



M-HEALTH RESEARCH TRENDS FOR PATIENTS WITH CHRONIC ILLNESS : A BIBLIOMETRIC ANALYSIS

Authors:

Dwi Yulianingsih Putri Hanardi¹, Erna Rochmawati^{1*}

^{1,2}*Master of Nursing Program, Universitas Muhammadiyah Yogyakarta, Jl
Brawijaya, Tamantirto, Kasihan, DI Yogyakarta, 55183*

Corresponding email: erna.rochmawati@umy.ac.id

About the author

- | | |
|---------------------------|---|
| 1. 1 st author | : Dwi Yulianingsih Putri Hanardi |
| Affiliation | : Master of Nursing Program, Universitas Muhammadiyah Yogyakarta,
Jl Brawijaya, Tamantirto, Kasihan, DI Yogyakarta, 55183 |
| Email of author | : dwi.yulia.psc21@mail.umy.ac.id |
| ORCID ID | : https://orcid.org/0000-0003-2193-6812 |
| Google Scholar | : https://scholar.google.com/citations?user=yxRaTtYAAAAJ&hl=id |
| URL | : +62274387656 |
| Phone number | |
| 2 st author | : Erna Rochmawati |
| Affiliation | : Master of Nursing Program, Universitas Muhammadiyah Yogyakarta,
Jl Brawijaya, Tamantirto, Kasihan, DI Yogyakarta, 55183 |
| Email of author | : erna.rochmawati@umy.ac.id |
| ORCID ID | : https://orcid.org/0000-0003-2193-6812 |
| Google Scholar | : https://scholar.google.com/citations?user=IvG4FDsAAAAJ&hl=en&oi=ao |
| URL | |
| Phone number | : +62274387656 |

ABSTRACT

Digital technology in the health sector including the m-health applications that have been widely used by health care systems. However, little is known on the research trend of the use of m-health for patients with chronic illness. The review aimed to explore the development and trend of research that investigates the use of m-health in patients with chronic illness. A bibliometric analysis was conducted. Keywords related to m-health, and chronic illness, hypertension, diabetes mellitus, and COPD were used to search available literatures in SCOPUS. Boolean phrase AND and OR was used to combine the keywords. Any studies published from 2017 until 2022 were included. An analysis conducted on 1717 original articles and reviews revealed that the countries that produce the most articles in this field are Taiwan, the United States, and followed by Australia. Network analysis based on keyword cooccurrence reveals three main keyword types namely: patient, telehealth and quality of life. The results of the bibliometric analysis show an increasing trend of publications and users of m-health technology from 2017 to 2022 for patients with chronic diseases. This explains that m-health technology for patients with chronic diseases is used as a form of health service to patients in promoting health, providing information, preventing the effects of further disease, treating, and managing chronic diseases at low cost and easily accessible.

Keywords: M-health; Chronic illness; Bibliometric analysis; network analysis

ABSTRAK

Teknologi digital di bidang kesehatan termasuk aplikasi m-health yang telah banyak digunakan oleh sistem pelayanan kesehatan. Namun, sedikit yang diketahui tentang tren penelitian penggunaan m-health untuk pasien dengan penyakit kronis. Ulasan ini bertujuan untuk mengeksplorasi perkembangan dan tren penelitian yang menyelidiki penggunaan m-health pada pasien dengan penyakit kronis. Analisis bibliometrik dilakukan. Kata kunci yang terkait dengan m-health, dan penyakit kronis, hipertensi, diabetes melitus, dan PPOK digunakan untuk mencari literatur yang tersedia di SCOPUS. Frasa Boolean AND dan OR digunakan untuk menggabungkan kata kunci. Setiap penelitian yang diterbitkan dari 2017 hingga 2022 disertakan. Analisis yang dilakukan pada 1717 artikel asli dan ulasan mengungkapkan bahwa negara-negara yang menghasilkan artikel terbanyak di bidang ini adalah Taiwan, Amerika Serikat, dan diikuti oleh Australia. Analisis jaringan berdasarkan keyword cooccurrence mengungkapkan tiga jenis kata kunci utama yaitu: pasien, telehealth dan kualitas hidup. Hasil analisis bibliometrik menunjukkan tren peningkatan publikasi dan pengguna teknologi m-health dari tahun 2017 hingga 2022 untuk pasien dengan penyakit kronis. Hal ini menjelaskan bahwa teknologi m-health untuk pasien dengan penyakit kronis digunakan sebagai bentuk pelayanan kesehatan kepada pasien dalam mempromosikan kesehatan, memberikan informasi, mencegah efek penyakit lebih lanjut, mengobati, dan mengelola penyakit kronis dengan biaya rendah dan mudah diakses.

Kata kunci: M-health; Penyakit kronis; Analisis bibliometrik; Analisis Jaringan

INTRODUCTION

The current problems in the health sector have encouraged many scientists to develop science and technology. In recent years, the development of digital technology in the health sector has increased rapidly, such as the use of mobile health applications that have been widely used by hospitals and other health care clinics to monitor patient disease progress and improve health care efficiency (Peng et al., 2020). Many sources of health information are packaged in a smartphone-based application known as m-health (Mobile Health). According to the World Health Organization (WHO), m-health is a medical practice or primary health care that uses mobile devices, for example smartphones (Rajak & Shaw, 2019). M-health technologies are emerging as an important platform for the delivery of behavioral interventions by offering innovative ways of delivering care using mobile technologies such as mobile phones, handheld tablets and other wireless devices to not only patients but families and caregivers (Kubo et al., 2019). M-health exists as a key driver in improving patient health by facilitating behavior change and healthcare delivery (MacKinnon & Brittain, 2020). When the Covid-19 pandemic hit almost all countries in the world, patients with chronic illnesses had difficulties accessing face-to-face medical services at hospitals, health centers, and clinics. M-health is becoming an alternative in chronic disease self-management due to its high efficacy, accessibility and cost-effectiveness (Fan & Zhao, 2022). There is an increase in the use of m-health in supporting chronic illness management (Sittig, Wang, Iyengar, Myneni, & Franklin, 2020). A study conducted by Ramachandran et al in 2015 demonstrated the interest of 60% of patients attending chronic disease follow-ups to accept the use of health applications through their mobile phones in chronic disease care (Amdie & Woo, 2020). So the authors think it is necessary to analyze the development of m-health research trends in improving the quality of life of patients with chronic kidney diseases. One of the research designs to analyze publication structure and journal development trends is bibliometrics. The use of bibliometric analysis can better explain the evolution of a research direction (Wang, Xu, & Škare, 2020).

M-health technology aims to create, store, obtain, and transmit real-time data to users of this technology which includes various tools such as mobile web-based applications on smartphones or short message service (SMS)-based portable devices that contain patient monitoring, appointment reminders, and patient medication adherence in order to improve the safety and quality of patient care (del Río-Lanza, Suárez-Vázquez, Suárez-Álvarez, & Iglesias-Argüelles, 2020). The use of m-health is increasing, one of which is for the management of chronic diseases. Mobile applications (apps) can be used as educational interventions to encourage information sharing between patients and healthcare practitioners. In addition to offering social media elements for support and helping cancer patients modify their behaviour, mobile applications have the potential to reach a larger patient base than traditional communication channels when it comes to decision and information tools. Another benefit is that patients can ask questions through a questionnaire or request information via mobile apps, which will prompt the health care system to respond with standardised or customised comments (Tanabe et al., 2018).

Several reports on chronic disease management have shown positive results, including improving symptoms of chronic lung disease and heart failure symptoms, reducing mortality, as well as the number of hospitalized patients, as well as improving quality of life and improving glycemic control in diabetic patients, also controlling blood pressure in hypertensive patients (Marcolino et al., 2018). The application of m-health technology between health services and individuals, which is an effort to promote health and provide information, has received great attention in the prevention, treatment and management of chronic diseases. The power of this technology is able to take advantage of existing cellular infrastructure with the existence of cellphones that have been widely used by the entire population (Grande & Sherman, 2018). Although the use of m-health technology is widely used and recognized as a cost-effective way of providing health services and providing information in managing both acute and chronic diseases. But this technology also has some obstacles, especially for the elderly with chronic diseases (Aranha, James, Deasy, & Heavin, 2021). Although there is a significant body of research being done on the creation and use of m-health for patient with chronic illness, little data is available to indicate the general direction of the field. Thus, the review's objective was to examine the growth and direction of research on m-health adoption and its connection to chronic illness.

METHODS

This study used bibliometric analysis to visually observe network visualization in describing research trends in the last five years based on the most dominant keywords regarding m-health research to improve the quality of life of patients with chronic illness.

Literature search

A literature search was conducted in Scopus data base to search available studies. The keywords used in the literature search including: m-Health; and Chronic Illness, and their synonyms. The searching statement using Boolean AND or OR as follows: “m-health” OR “mobile-application”, AND “chronic illness using” OR “cancer” OR “hypertension” OR “Chronic Obstructive Pulmonary Disease”. The inclusion criteria were: (i) published between 2017 and 2022; (ii) written in English; (iii) research articles. The search was carried out on February 2023. Based on data searches of 1717 articles, the results of screening articles were 1241 out of 10 the minimum number occurrences of terms.

Data analysis

Vosviewer software is used in data analysis in this study. Use of vosviewer software to extract bibliographic information on researchers, countries/regions, references, and keywords (Peng et al., 2020). In this study, vosviewer was used to visualize the research developments over the last 5 years and the dominant keywords in this research topic. While the SCOPUS database analysis is used to see the most cited articles,

countries/regions and bibliography of researchers who are dominant in conducting research on this topic.

RESULTS

A total of 1717 articles on Scopus were obtained from search results with the keywords m-health chronic patients, the 10 most cited articles were analyzed (See table 1). The ten articles are dominated by research with a systematic review method. 556 excerpts article by Farahani et al in 2018 with title “Towards fog-driven IoT eHealth: Promises and challenges of IoT in medicine and healthcare” which is the most cited in this topic. 448 citations to articles written by Marcolino et al in 2018 are in second place with the title of the article “The impact of m-health interventions: Systematic review of systematic reviews”. In third place is an article by Michie et al in 2017 from the Journal of Medical Internet Research entitled "Developing and evaluating digital interventions to promote behavior change in health and health care: Recommendations resulting from an international workshop" with 394 citations. Califf in 2018 became the fourth author whose articles were widely cited on the topic of this paper with a total of 361 citations. The article entitled "Self-care for the prevention and management of cardiovascular disease and stroke: A scientific statement for healthcare professionals from the American heart association" written by Riegel et al in 2017 was ranked fifth with 228 citations. Furthermore, in the sixth, there are 178 article excerpts entitled "Effectiveness of m-health interventions for patients with diabetes: An overview of systematic reviews" by Kitsiou et al in 2017. Seventh is an article from Byambasuren et al in 2018 entitled “Prescribable m-health apps identified from an overview of systematic reviews” with a total of 158 citations. The article entitled "Consumer Mobile Health Apps: Current State, Barriers, and Future Directions" by Kao et al in 2017 ranks eighth most cited on this topic with 153 citations. Rank nine includes 150 citations to an article by Bonoto et al in 2017 entitled "Efficacy of mobile apps to support the care of patients with diabetes mellitus: A systematic review and meta-analysis of randomized controlled trials". Next, the tenth article by Bousquet et al in 2020 entitled "Allergic rhinitis" with 142 citations.

Table 1. Top 10 most cited articles

Title	Author and year	Source	Cited by
Towards fog-driven IoT eHealth: Promises and challenges of IoT in medicine and healthcare	Farahani, et al. 2018	Future Generation Computer Systems 78, pp. 659-676	556
The impact of m-health interventions: Systematic review of systematic reviews	Marcolino, et al. 2018	JMIR m-health and uHealth 6(1),e23	448
Developing and evaluating digital interventions to promote behavior change in health and health care: Recommendations resulting from an international workshop	Michie, et al. 2017	Journal of Medical Internet Research 19(6),e232	394
Biomarker definitions and their applications	Califf. 2018	Experimental Biology and Medicine	361

Self-care for the prevention and management of cardiovascular disease and stroke: A scientific statement for healthcare professionals from the American heart association	Riegel, et al. 2017	243(3), pp. 213-221 Journal of the American Heart Association 6(9),e006997	228
Effectiveness of m-health interventions for patients with diabetes: An overview of systematic reviews	Kitsiou, et al. 2017	PLoS ONE 12(3),e0173160	178
Prescribable m-health apps identified from an overview of systematic reviews	Byambasuren, et al. 2018	npj Digital Medicine 1(1),12	158
Consumer Mobile Health Apps: Current State, Barriers, and Future Directions	Kao, et al. 2017	PM and R 9(5), pp. S106-S115	153
Efficacy of mobile apps to support the care of patients with diabetes mellitus: A systematic review and meta-analysis of randomized controlled trials	Bonoto, et al. 2017	JMIR m-health and uHealth 5(3),e4	150
Allergic rhinitis	Bousquet, et al. 2020	Nature reviews disease primers 6(1),95	142

The United States is the most productive country in scientific publications regarding m-health in chronic patients with a frequency of 673. European countries dominate these scientific publications including the UK, Spain, Germany, Italy, the Netherlands and France with a frequency of 186, 121, 107, 88, 77, and 71. Then there are also Australia, China, and Canada which are in the top 10 productive countries in scientific publications with a frequency of 149, 127, and 104 (See chart 1).

Figure 1. Articles from various countries discussing m-health in chronic patients

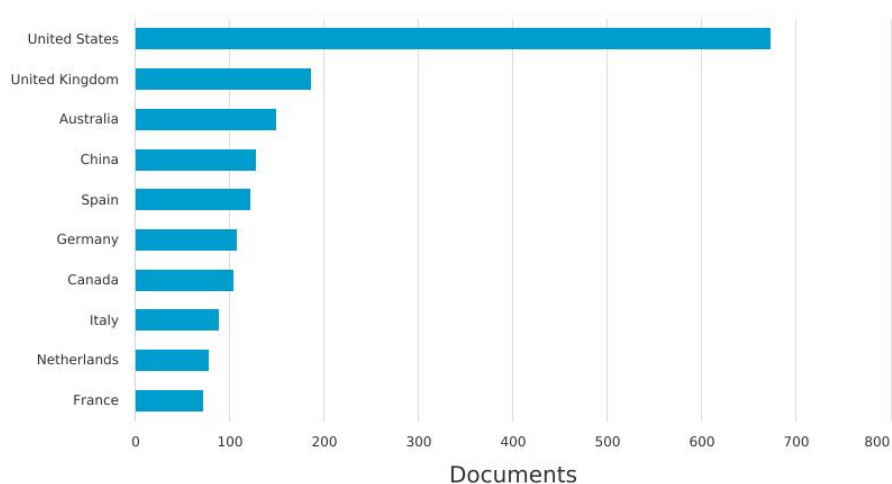


Figure 1. Research from various countries discussing m-health in chronic patients

Scientific publications regarding m-health in chronic patients show graphs of improvement from 2017 to 2022 with a percentage reaching 93%. In 2017 the frequency of scientific publications was 189, while in 2022 it increased to 365 (See chart 2).

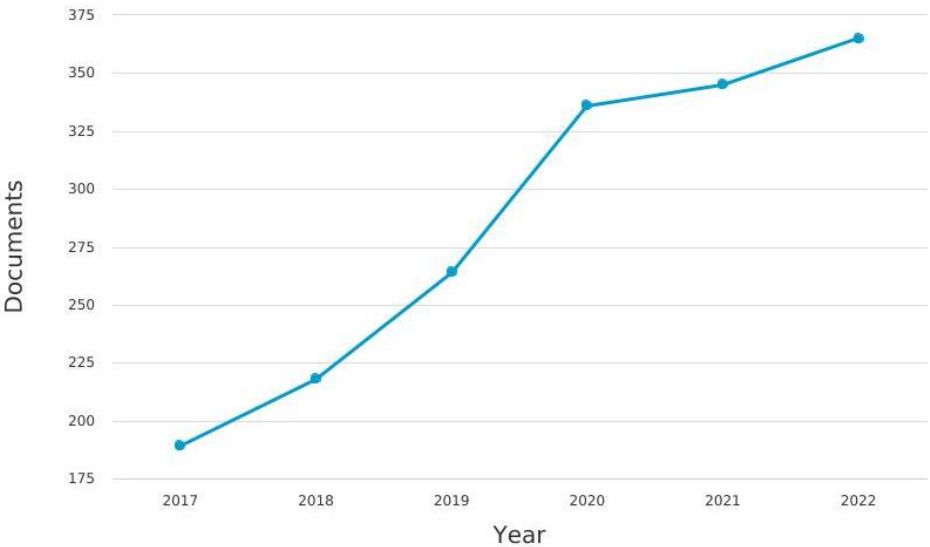


Figure 2. Graph of m-health studies in chronic patients from 2017 to 2022

From Figure 1 there are 32 authors who show involvement in discussing the topic of m-health in chronic patients. Of the 32 authors, Wang Y produced the most documents with a total of 18 documents and collaborated with 11 other authors. Then the second most document producer is Baumeister H with a total of 14 documents and collaborates with 5 other authors. The third is Wang J with 11 documents. Then fourth is Li J with 10 documents in collaboration with 7 other authors.

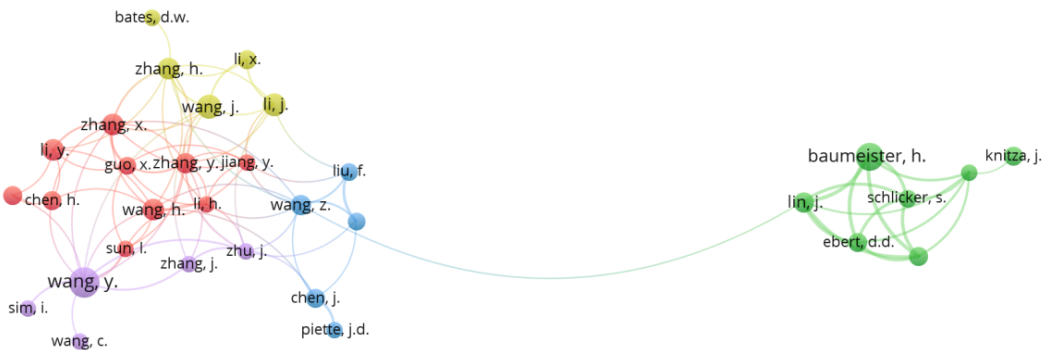


Figure 3. visualization of engaged authors' bibliographies

Figure 4 is a keyword mapping visualization that is most appropriate to the topic according to the author. There are 7 clusters, each cluster marked with a different color.

Cluster 1 is red (n=42 items), cluster 2 is green (n=27 items), cluster 3 is dark blue (n=22 items), cluster 4 is yellow (n=22 items), cluster 5 is purple (n=18 items), cluster 6 is light blue (n=16 items), and cluster 7 is orange (n=15 items). The 10 most dominant keywords according to the author can be seen in table 2, including: patient (n=1359), study (n=1082), technology (n=495), chronic disease (n=452), quality (n=447) , research (n=384), life (n=384), application (n=343), mobile health (n=324), and m-health (n=303). The 10 keywords are also the most discussed keywords in this research topic.

Table 2. The 10 most dominant keywords according to the author

Keywords	Frequency
Patient	1359
Study	1082
Technology	495
Chronic disease	452
Quality	447
Research	384
Life	384
Application	343
Mobile health	324
m-health	303

Visualization of the m-health study correlation to improve the quality of life of patients with chronic diseases can be seen in Figure 3. From this figure it can be seen that there is a link between the keywords mobile health, study, quality, life, chronic disease, and patient. These keywords are included in the top 10 most dominant keywords according to the author (see table 2).

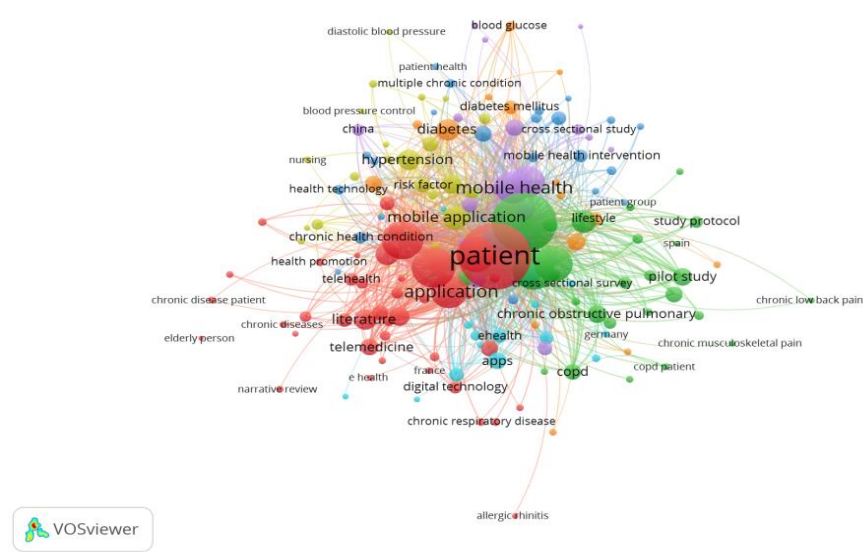


Figure 4. Keywords mapping

DISCUSSION

Research in the health sector using a systematic review method has been published since the 1970s and 1980s. The large number of articles with a systematic review method could be because this method is considered a pillar of evidence-based care that can be widely used to inform the development of reliable clinical guidelines (Munn et al., 2018). The number of articles cited indicates that an author is interested in another author's work on a particular topic (Vaishya, Patralekh, Vaish, Agarwal, & Vijay, 2018). m-health is inseparable from the increasing need for health services. Starting with the concept of the Internet of Thing (IoT) in the health care sector, it is hoped that it will be able to become a strong supporter and act as an agent such as patients, hospitals, analytical laboratories, and emergency services in providing device connections and cloud storage (Farahani et al., 2018).

The results of the bibliometric analysis in this paper show that countries in Europe and America dominate the top 10 most productive countries in scientific publications on the topic of m-health in chronic patients. This is because countries in Europe and America have a longer tradition of publishing articles about the link between m-health and chronic patients who are generally older adults (Tajudeen, Bahar, Maw Pin, & Saedon, 2022). China is the only country in the Asian region that is included in the top 10 productive countries in scientific publications regarding m-health in chronic patients. This is possible because the population of mobile phone users in China reaches 1.28 billion and 81% of the population accesses the internet using mobile phones. Under these conditions, China has the potential to implement health technology interventions such as m-health to improve health care (Ni et al., 2018).

The productivity of scientific publications regarding m-health in chronic patients has increased by 93% from 2017 to 2022. This shows that there is an increasing trend of using m-health in chronic patients, especially during the Covid-19 pandemic (Shamsabadi et al., 2022), due to restrictions on face-to-face health care for the prevention of infectious diseases and as a solution to reduce the density of visitors to health services directly (Jusob, George, & Mapp, 2022). Due to the Covid-19 pandemic and the high cost of medical care and limited medical resources, m-health is a solution for facilitating remote health care. Likewise, the increase in global chronic diseases presents challenges that can be partly mitigated by the use of m-health technology, especially for support, monitoring and treatment (Taha et al., 2022).

According to the author, the selection of keywords in the topic of m-health in chronic patients is considered to reflect future development trends (Ulfa, Azuma, & Steiner, 2022). Judging from the bibliometric analysis, the main keywords chosen by the author are the most dominant keywords in the topic of this paper, such as: patient, study, technology, and chronic disease. Thus it shows that the development trend of the topic of this paper has been widely published. Judging from the bibliometric analysis, the main keywords chosen by the author are the most dominant keywords in the topic of this paper, such as: patient, study, technology, and chronic disease. Thus it shows that the

development trend of the topic of this paper has been widely published. The linkages to each of these most dominant keywords indicate that m-health interventions are able to improve health outcomes in patients with chronic diseases. So it appears that future m-health research will have a positive impact (Lee, Choi, Lee, & Jiang, 2018).

CONCLUSION AND RECOMMENDATIONS

The results of the bibliometric analysis show an increasing trend of publications and users of m-health technology from 2017 to 2022 for patients with chronic diseases. This explains that m-health technology for patients with chronic diseases is used as a form of health service to patients in promoting health, providing information, preventing the effects of further disease, treating, and managing chronic diseases at low cost and easily accessible. Further research can develop m-health for patient with chronic illness to enable the improvement patient's quality of life.

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