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# The State of Health Information Systems Research in Africa: A Scoping Review

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**Abstract.** Research on health information systems is gaining momentum, given the importance of the topic in curbing various healthcare issues which are challenging the African health system. The relevance of the topic is reflected in the exponential growth of technological innovations for health and scientific research that assesses their impact. This plethora of research avenues poses a situation of missing evidence on the state of the art of the topic in its diversity. In this research, we report on an overview of research on health information systems across Africa, outlining key insights such as current trends and institutions addressing the topic. We examined 353 articles collected in the Scopus database, and screened them using the biblioshiny. Based on the findings, we ascertained the intricacy of the topic and pinpointed key areas for future research. The outcomes of our research provide information for practitioners engaged in understanding the advancement and state of the art of technology for healthcare in Africa, and research analysis for scholars and researchers on health technologies in Africa.

**Keywords:** Health Information Systems, Healthcare, Africa, Bibliometrics

## 1 Introduction

Since the onset of recent healthcare crises and pandemics such as Ebola and Covid19, it has become more challenging to envision a safe and effective health environment without the use of Information and Communication Technologies. The health fabric of many states is now based on critical data and information for health needs analysis and quality service delivery [1]. The African context represents a significant window of opportunity regarding the sheer volume of information produced but not aggregated due to their states, which makes its use difficult and unstructured [2]. The advent of technological tools has significantly reshaped the health landscape, its data and information, and working practices. For clinicians, the ever-growing demand for health services ought to be at the core of innovations that pertain to the health care system, and they should be key performers in monitoring the evolution of needs by disease, and any resulting technological changes [3].

The use of health information systems in Africa has been presented as a solution to address shortcomings related to cost-effectiveness, quality of health care delivery, data security and process efficiency [4]. Thus, policymakers and government decision-makers emphasized the necessity for the health sector to emulate the examples set by other industries, where the use of technology has been instrumental in expanding access to critical data for decision making, automating formerly resource-intensive processes and tasks, and minimizing human error [5-7].

A number of previous investigations have employed bibliometric analysis to construe the research evidence on health information systems, the role of technology in health within Africa, and the relevance of cutting-edge technologies in the fight against epidemics. To our knowledge, no research has documented the emerging literature on mapping health information systems research in Africa, explicitly through the use of bibliometric analysis. Pertaining to our topic, a systematic review is a relevant source of the progress and state of the art which will provide statistics, information on affiliations, origin of studies, as well as the thematic overview of the topic. Thus, a major contribution of this research for practitioners and scholars lies in the documentation of the state of the art of the current literature on health information systems in Africa. In addition, one of the contributing components of our research is the prioritization of themes that drive research on this topic in Africa, along with the compilation of lacunae and promiscuous avenues of research that serve as a foundation for future research and a forum for practitioners to engage in dialogue.

This research underscores the complex nature of discussions around health information systems in Africa, especially the technological, social and economic endeavors that need to be made. Also, it demonstrates the relevance of such an innovation in transforming the African health landscape, which has a significant impact on the One Health vision [8, 9]. The research enables a variety of institutions to engage in prioritized, results-oriented thinking with efficient resource allocation. The remainder of this paper focuses on the methodology identified and applied to this research, the associated findings, and the implications.

## **2 Methodology**

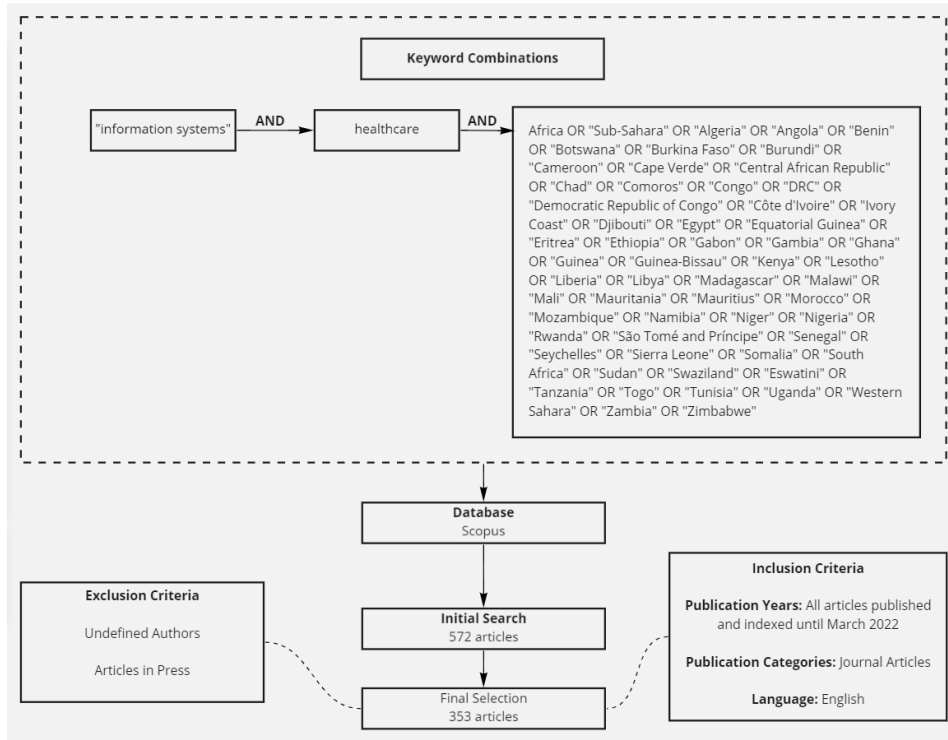
The study is based on a systematic literature review methodology, which is built upon the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) paradigm. Systematic reviews have been applied by researchers in providing insights on how empirical studies employed co-design strategies in mobile health (mHealth) systems development [10]. The PRISMA statement guidelines undergirds this study by adopting the four (4) steps - identification, screening, eligibility and inclusion criteria [11-13]. A systematic literature review acts as an instrumental source of summarize evidence relating to efficacy of any domain of discourse accurately and reliably [14]. The PRISMA guidelines have been adopted by studies focused on information systems in Africa, as such it was deemed as an efficient backing for this study [15, 16].

## **2.1 Setting the Academic Scope and Study Background**

The academic field engaged in this study is health information systems, and the background to the study is Africa. Recognizing that health information systems contribute to improving the health system throughout all levels of performance (strategic, social), health information systems research in Africa has the substantial promise of providing transformational proof to issues surrounding the use of technology in health, in a weakened environment, and amidst uncertainty.

## **2.2 Identification and Curation of Relevant Publications on the Subject**

We compiled bibliometric records from the Scopus database due to its completeness, inclusivity, ease of use, comprehensiveness, and credibility with regards to research sources [17, 18]. Studies have recommended Scopus as enough for systematic reviews because it is an effective search engine and contains majority of the credible research publications [19, 20]. Fig.1 illustrates the research methodology by visually depicting keyword combinations. The results of our keyword combination yielded a sample size of  $N = 572$  articles published and indexed until March 2022. By applying the PRISMA guidelines, we furthermore derived a subset of the final list of articles to  $N=353$ , by excluding non-English articles, undefined authors, articles in press (due to the fact that articles in press are likely to be withdrawn since they are not yet officially published), and limiting sources to scientific journals only.



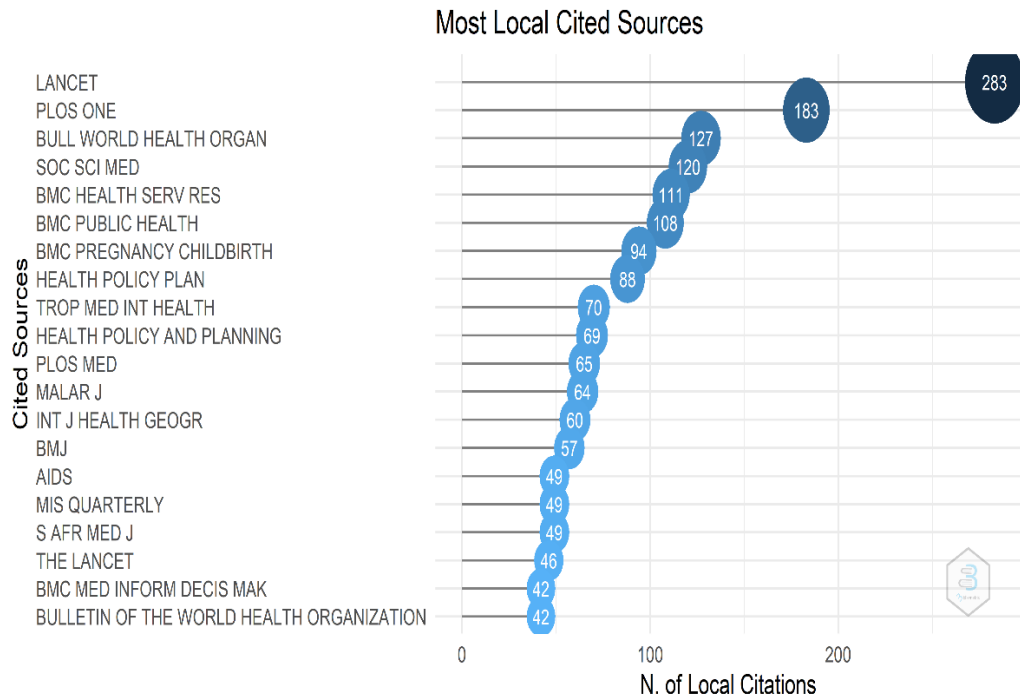
**Fig. 1.** Research Design

### 2.3 Bibliometric Assessment

In order to obtain the relevant results for the study, we adopted the bibliometrix package - an open-source scientometrics and bibliometrics research tool - in R and used the biblioshiny tool as our knowledge extraction tool [21]. The tool has a proven track record of performing elaborate analysis of a large set of compiled data, generating reliable outputs with an easily readable and understandable layout [22, 23]. In the next section, we present the results of our knowledge extraction and data analysis.

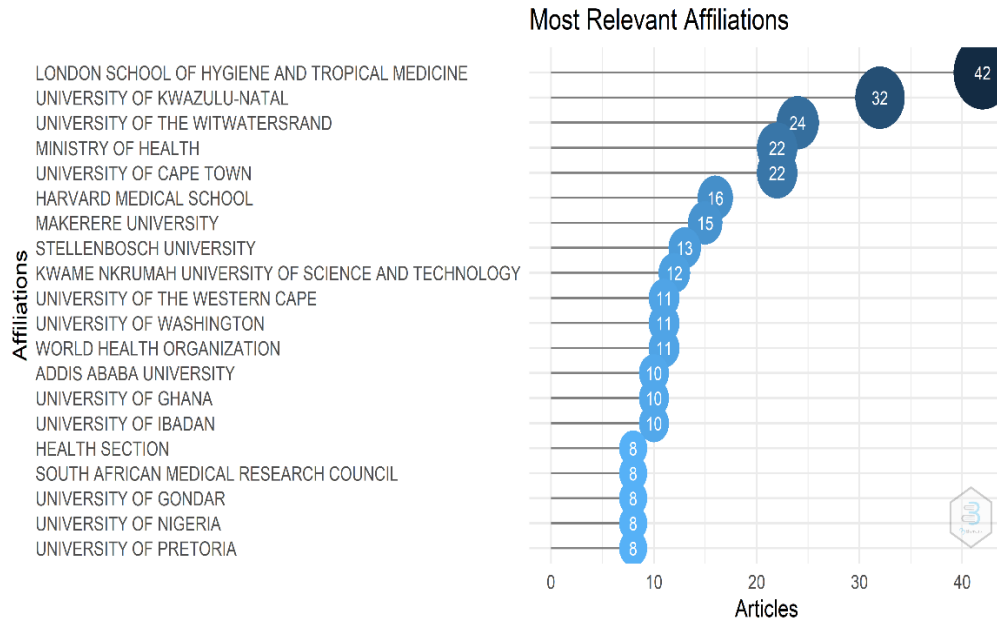
## 3 Findings

In this section, we uncover our research findings. The bibliometric analysis generated essential insights that highlighted the scientific production and cited sources, most relevant affiliations of authors, topic trends based on keywords, and a co-occurrence map network with respect to healthcare information systems research in Africa. From our data source, Scopus, the earliest research papers on information systems and healthcare with respect to Africa were published as early as 1995. Out of 353 articles, the average citations per document was 10.73, with 1973 authors and 5.59 authors per document.



**Fig. 2.** Most Local Cited Sources.

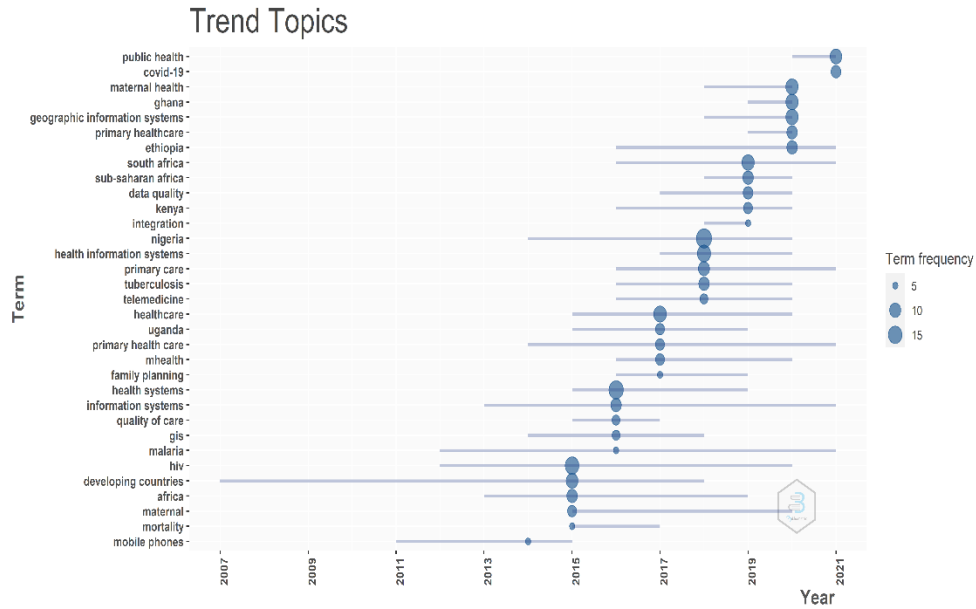
Figure 2 highlights the most cited sources with the number of local clusters on the x-axis and the cited sources on the y-axis. Lancet topped the number of cited sources for research on healthcare and information systems research in Africa.



**Fig. 3.** Most Relevant Affiliations

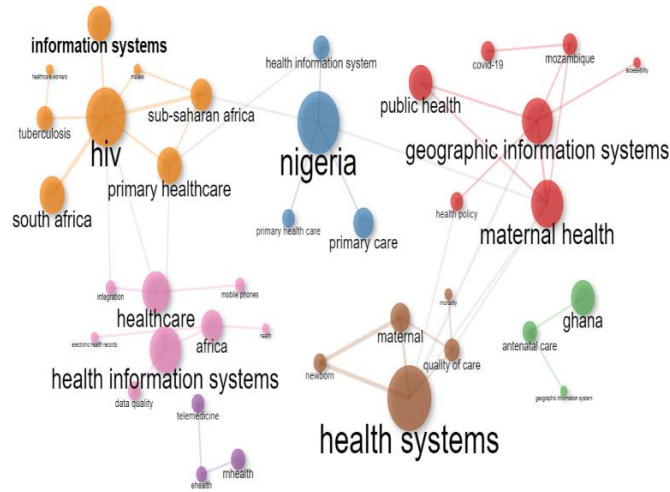
Another relevant statistic is the affiliation of authors (as highlighted in Figure 3) with the London School of Hygiene and Tropical Medicine (UK), University of Kwazulu Natal (South Africa), Ministry of Health (which is as a result of affiliation name disambiguation), and the University of Cape Town (South Africa) being the topmost institutions. The presence of Ministry of Health research, indicates the immense contribution by scientists and academics associated with government institutions as a means of improving healthcare delivery within the various countries in Africa. Also, corresponding authors and their countries of affiliation by publication count are South Africa (53), USA (48), United Kingdom (34), Ghana (15), Nigeria (14), Ethiopia (13), Kenya (10), Canada (7), Netherlands (6), and Australia (5) respectively. This is indicative of the fact that researchers within the sub-Saharan region are putting in the effort to tell the story of the state of healthcare and information systems within their region and contribute towards its development.





**Fig. 4.** Trend Topics (Author Keywords)

Figure 4 illustrates topical trends with respect to research on information systems and healthcare in Africa. By observation, one can infer that topics such as public health, data quality, and primary healthcare will be the focus of future studies with regards to information systems in African healthcare studies. Themes such as malaria and health systems continue to be studied. One can also observe the sudden decline in certain topics right after 2019, and this could most probably be linked to the covid-19 pandemic and a shift of research focus. Studies confirm this observation (publication boom) by indicating the fact that there was an urgency to disseminate new research findings, with Nigeria ranking second (2nd) in research productivity with respect to covid-19 studies [24-26]



**Fig. 5.** Co-occurrence Network Map (based on Authors' Keywords)

Fig. 5 illustrates the co-occurrence network map of health care and information systems research in Africa, drawn from the authors' keywords. A co-occurrence network is graph  $G(V, E, W)$ , where  $V$  is the vertex set (representative of entities - keywords in this case),  $E$  is indicative of the set of edges that connect vertices, and  $W$  is a set of weights associated with the edges (it is indicative of the strength of the relationship) [27]. The network parameters include : (a) the Louvain clustering algorithm which is used to cluster words, after which each word is scored based on the sum of several scoring approaches such as word score based on dependency relations, and term frequency score of each word [28] (b) graph normalization by association, the number of nodes (50) and the minimum number of edges (2). The graph is composed of seven (7) clusters. The red cluster shines a light on geographic information systems (GIS) linked to public health, maternal health, accessibility, healthcare policy, covid-19 and the country of Mozambique. From these nodes, one can conclude that one of the key components of IS and healthcare research in Africa is targeted at providing accessible services to maternal healthcare as well as the utilization of GIS for healthcare provision especially with respect to contact tracing during the COVID-19 pandemic in 2020.

The blue cluster links maternal health (from the red cluster) to Nigeria (the central node) which is linked to health information systems and primary healthcare. It can be deduced that healthcare and information systems research focused on Nigeria has been narrowed down to the need for quality primary healthcare delivery via IS within the rural and public health scope.

The green cluster is an isolated cluster with three (3) nodes: Ghana, antenatal care and GIS. This cluster buttresses the points made in studies that highlight the use of GIS in evaluating the impact of community-based health initiatives in rural Ghana[29]. Studies have also focused on the application of GIS (road network analysis) to analyze

the distance from the homes of women living in Bo, Sierra Leone to the nearest healthcare providers and to their preferred acute care providers[30].

The orange cluster has the keywords HIV, information systems, primary healthcare, tuberculosis, South Africa, Sub-Saharan Africa, Malawi, and healthcare workers. Studies have revealed the positive strides South Africa has taken in curbing the HIV crisis and tuberculosis related issues via formidable policies and health information systems[31]. Such initiatives have eased the burden on health workers and optimized the process of delivering quality healthcare.

The pink cluster which is healthcare information systems, healthcare, Africa, data quality, mobile phones, integration, and health. In recent years, studies on data quality interventions (i.e. effective management) have been a priority of healthcare research in Africa[32]. One study highlighted the improvement in data quality with respect to reports submitted to health authorities in South Africa [33]. Studies continue to focus on assessing and improving data quality in electronic healthcare records for optimal service delivery[34].

The brown cluster comprises the following keywords: health system, maternal, newborn, quality of care, and mortality. Previous studies have revealed the huge rate of infant and maternal mortality within African countries [35, 36]. Conversely, research has also focused on countering child and maternal mortality [37].

Finally, the purple cluster which constitutes the tokens mhealth, ehealth, and telemedicine reveal the adoption of technology within Africa's healthcare sector. Digital healthcare initiatives have been integrated in the African healthcare experience for healthcare education, disease prevention initiatives, medical appointments and drug adherence programs[38]. They were adopted as a form of sustainable technology capable of protecting patients, medical practitioners during the covid-19 pandemic to reduce patients' social mobility (so as to decrease viral spread) [39]. It is evident that technological integration within healthcare in Africa has come a long way and will continue to make progressive strides.

## 4 Conclusion & Research Avenues

In this research, we report on a systematic overview of the nascent literature on health information systems in Africa. The methodology applied revealed how complex the topic is, considering the major interests at stake, and the importance of Africa's health system in the global health agenda as spurred on by the World Health Organization (WHO). Various research priorities such as health data quality, primary health care and telemedicine emerged as key factors that warrant further investigation by researchers. The fight against diseases such as tuberculosis and HIV/AIDS is still a major issue for the African continent [31, 40, 41]. In our research, we note some limitations. One practical implication of our study includes validating the efficacy of data-driven methodologies as tools for furthering knowledge discovery research in order to provide factual insights to researchers and knowledge workers. Another implication is in the adoption, utilization and management of digital transformation tools as decision support systems for quality healthcare delivery. Theoretical implications of the study include the necessity of developing and integrating data-driven mobile-based frameworks in healthcare

delivery for the sub-region owing to the fact that mobile usage in Africa is at an all-time high.

Our research derives its entire analytical focus and implication from articles indexed in Scopus only. This restriction would indicate a level of bias at a scale, as well as an underestimation of the state of the art. We therefore advocate for further research to extend our reflections to other databases and publication sources.

## References

1. Smith, M., et al., *Integrated health information systems in Tanzania: experience and challenges*. The Electronic journal of information systems in developing countries, 2008. **33**(1): p. 1-21.
2. Katuu, S., *Transforming South Africa's health sector: The eHealth Strategy, the implementation of electronic document and records management systems (EDRMS) and the utility of maturity models*. Journal of Science and Technology Policy Management, 2016. **7**(3): p. 330-345.
3. Rodrigues, J.J.P.C., *Health information systems: concepts, methodologies, tools, and applications: concepts, methodologies, tools, and applications*. Vol. 1. 2009: Igi Global.
4. Kuika Watat, J. and G.M. Jonathan. *Transforming Marginalized Communities through Virtual Healthcare during a Pandemic*. 2021. ACIS 2021 Proceedings. 44. <https://aisel.aisnet.org/acis2021/44>.
5. Agbozo, E., J.K. Watat, and S.A. Olaleye, 5 - *COVID-19 outlook in the United States of America: a data-driven thematic approach*, in *Data Science for COVID-19*, U. Kose, et al., Editors. 2022, Academic Press. p. 77-93.
6. Kuika Watat, J., et al. *Health is Wealth: A Conceptual Overview of Virtual Healthcare & Future Research Directions [1995–2021]*. in *Information Systems. EMCIS 2021. Lecture Notes in Business Information Processing, vol 437*. Springer, Cham. [https://doi.org/10.1007/978-3-030-95947-0\\_33](https://doi.org/10.1007/978-3-030-95947-0_33). 2022.
7. Kuika Watat, J. and M. Moukoko Mbonjo. *Social Media and Public Health Emergency of International Concern: The COVID-19 Outbreak*. in *Re-imagining Diffusion and Adoption of Information Technology and Systems: A Continuing Conversation. TDIT 2020. IFIP Advances in Information and Communication Technology, vol 617*. Springer, Cham. [https://doi.org/10.1007/978-3-030-64849-7\\_55](https://doi.org/10.1007/978-3-030-64849-7_55) 2020. Cham: Springer International Publishing.
8. Ledikwe, J.H., et al., *Improving the quality of health information: a qualitative assessment of data management and reporting systems in Botswana*. Health research policy and systems, 2014. **12**(1): p. 1-10.
9. Guetibi, S., M.E. Hammoumi, and A.C. Brito, *Process Approach for Information Systems in Health Care: A Systematic Review and PRISMA Method*, in *Proceedings of the 2018 International Conference on Software Engineering and Information Management*. 2018, Association for Computing Machinery: Casablanca, Morocco. p. 108–112.

10. Noorbergen, T.J., et al., *Co-design in mHealth systems development: insights From a systematic literature review*. AIS Transactions on Human-Computer Interaction, 2021. **13**(2): p. 175-205.
11. Gough, D., S. Oliver, and J. Thomas, *An introduction to systematic reviews*. 2017: Sage.
12. Rojon, C., A. Okupe, and A. McDowall, *Utilization and development of systematic reviews in management research: What do we know and where do we go from here?* International Journal of Management Reviews, 2021. **23**(2): p. 191-223.
13. Selçuk, A.A., *A guide for systematic reviews: PRISMA*. Turkish archives of otorhinolaryngology, 2019. **57**(1): p. 57.
14. Liberati, A., et al., *The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration*. Journal of clinical epidemiology, 2009. **62**(10): p. e1-e34.
15. Ayanore, M.A., et al., *Towards resilient health systems in Sub-Saharan Africa: a systematic review of the english language literature on health workforce, surveillance, and health governance issues for health systems strengthening*. Annals of global health, 2019. **85**(1).
16. Otieno, P., et al., *Chronic care models and opportunities for improving health care practice and outcomes in Sub-Saharan Africa: Protocol for systematic review*. 2020, Research Square.
17. Pech, G. and C. Delgado, *Assessing the publication impact using citation data from both Scopus and WoS databases: an approach validated in 15 research fields*. Scientometrics, 2020. **125**(2): p. 909-924.
18. Jalali, M.S., et al., *Health care and cybersecurity: bibliometric analysis of the literature*. Journal of medical Internet research, 2019. **21**(2): p. e12644.
19. Almeida-Filho, N., et al., *Research on health inequalities in Latin America and the Caribbean: bibliometric analysis (1971–2000) and descriptive content analysis (1971–1995)*. American Journal of Public Health, 2003. **93**(12): p. 2037-2043.
20. Wahle, F., et al., *Toward the design of evidence-based mental health information systems for people with depression: a systematic literature review and meta-analysis*. Journal of medical internet research, 2017. **19**(5): p. e191.
21. Aria, M. and C. Cuccurullo, *bibliometrix: An R-tool for comprehensive science mapping analysis*. Journal of informetrics, 2017. **11**(4): p. 959-975.
22. Ahmi, A., *Bibliometric Analysis using R for Non-Coders: A practical handbook in conducting bibliometric analysis studies using Biblioshiny for Bibliometrix R package*. 2022.
23. Aria, M. and C. Cuccurullo, *Biblioshiny bibliometrix for no coders*. 2020, Obtenido de <https://bibliometrix.org/biblioshiny/assets/player> ....
24. Aggarwal, A., et al., *Scientometric analysis of medical publications during COVID-19 pandemic: the twenty-twenty research boom*. Minerva Med, 2021. **112**(5): p. 631-640.
25. Gai, N., et al., *General medical publications during COVID-19 show increased dissemination despite lower validation*. PLoS One, 2021. **16**(2): p. e0246427.
26. Anwar, M. and T. Zhewei, *Research Productivity of Library Philosophy and Practice during the Period of COVID 19*. Library Philosophy & Practice (e-journal), 2020.

27. Carvalho, D., et al., *A process to support analysts in exploring and selecting content from online forums*. Social Networking, 2014. **2014**.
28. Babu, M.H.A. and G. Mani, *Customized News Filtering and Summarization System Based on Personal Interest*. Procedia Engineering, 2012. **38**: p. 2214-2221.
29. Ebener, S., et al., *The geography of maternal and newborn health: the state of the art*. International Journal of Health Geographics, 2015. **14**(1): p. 19.
30. Fleming, L.C., et al., *Health-care availability, preference, and distance for women in urban Bo, Sierra Leone*. International Journal of Public Health, 2016. **61**(9): p. 1079-1088.
31. Koivu, A., et al., *Vertical interventions and parallel structures: A case study of the HIV and tuberculosis health information systems in South Africa*. Journal of Health Informatics in Developing Countries, 2017. **11**(2).
32. Mphatswe, W., et al., *Improving public health information: a data quality intervention in KwaZulu-Natal, South Africa*. Bulletin of the World Health Organization, 2012. **90**: p. 176-182.
33. English, R., et al., *Health information systems in South Africa*. South African health review, 2011. **2011**(1): p. 81-89.
34. Darko-Yawson, S. and G. Ellingsen, *Assessing and Improving EHRs Data Quality through a Socio-technical Approach*. Procedia Computer Science, 2016. **98**: p. 243-250.
35. Adjiwanou, V. and T. LeGrand, *Gender inequality and the use of maternal healthcare services in rural sub-Saharan Africa*. Health Place, 2014. **29**: p. 67-78.
36. Akinyemi, J.O., et al., *Independent and combined effects of maternal smoking and solid fuel on infant and child mortality in sub-Saharan Africa*. Trop Med Int Health, 2016. **21**(12): p. 1572-1582.
37. Budu, E., et al., *Maternal healthcare utilisation and complete childhood vaccination in sub-Saharan Africa: a cross-sectional study of 29 nationally representative surveys*. BMJ Open, 2021. **11**(5): p. e045992.
38. Tapera, R. and Y. Singh, *A bibliometric analysis of medical informatics and telemedicine in sub-Saharan Africa and BRICS nations*. Journal of public health research, 2021. **10**(3): p. 1903.
39. Adetunji, C.O., et al., *eHealth, mHealth, and Telemedicine for COVID-19 Pandemic*, in *Assessing COVID-19 and Other Pandemics and Epidemics using Computational Modelling and Data Analysis*. 2022, Springer. p. 157-168.
40. Hochgesang, M., et al., *Scaling-up health information systems to improve HIV treatment: An assessment of initial patient monitoring systems in Mozambique*. International Journal of Medical Informatics, 2017. **97**: p. 322-330.
41. Nicol, E., L. Dudley, and D. Bradshaw, *Assessing the quality of routine data for the prevention of mother-to-child transmission of HIV: An analytical observational study in two health districts with high HIV prevalence in South Africa*. International Journal of Medical Informatics, 2016. **95**: p. 60-70.