

Exploration of Ways to Improve Medical International Educational Exchange Ability: A Bibliometric Study

Yang Wu^{1†}, Miaoran Wang^{2†}, Ranran Zhao^{3*}, Xiaolin Ma^{4*}

¹Institute of Information on Traditional Chinese Medicine, China Academy of Chinese Medical Sciences, Beijing 100700, China

²Xiyuan Hospital, China Academy of Chinese Medical Sciences, Beijing 100091, China

³Graduate School of China Academy of Chinese Medical Sciences, Beijing 100700, China

⁴Institute of Chinese Materia Medica, China Academy of Chinese Medical Sciences, Beijing 100700, China

[†]These authors contributed equally to this work and shared first authorship.

**Authors to whom correspondence should be addressed.*

Copyright: © 2026 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract: Medical research and human health are deeply connected, and international medical exchanges play an important role in raising research level. This study employs bibliometric and visual analytic approaches to identify effective strategies for improving international medical collaborations. We retrieved relevant literature from the Web of Science Core Collection, including SCI-Expanded, SSCI, CPCI-S, and CPCI-SSH databases, covering the period 1992–2022. CiteSpace software was utilized to generate knowledge visualization maps. A total of 443 articles were included in the analysis. The number of publications related to international educational exchange in medicine has grown steadily over time. Keyword co-occurrence analysis identified “international educational exchange,” “higher education,” “healthcare,” and “global health” as the most prevalent terms. Remote online training has emerged as a prevalent modality for international educational exchange and cooperation. Technologies leveraging computer networks for platform-based learning have attained increasing sophistication. Future international collaboration will be characterized by openness, resource-sharing, diversity, and digitalization (intelligence).

Keywords: Medical education; International exchange; Ability improvement; Bibliometrics analysis; Remote online training

Online publication: May 28, 2026

1. Introduction

The improvement of medicine is one of the important symbols of the progress of human social civilization.

The level of medical research is directly associated with human health, and promoting international medical exchanges is an important aspect to promote the level of medical research. During the COVID-19 pandemic, people can conduct international medical educational exchanges online, such as the International Synchronous Hybrid Learning Experience ^[1].

However, it has formed some obstacles to the international educational exchange of offline medical research. For instance, the COVID-19 pandemic affected the delivery of some vaccinology courses, which were subsequently held online or in hybrid mode ^[2]. It is necessary to strengthen capabilities for international exchanges in medical education and promote global health cooperation. However, there are few articles about how to improve medical international educational exchange ability.

Additionally, due to the rapid development of medicine, it is meaningful to improve the ability of medical researchers by obtaining the latest medical research progress in a timely manner through more appropriate medical international educational exchange paths.

2. Methods

In this study, we adopted the method of bibliometric study for statistical mining analysis. We mainly collected articles related to medical international education and communication on WoS and manually screened them, then applied CiteSpace to collect medical international education and communication articles from 1992 to 2022 to analyze the research hotspots of medical international education and communication during the past 30 years.

2.1. Data collection

The retrieval strategy of this paper is to select the core collection in the Web of Science, Science Citation Index Expanded (SCI-Expanded) from 1900 to 2022, Social Sciences Citation Index (SSCI) from 1983 to 2022, Conference Proceedings Citation Index–Science (CPC-S) from 1996 to 2022 and Conference Proceedings Citation Index–Social Science & Humanities (CPC-SSH) from 1996 to 2022, the customized search formula is “TS = international educational exchange.” The results show that there are 782 articles. Then, the articles related to medical treatment and education are manually screened in the Web of Science category. As a result, there are 443 related articles from 1992 to 2022.

2.2. Data analysis

Microsoft Excel 2007 and CiteSpace software are used for trend analysis and visualization. CiteSpace software is a citation visualization and analysis software based on scientometrics and data visualization. It was developed by Prof. Chen Chaomei of Drexel University using Java language.

We used Microsoft Excel 2007 to analyze the trend of 443 publications from 1992–2022. We also used CiteSpace for visualization, such as co-authorship analysis, co-citation analysis of references, co-citation analysis of authors, co-occurrence analysis of keywords, etc.

2.3. Ethics statement

This article is based on previously conducted studies and does not contain any new studies with human participants or animals performed by any of the authors.

3. Results

3.1. The trend of publications

The trend of publications reflects the research enthusiasm of people on international educational exchange related to medicine and education in recent years. According to **Figure 1**, during the period from 1992 to 2022, before 2005, there were less than 6 articles per year. From 2005 to 2017, the number of articles published was more than 8, reaching the highest in 2018, with a total of 48 articles. From 2019 to 2022, the number of articles decreased steadily which was estimated to be affected by the COVID-19 epidemic.

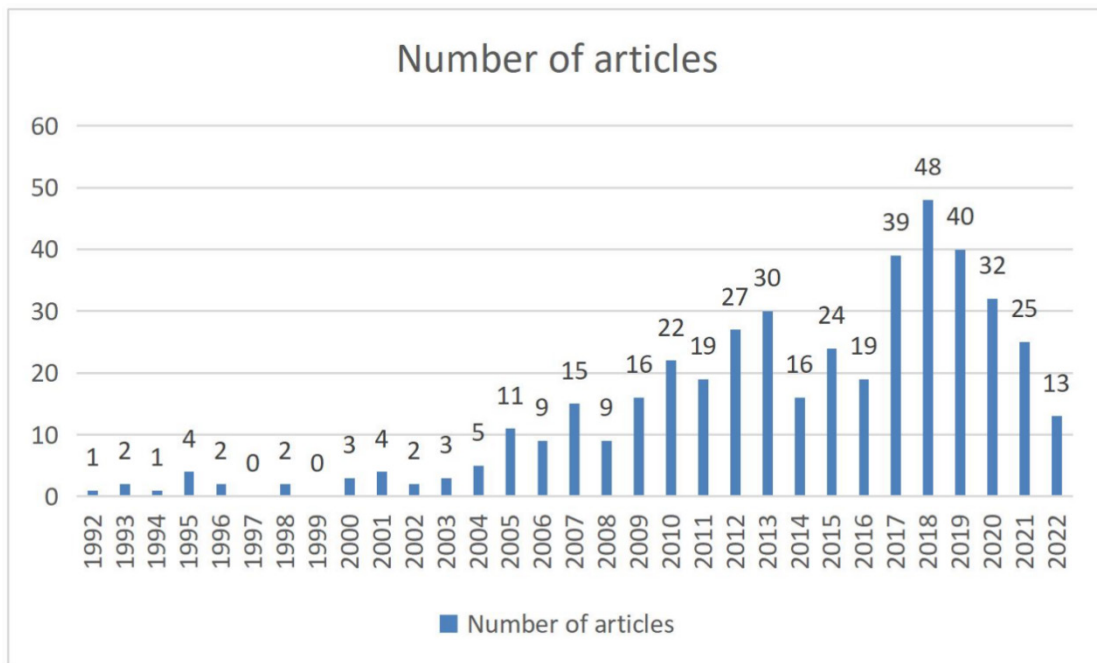


Figure 1. Trend of international educational exchange research in medicine and education research from 1992–2022

3.2. Co-authorship analysis

In **Table 1** and **Figure 2**, Ban and Haux both have four articles, followed by Georgescu and O’dowd, with three articles.

In the field of international educational exchange of emergency medicine, Ban, one of the authors, used the Tuscan Emergency Medicine Initiative, namely didactical lectures, workshops, simulations, and clinical rotations to carry out international educational exchange of Emergency Medicine ^[3]. The Tuscan Emergency Medicine Initiative established eight factors (The Eight Cs), namely collaboration, context, culture, credibility, consulting, consistency, critique, and conclusion ^[3], and its effectiveness is also evaluated ^[4-6].

Table 1. Authors with more than 2 articles published

Rank	Articles	Authors	Rank	Articles	Authors
1	4	Ban, Kevin M	15	2	De bruyn, W
2	4	Haux, R	16	2	Ehrenstein, Vera
3	3	Georgescu, N	17	2	Gensini, Gian Franco
4	3	O'dowd, Robert	18	2	Jaspers, MWM
5	2	Ammenwerth, E	19	2	Kifor, C
6	2	Araiza Vazquez, Maria de Jesus	20	2	Medvedev, Y
7	2	Arslanov, R	21	2	Oprean, C
8	2	Barov, S	22	2	Pastrana Palma, Alberto
9	2	Berni, Giancarlo	23	2	Pena Aguilar, Juan Manuel
10	2	Bigaignon-Cantineau, Janine	24	2	Rosen, Peter
11	2	Binda, Jacek	25	2	Stofkova, Katarina Repkova
12	2	Bruce, Alan	26	2	Valencia Perez, Luis Rodrigo
13	2	Chhaganlal, Kajal	27	2	Weiner, Scott G
14	2	Coucke, Trees			

CiteSpace v. 5.10.R6 (64-bit) Basic
 June 6, 2023 at 8:42:17 PM CST
 WoS: C:\Users\medide\Downloads\weosshale\data
 Timespan: 1992-2022 (Slice Length=1)
 Selection Criteria: g-index (k=25) [LRF=1.0, LHM=10, LBW=5, w=1.0]
 Network: N=544, E=975 (Density=0.0039)
 Largest CC: 13 (2%)
 Nodes Labeled: 1.0%

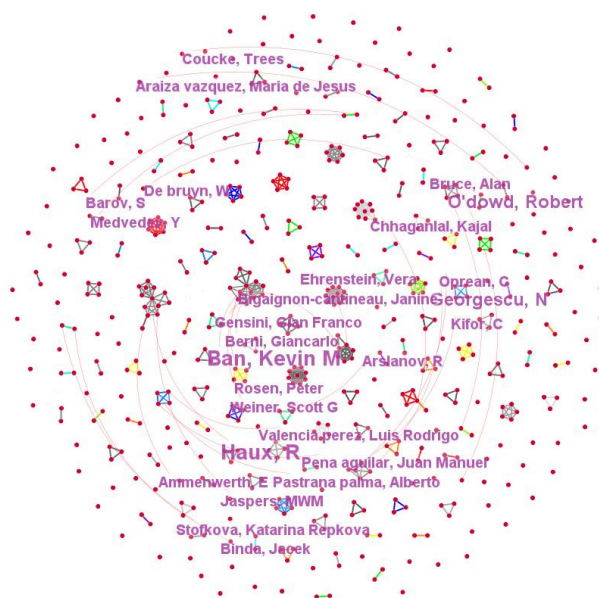


Figure 2. Author analyses

In the field of international medical information education and exchange, one of the authors, Haux, launched the Amsterdam Medical Informatics Program and organized a summer school for international medical students' medical informatics training and exchange to train international courses related to medical information processing and information and communication technology [7-9].

Other authors' articles include research on international engineering education, highlighting continuous professional development and lifelong learning ^[10], as well as virtual education and remote cooperation for foreign language (English) international education ^[11-13].

As shown in **Figure 3**, several authors exhibit citation bursts, indicating their research activity in this field. For example, Bruce recommended information and communication technology (ICT) and digital learning platforms to develop learners' language ability, skills, and English level, and promote modernization, internationalization, and lifelong learning ^[14]. Bruce also proposed to establish a free international platform, open educational resources, and promote exchanges ^[15]. Arslanov recommended the international exchange of history in cooperation to overcome racial and cultural barriers ^[16,17].

Top 15 Authors with the Strongest Citation Bursts

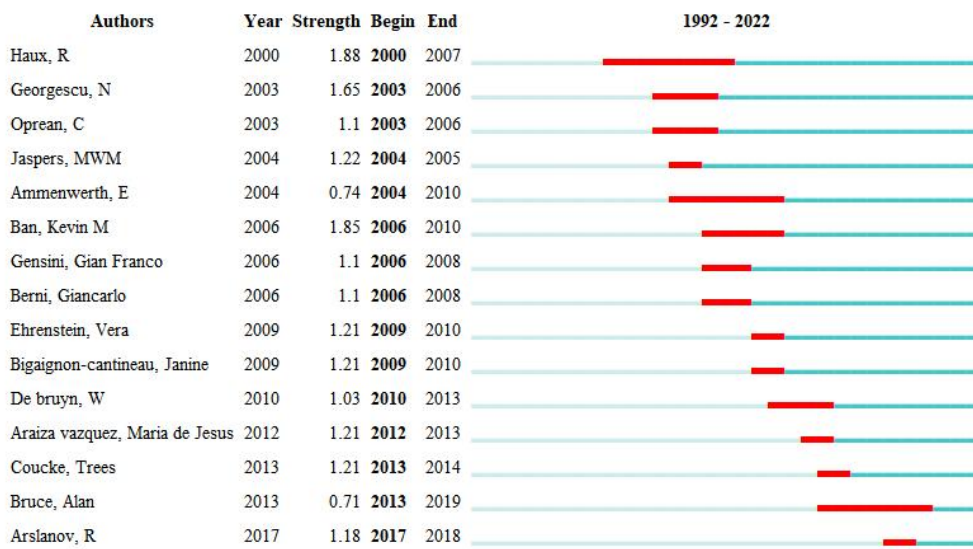


Figure 3. Burst analysis of authors based on the number of articles

From 1992 to 2022 in **Figure 4**, among the top 10 countries in **Table 2**, the USA ranked first, with 105 articles published, far exceeding other countries. The articles were published from 1994, which was relatively early during the period of 1992–2022, followed by 37 articles in Spain, 35 articles in Germany, 35 articles in Russia, and 34 articles in China. The years of publication were from 1995, 1996, 2001, and 2000.

Table 2. Top 10 countries in terms of number of articles

Rank	Countries	Year	Publications
1	USA	1994	105
2	Spain	1995	37
3	Germany	1996	35
4	Russia	2001	35
5	China	2000	34
6	England	1995	32

5	3	2007	Kyushu Univ	Spain
6	3	2006	Tufts Univ	USA
7	3	2017	Bohai Univ	China
8	3	2010	Dublin Inst Technol	Ireland
9	3	2011	Dalhousie Univ	Canada
10	3	2014	Boston Children's Hosp	USA
11	3	2004	Univ Amsterdam	Netherlands
12	3	2018	Univ Sao Paulo	Brazil
13	3	2008	Charite Univ Med Berlin	Germany
14	2	2006	Univ Florence	Italy
15	2	2011	Amer Coll Surg	USA
16	2	2009	Civil Hosp Strasbourg	France
17	2	2009	Purdue Univ	USA
18	2	2012	Alexandru Ioan Cuza Univ	Romania
19	2	1998	Univ S Australia	Australia
20	2	2009	Brigham Young Univ	USA
21	2	2009	Aarhus Univ Hosp	Denmark
22	2	2018	Financial Univ Govt Russian Federat	Russia
23	2	2006	Ohio State Univ	USA
24	2	2020	Beijing Normal Univ	China
25	2	2017	Bielsko Biala Sch Finance & Law	Poland
26	2	2007	Hanyang Univ	Republic of Korea
27	2	2016	Indiana Univ	USA
28	2	2017	Windesheim Univ Appl Sci	Netherlands
29	2	2009	Odense Univ Hosp	Denmark
30	2	2009	Birmingham Heartlands Hosp	England
31	2	2007	Graz Univ Technol	Austria
32	2	2013	Arizona State Univ	USA
33	2	2015	Karolinska Inst	Sweden
34	2	2017	Don State Tech Univ	Russia
35	2	2015	Oregon Hlth & Sci Univ	USA
36	2	2006	Tuscan Emergency Med Initiat	Italy
37	2	2007	Sheffield Hallam Univ	England
38	2	2015	Columbia Univ	USA
39	2	2017	Edinburgh Napier Univ	Scotland
40	2	2013	KAHO St Lieven	Belgium
41	2	2009	McMaster Univ	Canada

42	2	2017	Univ Zilina	Slovakia
43	2	2010	McGill Univ	Canada
44	2	2009	Boston Univ	USA
45	2	2005	Univ Minnesota	USA
46	2	2017	Harvard Med Sch	USA
47	2	2018	Plekhanov Russian Univ Econ	Russia
48	2	2012	Autonome Univ Nuevo Leon	Mexico
49	2	2003	Lucian Blaga Univ Sibiu	Romania
50	2	2012	Politecn Milan	Italy
51	2	2005	Mt Sinai Hosp	Canada
52	2	2019	Chiang Mai Univ	Thailand
53	2	2007	Bialystok Tech Univ	Poland
54	2	2011	Michigan Technol Univ	USA

CiteSpace, v. 5.1.R5 (64-bit) Basic
June 7, 2023 at 11:00:13 AM CST
W/S: C:\Users\jry\Desktop\hoshai\data
Timespan: 1992-2023 (Slice Length=1)
Selection Criteria: g-index(Q)=0.25, LRF=0.3, UN=10, LBY=5, w=1.0
Network: N=456, E=488 (Density=0.0047)
Largest CC: 29 (5%)
Nodes Labeled: 1.0%
Pruning: None
Modularity Q=0.9741
Weighted Mean Silhouette S=1
Harmonic Mean(Q, S)=0.9869

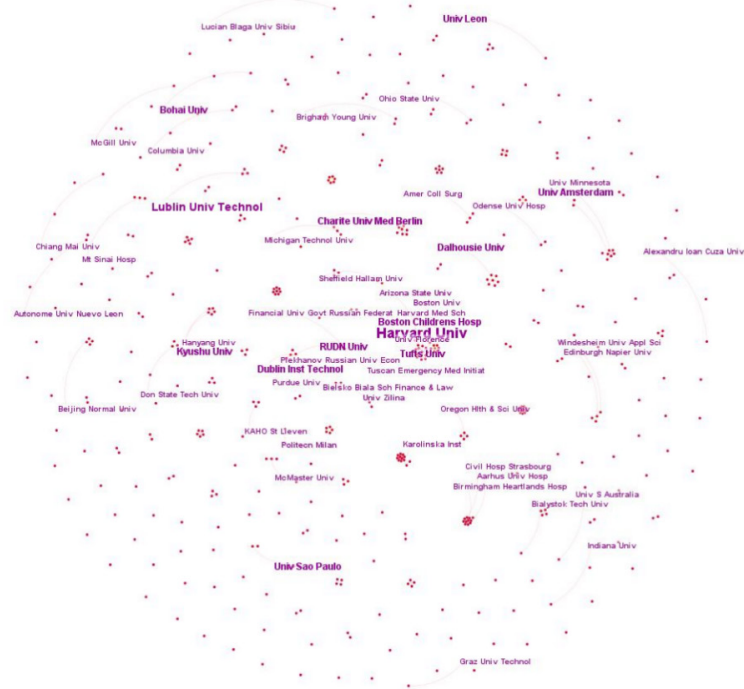


Figure 5. Analysis of institutional cooperation

3.3. Co-citation analysis of references

In the co-citation analysis of references shown in Table 4 and Figure 6, the article quoting Richardson and de Wit puts forward the “Virtual exchange (VE)” of foreign language education in international cooperation [11–13]. This article, citing Ambrose, addresses the challenges of online international collaborative learning in global health education to advance curriculum internationalization [18], highlighting active learning,

mainly including international group discussion (IGD), student-teacher experience (STE), role-playing activities (RPA)^[19], and computer-mediated intercultural communication (CMIC)^[20].

Table 4. Co-citation frequency of references (≥ 2)

Rank	Frequency	Year	Source
1	3	2016	Richardson S, 2016, ROUT RES HIGH EDUC, V0, P1
2	3	2017	Ambrose M, 2017, BMC MED EDUC, V17, P0, DOI 10.1186/s12909-016-0851-6
3	3	2016	de Wit H, 2016, ROUT STU LANG I C, V0, P69
4	2	2005	Hsu EB, 2005, J EMERG MED, V28, P231, DOI 10.1016/j.jemermed.2004.07.014
5	2	2016	Soltes V, 2016, INTED PROC, V0, P4418
6	2	2015	Loh LC, 2015, GLOBALIZATION HEALTH, V11, P0, DOI 10.1186/s12992-015-0135-7
7	2	2016	Kasper J, 2016, ACAD MED, V91, P628, DOI 10.1097/ACM.0000000000001054
8	2	2001	CHISHOLM CU, 2001, P 4 UICEE ANN C ENG, V0, P0
9	2	2018	Browne CA, 2018, NURS EDUC TODAY, V66, P1, DOI 10.1016/j.nedt.2018.03.023
10	2	2013	Stofkova Z, 2013, EDULEARN PROC, V0, P2456
11	2	2014	Abedini NC, 2014, ACAD MED, V89, P1014, DOI 10.1097/ACM.0000000000000291
12	2	2018	ODowd R., 2018, J VIRTUAL EXCHANGE, V1, P1, DOI 10.14705/rpnet.2018.jve.1
13	2	2015	Kent-Wilkinson A, 2015, NURS EDUC TODAY, V35, P941, DOI 10.1016/j.nedt.2015.03.012
14	2	2015	Leask B., 2015, INT HIGHER ED, V0, P0
15	2	2000	Scholes J, 2000, NURS INQ, V7, P61, DOI 10.1046/j.1440-1800.2000.00047.x
16	2	2015	Kumwenda B, 2015, MED EDUC, V49, P623, DOI 10.1111/medu.12727
17	2	2016	Kohlbray PW, 2016, J NURS SCHOLARSHIP, V48, P303, DOI 10.1111/jnu.12209
18	2	2013	Astle B., 2013, IJNES, V10, P227, DOI 10.1515/ijnes-2012-0045
19	2	2015	Browne CA, 2015, NURS EDUC TODAY, V35, P1028, DOI 10.1016/j.nedt.2015.05.012
20	2	2013	UNICEF, 2013, INF AN UNICEF MEX 20, V0, P0
21	2	2012	Staker H., 2012, CLASSIFYING K 12 BLE, V0, P0
22	2	2016	Lewis T, 2016, ROUT STU LANG I C, V0, P1
23	2	2015	Bodnar BE, 2015, PLOS ONE, V10, P0, DOI 10.1371/journal.pone.0119798
24	2	2010	Benner P., 2010, ED NURSES CALL RADIC, V0, P0
25	2	2015	Beelen J, 2015, EUROPEAN HIGHER EDUCATION AREA: BETWEEN CRITICAL REFLECTIONS AND FUTURE POLICIES, V0, P59, DOI 10.1007/978-3-319-20877-0, 5
26	2	2007	Balandin S, 2007, MED TEACH, V29, P872, DOI 10.1080/01421590701784364
27	2	2016	Helm F, 2016, ROUT STU LANG I C, V0, P150
28	2	2017	Marshall JE, 2017, MIDWIFERY, V44, P7, DOI 10.1016/j.midw.2016.10.013
29	2	2015	Schultheis Moore A., 2015, GLOBALLY NETWORKED T, V0, P0
30	2	2017	Dooly M., 2017, HDB TECHNOLOGY 2 LAN, V0, PP169, DOI 10.1002/9781118914069.ch12
31	2	2015	Pappas C., 2015, ADVANTAGES DISADVANT, V0, P0
32	2	2015	ODowd R, 2015, LANG LEARN J, V43, P194, DOI 10.1080/09571736.2013.853374

33	2	2017	Gower S, 2017, J ADV NURS, V73, P2395, DOI 10.1111/jan.13320
34	2	2020	Byram M., 2020, TEACHING ASSESSING I, V2nd, P0
35	2	2007	Ban KM, 2007, ANN EMERG MED, V50, P726, DOI 10.1016/j.annemergmed.2007.05.023
36	2	2014	SEGOB, 2014, PROGR ESP PUEBL IND, V0, P0
37	2	2021	Singh H, 2021, ADV EDUC TECHNOL INS, V0, PP15, DOI 10.4018/978-1-7998-7607-6.ch002
38	2	2005	Arnold JL, 2005, EMERG MED CLIN N AM, V23, P133, DOI 10.1016/j.emc.2004.10.001
39	2	2012	Kulbok Pamela A, 2012, INT J NURS EDUC SCHOLARSH, V9, P1, DOI 10.1515/1548-923X.2365
40	2	2016	ODowd R, 2016, ROUT STU LANG I C, V0, P273

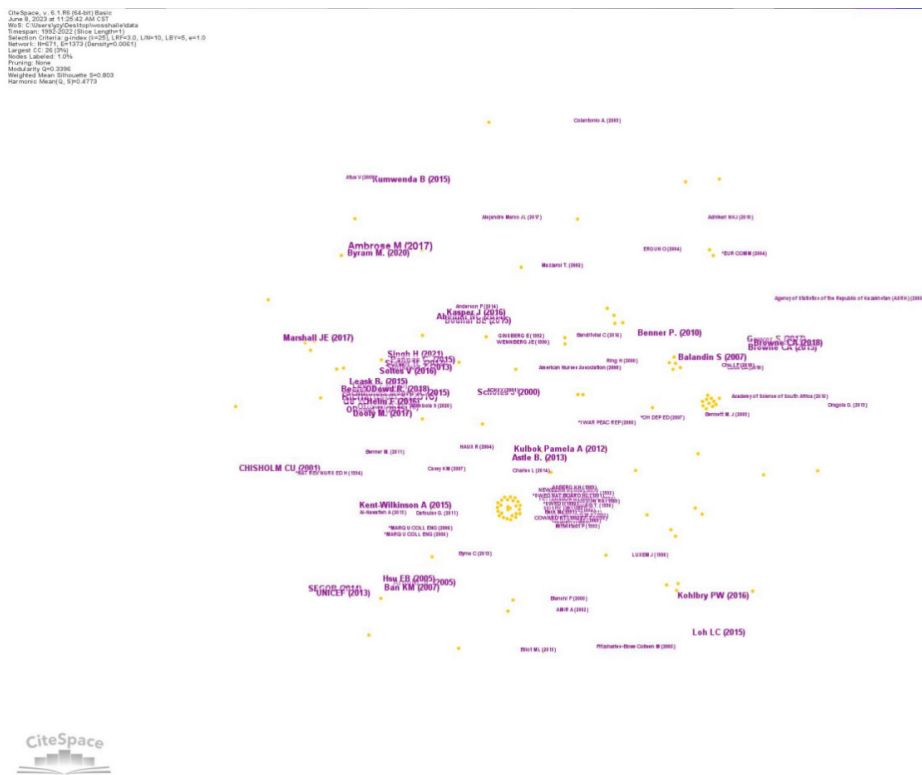


Figure 6. Co-citation of references

3.4. Co-citation analysis of authors

The co-citation analysis of authors in **Table 5** and **Figure 7**, the frequency of the European Commission is 10, and the starting time is 2014. Compared with 1992–2022, the frequency of UNESCO is 7, and the starting time is 1992. The early years from 1992 to 2022, it is speculated that UNESCO conducts research on international educational exchanges.

Table 5. Authors with co-citation frequency ≥ 4

Rank	Frequency	Year	Cited authors
1	10	2014	EUROPEAN COMMISSION
2	7	2012	ALTBACH PHILIP G
3	7	1992	UNESCO
4	7	2012	WHO
5	6	2015	ABEDINI NC
6	4	2011	BYRAM M
7	4	2013	WORLD BANK
8	4	2010	AMERICAN NURSES ASSOCIATION
9	4	2012	OECD
10	4	1992	ALTBACH P. G
11	4	2020	COHEN L
12	4	2020	BROWNE CA
13	4	2020	BRAUN V

CiteSpace v. 5.1.R6 (64-bit) Basic
 June 9, 2023 at 11:40:52 AM CST
 WoS: C:\Users\jgry\Desktop\woshah\data
 Pruning: LRF=0.02 (Basic Linkage)
 Selection: Criteria: g-index (g=0.95), LRF=0.0, M=0.1, ZIN=10, LRFHS=0.1
 Network: N=766, E=2123 (Density=0.9972)
 Largest CC: 387 (50.6%)
 Nodes Labeled: 1.0%
 Pruning: None
 Modularity Q=0.3296
 Weighted Mean Silhouette S=0.803
 Harmonic Mean Q, S=0.4773

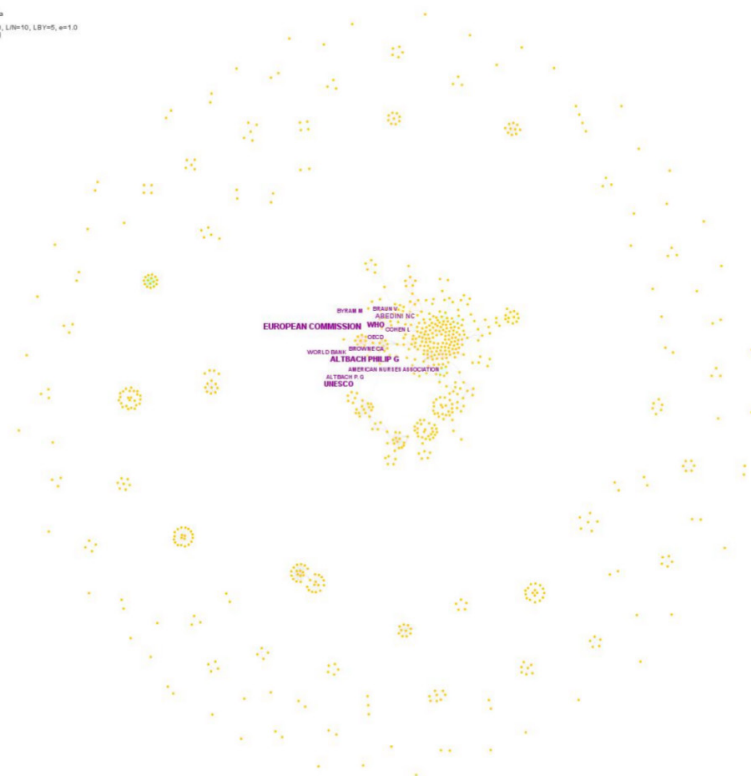


Figure 7. Co-citation of authors

3.5. Co-occurrence analysis of keywords

In **Table 6** and **Figure 8**, in addition to the frequency of 43 international educational exchanges, there are several notable related keywords, such as “developing country” with a frequency of 9 in 2005. “Capacity building” with a frequency of 5 in 2011, “big data” with a frequency of 3 in 2016, “cultural competitiveness” with a frequency of 3 in 2013, “perception” with a frequency of 3 in 2020, and “blended learning” with a frequency of 3 in 2017. It is speculated that international educational communication capacity building, big data, perceptual ability training, and blended learning are gradually valued by researchers.

Table 6. Keywords with frequency ≥ 3

Rank	Frequency	Year	Keywords	Rank	Frequency	Year	Keywords
1	43	1993	international educational exchange	22	4	2014	nursing education
2	24	2005	higher education	23	4	2005	collaboration
3	15	2004	education	24	4	2017	clinical placement
4	14	2004	care	25	4	2017	community
5	12	2017	global health	26	4	2000	health informatics
6	10	2005	abroad	27	4	2016	exchange
7	9	2005	developing country	28	3	2019	medical mission
8	9	2005	student	29	3	2004	comparative education
9	9	2007	international cooperation	30	3	2016	big data
10	8	2007	international collaboration	31	3	2015	communication
11	7	2005	experience	32	3	2019	collaborative learning
12	7	2010	competence	33	3	2006	emergency medicine
13	7	2005	health	34	3	2003	international exchange
14	7	2005	challenge	35	3	2013	cultural competency
15	6	2011	educational exchange	36	3	2019	social media
16	5	2009	bologna proce	37	3	2019	cancer
17	5	2011	capacity building	38	3	2000	medical informatics
18	5	2008	china	39	3	2020	perception
19	5	2017	nursing student	40	3	2010	country
20	5	2008	impact	41	3	2017	blended learning
21	4	2017	program				

CiteSpace v. 5.10.R (64-bit) Build
 June 7, 2022 at 11:24:58 AM CEST
 Web: C:\Users\p220110\Documents\CiteSpace
 Tomographic Coherence: 0.9721 (0.9721, 0.9721, 0.9721, 0.9721, 0.9721)
 Modularity: 0.9721 (0.9721, 0.9721, 0.9721, 0.9721, 0.9721)
 Weighted Mean Silhouette: 0.9721
 Pruning: None
 Modularity Gain: 0.9721
 Weighted Mean Silhouette Gain: 0.9721
 Harmonic Mean(Q, S): 0.9721



Figure 8. Co-occurrence of keywords

In Figure 9, #6 Online tumour conference highlight the online communication mode of important and difficult problems in medicine.

Figure 10 shows that from “international educational exchange” to “collaborative learning,” the research on international educational exchange becomes more concrete.

CiteSpace v. 5.10.R (64-bit) Build
 June 7, 2022 at 11:24:58 AM CEST
 Web: C:\Users\p220110\Documents\CiteSpace
 Tomographic Coherence: 0.9721 (0.9721, 0.9721, 0.9721, 0.9721, 0.9721)
 Modularity: 0.9721 (0.9721, 0.9721, 0.9721, 0.9721, 0.9721)
 Weighted Mean Silhouette: 0.9721
 Pruning: None
 Modularity Gain: 0.9721
 Weighted Mean Silhouette Gain: 0.9721
 Harmonic Mean(Q, S): 0.9721

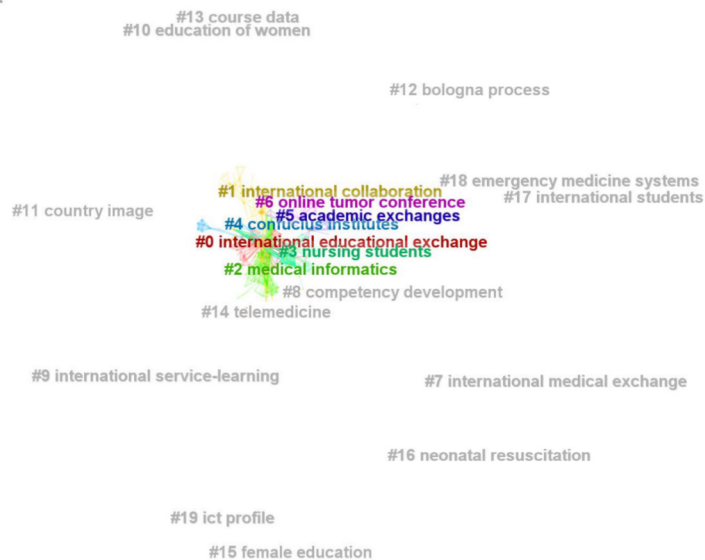


Figure 9. Clusters of keywords

Top 19 Keywords with the Strongest Citation Bursts

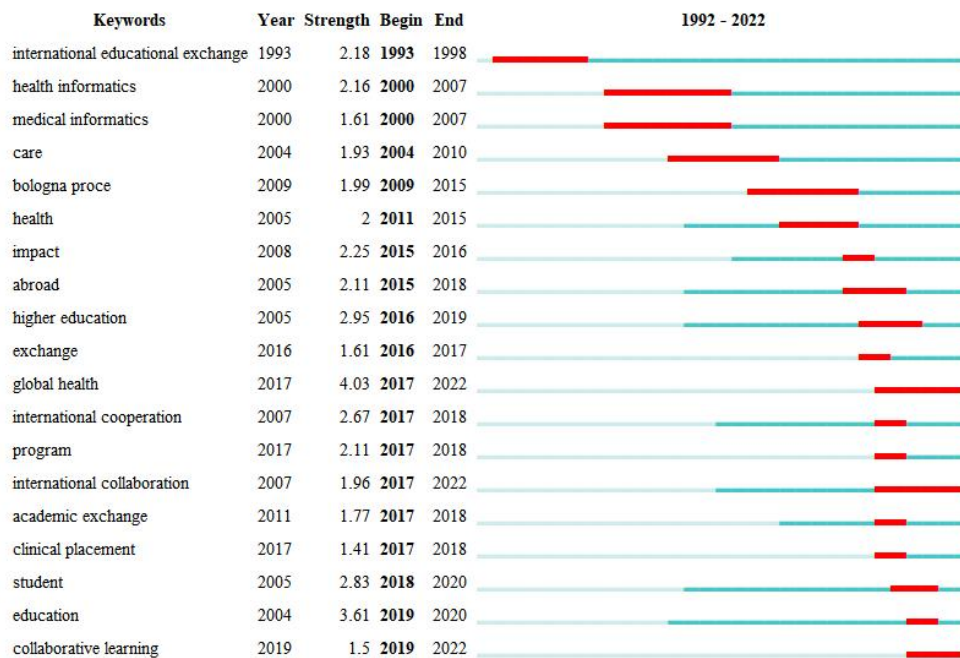


Figure 10. Burst analysis of keywords ($\gamma = 0.4$)

4. Discussion

Cross-border scientific collaboration has long been recognized as a powerful tool for aligning professional standards and co-creating knowledge ^[21]. In recent decades, the development of internet infrastructure, open-access academic publishing, and digital communication tools has transformed how scholars interact. The model of indirect, text-based exchange is shifting to direct, platform-based communication ^[22]. This shift is particularly evident in international education, where bibliometrics provides a valuable tool for measuring interaction quality ^[23].

This study applies CiteSpace software to analyze 443 articles on capacity building in international medical education exchange. Through this approach, we systematically delineate the developmental trajectory and research architecture of the field. The results demonstrate that communication paradigms in this domain are progressively transitioning from traditional forms grounded in geographical mobility toward diversified collaborative modalities underpinned by information technology. This transformation was particularly pronounced during the COVID-19 pandemic, wherein restrictions on face-to-face interactions catalyzed the rapid proliferation of online and remote modalities, which have subsequently endured as ordinary options in the post-pandemic period.

Analysis of keyword frequencies and literature distribution reveals a sustained upward trend in the proportion of remote communication and virtual collaboration. This shift is not attributable to a single determining factor, but rather arises from the synergistic interaction of multiple mechanisms. On one hand, developments in information and communication technologies have lowered the time and financial costs of cross-border exchanges, making frequent interactions possible. On the other hand, the growing demand for

knowledge renewal in global health has driven researchers to adopt more timely communication approaches. Furthermore, online learning environments has influenced participants' behavioral expectations and interactional patterns, helping virtual collaboration gradually gain acceptance as a practical, regular form of academic activity. Under the combined effects of these conditions, platform-based learning and remote training have incrementally become pivotal vehicles for contemporary international medical education exchange.

Notwithstanding technological affordances, linguistic competence and cross-cultural understanding continue to constitute significant constraints on exchange quality. Concurrently, the emergence of keywords such as “cultural competitiveness” and “perception” indicates that researchers have commenced attending to the concrete manifestations of cultural differentiation within exchange processes and their ramifications for collaborative efficacy. Consequently, exclusive reliance on technological modalities is insufficient for comprehensively enhancing exchange capabilities; systematic cultivation of linguistic articulation, cultural comprehension, and communicative strategization is additionally required.

Based on these findings, international medical education exchange capabilities may be developed from three aspects. The technological infrastructure dimension encompasses the accessibility and utilization patterns of digital platforms, online curricula, and remote collaborative instruments. The individual capacity dimension comprises linguistic expressive competence, cross-cultural communicative proficiency, and academic exchange skills. The institutional and organizational dimension incorporates curriculum planning, program management, and objective quality-assessment metrics. These dimensions do not operate in linear isolation, they become mutually embedded and synergistically activated within concrete practice, thereby conditioning the actual efficacy of exchange activities.

Engagement in international medical education may hold significant personal value ^[24], especially given the growing importance of academic medical training in clinical practice ^[25]. Other emerging areas—such as telemedicine diagnosis, virtual reality simulation, and blockchain applications—are also advancing rapidly and may complement future medical education ^[26]. Participants should be equipped with the knowledge and skills needed to conduct research and stay updated on developments in their fields ^[27]. They should also consider international exchange opportunities in light of their personal circumstances and professional goals ^[28]. Developing language and communication skills throughout the learning process is important for success in global academic contexts ^[29].

5. Conclusion

This study is a bibliometric analysis systematically examining international educational exchanges in medicine. Through quantitative mapping of the knowledge structure, this analysis elucidates the primary pathways of international academic collaboration. By visualizing geographic distributions and collaborative networks, bibliometric methods reveal developmental trends and underlying patterns within the field.

Looking forward, international cooperation and exchange in medical education are increasingly characterized by openness, sharing, diversity, and digitalization (intelligence).

Funding

This paper was supported by the Comprehensive Reform and Development of Graduate Education at the Graduate School of the China Academy of Chinese Medical Sciences.

Disclosure statement

The authors declare no conflict of interest.

Author contributions

Conception and design: Ranran Zhao, Xiaolin Ma

Collection and assembly of data: Yang Wu, Miaoran Wang

Data analysis and interpretation: Yang Wu

Manuscript writing: Yang Wu, Miaoran Wang

Final approval of manuscript: All authors.

References

- [1] Rodríguez C, Rahimzadeh V, Bartlett-Esquilant G, et al., 2002, Insights for Teaching During a Pandemic: Lessons From a PreCOVID-19 International Synchronous Hybrid Learning Experience. *Family Medicine*, 54(6): 472–477.
- [2] Duclos P, MacDonald NE, Dochez C, et al., 2022, Report of the 2nd Workshop of the International Collaboration on Advanced Vaccinology Training. *Vaccine*, 40(47): 6689–6699.
- [3] Weiner SG, Sanchez LD, Rosen P, et al., 2010, A Qualification Course in an International Emergency Medicine Intervention. *Journal of Emergency Medicine*, 39(2): 234–239.
- [4] Weiner SG, Kelly SP, Rosen P, et al., 2008, The Eight Cs: A Guide to Success in an International Emergency Medicine Educational Collaboration. *Academic Emergency Medicine*, 15(7): 678–682.
- [5] Weiner SG, Anderson PD, Sanchez LD, et al., 2008, Evaluation of an International Emergency Medicine Intervention in Tuscany. *European Journal of Emergency Medicine*, 15(2): 75–79.
- [6] Weiner SG, Ban KM, Sanchez LD, et al., 2006, A Comparison between the Efficacy of Lectures Given by Emergency and Non-Emergency Physicians in an International Emergency Medicine Educational Intervention. *Internal and Emergency Medicine*, 1(1): 67–71.
- [7] Jaspers MWM, Gardner RM, Gatewood LC, et al., 2007, An International Summer School on Health Informatics: A Collaborative Effort of the Amsterdam Medical Informatics Program and IΦE: the International Partnership for Health Informatics Education. *International Journal of Medical Informatics*, 76(7): 538–546.
- [8] Jaspers MWM, Gardner RM, Gatewood LC, et al., 2005, The International Partnership for Health Informatics Education - Lessons Learned from Six Years of Experience. *Methods of Information in Medicine*, 44(1): 25–31.
- [9] Jaspers MWM, Ammenwerth E, Ter Burga W, et al., 2004, An International Course on Strategic Information Management for Medical Informatics Students: International Perspectives and Evaluation. *International Journal of Medical Informatics*, 73(11–12): 807–815.
- [10] Oprean C, Kifor C, Georgescu N, 2005, The Balkan Region Centre for Engineering Education: A Satellite Centre of the UNESCO International Centre for Engineering Education (U. I. C. E. E. Lucian Blaga Univ Sibiu, Trans.) 3rd Balkan Region Conference on Engineering Education, Sibiu, Romania, 19–21.
- [11] O'Dowd R, 2020, A Transnational Model of Virtual Exchange for Global Citizenship Education. *Language*

- Teaching, 53(4): 477–490.
- [12] Garcés P, O’Dowd R, 2021, Upscaling Virtual Exchange in University Education: Moving From Innovative Classroom Practice to Regional Governmental Policy. *Journal of Studies in International Education*, 25(3): 283–300.
- [13] O’Dowd R, Sauro S, Spector-Cohen E, 2020, The Role of Pedagogical Mentoring in Virtual Exchange. *TESOL Quarterly*, 54(1): 146–172.
- [14] Bakeer A, Bruce A, Pixel, 2019, Beyond Marginalized Fragmentation: Technology and Innovation in English-Language Learning in Palestinian HEIs 12th International Conference Innovation in Language Learning, Florence, Italy, 120–126.
- [15] Richter T, Bruce A, Hoel T, et al., 2013, Barriers Against Open Educational Resources and Possible Solutions: Teachers’ Perspectives and Recommendations, 6th International Conference on Education, Research and Innovation (ICERI), Seville, Spain, 6489–6498.
- [16] Ponomarenko L, Arslanov R, Kozmenko V, et al., 2018, The Cooperation Between Russia and France in the Field of History Education: Traditions and Prospects, 12th International Technology, Education and Development Conference (INTED), Valencia, Spain, 4987–4992.
- [17] Dolzhikova A, Arslanov R, Moseikina M, et al., 2017, The Double Degree Program “History and Dialogue of Cultures” of the Peoples’ Friendship University of Russia and the University Grenoble-Alpes as an Aspect of Intellectual Migration and French-Russian International Cooperation in the Field of Education, 9th International Conference on Education and New Learning Technologies (EDULEARN), Barcelona, Spain, 7899–7903.
- [18] Vicente CR, Jacobs F, de Carvalho DS, et al., Creating a Platform to Enable Collaborative Learning in One Health: The Joint Initiative for Teaching and Learning on Global Health Challenges and One Health experience, 2021, *One Health*, 12.
- [19] Rodis OMM, Locsin RC, 2019, The Implementation of the Japanese Dental English Core Curriculum: Active Learning Based on Peer-Teaching and Learning Activities. *BMC Medical Education*, 19.
- [20] Lee K, 2018, Implementing Computer-Mediated Intercultural Communication in English Education: A Critical Reflection on Its Pedagogical Challenges. *Journal of Computer Assisted Learning*, 34(6): 673–687.
- [21] Gristwood A, Casano AM, Nikic I, 2015, Lindau in the 21st Century: More Women, More Dialog, More Passion “An Interview with Countess Bettina Bernadotte and Wolfgang Schurer from the Lindau Nobel Laureate Meetings.” *Embo Reports*, 16(4): 407–410.
- [22] Agarwala A, Kohli P, Virani SS, 2019, Popular Media and Cardiovascular Medicine: “With Great Power There Must Also Come Great Responsibility.” *Current Atherosclerosis Reports*, 21(11).
- [23] Zhang XA, Zhao Y, Zhou YT, et al., 2022, Trends in Research on Sick Sinus Syndrome: A Bibliometric Analysis from 2000 to 2022. *Frontiers in Cardiovascular Medicine*, 9.
- [24] Cohen MS, Jacobs JP, Quintessenza JA, et al., 2007, Mentorship, Learning Curves, and Balance. *Cardiology in the Young*, 17: 164–174.
- [25] Husain K, Awang A, Kamel N, et al., 2019, Intersection-Based Link-Adaptive Beaconless Forwarding in Urban Vehicular Ad-Hoc Networks. *Sensors*, 19(5).
- [26] Drosatos G, Kaldoudi E, 2019, Blockchain Applications in the Biomedical Domain: A Scoping Review. *Computational and Structural Biotechnology Journal*, 17: 229–240.
- [27] Binns C, Low WY, 2019, Publish or the Population Perishes: The Challenges of Regional Publishing in Public Health. *Asia-Pacific Journal of Public Health*, 31(5): 396–403.

- [28] Jiménez-Saiz R, Rosace D, 2019, Is Hybrid-PBL Advancing Teaching in Biomedicine? A Systematic Review. *BMC Medical Education*, 19.
- [29] Berman AC, 2015, Good Teaching Is Good Teaching: A Narrative Review for Effective Medical Educators. *Anatomical Sciences Education*, 8(4): 386–394.

Publisher's note

Bio-Byword Scientific Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.