Raumfahrt (DLR) is the leading affiliation with 954 publications, accounting for 8.20% of the total. It is located in Germany. The Fourth Military Medical University and the Ministry of Education of the People's Republic of China have significant contributions to aerospace medicine publications with 520(4.47%) and 247(2.12%) respectively. The United States has contributed a significant publication, from NASA Johnson Space Center 303 publications with 2.60%, U.S. Air Force School of Aerospace Medicine 239 publications with 2.05%. Furthermore, various affiliations have contributed from the United States, Russia and Germany in aerospace medicine publications.

Funding sponsors-wise publications

Table 8 - Funding sponsors-wise publications

S. No	Funding Sponsor	Publications	Percentage	Sponsored country
1	National Natural Science Foundation of China	650	5.58	China
2	National Aeronautics and Space Administration	479	4.11	United States
3	National Institute of Health	330	2.83	United States
4	Deutsches Zentrum Fur Luft-Und Raumfahrt	302	2.59	German
5	European Space Agency	197	1.69	Europe
6	U.S. Department of Defence	161	1.38	United States
7	National Science Foundation	119	1.02	United States
8	Deutsche Forschungsgemeinschaft	99	0.85	Germany
9	National Key Research and Development Program of China	89	0.76	China
10	National Heart, Lung, and Blood Institute	83	0.71	United States
	Other funding sponsors	9121	78.42	
	Total	11630	100	

Table 8 indicates the Funding sponsors-wise publications in aerospace medicine publications along with the percentage and their countries. The National Natural Science Foundation of China has published 650 publications with 5.58%. It was the leading funding sponsor in China. It indicates a strong emphasis on research and development in China. The National Aeronautics and Space Administration has published 479 publications with 4.11% and it is located in the United States. It is a major player in funding research, particularly in the field

of aeronautics and space. Likewise, the National Institute of Health, also located in the United States, has published 330 publications with 2.83%. Moreover, funding sponsors from Germany, Europe, and China contributed a crucial role in advancing scientific knowledge in aerospace medicine publications.

Language-wise publications

Table 9 - Language-wise publications

S. No	Language	Publications	Percentage
1	English	11067	95.15
2	Chinese	259	2.22
3	Russian	179	1.53
4	German	37	0.31
5	Spanish	20	0.17
6	Persian	13	0.11
7	Japanese	12	0.10
8	French	9	0.07
9	Portuguese	8	0.06
10	Polish	5	0.04
	Other languages	21	0.18
	Total	11630	100

Table 9 presents the language-wise publications of aerospace medicine literature. English is the primary language in aerospace medicine publications with 11067(95.15%). Non-English languages like Chinese 259(2.22%), Russian 179(1.53%), German 37(0.31%), Spanish 20(0.17%) and other languages contributed a smaller number of publications. Overall, the results show that the English language plays a crucial role in aerospace publications than other languages.

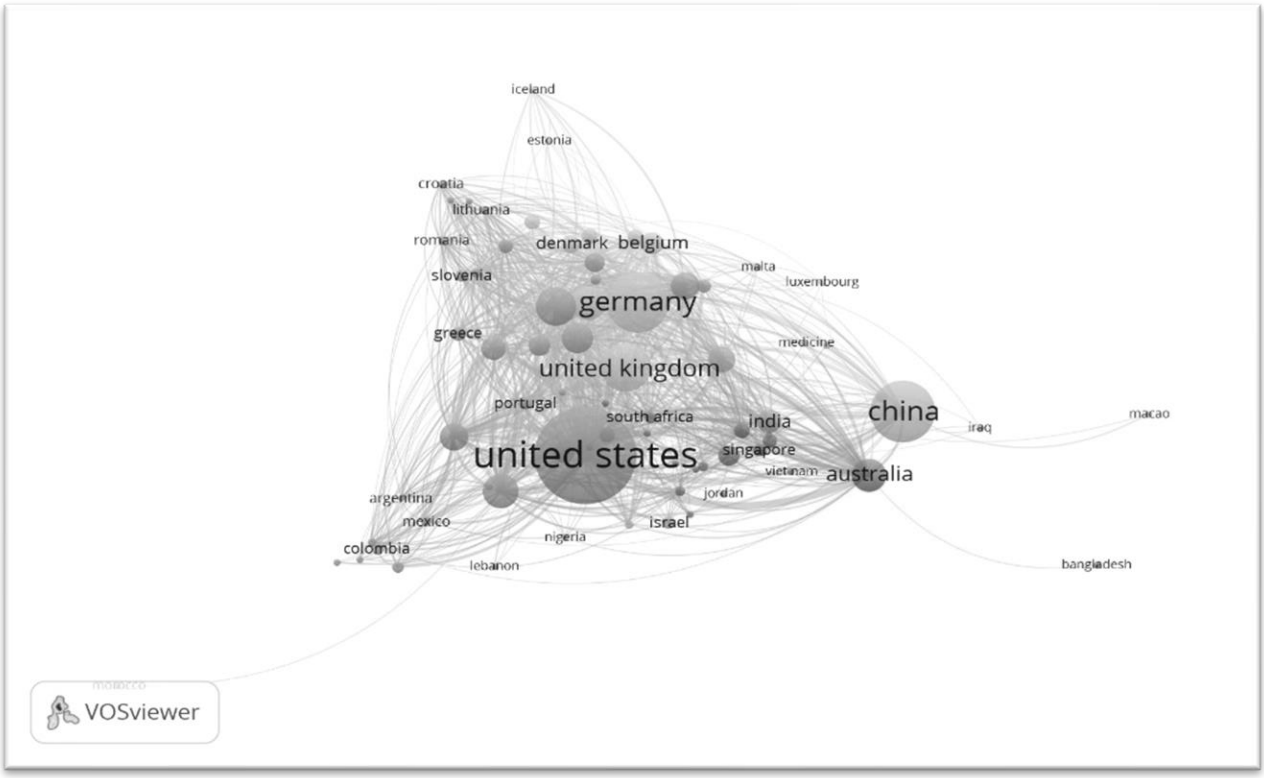
Country-wise publications

Table 10 - Country-wise publications

S. No	Country	Publications	Percentage	Citations
1	United States	4122	35.44	71533
2	China	1647	14.16	18871
3	Germany	1602	13.77	26602
4	United Kingdom	1034	8.89	16734
5	Italy	640	5.50	12228
6	France	527	4.53	9051
7	Canada	525	4.51	9151
8	Australia	490	4.21	8756
9	Russian Federation	412	3.61	3087
10	Netherland	335	2.88	6165

Table 10 and Figure 4 depict the country-wise publications of aerospace medicine, including their percentage, and citations. The United States has published significantly in both the number of publications, 4122 and citations 71533 accounting for 35.44% of the total publications. China has the second highest number of publications 1647, but the citations of 18871 are lower than other countries like the U.S. 71533 and Germany 26602. Germany has published 1602 lowest publications, but it has more significant citations 26602 than China. Furthermore, other countries published less than 1000 publications in aerospace medicine publications.

Figure 4. Country-wise publications



Subject area-wise publications

Table 11 - Subject area-wise publications

S. No	Subject area	Publications
1	Medicine	6818
2	Engineering	1993
3	Biochemistry, Genetics, and Molecular Biology	1929
4	Computer Science	980
5	Physics and Astronomy	852
6	Neuroscience	831
7	Social Sciences	705

8	Psychology	560
9	Agriculture and Biological Sciences	558
10	Health Professions	508

Table 11 presents the subject area-wise publications of aerospace medicine literature. Medicine subject area has the highest number of publications 6818, which indicates a strong research focus in researchers and funding in the medical field. Engineering 1993 publications and Life sciences such as Biochemistry, Genetics, and Molecular Biology were published in 1929 publications respectively. Other subject areas like Computer science, Physics and Astronomy, Neuroscience and Social sciences were published in less than 1000 publications in aerospace medicine publications.

4 Conclusion

Scientific productivity and collaborative network analysis on aerospace medicine research have been conducted through the Scopus database in a scientometric approach from 2014 to 2023. From the study results, the productivity of aerospace medicine such as year-wise publications were found in growing trend from 2014(708) to 2023(1564) and the annual growth rate was found with some fluctuations in the study period from 2014 to 2023. The author Rittweger, J. has been identified as the most eminent author in aerospace medicine publications. In collaborative authors networks, the authors Wang X and Wang Y collaboratively published 4 publications with 0.03 per cent. The article is the most used document type in aerospace medicine publications, 7976 articles were published in the study period. Aerospace medicine and human performance sources have published the most numbers of 1554 articles with 13.36%. Human keyword 6663 has been used more frequently in aerospace medicine publications than aerospace medicine keyword 1874. Deutsches Zentrum Fur Luft-Und Raumfahrt (DLR) in Germany has been identified as the most contributed affiliation, it was published in 954 publications with 8.20%. National Natural Science Foundation of China is the prominent funding sponsor in aerospace medicine publications, it has published 650 publications with a percentage of 5.58. English is the predominant language in aerospace medicine publications, it has contributed to 11067(95.15%) publications. The United States is the most productive country, it has published 4122(35.44%) publications than other countries. Medicine subject area was involved in most of the publications in aerospace medicine, it accounted for 6818 publications. This scientometric assessment will be helpful for aerospace medicine professionals, researchers, practitioners, policymakers, and governments for forecasting purposes, to find out the hotspots in aerospace medicine, and to make the right decision in the aerospace medicine discipline. In conclusion, the authors have suggested that

this research can be expanded with the consideration of other databases like PubMed and Web of Science with different period limitations, approaches and themes. These are the authenticated databases, that provide the authenticated information to conduct further scientometric studies.

References

CAMPBELL, M. R.; Mohler, S. R.; Harsch, V. A.; Baisden, D. Hubertus strughold: the father of space medicine. **Aviation, Space and Environmental Medicine,**v. 78, n.7, p. 716-719, 2007.

EITO-BRUN, R.; LEDESMA RODRIGUEZ, M. 50 years of space research in Europe: a bibliometric profile of the European Space Agency (ESA).**Scientometrics**, v. 109, n. 1, p. 551-576, 2016. https://doi.org/10.1007/s11192-016-2053-8

HANCERLIOGULLARI, K. Ö. A scientometric analysis of space medicine. **Politeknik Dergisi**, v.25, n. 1, p. 405-410, 2022. https://doi.org/10.2339/politeknik.1015295

HODKINSON, P. D.; Anderton, R. A.; Posselt, B. N.; Fong, K. J. An overview of space medicine. **British Journal of Anaesthesia**, v. 119, n. suppl_1, p. 143-153, 2017. https://doi.org/10.1093/bja/aex336

JESUS-NAVARRETE, A. de; Gomez-Morales, J. S.; Zacarias-de-León, G.; Jacobson, B. Scientific productivity and visibility from El Colegio de la Frontera Sur: 26 years of multidisciplinary research in Mexico. **Library Research: archiving, library science and information,** v. 37, *n.* 95, p. 13-33, 2023. https://dx.doi.org/10.22201/iibi.24488321xe.2023.95.58710

LIM, J. Introduction to aerospace medicine. **Journal of the Korean Medical Association**, v. 55, n. 7, p. 649-659, 2012. https://doi.org/10.5124/jkma.2012.55.7.649

MARTINEZ-COMECHE.; J. A. Twenty-five years of research in social networks: evolution of topics between 1997 and 2021 using the algorism Latent Dirichlet Allocation. **Archival science, library science and information***,* v. 37, n. 96, p. 145-177, 2023. https://dx.doi.org/10.22201/iibi.24488321xe.2023.96.58777

NALIMOV, V. V.; MULCHENKO, B. M. **Scientometric Studies of Science as a Process of Information.** Moscow, Russia: Science, 1969.

PENKOVA, S.; CARLOS, S. B. Scientific productivity in library science and information science in Puerto Rico (1961-2020). **Investigacion Bibliotecologica**, v.37, n. 97, p. 135-152, 2023.

PERSSON, O.; Danell, R.; Schneider, J. How to use bibexcel for various types of bibliometric analysis. **Celebrating scholarly communication studies: A Festschrift for Olle Persson at his 60th Birthday,** v. 5, p. 9-24, 2009.

POOL, S. L.; DAVIS, J. R. Space medicine roots: a historical perspective for the current direction. **Aviation, space, and environmental medicine,** v.78, n. 4, p. A3-A4, 2007.

RESTREPO-ARANGO, C. Identification of the research themes of Choco in the literature indexed in Scopus. **Investigacion Bibliotecologica**, v. 38, n. 98, p. 99-120, 2024.

SEMA, K. Scientific productivity of researchers from the National University of Asuncion (UNA): verification of the Lotka model. **Library Science Research and Information***,* v. 37, n. 96, p. 170-200, 2023.

SHARIATI, S. H.; ZAREIY, S. History of aerospace medicine. **Ebnesina**, v. 12, n. 2, p. 28-31, 2009. https://www.asma.org/journal

TASKIN, Z.; AYDINOGLU, A. U. Collaborative Interdisciplinary astrobiology research: a bibliometric study of the Nasa Astrobiology Institute. **Scientometrics,** v**.** 103, n. 3, p. 1003-1022, 2015.

VAN ECK, N. J.; WALTMAN, L. Citation-based clustering of publications using citnetexplorer and vosviewer. **Scientometrics,** v.111, p. 1053-1070, 2017. https://doi.org/10.1007/s11192-017-2300-7

ZHANG, X. M.; Zhang, X.; Luo, X.; Guo, H. T.; Zhang, L.; Guo, J. W. Knowledge mapping visualization analysis of the military health and medicine papers published in the web of science over the past 10 years. **Military Medical Research**, v. 4, p. 1-10, 2017. https://doi.org/10.1186/s40779-017-0131-8