

Global Trends of Research on Hospital Quality and Mobile Application: A Bibliometric Study Based on VOSviewer

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Abstract— Many researchers with various focuses and approaches have studied using mobile applications to improve hospital quality. However, a few have been carried out using a bibliometric study approach. The study used 1229 Scopus databases and a wide variety of bibliometric indicators such as publication trends, citations, and research keywords. Performed data analysis and bibliometric graphical visualization using VOSviewer software. The results show that there are 184 concepts divided into four research clusters. This research theme's latest topics are artificial intelligence, healthcare systems, and clinical decision-making. Meanwhile, topics that are still rarely carried out research are pathophysiology, procedure, pregnancy, and psychology. Bibliometric studies help provide a comprehensive and in-depth look at research on the theme of hospital quality and mobile applications for future researchers interested in discovering new knowledge and topics in this field.

Keywords— Hospital Quality, Mobile Application, Scopus, Publication Trends, VOSviewer.

I. INTRODUCTION

Hospital Quality is essential in a health facility service; according to the Institute Of Medicine, quality is how far health services are provided to patients to improve the degree of health that is consistent with professional knowledge that is up to date. In this sense, three elements must be met, namely the principle of quality, professional practitioner skills, and the fulfillment of market needs [1].

In the era of Healthcare 4.0, the use of information technology systems is essential and is expected to improve the quality of hospitals [2]. In a simple application, the use of a technology system in the form of SMS (Short Message Services) can help HIV patients in increasing treatment adherence and physical activity to produce optimal treatment outcomes [3]. One of the uses of technology systems is mobile applications to improve quality in all aspects of the hospital. The use of Mobile applications by outpatients diagnosed with diabetes mellitus is used to monitor the application of education that doctors have provided and record blood sugar levels, body mass index, blood pressure, and lipid profiles [4]. Mobile applications are used in patients with coronary heart failure to improve self-care at home [5]. The development of the Stress Reduction Mobile Application has excellent efficacy in patients with depression [6]. Not only that, the use of Mobile Applications is used for more than just patients. The

Mobile Application is also a monitoring tool for nurses' professional actions. It reduces the workload experienced by health professionals, reduces waste of time and errors, and, ultimately, improves the quality of services provided [7], [8]. Mobile Applications can significantly improve communication and teamwork in hospitals, provided that challenges such as organizational culture, technology, and security are well managed [9].

The use of information technology systems must continue to be well developed, and some have had a positive impact from their application; throughout the world, health sciences and technology continue to proliferate. Quality improvement of all aspects of the hospital must be improved, starting from non-medical hospital staff, professionals, outpatient and inpatient services, administration, nutrition installation, laundry installation, and security; it can happen if the management and utilization of information technology are carried out properly and correctly.

II. METHODS

The initial research step starts with collecting Scopus database research articles with the keywords "Hospital Quality" and "Mobile Application" (n=1229); we use search words (TITLE-ABS-KEY(hospital AND quality) AND TITLE-ABS-KEY (mobile AND application)). The next step is to limit the search for publications by year, i.e., from 2017 to 2022 (n=814).

The next step is to restrict the search by the research subject area, including medicine, nursing, biochemistry, genetics, molecular biology, health professions, neuroscience, pharmacology, toxicology and pharmaceuticals, immunology and microbiology, multidisciplinary, psychology, dentistry (n=676). The last step is to limit the search to English (n=421). After that, the data is analyzed using VOSviewer software version 1.6.18 to see the pattern and spread of the theme, year, and authorship of all data used.

III. FINDING

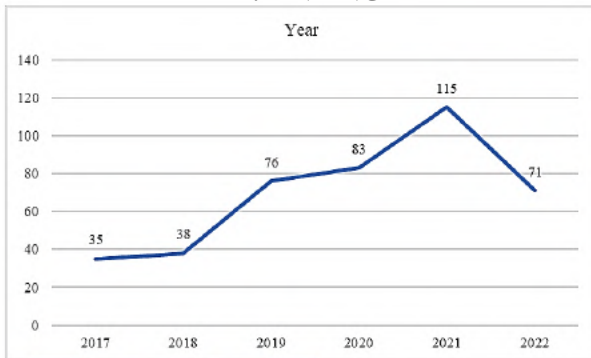


Fig.1. The number of articles published annually.

Fig shows a pattern in the number of scientific publications by year. In this chart, there is an increase in the trend of the number of studies from year to year; in 2017, there were 35 studies; in 2018, there were 38 studies; in 2019, there were 76 studies; in 2020, there were 83 studies. The highest number of publications was found in 2021 (115). The decline in the trend occurred in 2022 when there were only 71 studies.

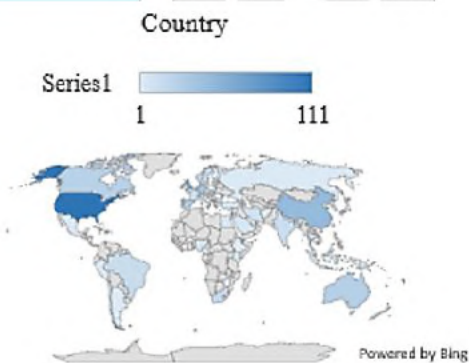


Fig.2. Distribution of research by country.

The figure above shows the distribution map where the data is taken; most countries that research the relationship between hospital quality and mobile applications are developed countries, including the United States with 111 studies, the United Kingdom with 61 studies, China with 46 studies, Germany with 35

studies, the Netherlands with 31 studies, Spain with 27 studies, Australia with 26 studies, and so on.

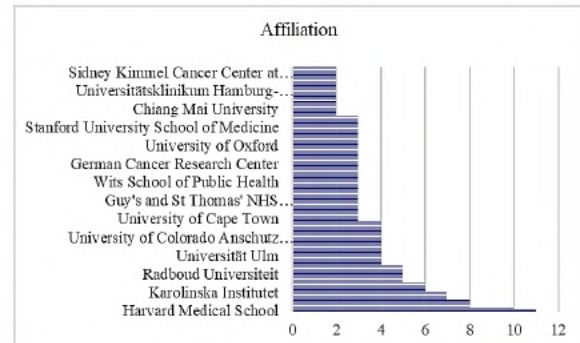


Fig.3. Distribution of research by affiliation

In the affiliate data, 418 affiliates were obtained from all studies; of the 418 affiliates, there were affiliates with the highest number, including Harvard Medical School, Imperial College London with 11 studies; University College London published ten studies; University of Toronto, KU Leuven, Massachusetts General Hospital, OsloMet– storbyuniversitetet, Oslo Universitetssykehus published eight studies; Friedrich-Alexander-Universität Erlangen-Nürnberg, Radboud University Medical Center, Universitetet I Oslo, King's College London, Karolinska Institutet publishes seven journals related to hospital quality and mobile application.

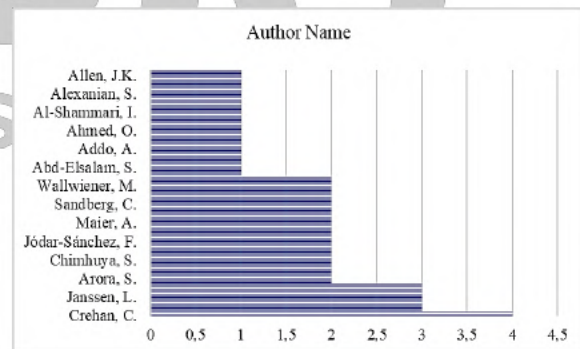


Fig.4. Most common researcher

In all research data obtained, 160 authors contributed to the entire study; there were several authors with high publication rates related to hospital quality and mobile applications, including Crehan, C; Heys, M; Hull-Bailey, T, with four published studies. Andrykowski, M.A; Baumeister, H; Børøund, E; Chiume, M; Clark, M.M; Conco, D.N; Darzi, A; Ehlers, S.L; Ibisomi, L; Janssen, L; Lakhanpaul, M; Langius-Eklöf, A; Matthys, C; Nishimwe, A; Nyssen, M; Stinson, J; Sundberg, K with three studies each that have been published and so on.

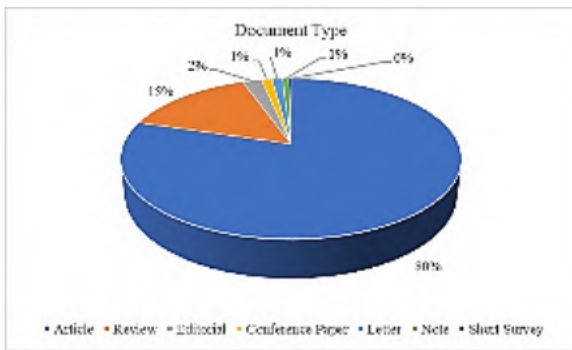


Fig.5. Distribution of document types of research publications.

In the data collected, there are several types of documents published by all researchers from a total of 418; there are 80% (333) are research articles, 15% (62) are research review types, 2% (9) are editorial types, 1% are conference papers, letters, notes.

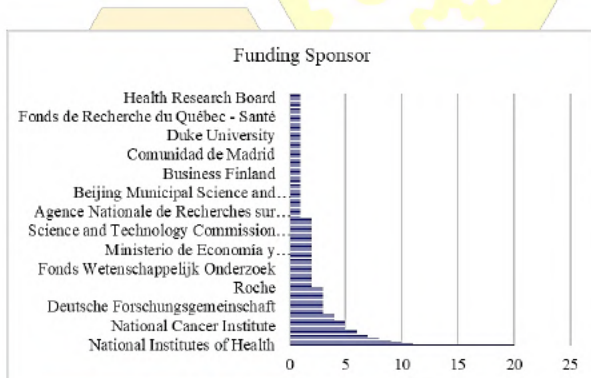


Fig.6. Distribution of research sponsorship funds.

Figure 6 shows the number of publications based on sponsorship funding. The most frequent publication sponsors found in 418 publications are the National Institutes of Health (20), National Institutes for Health Research (11), National Natural Science Foundation of China (10), Wellcome Trust (9), and National Research Foundation of Korea (8). The sponsors who do the least funding include the Health Service Executive (1), Health Resources and Services Administration (1), Health Research Board (1), and so on.

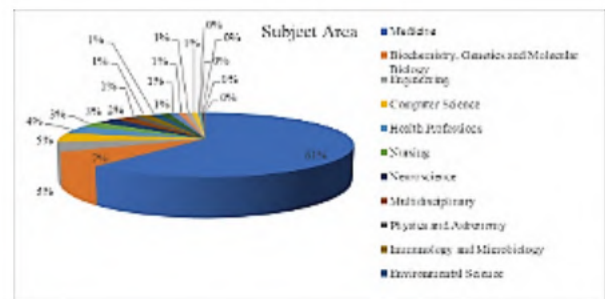


Fig.7. Number of publications by research field.

Figure 7 shows an overview of a widely researched field of hospital quality and mobile applications. The most studied subject areas were medicine (373), Biochemistry, Genetics and Molecular Biology (45), Engineering (29), Computer Science (28), and Health Professions (25).

Table 1. Citation of publications by subject area

Title	Author and Year	Source	Subject Area	Cited by (n)
Effectiveness, acceptability, and usefulness of mobile applications for cardiovascular disease self-management: Systematic review with meta-synthesis of quantitative and qualitative data	[10]	European Journal of Preventive Cardiology 25(5), pp. 505-521	Medicine	132
Digital contact tracing technologies in epidemics: a rapid review	[11]	Cochrane Database of Systematic Reviews 2020(8),CD013699		66
The use of trained volunteers in the response to out-of-hospital cardiac arrest – the GoodSAM experience	[12]	Resuscitation 121, pp. 123-126		60
Using a smartphone-based self-management platform to support medication adherence and clinical consultation in Parkinson's disease	[13]	npj Parkinson's Disease 3(1),0003		58

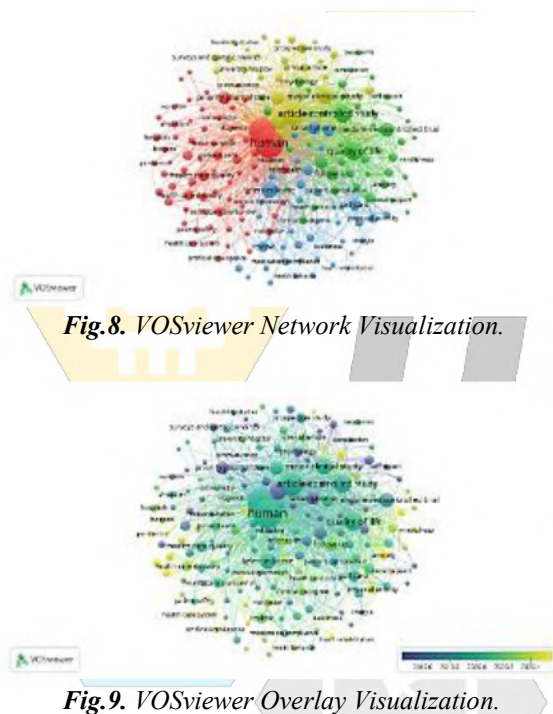
Effectiveness, acceptability, and usefulness of mobile applications for cardiovascular disease self-management: Systematic review with meta-synthesis of quantitative and qualitative data	[10]	European Journal of Preventive Cardiology 25(5), pp. 505-521	Biochemistry, Genetics, and Molecular Biology	132
Digital contact tracing technologies in epidemics: a rapid review	[11]	Cochrane Database of Systematic Reviews 2020(8),CD013699		66
The use of trained volunteers in the response to out-of-hospital cardiac arrest – the GoodSAM experience	[12]	Resuscitation 121, pp. 123-126		60
Using a smartphone-based self-management platform to support medication adherence and clinical consultation in Parkinson's disease	[13]	npj Parkinson's Disease 3(1),0003		58
Wearable sensors to improve the detection of patient deterioration	[14]	Expert Review of Medical Devices 16(2), pp. 145-154	Engineering	33
Improved aftercare in LVAD patients: Development and feasibility of a smartphone application as a first step for telemonitoring	[15]	Artificial Organs 44(3), pp. 248-256		11
A new integrated system for assistance in communicating with and telemonitoring severely disabled patients	[16]	Sensors (Switzerland) 19(9),2026		11
Hospital Diabetes Meeting 2020	[17]	Journal of Diabetes Science and Technology 14(5), pp. 928-944		7
Using voice to create hospital progress notes: Description of a mobile application and supporting system integrated with a commercial electronic health record	[18]	Journal of Biomedical Informatics 77, pp. 91-96	Computer Science	19
How telemedicine integrated into China's anti-COVID-19 strategies: a case from a National Referral Center	[19]	BMJ health & care informatics 27(3)		16
Implementation of a mobile clinical decision support application to augment local antimicrobial stewardship	[20]	Journal of Pathology Informatics 9(1),A1		13
Limitations in and Solutions for Improving the Functionality of Picture Archiving and Communication System: an Exploratory Study of PACS Professionals' Perspectives	[21]	Journal of Digital Imaging 32(1), pp. 54-67		12

In the table above, it is obtained based on the subject areas that are most cited from the subject of medicine with the title Effectiveness, acceptability and usefulness of mobile applications for cardiovascular disease self-management: Systematic review with meta-synthesis of quantitative and qualitative data [10] which has been cited 132 times, Digital contact tracing technologies in epidemics: a rapid review [11] which has been cited 66 times.

Using VOSviewer, an analysis was carried out with the theme (Figure 7) and the year of publication (Figure 8). After the data was analyzed, 4 clusters were obtained that mapped the topic of Hospital Quality and Mobile Application. The number, theme, and color of clusters are distinguished using network visualization from VOSviewer. Of the total themes, the entire cluster (184) is composed of cluster 1 (69), cluster 2 (46), cluster 3 (40), and cluster 4 (29). The cluster is loaded and described in Table 2.

Table 2. Cluster of research

Cluster	Theme	Total 100% (n=184)
Cluster 1	Artificial intelligence, clinical decision making, digital health, communication, electronic health record, human, mobile application, nurse, organization and management, quality improvement, telehealth.	69 Item
Cluster 2	Anxiety, breast cancer, clinical outcome, clinical protocol, cost-effective analysis, device, health care cost, mental health, patient compliance, psychology.	46 Item
Cluster 3	Blood pressure, cardiovascular disease, chronic disease, diabetes Mellitus, glucose blood level, health education, text messaging, software, smartphone	40 Item
Cluster 4	Article, clinical trial, cohort analysis, comparative study, cross-sectional study, feasibility study, methodology, observational study, research design	29 Item



such as pathophysiology, procedure, pregnancy, psychology, education, and treatment duration have been studied for a long time.



Figure 10 shows the Density Visualization of all publications containing the core themes often found in those 481 publications. The analysis results that themes such as human articles, controlled study, quality of life, education, follow-up, telemedicine, and major clinical studies are often raised as the theme of a study. Meanwhile, themes still need to be included include artificial intelligence, healthcare systems, workflows, pandemics, surveys and questionnaires, feasibility studies, self-reports, social support, social media, communication, and smartphones.

The figure above shows a visualization of the publication theme used by year. The new publication themes are artificial intelligence, healthcare systems, clinical decision-making, personalized medicine, public health, digital health, patient-reported outcomes, technology, and healthcare access. Meanwhile, themes

Table 3. Publications with the highest citation

Title	Author and Year	Source	Cited by (n)
Effectiveness, acceptability, and usefulness of mobile applications for cardiovascular disease self-management: Systematic review with meta-synthesis of quantitative and qualitative data	[10]	European Journal of Preventive Cardiology 25(5), pp. 505-521	132
Digital contact tracing technologies in epidemics: a rapid review	[11]	Cochrane Database of Systematic Reviews	66

		2020(8),CD013699	
The use of trained volunteers in the response to out-of-hospital cardiac arrest – the GoodSAM experience	[12]	Resuscitation 121, pp. 123-126	60
Using a smartphone-based self-management platform to support medication adherence and clinical consultation in Parkinson's disease	[13]	npj Parkinson's Disease 3(1),0003	58
Smartphones in the secondary prevention of cardiovascular disease: A systematic review	[22]	BMC Cardiovascular Disorders 18(1),25	57
Research on Clinical Preventive Services for Adolescents and Young Adults: Where Are We and We Need to Go?	[23]	Journal of Adolescent Health 60(3), pp. 249-260	57
A telehealth system for automated diagnosis of asthma and chronic obstructive pulmonary disease	[24]	Journal of the American Medical Informatics Association 25(9), pp. 1213-1217	55

IV. DISCUSSION

Hospital quality is very important to continue improving[1]. There has been much research that has been done on the use of technology in enhancing quality. Some hospitals have adopted and developed information technology in hospital management systems to help their performance [25]. M-health refers to healthcare practices supported by mobile devices, such as phones and tablets. In primary care, healthcare workers often use mobile devices to register patients, track their health, make care decisions, and communicate with patients and other healthcare workers [26]. The use of applications in diabetes mellitus patients that are useful for patient self-management includes insulin dose calculators, recording blood sugar levels, and regulating dietary patterns [27]. In other research related to diabetes, some applications can early detect diabetes mellitus based on symptoms [28]. The application of digital health intervention in acute myocardial infarction patients can increase the cost-effectiveness of hospitals implementing it; patients who come will still get standard treatment but at a lower price [29]. The use of technology, especially mobile applications, is also applied by hospital management to train midwives in performing Point-of-care ultrasound (POCUS) ultrasound [30]. In the organizational field, mobile technology leads to improved workflows, strengthening the quality and efficiency of communication and enhancing accessibility and relationships between teams; this is based on the results of systematic reviews [31].

The use of information technology is mainly carried out due to its positive impact, as evidenced by the large amount of literature that discusses the research, and

most of them gives a positive response to the presence of technological systems; of course, this will continue to develop due to technological advances that continue to develop as well.

V. CONCLUSIONS

In collecting data, 481 studies were obtained related to Hospital quality and Mobile applications; four dominant research clusters were Medicine, Biochemistry, Genetics, Molecular Biology, Engineering, and Medical Sciences. The highest number of studies according to this theme is in 2021, which is 115.

The country that conducts the most research on this theme is the United Kingdom, with 61 studies. Research affiliations with this theme are affiliated with Harvard Medical School and Imperial College

London with 11 studies. The researchers who conducted the most research on this theme were Crehan, C.; Heys, M, hull-bailey, T, with four studies.

The funding for this research theme is also the most funded by the National Institutes of Health as many as 20 researchers, and the most scientific fields are in medicine. In the use of information technology, especially mobile applications, it is found that there is a good impact if the implementation is carried out properly and correctly.

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