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Trends Research Medication Adherence of Hypertensive Patients: Bibliometric Analysis

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ABSTRACT

Background: Hypertension is a serious global health problem. Medication adherence is one of the important factors in its control. However, hypertension patients' adherence to medication is still a major obstacle. Many studies have addressed medication adherence in hypertensive patients. However, the mapping of scientific contributions related to the topic is still limited. Therefore, bibliometric analysis is needed to identify them.
Purpose: This study aims to analyze publication trends and contributions of authors, sources, institutions, and countries, as well as potential future research directions in hypertension treatment adherence.
Methods: This study used bibliometric analysis with the Scopus database. Articles published between 2014 and 2023 were analyzed using the keywords "hypertension", "high blood pressure", "medication adherence", and "medication compliance", combined with boolean operators. The initial documents identified were 4,558 articles. The search focused on article titles, abstracts, keywords, restricted to publications in English, and completed metadata. A total of 3,100 articles met the inclusion and exclusion criteria for analysis.
Results: Scientific publications on hypertension medication adherence increased steadily over the period 2014-2023, with 364 publications in 2020 as the peak. By number of publications, the most prolific author was Bosworth with 28 articles, while the journal Patient Preference and Adherence led with 88 articles. The United States was the most productive country with 6,320 publications. Cluster analysis identified five main clusters, with hypertension and medication compliance as dominant topics and mobile health, health education, and adherence monitoring as emerging topics.
Conclusion: The topic of hypertension medication adherence remains important to research, with great potential in the currently under-discussed areas of mobile health and health education. Future research could focus on innovative interventions in these areas to improve patient medication adherence.

Keywords: *Bibliometric analysis; Health education; Hypertension; Medication adherence; Mobile health*

INTRODUCTION

The world places hypertension as one of the global issues. Hypertension that is not well controlled can cause several complications including cardiovascular disease, stroke,

kidney failure, and even death (Alawneh, Yasin and Musmar, 2022; Denisova et al., 2022; Burnier and Damianaki, 2023). The prevalence of hypertension shows an increasing trend every year in several countries such as Indonesia, Nepal, and Bangladesh (Badan Penelitian dan Pengembangan, 2014, 2019; Chowdhury et al., 2020; Dhungana, Pandey and Shrestha, 2021; Badan Kebijakan Pembangunan Kesehatan, 2024). Efforts to control hypertension include pharmacological therapy. It is known as one of the effective ways to control hypertension (Campos et al., 2023; Karim et al., 2023; Podzolkov et al., 2023). However, the level of adherence of hypertensive patients to treatment is still a major obstacle in controlling cases of hypertension (Poulter et al., 2020). The results of the 2023 Indonesian Health Survey reported that hypertensive patients who did not regularly take medication were 32.27%, and did not take medication at all were 13.33%.

In addressing the problem of treatment non-adherence of hypertensive patients, researchers have developed various interventions to improve their treatment adherence, such as education, use of smartphones, collaboration of health workers in work teams, simplification of dosage, creating reminders for treatment, and providing financial incentives (Ampofo, Khan and Ibitoye, 2020; Anderson et al., 2020; Mohammadi Torkabad, Negahban Bonabi and Heidari, 2020; Svarstad, Brown and Shireman, 2022). Other researchers focus on examining risk factors for hypertension patient non-adherence (Algabbani and Algabbani, 2020; Burnier, Polychronopoulou and Wuerzner, 2020; Poulter et al., 2020). However, no study has specifically mapped the trend of study productivity and the contribution of authors, journals, institutions, and countries in adherence studies on medication adherence in hypertensive patients so far. A bibliometric approach can be used to generate such information, and the information will provide recommendations for reference frameworks and future study directions.

The use of bibliometric approaches in the study of health has been widely used in medicine and health care topics (Thompson and Walker, 2015; Kokol, Blažun Vošner and Završnik, 2021), eHealth and Digital Health (Ahmadvand et al., 2019; Kageyama et al., 2022; Tajudeen et al., 2022; Tian and Chen, 2022), hypertension cases (Devos and Menard, 2019; Devos and Ménard, 2020; Lou et al., 2023), medication adherence in infectious diseases and non-communicable diseases (Sweileh et al., 2019; Ye and Zhang, 2019). Therefore, this study aimed to conduct a comprehensive bibliometric analysis on medication adherence in hypertensive patients based on reported articles. We analyzed the reported articles on medication adherence in hypertensive patients, focusing on: (1) trend per year; (2) author contribution; (3) journal contribution; (4) affiliation contribution; (5) country contribution; and (6) projection of potential future research area.

MATERIALS AND METHODS

The PICO (population, interventions, comparisons, outcomes) formula was used as an approach in developing keywords to search for article documents in journal databases (Methley et al., 2014). In this study, the Population component used the keywords "hypertension" and "high blood pressure", the Outcome component used the keywords "medication adherence" and "medication compliance", while the Interventions and Comparison components were not used in the article document search. The keywords

were combined using Boolean operators "OR" and "AND" to search for article documents in the journal database. The article search was conducted on 20 May 2023 on the Scopus database. The search strategy used a combination of keywords ((TITLE-ABS-KEY (hypertension) OR TITLE-ABS-KEY ("high blood pressure")) AND ((TITLE-ABS-KEY ("medication adherence") OR TITLE-ABS-KEY ("medication compliance")) AND PUBYEAR> 2013 AND PUBYEAR < 2024 AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (LANGUAGE , "English")). Furthermore, the article document selection process and the results are explained using the PRISMA flowchart as shown in Figure 1 (Page et al., 2021).

Data were analyzed descriptively using VOS viewer, bibliometric, and Microsoft Excel software to answer the study questions: (1) What is the trend of hypertension treatment adherence research? (2) What is the contribution of authors in hypertension treatment adherence research? (3) What is the contribution of journals in hypertension treatment adherence research? (4) What is the contribution of affiliations in hypertension treatment adherence research? (5) What is the contribution of countries in hypertension treatment adherence research? and (6) What is the projection of the potential for further hypertension treatment adherence research? Co-occurrences analysis with VOS viewer uses a thesaurus to group similar topics but with slightly different keywords; for example, the topics of educational training, health coaching, health education, health knowledge, health literacy, health promotion, patient education, patient information leaflets, and patient medication knowledge are grouped into the topic of health education. The results of the analysis will be presented in the form of tables, graphs, and maps.

Inclusion and exclusion criteria were used to screen the articles. The inclusion criteria used were (1) Publication time period 2014-2023; (2) Type of publication was a journal; and (3) English language. Exclusion criteria for excluding articles were incomplete metadata. Screening was conducted using bibliometric. There were 3,100 articles submitted for analysis. Details of the article selection process are presented in Figure 1.

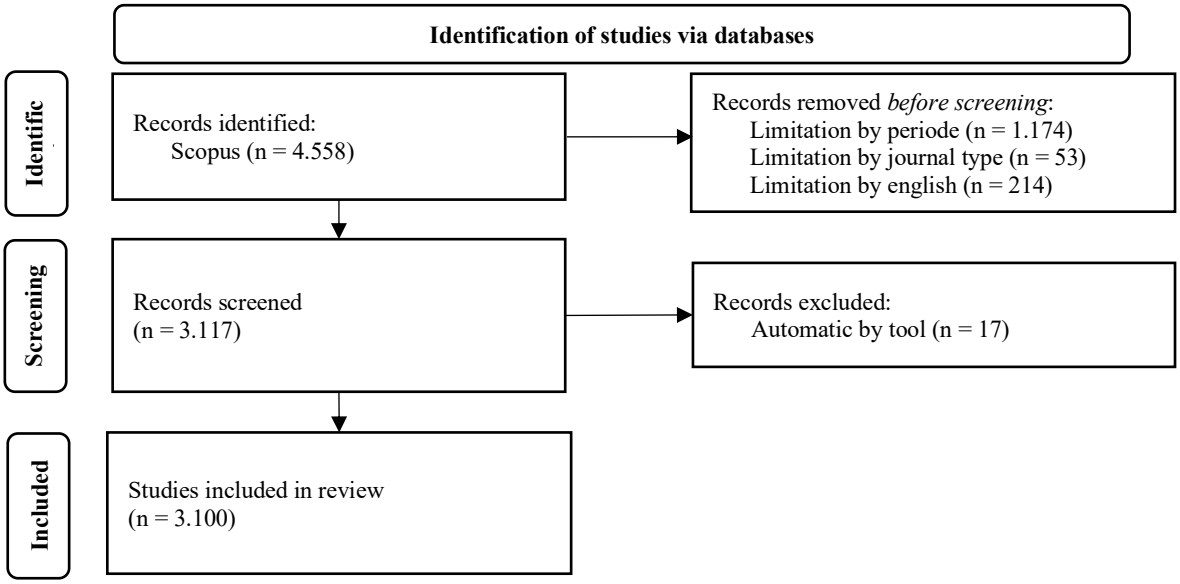

Figure 1 Flow diagram of article selection

RESULTS

Data characteristics

Based on a search using the Scopus database for a 10-year publication period from 2014 to 2023, 3,100 article documents related to hypertension patient medication adherence were obtained. The articles came from 982 sources, 15,062 authors, and the document type consisted of 2,579 articles, 27 conference papers, 45 editorials, 25 erratum's, 33 letters, 40 notes, 346 reviews, and 4 short surveys. More detailed characteristics of the study data are shown in Table 1.

Table 1. Data Characteristics

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	2014:2023
Sources (Journals, Books, etc)	982
Documents	3100
AUTHORS	
Authors	15062
DOCUMENT TYPES	
article	2579
conference paper	27
editorial	45
erratum	25
letter	33
note	40

retracted	1
review	346
short survey	4

Trend overview of hypertension patient medication adherence study

The development of publications on hypertension treatment adherence is shown in Figure 2. The number of documents published on hypertension treatment adherence in 10 years (2013 to 2023) in the Scopus database generally increased. However, the increase is not too sharp and tends to be stable. This shows that the research published in this field tends to be constant every year, with a minimum number of 241 publications in 2014 and a maximum of 364 publications in 2020. The trend for the next 5 years will continue to increase; this is based on the regression equation y = 12.879 (year) + 240.87, which can be used to predict the number of publications in the following years.

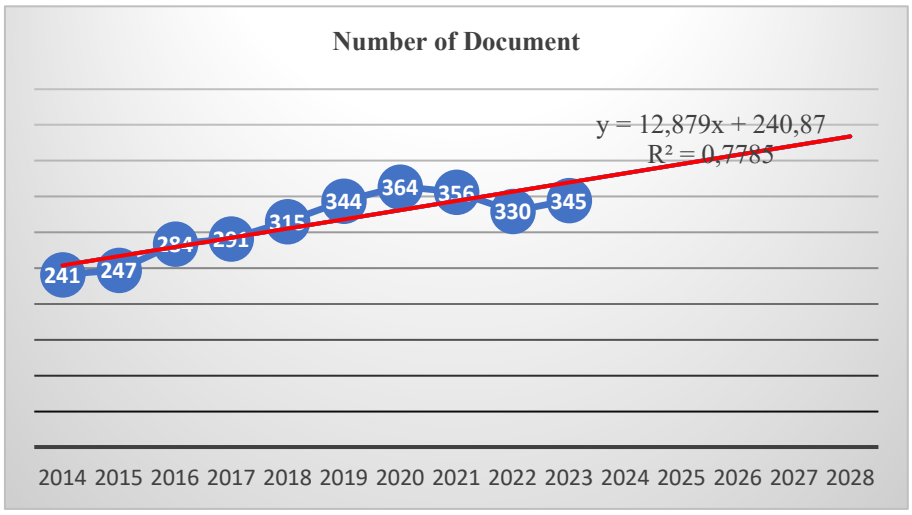

Figure 2. The progression of hypertension patient medication adherence research publications

Author contribution to the publication of hypertension patient medication adherence

Table 2 shows the 10 most productive authors who published their study results in the field of hypertension patient treatment adherence. The first place is Boswort HB with 28 articles, followed by Choudhry NK, and Morisky DE with 25 articles, Wang J with 24 articles, Muntner P with 20 articles, Ogedegbe G with 19 articles, and then Gupta P, Krousel-Wood M, Schmieder RE, and Wang Y with 18 articles.

Cluster analysis of authors to see the collaboration of author networks with a minimum cluster size criterion of 15 author appearances in the article resulted in 4 clusters as shown in Figure 2. Cluster 1 (red colour) includes Gupta, Mahfoud, Mancia, Patel, and Burnier. Cluster 2 (green colour) includes Morisky, Choudhry, Uchmanowicz, and Peacock. Cluster 3 (blue colour) includes Boshwort, Wang J, Chusman, and Zullig. Cluster 4 (yellow colour) includes Ogedegbe, Kronish, Steiner, and Ovbiagele.

Table 2. Top 10 author in publication medication adherence in hypertension

Authors	Articles
Bosworth HB	28
Choudhry NK	25
Morisky DE	25
Wang J	24
Muntner P	20
Ogedegbe G	19
Gupta P	18
Krousel-Wood M	18
Schmieder RE	18
Wang Y	18

Journal contribution to the publication of hypertension patient medication adherence

Figure 4 illustrates the 10 most productive journal sources that have an impact on the scientific development of hypertension patient treatment adherence. Figure 4.a shows the 10 most productive journals, including Patient Preference and Adherence (n = 88), followed by Plos One (n = 77), Journal of Clinical Hypertension (n = 66), BMJ Open (n = 63), Hypertension (n = 42), Journal of Hypertension (n = 42), Journal of Managed Care and Speciality Pharmacy (n = 35), American Journal of Hypertension (n = 34), Journal of Human Hypertension (n = 31), and International Journal of Environmental Research and Public Health (n = 29). While Figure 4.b. shows the 10 journals that have the highest h-index include Plos One, followed by Hypertension, Patient Preference and Adherence, Journal of Clinical Hypertension, Journal of Hypertension, BMJ Open, Journal of Human Hypertension, American Journal of Hypertension, BMC Cardiovascular Disorders, and Journal of Managed Care and Speciality Pharmacy.

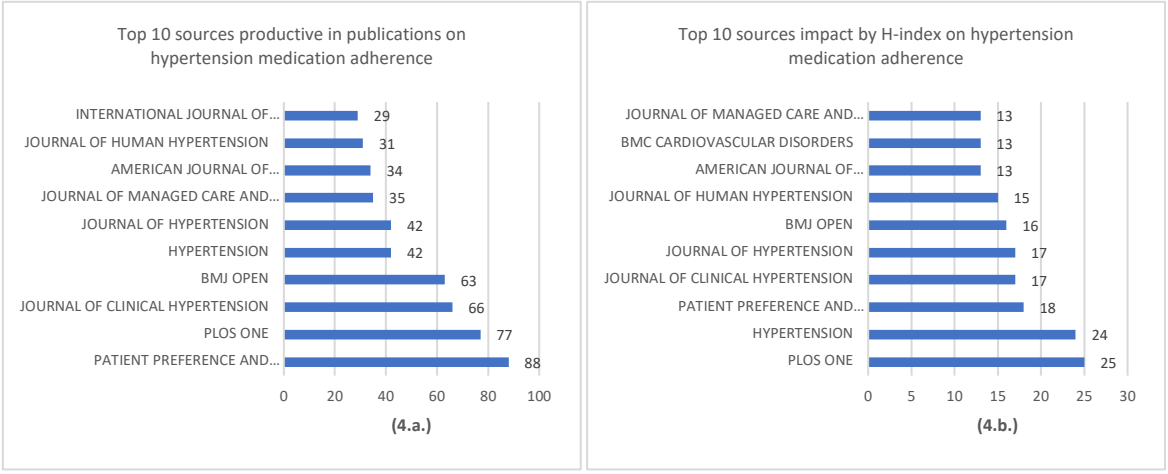

Figure (4a)Top 10 sources production in publication on hypertension medication adherence, (4b) Top 10 sources impact by H-index on hypertension medication adherence

Contribution of affiliation in the publication of hypertension patient medication adherence

Table 3 shows the top 10 affiliations in the publication of hypertension patient treatment adherence. The University of Alabama at Brimingham was the most productive (n = 130), followed by the University of California (n = 118), Medical University of South Carolina (n = 98), University of Michigan (n = 89), University of Toronto (n = 83), Duke University (n = 79), University of Sydney (n = 72), Icahn School of Medicine at Mount Sinai (n = 71), National University of Singapore (n = 71), and Harvard Medical School (n = 68).

Table 3. Top 10 affiliation in publication medication adherence in hypertension

Affiliation	Articles
University of Alabama at Birmingham	130
University of California	118
Medical University of South Carolina	98
University of Michigan	89
University of Toronto	83
Duke University	79
University of Sydney	72
Icahn School of Medicine at Mount Sinai	71
National University of Singapore	71
Harvard Medical School	68

Country contribution in the publication of hypertension patient medication adherence

Figure 6 shows the distribution of publications by country in the publication of medication adherence among hypertensive patients. The USA is the most productive country (n = 6,320), followed by China (n = 1,207), the UK (n = 872), Canada (n = 592), South Korea (n = 565), Brazil (n = 533), Australia (n = 525), India (n = 517), Italy (n = 510), and Spain (n = 507).

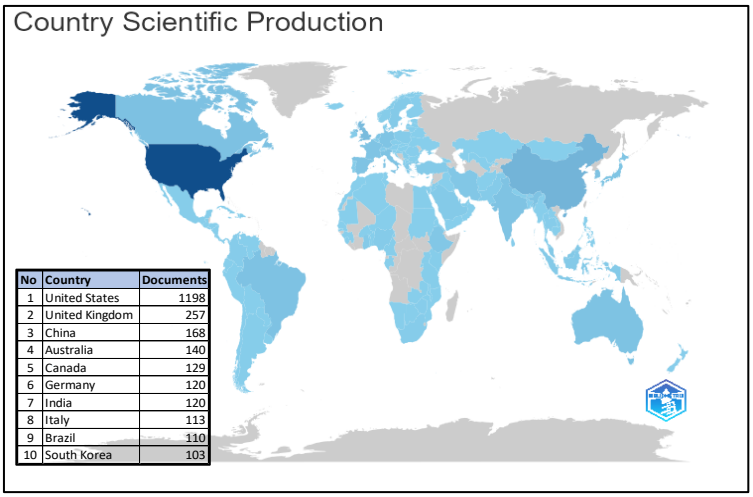

Figure 6. Contribution of countries in publication medication adherence in hypertension

Cluster and research topic opportunities

Figure 7.a. shows the research topics grouped into 5 major clusters: Cluster 1 (red colour) consists of 7 topics, including anti-hypertensive drugs, blood pressure monitoring, depression, hypertension, medication adherence, medication monitoring, and persistence. Cluster 2 (green colour) consists of 7 topics, including behaviour change, chronic diseases, diabetes, health education, mobile health, primary health care, and self-management. Cluster 3 (blue colour) consists of 7 topics, including African, cardiovascular disease, intervention, prevention, randomised control trial, risk factor, and stroke. Cluster 4 (yellow colour) consists of 2 topics, including elderly patients and pharmaceutical services. Cluster 5 (purple colour) consists of 2 topics, including assessment and therapy. The research topics of hypertension and medication compliance fall into the basic theme quadrant, indicating that these topics are still very relevant for study as shown in Figure 7.b. Meanwhile, the newer topics include health education, mobile health, and depression, as shown in Figures 7.c. and 7.d.

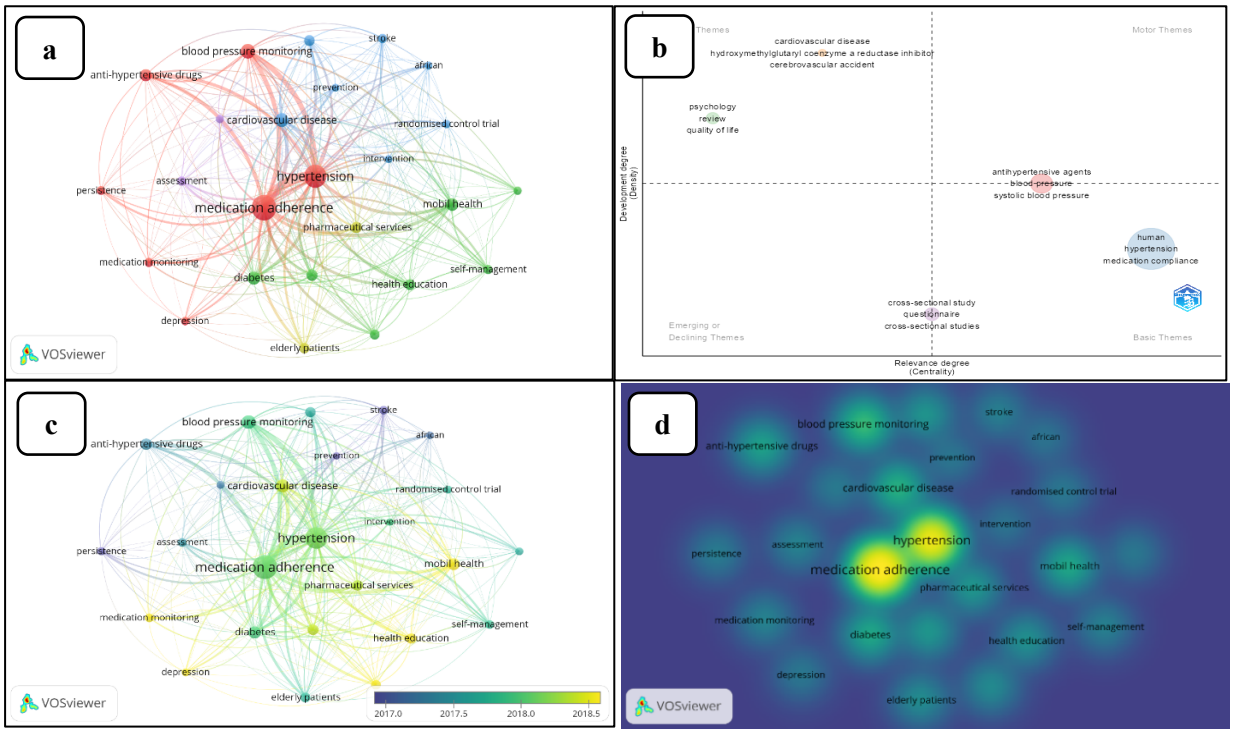

Figure 7. Research clusters and future research opportunities

DISCUSSION

The number of published documents on hypertension patients' medication adherence during the period of 2014-2023 has increased significantly. The number each

year is no less than 200 articles. The number of articles in 2024-2028 is predicted to increase steadily. This supports the findings of another study that found that adherence to chronic disease treatment remains a global issue (Vrijens et al., 2017). Another study found that the focus of medication adherence research is gradually shifting from infectious diseases to chronic diseases (Ye and Zhang, 2019). Therefore, researchers will certainly be interested in studying those topics.

Boswort HB, Choudhry NK, Morisky DE, Wang J, Muntner P, Ogedegbe G, Gupta P, Krousel-Wood M, Schmieder RE, and Wang Y are the most productive authors during the period from 2014 to 2023. Meanwhile, Patient Preference and Adherence is the most productive journal. This journal is an open-access journal, with special topics discussed including patient satisfaction, treatment acceptance, treatment adherence, quality of life, and health management modeling. It recorded 344,738 annual downloads/views and has a 2.2 Impact Factor (Press, no date; Patient Preference and Adherence - Impact Factor, Quartile, Ranking, no date). Plos One is the most influential journal on the topic of medication adherence in hypertensive patients. This journal is a multidisciplinary journal with an Impact Factor of 3.7 (PLoS One - Impact Factor, Quartile, Ranking, no date).

University of Alabama at Brimingham, University of California, Medical University of South Carolina, University of Michigan, University of Toronto, Duke University, University of Sydney, Icahn School of Medicine at Mount Sinai, National University of Singapore and Harvard Medical School are productive affiliates. Meanwhile, the USA, China, UK, Canada, South Korea, Brazil, Australia, India, Italy, and Spain are the most productive countries. The important finding is that there is a highly relevant connection between journals, affiliates, and countries. University of Alabama as the most productive affiliation and PLOS ONE as the journal with the highest impact factor, both are located in the USA (ABOUT UAB - The University of Alabama at Birmingham | UAB, no date; PLoS One - Impact Factor, Quartile, Ranking, no date).

Publication topics are grouped into 5 major clusters. The topics of hypertension and medication compliance are still very relevant for study (Vrijens et al., 2017; Ye and Zhang, 2019; Devos and Ménard, 2020; Poulter et al., 2020; Dhungana, Pandey and Shrestha, 2021; Lou et al., 2023). Meanwhile, the trend of new publication topics includes health education, mobile health, and medication adherence. This reinforces relatively recent articles related to global eHealth, mobile technologies, and education as an intervention for medication adherence in hypertensive patients (Ahmadvand et al., 2019; Ampofo, Khan and Ibitoye, 2020; Tajudeen et al., 2022; Tian and Chen, 2022).

CONCLUSIONS

This study uses bibliometric methods to examine and map the state of research and its development in a specific field. The use of bibliometric analysis in the field of health has developed rapidly. In a bibliometric analysis of the research topic on hypertension patients' medication adherence from 2014 to 2023, a positive and stable publication trend was found. The USA is the most productive country, where Bosworth HB is the most productive author and PLOS ONE is the most productive journal. The research

topics of medication compliance and hypertension are the most widely studied. Meanwhile, the topics of health education, mobile health, and compliance monitoring are relatively new areas of research. Thus, these topics remain relevant for future study.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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