Medicine Insights

Review

Knowledge Domain and Emerging Trends in Internet-based diagnosis and treatment services：A Scientometric Review Based on CiteSpace V Analysis

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Abstract: Background: In the battle against the COVID-19 pandemic, Internet-based diagnosis and treatment services offer a promising technological avenue for effective healthcare delivery. However, there remains a scarcity of bibliometric analyses on Internet-based diagnosis and treatment services within the healthcare domain. This study aims to address this gap by conducting a comprehensive examination of research advancements, highlighting prevalent themes, and delineating emerging trends in Internet-based diagnosis and treatment research using CiteSpace V. Methods: The Web of Science Core Collection (WoSCC) was utilized to gather literature on Internet-based diagnosis and treatment within the healthcare sector spanning from 2001 to 2021. CiteSpace V facilitated keyword analysis, created dual-map overlays of journals, generated timeline views of co-cited references, and analyzed literature information. This encompassed variables such as involved countries and institutions, journals publishing relevant research, authors and cited authors, cited references, highly cited works, H-index, average citations, prevalent subjects of interest, and emerging frontiers in the field. Results: WoSCC identified a total of 1259 papers on Internet-based diagnosis and treatment for bibliometric analysis. Annual publications generally exhibited an upward trend. The United States contributed the most publications (465 papers) and the highest number of highly cited papers (9). Poland had the highest average citations per item (42.12). Gerhard Andersson emerged as the most influential author, with 16 publications and a co-citation count of 216. The six primary topics in Internet-based diagnosis and treatment services were health anxiety, randomized controlled trials, IoT platforms, health-related quality, Chinese men, and Internet gaming disorder. The eight emerging topics were medical devices, artificial intelligence, health-related quality, breast cancer, prostate cancer, patient care, treatment decisions, and HIV. With the development of Internet-based diagnosis and treatment technology, major ongoing research trends include the deep application of artificial intelligence in the medical field, enhancing patient satisfaction in clinical practice, improving health-related quality, and treating breast cancer patients. Conclusions: This study provides a comprehensive examination of Internet-based diagnosis and treatment services within the healthcare sector, offering valuable insights that provide significant guidance for future development in the field.

Keywords: Internet-based diagnosis and treatment; Scientometric review; Heath care; CiteSpace V

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1. Background

Amid the battle against the COVID-19 pandemic, numerous nations have bolstered their utilization of Internet-based healthcare services [1], encompassing telemedicine and online consultations. Telemedicine has proven its efficacy amidst the COVID-19 crisis, offering diversified clinical care services to patients with chronic ailments, thereby playing a pivotal role in epidemic mitigation. It has facilitated the heightened utilization of medical resources while concurrently mitigating the risk of cross-infection associated with hospital-based treatments [2]. Telemedicine, characterized as a novel application of the Internet within the healthcare sector, encompasses an array of services, including health education, medical information retrieval, electronic health records management, disease risk assessment, online consultations, electronic prescribing, teletherapy, and rehabilitation treatments, all of which leverage the Internet as both a conduit and a platform [4]. In 2018, the National Health Commission of the People's Republic of China introduced the Measures for the Administration of Internet Diagnosis and Treatment (for Trial Implementation), authorizing physicians to conduct online diagnosis and treatment, issue prescriptions for subsequent online consultations, specifically for certain chronic diseases. Consequently, Internet-based diagnosis and treatment services have garnered considerable attention [1]. Across different nations, Internet-based diagnosis and treatment are denoted by various terms, such as telemedicine, cyberchondria, and self-diagnosis. In this paper, Internet-based diagnosis and treatment services are delineated as the provision of follow-up visits by physicians for common diseases through online platforms [3]. While the extensive adoption of Internet-based diagnosis and treatment service technology is hindered by elevated production costs and associated technical challenges [5], its rapid advancement during the COVID-19 pandemic is evident due to its distinctive advantages, including immediacy, supportiveness, and efficacy [6,7,8,9]. Additionally, the comparable effectiveness of Internet-delivered treatments to traditional face-to-face interventions, along with Internet-based cognitive behavioral therapy, further underscores the potential of Internet-based diagnosis and treatment services in healthcare delivery. Hence, Internet-based diagnosis and treatment services emerge as a promising technology with considerable potential for integration into healthcare systems.

Over the past two decades, the field of Internet-based diagnosis and treatment services has witnessed a plethora of publications. However, a comprehensive review of these papers has been lacking. Bibliometric analysis has emerged as a valuable tool for assessing the progression of research within specific domains, employing quantitative measures through statistical and geometrical methods [10,11]. Such analyses primarily focus on the metrological properties of data related to a particular subject, often utilized to gauge advancements within a field over time and facilitate readers' clear and intuitive comprehension of its development [12]. Notably, numerous bibliometric studies have been featured in prominent medical journals over the past two decades [13,14,15], thus warranting the application of bibliometric analysis to the realm of Internet-based diagnosis and treatment services. This paper, in particular, concentrates on delineating the network of co-authors, co-occurring keywords, co-citation references, and the burst of co-citation references utilizing CiteSpace V, a visualization tool designed to analyze references sourced from the Web of Science Core Collection [16]. Consequently, this approach enables the exploration of knowledge domains, quantified research patterns, and emerging trends within the field of Internet-based diagnosis and treatment services, thereby facilitating the acquisition of more precise and comprehensive information in this research area.

2. Materials and Methods

2.1. Sources of data and searching strategies

To mitigate biases stemming from daily database updates, articles were retrieved on a single day, December 31, 2021, from the Science Citation Index-Expanded (SCI-EXPANDED), Conference Proceedings Citation Index-Science (CPCI-S), Conference Proceedings Citation Index-Social Science & Humanities (CPCI-SSH), Current Chemical Reactions (CCR-Expanded), and Index Chemicus (IC) of the Web of Science Core Collection (WoSCC). The specific retrieval criteria were as follows: "(TS = (Internet-based diagnosis and treatment)) AND LANGUAGE: (English) Refined by DOCUMENT TYPES: (Article) timespan: from January 1, 2001, to December 31, 2021." Only articles meeting these criteria were included in this study.

2.2. Data retrieval and checks

From January 1st, 2001, to December 31st, 2021, a total of 1732 records were retrieved from the Web of Science Core Collection (WoSCC) using the search theme "Internet-based diagnosis and treatment". After excluding 473 anomalies, non-article, and non-English records, 1259 entries were retained for subsequent analysis.

2.3. Data analysis and statistics

The printing features, including the H-index, impact factor, select annual publications, journal sources, citation counts, authors, institutes, and countries/regions, were analyzed using the WoSCC literature analysis tool. The impact factor denotes the yearly citations garnered by all articles published by a journal within a specific year [17], thus offering an approximation of research output when conducting bibliometric analyses. Meanwhile, the H-index amalgamates citation impact per publication with factors such as productivity, serving as a valuable metric for assessing research quality [18].

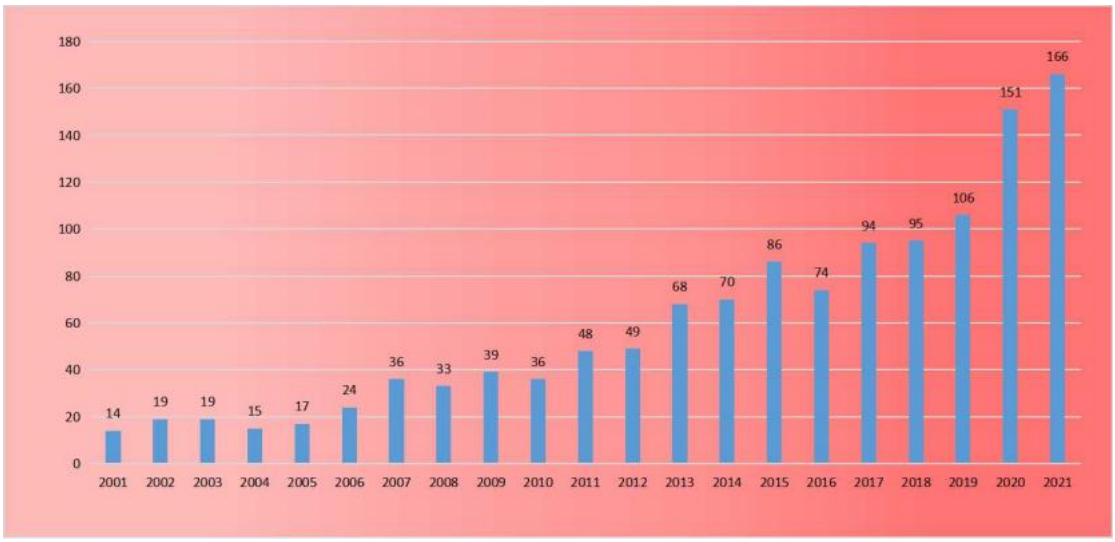
Consequently, CiteSpace V software was employed to explore relationships among journals, evaluate collaborative networks among countries, institutes, and authors, generate visualization maps, identify keywords exhibiting significant citation bursts, and uncover co-cited authors and references within this study. For this analysis, the 50 most highly cited papers from a one-year period were utilized to construct individual networks [19,20,21,22,23]. Term frequency-inverse document frequency (TF-IDF) weighting was applied to analyze data within each group. TF-IDF is a statistical algorithm that assesses the importance of a word within a corpus of documents [24].

3. Results and discussion

3.1. Growth forecast and yearly publications

A total of 1259 articles met the retrieval criteria. Figure 1 illustrates the annual distribution of published articles, ranging from 14 papers in 2001 to 166 papers in 2021. On average, approximately 60 articles were published annually, with a consistent upward trend in the number of publications per year. Remarkably, the number of publications peaked at 166 articles in 2021.

Figure 1. Publication outputs. The annual number of publications in Internet-based diagnosis and treatment service research from 2001 to 2021.



3.2. Journal distribution

In the realm of Internet-based diagnosis and treatment services, a total of 351 academic journals have contributed publications on this subject, as illustrated in Table 1, which presents the top 10 journals. PLOS ONE (impact factor (IF) 2020 = 3.240) emerged with the highest number of publications (143 articles, 8.932%), followed by the Journal of Medical Internet Research (IF 2020 = 5.428; 94 publications, 5.871%), LANCET (IF 2020 = 79.323; 90 publications, 5.621%), Jama-journal of the American Medical Association (IF 2020 = 56.274; 75 publications, 4.685%), and Behaviour Research and Therapy (IF 2020 = 4.473; 74 publications; 4.622%).

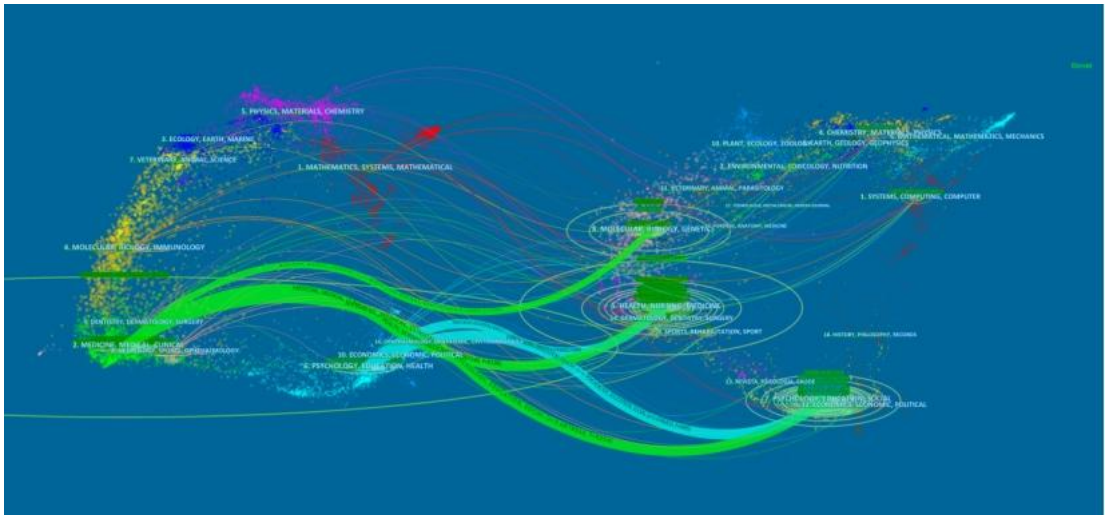
Table 1. The top 10 journals that published articles in Internet-based diagnosis and treatment service research.

Rank	Journal title	Country	Count	Percent	IF (2020)
1	Plos One	United States of America	143	8.932	3.240
2	Journal of Medical Internet Research	Canada	94	5.871	5.428
3	Lancet	United Kingdom	90	5.621	79.323
4	The Journal of the American Medical Association	United States of America	75	4.685	56.274
5	Behavour Research and Therapy	United Kingdom	74	4.622	4.473
6	Clinical Psychology Review	United Kingdom	74	4.622	12.792
7	American Journal of Psychiatry	United States of America	69	4.310	18.112
8	Psychological Medicines	United Kingdom	68	4.247	7.723
9	New England Journal of Medicine	United States of America	68	4.247	91.253
10	Journal of Clinical Psychology	United States of America	66	4.122	5.348

Additionally, a dual-map overlay analysis was conducted on the journals. Specifically, the base map portrays data on various topics covered within the journal, while the overlay depicts the co-citation map of the Internet-based diagnosis and

treatment service research field. This dual-map overlay delineates the collaborative relationships between citing publications and cited references across different domains[25] (Figure 2). Notably, papers were predominantly cited within three areas: health and medicine, psychology and education, and molecular biology and immunology. Among these fields, the circles representing health, medicine, molecular biology, and immunology were larger, indicative of a higher number of coauthors and publications. The lines in the figure symbolize the connections between citing publications and cited references, with each cited field having publications citing it. Molecular biology and immunology stood out as fields cited by publications in other domains, underscoring their significant position within the cited references of Internet-based diagnosis and treatment service research.

Figure 2. The dual-map overlay of journals related to Internet-based diagnosis and treatment service research.



3.3. Profiling of institutes and countries

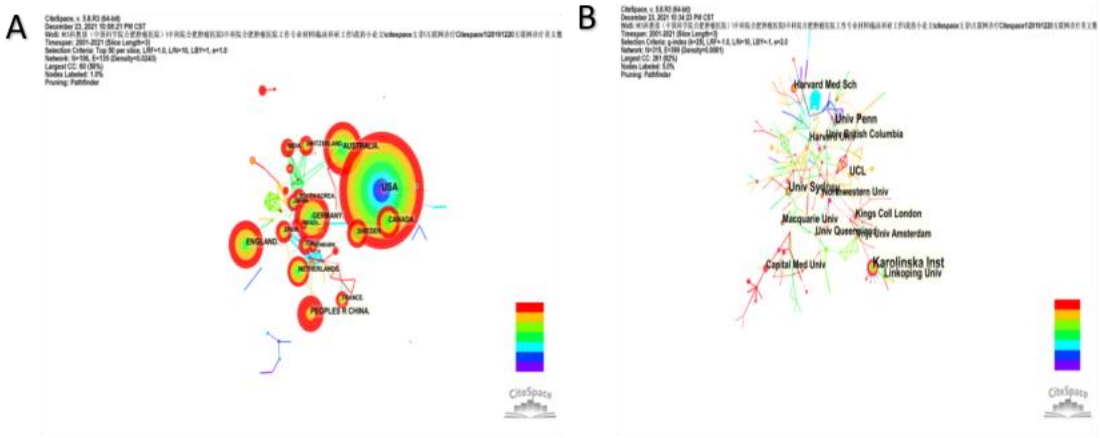
A total of 120 regions/countries contributed to the publication of 1259 articles in Internet-based diagnosis and treatment services research. Extensive collaboration was observed among these regions/countries, as depicted in Figure 3A. Among the top 10 regions/countries actively involved in Internet-based diagnosis and treatment service research (Table 2), the United States of America led with 465 publications, followed by the United Kingdom (158), Australia (124), Germany (119), and the People's Republic of China (114).

Furthermore, the research involved approximately 544 institutes in the field of Internet-based diagnosis and treatment services. Extensive collaboration among these institutes was evident, as illustrated in Figure 3B. Approximately 14.69% of the total publications originated from the top 10 institutes (Table 2). The Karolinska Institute emerged as the leading institute, followed by Sydney University, University of Pennsylvania, Vrije University Amsterdam, and University College London.

Table 2. The top 10 countries and institutes publications in Internet-based diagnosis and treatment service research.

Rank	Country	Count	Percent	Institute	Count	Percent
1	United States of America	465	36.93	Karolinska Institute	44	3.49
2	United Kingdom	158	12.55	Sydney University	18	1.43
3	Australia	124	9.85	University of Pennsylvania	16	1.27
4	Germany	119	9.45	Vrije University Amsterdam	15	1.19
5	The People's Republic of China	114	9.05	University College London	15	1.19
6	Canada	79	6.27	University Melbourne	14	1.11
7	Sweden	71	5.64	Harvard Medical School	13	1.03
8	Netherlands	71	5.64	Harvard University	13	1.03
9	India	50	3.97	University of british columbia	13	1.03
10	Spain	48	3.81	King's College London	12	0.95

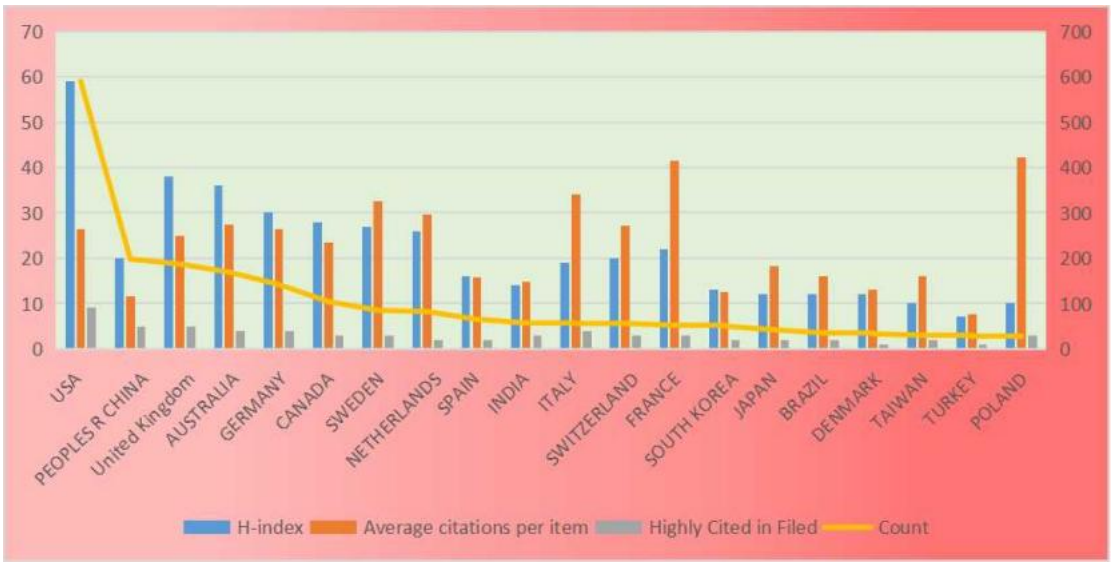
Figure 3. The distribution of countries and institutes **A** The network map of countries/regions that in the case of erectile dysfunction (Internet-based diagnosis and treatment service) research **B** The network map of institutes involved in Internet-based diagnosis and treatment service research.



3.4. Analysis of highly cited, H-index, and average citations

Among the top ten affluent countries (Figure 4), the USA contributed the highest number of highly cited papers (9), followed by the People's Republic, United Kingdom, Australia, and Germany. Interestingly, Poland boasted the highest average number of citations per item (42.12); however, it ranked 20th overall.

Figure 4. The distribution of highly cited, H-index, and average citations in the top twenty countries in Internet-based diagnosis and treatment service research.



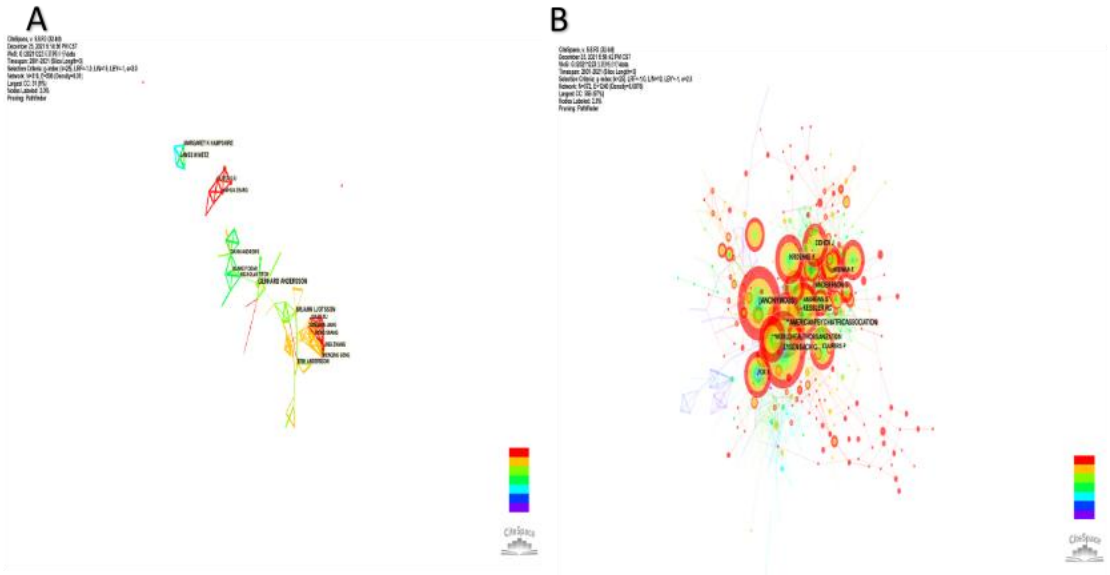
3.5. Profiling of authors

As revealed by the findings, a total of 318 authors were involved in Internet-based diagnosis and treatment service research. The collaboration network among these authors is illustrated in Figure 5A. Among the top 10 contributing authors (Table 3), Gerhard Andersson led with 16 articles, followed by Brjann Ljotsson (13 publications), Margaret K Hampshire (10 publications), Guiyou Liu (9 publications), Haihua Zhang (9 publications), Zhifa Han (8 publications), Jing Zhang (8 publications), Erik Andersson (8 publications), Tao Wang (8 publications), and Yongjun Jiang (7 publications). Furthermore, the data on author citations were analyzed using CiteSpace V and visualized in a co-citation network (Figure 5B). Among the top 10 co-cited authors (Table 3), Eysenbach, Gunther (119 co-citations) held the top position, followed by Kessler, Ronald C (99 co-citations), Andersson, Gerhard (91 co-citations), Kroenke, Kurt (91 co-citations), Cohen, Jacob (87 co-citations), Cuijpers, Pim (77 co-citations), Andrews, Gavin (71 co-citations), Hedman, Erik (65 co-citations), Sheehan, David V. (61 co-citations), and BECK AT (58 co-citations).

Table 3. The top 10 authors, co-cited authors, and co-cited references in Internet-based diagnosis and treatment service research.

Rank	Author	Count	Co-cited author	Count	Co-cited reference	Count
1	Gerhard Andersson	16	Eysenbach, Gunther	119	Kroenke K, 2001, J Gen Intern Med, V16, P606	52
2	Brjann Ljotsson	13	Kessler, Ronald C	99	Association AP, 2013, Diagnostic Stat Manu, V0, P0	52
3	Margaret K Hampshire	10	Andersson, Gerhard	91	Spitzer RL, 2006, Arch Intern Med, V166, P1092	45
4	Guiyou Liu	9	Kroenke, Kurt	91	Spek V, 2007, Psychol Med, V37, P319	36
5	Haihua Zhang	9	Cohen, Jacob	87	Braun V, 2006, Qual ResPsychol, V3, P77	35
6	Zhifa Han	8	Cuijpers, Pim	77	Andrews G, 2010, PLOS ONE, V5, P0, DOI 10.1371/journal.pone.0013196	32
7	Jing Zhang	8	Andrews, Gavin	71	Andersson Gerhard, 2009, Cognitive Behaviour Therapy, V38, P196, DOI 10.1080/16506070903318960	32
8	Erik Andersson	8	Hedman, Erik	65	JACOBSON NS, 1991, J CONSULT CLIN PSYCH, V59, P12, DOI 10.1037/0022-006X.59.1.12	31
9	Tao Wang	8	Sheehan, David V.	61	Spek V, 2007, PSYCHOL MED, V37, P319, DOI 10.1017/S0033291706008944	28
10	Yongjun Jiang	7	BECK AT	58	Eysenbach G, 2011, J MED INTERNET RES, V13, P0, DOI 10.2196/jmir.1923	22

Figure 5. The distribution of authors **A** The network map of active authors offered up to Internet-based diagnosis and treatment service research **B** The network map of co-cited authors offered access to Internet-based diagnosis and treatment service research.



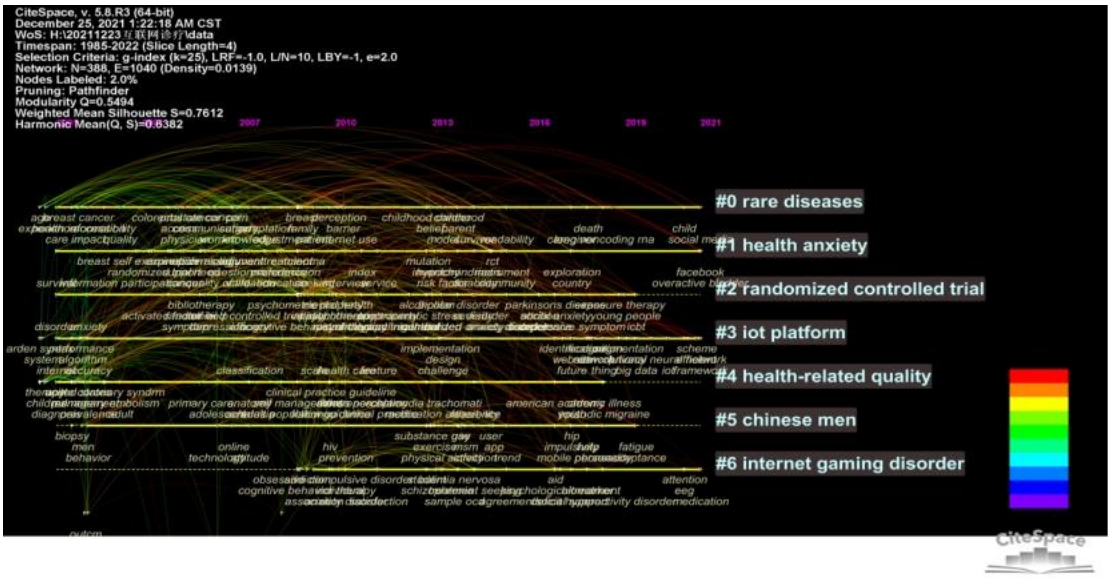
3.6. Analysis of references

Furthermore, a network of co-cited references is presented in Table 4. As illustrated in the table, studies by Andrews G (2010) [26], Hedman E (2012) [27], Andrews G (2009) [28], Andrews G (2014) [29], and Richards D (2012) [30] are among the most frequently cited documents (each cited more than 8 times). These papers likely represent focal points in the field of Internet-based diagnosis and treatment service research and may be considered classic literature deserving of researchers' attention. The terms extracted from the reference lists of these articles were utilized to label the groups, as depicted in Figure 6. Within the network (Figure 6), the top six substantial clusters were labeled as '#1 health anxiety', '#2 randomized controlled trial', '#3 IoT platform', '#4 health-related quality', '#5 Chinese men', and '#6 Internet gaming disorder', respectively.

Table 4. The co-citation table of references from publications in Internet-based diagnosis and treatment service research.

Rank	Count	Co-cited reference
1	13	Andrews G, 2010, Plos One, V5, P0, DOI 10.1371/journal.pone.0013196
2	12	Hedman E, 2012, Expert Rev Pharm Out, V12, P745, DOI 10.1586/ERP.12.67
3	11	Andersson G, 2009, Cognitive Behaviour Therapy, V38, P196, DOI 10.1080/16506070903318960
4	10	Andersson G, 2014, World PsychiatryS, V13, P4, DOI 10.1002/wps.20083
5	8	Richards D, 2012, Clin Psychol Rev, V32, P329, DOI 10.1016/j.cpr.2012.02.004

Figure 6. The timeline view of burst words from publications in Internet-based diagnosis and treatment service research.



3.7. Analysis of burst keywords

The CiteSpace V tool was utilized to identify keywords exhibiting high-citation bursts (Figure 7). Keywords that were not deemed research priorities were excluded. Among the keywords displaying citation bursts from 2001 in the subject of Internet-based diagnosis and treatment services were: 'medical thing' (2019-2021), 'artificial intelligence' (2016-2021), 'health-related quality' (2016-2018), 'breast cancer' (2001-2009), 'prostate cancer' (2001-2015), 'patient care' (2001-2012), 'treatment decision' (2007-2012), and 'HIV' (2013-2018) (excluding keywords not directly related to research).

Figure 7. The keywords with strong citation bursts in articles related to Internet-based diagnosis and treatment service published from 2001 to 2021.

Top 30 Keywords with the Strongest Citation Bursts

Keywords	Year	Strength	Begin	End	2001 - 2021
breast cancer	2001	7.28	2001	2009	
management	2001	5.77	2001	2009	
web site	2001	5.53	2001	2009	
prostate cancer	2001	5.4	2001	2015	
medical information	2001	5.37	2001	2015	
children	2001	5.25	2001	2009	
patient care	2001	4.93	2001	2012	
trial	2001	4.38	2001	2015	
internet-based survey	2001	4.61	2004	2015	
women	2001	6.09	2007	2015	
treatment decision	2001	5.98	2007	2012	
knowledge	2001	5.31	2007	2012	
web	2001	4.41	2007	2015	
internet survey	2001	4.28	2007	2018	
social phobia	2001	7.08	2010	2015	
self help	2001	6.32	2010	2015	
cognitive behavior therapy	2001	5.42	2010	2018	
panic disorder	2001	4.85	2010	2015	
primary outcome measure	2001	4.84	2010	2015	
posttraumatic stress disorder	2001	4.65	2010	2015	
control condition	2001	4.37	2010	2015	
hiv	2001	6.17	2013	2018	
mean age	2001	6.15	2013	2015	
statistical manual	2001	6.04	2013	2018	
health-related quality	2001	5.69	2016	2018	
young adult	2001	5.15	2016	2018	
artificial intelligence	2001	5.07	2016	2021	
medical thing	2001	5.27	2019	2021	
data analysis	2001	4.31	2019	2021	
thing	2001	4.28	2019	2021	

3.8. General information

The objective of this study was to conduct a comprehensive analysis of the global scientific outputs within Internet-based diagnosis and treatment service research from 2001 to 2021, aiming to identify trends and hotspots based on the analysis. The publication trend exhibited a stable trajectory during the search period. Among the top 10 academic journals, NEW ENGL J MED (IF 2020 = 91.253) boasted an impact factor exceeding 90, followed by the LANCET (IF 2020 = 79.323). Additionally, six journals, namely JAMA-J AM MED ASSOC (IF 2020 = 56.274), J CLIN ONCOL (IF 2020 = 44.544), AM J PSYCHIAT (IF 2020 = 18.112), ARCH GEN PSYCHIAT (IF 2020 = 14.480), BMJ-BRIT MED J (IF 2020 = 14.093), and CLIN PSYCHOL REV (IF 2020 = 12.792), exhibited impact factors ranging from 59 to 10.

The United States contributed the highest number of publications and citations compared to the top 10 contributing regions/countries in Internet-based diagnosis and treatment service frontier studies. A similar performance was observed for the top H-index and ESI articles, as well as research quality, with the USA leading in each category. Notably, 185 papers (14.69%) originated from the top 10 institutes. Additionally, two of the top five institutes were from Sweden, while three each were from the USA, Australia, and the United Kingdom.

3.9. Citation analysis

Each author within the top 5 groups contributed more than 9 publications, which are considered to be at the forefront of Internet-based diagnosis and treatment service research. However, only three of these authors were listed among the top co-cited authors, suggesting that esteemed researchers should prioritize the quality of their research in addition to the quantity of papers.

The top 20 co-cited articles are detailed in Table 3. A paper authored by Hatzimouratidis Kin in 2010 received the highest number of citations, followed by 221 co-citations for a paper by Thompson IM in 2005, Bhasin S (2010, 172 co-citations), Inman BA (2009, 161 co-citations), and Lewis RW (2010, 158 co-citations). These papers were published in journals such as Jama-J Am Med Assoc, J Clin Endocr Metab, Mayo Clin Proc, and J Sex Med.

Over the past 30 years, numerous articles with high impact factors have contributed significantly to the advancement of Internet-based diagnosis and treatment service research. Examples include sixty-eight articles in NEW ENGL J MED, ninety articles in Lancet, seventy-five articles in J AM MED ASSOC, and fifty-eight articles in J CLIN. 3.1. Subsection

4. Research frontiers

Burst keywords were identified utilizing CiteSpace V, offering potential insights into emerging research areas. In Figure 7, red lines denote periods of citation bursts, while blue lines indicate time intervals. The subsequent list delineates three frontiers of Internet-based diagnosis and treatment service research:

4.1. Artificial intelligence

In recent years, advancements in Internet and related technologies have facilitated the deep integration of artificial intelligence (AI) into the medical field [31]. Consequently, the application of AI and Internet-based diagnosis and treatment services has become an intriguing topic [31]. Technologies such as the Internet of Things, artificial intelligence, big data analytics, and 3D printing have been extensively employed to combat the COVID-19 pandemic and enhance healthcare services [32]. Information and Communication Technology (ICT) addresses various challenges posed by the pandemic and significantly enhances service quality in the healthcare sector [33], thereby aiding physicians in real-world clinical decision-making, population health

management, and patient administration [34]. As AI continues to evolve, it enables the analysis of online health-related information, providing valuable references for physicians to enhance their Internet-based diagnosis and treatment services [35]. However, few studies have focused on utilizing AI to examine disease interactions within Internet-based diagnosis and treatment services [36]. Furthermore, the adoption of other approaches, such as AI for disease prediction and AI robotics for Internet-based diagnosis and treatment services, warrants greater attention from researchers, as these critical approaches lack sufficient research [37]. Consequently, given the rapid evolution of the field and the myriad potential applications of AI in Internet-based diagnosis and treatment services, AI is poised to revolutionize Internet-based diagnosis and treatment services in the forthcoming decade [38].

4.2. Health-related quality

Internet-based diagnosis and treatment services have the potential to enhance patient satisfaction in clinical practice and improve health-related quality [39]. David's study revealed a strong correlation of responses between Internet-based and phone-based administration of the Expanded Prostate Cancer Index Composite-26 (EPIC-26) [40]. Félix Compen suggested that individual Internet-based Mindfulness-based cognitive therapy (eMBCT) could alleviate psychological distress in cancer patients [41]. Despite evidence supporting the use of the Internet as a valuable tool for engaging patients effectively and managing chemotherapy-related symptoms outside clinic visits, methodological limitations in the existing evidence base necessitate further well-planned and high-quality research [42]. Therefore, exploring Internet-based diagnosis and treatment services represents a new research direction that could significantly benefit healthcare management.

4.3. Breast cancer

The utilization of advanced Internet-based diagnosis and treatment services for breast cancer detection has demonstrated notable efficiency and aids users in early breast cancer detection [43]. The Computer-Aided Diagnosis (CAD) framework proves beneficial in identifying breast abnormalities without requiring expert radiologists and offers a model capable of achieving earlier and more accurate breast tumor detection [44]. Medina's study presented the development and initial outcomes of a step-by-step psychosocial eHealth ecosystem designed to facilitate risk assessment and prevention of early emotional distress among breast cancer survivors [45]. Despite evidence supporting the effectiveness of using the Internet as a valuable tool for successful breast cancer patient care, methodological limitations in the existing evidence base underscore the need for further well-planned and high-quality research [46]. Consequently, this study sets the stage for future research endeavors aimed at improving the detection and treatment of breast cancer patients.

5. Conclusion

Publications on bibliometric studies of Internet-based diagnosis and treatment papers have experienced rapid growth over the past two decades. Initially, CiteSpace V was utilized to generate a visualization network of the Internet. We examined major clusters, emerging patterns in references, and other topics based on CiteSpace data. Our analysis revealed that forefront knowledge areas in Internet-based diagnosis and treatment research include artificial intelligence, health-related quality, and breast cancer, identified through clustering software and analysis of burst keywords. The present study employed a quantitative scientometric approach to delineate references within this sector and explore the progression of Internet-based diagnosis and treatment references research. This data will aid professional researchers in visualizing recognition patterns and trends.

In summary, the number of publications in Internet-based diagnosis and treatment service research has seen a significant increase over the past two decades. The United States, United Kingdom, and China emerged as the top three countries contributing to Internet-based diagnosis and treatment service studies. Furthermore, active collaboration was observed among developed countries, with the United States being the predominant country engaged in such research. Noteworthy authors such as Gerhard Andersson, Brjann Ljotsson, and Margaret K Hampshire may serve as ideal candidates for academic cooperation. Artificial intelligence, health-related quality, breast cancer, and prostate cancer were identified as potential research frontiers, warranting close attention from researchers in the coming years. Ultimately, this study sheds light on the utilization of Internet-based diagnosis and treatment services in healthcare and offers valuable insights for researchers seeking new perspectives on potential collaborators, cooperative institutions, hot topics, and research frontiers in Internet-based diagnosis and treatment.

6. Strengths and limitations

This study represents the first bibliometric analysis of Internet-based diagnosis and treatment service research spanning over 20 years. However, the majority of publications retrieved from the database were written in English, which may have led to a somewhat incomplete analysis. Additionally, this study focused specifically on original and reviewed articles published between 2001 and 2021 as classified by the Web of Science Core Collection (WoSCC). This selection criteria may not encompass all literature related to Internet-based diagnosis and treatment services, as other types of records published in books and conferences were not included. While databases like PubMed, Scopus, and Embase could offer broader coverage, their "extra coverage" might be attributed to journals with potentially limited readership.

Given our objective to conduct a high-quality bibliometric analysis to identify research trends in the Internet-based diagnosis and treatment service field, the WoSCC was deemed the most suitable choice. Consequently, articles from other databases were excluded. Lastly, although the Web of Science database continues to update, this study includes the vast majority of papers in Internet-based diagnosis and treatment research from 2001 to 2021.

Author Contributions: Mengfei Sheng and Jiangping Zhou conceived and designed the analysis, downloaded and analyzed the data, contributed analysis tools, prepared figures and/or tables, authored or reviewed drafts of the paper, and approved the final draft. Baoxiang Song and Change Zhu downloaded and analyzed the data, authored or reviewed drafts of the paper, and approved the final draft.

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