# E-Pharmacy contribution towards the behaviour of stakeholders: A bibliometric synthesis of SCOPUS data (1997-2024)

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https://doi.org/10.63340/samt/10013

***Abstract:*** *E-pharmacy is an online platform that allows customers for doctor consultation, order and home delivery of pharmaceutical products etc. digitally. This healthcare method has expanded substantially in recent years due to technological advancement & covid-19. This study examines data from 454 Scopus indexed papers from 1997 to 2024. Using "R" and VOS-viewer, the database of research publications will be examined. Mappings of bibliometric analysis (bibliographic coupling, citation, co-occurrence and co-authorship) between cited publications, countries, authors & keywords will be plotted by using the software to identify patterns and get a comprehensive grasp of e-pharmacy trends and evolution over twenty-eight years.*

***Keywords****: E-pharmacy, Bibliometric Analysis, Online Pharmacy, Biblioshiny, and VOS viewer.*

## Introduction

The introduction of digital technology has had a significant impact on a variety of different businesses, including the healthcare sector. Through the use of these technological breakthroughs, online pharmacy has emerged as a significant disruptor in the pharmaceutical sector. The practice of obtaining pharmaceuticals and other health-related items by using the internet is termed as online pharmacy or e-pharmacy, which is also known as online pharmacy. Over the past several years, there has been a significant expansion of online pharmacies, which may be attributed to the changing tastes of customers, the expansion of internet access, and the advancement of technol-

ogy. According to Pál et al. (2015) medicine, in contrast to other e-commerce products, occupies a distinctive status owing to its therapeutic attributes.

As a result, providing information along with cautions is crucial. Excessive or inappropriate drug usage might pose serious health risks. Customers who previously relied solely on doctor recommendations can now quickly get healthcare products, including prescription prescriptions, thanks to the World Wide Web. Despite being readily available online, the supply of medicine is controlled and distinguished from other products by its unique qualities. Therefore, strict laws and restrictions are needed for its commercialization and distribution. This distinguishes the online pharmacy from its competitors. One significant retail industry in e-commerce is consumer healthcare. All restrictions and limitations on the distribution and sale of products and services have been superseded by e-commerce (Bailey, 2005). According to Ashames et al. (2019) pharmaceuticals represent a vital category of products that undergo stringent evaluation. According to Orizio et al. (2011), little over 6% of people worldwide buy medications via internet pharmacies. Fittler et al. (2018) conducted a survey of outpatients in Hungary, 4.17% of participants buy medications online. Just 2.7% of Saudi Arabian participants said they would be likely to use drugs in the future, according to Abanmy (2017). A significant 85.8% of Indian participants reported being aware of online pharmacies. just 6% had ever purchased medication online in 2018 (Sah et al., 2018). According to Ndem et al. (2019), less than one-third of survey respondents in Nigeria are aware that online pharmacies are available. However, as per Mouratidis & Papagiannakis, (2021) in the post-COVID era, the previously mentioned values have undergone significant revisions.

According to Bowman et al. (2019), the pharmaceutical industry uses the internet as an uncontrolled conduit. There is a greater likelihood that susceptible populations may be exploited by a number of malicious persons (Samant and Deshpande, 2018). Sabbir et al. (2020) concluded that customer buying patterns with regard to online pharmacies are concerning in a number of developing countries, including India is what this study looks at. Indian consumers are increasingly purchasing drugs online as a result of increased internet access and technology literacy following COVID-19 (Sah et al., 2018). These online pharmacy platforms offer a handy method to obtain a diverse collection of pharmaceuticals, including supplements, OTC drugs, and prescription drugs. According to Henney et al. (1999) e-pharmacies are internet-based pharmacies.

The e-pharmacy sector of India encompasses online branches of traditional conventional pharmacies, independent e-pharmacy websites, mobile apps, and social media platforms that collaborate with conventional pharmacy establishments, all of which are categorized as online pharmacies (Fung et al., 2004; Sah et al., 2018) in this research article. Furthermore, the study on e-pharmacies procurement has extensively utilized the term 'medicines' to include all types of pharmaceuticals products like generic and branded medicines (Ndem et al., 2019). This study defines e-pharmacies as online providers of pharmaceutical products and medical services, utilizing a supply chain framework for delivery. The widespread adoption of e-pharmacies can be attributed to several factors, such as the convenience of obtaining prescription medications from home, access to a wide range of products, and the provision of fast delivery services. In response to the global COVID-19 epidemic, individuals turned to internet services in order to satisfy their healthcare requirements while adhering to social distancing measures. This expansion was further accelerated as a result of this pandemic. In response, governments in a number of countries have begun to regulate and assist online pharmacies in order to improve access to pharmaceuticals, particularly in places that are neglected. Personalized healthcare services, consultations driven by artificial intelligence, and automated prescription verification are some of the important technology breakthroughs that are driving this expansion. Consumer convenience is another factor that is driving this growth. The outcome of this is that it

this growth. The outcome of this is that it is anticipated that the e-pharmacy industry will continue to flourish, providing millions of people all over the world with a contemporary and conveniently available healthcare option. Academic research on e-pharmacy has experienced significant expansion and investigation, with the number of scholarly papers indexed in Scopus increasing to 454 by 2024. Consequently, e-pharmacy or internet pharmacy requires a literature study. The bibliometric analysis is conducted utilizing the R package and VOS viewer. E-pharmacy has gained significance for all stakeholders in research, practice, and policy contexts owing to its evolving difficulties and potential. It influences and is interconnected with several fields. This study examined countries such as the US, UK, and China that have advanced the conceptual framework of "e-pharmacy," whereas other nations have yet to adapt and establish their contextual frameworks due to varying conditions between countries.

## Literature Review

Due to their convenience and accessibility, e-pharmacies have become more and more popular in recent years (Lostakova et al., 2012). For a variety of reasons, consumers are increasingly choosing online pharmacies. Among these, the wide range of pharmaceutical products offered by e-pharmacies ensures customer privacy and makes essential information easier to access (Singh and Rana, 2022). E-pharmacies are appealing due to their accessibility (Gupta, 2020). E-pharmacy is a desirable alternative due to the ease of placing orders from home and having them delivered right to one's door. This ease reduces the requirement to go to a conventional pharmacy store, which appeals to people with hectic schedules or limited mobility. Many poor people in developing countries like India face obstacles to get access to quality healthcare, which intensifies their health problems and perpetuates their cycle of poverty.

According to Dhagarra et al. (2020) utilizing technology to access healthcare is regarded as essential for bridging this gap and enhancing patient accessibility. According to Singh et al. (2020), e-pharmacies are a game-changer in modern healthcare since they improve consumer access and empower people to take control of their health. Thusi (2022) in a study highlights technological developments have accelerated e-pharmacies' growth and development. E-pharmacy services are now more easily available and user-friendly for those who are constantly on the go because to the increased use of smartphones and mobile applications (Raut et al., 2022). Smart phones have made it more convenient to utilize e-pharmacy platforms and have allowed them to be easily integrated into daily life. Artificial intelligence (AI) and mobile technologies are critical components of e-pharmacy. According to Khan et al. (2023), artificial intelligence enhances inventory management, customizes recommendations, and enhances customer experiences. Public understanding is deficient concerning the advantages of utilizing Internet pharmacies; therefore, it is essential to illustrate the usage and benefits of e-pharmacies, accompanied by improved guidance for consumers. The clients predominantly valued the "home delivery" service for online-ordered medications and expressed a preference for online ordering during instances of severe sickness. The e-pharmacy program is easy to use, according to the results. Customers would grow suspicious if there was out-of-date and false information available. A study by Singh et al. (2020) examined how E-Pharmacy affected the pharmaceutical industry and society during a pandemic. During the pandemic the impact of e-pharmacies are investigated in this study. Many positive impacts of e-pharmacy on society have been explained by the author. E-pharmacy's goal is to supply medicine to every area at a fair price. In e-pharmacy, self-medication becomes a serious problem. Because the Drug and Cosmetics Act 1940 and the Pharmacy Act 1948 were so outdated and lacked provisions for the operation did not include the required planning for the operation of online pharmacies, the Indian government created regulations for their operation. This research examines the numerous aspects influencing the adoption of online pharmacy among the general populace. Major reasons include cost-effectiveness, convenience, accessibility of rare medications, and confidentiality.

The author has identified many more variables contributing to the rapid boom of e-pharmacy in India, such as the Digital India project, a government e-healthcare program, and foreign direct investment. A study on e-pharmacy customer purchase behaviour was conducted by Gupta et al. (2020). Randomly one hundred respondents from Jaipur city were chosen for this study. According to the study's findings, consumers had a remarkably high level of e-pharmacy expertise. Pharmaceuticals are available to Jaipur residents both online and in-store. The government and pertinent organizations must, however, make a concerted effort to inform the public about the numerous dangers of buying prescription drugs from online pharmacies. From an Indian perspective, Salter et al. (2014) studied E-Pharmacies: An Emerging Market in Indian Retail Pharmacy. This survey evaluated 252 respondents, of whom 66% purchased medication online. The author proposed that, in the absence of established guidelines for online pharmaceutical sales, there should be thorough verification of scanned prescriptions at the time of order placement, followed by a re-verification upon delivery to prevent medication misuse.

Pujari et al. (2016) explained the consumer pharmaceutical buying behavior for prescription and non-prescription medications. The study aimed to identify the sources of information individuals select regarding pharmaceutical products. What factors impact purchase behavior in the selection of medications? The poll was conducted with 100 participants, with intriguing results. Only 60% of the population purchased medication based on a physician's recommendation, but other influences such as magazines, online literature, familial, and peer counsel also played a role in the decision-making process. The author observes that individuals prefer to select their prescriptions based on personal preference and cost, whereas recommendations from pharmacists and physicians do not significantly impact financial considerations.

**Objectives of the Study**

1. To methodically explore the current literature on e-pharmacy available in Scopus, focusing on aspects such as author, source, document, country, and keywords.

2. To explore the research gaps and facilitate the prediction of the future trajectory relating to e-pharmacy.

**The Sample**

To conduct bibliometric analysis, the study undertakes the Scopus database extracted from Scopus website. The research ensures comprehensive coverage of publications related to E-pharmacy and Online pharmacy for the period ranging between 1997 to 2024 and employed the keyword combinations "E-pharmacy" and "Online Pharmacy". The findings from the aforementioned source indicate a total no of 454 publications, as illustrated in Figure 1.

**The Tool**

The research is carried using the bibliometric analysis, created by data retrieved from Elsevier BV, to investigate e-pharmacy studies. SCOPUS is the preeminent and most dependable database source for analyzing scientific publications. This research was picked because of its reliability based on document repositories and relevance, like the authors' countries, citation counts per document, significant journals, and average annual publications. VOSviewer software package and Biblioshiny in R-Studio is used to carry bibliometric analysis. VOSviewer employs fractional counting of bibliometric connections to mitigate the bias caused by a high number of authors on publications. Biblioshiny, an R-Studio software, is among the premier programming tools for data computation and graphical representation, employing both quantitative and scientific methodologies for comprehensive bibliometric analysis (Abdullah et al., 2022). Bibliographic coupling, co-citation analysis, citation analysis, and co-authorship analysis are commonly used in bibliometric studies (Caviggioli & Ughetto, 2019).

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## Conceptual Framework

This paper seeks to identify and evaluate documents related to "E-pharmacy" through bibliometric analysis of the pertinent literature, utilizing VOS viewer to develop networks and clusters of keywords, authors' contributions, their countries of origin, and cited documents. The study encompasses 28 years of intensive research carried from 1997 to 2024, utilizing a total of 454 Scopus-based documents, reflected in the graph below. Figure 1 illustrates the approach for data acquisition. In accordance with the study's scope, "e-pharmacy" was utilized as a pertinent term for literature retrieval in the SCOPUS database. A bifurcated data filtration procedure was executed on the search outcomes. As of 23/10/2024, the SCOPUS database search reported 1780 documents. The initial stage categorized the papers by topic areas such as Business, Management, Social Sciences, Arts and Humanities, Econometrics and Finance; Economics, and transdisciplinary fields, contributing a total of 875 documents. The second phase refined the search to include only journal articles in English, where 454 documents were finally used to carry and develop networks for concluding remarks.

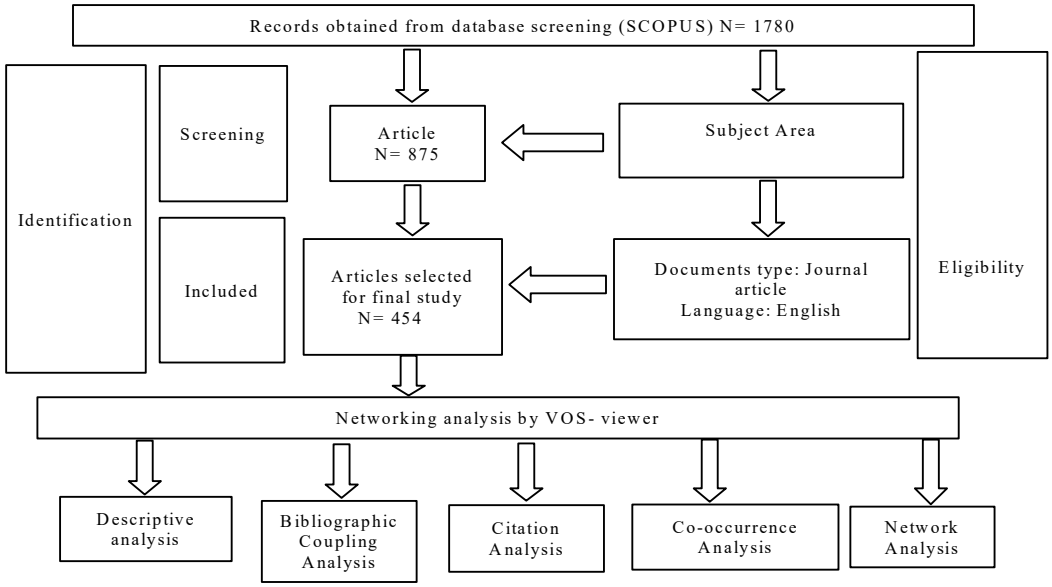


**Figure 1: Methodological procedure for data collection**

## Analysis and Findings

### Descriptive Analysis

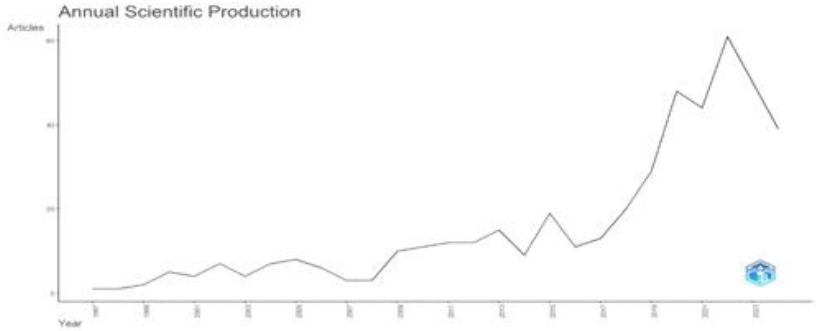


**Figure 2: Publication trends of e-pharmacy from 1997-2024**

Using the R tool, the primary data in Table 1 below shows that there is no yearly growth rate because the pharmacy industry is always evolving through innovation and records become outdated quickly. The contributing study's average age is only 28 years old, and no data are excluded for decision-making based on future trends. The study indicated that the credibility of both national and international research is notably lower in terms of references and citations.

**Table 1: 'Year wise papers'**

| Years | Papers | Years | Papers |
|---|---|---|---|
| 1997 | 1 | 2011 | 12 |
| 1998 | 1 | 2012 | 12 |
| 1999 | 2 | 2013 | 15 |
| 2000 | 5 | 2014 | 9 |
| 2001 | 4 | 2015 | 19 |
| 2002 | 7 | 2016 | 11 |
| 2003 | 4 | 2017 | 13 |
| 2004 | 7 | 2018 | 20 |
| 2005 | 8 | 2019 | 29 |
| 2006 | 6 | 2020 | 48 |
| 2007 | 3 | 2021 | 44 |
| 2008 | 3 | 2022 | 61 |
| 2009 | 10 | 2023 | 50 |
| 2010 | 11 | 2024 | 39 |

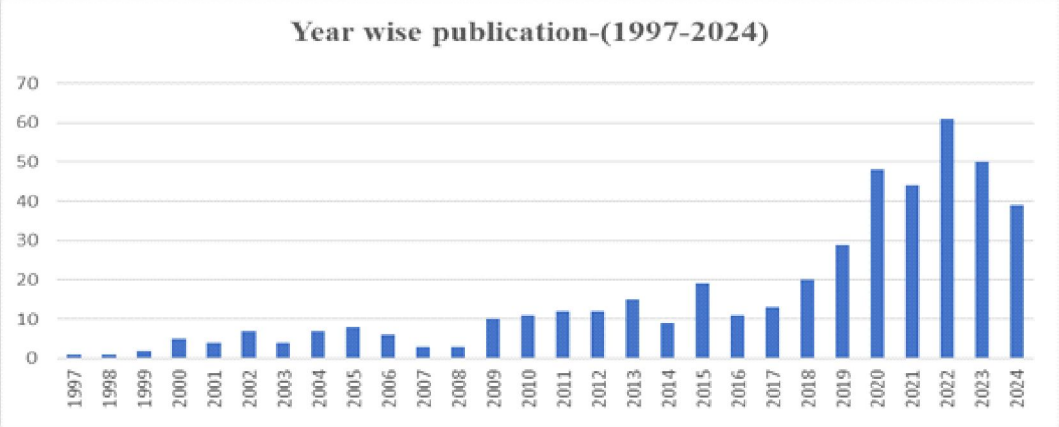


**Figure 3: year wise publication of papers from 1997-2024**

The above data demonstrates the trend in academic article publishing over nearly thirty years, commencing from 1997 to 1998 only one paper each year were published. The figures thereafter saw a gradual increase, starting with two publications in 1999 and a more significant rise to five in 2000. In the early 2000s, publications varied but progressively rose, with 4 articles in 2001, 7 in 2002, a minor decline to 4 in 2003, a rise to 7 in 2004, and culminating at 8 in 2005. Between 2006 and 2008, the yearly output fluctuated between 3 and 6 publications, reflecting consistent although highlighting moderate research engagement. Significant rise in academic production started in 2009 with 10 articles, increasing to 11 in 2010, and reaching 12 in both 2011 and 2012. The progressive upsurge continued, attaining 15 in 2013, followed by a little decline to 9 in 2014. A significant increase started in 2015 with 19 publications, subsequently rising to 20 by 2018 and further escalating to 29 in 2019. The increasing trend escalated in 2020, a year characterized by a significant rise to 48 articles, perhaps indicating changes in worldwide research agendas. The apex year was

2022, including a notable 61 publications, succeeded by modest reductions to 50 in 2023 and 39 in 2024. This general rising trajectory, accompanied by intermittent oscillations, signifies an increasing prioritization of research and publishing over time, with recent declines potentially reflecting alterations in financing or academic emphasis.

**Bibliographic Coupling Analysis**

Bibliographic coupling involves correlating two publications that reference the same document, predicated on the probability that their topics are analogous (Shin and Perdue, 2019). When two papers have a similar citation, they are bibliographically "coupled."

**Bibliographic Coupling Analysis (Authors)**

Table 2 delineates the ten most prominent authors according to bibliographic coupling. Out of 1,622 authors, only 30 met the criteria of having at least 2 documents and a minimum of 50 citations. Tim k. Mackey authored many papers among which "Digital danger: a review of the global public health, patient safety and cybersecurity threats posed by illicit online pharmacies" is one of them. Bryan A. Liang is in 2nd position with 390 citations of 9 documents and 756 total link strength. He has the h-index of 43. In the paper "Mapping of Health Communication and Education Strategies Addressing the Public Health Dangers of Illicit Online Pharmacies" the results suggest that while certain groups are actively involved in the problem, communication and education programs have demonstrated dubious success in engaging the public. The third position is occupied by Lajos Botz with 926 total link strength, 5 documents and 153 citations. The h-index of Lajos Botz is 24. The paper titled "Consumers Turning to the Internet Pharmacy Market: Cross-Sectional Study on the Frequency and Attitudes of Hungarian Patients Purchasing Medications Online" indicates that improved communication between patients and providers, along with promotional initiatives, is crucial for educating the public about the safe use of online pharmacies, as these strategies can effectively reduce risks to patient safety.

**Table 2: Results of bibliographic coupling (Authors)**

| Authors Name | | Total link strength | Documents | Citations | H-Index |
|---|---|---|---|---|---|
| Tim K. Mackey | | 834 | 13 | 444 | 53 |
| Bryan A. Liang | | 756 | 9 | 390 | 43 |
| Lajos Botz | | 926 | 5 | 153 | 24 |
| András Fittler | | 939 | 9 | 133 | 13 |
| Luigi Caimi | | 617 | 4 | 126 | 1 |
| Serena Domenighini | | 617 | 4 | 126 | NA |
| Umberto Gelatti | | 617 | 4 | 126 | 27 |
| Grazia Orizio | | 617 | 4 | 126 | NA |
| Maura Bressanelli | | 561 | 3 | 78 | |

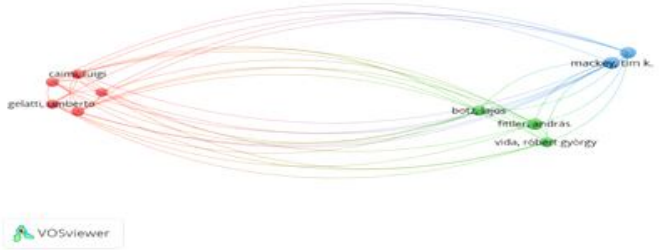


**Figure 4: Bibliographic Coupling (Authors)**

**Bibliographic coupling analysis (Organizations)**

Table 3 illustrates the 8 most significant organizations based on bibliographic coupling. Among 1,090 organizations, only 10 satisfied the requirements of possessing a minimum of 2 papers and at least 30 citations. The data shows how different organizations contribute to academic publications through research output and effect. The Institute of Health Law Studies at California Western School of Law has the most links (153) and citations (279) from 4 documents, indicating its importance in collaborative research. The San Diego Center for Patient Safety at UC San Diego has 118 links and 187 citations from 2 documents, showing targeted yet effective research. Others, like Sapienza University in Rome's Department of Neurology and Psychiatry, have fewer documents (2) but 86 citations, indicating focused but significant study. The University of Lugano Institute of Communication and Health and UC San Diego Department of Anesthesiology provide 73 and 43 citations, respectively, across similar document counts, demonstrating their collaborative and interdisciplinary activities.

**Table 3: Results of bibliographic coupling (Organizations)**

| Organizations | Total link strength | Documents | Citations |
|---|---|---|---|
| Institute of Health Law Studies, California Western School of Law, San Diego, Ca, United States | 153 | 4 | 279 |
| San Diego Center For Patient Safety, University of California, San Diego School of Medicine, San Diego, Ca, United States | 118 | 2 | 187 |
| Department of Neurology and Psychiatry, Sapienza University Of Rome, Rome, Italy | 3 | 2 | 86 |
| Institute of Communication and Health, University of Lugano, Switzerland | 16 | 2 | 73 |
| Institute of Health Law Studies, California Western School of Law, San Diego, Ca 92101, 350 Cedar Street, United States | 67 | 2 | 66 |
| Institute of Communication and Health, University of Lugano, Lugano, Switzerland | 32 | 2 | 53 |
| Department of Anaesthesiology, University of California, San Diego School of Medicine, San Diego, Ca, United States | 128 | 4 | 43 |
| Global Health Policy Institute, San Diego, Ca, United States | 9 | 2 | 35 |

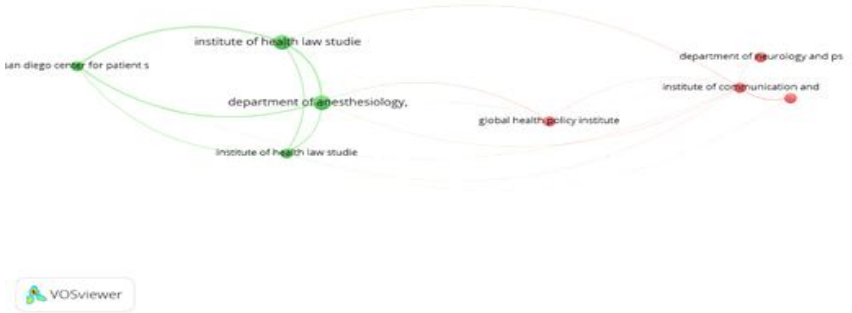


**Figure 5: Bibliographic Coupling (Organizations)**

**Bibliographic coupling analysis (Countries)**

The United States has the highest total link strength of 2789, indicating robust research relationships, followed by the United Kingdom at 2240 and Australia at 1213. The United States is in top of list with 136 papers, United Kingdom and Australia are in second and third rank with 51 and 23 papers. Citation counts reflect this tendency, with the United States receiving 2607 citations, markedly surpassing the United Kingdom's 981 and Australia's 587. The H-Index, which quantifies both the productivity and citation effect of publications, ranks the United States first with a score of 3051, followed by the United Kingdom and Australia with values of 1928 and 1377, respectively. This data highlights that the United States, United Kingdom, and Australia, are the hotspots for studies on e-pharmacy followed by Italy, India, China etc.

**Table 4: Results of bibliographic coupling (Countries)**

| Country | Total link strength | Documents | Citations | H-Index |
|---|---|---|---|---|
| United States | 2789 | 136 | 2607 | 3051 |
| United Kingdom | 2240 | 51 | 981 | 1928 |
| Australia | 1213 | 23 | 587 | 1377 |
| Italy | 1111 | 12 | 353 | 1333 |
| India | 720 | 43 | 304 | 858 |
| China | 726 | 34 | 285 | 1333 |
| Netherlands | 609 | 11 | 246 | 1373 |
| Hungary | 1151 | 12 | 216 | 599 |
| Switzerland | 628 | 9 | 182 | 1291 |
| Saudi Arabia | 511 | 11 | 158 | 568 |
| Canada | 332 | 15 | 152 | 1562 |
| Germany | 379 | 11 | 132 | 1690 |
| South Korea | 220 | 5 | 127 | 934 |
| Spain | 230 | 7 | 74 | 1215 |
| Poland | 176 | 6 | 67 | 738 |
| Sweden | 135 | 5 | 50 | 1159 |

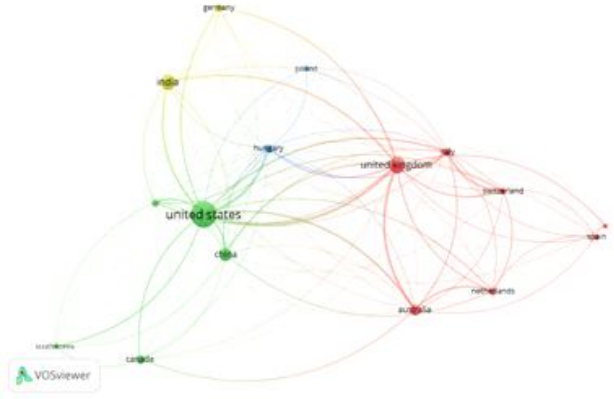


**Figure 6: Bibliographic Coupling (Countries)**

Citation Analysis

Citation analysis quantifies the frequency with which one author references another in the selected literature. Caviggioli and Ughetto (2019) described citation analysis as a method for evaluating the quality or significance of an article, author, or institution based on the frequency of citations received. This article analyzed citations from authors, organizations, and countries.

**Citation Analysis (Authors)**

The data in table no. 5 presents that Tim K. Mackey has the highest total link strength at 60, indicating strong connections within his research network. He has authored 13 documents, which have collectively earned an impressive 444 citations, suggesting his work is highly influential and widely referenced.

Bryan A. Liang follows with a total link strength of 48, showing significant research connectivity. Liang has published 9 documents, which have received a total of 390 citations, underscoring his impact and the broad recognition of his contributions.

Fabrizio Schifano stands out with a total link strength of 51, placing him between Mackey and Liang in terms of research networking. Schifano has authored 5 documents with a total of 199 citations. Although he has fewer publications, the citation count per document suggests a high impact, indicating that his research is highly regarded.

**Table 5: Results of author's citation analysis**

| Authors | Total Link Strength | Documents | Citations | H-Index |
|---|---|---|---|---|
| Tim K. Mackey | 60 | 13 | 444 | 53 |
| Bryan A. Liang | 48 | 9 | 390 | 43 |
| Fabrizio Schifano | 51 | 5 | 199 | 77 |
| Janani Kalyanam | 14 | 3 | 161 | 11 |
| Lajos Botz | 59 | 5 | 153 | 24 |
| Takeo Katsuki | 7 | 2 | 143 | 13 |
| András Fittler | 49 | 9 | 133 | 13 |

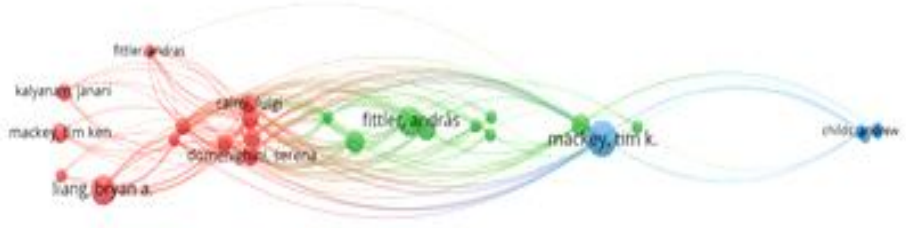


**Figure 7: Citation analysis of Authors**

**Citation Analysis (Countries)**

Among 71 countries, only 16 meet the thresholds when preferred based on a minimum of 5 document and 50 citations. The 16 countries are analyzed; the largest network plotted in VOS viewer consists of 15 countries. The network consists of 4 clusters in different color codes. The United States appears in top position with total link strength of 72, documents 136 and 2607 citations. The United Kingdom has total 51 documents with total link strength of 73 and 981 citations. After the UK, the 3rd rank goes to Australia, which has 23 documents, 37 total link strength and 587 citations.

**Table 6: Results of citation analysis of Countries**

| Countries | Total link strength | Documents | Citations | H-Index |
|---|---|---|---|---|
| United States | 72 | 136 | 2607 | 3051 |
| United Kingdom | 73 | 51 | 981 | 1928 |
| Australia | 37 | 23 | 587 | 1377 |
| Italy | 80 | 12 | 353 | 1333 |

| | | | | |
|---|---|---|---|---|
| India | 25 | 43 | 304 | 858 |
| China | 24 | 34 | 285 | 1333 |
| Netherlands | 9 | 11 | 246 | 1373 |
| Hungary | 46 | 12 | 216 | 599 |
| Switzerland | 60 | 9 | 182 | 1291 |
| Saudi Arabia | 14 | 11 | 158 | 568 |

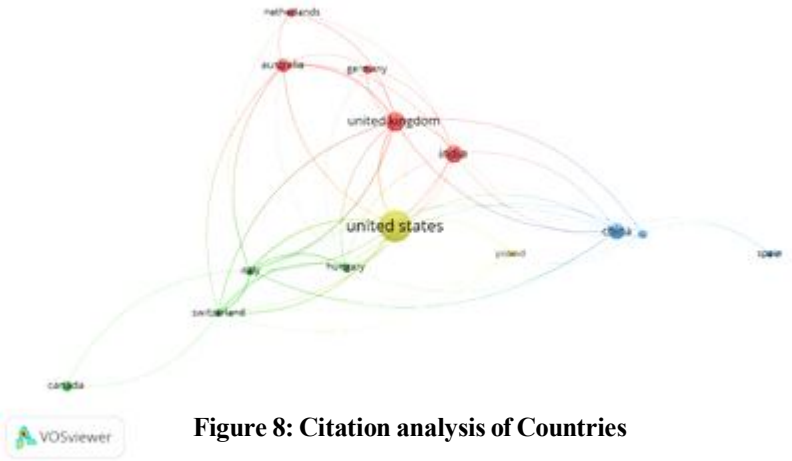


**Figure 8: Citation analysis of Countries**

**Citation Analysis (Organizations)**

The data illustrates the scientific influence of three distinguished organizations: The Institute of Health Law Studies at California Western School of Law, the Department of Neurology and Psychiatry at Sapienza University of Rome, and the Institute of Communication and Health at the University of Lugano. The Institute of Health Law Studies has a total link strength of 4, four published papers and 279 citations signifying a moderate degree of research connectedness within its domain. The Department of Neurology and Psychiatry at Sapienza University of Rome has a total link strength of 1 and has published 2 publications that have together received 86 citations. Despite its comparatively low total link strength, its papers have garnered significant attention, indicating that its research is influential in the domains of e-pharmacy. The Institute of Communication and Health at the University of Lugano exhibits a total link strength of 8, signifying substantial research network connectedness; yet, it has produced a limited number of publications 2, accumulating a total of 73 citations. This indicates that the institute's contributions are effectively incorporated throughout the scientific community, albeit its impact in terms of citation frequency is rather constrained compared to others.

**Table 7: Results of citation analysis of Organizations**

| | | | |
|---|---|---|---|
| Institute of Health Law Studies, California Western School of Law, San Diego, Ca, United States | 4 | 4 | 279 |
| Department of Neurology and Psychiatry, Sapienza University of Rome, Rome, Italy | 1 | 2 | 86 |
| Institute of Communication and Health, University of Lugano, Switzerland | 8 | 2 | 73 |

| | | | |
|---|---|---|---|
| Institute of Health Law Studies, California Western School of Law, San Diego, Ca 92101, 350 Cedar Street, United States | 1 | 2 | 66 |
| Institute of Communication and Health, University of Lugano, Lugano, Switzerland | 13 | 2 | 53 |
| Department of Anesthesiology, University of California, San Diego School of Medicine, San Diego, Ca, United States | 4 | 4 | 43 |
| Department of Pharmaceutics, Faculty of Pharmacy, University of Pécs, Hungary | 1 | 4 | 23 |
| Department of Maternal and Child Health, Gillings School of Global Public Health, University Of North Carolina At Chapel Hill, Chapel Hill, Nc, United States | 1 | 2 | 18 |
| Division of Practice Advancement and Clinical Education, Eshelman School of Pharmacy, University Of North Carolina At Chapel Hill, Chapel Hill, Nc, United States | 1 | 2 | 18 |
| Global Health Policy and Data Institute, San Diego, Ca, United States | 3 | 4 | 17 |


**Figure 9: Citation analysis of Departments**

**Citation Analysis (Sources)**

The data indicates that the Journal of Medical Internet Research, International Journal of Drug Policy, and Pharmacoepidemiology and Drug Safety are the three foremost sources, as evidenced by their total link strength, documents, and citations. The Journal of Medical Internet Research excels in all three categories, with a total link strength of 17 over 18 documents and an impressive citation count of 519. This signifies that the journal is extensively integrated into the research network and has considerable influence on both the quantity of published works and the frequency of citations obtained. The International Journal of Drug Policy possesses a total link strength of 7, although it retains a robust presence with 7 documents and 314 citations. This indicates that although it may not possess the extensive networking of the Journal of Medical Internet Research, the publications published in this journal are nonetheless often referenced, demonstrating significant impact within its own domain.

Finally, Pharmacoepidemiology and Drug Safety with only 3 documents possesses the total link strength of 8 and a total of 105 citations. Despite having a lower publishing volume, its citation count in relation to the quantity of papers indicates that it produces significant work within its specialized area. The data indicates differing degrees of network strength, publishing frequency, and citation impact among different journals, highlighting each journal's distinct contribution to the advancement of research and knowledge in e-pharmacy.

**Table 8: Results of citation analysis of Sources**

| Sources | Total link strength | Documents | Citations |
|---|---|---|---|
| Journal of medical internet research | 17 | 18 | 519 |
| International journal of drug policy | 7 | 7 | 314 |
| Pharmacoepidemiology and drug safety | 8 | 3 | 105 |
| Journal of pharmaceutical policy and practice | 3 | 4 | 92 |
| Drugs: education, prevention and policy | 4 | 3 | 80 |
| International journal of environmental research and public health | 1 | 4 | 64 |
| European journal of clinical pharmacology | 1 | 2 | 59 |
| Research in social and administrative pharmacy | 6 | 4 | 57 |
| Saudi pharmaceutical journal | 13 | 5 | 53 |
| Substance use and misuse | 4 | 2 | 45 |

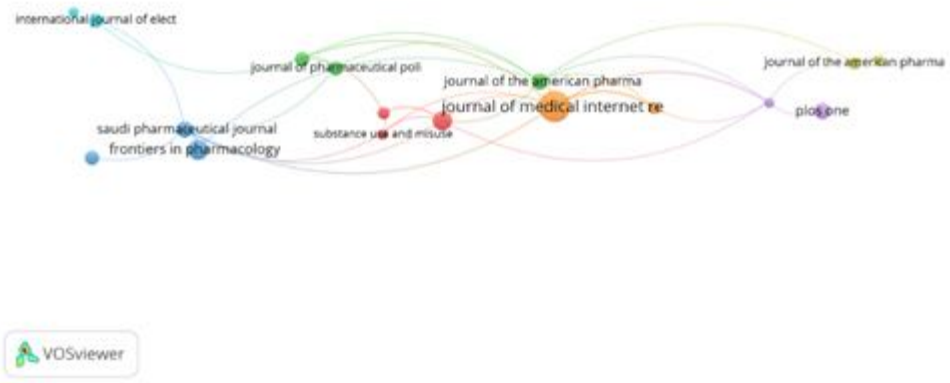


**Figure 10: Citation analysis of Sources**

### Co-Occurrence Analysis

The co-occurrence analysis delineates the terms that identify the study topic, significant areas of study, and the methodologies or technologies utilized in a certain domain. The bibliometrics tool distinguishes between the keywords of the author and those of the journal indexer.

### Co-Occurrence Analysis (Author Keywords and Index Keywords)

Table 9 contains most used author keywords and index keywords. The minimum number of occurrences for author keywords is established at 10. Out of the 1269 keywords analyzed, only 12 satisfied this criterion. 'Online Pharmacy' is the most used keyword by the authors with occurrence of 49 followed by Internet, Online Pharmacies, E-Pharmacy, Public health etc., whereas minimal occurrences of a keyword is set at 10 to get the most index keywords, out of the 3238, only140 keywords met the threshold. 'Human' is the most indexer keyword with 330 occurrences. As evidenced from the co-occurrence analysis, the authors have more research related with Online Pharmacy. In contrast, the index keywords focused on demographic characteristics like young adults, male, female, etc.

**Table 9: Results of Cooccurrence analysis of Keywords (Author and Index)**

| Author Key Words | Total link strength | Occurrences | Index Keywords | Total link strength | Occurrences |
|---|---|---|---|---|---|
| Online Pharmacy | 29 | 49 | Human | 3935 | 330 |
| Internet | 37 | 42 | Article | 3748 | 312 |
| Online Pharmacies | 27 | 36 | Humans | 2729 | 206 |
| E-Pharmacy | 5 | 20 | Online Pharmacy | 2106 | 172 |
| Public Health | 18 | 15 | Internet | 1786 | 138 |
| Covid-19 | 9 | 13 | Prescription | 1707 | 122 |
| Internet Pharmacy | 7 | 13 | Pharmacy | 1434 | 114 |
| Prescription Drugs | 17 | 13 | Female | 1658 | 111 |
| Telemedicine | 4 | 12 | Male | 1641 | 109 |
| Social Media | 5 | 11 | Adult | 1494 | 101 |

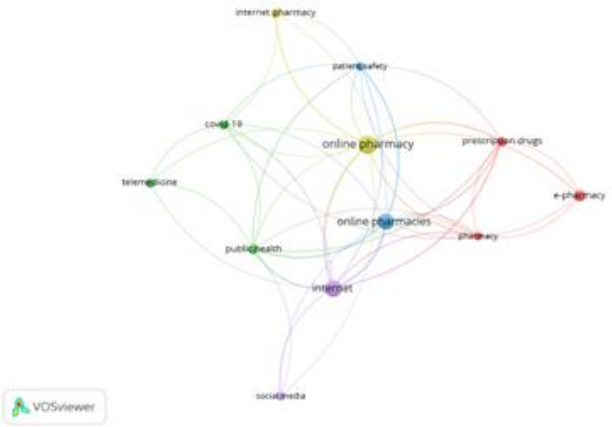


**Figure 11: Cooccurrence analysis of Keywords (Author)**

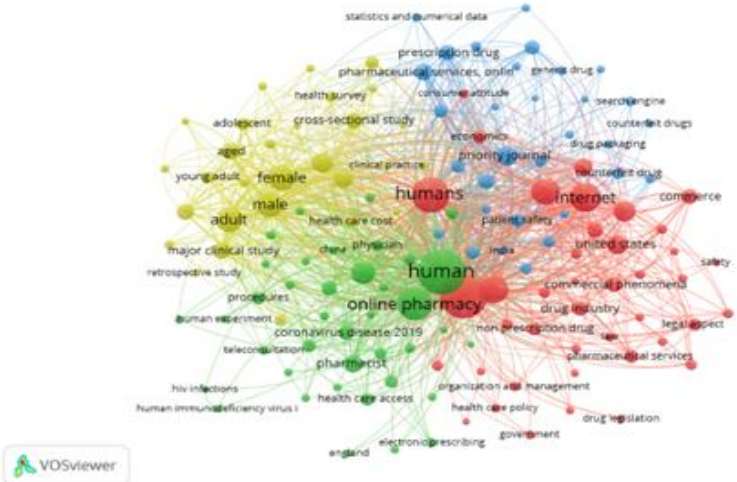


**Figure 12: Cooccurrence analysis of Keywords (Index)**

## Network Analysis

### Co-authorship (Authors)

Co-authorship may be seen as a well-documented network, whereby authors themselves serve as nodes and co-authorship serves as the links between them. The co-authorship analysis included only authors with a minimum of two publications and at least fifty citations. Consequently, of the 1622 authors, only 30 match the prerequisites. VOSviewer exhibited the most extensive network with only 11 authors, categorized into 2 clusters with distinct color codes. The 11 authors possess 19 interconnections, with a total link strength of 37. The top 3 notable authors for collaboration are Timothy Ken Mackey (links = 6, total link strength = 14), András Fittler (links = 5, total link strength = 12), and György Róbert Vida (links = 4, total link strength = 10).

**Table 10: Results of Co-authorship (Authors)**

| Authors | Links | Total link strength |
|---|---|---|
| Mackey, Tim K. | 6 | 14 |
| Fittler, András | 5 | 12 |
| Vida, Róbert György | 4 | 10 |
| Botz, Lajos | 4 | 9 |
| Liang, Bryan A. | 2 | 9 |
| Katsuki, Takeo | 4 | 4 |
| Káplár, Mátyás | 3 | 4 |
| Mackey, Tim Ken | 4 | 4 |
| Cuomo, Raphael | 3 | 3 |
| Kalyanam, Janani | 2 | 3 |

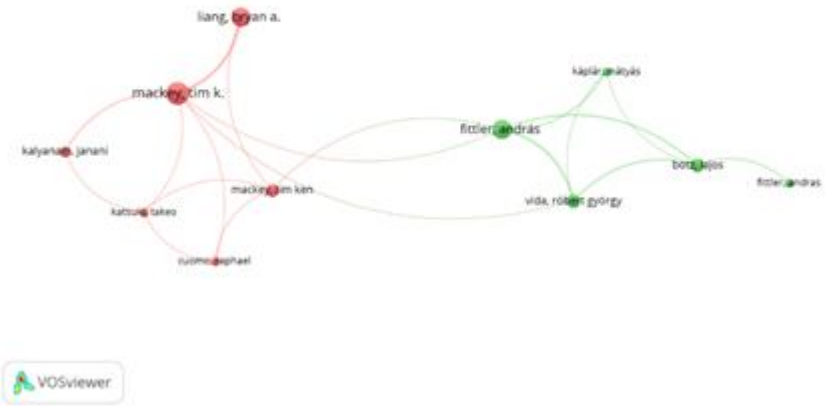


**Figure 13: Results of Co-authorship (Authors)**

### Co-authorship (Organizations)

When considering organizations based on the condition that they have at least 1 publication and 50 citations, only 99 of 1090 meet the criterion. VOSviewer plotted the largest network of only 11 organizations with one cluster of red colour code. There are 55 links between them. The red color cluster consists of 11 items. All the 11 organizations have maximum collaboration with each other, and each has 10 links.

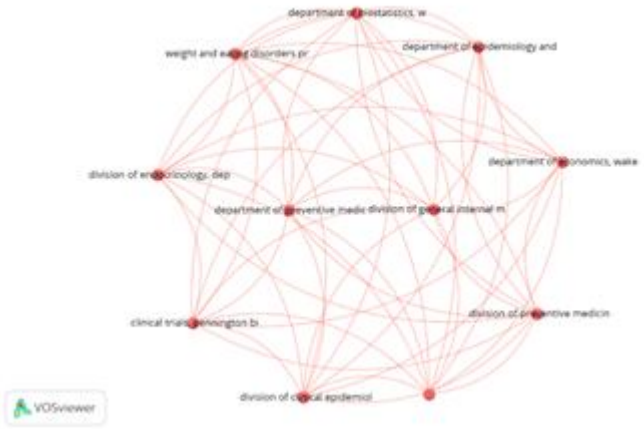


**Figure 14: Co-authorship (Organizations)**

**Co-authorship (Countries)**

Figure 15 denotes the co-authorship networks of countries. Out of 71 countries, only 16 meet the thresholds when preferred based on a minimum of 5 document and 50 citations. The 16 countries are analyzed; the largest network plotted in VOS viewer consists of 16 countries. The collaboration network consists of 3 clusters in different color codes. The United Kingdom appears to have maximum collaboration with 51 documents and 12 links. Interestingly, The United States has total 136 documents which is 85 more than the UK but has only 9 links. After the USA, the 3rd rank goes to Netherland, which has 11 documents and 7 links.

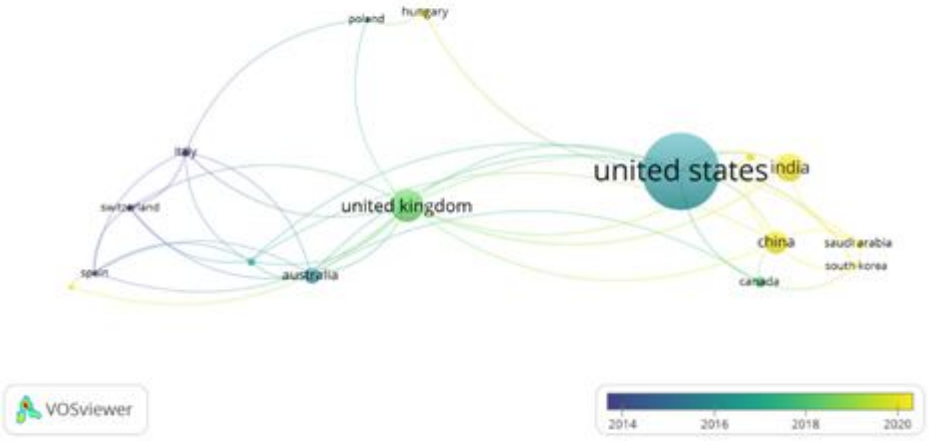


**Figure 15: Co-authorship (Countries)**

## Conclusion

This bibliometric review article on e-pharmacy offers two contributions. Initially, it analyzes patterns in publications, prominent authors, nations, organizations, and leading journals about e-pharmacy to facilitate enhanced comprehension among researchers and management practitioners. Re-

search accumulated over the last 28 years has been meticulously curated to provide a thorough picture of the e-pharmacy sector. Furthermore, insights gleaned from the bibliographic analysis helped identify articles, sources, and authors that shared common sets of keywords, highlighting the increasing interest of governments and businesses in developing and managing e-pharmacy. The advancement of technology significantly influences e-pharmacy or online pharmacy, although academic attention in these areas has been limited. The COVID-19 pandemic has accelerated the adoption of e-pharmacy. It is important to highlight that studies on e-pharmacy are more common in the USA and other developed countries. This study can inform future inquiries by pinpointing significant trends and areas that warrant further exploration. Employing various databases such as WoS and SSRN can provide a broader perspective on e-pharmacy. Secondly, there are very few works done on e-pharmacy in India. Also, very few Indian researchers have selected the topic for their research work. While the United States is at the forefront of international research efforts, India's output is relatively modest with few documents. This highlights India's underrepresentation in high-impact research. The disparity suggests a need for India to enhance research infrastructure, funding, and international collaborations to improve its global academic and scientific standing. For Indian researchers, this analysis underscores the need to enhance their global research footprint by increasing document output in e-pharmacy.

**Limitations**

This bibliometric research has significant drawbacks. The selected papers for this study are only from SCOPUS; future investigations may consider utilizing articles from Web of Science, Proquest and Google Scholar to encompass the most significant publications with enhanced relevance. Additionally, we confined our study to journal publications, excluding dissertations, book chapters, and conference proceedings. The evaluation included encompassed software tools such as Biblioshiny and VOSviewer for analysis where future researches may consider utilizing CitNetExplorer and SciMat. The study's sample articles are restricted from 1997 to 2024. Future research may consider these papers periodically.

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