BIS HEALTH AND ENVIRONMENTAL SCIENCE

Volume 2 2025 | DOI: 10.31603/bishes.245
6th Borobudur International Symposium on Science and Technology (BIS-STE) 2024

UNIMMA PRESS
Universitas Muhammadiyah Magelang

Bibliometric analysis of global telepharmacy research development: Trends, productivity, and future opportunities

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Abstract

Several countries have implemented e-pharmacy as a pharmaceutical service system during the COVID-19 pandemic. E-pharmacy is a pharmacy that operates via the internet and sends orders to customers via electronic mail (e-mail) or online pharmacy web portals. The aim of this study is to map the development of telepharmacy research worldwide. A bibliometric analysis was conducted in May 2016 using the Scopus database with the keyword "telepharmacy." The collected data were analyzed descriptively based on publication year, country of publication, journal name, researcher productivity, and research subjects. The extracted data were then converted into a Comma Separated Values (CSV) format and processed using the VOSviewer application to generate a bibliometric map of telepharmacy research. The findings indicate a significant increase in telepharmacy-related publications from 1998 to 2022, with most studies published in the Bulletin of Indonesian Economic Studies. The United States contributed the highest number of publications, while the most productive researchers in this field were Petterson and Scott, followed by Margusino-Framinan and Morillo-Verdugo. Despite the increase in publications, telepharmacy remains a relatively new research topic, with only 254 documents found in the Scopus database. Telepharmacy research is still in its early stages, but it has shown steady growth over the years. Given its potential impact on pharmacy education, diabetes management, hospital and ambulatory care, treatment regulation, and pharmaceutical services, telepharmacy should be prioritized as a research area. Further studies are needed to explore and develop innovative service models that can contribute to advancements in healthcare technology and pharmacy practices worldwide.

Published:
May 26, 2025

Selection and Peer-review under the responsibility of the 6th BIS-STE 2024 Committee

Keywords

Telepharmacy, Bibliometric, Health technology

Introduction

The Covid-19 pandemic has changed people's habits globally in meeting their needs and making it easier to access and obtain health services. This condition triggers the

emergence of technology-based health service innovations. The current COVID-19 pandemic has presented many challenges and opportunities for pharmacists to improve and expand their pharmaceutical practices. One of them is by applying telepharmacy services or the provision of pharmaceutical services using telephone or video conferencing technology [1] although currently the implementation of telepharmacy is a significant challenge for pharmacists who exist in hospitals and community pharmacies, especially in terms of providing pharmaceutical care to outpatients [2]. One of the forms of development is innovation in telemedicine and telepharmacy. These two types of services have actually spread all over the world and Indonesia is no exception. In its implementation, telemedicine and telepharmacy are becoming more and more developed in accordance with the demands of health conditions in the community. Covid-19 has changed communication patterns and habits not only for the community, but also for the government as a provider of systems and regulations. The government must be able to provide guarantees for the security of patient data and also guarantee legal certainty for health service providers themselves. Competence and mastery of technological advances to support health service activities are absolutely necessary to be able to provide more satisfying services [3].

Telemedicine and telepharmacy have rapidly developed worldwide, including in Indonesia, in response to community healthcare needs. The pandemic has altered communication patterns not only among the public but also in how governments regulate and provide healthcare systems. Governments must ensure the security of patient data and establish clear legal frameworks for healthcare providers. Additionally, technological competence is essential for delivering high-quality healthcare services [4], [5].

Pharmacy services at the pharmacy during COVID-19 must have a system that can prevent disease transmission while meeting the needs of patients. Pharmacy must serve as a strong supporter of patient medicines and supplies of protective equipment. Pharmacists must be prepared to provide skilled and effective pharmaceutical services to the patient population to ensure medication safety and promote overall control of the COVID-19 pandemic [6]. Several countries have implemented e-pharmacy as a pharmaceutical service system during the COVID-19 pandemic. E-pharmacy is a pharmacy that operates via the internet and sends orders to customers via electronic mail (e-mail) or online pharmacy web portals. E-pharmacy site can be a health blog that provides information about purchased drugs such as indications, side effects, dosages, and information about various medical conditions to increase patient knowledge and awareness [7]. Telepharmacy enable health services such as drug review, patient counseling, and verification of prescriptions by qualified pharmacists for patients located far from distant hospitals, pharmacies, or health centers [8]. Providing appropriate pharmaceutical services to patients and conducting consultations with other health professionals play an important role in reducing the use of inappropriate

and less effective drugs. This can reduce adverse drug effects and interactions, result in drug effectiveness and reduce costs [9].

The objective of this study to ascertain the progression of telepharmacy research in terms of bibliometric map distribution and research trends. Data mapping software called VOSviewer is used [10]. It is believed that bibliometric analysis is effective at producing datasets that may be used to raise the caliber of study [11].

Methods

This study uses quantitative methods with bibliometric analysis techniques to find out the map of research on telepharmacy. The data used in this study sourced from Scopus which amounted to 141 documents. The time span used by the benchmark in this study is not limited. Data analysis was carried out using statistical analysis to calculate the number of documents and percentages. Meanwhile, to determine the relationship between documents, VOSviewer is used as the instrument.

Inclusion and Exclusion Criteria The data used in this study is data from international publications on the topic of telepharmacy which were obtained from the Scopus website (www.scopus. com). Data collection was carried out in August 2022 by searching through Scopus with agricultural and Indonesian keywords in the category of article title, abstract, keywords in the period 1998-2022. From the search results obtained publications in the form of articles as many as 260 article titles. Data in the form of the number of publications per year, journals containing telepharmacy articles, authors, origin of the subject authors were analyzed, and the publication development map was analyzed using VOSViewer software.

Results and Discussion

The trend of telepharmacy studies has increased from year to year. This means that the need for the development of a telepharmacy service model is seen as an important and interesting topic to study. Meanwhile, from 260 indexed in Scopus documents, there are 9 types of documents that can be classified and the most are original research articles (159) and reviews (41). The dominance of original research articles suggests that many studies have been conducted to explore various aspects of telepharmacy, such as service models, regulations, and implementation in different countries. Meanwhile, the significant number of literature reviews indicates efforts to summarize previous findings and identify research gaps that still need further exploration. Authors Network can be seen on Table 1.

The increase in the number of publications confirms that telepharmacy is an evolving field with great potential for continued study. Future research can focus on optimizing service models, evaluating the effectiveness of telepharmacy in various clinical conditions, and developing policies to support its broader implementation [12], [13],

[14]. Document productivity and Network visualization of author publication trends can be seen on Figure 1 and Figure 2.

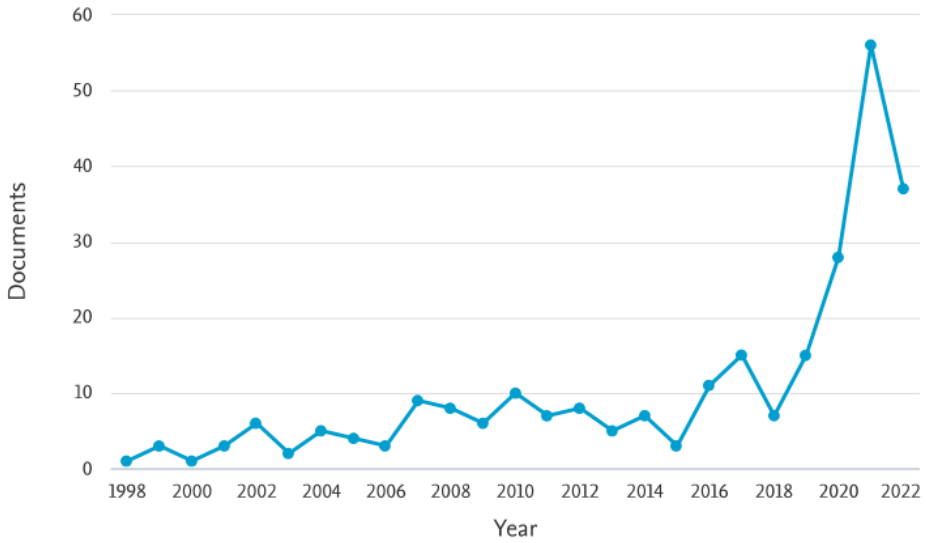


Figure 1. Documents productivity

Table 1. Authors Network

Author	Documents	Citations	Total link strength
Margusino-framinan L	4	51	31
Morillo-verdugo R	4	51	31
Chausa P	2	64	25
Gatell J.M	2	64	25
Peterson C.D	7	91	25
Scott D.M	7	81	25
Monte-boquet	2	29	20
Blanch J	1	57	19
Blanco J.L	1	57	19
Canal N	1	57	19
Codina C	1	57	19

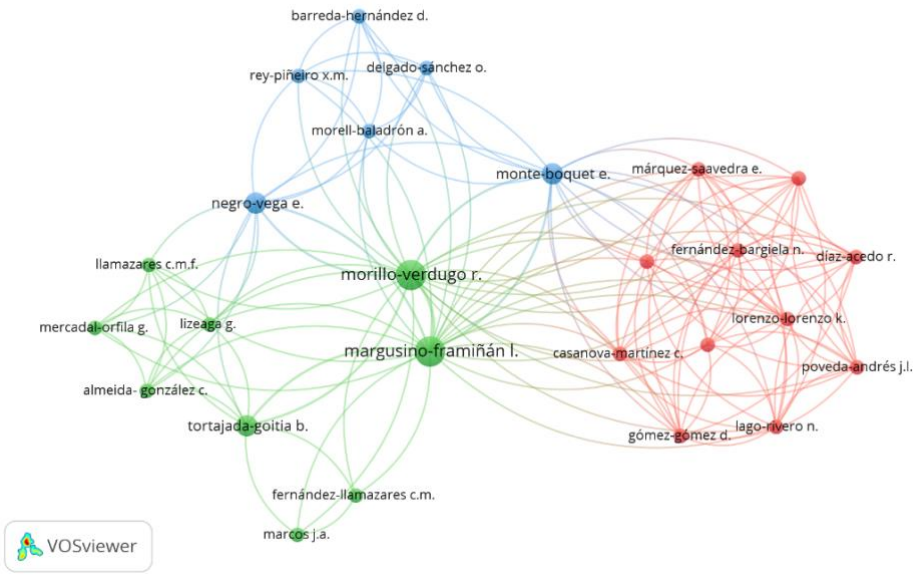


Figure 2. Network visualization of author publication trends

Figure 1 provides an overview of the authors who often publish research results related to the topic of telepharmacy research, which can then be used as material for reference. Countries Network can be seen on Table 2.

Countries

The analysis of Table 2 telepharmacy publications indicates an uneven distribution, with a dominance of research originating from developed countries such as the United States, Italy, the United Kingdom, and the United Arab Emirates. Among these, the United States stands out as the most productive country in telepharmacy research, contributing 100 documents with the highest citation rate. This dominance suggests that telepharmacy is a well-explored topic in high-income nations, where healthcare infrastructure and digital health adoption are more advanced.

Table 2. Countries Network

Country	Document	Citations	Total link strength
United States	100	1387	7
Italy	8	117	6
United Arab Emirates	6	30	11
China	5	6	4
India	5	12	4
Egypt	5	47	9
Pakistan	4	13	6
Saudi Arabia	4	15	6
Russian Federation	3	70	3
Serbia	2	1	2

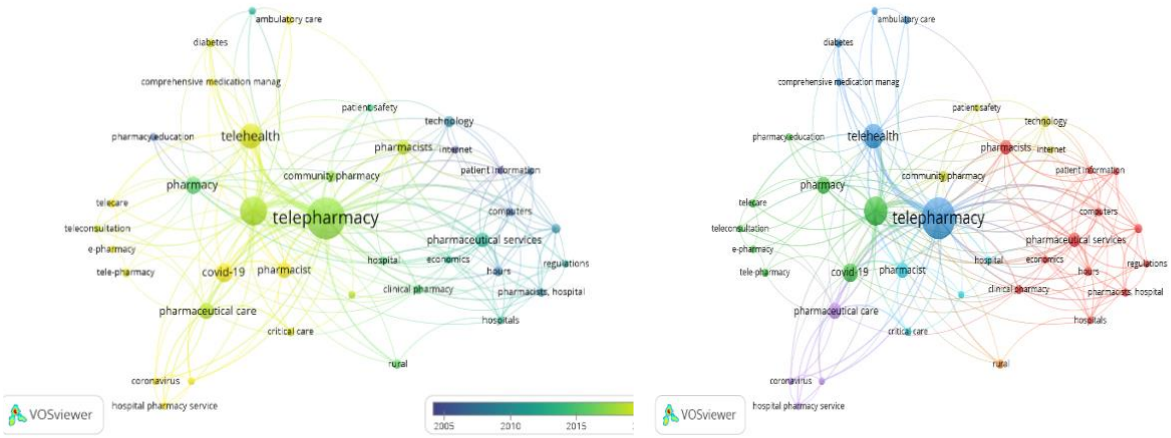
However, developing countries have significantly less representation in telepharmacy research. The limited number of studies from these regions presents a substantial research gap and an opportunity for further exploration. Given the increasing global interest in digital health solutions, developing countries should prioritize telepharmacy research to address local healthcare challenges, especially in areas with limited access to pharmaceutical services.

The lack of research in developing nations also highlights the potential for future scientific contributions, making telepharmacy a highly relevant topic for reputable scientific journals. Researchers from developing regions could explore context-specific applications of telepharmacy, such as its role in rural healthcare delivery, medication accessibility, and chronic disease management, to bridge the knowledge gap and enhance healthcare equity worldwide. Bridging Research Gaps and Contributions to the Field. To further strengthen the role of telepharmacy, future research should focus on Assessing the Implementation of Telepharmacy in Developing Countries – Investigating barriers such as regulatory challenges, digital literacy, and healthcare infrastructure [15], [16]. Comparing Telepharmacy Models Across Different Healthcare Systems – Understanding how different countries integrate telepharmacy into their national health strategies [17]. Evaluating the Economic and Clinical Impact of Telepharmacy – Measuring the effectiveness of telepharmacy in reducing healthcare costs, improving patient outcomes, and increasing medication adherence [18].

By addressing these areas, telepharmacy research can expand beyond high-income countries, making digital pharmaceutical care more accessible worldwide. Developing countries, in particular, stand to benefit greatly from telepharmacy adoption, especially in remote or underserved regions [19]. Visualization Based on Keywords can be seen on Figure 3.

Keywords

The author maps keywords on each document using VOSviewer. VOSviewer is a computer program that can be developed to build and view bibliometric maps. Vosviewer offers a text-mining function that can be used to visualize the network in citing an article. Keywords that have been mapped using VOSviewer can be seen in Figure 2 presenting a network visualization of keywords that have been made by the author, namely telepharmacy. Figure 2 showed that color, circle size, font size, and line thickness all indicate the strength of the relationship between keywords [20]. Based on Figure 3b, it shows that the most written documents are those regarding telepharmacy and its relationship with telemedicine, telehealth, pharmaceutical services, pharmaceutical care, Covid-19, and pharmacist. The larger the circle shown on each keyword, the more often that keyword is used or the more documents written about the theme. Visualization Based on Keywords Density can be seen on Figure 4.



(a) **(b)**

Figure 3. Visualization Based on Keywords: (a) overlay; (b) keywords link

The results of the keyword density analysis show that in recent years, the topic of telepharmacy is seen as a sexy issue among health academics, especially pharmacy. If explored further, there are many other studies that discuss this topic. However, from the many studies that have been conducted, there has been no discussion of efforts to implement telepharmacy in the fields of pharmacy education, diabetes, treatment management, regulation, hospital and ambulatory care. Whereas through telepharmacy studies, pharmaceutical services can optimize therapeutic outcomes and provide convenience for the public in accessing these services. One of them is through the Language and Literature Studio courses that are included in the curriculum structure of several universities. The limitation of this study is that the articles reviewed are only

obtained from the Scopus database, therefore they do not have comparable data. Consequently, future studies need to use a comparative analysis approach involving the Scopus database and the Web of Sciences (WoS).

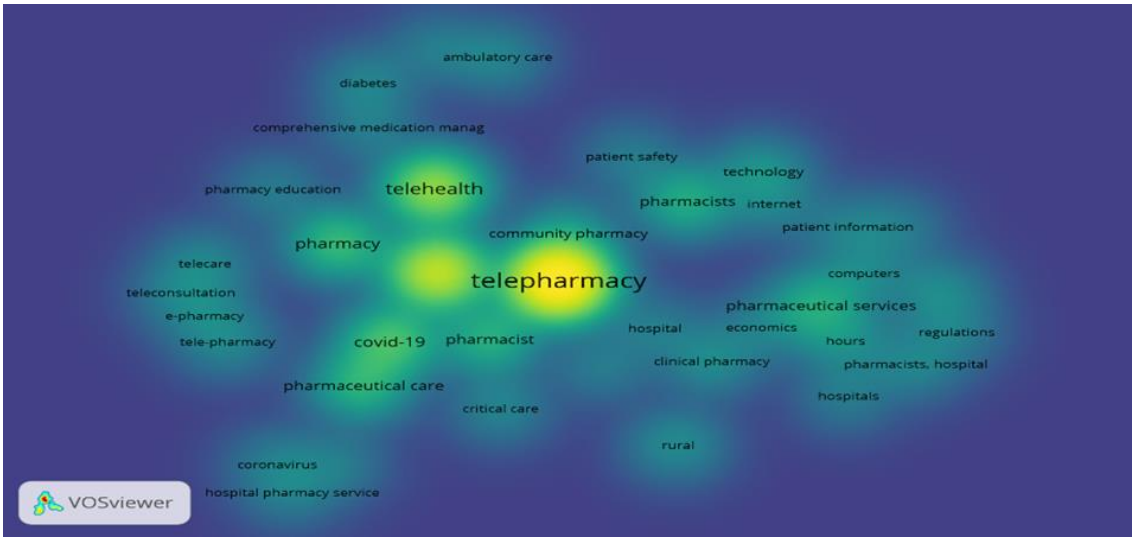


Figure 4. Visualization Based on Keywords Density

Telepharmacy has become a promising approach to overcoming healthcare challenges, particularly in managing chronic conditions and enhancing medication adherence. With the rising prevalence of chronic diseases such as diabetes, hypertension, and cardiovascular disorders, telepharmacy facilitates remote pharmaceutical care, ensuring continuous patient support and improved health outcomes [8]. One of the primary advantages of telepharmacy is its capability to assist in managing chronic illnesses by offering virtual consultations, medication monitoring, and tailored interventions. Patients with chronic conditions often require prolonged medication therapy and regular treatment modifications. Through telepharmacy services, pharmacists can conduct virtual medication assessments, optimize treatment plans, and intervene promptly to prevent complications [21]. For example, research indicates that telepharmacy services play a crucial role in diabetes management by improving glycemic control. A study by [22] found that patients receiving remote pharmacist counseling exhibited better adherence to insulin therapy and showed significant improvements in HbA1c levels compared to those receiving conventional in-person care. Likewise, for patients with hypertension, telepharmacy interventions, such as remote medication monitoring and lifestyle counseling, have been associated with better blood pressure regulation [23]. Medication non-adherence poses a significant challenge to effective treatment, especially among individuals with chronic illnesses. Telepharmacy helps mitigate this issue by incorporating automated medication reminders, virtual follow-ups, and digital adherence tracking. Studies suggest that pharmacist-led teleconsultations enhance patient comprehension of their medication regimens, ultimately leading to higher adherence rates [4].

a systematic review by [24] found that telepharmacy interventions, such as mobile app-based reminders and video consultations, significantly improved medication adherence

among elderly patients with polypharmacy. This suggests that integrating telepharmacy into chronic disease management can reduce hospital readmissions and improve overall patient well-being. Bridging Research Gaps and Contributions to the Field Despite the growing body of literature on telepharmacy, several research gaps remain. This study contributes to the field by mapping the development of telepharmacy research globally, highlighting key trends, leading researchers, and publication patterns. The findings reinforce the need for further exploration of telepharmacy's long-term impact on patient outcomes, cost-effectiveness, and integration into national healthcare policies. Future research should focus on: Evaluating Cost-Effectiveness – Assessing the financial benefits of telepharmacy compared to traditional pharmaceutical services. Expanding Telepharmacy in Rural Areas – Investigating how telepharmacy can improve healthcare access in underserved regions. Regulatory Frameworks and Standardization – Developing global guidelines for the implementation and evaluation of telepharmacy services. By addressing these gaps, telepharmacy can be positioned as a vital component of modern healthcare, ensuring equitable access to pharmaceutical care while enhancing chronic disease management and medication adherence. that most participants are likely to prefer the use of telepharmacy, especially during crises such as the current COVID-19 pandemic. Telepharmacy can be applied as an important means and a crucial service to lessen the load on healthcare organizations and expand drug supply shelters in pharmacies. However, there are still substantial hurdles to overcome in order to successfully implement the telemedicine platform as part of mainstream practice [25].

Conclusion

The topic of telepharmacy is still a new issue and has not been widely studied. Although it has increased from year to year, this topic is still considered a new thing in the world of scientific publications. The Scopus database found only 260 documents. Therefore, telepharmacy should be a research priority. Telepharmacy provides many opportunities and opportunities for researchers to develop service models in the context of pharmacy education, diabetes, treatment management, regulation, hospital and ambulatory so as to have a real impact on the development of science and technology in the future.

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