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Journal indexing and scientific impact of Africa's public health research: current status, barriers, facilitators and opportunities

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Thesis Submitted in accordance with the requirements of the School of Public Health, University of Witwatersrand for the degree of Doctor of Philosophy.

October, 2025.

DECLARATION

I, Apatsa Selemani, hereby declare that this thesis is my original work and has not been presented for any other awards at any other University.

Name of Candidate Apatsa Selemani



Signature _____

Date 15th October, 2025.

Dedication

I would like to dedicate this work to my late dear parents who I am confident would have been more proud of this achievement than I am.

To my genius dad, Charles Selemani, who wished he could go further with education but circumstances would not allow: When I heard your story while in grade 3 of elementary school, that same day, I promised myself to go as far as where school goes; the highest academic award. It has come home dad.

To my beautiful loving mum, Alefa Khoswe Selemani: your last words to me on the phone before passing away are as fresh as ever in my mind; '*limbikilani sukuluyo, makolo anu ndi abale anu adzakusamaleni idzakhala sukuluyo*'. I responded that I would see you in two weeks' time but you were gone the following day. I did it mum, the school, and I got to the end.

You guys never went far with school; mum stopped at elementary level while dad stopped at junior high school but you wanted me to go far with school, and I did guys.

Presentations/publications from this study

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- Selemani A, Wella K, Chen YF, Uthman O, Igumbor J. Determinants of African health science journal coverage in WoS, Scopus, and PubMed.
- Selemani A, Wella K, Chen YF, Uthman O, Igumbor J. Global inequities in health science communication: the post-colonial effect.
- Selemani A, Wella K, Chen YF, Uthman O, Igumbor J. African journal editor's preferences for journal indexing services: a discrete choice experiment

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- Selemani A, Wella K, Chen YF, Vicente-Crespo M, Uthman O, Igumbor J. A Scientometric Analysis of Africa's Health Science Journals Indexed in International and Regional Databases: a comparative analysis. CARTA PhD seminar. Kampala, Uganda.

Abstract

Background: African health research has limited global visibility due to underrepresentation of African journals in major citation databases, which reduces their scholarly impact. However, there is limited evidence concerning barriers and enablers of African health science journal indexing, hindering efforts to improve their visibility and impact.

Aim: This thesis sought to investigate challenges, enablers, and opportunities for improving journal indexing and the scientific impact of African public health research.

Methodology: A sequential mixed-methods approach was used, incorporating a scoping review, scientometric analysis, analytical cross-sectional analysis, in-depth interviews (IDIs), and a discrete choice experiment (DCE). The scoping review analyzed bibliometric and scientometric studies of African health research. The scientometric and analytical cross-sectional studies utilized the web scraping technique, and manual collection of journal metrics for the former, and country-specific data for the latter. The analytical cross-sectional study compared African health science journals with western European health science journals. The IDIs purposively recruited 18 editors from 7 African countries while the DCE recruited 86 African journal editors. The study was guided by the research impact payback model and the post-colonial theory.

Findings: The study found limited representation of African journals in indexing services such as Web of Science, Scopus, and PubMed. Some countries were entirely absent in the indexes, highlighting the restricted visibility of African health research. A country's economic status was a significant determinant of journal indexing between African and western European health science journals. Barriers and facilitators were multifaceted; structural inequalities influenced by post-colonial legacies that shaped funding, infrastructure, and access to indexing services. Development of alternative inclusive research evaluation indicators, and indexing services for African context, was seen as an important direction to take.

Conclusion: The study highlights the need for systemic reforms to address existing structural inequities in knowledge production and dissemination. It recommends developing inclusive research evaluation indicators and establishing context-specific indexing platforms to enhance the visibility and impact of African health research.

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List of Abbreviations/Nomenclature

AIM African Index Medicus

AJOL African Journals Online

DCE Discrete Choice Experiment

GDP Gross Domestic Product

GNI Gross National Income

HICs High Income Countries

ICTs Information Communication Technologies

IDIs In-depth Interviews

LMICs Low and Middle Income Countries

SSA Sub Saharan Africa

WoS Web of Science

Chapter 1: Introduction

1.1 Background and rationale

As a concept, research impact lacks a universally agreed upon definition due to inherent disciplinary differences in the research output, and how to measure impact or what could be regarded as impactful. However, Roemer & Borchardt (2015) broadly defines the concept as the influence, benefits or change that follows the conduct of research. Morton (2012) argues that it can best be understood as a continuum of research utilisation, from more conceptual uses to more instrumental uses. Hence, the conclusion that research impact assessment depends on the perspective, and purpose for doing the assessment.

Research impact is of two types; academic and societal. Academic impact, commonly referred to as scientific or scholarly impact, fundamentally focuses on the contribution of knowledge to a specific field of study (Greenhalgh et al., 2016; Medawar, 1999; Milat et al., 2015; Roemer & Borchardt, 2015). In contrast, societal impact also referred to as non-academic impact or impact beyond academia, focuses on benefits that have much broader reach such as societal, economic, cultural, and environmental benefits (Greenhalgh et al., 2016; Medawar, 1999; Milat et al., 2015; Roemer & Borchardt, 2015). Practically, however, the two types are not completely exclusive; sometimes they display overlaps and borderline differences, attributable to increasing research collaboration between universities, industry and governments, and due to translation of academic research outputs into actionable insights or products for societal benefits.

Following these different perspectives, measuring research impact becomes a complex issue, which is more common in non-academic research due to its many forms and pathways of research output. Various frameworks have been developed to help measure research impact beyond academia, with a major focus on benefitting society (Greenhalgh et al., 2016; Milat et al., 2015). Some of the commonly used or studied frameworks include the Payback Model, The Research Impact Framework, Canadian Academy of Health Sciences (CAHS) Framework, UK Research Excellence Framework (Greenhalgh et al., 2016; Milat et al., 2015).

In academia, publishing research in journals and conference proceedings are some of the well-established ways of disseminating research results (Nwangwu, 2008). More importantly, these ways do not only make impact of research relatively easy to track, but they also have well-

established methods and criteria for measurement, albeit with some controversies. Historically, scientific impact assessment was done by peers in the respective field of study (Hicks, Wouters, Waltman, De Rijcke, et al., 2015), which is the qualitative component of measuring research impact. Recently, however, prominence has been given to quantifying scientific impact through the use of metrics at different levels, namely author, article, journal, funder, discipline, and institution, and country. Fundamentally, the method focuses on the number of times a research output has been referred to or cited by another output or other authors. Consequently, this quantitative study of citation metrics as proxy of scientific impact of scientific research output is referred to as scientometrics (Roemer & Borchardt, 2015).

Citation-based measures are increasingly popular; they have gained authority to the extent that they influence the production and direction of research, and are considered proxy of research quality. They are being widely used in research evaluation systems, recruitment of academic staff, promotion and tenure decisions, allocation of health research funding, university rankings, by researchers in selecting a journal to publish with, and by readers or policy-makers as sources of evidence for research productivity and prestige. (Beshyah, 2019; Le Roux, 2006; Nwosu, 2006; Roemer & Borchardt, 2015). In fact, some of these decisions directly affect public health interventions, practice and policies. Thus, scientific impact of research affects and shapes the wider societal, economic, and cultural impacts and landscapes of research, beyond academia.

Nevertheless, the measurement of scientific impact is a contested issue. Some argue that citation count cannot be relied upon as there are several reasons for citing, which may either be positive or negative (Morton, 2012). Others raise concerns about over-reliance on citation metrics to measure the impact of research due to several challenges with the method (Beshyah, 2019; DORA, 2012; Hicks, Wouters, Waltman, De Rijcke, et al., 2015; Seglen, 1997; Zhang et al., 2017). For instance, the Journal Impact Factor (JIF) faces significant criticisms that challenge its validity as a measure of research impact. Key issues include highly skewed citation distributions, field-specific variations that hinder cross-disciplinary comparisons, and the aggregation of diverse article types that can distort perceived impact. Additionally, the potential for manipulation through editorial policies raises concerns about the integrity of the metric, while the lack of transparency in the underlying data diminishes trust in its application.

These shortcomings highlight the necessity for a more significant approach to research evaluation in health research, advocating for the development of context-sensitive metrics that prioritize local relevance and societal impact, alongside greater transparency in assessment practices. Such measures can lead to a more equitable evaluation framework that better reflects the true contributions of research outputs.(DORA, 2012, para. 2). Caution, therefore, needs to be exercised when applying these metrics in making decisions. In the absence of reliable statistics or method to measure impact, scientific journal metrics and all other metrics are still used in important decisions that affect public health research despite their flaws.

It is also important to note that the dissemination of health research findings in the form of publications or other forms of research communication to targeted audience is fundamental for scientific impact or influence of research to be realised (Bickton et al., 2019).Thus, scientific impact heavily depends on, among other factors, strategies for disseminating the research output to targeted readership. In fact, it is one of the major factors because, as rightly observed by Ebrahim et al. (2014), visibility and accessibility of research output highly influences scientific impact of the research in question.

Additionally, the level of scientific impact (metrics) reported also depends on the coverage of journals by the data source of scientometrics (abstract and citation databases), and method of analysis used. As one of the major dissemination strategies for research output, journal indexing is an important subject worth studying when it comes to improving scientific impact of research. This is the case because journal indexing service provided by abstract and citation databases improves visibility, marketability, discoverability, and readership of research output to the global world (Le Roux, 2006). Besides, citation databases provide quality assurance due to high standards set to evaluate the quality of journals to be included in their indexes (Murray, 2009; Rohra, 2011), thereby offering credibility and prestige to their indexed journals (Le Roux, 2006).

Furthermore, abstract and citation databases provide citation metrics data for journals, authors, and articles, which are, used to measure influence or impact to its targeted readership. Major abstract and citation databases include Web of Science (WoS), Scopus, and PubMed (Walters, 2017). In the light of the benefits and metrics offered by the abstract and citation databases, they (abstracts and databases) become authorities in measuring scientific impact, while inclusion of journals in these databases serves as proxies of journal quality and research quality (Le Roux, 2006). Google

scholar, an academic search engine, is also a major data source that provides citation metrics data (Walters, 2017). Unlike the abstract and citation databases mentioned, it does not have strict criteria for journal inclusion, thereby having a slightly different authority in measuring research impact.

Therefore, the data sources indirectly influence public health decisions or evidence-based public health practice. For instance, evidence-based public health practice partly depends on evidence synthesis and reviews whose data sources are the abstract and citation databases under study. It is against this background that this study focuses on ways to promote scientific impact of Africa's health research, largely in terms of indexing of African journals. It is also the important public health decisions affecting health research and population health that depend on journal indexing and scientific impact metrics that justify the need for this study.

In this thesis, scientific impact was measured using a combination of scientometric indicators and contextual factors that reflect both the visibility and influence of research outputs. It focused on the following key indicators: citation counts, journal indexing status, impact metrics such as H-Index, CiteScore and Journal Impact Factor (more details about these indicators are explained in chapter 2 and chapter 3). These measures were selected because they together show both the academic recognition and the broader dissemination of research findings, aligning with the study's aim to assess how indexing and publication practices influence the visibility and impact of public health research in Africa.

Despite this important role of journal indexing, ironically, evidence reports limited coverage of African journals and research in major abstract and citation databases. This situation, in turn, limits the influence of Africa's health research to address local public health challenges in an effort to reduce health inequalities and improve population health. This is the case regardless of Africa having the highest burden of disease (Abbafati et al., 2020), which could benefit from research. Compounding the issue, Africa's health research output and scientific impact is reportedly relatively low (Bickton et al., 2019; Siriwardhana, 2015). Overall, Africa does not only contribute less than 1% of global research output (Duermeijer et al., 2020), but also no African country is spending more than 1% of its Global Domestic Product (GDP) on research and development as compared to 2% to 3% spent by Europe and North America, respectively (World Bank & Elsevier, 2014) . What is of even greater concern is that these statistics do not resonate with Africa's 12%

share of the global population (Blom et al., 2016), and its 31% share of global disease burden (Kirigia et al., 2015; Saric et al., 2018).

Notwithstanding the foregoing, between 2003 and 2012 Sub-Saharan Africa research output, in general, got doubled while its scientific impact increased from 0.06-0.16% to 0.12-0.28% (World Bank & Elsevier, 2014). Furthermore, a few African countries (South Africa, Egypt, Kenya, Nigeria) seem to be performing better than the rest in research productivity and scientific impact (Plancikova et al., 2020; Uthman et al., 2015). Evidence shows that, given the right resources and enabling environment, the research output and scientific impact of research from developing countries will increase (Igumbor et al., 2020b; Charon Duermeijer et al., 2018). For instance, Duermeijer et al., (2018) observes that, in Egypt, provision of research support such as capacity building programmes by local government is one of the factors contributing to increases in research productivity and impact . One common denominator among the countries that seem to perform better in terms of productivity and impact in Africa is their economic status which underscores the importance of funding.

1.2 **Problem statement**

Despite several investments and positive strides made in Africa's health research, poor visibility of Africa's health research globally persists, partly due to underrepresentation of African journals in major citation databases (Bickton et al., 2019), which ultimately affects their scholarly impact. Actually, several studies have reported low scientific impact of Africa's health research compared to other regions of the world (Bickton et al., 2019; Siriwardhana, 2015). Some of the reasons cited for this underrepresentation of journals in major databases include poor editorial standards of African journals (Diego Chavarro & Ràfols, 2017; Garfield, 1994, 2006), editorial bias against authors and journals from Africa (Diego Andrés Chavarro, 2016; Rohra, 2011), and poor economic status of African countries limiting research and journal funding (Bickton et al., 2019). However, these claims are not supported by or have limited empirical evidence.

In addition, existing evidence largely focuses on indications of the low representation such as citation metric gaps and indexing disparities (Ezema & Onyancha, 2016; Ogunfolaji et al., 2022; Pranckutė, 2021), but is limited on providing empirical evidence on perspectives of African editors on its influencing factors, and how journals characteristics influence such indications. The critical gap in existing literature is that it does not sufficiently capture the perspectives (based on

experience) of African editors or empirically model the preferences and trade-offs influencing journal indexing choices, and empirically test the claims of bias and economic status on indexing coverage. The objectives of this study directly address this gap. First objective summarises barriers and enablers, and quantifies the extent of under-representation. Second objective systematically tests claims of indexing bias and economic status by assessing the relationship between journal characteristics and their likelihood of being indexed. Third objective captures insider perspectives often absent from global discourse. Fourth objective rigorously tests how specific indexing database attributes affect journal indexing choices. Together, these objectives move beyond documenting inequalities to providing contextually grounded evidence and actionable insights, thereby linking the broader problem of under-representation to actual pathways for strengthening African scholarly impact.

More so, in the light of recent developments in research and scholarly communication, including several initiatives employed to improve research capacity in Africa (Fonn et al., 2020; Harle, 2009, 2010; Igumbor et al., 2020b; Uwizeye et al., 2020; World Bank & Elsevier, 2014), it changes in barriers, facilitators, and opportunities to promoting scientific impact of public health science research output from Africa are anticipated to occur (Siriwardhana, 2015). Evidently during the last 10 years, research capacity and research output in Africa has increased (Kasprowicz et al.,2020).

This thesis provides new evidence to the existing body of literature concerning barriers and enablers of journal indexing and scientific impact of African journals and health research. For instance, this study contributes new evidence to a study by Chavarro (2016) who reported similar evidence from Latin American countries. This new evidence include comparison with another region, additional data sources, differences in variables studied, study design used; and different languages studied considering that many journals from Africa are in English and French. This thesis, therefore, examines geographical location as an important variable of editorial bias when language is controlled. Likewise, the study focuses on African countries' economy which is different from Latin-American countries' economy and other Spanish speaking countries, namely Portugal and Spain, reported by Chavarro. The comparison with western European journals with a majority of them being developing countries, also provide new evidence. Western Europe was purposively selected to represent developed countries with varied characteristics that are

comparatively important characteristics for the study such as GDP, different languages, and journals run by commercial publishers. The present thesis also focused on African journal editors' perspectives, including their preferences for indexing, which is not reported in the literature.

1.3 Research Aim

To explore the barriers, facilitators, and opportunities for journal indexing and scientific impact of health research from Africa.

1.4 Specific objectives

1) To establish current status of Africa's health research scholarly impact.
2) To compare African and western European countries' journal indexing coverage in international citation databases by key objective editorial standards and selected contextual journal characteristics.
3) To explore the major barriers and facilitators to index African health science journals in international citation databases as perceived by African journal editors.
4) To assess Africa's health science journal editors' preference of indexing services.

1.5 Significance of the study

This thesis is significant in that it provides empirical evidence which may inform formulation of health research policies and research evaluation policies in African health research institutions and universities. The thesis explores current barriers and facilitators, thereby contributing new knowledge to existing literature on scholarly publishing, especially on challenges faced by journals from Africa such as limited funding, lack of technical infrastructure, and minimal representation in international indexing databases. Evidently, it compares African journals with western European journals, revealing global systemic inequalities in the dissemination, discoverability and influence of health research globally. By demonstrating limited coverage of African journals by major citation databases, the thesis may inform the need to improve dissemination strategies of research findings by both African researchers and journals. Actionable recommendations based on the findings may help reduce policy gaps, and, in turn, promote the use of local research in addressing public health challenges specific to African contexts.

The thesis also identified key potential entry points for policy, research and practical interventions to promote health research impact in Africa. The study has, for instance, revealed limited funding by local governments and unequal collaboration as key entry point areas of intervention. This finding could contribute to development of funding models, such as public-private partnerships, and advocacy for more equitable international collaboration. The thesis also reinforces the importance of African-led initiatives in optimizing health research productivity and addressing specific health challenges. Evidence shows that African-led initiatives have the potential to improve health research productivity and impact by addressing key local scientific and health challenges (Kasprowicz et al.,2020), thereby contributing to better health and well-being of African population. Therefore, the study contributes to African led solutions that consequently increase global recognition of Africa's health research.

By addressing the strengths and weaknesses of existing scientific metrics, the thesis advocates for the adoption of more context-relevant evaluation frameworks. This is the case because it raises awareness concerning the strengths and flaws of scientific metrics, and direct proper application of scientific metrics to health research. The thesis, likewise, contributes evidence regarding credibility of criteria/standards used to index journals by international indexers. Its results may justify the need to develop regional or national citation databases that use selection criteria that responds to the African context amidst inherent challenges. Similarly, it may guide the development of the databases or journal indexing standards, especially at policy level, that consider local publishing practices and often overlooked non-English language research publications.

The thesis also identified facilitators that have successfully supported journal indexing, research productivity and scientific impact in Africa such as collaborative partnerships, local research funding, international collaboration, editorial training and digital publishing platforms. These insights can guide capacity-building initiatives for editors, reviewers, and researchers. Equally important, the thesis identified gaps for future research that may promote understanding of barriers and facilitators, to strengthen Africa's contribution to global public health knowledge.

Chapter 2: Literature Survey and theoretical frameworks

2.1 Introduction

This chapter reviews literature relevant to the present study. The review begins by operationalizing concepts used in the thesis and how they are related with each other. In turn, the chapter reviews previous studies related to the objectives of the study. Considering that the first study in the thesis is also a scoping review of the current status of scientific impact of African health research, this chapter only highlights briefly studies that report on current status. The scoping review, which is described in subsequent chapters, goes further to analyze and synthesize all studies that report on scientific impact of Africa's health research and journal indexing.

The review presented in this chapter is based on systematic searches of literature in several multidisciplinary and discipline specific abstract and citation databases, and other academic and general data sources such as PubMed/MEDLINEMEDLINE, EBSO CINAHL (Academic search premiere), Web of Science, Dimensions, Scopus, EMBASE, Semantic Scholar, Google scholar, Google, Directory of Open Access journals (DOAJ), African Journals Online (AJOL), African Index Medicus (AIM). Artificial Intelligence enhanced discovery research tools such as Mendeley and Connected Papers were also used to identify more studies related to the studies found and the key concepts relevant to this thesis.

2.2 Operationalization of concepts

Concept operationalization refers to the process of defining theoretical or abstract concepts using specific procedures, indicators or operations that are used to measure or identify the concept in the empirical world. Concept operationalization is a crucial step in research study for several reasons (Saperas & Carrasco-Campos, 2015). Firstly, it clarifies what is really being measured(Saperas & Carrasco-Campos, 2015). Secondly, it allows replicability of research findings because of consistency in how the concept is defined and measured. Thirdly, it allows validation of results, and helps comparability across different studies. Finally, it helps in the appropriate selection of data analysis methods.

The sections below define the major concepts used in this thesis and how they relate to each other. Thereafter, the thesis briefly reviews findings of previous studies related to its objectives. Understanding research impact pathway and its relationship to journal indexing helps pinpoint

barriers, facilitators and opportunities along the impact pathway, thereby making intervention easy and effective.

2.3 Defining impact

The common dictionary definitions of the word impact refer to either a force of one thing on the other, or an effect or influence of one thing on the other (Cambridge, 2024). Combining the words "force" and "effect" gives us "impact," which means a way to measure how much something has changed or influenced a situation, and to what degree that change has occurred (Roemer & Borchardt, 2015). These definitions, do not prescribe whether the effect or force of the effect is positive or negative; impact may go both ways. Regarding research impact, there exists variations in the terminology of impact, with some attempting to differentiate between research outputs, outcomes, impacts, benefit and value (Roemer & Borchardt, 2015). Notwithstanding marginal differences regarding how these terms are used, they all show marked effect or influence from research activity.

The concept of research impact is complex and multifaceted, involving the multiple ways in which knowledge is generated and utilized (Greenhalgh et al., 2016). Impact can occur through various mechanisms, including the development of new products, services, policies, or practices that improve health outcomes, economic productivity, or societal well-being. With a traditional view that research is commonly done in academic community to generate new knowledge or service or practices, the immediate benefits of research are considered as contribution of knowledge in academia or field of study. However, there is growing interest to understand impact beyond academia to establish its value to wider society. The definition may also vary depending on type of research, discipline and purpose. For this study, the primary focus of impact is on the intellectual contribution while recognizing that research impact pathway is a continuum from the initial process of research, through to the intellectual contribution and to wider societal benefits. Notably, the terms, scientific impact and scholarly impact, are used interchangeably in this thesis.

2.4 Research impact evaluation and its rationale

Butler et al., (2017) observes that , since universities were traditionally taken as a hub of research activity contributing to knowledge production and transformation, their impact evaluation approach usually focused on measuring immediate outputs such as publications' productivity,

citation analysis and social networks. The common methods employed were peer review (qualitative), and bibliometrics or scientometrics (quantitative). However, prominence has recently been given to evaluating impact beyond the immediate academic benefits, particularly by focusing of benefits to society at large in a number of dimensions, including economic, cultural, environmental, and policy. This dimension of impact is not the primary focus of this PhD project. Nonetheless, considering that these two dimensions of impact are related all aspects of impact are discussed, albeit with a major focus on scholarly impact of research.

Penfield et al., (2014) argues that in order to determine the limits and relevance of the assessment exercise in research impact evaluation, it is very important to consider who does the impact evaluation and the purpose for which the evaluation is done. This makes a lot of sense because, usually, the purpose for doing assessment determines which aspect or dimension of research impact the assessment focused on. For instance, if a funder commissions research impact assessment, the definition or evaluation methods will lean more towards return on investment to determine fulfilment of their objectives, and benefits to the target society. It is less likely to emphasize scholarly impact of research, except on the dimension of influencing policy. In contrast, when the purpose of assessment is to understand contribution to knowledge e.g. an academic department or field of study the focus of assessment leans more towards scholarly impact.

It is also important to note that scholarly and societal views are related in certain ways; they differ only in their emphasis on intended audience and purpose. It is also common to see measures of societal impact include scholarly impact metrics. For instance, while popular research impact frameworks discussed below focus on benefits beyond academia, they include an aspect of scholarly impact assessment. This relationship is demonstrated in detail later under the conceptual model and theoretical framework in section 2.8.

A number of reasons justify the need to conduct research impact assessment for universities, charitable organizations and other research institutions (Carlson et al., 2021; Glasziou et al., 2014; Hughes & CBR, 2012; Penfield et al., 2014). Firstly, the assessment helps to monitor and manage performance of individuals, institutions, countries or any associations, including understanding and sharing their contribution to various stakeholders. Similarly, it helps account for value against investment to different stakeholders such as funders, governments, and universities. Furthermore, following the account for value and report on performance, impact evaluation helps inform future

funding decisions concerning where and how to appropriately allocate funding. Finally, it helps to understand research impact pathways that permit interventions that maximize the impact of research, which is the justification for this study.

Despite these justifications for conducting research impact evaluation, some quarters argue that impact evaluation may compromise creativity in the quest for knowledge in academia (Greenhalgh et al., 2016; Penfield et al., 2014). Others dismiss impact evaluation for its methodological flaws, highlighted in section 1.1 (Wilsdon et al., 2015).

2.4.1 **Methods for Assessing Research Impact**

Several methods are often used in various combinations to assess research impact, including publication and citation analysis, interviews with principal investigators, peer assessment, case studies, and document/desk analysis (Milat et al., 2015). Publication and citation analysis assesses the scholarly impact of research by analyzing publication rates and citation counts while interviews with principal investigators provide insights into the research process and the perceived impacts of the research. Peer assessment method, in contrast, involves evaluating research impact through peer review processes, such as grant reviews or journal peer reviews. On its part, case study method employs in-depth studies that examine specific research projects and their impacts, often using a narrative approach, whereas document analysis method involves analyzing documents, such as research reports, policy documents, or media coverage, to evaluate research impact.

It is important to note that there is no one standard for assessing research impact to reflect actual benefits accrued from research. A review of several impact evaluation studies by Milat et al.,(2015) established that common methods for impact assessment heavily relied on interviewing principal investigator of the research. However, the authors observed that research impact evaluation would be more reliable if the assessment depended more on policy makers and end users of research to determine the extent of impact. This view, while rich as far as the need to account for both scholarly and societal impact is concerned, is still limited in its data collection methods. Considering complexity and challenges associated with conducting impact assessment, Milat et al., (2015) recommended that there should be a balance between comprehensive assessment that employs multiple methods, and feasibility to implement the assessment.

2.4.2 **Challenges in research impact evaluation**

Research impact can occur through multiple mechanisms, making it difficult to capture all the benefits generated (Greenhalgh et al., 2016). Conducting comprehensive research impact evaluations can be resource-intensive, particularly when involving multiple stakeholders and methods. Similarly, the lack of standardization in research impact evaluation frameworks and methods can make it difficult to compare and aggregate results across studies. One possible solution is to consider several factors such as the purpose of evaluation, data source, field of study, time and context when making comparison. Additionally, research impact variations across disciplines may pose challenges in comparing impacts of research from different disciplines (Greenhalgh et al., 2016; Penfield et al., 2014). For instance, comparing impact of research from Arts and Humanities discipline, with public health research from the Biomedical Sciences discipline may give unreliable results due to inherent differences between the two disciplines. Unlike research in other disciplines, social sciences and humanities research often tackles issues that are relevant at regional and national level, hence the present thesis focuses on one discipline.

Penfield and others (2014), highlighted five additional challenges of evaluating research impact, namely, time lag, developmental nature of research, attribution, knowledge creep, and challenges in gathering evidence. Time at which assessment is done matters because the time it takes from research inception to impact may either be short or very long. Similarly, the time for conducting impact assessment matters greatly because the developmental nature of research may vary according to the increase and decrease of the impact of the research at given points just as research impact may be temporary or long lasting. Furthermore, the 'knowledge creep', which refers to the slow but often unrecognized absorption of new information or findings into existing knowledge and practices over time is difficult to track or account for. This can lead to the contributions of significant research being undervalued or overlooked owing to incremental nature of knowledge assimilation shadowing the original attribution.

The aforementioned reasons justify the need for conducting regular impact assessment and also updating previous evaluations, hence the need to be cautious when interpreting and comparing results of impact assessment. In this light, the present study conducted a scoping review as well as a scientometric analysis to establish current status of scholarly impact of African health science journals and Africa's research.

Furthermore, the complexity of the impact pathways, which involves interaction of many actors and activities becomes very hard to always pinpoint a direct cause and effect of research to impact (Greenhalgh et al., 2016; Penfield et al., 2014; Qin, 2014). Practically, therefore, attributing impact to a single study or individual may not generate a true reflection of reality. For instance, some studies that discover something significant may provide a foundation for future studies, and may not be cited or recognized as to have made any impact. Another example could be not citing negative findings, though, negative findings may not be attributed as informing the right way of not repeating the problem. Thus, the findings may help inform another study to try a different method or to develop a better service or product. One possibility is to collect qualitative data from users of such research output to cite how it influenced their future work, ideologies or practice, which may not be feasible in reality. Even the method of collecting qualitative data from principal investigators may underestimate the actual impact of research because they may not be aware of how it has influenced other individuals who did not attribute their work or did not reveal to them that they read their work. Therefore, lack of evidence to directly show linkage between research and impact poses a challenge in situations where it is difficult to collect such evidence.

These challenges aside, using multiple assessment methods provides a more comprehensive understanding of research impact, as one method would complement the weaknesses of another (Wilsdon et al., 2015). Additionally, the rapid development of electronic databases and big data analytics promises efficiency and scalability of research impact evaluation as it will resolve some challenges by automating some tasks, reducing costs and improving accuracy in gathering and analyzing real time impact data (Hicks, Wouters, Waltman, de Rijcke, et al., 2015). Furthermore, impact evaluation should consider focusing more on long-term impacts while acknowledging other immediate and different time point impact variations. In the absence of a perfect and standardized approach or methods for impact evaluation, the current ones are sufficient for accounting for investment in research, track impact as well as make informed decisions. More importantly, the methods need to be used appropriately and to be interpret cautiously, considering purpose and context of the evaluation (DORA, 2012; Hicks, Wouters, Waltman, de Rijcke, et al., 2015; Wilsdon et al., 2015)..

2.4.3 **Rationale for understanding factors affecting scientific impact of research**

, The significance of the scholarly impact of research cannot be overemphasized. Therefore, the rationale for studying and understanding factors that affect scientific or scholarly impact of health research includes the following (Confraria et al., 2017; Didegah & Thelwall, 2013; Gonzalez-Brambila & Veloso, 2007; McManus et al., 2023; Timsit et al., 2019):

1. **Research Advancement**: This helps researchers focus their efforts on areas and practices that are more likely to yield high-impact results, thereby boosting the quality and relevance of their research.
2. **Institutional Strategy**: Knowledge about this can help develop strategies that enhance research impact such as providing resources, fostering collaborative environments, and prioritizing specific research areas that have a higher potential for impact.
3. **Policy Development**: Policy makers can create informed policies that encourage impactful research. This can involve funding decisions, the establishment of research priorities, and the creation of incentives for high-impact work.
4. **Resource Allocation**: Understanding factors affecting research allocation helps in the efficient allocation of resources. Institutions and funding bodies can invest in projects and researchers that are more likely to produce significant outcomes.
5. **Evaluation and Metrics**: Research results or knowledge may provide a basis for developing and refining metrics and evaluation tools to assess the impact of research. This can be important for reporting and accountability purposes.
6. **Global Competitiveness**: For countries and regions, understanding and leveraging factors that influence scientific impact can enhance their competitiveness in the global scientific community.
7. **Societal Benefits**: Research with high scholarly impact often leads to significant societal benefits, including technological advancements, improved healthcare, and answers to critical issues such as climate change and poverty.

Overall, understanding these factors helps in maximizing the benefits of scientific research, ensuring that it contributes effectively to knowledge, societal progress, and economic development.

2.5 Journal Indexing and scholarly impact of research

Journal indexing is a critical aspect of scholarly communication that increases visibility and facilitates access to academic research. This is achieved through the organization, retrieval and dissemination of research that the indexing services provide. The current field of indexing of academic journals can be traced back as far as early 1960's when Eugene Garfield introduced the Science Citation Index (Alenzi et al., 2010; Garfield, 2006; Gasparyan et al., 2013). Developments in library science and Information and Communication Technologies (ICTs) have facilitated the growth of the field. Furthermore, the Science Citation Index has grown to include other indexes, and has been joined by several other indexing services such as Scopus, PubMed, Global Index Medicus, African Journals Online, Directory of Open Access Journals, CABI abstracts, Dimensions, and others.

Journals that are indexed increase their chances of being discovered and accessed thereby increasing their chances of being read and cited too (Bong & Ale Ebrahim, 2017). Therefore, journal indexing boosts journals reach and impact (Roux & Nwosu, 2006). Journal indexing services also called indexers provide a 'searchable database with subject, author, and the title access to individual articles from a selection of journals they choose to include in their databases (Bhardwaj & Bhardwaj, 2017).

Beyond these basic functions, some indexers, referred to as abstract and citation databases, provides usage and citation data as evidence of impact of the research. Regardless of whether a journal wants to be indexed or not, research authors are also required to disseminate their research through journals that are indexed for wider visibility and impact. Therefore, this need influences journals to index with popular and reputable indexers. Some institutions or countries have policies that specify the indexers that the journals should be abstracted and indexed for an article to be recognized for promotion or tenure decisions (Dhammi & Haq, 2016). Some funders even give guidelines on which journals to use for dissemination of research output to increase its visibility and accessibility.

Due to their strict criteria for indexing journals, the indexers have gained themselves a reputation among scholars to the extent that publishing in a journal indexed by a reputable indexer validates quality of their research and provides prestige (Bhardwaj & Bhardwaj, 2017). Journal editors also strive to have their journals abstracted and indexed in these reputable indexers to not only increase visibility and accessibility of their journals but to also attract author submissions by the status of their journals being indexed by such reputable indexers (Sandesh & Wahrekar, 2017). Indexing reflects journals' ability to meet high editorial and ethical research standards in scientific research and publishing. Therefore, indexing reflects quality and credibility of a journal, including quality of research published in the indexed journal (Bhardwaj & Bhardwaj, 2017).

2.5.1 Basic criteria for journal indexing

Indexing services have some basic technical requirements for journals selected to be indexed. These include, each journal item being separated from others and having information for the indexer; the title page containing details such as the publication type, title, author names, affiliations, correspondence, copyright details, processing history (submission, revision, acceptance, and online availability dates), citation mode, digital access, usually in the form of Digital Object Identifier (DOI), abstract, and author keywords, disclosure of research funding information; and ensuring correctness of references section for citation tracking databases (Gasparyan et al., 2013; Markusova, 2012).

Apart from the basic criteria, there are other selection criteria or standards that differ depending on the aims, professional scope, and indexing sources aimed at selecting the most influential and high quality journal (Gasparyan et al., 2013). The common ones are peer review, timeliness of publication, international editorial board (current practicing expert in the field), the need for contributing authors' affiliation to be from different countries/institutions, impact factor, and adherence to international guidelines for publication ethics (Astaneh & Masoumi, 2018), online submission system, and availability of a website (Asubiaro & Onaolapo, 2023; Gasparyan et al., 2013; Markusova, 2012).

2.5.2 Methods for measuring scientific impact

Measuring scientific impact of research is relatively easy and cheaper as compared to impact beyond academia, as described earlier. The approach is essentially quantitative, with bibliometrics

and scientometrics, being the popular ones (Roemer & Borchardt, 2015). Recently, alternative metrics (altmetrics), which are based on social media mentions and reads, are also gaining popularity to give a different perspective ignored for some time (Roemer & Borchardt, 2015). With the proliferation of ICTs, the field of informetrics has also emerged to encompass resources that are not covered by the pioneering methods. This is the case because, traditionally, bibliometrics focused on measuring printed books and journals quantitatively hence ignores some new information formats.

The common methods for measuring scholarly impact of research are publications counts, citation and social network analysis, return on investment, alternative metrics and usage metrics (Roemer & Borchardt, 2015). These are conducted at individual researcher level, publication/article level, journals level, institution or research community level, funder level, and country level. On the one hand, publication count is a basic measure of research productivity by counting the number of publications by an individual, institutions, research community or country. On the other, usage metrics focuses on number of views and downloads from online platform signifying immediate interest and reach of research findings.

2.5.3 **Advantages and Flaws of Metrics**

Quantity and quality of research impact has several quantitative indicators, or metrics. The common ones are presented below in Table 1 (Kavic & Satava, 2021; Roemer & Borchardt, 2015). It is imperative to note that these metrics or indicators of impact are tied to data sources such as Google Scholar, Web of Science, Scopus, PubMed, and Dimensions. While having certain flaws, according to Garcia-villar and Garcia-Santos, (2021); Bornmann, (2014); Moed & Halevi (2015), these indicators offer the following advantages when used to gauge impact of research:

- They are simple to use and calculate
- They have direct measure of influence within the field or discipline
- Their field-normalized metrics adjusts for differences across disciplines
- They enable comparison across different researchers, institutions and countries

Nonetheless, as cited by Hicks et al., (2015); MacRoberts & MacRoberts, (2010); Waltman, (2016); Moed & Halevi, (2015); Garcia-villar and Garcia-santos, (2021) quantitative indicators have attracted considerable criticism, particularly that:

- Some metrics do not account for field variations
- They ignore context of citations
- They are highly influenced by age or time hence their possible bias against early career researchers
- They may be highly influenced by highly cited articles
- They may be susceptible to manipulation by editorial policies and citation practices/cartels
- They over-rely on quantitative data, which undermines the role of qualitative assessments of impact.

Table 1: Summary of common metrics or indicators of scientific impact

Metric	Category	Provided by (Institution/Database)
h-index	Author	Google Scholar, Scopus, Web of Science
i10-index	Author	Google Scholar
g-index	Author	Harzing's Publish or Perish (PoP)
Altmetric Attention Score	Author, Article	Altmetric
Journal Impact Factor (IF)	Journal	Clarivate (Web of Science - JCR)
SCImago Journal Rank (SJR)	Journal	SCImago, Scopus
Eigenfactor Score	Journal	Eigenfactor Project, Web of Science
Article Influence Score	Journal	Eigenfactor Project
CiteScore	Journal	Scopus
Source Normalised Impact per Paper (SNIP)	Journal	CWTS, Leiden University, Scopus
Journal Citation Indicator	Journal	Web of Science
Field-Weighted Citation Impact (FWCI)	Article	Scopus
Downloads and Views Count	Article	Publisher databases (Springer, Elsevier, etc.)
University Rankings (QS, THE, ARWU)	Institution	QS, Times Higher Education (THE), ARWU
h5-index	Research Group, Journal, Author	Google Scholar Metrics
Gross Expenditure on R&D (GERD)	Country	OECD, UNESCO
Scientific Publications per Capita	Country	OECD, Scimago

Concern about the misappropriation of research metrics has led to calls to guide researchers and administrators on their proper application. The DORA, Leiden manifesto and Metric tide, for example, provide guidance regarding the proper understanding and application of research metrics

while acknowledging its flaws (DORA, 2012, 2024; Hicks, Wouters, Waltman, de Rijcke, et al., 2015; Wilsdon et al., 2015). Some of these tools, e.g. DORA, actually completely discourages use of research metrics in research quality assessment for individual researchers and research projects due to their inherent problems. However, they acknowledge their utility in tracking the growth and decline of research fields through bibliometrics and scientometrics (DORA, 2024).

2.6 Current status of Africa's health research scientific impact

Africa's health research scientific impact is reported to be relatively low than that of other regions (Bickton et al., 2019; Siriwardhana, 2015). One explanation is that the lower coverage of African journals indexed in renowned databases limits their visibility and accessibility (Asubiaro, 2023; Ogunfolaji et al., 2022). Readers usually depend on these renown data sources for tracking research activity and progress, and as sources of evidence, hence African health science's tendency to be globally underrepresented. With the global world and digital environment, online presence, especially in these renowned databases, is more significant for local researchers who rely on the same databases as source of evidence. It is, therefore, imperative to study current status of journal indexing and scholarly impact of Africa's research together with data sources that are used to demonstrate coverage biases and other limitations. As far as data sources limitations are concerned, it is also important to recognize that the metrics used in assessment and comparison of scholarly impact are data source dependent (Asubiaro & Onaolapo, 2023).

However, some African countries such as South Africa and Egypt appear to be doing better in research productivity and impact on the global map (Mouako et al., 2022). Usually, studies that report on scientific impact of global literature focus on top 200, top 100, top 50 impactful papers or researchers, which makes African health research obscure (Abdou et al., 2022; Djoutsop et al., 2021; Hernández-González et al., 2022; Kanmodi et al., 2022; Kanmounye et al., 2021; Khalili et al., 2018; López-Muñoz et al., 2022; Martín-Del-Río et al., 2018; Mei et al., 2016; Sweileh, 2017, 2016; Tang et al., 2016; Valderrama Zurián et al., 2021; Xie & Micieli, 2022). The problem is exacerbated by the coverage bias of the data sources used to do the assessment which excludes many African medical and health science journals (Ezema & Onyancha, 2016). This, consequently, makes smaller countries to be invisible regarding productivity and impact (Asubiaro & Onaolapo, 2023), and data on their performance and reasons behind their performance to be

missing. Therefore, the present study aimed at establishing scientific impact of Africa's health research by focusing only on African countries thereby make smaller countries salient.

Since impact is time dependent, within this thesis a review was conducted to analyse current bibliometric and scientometric studies of Africa's health research to establish the reported impact during the immediate past 12-year period. Additionally, the study conducted a scientometric analysis of Africa's health science journals to quantitatively establish their current status. Results of both studies are presented in Chapter 4.

2.7 Barriers, facilitators and opportunities of journal indexing and scholarly impact

Several factors affect journal indexing and scientific impact of health research. The factors may differ between High Income Countries (HICs) and Low and Middle -Income Countries, hence this literature largely focused on factors from LMICs in line with the focus of the study. The subsequent sections briefly discuss and summarise some of the factors but a detailed analysis of factors unique to Africa are presented in Chapter 4, sub-section 2.1, which reports on a scoping review of Africa's health research based on bibliometric and scientometric studies. As already mentioned under section 2.5, journal indexing offers visibility, credibility, prestige, boost impact of research. Therefore, it follows that Factors that influence journal indexing and scientific impact may be closely related and may mostly be the same, because journal indexing is an important step/stage along the research impact pathway, as discussed later in section 2.8. Consequently, the factors affecting journal indexing and scientific impact have been presented together in the subsequent sections.

2.7.1 Barriers of journal indexing and scholarly impact

The barriers to journal indexing and scientific impact of health research are multifaceted, requiring a comprehensive approach to addressing them. Some of the barriers are lack of funding as reflected by actual research funding, poor research infrastructure, language, and lack of technical expertise to run and manage journals such as lack of robust editorial services (Omoni & Odera, 2019). Inadequate funding and weak research infrastructure limit the capacity of local journals to meet international indexing criteria, sustain rigorous peer review, and adopt modern digital publishing standards. For instance, Bickton et al., (Bickton et al., 2019) observed that the poor economic status of developing countries influences many factors related to journal indexing such as funding

management of a journal on a business model, funding research projects and infrastructure, and training of researchers. Many journals in Africa rely on public funding as compared to many privately-owned commercial journals from developed countries (Bickton et al., 2019; Le Roux, 2006).

Additionally, there is a 'slim' authorship base with expertise in writing for publication which reduces article submissions and quality of publishable submissions (Bickton et al., 2019). Related to this lack of authorship expertise is the editorial team, including invited-reviewers, which is made worse by lack of proper succession planning of editorial members to continue running journals when founding or current members retire or leave (Bickton et al., 2019). The slim authorship base and limited number of experienced editors across Africa reduces the region's capacity to sustain effective scholarly publishing systems. This affects the quality assurance processes such as peer review, editorial management, and publication ethics thereby hindering journals from meeting international or even better indexing and editorial standards. This does not only reduce the credibility and visibility of African journals but also perpetuates dependence on external editorial systems or support, strengthening structural imbalances in global knowledge production.

Also, brain drain adds to this challenge as the cream of African academics relocate to developed countries for better working conditions and income (Confraria & Godinho, 2015). The migration of skilled researchers, editors, and academics to institutions in the global north results in a loss of local expertise, mentorship, and institutional continuity. This results in limited supervisory capacity, fewer peer reviewers, and reduced ability to sustain high-quality journals locally. Besides, the relocation of African scholars often shifts the centre of knowledge production and authorship acknowledgment to the global north, as research outputs generated by diaspora academics are frequently published under foreign institutional affiliations.

Following this brain-drain, there is already a related barrier of heavy teaching and clinical workload (Arabi, 2021, Asfaw, 2021), that limit researchers' time for writing and publishing mentorship or peer review, for both early career researchers and senior academics. In many universities and teaching hospitals, staff are required to handle large class sizes, extensive administrative duties, and demanding service delivery responsibilities with limited institutional support. This leaves little protected time for research design, data analysis, manuscript preparation, or engagement with scholarly publishing processes. Consequently, the region's scholarly output

and impact remains low relative to its knowledge potential, thereby limiting contributions to indexed journals and supporting perceptions of low research visibility.

Furthermore, the rise of predatory journals also poses challenges to African journals and research impact as experienced researchers or junior researchers tend to lean on the side of caution when submitting articles or accepting reviewer role; they choose already established high ranking journals (Bickton et al., 2019). This is made worse by controversies regarding lack of globally agreed definition of what is a predatory journal (Grudniewicz et al., 2019). The confusion makes some African journals to be wrongly classified as predatory because they are new or do not have high impact factor or are open access. For instance, a low quality journal may be wrongly classified as predatory, which tends to prevent development of low quality journals into high quality ones (Chung, 2019).

The legacy of colonial science also affects the collaboration and partnership of African authors and academics (Confraria & Godinho, 2015).The research institutes or universities established by the colonial masters still exist and the ties between the colonial masters and colonies are maintained, which allows former colonial masters to continue having influence on the research landscape. There are also strong ties between African researchers who studied in the global north with their training institutions or supervisors. While these collaborations or partnerships benefit and facilitate research in African countries, they tend to have certain negative effects on Africa's scientific endeavors (Confraria & Godinho, 2015).

2.7.2 **Facilitators of journal indexing and scholarly impact**

Despite the aforementioned challenges, the open access model, adoption of digital technologies and international research collaboration have facilitated journal indexing and research impact (Adams et al., 2021; Breugelmans et al., 2018; Fonn et al., 2018). Developments in technology, including information and communication technologies (ICTs) and open access platforms, extend dissemination, accessibility, and discoverability of African research, reducing traditional barriers associated with subscription-based publishing. International collaborations provide mentorship, methodological support, and opportunities for co-authorship, which can improve the scientific rigor and citation potential of publications, while also facilitating journal recognition in global indexing systems.

A number of studies have reported increased visibility, citation impact and article submissions following adoption of the Open Access (OA) publishing model (Ezema & Onyancha, 2017; Saqr et al., 2020). The OA model allows users to easily access articles which are normally not accessible behind paywalls when published through the subscription-based model. This is especially the case in underrepresented regions such as the global south (Oppenheim, 2008; Saqr et al., 2020).

However, the proliferation of predatory journals exploited the business OA publishing model where authors pay and reader accesses for free, by publishing articles without undergoing proper peer-review processes, and following ethical standards. Since the publication of Beal's list of predatory journals, some doubts surrounded the OA model until established publishers started to adopt the OA model. In fact, OA movements, including funders which required that research output of the projects they fund be disseminated through OA journals, had an influence in this change(Oppenheim, 2008).

Other facilitators to journals indexing and research impact include local research funding, capacity building, and research topic relevance (Adams et al., 2021). Local research funding strengthens the capacity of researchers and institutions to produce high-quality outputs, enabling adherence to rigorous publishing standards required for indexed journals. Whereas capacity-building initiatives, including training in research methods, scientific writing, and editorial management, improve both authorship quality and the operational standards of local journals, thereby improving their eligibility for indexing. Focusing on topics which are relevant locally or regionally increases the likelihood that publications are cited and used in policy and practice, contributing to real-world impact.

Confraria et al., (2017) established that previous citation impact, level of international collaboration and total number of publications in specific discipline were determinants of scholarly impact. They further reported that field specialization was an important determinant of scholarly impact in the global south unlike in the global north. Perhaps some fields have more funding and research activity happening (e.g. health) and some are global in nature, well developed with more expertise, hence the influence of specialty.

Recognizing that journal indexing alone does not suffice visibility and impact of a publication, especially recognizing that 43% of WoS indexed articles are not cited, Bong and Ebrahim (2017) recommends use of different tools to promote visibility and impact of research in three stages of

research publication. The first occurs during manuscript preparation and submission and it involves employing appropriate titles, abstracts and keywords that are search-engine friendly, using unique identifiers of names such as ORCID, publishing highly cited types of papers such as reviews, international collaboration for multidisciplinary research, and publishing in high ranking journals. The second stage occurs after publication by employing marketing promotion strategies such as social media, academic blogs, magazines, and depositing research in open access repositories. The final stage happens after receiving mentions or citations by employing altmetrics and form social networks with those that have mentioned their work through social media sites such as LinkedIn, and invite them for future works or share them alerts of new publications. These methods have also been reported by other studies that they facilitate visibility and impact of research (Cintra et al., 2018; Ladeiras-Lopes et al., 2020, 2022). This shows that research impact is influenced by so many factors at each stage of the research process, hence the need to focus on factors at each stage of the research impact continuum.

2.7.3 Opportunities of journal indexing and scholarly impact

One of the opportunities suggested was to devise alternative strategies to promote visibility of Africa's health research without relying on the conventional and popular citation databases (Chavarro et al., 2019). One practical way is developing regional or national indexing databases, hence the present study's decision to seek to understand attributes that African journal editors would prefer when deciding which indexing service to choose. Another strategy is to use alternative metrics (altmetrics) to measure visibility of African health research output (Ladeiras-Lopes et al., 2022). This is achieved through promotion of research publications using social media and other web 2.0 technologies (Roemer & Borchardt, 2015). Without replacing the role played by peer reviewed journal articles and citations (Haustein et al., 2015), Altmetrics point towards the journal article by highlighting the attention that the article received by the wider society.

A study by Asubiaro published in 2023 established three research gaps and made three recommendations for further research, which the present PhD research project started in early 2021, partly addresses (Asubiaro, 2023). Asubiaro's (2023) study compared SSA journal coverage by WoS, Scopus, EMBASE, AJOL, AIM, and established limited coverage of SSA journals by WoS and Scopus, and made the following recommendation for future research:

1. Explore journal editors' (from different regions of the world) perspective on fairness of journal inclusion by indexing databases
2. Examine how selection criteria affects likelihood of an SSA journal being indexed in international indexing databases
3. Determine how neo-colonialism affects international academic publishing and indexing.

2.8 Conceptual models and Theoretical frameworks

The study was guided by a combination of a conceptual model and a theoretical framework, namely The Research Impact Payback Model (Donovan & Hanney, 2011), and the Post-colonial theory (Sawant, 2012). A number of frameworks and models have been developed to assess research impact, each with its strengths and limitations. They act as tools that guide definition of constructs, methods for assessment and evaluation. Based on their focus, they target different dimensions including policy value, scholarly value, practice, economic value, cultural value, environmental value and societal value. A common theme concerning them is that they attempt to measure benefits beyond immediate academic or theoretical value of research. Some of the most widely used frameworks are the Payback Model, the Research Impact Framework, the Canadian Academy of Health Sciences, Monetisation, the UK Research Excellence Framework (REF), the Australian Research Quality Framework, the Health Services Research Impact Framework, and the Banzi Health Research Impact Framework (Greenhalgh et al., 2016; Milat et al., 2015; Penfield et al., 2014). It is outside the scope of this review to describe every framework and model of assessment, but the one selected to guide this study, namely the Payback Model, is briefly described in the theoretical framework section below. There are several literature reviews one can learn from that describe and evaluate the tools (Greenhalgh et al., 2016; Milat et al., 2015; Penfield et al., 2014).

A number of related theories and frameworks, such as The Australian Research Quality Framework (Australian RQF), The UK Research Excellence Framework (UK REF), and Knowledge Translation (KT) model were considered to guide this thesis. The Australian Research Quality Framework (Australian RQF) ended up not being selected because of its tendency to majorly focus on economic, societal, and cultural benefits excluding academic benefits and the research process. The UK Research Excellence Framework (UK REF) was deemed appropriate for the study, however, it was not selected because it is not specifically developed for health

science research as compared to the Payback Model. Impacts derived from research may vary across disciplines (Penfield et al 2014), hence the need to compare types of impacts within discipline of health science or Biomedical Science. Knowledge Translation (KT) theory is a concept that helps to bridge the gap between research findings and practical applications. This model was not chosen because it concerns itself with translating academic outputs or evidence to inform policy and practice in order to have a broader societal impact, while not clearly displaying the entire research process which makes it difficult to identify challenges and facilitators at other stages of the research process that may influence impact.

2.8.1 **The Payback Model**

The Payback model was developed to examine the impact or payback of health services research, by Martin Buxton and Stephen Hanney at the Health Economics Research Group (HERG) at Brunel University, United Kingdom (Donovan & Hanney, 2011). The model has two major representations; the logic model showing research process from definition of topic to research outcomes, and the multidimensional categorization of benefits showing academic, economic, environmental, and societal benefits (Donovan & Hanney, 2011; Hanney, 2005). The model was chosen because it shows both academic outputs and wider societal benefits of research. It also systematically connects the research process with its associated benefits, hence its versatility in exploring and understanding barriers, facilitators and opportunities of research at every stage of the process while it remains focused on impact that follows journal indexing. More importantly, the model was specifically developed to assess impact of health research and it is the most widely used model in research impact evaluation (Greenhalgh et al., 2016; Milat et al., 2015).

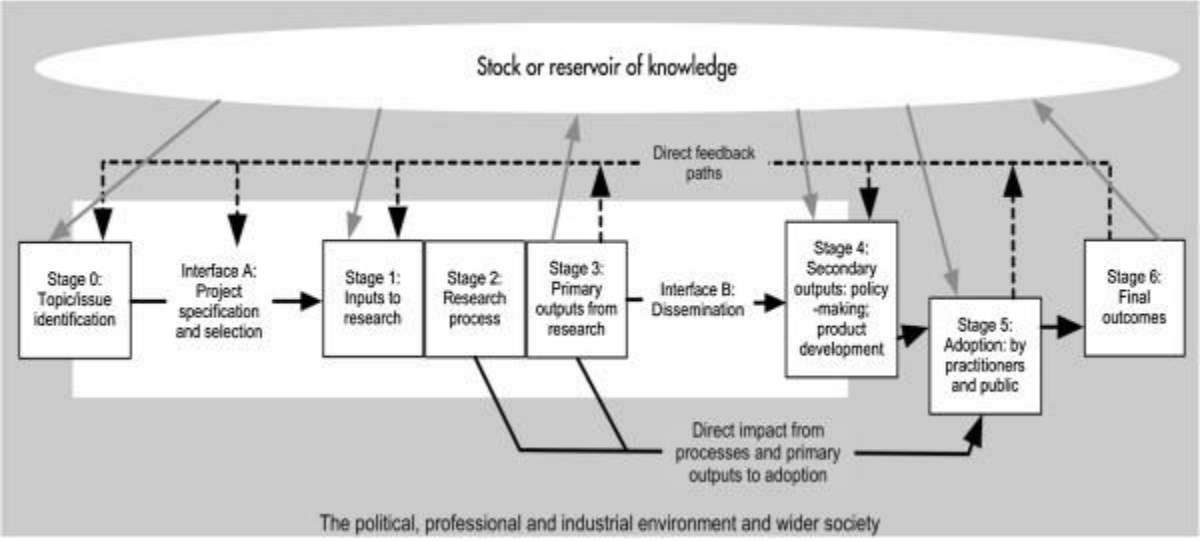


Figure 1: The Logic Model of the Payback Framework.(source: Donovan & Hanney, 2011)

2.8.1.1 Major Aspects of Payback Model

a) Logic Model Representation:

- Research Inputs: funding, staff, and infrastructure required for research.
- Research Processes: methodologies and activities used throughout research.
- Research Outputs: include immediate results like publication papers and reports.
- Research outcomes: both short-term and long-term study outcomes, such as changes in knowledge, behaviour, and policies.

b) Multi-dimensional Categorisation of Benefits

- Knowledge production: Academic outputs include journal papers, books, and conference presentations.
- Research capacity building: involves developing skills, experience, and infrastructure to improve future research capacities.
- Informing policy and product development: contribution to policy-making process and new product and technologies development.
- Health and health sector benefits: improved health outcomes and efficient healthcare system.
- Widespread societal benefits: focuses on impacts on society, such as economic benefits, social improvements, and enhanced quality of life.

2.8.1.2 Application to the Study on Journal Indexing and Scientific Impact of Public Health Research from Africa

The study was centered at stage 3 and Interface B of the logic representation of the model which, practically, are influenced by and result in other stages of the model. The research output is disseminated through peer reviewed printed or online journal paper or other alternative outlets such as research reports, policy brief, press releases (Moreland & Denham, 2019), including web 2.0 and social media such as tweets, blogs and podcast (Bong & Ale Ebrahim, 2017; Ebrahim et al., 2013). It is at Interface B, i.e. dissemination, that journal indexing becomes an essential step in increasing visibility and reputation of the research output. Several studies have reported an increase in scientific impact due to increased visibility of research output (Bong & Ale Ebrahim, 2017; Ebrahim et al., 2013; Ivanović et al., 2013; Wang et al., 2011). Specifically, journal indexing in reputable indexing services such as WoS, Scopus and PubMed, improves visibility and credibility of journals, thereby increasing its scientific impact (Ebrahim, 2013; Chavarro et al., 2019; Garfield, 2006; Le Roux, 2006).

The model added value to the methodology of the study because it offers a comprehensive framework for understanding research impact as a continuum from research process to outcomes. It, particularly, was helpful in the designing of data collection tools to identify barriers and facilitators along the impact pathway by providing the research process stages (logic model representation) and different impact domains. For instance, the inputs stage helped to explore factors related to research funding, research agenda, author capacity, and research infrastructure. The categorization of impacts in distinct domains also helped structure the data collection, analysis and discussion to focus on impact occurring at different stages in the research impact continuum, distinguishing the impacts or paybacks while also showing how they are related. This enabled the study to easily identify barriers and facilitators that affect which research impact domain at each stage of the process.

2.8.2 **Post-Colonial theory**

Mostly attributed to Edward Said's book, *Orientalism*, as its foundational work, post colonialism refers to 'a literary theory or critical approach that deals with literature produced in countries that were once, or are now, colonies of other countries… also is literature written in or by citizens of colonizing countries that takes colonies or their peoples as its subject matter...based around

concepts of otherness and resistance' (Ruffner, 2008). The theory aims to analyze and critique the lasting effects of colonialism and imperialism (Mishra, 2020). It examines how colonialism has influenced the political and economic aspects of both the colonizers and the colonized societies, focusing on issues such as identity, power dynamics and acts of resistance. This theory emerged in the mid-20th century as a response to movements for decolonization in regions such as Asia, Africa and the Caribbean. Influential figures such as Edward Said, Homi K. Bhabha, and Gayatri Chakravorty Spivak played critical roles in shaping the theory's development (Mishra, 2020; Sawant, 2011). Postcolonial theory raises questions about how historical colonial experiences continue to shape today's political landscapes as well as cultural identities.

Despite offering important insights into the long-term impacts of colonialism, postcolonial theory has been criticized for a number of flaws and limitations. Its tendency for very abstract and theoretically complicated ideas, which can make it detached from tangible reality, is one of its main criticisms (Ahmad, 1992). Scholars also contend that postcolonial theory frequently essentializes colonial and postcolonial identities while ignoring the power dynamics and internal diversity of formerly colonized nations (Chibber, 2013). It also often disregards economic and class factors in favor of cultural and discursive analysis, which has led to allegations of idealism (Lazarus, 2011). Additionally, post colonialism has been criticised for focusing too much on European colonialism at the expense of other types of oppression and imperialism (Dirlik, 1994). Despite these critics, postcolonial theory is still an important framework for understanding historical and contemporary power dynamics.

2.8.2.1 Major Aspects of Post-Colonial Theory

1. **Colonial Discourse**: Analyzing how language, literature, and other forms of cultural production have been used to justify and perpetuate colonial domination.
2. **Hybridity and Identity**: Exploring the complex identities formed through the interactions between colonizers and colonized.
3. **Subaltern Studies**: Investigating the perspectives and experiences of those marginalized by colonial and post-colonial power structures.
4. **Resistance and Agency**: Examining the various forms of resistance against colonial rule and the assertion of agency by colonized peoples.

5. **Decolonization**: Focusing on the processes and challenges of decolonization, including the reclamation of indigenous knowledge and cultural practices.
6. **Neo-colonialism**: Critiquing the continuing economic and cultural dominance of former colonial powers in the post-colonial world.

2.8.2.2 Application to the Study on Journal Indexing and Scientific Impact of Public Health Research from Africa

The Post-colonial theory, largely, helped in the analysis and interpretation of findings of this study. The aspects of language, identity, funding, international collaboration and partnerships were better seen through the post-colonial theoretical lens to realize their effects as barriers or facilitators of journal indexing and scholarly impact of African health research. For instance, neocolonialism helped see international funding of African research from the perspective of power and dominance, which is a barrier, by the global north, unlike mere developmental aid, although it is also reported as a facilitator of journal indexing and scholarly impact of African health research.

Furthermore, the theory proved helpful during the design of the study and during data collection by enabling it to explore economic, geographical, and language differences among countries included in the study. During in-depth interviews (IDIs), the aspects of decolonization and resistance as a response to dominance were explored in detail to determine their influence on journal indexing and scholarly impact of Africa's health research. The study also focused on the experiences of the subaltern group; the editors of African journals.

Chapter 3: Research Methodology

3.1 Introduction

This chapter presents philosophical assumptions and the methodology that guided the research, followed by a separate presentation of methods for each objective. This approach was deemed suitable because of its perceived ability to uncover significant barriers and facilitators for journal indexing and scientific impact in Africa and its ability to serve as a logical foundation for the research design that could provide coherence and clarity. Details about actual data collection and analysis processes, and results for each objective are presented in Chapter 4. It is also important to note that there is also textual overlap between this thesis and published work (s) derived from this project. For instance, currently, one paper was published on scientometric analysis, while another paper on scoping review was submitted to a journal. Additionally, at least two more papers are yet to be submitted to journals for publication. Full details of the proposed publications are given in preliminary page iv.

3.2 Research paradigm or Philosophical assumptions

Research paradigm is a concept that refers to the worldview or philosophical assumptions including ideas, beliefs and biases that guide the research process (Creswell & Creswell, 2018). The concept provides a structure that guides the methodology, design, and interpretation of a research study (Kankam 2019). There exist four major research paradigms, namely positivism, interpretivism, critical realism, and pragmatism, and each one of them offers unique perspectives on how research should be understood and conducted. This study adopted pragmatism as its philosophical underpinning due to the paradigm's practical orientation and methodological flexibility.

Pragmatism focuses on practical outcomes, context and the usefulness of research in addressing real-world problems (Creswell & Creswell, 2018). This study focused on barriers and facilitators of journal indexing and scientific impact, unique to Africa, hence by understanding what works in practice or not, it can identify and recommend actionable steps to be taken to improve journal indexing and scientific impact of health research from Africa. Pragmatism is also not committed to any one system of philosophy or reality; instead it advocates for methods that are most effective

in answering the research question. Pragmatism afforded this study opportunity to combine qualitative and quantitative methods derived from information science, transportation engineering (DCE), and public health to achieve its objectives. For instance, it allowed its quantitative phase, the first and the second objective, to broadly identify barriers, facilitators and opportunities of journal indexing and scientific impact of Africa's health research, that were explored further at deeper level and contextualized during the qualitative phase in objective three. The strength of pragmatism does not just reside in its flexibility but also in its emphasis on practical solutions which makes it highly applicable to diverse and complex issues (Creswell & Plano Clark, 2011). Its flaw, however, is that some researchers perceive it prone to methodological inconsistencies due to its lack of a firm philosophical grounding (Morgan, 2007).

3.3 Research approach or methodology

The study adopted mixed methods methodology which allows for integration of qualitative and quantitative data to have deeper insight of the problem under study. Specifically, the study employed a sequential mixed methods approach (Leech, 2012). The mixed methods approach was employed, particularly, because it helps uncover actionable insights for policy and practice. The integration of qualitative and quantitative methodologies, thus, ensured stronger understanding of the barriers, challenges and opportunities under study, and helped overcome limitations of each individual methodology when used on its own (Creswell, & Creswell, 2018). For instance, while the quantitative methods provided a general overview and allowed for generalisation of findings to different contexts, the qualitative method revealed contextual significance of the factors driving the challenges and enablers. Hence, the integration of multiple methods ensured validity of results through cross-checking of findings, richness of data that provide both breadth and depth, and credibility of findings when different methods' results corroborate.

The study was conducted in three phases, with the first one concerning itself with pursuing the study's first two objectives that feed into qualitative objective number three, the focal point of the second phase. The third phase involved the Discrete Choice Experiment (DCE), which was fed by the qualitative data of phase two. The DCE was aimed at confirming/exploring further the findings from phase one and phase two, which suggested key themes surrounding development of contextually relevant indexing standards and citation databases, failure to meet some standards or to index due to financial challenges, and issues of prestige (post-colonial mentality). The

integration of these methods enabled the iterative exploration of the same problem to comprehensively uncover African contextual challenges of journal indexing and scientific impact. In addition, the sequential mixed methods design allowed the complementary interpretation of study results in chapter 5, where results from different objectives are integrated. For instance, results from the cross-analytical study on journal indexing coverage are discussed together to results from the IDIs to explain possible reasons for the significant differences in journal coverage. The study design and research methods for each of the objectives are explained in detail below around objectives. Figure 3 below diagrammatically summarises the objectives and studies conducted.

The methods were carefully chosen and presented to align with the research objectives to ensure coherence and focus throughout the study. For each objective, a corresponding method was selected based on its ability to generate relevant data. This approach not only enhanced transparency and allowed for rigorous evaluation of the research process, but also ensured that the study addressed its objectives comprehensively. Explicitly linking methods to objectives demonstrated the appropriateness and rigor of the methodological framework while providing a clear pathway for replication and application in future research.

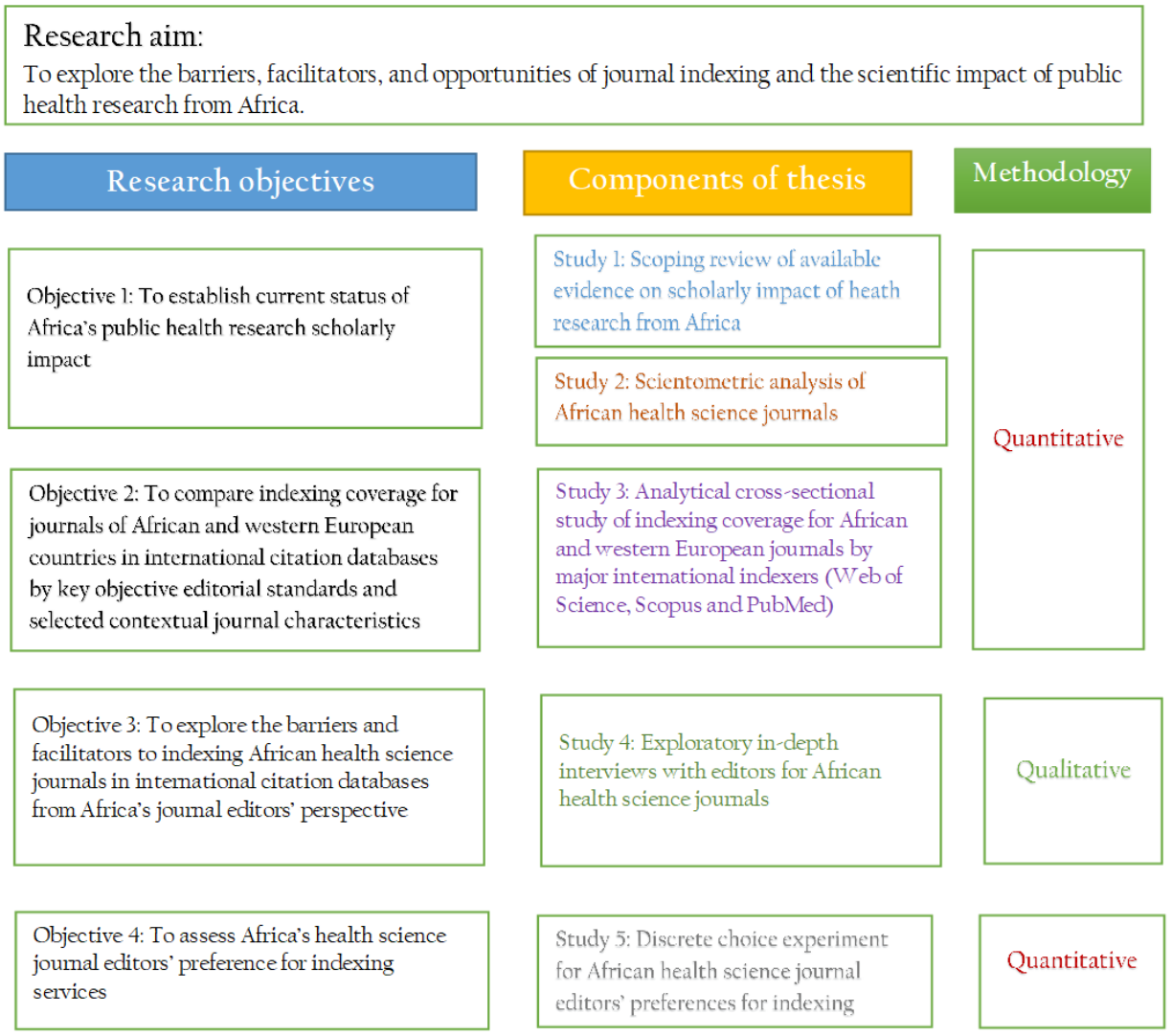


Figure 2: Research components and their corresponding objectives

3.4 Objective 1: To establish current status of Africa's health research scholarly impact.

This objective was achieved by conducting two studies: a scoping literature review and a scientometrics analysis. The methods for each of the studies are explained in detail in subsequent sections. The scoping review summarized evidence available on studies that report the status of Africa's scholarly impact, including its contributing factors. This helped identify key themes and gaps for future research such as lack of studies that measure Africa's research performance, which was addressed by the scientometric analysis. The scientometric analysis established the current

status of Africa's scholarly impact by measuring and visualizing the performance, trends, and structure of Africa's scholarly impact. It also established journal indexing geographical coverage of WoS, Scopus and PubMed.

Combining these two methods helped minimize limitations of using one method to achieve the first research objective. A scoping review is usually highly descriptive and its qualitative synthesis relies heavily on the interpretation of the researcher, hence potential subjectivity. The scientometric analysis, in contrast, relies on major databases and may miss out on unindexed publications mostly from Africa, may also have data inaccuracies, and cannot measure other aspects of impact due to its heavy reliance on metrics. Even when combined, neither method fully contextualizes why certain barriers persist in African research, hence the study's use of in-depth interviews (IDIs) in phase two to address this limitation.

3.4.1 Scoping review

The review aimed at summarising all available evidence and identifying gaps in the current scholarly impact of health research from Africa. Additionally, the review identified barriers and facilitators of Africa's scientific impact that were explored during IDIs of objective three. The finding of the review also informed the potential attributes included in the DCE of objective four. Furthermore, it identified areas requiring intervention or policy focus.

Research method

Conducting a scoping review was considered appropriate because of its exploratory nature and its ability to allow a systematic approach to identify and analyse all available evidence on a broader topic, unlike the systematic review which requires a more focused and specific question (Gough et al., 2012). The Arksey and O'Malley's framework was adopted for conducting the scoping review. The framework is composed of five stages, namely identifying the research question, identifying the relevant studies, selecting the studies, charting data, and collating, summarizing, and reporting results (Arksey & O'Malley, 2005).

Review question(s)

The main review question of the study was:

- What is the research landscape of Africa's health research scientific impact?

The following specific questions were derived from the main review questions:

- What is the reported citation/scientific impact of Africa's health research?
- What are the commonly used data sources?
- Which indicators or metrics are reported or used for reporting and citation analysis?
- Which public health thematic areas or subjects are researched?
- What is potentially hindering the growth of Africa's health research and its scientific impact?
- What are the facilitators and opportunities for the growth of scientific impact of Africa's health research?

- ***Eligibility criteria***

The study used the Participants, Concept and Context (PCC) framework recommended by JBI to identify the main concepts from the review question to be used in the search strategy.

  - ***Participants***

The participants include health researchers, institutions, funders, and research administrators.

  - ***Concept***

The research included studies on the scientific impact of health research conducted in Africa. Since health is multidisciplinary, any article that studied a topic or subject related to public health, or health science, or medicine was included hence the interchangeable use of the terms "health science research'' or "health research' in this study. The research excluded studies that reported the general scientific impact of research from Africa, for example, all disciplines. Public health research was defined in this study as 'research that contributes to the understanding of how population health is influenced by determinants (genetic, environmental, social and others) or to the identification of effective interventions for improving health and reducing health inequalities' (Clarke et al., 2007, p. 43). Scientific impact focuses on the knowledge added to a particular topic of study commonly measured quantitatively by analyzing citations received by a particular publication, including contributing factors (Waltman, 2016).

  - ***Context***

The context of the study was Africa as a geographical location. Studies that have a global focus and studies that combined African countries with non-African countries were excluded.

  - ***Types of Sources***

The review concerned itself with bibliometric and scientometric studies only.

Study population and data collection procedure (search strategy)

The study population for this research was composed of published research papers and grey literature that report on the scholarly impact of health research from Africa, particularly bibliometrics and scientometric studies focused on Africa and African countries only. A scoping review protocol was developed to guide the review, while a systematic search was conducted to identify both published studies and grey literature. The studies were identified through structured searches in a number of abstract and citation databases; WoS, EMBASE, CINAHL (EBSCO Host), Dimensions, PubMed, Cochrane Library and African Index Medicus (AIM). Simple searches were also conducted in African Journals Online (AJOL), Directory of Open Access Journals (DOAJ), and Google Scholar. Grey literature was searched in ProQuest Dissertations and Thesis Global. An example of the search strategy in Cochrane Library and EMBASE is presented in Appendix I.

Preliminary searches were conducted in PubMed, Dimensions and Cochrane Library to gauge availability of articles on the subject. The keywords identified in the titles and abstracts of the articles involved were, in turn, used to develop a full search strategy that was adapted to each data source. Citation tracking and searching of key journals was also performed (Arksey & O'Malley, 2005; Peters et al., 2020). No language restriction was employed to identify all available evidence on the topic under study. However, the full text screening was limited to only English language articles due to the fact that the review team could not understand other languages. However, articles in other languages were still reported, with those whose abstracts were in English being used to report some outcome variables of the study. Overall, less than 5 studies with English abstracts but with full text in another language particularly French emerged from the sample. The searches were limited by the year of publication from 2010 to 2023 to focus on the current state of affairs.

Selection of studies

Selection of studies followed the pre-defined inclusion criteria that were detailed in the scoping review protocol (Peters et al., 2020). Specifically, only bibliometric and scientometric studies that focused on Africa or African countries only were included. Two reviewers, namely the PhD candidate and one supervisor, independently pre-screened titles and abstracts of all studies

identified and selected potentially relevant studies for full-text screening. Full text screening followed to select studies that were included in the final analysis and review. Disagreements that emerged were discussed and resolved by consensus.

Data management and analysis

Covidence software (Peters et al., 2020) was used for data management and analysis. The identified studies were imported into Covidence software for deduplication and pre-screening. Covidence was also used for data extraction of included studies. A data charting tool designed in Covidence by the PhD candidate was used for the charting of included articles. Data extracted were title, author, year of publication, aims and objectives, methods, key findings and results related to outcome variables. The outcome variables of the review included the following: reported level of productivity and scientific impact of journals and articles from Africa; data sources and method (measures) of scientific analysis and reporting metrics; health research thematic areas or subjects studied; African countries studied; barriers, facilitators of scientific impact including proposed solutions; and gaps in scientific impact of health research from Africa.

Reporting of results

The scoping review process followed the PRISMA-ScR extension guidelines for reporting scoping reviews (Peters et al., 2020). Results were analysed using descriptive qualitative content analysis (Peters et al., 2020). Data were presented descriptively based on the questions and objectives of the review. Identified studies were also summarised in a tabular form. Results of the study are presented in Chapter 4.2.

3.4.2 Scientometric analysis

A scientometric analysis of African health science journals was conducted to complement the scoping review of available literature in establishing current status of Africa's scholarly impact. The analysis measured and visualized the performance, trends, and structure of health research from Africa. The scientometric analysis concerned itself with African health science journals only and its results were published in a peer-reviewed journal appearing in Appendix XIII.

Research method

The scientometric analysis was adopted to study African health science journals because it focuses on science unlike a bibliometric study which combines all disciplines or domains. Additionally, it also captures the social structure of science.

Selection of Journals

The inclusion criteria were being an African health science journal with an active publishing status. Journals showing that they are African but originate or affiliated with a non-African country were removed. Web scraping, a data mining technique, was first used to extract 422 African medical and health sciences journals from Ulrichsweb global directory of serials whose status was indicated as "active'', meaning the journal is actively publishing. Ulrichsweb is one of the largest and key serials directories in the world and provides data with the level of detail required in this study (Zhao, 2014). Ulrichsweb categorizes health related journals under medical and health science journals. A manual search was conducted in WoS, Scopus, PubMed, AJOL, and AIM to confirm, and also identified 202 additional health science journals from Africa not included in the initial list.

A total of 624 active African health sciences journals were identified; 422 from web scrapping and 202 from additional manual search in WoS, Scopus and AJOL. Two journals whose origins were identified as European and Indian were removed, creating a final list of 622 journals. However, for journal metric analyses, the study considered 221 journals because their journal metric values had been collected. A total of 57 journals from WoS and 98 from Scopus were used for country collaboration analysis, because, unlike PubMed, they could provide data in a format that would allow this analysis. Notably, duplicates or overlaps emerged in the process; some journals identified in WoS had also been indexed in Scopus or PubMed. For instance, 41 journals had been indexed by both WoS and Scopus.

WoS, Scopus and PubMed were selected because they are databases under study in this thesis. They also represent the largest journal indexers, whereas AJOL and AIM represent African region indexers. Additionally, WoS and Scopus are the common data sources used, and reported in literature (Li et al., 2021).

Collecting data on journal metrics

A manual search for journals' metrics was conducted in WoS (JIF and JCI), Scopus (SNIP and Citescore), and Google scholar (H5-Index). Data was collected between February and May 2023, and entered using a Microsoft Excel application. Bibliographic and citation data files were also downloaded from PubMed, WoS and Scopus to run analyses for author collaborations, and topical coverage in African health sciences journals. AJOL and AIM do not provide citation data files in a format suitable for topical coverage and author collaboration analyses.

The journal metrics selected for this study are all calculated based on different timeframes; 2 years, 3 years and 4 years, and are also calculated using different formulae. Therefore, comparison of journal impact was made within each metric category and not across or against each other. The study also aimed to establish current status, consequently, we did not compare the impact trends over a period of time. The following are definitions of journal metrics used in the present study:

- H5-index: the number of articles (h) published in the report year and the preceding four years that were cited at least h times (Walters, 2017).
- Journal Impact Factor (JIF by ISIS): 'a measure of the total number of citations for each of the papers published in a particular journal during the previous 2 years divided by the total number of eligible articles within that particular period' (Bakuwa, 2014).
- Journal Citation Indicator (JCI): the average Category Normalized Citation Impact (CNCI) of citable items (articles & reviews) published by a journal over a recent three-year period.
- Source Normalised Impact per Paper (SNIP): the 'ratio of the journal's citation count per paper and the citation potential in its subject field' (Moed, 2010).
- Citescore: the number of citations received by a journal in one year to documents published in the three previous years, divided by the number of documents indexed in Scopus published in those same three years.

Table 2 Summary of Journal metrics focus, timeframe and coverage

Metric	Focus	Time Frame	Citation Normalization	Creator
H5-Index	Citations of articles over 5 years	5 years	No normalization	Google Scholar
JIF	Average citations per article	2 years	No normalization	Web of Science
JCI	Citations relative to field norms	3 years	Field-normalized	Web of Science
CiteScore	Average citations per document	4 years	No normalization	Scopus
SNIP	Contextual citation impact	3 years	Field-normalized	Scopus

Data analysis and visualisation

STATA version 16 (StataCorp., 2019) and Microsoft Excel version (Microsoft Corporation, 2018) were used to run summary descriptive statistics, while VoSviewer software (Clemente, 2012) was used to analyse topical focus coverage based on all keywords co-occurrence (author keywords and MeSH keywords) mapping instead of term co-occurrence. Keywords were preferred because they either define or represent the main subject matter of the article whereas frequent terms may not necessarily represent the main subject matter of the publication or article. Co-occurrence mapping shows how many times keywords or terms appear in more than one publication. In terms of authorship collaboration (social structure), VoSviewer was used to visualise co-authorship across countries to show collaboration patterns. However, PubMed database files did not provide data on country affiliation hence co-authorship analyses could not be run based on country names. Consequently, organisational or institutional affiliations were used to determine the nationality of authors.

Presentation of results

Results of the scientometric analysis are presented in Chapter 4.3 using tables, figures, visualisation networks, and narratively. More tables and figures are presented in Appendices of the thesis.

3.5 Objective 2: To compare African and western European countries' journal indexing coverage in international citation databases by key objective editorial standards and contextual journal characteristics.

Health science journals were the unit of analysis because focusing on public health journals only would limit coverage. Health science journals included all journals that published public health research, specially classified by the data sources under the public health science category. This comparative analysis was done to understand disparities in journal indexing coverage and factors that influence inclusion of journals in major databases between African and western European countries. This helped to highlight structural inequities in global health research visibility and impact. By providing insights into how contextual challenges such as economic status of country, and editorial policies may influence the visibility and impact of health research, the results may inform strategies to promote Africa's journal indexing and scientific impact.

Research method

An analytical cross-sectional study was used to test the claim that journals from Africa are discriminated against by international journal indexers such as WoS, PubMed and Scopus. These databases were chosen because, at the time of the study, they were the major data sources for scientific impact metrics (Walters, 2017). Furthermore, they were reported or criticised by literature as major indexers biased against developing countries (Chavaro, 2019). The study hypothesised that some journals from Africa met the objective criteria for inclusion but were being excluded from these international indexers due to certain contextual factors. The comparison was between health science journals from two regions; western Europe, and Africa, which according to World Bank classification of countries, had 17 and 54 countries, respectively.

Key and common objective criteria used by indexing databases for inclusion of journals, namely having international editorial board, international authorship affiliation, abstract and keywords in English, were utilised as explanatory variables for objective 2. These standards were selected to represent many standards which are used but are not included in this analysis, namely scientific impact, formatting issues, availability of website, publishing regularity, peer review process, and ethical statement. This was partly done to make the model simple, hence not overfitting it, considering its sample size, and for easy interpretation. Other variables were removed due to

multicollinearity, as explained in section 4.3 below. The model also included important details of a journal, namely originating region of the journal (either western Europe and Africa), Health expenditure (as % of GDP), and Gross National Income (GNI) to signify economy of country. The GNI categorises countries as Lower Income Countries (LICs), Lower Middle Income Countries (LMICs), Middle Income Countries (MICs), and High Income Countries (HICs).

Health expenditure and GNI were selected to represent contextual factors because they may have a direct influence on the ability of journals to fulfil some indexing requirements. The scientific impact or journal impact factor was not included because it is influenced by the same indexing. The peer review process, though important, was not included because it was difficult to objectively measure considering that journals may just state that they follow peer review process without explaining how that is actually implemented, which may require other methods to measure. The other requirements such as availability of website, and formatting issues were regarded as basic formatting requirements but not key to scientific quality. Publishing regularity, while important in determining sustainability of journal, was not included to make the model simpler by focusing on the key requirements.

Study population and selection of journals

A census of the targeted study population was composed of all African and western Europe health science journals. Based on the Ulrichsweb categorization of disciplines, this includes all medical and public health science journals. Due to limited number of journals from Africa, a targeted search for additional journals which may have been missed was conducted in WoS, Scopus, PubMed, AJOL and AIM. Duplicate entries of journals available across databases were removed. The final list of journals was selected based on characteristics such as having active status, being an online journal and availability of all required data for analysis. A final list of 5384 medical and health science journals from Western Europe, and 329 from Africa were included.

Data Sources and data collection procedures

Apart from data from Ulrichsweb directory of periodicals, each journal's website was visited to collect journal characteristics which were variables of interest as shown in the data extraction tool presented in Appendix VIII. Data on journal's characteristics such as publication country,

language, title, indexer, publication status were collected from Ulrichsweb periodicals directory. Notably, some journals from western Europe and a few from Africa were owned by commercial institutions or publishers with offices in different parts of the world hence the possibility of them not truly reflecting their publication country (Chavarro et al., 2019). However, the majority of journals from Africa reflected country of origin as they were owned or funded by universities or professional bodies (Bickton et al., 2019). Data on country's GNI and Health expenditure (presented as % of GDP) were collected from World Bank website. The study used data for the year 2022 for GNI, and 2020 for Health expenditure because they were the latest data available. A journal was considered an English-language journal if its main text was in English, and had an abstract and title written in English, regardless of other languages used.

Data management and analysis

Microsoft Excel and Stata 16 application softwares were used for data management and analysis. Proportions were used to compare coverage considering that western Europe had a larger number of journals than Africa's. Both univariate and multivariate logistic regression models were used to illustrate the association between the dependent variable and independent variables. Six models, thus three univariate models and three multivariate models, were built for each outcome variable, which was being indexed by either WoS, or Scopus, or PubMed, respectively. A logistic regression analysis becomes appropriate when the dependent variable has categorical data which can be coded as binary values (0,1) as is the case in this study where the dependent variable, being indexed in WoS, as an example of one of the outcome variables, had a Yes (1) or No (0) binary values (Gronmo, 2020). A 5% significance level and 95% confidence intervals were used.

However, binary logistic regression may oversimplify the complex factors influencing journal indexing and scientific impact by reducing them to binary outcomes. It assumes a linear relationship between predictors and the log odds of the outcome, potentially missing non-linear interactions. It also does not show causality but rather shows an association between a predictor and an outcome. Additionally, it may struggle with multicollinearity or insufficient data for rare events. These limitations were addressed by testing for interaction effects and multicollinearity. Furthermore, the reporting and interpretation of results did not claim any causality between predictors and an outcome but rather an association between the two, using odds ratios.

The research hypothesis was that all journals from Africa and western Europe that fulfil the key editorial standards were indexed by WoS, Scopus, and PubMed. For GNI and Health expenditure. The understanding was that excluded journals were associated with lower GNI and lower health expenditure. These two variables have influence on research capacity and productivity which may have an effect on ability to meet objective standards for journal indexing. Language revealed if journals were really biased linguistically as suggested by other authors (Chavarro et al., 2019).

Presentations of results

Results are presented as proportions and odds ratios with the aid of tables and figures, in chapter 4.4.

3.6 Objective 3: To explore the barriers and facilitators to index African health science journals in international citation databases from Africa's journal editors' perspective.

This objective sought to uncover the barriers and facilitators influencing the indexing of African health science journals in international citation databases, drawing insights directly from the perspectives of African journal editors. Understanding these factors was critical for addressing systemic challenges and identifying practical solutions that enhance the visibility and accessibility of African research on global platforms. By exploring these perspectives, the study contributes to the overarching aim of promoting equitable representation of African health science research in global scholarly communication, ultimately supporting efforts to strengthen the continent's research impact and influence. In addition to issues that arose during the interview process, this objective explored challenges, enablers and opportunities identified during phase one of the study; from the scoping review and the scientometric analysis, and the analytical cross-sectional study.

Research method

An exploratory qualitative study using IDIs was employed to understand journal editors' experiences and views regarding barriers, facilitators and opportunities to journal indexing and scientific impact of health research from Africa. Individual interviews are appropriate for deeper exploration of individual experiences, and allow data collection on complex issues and detailed narratives, as required by the study's objective, as compared to focus group discussions (FDGs) which are appropriate for group shared experiences (Creswell & Clark, 2020). The study's research objective required IDIs as opposed to FGDs due to differences among African countries' GNI,

language, research investment, education levels, and number of universities. In addition, there were differences in contextual journal factors such as journal funding model, partnerships, and business model. Since the expected outcomes of the study were experiences and perspectives of individual editors, journals and countries, then IDIs were deemed appropriate to collect relevant data.

Sampling plan and sample size

The Maximum variation purposive sampling technique (Creswell & Clark, 2020) was used to select 18 African health sciences journal editors for IDIs. Qualitative research focuses on depth rather than breadth, hence 18 journal editors were considered sufficient because they reached data saturation. In addition, different regions, country's economic status, languages, old and new, indexed and non-indexed journals were represented in the sample. Maximum variation sampling allows 'the selection of cases with maximum variation for the purpose of documenting unique or diverse variations that have emerged in adapting to different conditions, and to identify important common patterns that cut across variations ' (Palinkas et al., 2015, p. 3).This technique afforded the study to select participants based on Africa's physical regional subgroups, and representation of population variations in terms of official language, economic status and visibility of their journals (based on results from objective 2).There exists 5 geographical subgroups; North Africa, West Africa, East Africa, Central Africa and Southern Africa, with a total of 7 official languages, excluding local official languages or co-official languages, namely English, French, Portuguese, Swahili, Arabic, Spanish and Amharic. These regions and different official languages were significant to research collaboration, and a journal's language which influences visibility and impact of research, hence the need to represent these different views.

In addition, economic status representation was considered because it influences research capacity. Optimal sample size for the IDIs was guided by data saturation and information power principles for determining sample size in qualitative research (Hagaman & Wutich, 2017). The study targeted 30 participants based on regional geographic representation but the actual sample size was reached at 18 participants. Despite challenges to find participants from other regions and countries that were required, the study managed to recruit participants from three regions of Africa, and stopped conducting interviews after reaching data saturation.

Data Collection procedures

I conducted 18 IDIs with African health science journal editors. The interviews were between 45 minutes, and 1 hour 30 minutes long. Six interviews; 4 with Nigerian participants and 2 with Malawian participants were conducted in person, while the rest were done online via Zoom software. A semi-structured interview guide was developed to guide the researcher during the IDIs but it was adapted in the course of the subsequent IDIs. The researcher conducted all the interviews in English language. The IDIs were audio-recorded automatically on Zoom, while face-to-face IDIs were recorded using Laptop and Mobile phone recording software. Informed consent was obtained from participants to record audio of the interviews to support transcription.

The initial plan was to select participants purposively in order to obtain representation from different parts of Africa, and also to consider journal age, originating country's economy, indexing status, and journal language. However, it was challenging to find study participants because they were not responding to e-mail invitations to the study. Hence, I changed to convenience sampling and snowballing, whereby I used the editors that I had found to suggest other editors that I could recruit into the study. I also used my social network to introduce me to potential participants, a method that practically enabled me to recruit the majority of the participants. Only 2 participants joined the study following the initial e-mail invitations I sent out.

Convenience sampling and snowballing can lead to selection bias in that participants are not randomly chosen, and may share similar characteristics thereby limiting the diversity of perspectives. This study acknowledges that the results may not be generalizable to other countries, and that countries with English language background were overrepresented. Similarly, due to non-response rate, this study acknowledges that some countries with unique characteristics such as countries with non-English official languages were not represented in the sample, a limitation which possibly denied the study certain significant insights. However, the sample covered purposively selected participants from countries with diverse characteristics required. In addition, the integration of multiple methods used in this study helped to minimize the effects of these limitations.

Data management and analysis

Research assistants transcribed audio recordings, with quality oversight by the PhD candidate. NVivo 12, a computer software package produced by QSR international, Melbourne, Australia was used for data management and analysis of the transcripts. Data were analysed using thematic content analysis, and the themes generated were used as basis for discussion (Creswell & Creswell, 2018).

Development of codes and themes

I analysed the data using thematic analysis methods utilizing the inductive coding approach where themes emerged from the data. Since I conducted the interviews, I had a general idea of what the participants said, and I used insights from the previous interview to explore more topics in subsequent interviews. Together with one of the supervisors who is an expert in qualitative data analysis, I started double coding 2 printed transcripts to come up with initial codes. We employed color coding (using highlighters) and pen to make notes in the margin. I then transferred all the transcripts into Nvivo (version 12), and continued coding using Nvivo. Based on the initial codes, I created axial codes by giving meaning to the codes and organised them. I had frequent meetings with the same supervisor to discuss the coding process and for peer review. I also searched literature on the common uses of those codes. I identified five themes and 18 sub-themes given in Table 10 (Chapter 4, section 4.4.1), which were further categorized into three global themes.

Trustworthiness of the data was achieved through member checking to ensure credibility, detailed description of study participants, and context of study to ensure transferability of results, and detailed explanation of methods to ensure confirmability (Creswell & Clark, 2020).

My positionality as a researcher

Before presenting the results of this study and the discussion, it is important that I briefly revisit my position as a researcher concerning the topic at hand and experiences which may have influenced my interviewing process, understanding, coding and interpretation of the results. I work as an assistant librarian in an academic institution focusing on health and medical education. I assist faculty, students and researchers in scholarly writing, and publishing including reviewing thesis/dissertations, and offering guidance on choosing journals to publish with. As part of my work, I review academic promotion dossiers to assess appropriateness of publications submitted in support of the application. My role is to apply university policies and guidelines, and also to use

my expert opinion to advise the committee on the appropriateness of the publications submitted. Sometimes, I review the dossiers for faculty before they submit for promotion to advise them on their appropriateness. Furthermore, my degree level training in Library and Information Science (LIS) was at a local public university in my home country in Africa, and this study is part of my PhD project in another African university.

I do not and have never worked for a journal in any role, be it reviewer or an editor. I have published in one African journal and the rest of my publications (as first author or co-author) have been with a non-African journal.

Born, raised, trained and working in Africa, I believe I am affected by the issues at hand, and I partake in the practices mentioned herein in one way or the other. Hence, my background knowledge and experience influenced my conceptualization of this project, data collection (interviewing process), understanding and interpretation of the results. For instant, questions asked to participants on the use of metrics during faculty promotion were based on work experience. I also used my network of librarians to help identify participants (journal editors) in some countries as some librarians are involved in or may know about journals in their universities or countries. My understanding of bibliometrics, citation analysis and editorial standards empowered me to critically analyse findings within the broader context of African scholarly communication. My experience in working in Africa helped me contextualize questions asked, and findings to reflect practical realities faced in Africa such as resource constraints and prestige.

This background had the potential to introduce bias such as focusing on expected themes (confirmation bias), and aligning interpretation based on professional experience. However, as a researcher, I tried as much as possible to minimize bias through reflexivity and transparency, particularly discussing my positionality; data double coding and peer review; and triangulating these results with findings from phase one and phase three of the study. Besides, the validation techniques employed in this study explained in this chapter also enabled me to ensure the reliability and accuracy of the study's results.

Presentation of results

Results of the study are presented in Chapter 4.5 as themes and subthemes with a few corresponding quotations from participants. The themes and subthemes are also summarised in tabular form. The results are presented with a brief discussion to give them context, however, detailed discussion of results is made in Chapter 5.

3.7 Objective 4: To assess Africa's journal editors' preference on indexing with regional citation databases over international citation databases.

Based on insights from the scoping review and IDIs, a DCE was designed and implemented to achieve research objective number 4.

Research method.

Research objective number 4 aimed at beginning to explore journal editors' preference for having a regional abstract and citation databases or continue using international ones. The editors were given two options of journal indexing services offering different packages, and were asked which one they would choose to index with. This was done to explore their preferences on journal indexing services, and their attributes including levels of attributes. The findings would help current indexing services improve their services by considering the contextual challenges faced by African health science editors. Additionally, it would inform development of new indexing services or standards that reflect African scholarly landscape. An analysis of the characteristics of indexing services using DCE provide insights into what factors make an indexing service attractive and affordable to journals. This is particularly relevant when it comes to distinguishing between the needs of low-resource journals that are often struggling with limited indexing opportunities on the one hand and well-funded ones, on the other, which benefit from established reputations and robust citation metrics.

In this context, a DCE was deemed appropriate because it would not only show the importance editors placed on different attributes, direction of their influence and relative importance but it would also give information on trade-offs that editors were willing to make between attributes to either continue with international indexers or to go for regional or national indexers (World Health Organisation, 2012). This allowed for recommendations given by this study to align closely with stakeholder priorities, and tailor interventions to real-world preferences. This is further important

considering that some challenges faced by African journals and their countries cannot change overnight, hence there is persistent need for them to base their choices on current realities and available options. In addition, a DCE allowed asking participating editors to choose from different hypothetical scenarios which could be used to determine their preferences without necessarily asking them their choice for services which are currently not available on the market (Mangham et al., 2008), such as an equivalent regional/national abstract and citation database.

Design of the experiment

Initial attributes and levels of the DCE were determined from literature review including scoping review in objective one, and IDIs results from objective three. The initial list of attributes was sent to other African researchers, supervisors and journal editors to select their five best preferred attributes and rank them accordingly. The initial list is attached as Appendix III, but the experiment ended up with five attributes: editorial board, metrics, visibility, cost, and reputation. The chosen attributes and levels, such as cost and visibility, are critical in this context because they directly reflect the priorities and challenges faced by stakeholders in journal indexing and scientific impact.

For example, cost is a key factor influencing the accessibility of indexing services and the feasibility of meeting international standards, particularly for resource-constrained journals. Visibility, on the other hand, is central to the study's objective of improving the global reach and recognition of African health science research in that it impacts citation potential and academic influence. The composition of an editorial board reflects a journal's credibility, expertise, and geographical diversity, which are key factors influencing perceptions of journal quality and its acceptance into prestigious indexing systems. Metrics such as citation counts and impact factors are essential indicators of a journal's influence and academic value. Their inclusion aligns with the study's focus on enhancing African journals' visibility and impact in global scholarly communication. Reputation influences perceptions of quality and prestige. Additionally, high-reputation journals are more likely to attract submissions from esteemed researchers, citations, and readership, thereby enhancing their chances of being included in international citation databases.

The first design was piloted with 30 participants who were African researchers and reviewers of African journals and international journals. The pilot gave prior parameters that were used for the final design. The pilot, similarly, gave some qualitative feedback on participants' understanding

of the terms used to define attributes and attribute levels including instructions on how to complete the questionnaire. The feedback was used to revise the final design and questionnaire.

The Bayesian D efficient, an experimental design method, was used to design the experiment choice sets using STATA software. The final design matrix is presented as Appendix IV. There were two journal indexing options to choose from, Option A and Option B, and the third option was an 'Opt out' should a participant chose neither of the two options. The 'opt-out' option enabled journal editors to reject all presented indexing service combinations in favor of an alternative not included in the choice set. This response is significant as it suggests that certain indexing attributes such as visibility, reputation, or cost serve as deal-breakers in decision-making. A high opt-out rate may indicate that indexing services with lower visibility or unclear reputation are not considered viable by editors. Furthermore, financial constraints may prevent lower-resource journals from selecting costly but well-recognized indexing services. Understanding these opt-out patterns provides valuable insights into the factors influencing journal indexing decisions and the barriers faced by different types of journals in achieving international recognition. A detailed list of the attributes and their levels are presented in Table 3.

Table 3: DCE attributes and Levels

Attribute	**Levels**
Visibility_1	High
Visibility_2	Low
Reputation_1	High prestigious
Reputation_2	Less prestigious
Intl_board 1 (International editorial board 1)	Not required
Intl_board 2 (International editorial board 2)	Required
Metrics_1	Available
Metrics_2	Not available
Cost_1	Free
Cost_2	$1000
Cost_3	$2000
Cost_4	$3000
Alt 1	Opt out
Alt 2	Option A
Alt 3	Option B

Study population and sampling plan

The study population was composed of all African health science journal editors, being few in number. Based on a total of 749 health science journals from Africa, we estimated that having two types of editors (chief and managerial) gave us a target population of about 1498.

Sample size was calculated using a DCE sample size calculation method, rule of thumb, which considers the number of attributes, levels of attributes, number of choice sets and constants, thus, assumed number of responses per participant (Yaekob et al., 2023).

The sample size calculation is shown below:

- 4 attributes having 2 levels each = 4x (2-1) =4
- 1 attribute having 4 levels = 1x (4-1) =3
- Therefore 4+3 = 7 parameters were measured, multiplied by 20 (assumed number of responses per individual respondent) = 140
- Then 140 divided by number of choice sets (12), we get 12. Since 12 is too small for a sample size (common practice and literature recommends multiplying by number between 5 to 10 to increase statistical power and see effect sizes which are possible for small samples)
- Hence 12x10 = 120 participants

Data collection procedures

An online questionnaire containing two parts was designed using Redcap, and a link was sent online to all participants. A copy of a manual version of the questionnaire is presented in Appendix V. DCEs are also commonly administered through online surveys (Pérez-troncoso, 2020). Participants were first given 2 weeks to complete the questionnaire before the researcher sent them a follow up e-mail making it 8 weeks from the first day the questionnaire link was sent. If a questionnaire is not completed after the 8 weeks it was counted as non-response. Due to a low response rate, the questionnaire was sent in 3 instances to 3 groups or batches of e-mails. Identifying details of the participants such as e-mail addresses and names were made anonymous (removed) and were not included in the collected data set. Participants were identified by participant identity numbers, which were assigned automatically using Redcap.

Data management and analysis

Data was downloaded from Redcap, and cleaned as well as analysed using STATA software. Demographic data were collected and used to provide context for interpreting the study's findings rather than serving as primary variables in the analysis. This data offered insights into the diversity of participants, such as their geographic location, professional roles, or experience levels, which helped frame the understanding of results within the appropriate socio-cultural and institutional contexts. By highlighting variations in demographics, the study ensured that the findings were not interpreted in isolation but rather as reflective of the diverse realities of the target population.

DCE data analysis is based on random utility model (World Health Organisation, 2012). Therefore, the primary outcome was marginal utility of the DCEs attributes. In this case, the primary outcome of the DCE was the editors' preference for attributes of the two hypothetical journal indexing services. The result for each attribute was interpreted as the value that editors give to that attribute, which they can trade-off with other attributes to index with either indexing service A or B or none of the two. Data were analysed using both multinomial and mixed logit models. Details of the regression models are presented together with results chapter in section 4.14.

Presentation of results

The study's results were presented and interpreted using the mixed logit model outcome, and tables and graphs were utilised to summarise the results. More details about data analysis and how the models were built are presented in Chapter 4 as an introduction to a presentation of DCE results.

3.8 Ethics approval and ethical considerations

The study obtained ethics approval from the Human Research Ethics Committee (HREC) of the University of Witwatersrand, South Africa, and was awarded ethics approval certificate number M220925 (Appendix IX). Objectives 1 and 2 used publicly available information hence no need for the study to ask for permission from gatekeepers. Verbal and written informed consent were sought for IDIs and DCE participants before commencement of the study. For in-person interviews, participants were provided with a printed consent form and study information sheet that included detailed information about the study, its objectives, and their rights as a participant. The researcher explained to prospective participants these details verbally, addressing any questions before obtaining signed consent from them. For online interviews, a participant received

an electronic consent form and a study information sheet by email prior to the interview. They were required to read and give consent, either by signing it electronically or by providing written confirmation via email. The researcher reiterated key points about confidentiality, voluntary participation, and data usage at the start of each online session and obtained verbal consent before starting the interview.

For the DCE survey, the invitation e-mail to respond to the survey had a link to the study information sheet and consent form. Participants were asked to sign and e-mail back a signed form which some did, but were also informed that their completion of the survey would signify that they consented to participate in the study. These approaches ensured that participants were fully informed and comfortable with the interview format.

Participants were assured of their privacy and confidentiality by telling them that their participation was anonymous, and that any information they would give would be treated with utmost confidentiality. This assurance enabled participants to develop trust in the study, which in turn encouraged them to open up and give honest responses about their experiences and professional insights. Consequently, the IDIs managed to collect rich and authentic data that contributed to the reliability and validity of the study findings.

For both IDIs that were conducted physically and online, all recordings and transcripts were securely stored in password-protected devices, with access restricted to the research team. Hard copies of consent forms and other printed transcripts were stored in locked cabinets. For online IDIs, Zoom, an encrypted video conferencing platform was used to prevent unauthorized access. This was achieved by sharing meeting access details with participants only and ensuring the host admitted only authorized members to join the meeting.

Additionally, for the IDIs, any identifying information was removed or masked during reporting of findings. Participants were informed that they were free to opt out of the study at any point without giving reasons, and that data that would have already been collected would be discarded. Questionnaire responses were generated anonymously and participants' IDs were used to identify participants. Despite sending the questionnaire through e-mail to participants, the settings in Redcap software used to design and administer the DCE survey, were changed to make responses anonymous. Hence, the downloaded raw data for analysis did not have any identifying details. The DCE survey was hosted on a secure Redcap platform owned by University of Witwatersrand with

restricted access to the principal investigator only, and other authorized users given rights by the principal investigator. The data set was only accessible to the principal investigator, supervisors and research assistants (statisticians). The nature of the study expected no physical and substantial psychological harm to be incurred by participants hence did not take any special measures to minimize them. The informed consent and study information sheet appear in Appendices XII and XI.

Chapter 4 Results

4.1 Introduction

This chapter present results of the study based on the research objectives. The study set out to achieve four objectives, namely, to:

1) Establish current status of the scientific impact of Africa's health research.
2) Compare African and western European countries' journal indexing coverage in international citation databases by key objective editorial standards and selected contextual journal characteristics.
3) Explore the barriers and facilitators to index African health science journals in international citation databases from Africa's journal editors' perspective.
4) Assess Africa's health science journal editors' preference on indexing with regional citation databases over international citation databases.

These objectives were achieved through 5 studies, namely a scoping review and scientometric analysis for objective 1; an analytical cross-sectional study for objective 2; a qualitative study using IDIs for objective 3; and a DCE for objective 4. Below are the results of the studies presented according to the objectives.

4.2 Objective 1: To establish current status of the scientific impact of Africa's health research.

Objective 1 was aimed at establishing the current status of Africa's health research by reviewing and assessing evidence available. This was achieved through a scoping review to summarize available evidence, and through a scientometric analysis of Africa's health science journals. The scoping review focused on articles published between 2010 and 2023. The scoping review revealed uneven yet developing landscape of research on journal indexing and scientific impact in Africa. findings on barriers and enablers agreed with trends observed in the scientometric and cross-analytical data analyses, and further explored in the qualitative IDIs and DCE studies. The results of the scoping review and the scientometric analysis are presented separately below.

4.2.1 **Scoping review study results**

The structured search retrieved 11,055 articles, and additional 21 articles were identified from other search techniques, making a total of 11,076 articles. Deduplication led to the removal of 843 articles with 10,233 remaining for pre-screening. After reading titles and abstracts, 220 articles were selected for full text screening and were assessed for eligibility. As presented in Figure 3, full text for one article could not be retrieved, and 141 articles were removed for different reasons, namely global focus, combined African country with non-African country, wrong design and outcomes, not health science domain. Seventy-eight articles were included in the final review.

4.2.1.1 Study geographic coverage and data sources used

At the screening stage, there were 109 potentially relevant articles that focused on scientific impact of African countries or regions together with other countries and regions of the world but they were excluded because of the inclusion and exclusion criteria for this study, as shown in Figure 3 (PRISMA diagram). However, Figure 4 shows that the majority of the articles in the final review focused on African region as a whole (Akhaddar & Akhaddar, 2019a; Balogun et al., 2021; Fonkou et al., 2021; Igwaran et al., 2021; Musa et al., 2022; Onyeka & Chukwuneke, 2014; Perryman et al., 2021; Phoobane et al., 2022; Seivright et al., 2021; Wiysonge et al., 2013), followed by South Africa (Majiet et al., 2021; Marsh 2020; Moodley et al., 2015; Mouako et al., 2022; Okaiyeto & Oguntibeju, 2021; Sooryamoorthy, 2010), Sub-Saharan Africa region (Akudinobi & Kilmarx, 2022; Benie-Bi et al., 2013; Hernandez-Villafuerte et al., 2016; Rees et al., 2021; Talib et al., 2019; Uthman, 2010), Tunisia (Abdelaziz et al., 2021; Azzaza et al., 2019, 2022; Ben Saad, 2020; Ben Youssef et al., 2018; Denguir et al., 2018; Zemni et al., 2018), Morocco (Akhaddar, 2019b; Arabi, 2021; El Bairi et al., 2021; Zoukal, Abdelaziz, et al., 2019), Ethiopia (Asfaw et al., 2021; Habtewold et al., 2022), Cameroon (Mbuagbaw & Cockburn, 2017; Wonkam et al., 2011). South Africa's dominance in studies may reflect its relative research capacity compared to other African countries. This highlights the uneven development of health research across the continent.

As shown in Figure 5, majority of the studies used PubMed as the data source, followed by Web of Science, Scopus, and a combination of either of these three. Other studies used one of these three or combined two or three of these databases together with other data sources, as shown in Figure 3. Few studies relied on AJOL and AIM databases, which are solely African research databases.

4.2.1.2 Scientific indicators or metrics reported

The majority of the studies measured research productivity per country or region, researcher, journal, institution and topic; then scientific impact of researcher, paper/articles, journal, country, institution; while others reported on collaboration of countries, researchers, institutions, regions, groups; common topics or diseases; and funding. There are also studies that compared different indicators with GDP and population of countries as well as global burden of diseases. While others focused on types of research or reports, study designs and editorial quality, language, authorship positions. Generally, the studies reported a gradual increase in research productivity and citation impact, while recognizing limitations in productivity and performance emanating from several challenges presented in the subsequent paragraphs.

Given the broad scope of the review, emphasis was placed on capturing the diversity of reported metrics and indicators rather than on undertaking detailed quantifications or comparative analyses. Additionally, objective 1 focused on categorising and describing the types of metrics and indicators reported in the literature, rather than quantifying their frequency or comparing their usage across studies. Furthermore, inconsistencies in reporting across articles did not allow reliable standardization, justifying the appropriateness of a descriptive approach for the study.

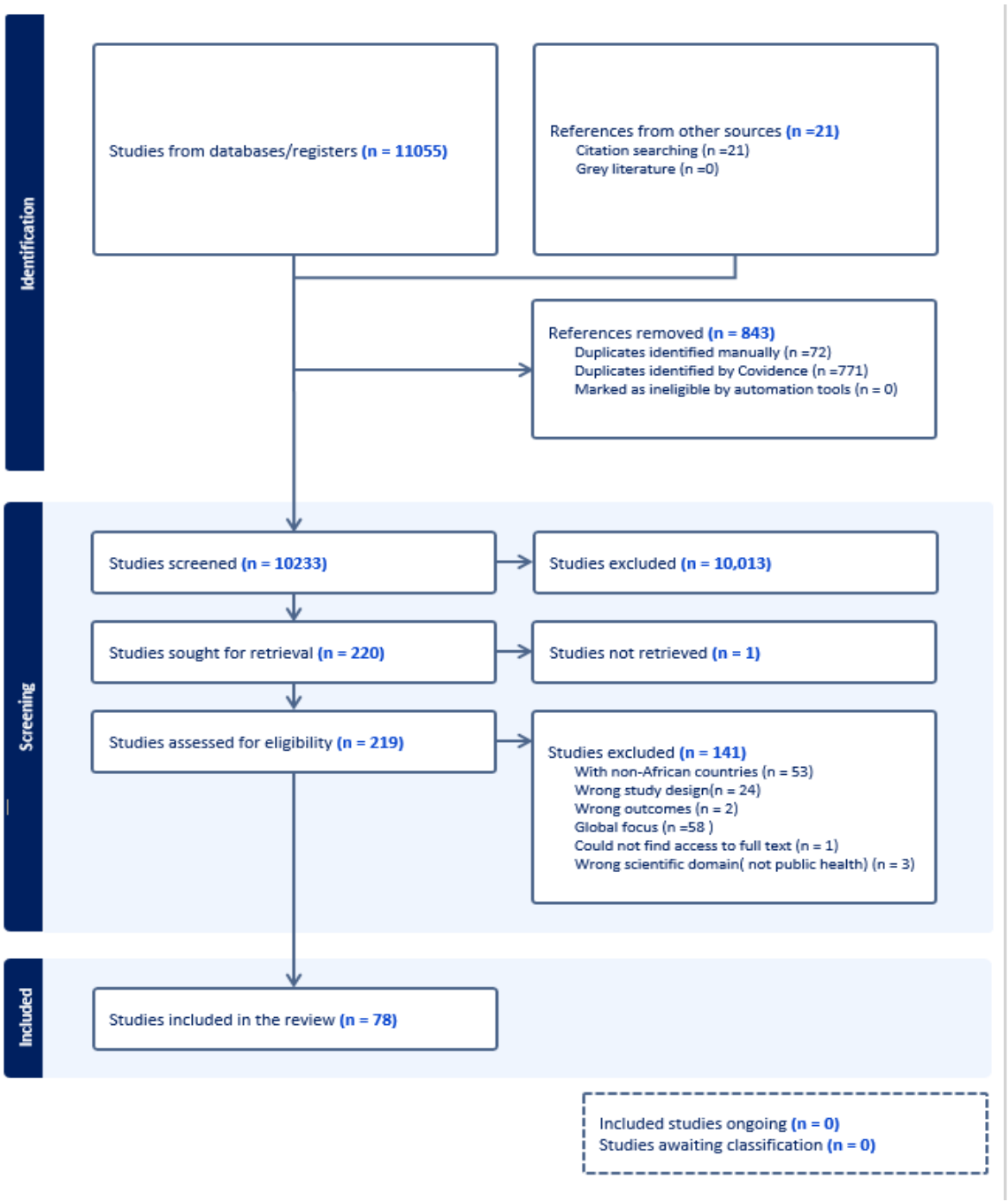


Figure 3:PRISMA Flow diagram on search process and study selection

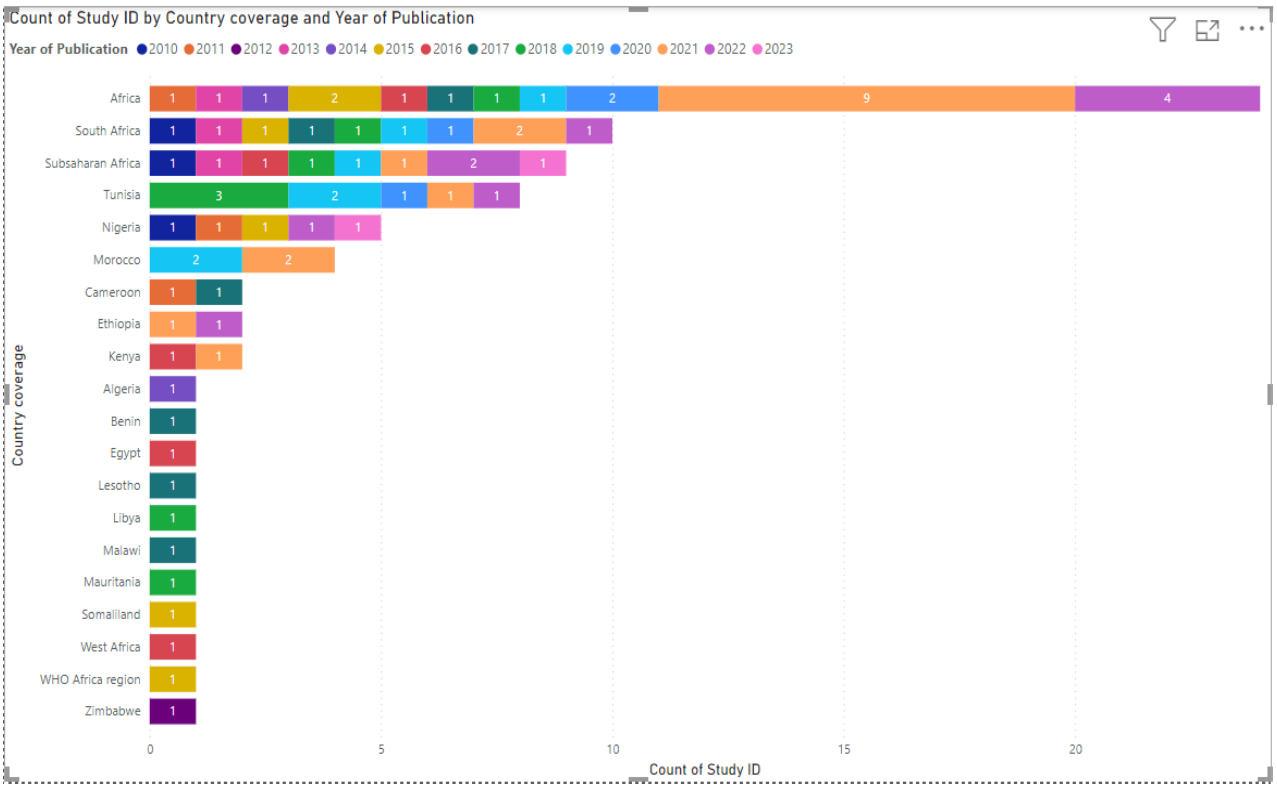


Figure 4: Geographic coverage of studies

4.2.1.3 Subject focus or diseases studied

The articles focused on different health subjects or themes based on titles of the studies (see Supplementary Table 1 in Appendices), including cancer, neurosurgery, general surgery, physical medicine and rehabilitation, human vaccine and immunization, malaria, health systems and public health, medical teachers research output and medical research, cardiovascular disease, medicine and health in general, quality of life, gender equity, PhD training and medical education. Some studies focused on specific journals from Africa while others focused on institutions such as research centers or universities research output or researchers. Other studies focused on funder, COVID 19, HIV/AIDS and on health professionals.

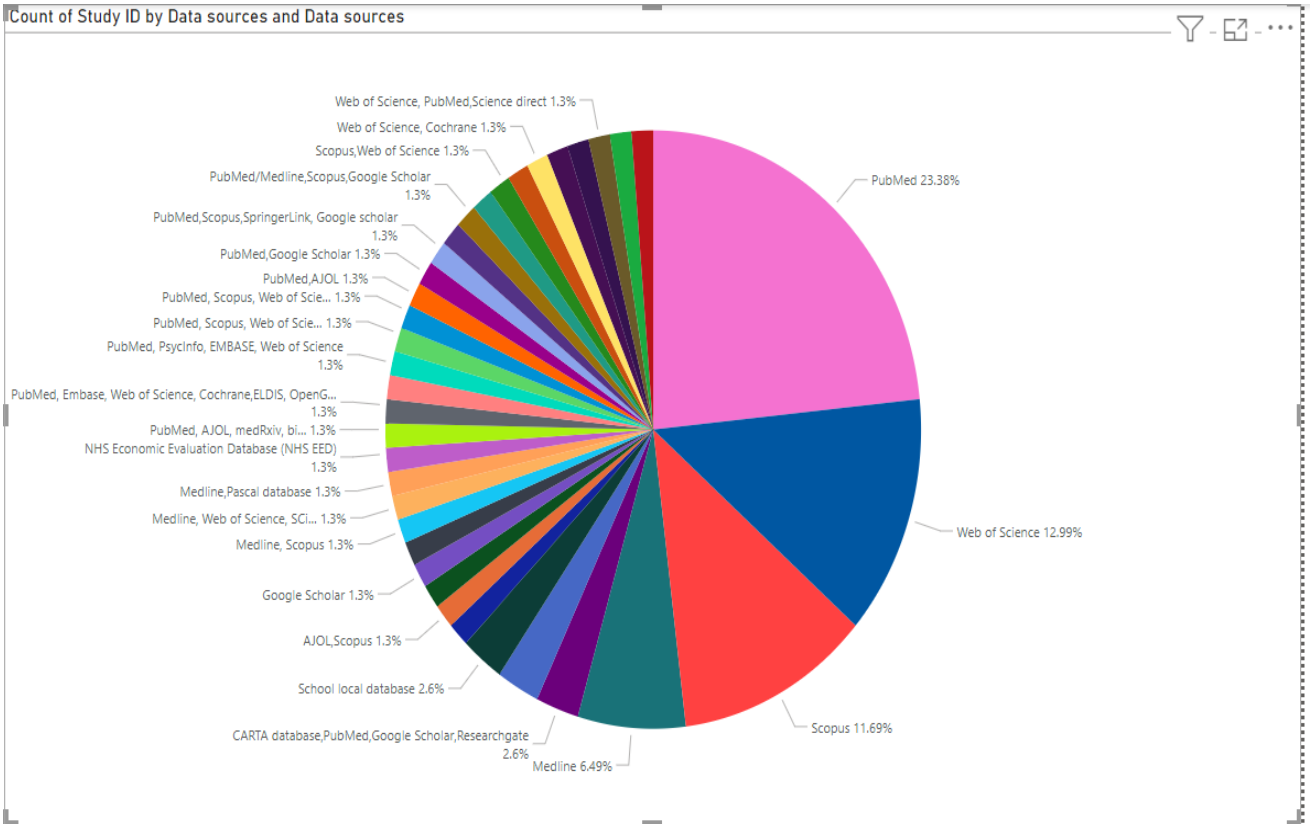


Figure 5: Common data sources used for bibliometrics and scientometrics

4.2.1.4 Challenges to Africa's health research productivity, visibility and impact

According to Supplementary Table 2 (in the Appendices), the studies reported a number of challenges which include: lack of skills in writing for publication or inexperienced researchers, language barriers for francophone countries, unfair distribution of resources to institution at national level, research funding by global north which sets research agenda and rules for publishing including authorship position and which journal to publish with, bias towards US affiliated authors. Other challenges include heavy clinical workload and lack of devoted time to research, excessive private practice for financial profit, lack of motivation and incentives, no intention to reapply for future grants hence no motivation, lack of official training in research methods, a lack of interest in the research itself, lack of research infrastructure, data discrepancies in databases and journals websites.

Table 4: Summary of challenges and facilitators of scientific impact of Africa's research

Challenges	Facilitators
Editorial bias/topics not relevant in global few/north hence not cited	Developments in ICTs and internet access (improved access to e-resources and electronic online submission)
Lack of skills in writing for publication/inexperienced researchers	Availability of resources or equipment for professional practice and for research/data/conducive research environment
Lack of official training in research methods	Training of professionals and increase in specialists in different professions/multidisciplinary
Language barriers for francophone countries	International exchange and collaboration or partnerships/local collaboration too
Unfair distribution of resources to institution at national level/ lack of logistic support and financial resources	Research funding by local governments
Research funding by global north/ sets research agenda/rules for publishing	Foreign research grants
Stringent authorship guidelines/bias towards US affiliated authors	Huge population
Heavy (clinical) workload/lack of devoted time to research	Topical relevance to community needs
Excessive private practice for financial profit/brain-drain	English Proficiency /articles written in English
Lack of motivation and incentives/research environment not conducive/political instability	Open access publishing model/APC waivers
Lack of interest in the research itself/no continuity plan	Programmes designed to improve institutional capacity/incentives
Lack of research infrastructure/strategies	Training and capacity building in writing for publication/mentorship
Insufficient access to internet/databases/high Subscription fees/APCs	Level of economic development
Local journals not index by international indexers/limited visibility/print journals	Growing interest in research (among young people)
Data discrepancies/incomplete data	Publishing in high impact journals/number of indexed journals
	Equity in authorship
	Political stability

4.2.1.5 Facilitators of Africa's health research productivity, visibility and impact

As shown in Supplementary Table 3 (in the Appendices), common facilitators mentioned in the studies include: developments in Information Communication Technologies (ICTs) and internet access (access to e-resources and electronic online submission); availability of resources or equipment for professional practice and for research; training of professionals and increase in specialists in different professions; international exchange and collaboration or partnerships; research funding by local governments, foreign research grants; huge population; topical relevance to community needs; open access publishing model; programmes designed to improve institutional

capacity training and capacity building in writing for publication/mentorship, level of economic development, equity in authorship, and publishing in high impact journals.

4.2.1.6 Recommendations and Opportunities to Africa's health research productivity, visibility and impact

Supplementary Table 4 (in the Appendices), shows that a number of studies also made recommendations and suggested opportunities that could be explored to resolve the existing situation. Some of the recommendations include: building capacity of SSA researchers such as training in medical writing and research methods; strengthening local journals; focusing on conducting systematic reviews and meta-analyses because they are inexpensive and less time-consuming, and provide the highest level of evidence; funders engaging SSA researchers in setting research agenda and providing more direct funding to SSA researchers; setting up governance structures that ensure equity in authorship and other aspects of research partnership; setting up appropriate measures to limit the public-to-private brain drain; especially for young academicians, strengthening collaboration; publishing in English journals; strengthening infrastructure; increasing research funding; ICTs; and indexation of local journals with major databases.

4.2.2 **Scientometric study results**

This analysis focused on assessing Africa's health science journals to establish their current scientific impact. The scientometric analysis quantitatively confirmed patterns highlighted in the scoping review. For instance, scientometric analysis confirmed that African health science journal coverage in WoS, Scopus and PubMed is limited which was a barrier identified in scoping review. The limited coverage also explains the absence of studies from many African countries on evidence synthesis identified in these databases during scoping review. It also showed international collaboration as a facilitator which was seen as common trend during scientometric analysis.

4.2.2.1 Health science journal geographical distribution based on indexing status

Among 622 identified African journals, only 15.9% (99) were indexed in Scopus and 12.1% (75) in WoS, which was a significant underrepresentation in the two major global databases. PubMed and AJOL lists 163 (26.2%) and 172 (27.7%) journals, respectively. The AIM, which is a dedicated African region medical and health sciences journals indexer, indexed 149 (24%) of the journals.

According to Figure 6, Egypt registered the highest number of journals indexed in WoS (36, 48%) while South Africa registered the highest number of journals indexed in Scopus (36,36%). Similarly, Nigeria contributed the highest number of journals indexed in PubMed (43, 26%) and AJOL (104, 60%), while South Africa contributed the highest number of journals in AIM (25, 17%). Notably, 21 African countries did not have any health sciences journal indexed in any of the international indexers (WoS, Scopus, PubMed) and regional (AJOL, AIM) indexers under study. More than 40 countries did not have any health science journal indexed in WoS, implying significant regional differences in WoS indexing. Furthermore, it indicates underrepresentation of these countries in the body of health science literature captured by WoS metrics and bibliometric analyses, which was also observed in scoping review with few countries represented in the number of studies identified.

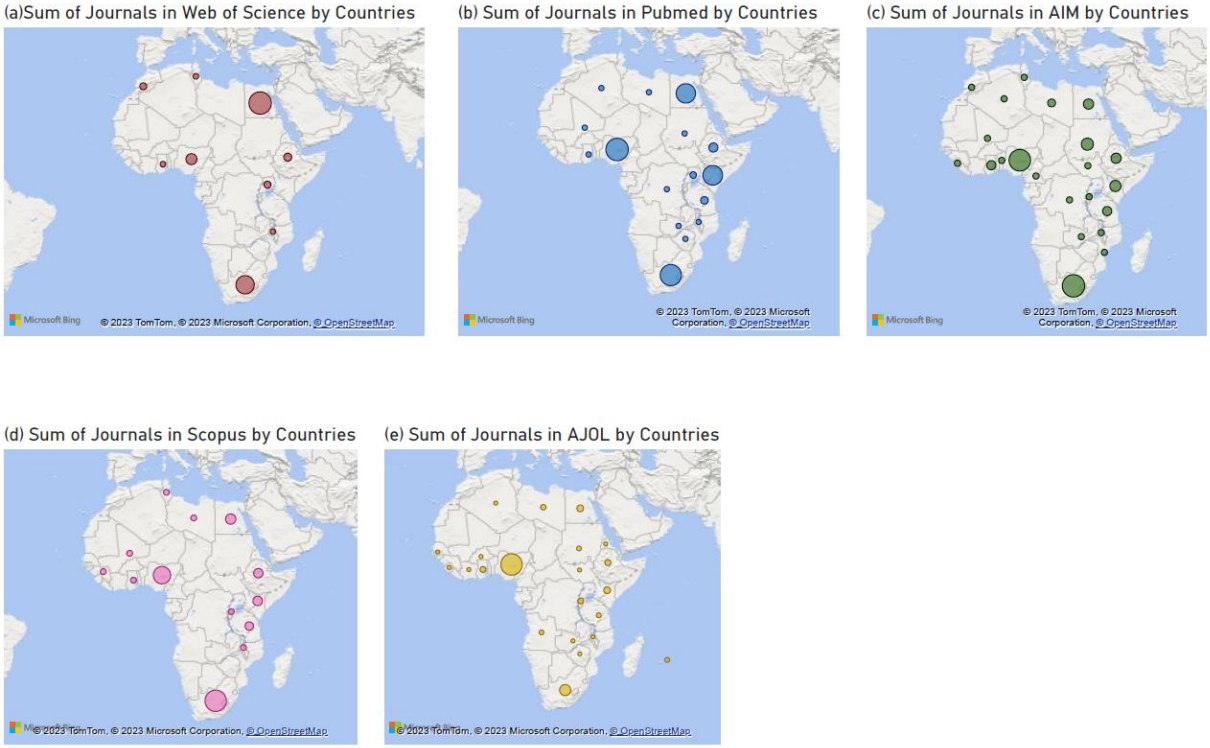


Figure 6: African health science Journal coverage by WoS, Scopus, PubMed, AJOL, and AIM

4.2.2.2 Citation scores of journals based on indexing status

Top performing journals by country using interquartile ranges

The data was first analysed using Interquartile Ranges (IQR) to show top performing journals disaggregated by country, and how the metrics of journals from different data sources were distributed by country. IQR depicted the variability of data without much influence from the outliers and skewed values. As presented in Table 3 and Table 4 below, Tunisia registered the highest median H5-Index with its journals having a median (IQR) of 16 (11, 21), while Egyptian journals registered the highest JIF median (IQR) value of 7.4 (2.1, 12.8). Similarly, Egyptian journals also registered the highest median (IQR) values on Citescore of 1.5 (0.5, 2.3), and discipline-specific metric SNIP of 0.54 (0.2705, 1.1745), while South African journals had highest JCI median (IQR) values of 0.28 (0.16, 0.43). The countries shaded in grey had only one journal, hence the same value appearing for median, lower quartile and upper quartile. These shaded countries could not be compared with other countries which had more than one journal because the median would not be statistically meaningful. Together, through citation analysis as proxy for impact, these metrics provide a more comprehensive understanding of scholarly influence across different dimensions, timeframes, and disciplines.

Table 5:Summary statistics (Median, lower and upper quartile) of journal metrics disaggregated by country of origin

Country	H5-Index	JIF	JCI	Cite score	SNIP
Egypt	8(5,15)	7.4435(2.087,12.8)	0.2(0.14,0.49)	1.5(0.5,2.3)	0.54(0.2705,1.1745)
South Africa	9(7,16)	1.242(0.982,1.816)	0.28(0.16,0.43)	1.1(0.65,2.25)	0.532(0.283,0.907)
Nigeria	9(5,12)	0.839(0.539,0.961)	0.145(0.105,0.26)	0.6(0.3,1.2)	0.269(0.1785,0.6085)
Kenya	8.5(4,17)		0.42(0.42,0.42)	0.7(0.5,2.4)	0.257(0.062,0.471)
Uganda	30(30,30)	1.108(1.108,1.108)	0.4(0.4,0.4)	2.1(2.1,2.1)	0.581(0.581,0.581)
Ethiopia	10(10,14)	0.314(0.128,0.5)	0.26(0.13,0.39)	1(0.8,2.1)	0.26(0.17,0.35)
Libya	17(17,17)			2.8(2.8,2.8)	0.964(0.964,0.964)
Malawi	21(21,21)	1.413(1.413,1.413)	0.29(0.29,0.29)	1.6(1.6,1.6)	0.785(0.785,0.785)
Rwanda	6(6,6)			0.4(0.4,0.4)	0.147(0.147,0.147)
Ghana	16(16,16)			1(1,1)	0.419(0.419,0.419)
Morocco	4(4,5)				
Tanzania	13(13,13)			1.2(1.2,1.2)	0.499(0.499,0.499)
Zambia	6(6,6)				
Cameroon	15(6,16)			1.5(1.5,1.5)	0.434(0.434,0.434)
Benin	6(6,6)			0.3(0.3,0.3)	0.361(0.361,0.361)
Mali	3(3,3)			0.2(0.2,0.2)	
Tunisia	16(11,21)		0.36(0.36,0.36)	0.8(0.8,0.8)	0.268(0.268,0.268)
Sudan	7(7,9)				
Congo	3(3,3)				
Burkina Faso	2(2,2)				
Algeria	6(6,6)				
Total	9(6,14))	1.076(0.6705,1.6335)	0.26(0.14,0.41)	1.1(0.5,2)	0.471(0.254,0.776)

Table 5 above presents the middle 50% quartile when the metric values for journals per each country are ordered from lowest to highest. Together with the median (50%) values, are presented the lower quartile (25%) and upper quartile (75%) values in brackets.

Table 6: Summary of Key metrics results.

Metric	Top Country	Median Value	Implication
H5-Index	Tunisia	16	Reflects high research productivity and visibility
JFI	Egypt	7.4	Indicates high citation rates
JCI	South Africa	0.28	Stronger citation performance relative to its discipline
Citescore	Egypt	1.5	Broad citation impact across recent articles, reflecting relevance and visibility
SNIP	Egypt	0.54	Higher contextual citation impact, accounting for field-specific difference

Top 10 and top 20 African health science journals with highest H5-Index, JIF, Citescore, SNIP, JCI.

As presented in Table 7, and supplementary Table 5 (Appendices), the Journal of Advanced Research from Egypt was ranked number 1 in almost all metrics regardless of data source, except JCI, an indicator that was not available for this journal. This may indicate journal quality, wider visibility, discipline influence and accessibility, demonstrating an example for other journals that strategic efforts in quality and visibility can yield better metric results. Thereafter, positions 2 to 10 or to 20 were occupied by different journal titles under each metric list. This position was possibly caused by differences in methods for calculating metrics, discipline or field differences, and journal's global focus versus regional focus.

Similarly, journals occupied different positions on each list; a journal would be in one position on one list, and appear in another position on another list. For instance, journals such as Pan African Medical Journal and African Health Sciences moved from positions 3 and 7 on Google scholar H5-Index to positions 39 and 32 on the SNIP list. Furthermore, some journals presented with blank cells in the table do not have values for some metrics because they were not covered by the data source that was used to calculate the metrics. Some journals had their coverage discontinued or had been newly included in indexers such as Scopus and WoS, hence their recent values for metrics could not be found considering that metrics are calculated for a specific period.

Country-wise, Egypt and South Africa contributed the same number of journals (15), followed by Nigeria (8), to the top 20 list of journals with highest Google Scholar H5-Index (Supplementary Table 3). The dominance of Egypt and South Africa implies that perhaps the two countries have effective strategies in journal publishing, visibility, and quality, therefore, they may serve as good models for other African countries. Only 19 health sciences journals from Africa had their JIF

calculated for 2022. South Africa led the list by contributing 9 journals, followed by Nigeria (4), Egypt (2) and Ethiopia (2). Kenya, Uganda and Malawi contributed one journal each. The higher number of journals without JIF from Africa indicated underrepresentation of journals from African region in WoS.

Supplementary Table 5 presents top 20 African health sciences journals sorted by Google Scholar H5-Index. The table has been sorted by Google Scholar H5-Index because there are more journals with Google Scholar H5-Index as compared to journals with metrics calculated from WoS and Scopus data.

Table 7: Ranking of journals at different metric scores.

Title	Country	H5-Index	SNIP	JFI	JCI	Citescore
Journal of Advanced Research	Egypt	1	1	1		1
Journal of Genetic Engineering and Biotechnology	Egypt	2	5			4
Pan African Medical Journal	Kenya	3	39			21
South African Medical Journal	South Africa	4	30	2	12	9
Ethiopian Journal of Health Sciences	Ethiopia	5			11	12
Nigerian Journal of Clinical Practice	Nigeria	6	17	9	11	15
African Health Sciences	Uganda	6	32	10	10	12
Alexandria Journal of Medicine	Egypt	7			6	
Eastern Mediterranean Health Journal	Egypt	8	16	3	7	10
African Journal of Disability	South Africa	9	12		9	11
International Journal of Africa Nursing Sciences	Nigeria	9	23			15
International Journal of Veterinary Science and Medicine	Egypt	10	4		2	2
SA Journal of Industrial Psychology	South Africa	10	21		6	9

Table 7 presents metrics on H5-Index, JIF and JCI, Citescore and SNIP whose data sources were Google Scholar, WoS and Scopus, respectively.

4.2.2.3 Topical focus of journals in different indexing sites

Further analysis compared topical coverage of the journals based on keywords with regards to their indexing database. Default parameters were used for clustering, which were minimum values; resolution of 1 and minimum cluster size 1. This was done to identify the most common studied subject. The visualisation map of PubMed data (refer to Figure 7) shows four dominant types of research methods; qualitative research, laboratory experimental studies, randomised control trials and case reports. In terms of topics, infectious diseases, non-communicable diseases/chronic

illnesses, maternal and child health, sexual and adolescent health, malnutrition and communicable diseases emerged as frequently studied topics. This trend reflects the nature of PubMed's major focus on biomedical sciences.

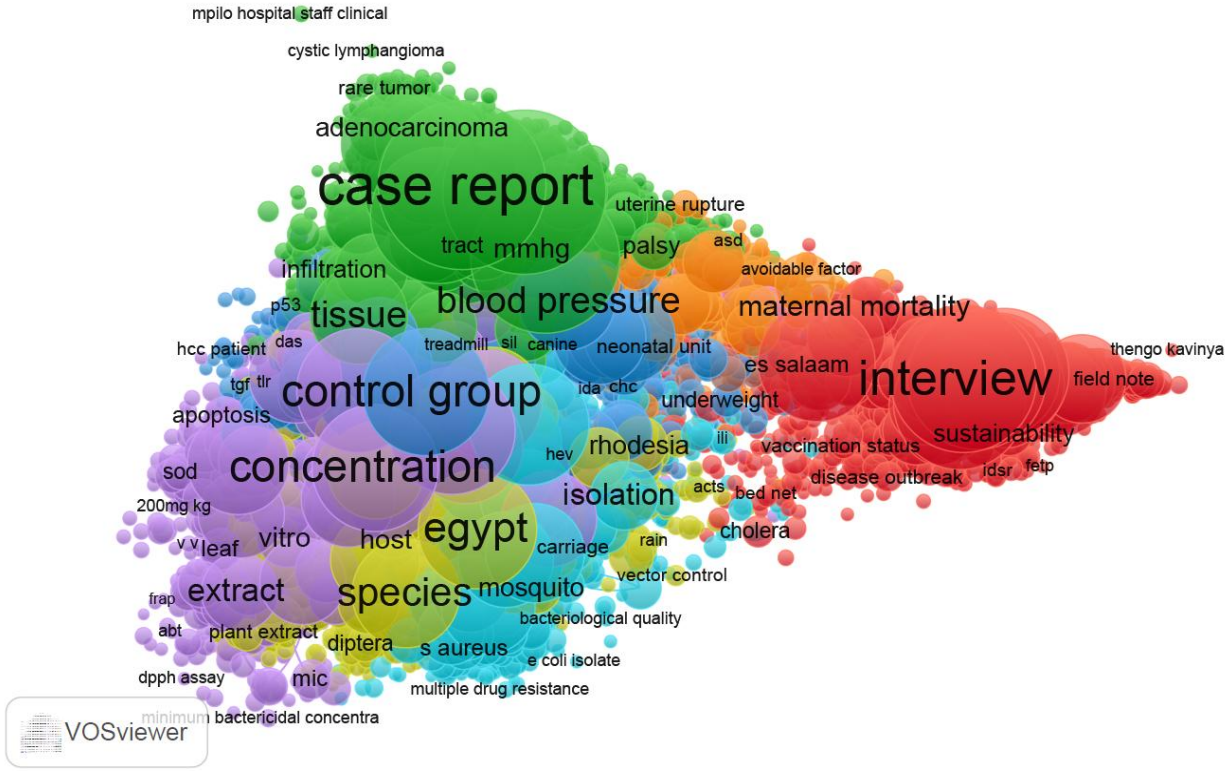


Figure 7: Visualisation of topical focus (PubMed Journals).

According to Figure 8, the visualisation map of Scopus data shows that the frequently studied topics were maternal and reproductive health, surgical conditions, physiology, chemistry and microbiology. Similarly, Figure 9 shows the visualisation map of WoS data, with three frequently studied topics which include microbiology, health systems and parasitology.

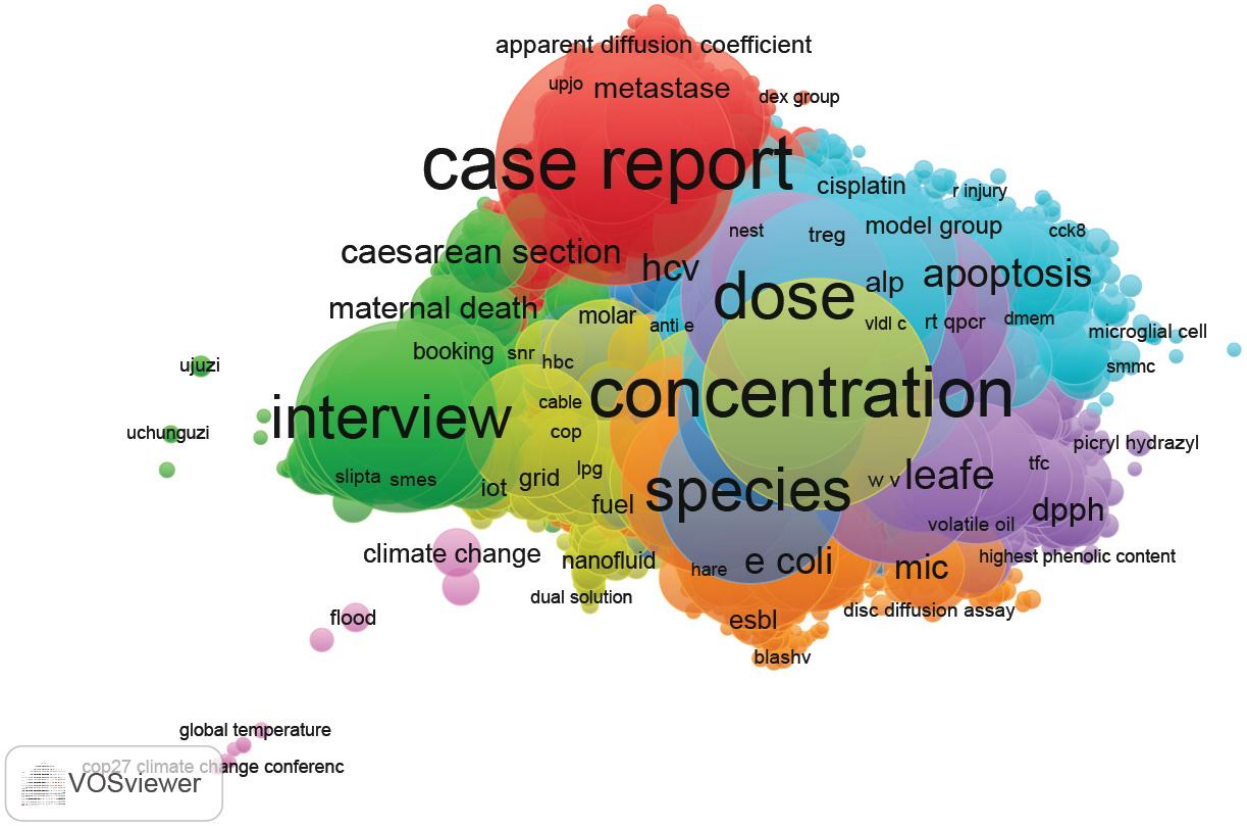


Figure 8:Visualisation of topical focus (Scopus Journals).

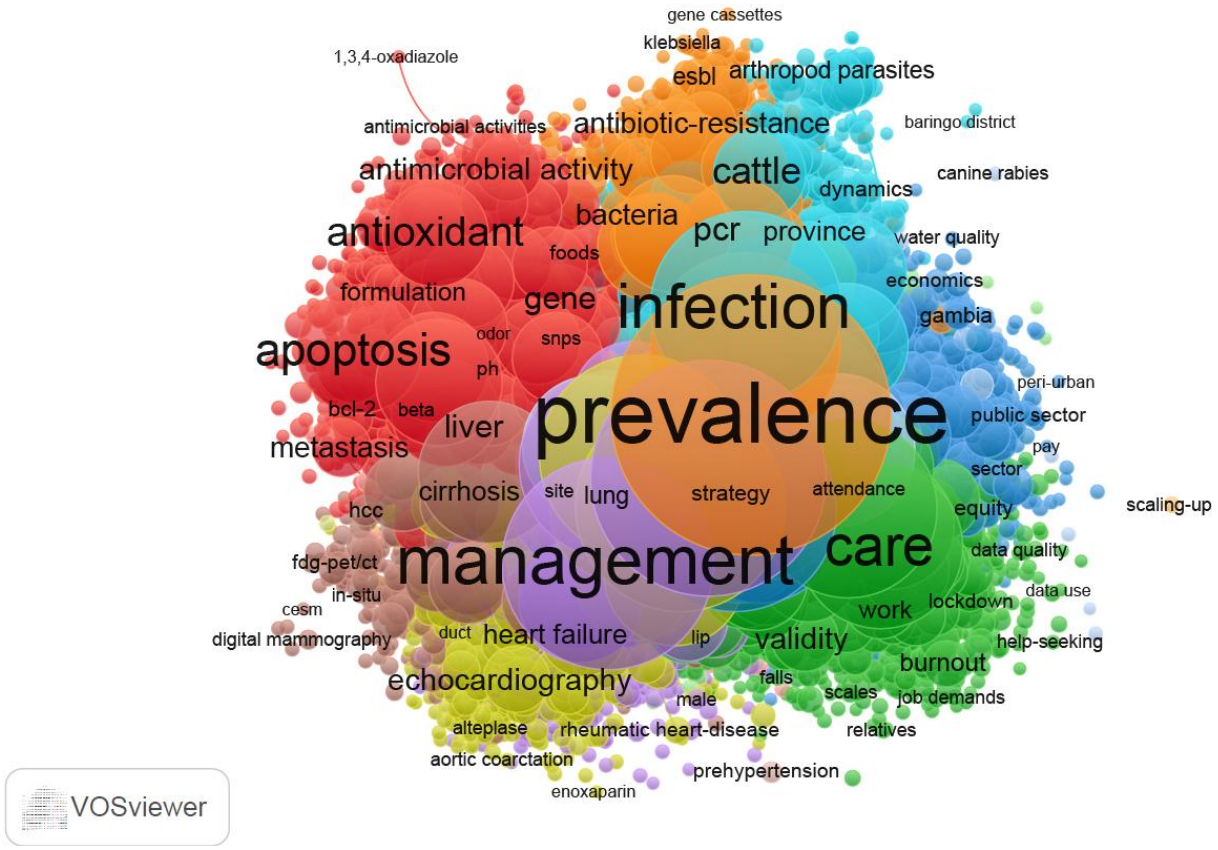


Figure 9:Visualisation of topical focus (Web of Science Journals).

4.2.2.4 Authorship patterns and collaboration of journals indexed in WoS and Scopus

The network visualisations do not show observable differences in their author collaboration pattern between the two databases (Figure 10 and 11). There is significantly higher research productivity from African countries with strong international collaborations such as South Africa, Egypt, Nigeria, Kenya, and Uganda. The bigger the nodes, the higher the research productivity, thus there were more studies with authors' affiliation from these countries. Also, a shorter distance between the nodes signifies closer collaboration. These highly productive African countries are characterised by collaborations with USA and England, and Middle East countries. For instance, both Figure 10 and 11 show strong collaboration between Egypt and Saudi Arabia and other Middle East countries, unlike with other African countries, especially SSAs. In Africa, Egypt mostly collaborated with North African countries, and with South Africa, Nigeria, Ghana, Kenya

and Congo. Similarly, other North African countries such as Tunisia, Morocco, Algeria had strong collaborations with their fellow North African countries.

The results also suggest existence of regional collaboration between SSA countries reflecting shared research priorities and logistical advantages. Countries such as Lesotho and Swaziland appeared to have collaborated with South Africa and USA only. On the other hand, the data showed that Madagascar did not collaborate with any African country. The visualisation maps demonstrate that Egypt is close to Middle East countries while Nigeria is very close to England (in the WoS data), in terms of collaboration. The map shows collaboration in publications, hence the presence of non-African countries and their clusters on the map.

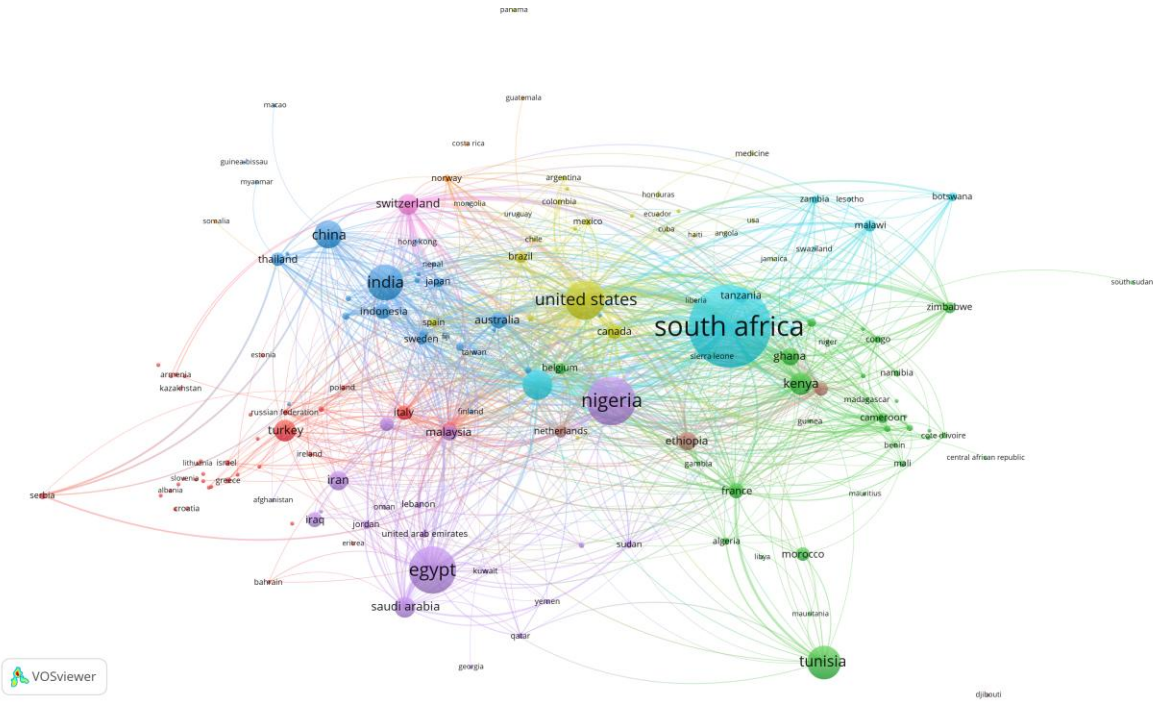


Figure 10:Visualisation network of author collaboration in African Journals (Scopus).

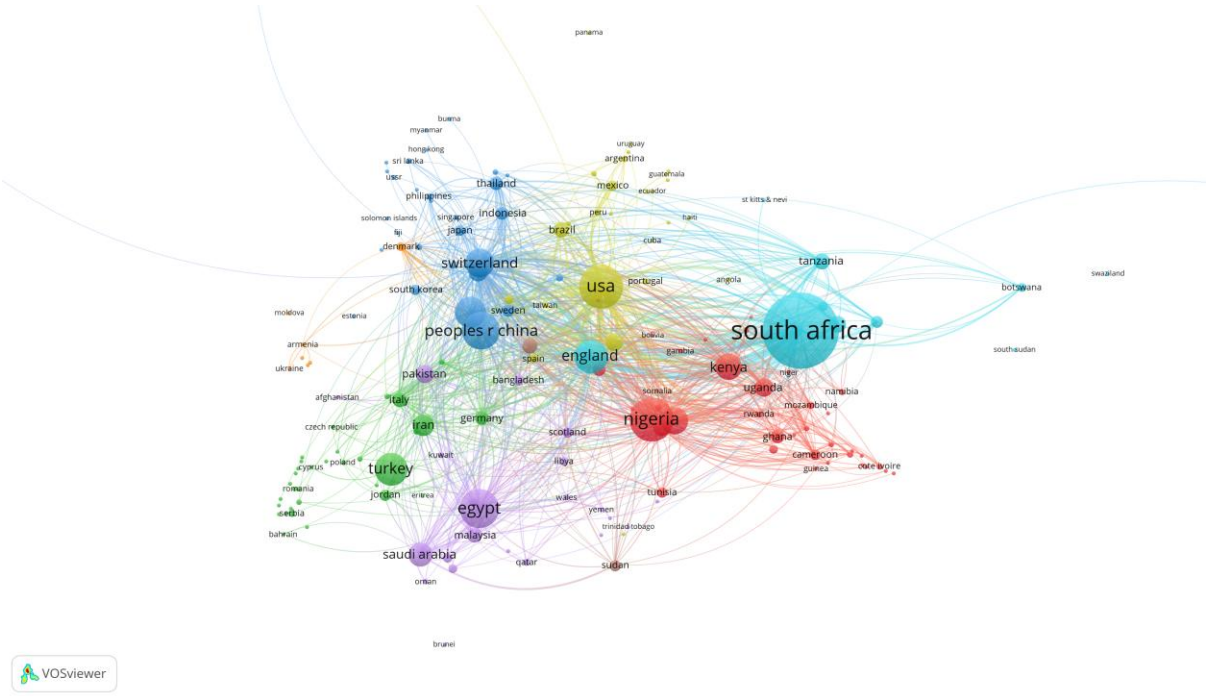


Figure 11: Visualisation network of author collaboration in African Journals (WoS).

4.3 Objective 2: To compare African and western European countries' journal indexing coverage in international citation databases by key objective editorial standards and contextual journal characteristics.

Objective 2 interrogated two claims given as reasons for low representation of African journals and research in major citation databases, which results in low research output and scientific impact of Africa's health research based on citation metrics. This was achieved by showing an association between an African health science journal being indexed and the journal having international editorial board, authorship from different countries, language of journal being English, and journals country of origin's, Gross National Income (GNI), and health expenditure which was calculated as a percentage of GDP.

The objective sought to determine journal coverage by international databases (WoS, Scopus and PubMed) based on key objective editorial standards and contextual journal characteristics between African and western European health science journals. This was achieved through an analytical cross-sectional study of African health science journals, and western European health science journals as a comparison group. Since African journals were already few, based on the main data source of the study, Ulrichsweb, all (329) African health science journals were included after data

cleaning. A census of all western European health science journals (5384) was also included after data cleaning, creating a total of 5713 health science journals.

4.3.1 **Comparison of Proportions of Journals**

According to Table 8 below, the proportion of journals indexed in WoS, Scopus and PubMed was significantly higher for journals from Western Europe than it was for African journals in all the three databases. The difference in proportion between western European journals and African journals was slightly higher in WoS (38.9%) than that of Scopus (35.5%) and PubMed (35.7%). The following were the differences between the databases:

- WoS: 52% of Western European journals indexed versus 13% of African journals.
- Scopus: 47.4% of Western European journals indexed versus 11.8% of African journals.
- PubMed: 53.4% of Western European journals indexed versus 17.6% of African journals.

Disaggregating the dataset by region and comparing proportion of journals indexed between databases, Table 9 below shows that PubMed indexed 5.7% and 4.5% more journals from Africa than did Scopus and WoS, respectively. Similarly, WoS indexed 4.5% more journals from western Europe than did Scopus, while PubMed indexed 5.9% more journals from western Europe than did WoS.

Table 8: Comparison of proportion of journals indexed in the databases between African and western European journals

Indexing Database	**Region**	**Mean**	**95% Conf. Interval**	**P<|z|**
Web of Science	1 (Africa)	0.130	0.094 to 0.167	
	2 (Europe)	0.520	0.506 to 0.533	
	Difference	-0.389	-0.428 to -0.350	0.001
Scopus	1 (Africa)	0.118	0.083 to 0.153	
	2 (Europe)	0.474	0.460 to 0.487	
	Difference	-0.355	-0.393 to -0.318	0.001
PubMed	1 (Africa)	0.176	0.135 to 0.217	
	2 (Europe)	0.534	0.520 to 0.547	
	Difference	-0.357	-0.401 to -0.314	0.001

Table 9: Comparison of proportion of indexed journals from Africa and western Europe between databases

Region	Comparison	Number Observations	Mean 1	Mean 2	Diff	95% Confidence Interval	P>|z|
Africa	WoS vs. Scopus	329	0.130	0.118	0.012	-0.038 -0.062	0.636
	WoS vs. PubMed	329	0.130	0.176	-0.045	-0.100 to 0.009	0.104
	Scopus vs. PubMed	329	0.118	0.176	-0.057	-0.111 to -0.003	0.036
Europe	WoS vs. Scopus	5384	0.520	0.474	0.045	0.027 to 0.064	<0.001
	WoS vs. PubMed	5384	0.520	0.534	-0.014	-0.032 to 0.004	0.142
	Scopus vs. PubMed	5384	0.474	0.534	-0.059	-0.078 to -0.041	<0.001

4.3.2 Logistic regression analysis

Logistic regression analyses were used to determine whether the differences between African and western European health science journals in journal coverage by international databases (WoS, Scopus and PubMed) could be explained by objective editorial standards and contextual journal characteristics. Notably, regression models depicted association but not causality. Three models were built based on three dependent outcomes of the study, each associated with one of the international databases; being indexed in WoS, being indexed in Scopus, and being indexed in PubMed.

Six predictive factors, namely geographical region (Africa versus western Europe); having an international editorial board; having international authorship affiliation; English language as main text or abstract of the article; belonging to a certain economic status group based on GNI classification; and annual health expenditure presented as % of GDP were included in the models. Data on education expenditure presented as % of GDP, and research and development presented as % of GDP, were collected but excluded in the models because too many countries had missing data or data required had not been reported a. The situation was even worse for African countries in that either only one country or none at all had data reported on these factors, making comparison not feasible.

While building the models, the univariate model was run first to obtain crude odds ratios to determine the significance of each covariate at p (value) = 0.1 alpha level, for each outcome.

Covariates that had a p value less than 0.1 were included in the multivariate model, which generated adjusted odds ratios to determine the effect of each covariate when controlling for the other covariates. The results in Table 5 below present the crude odds ratios first followed by adjusted odds ratios together with their corresponding P values and 95% confidence intervals.

During multivariate analyse, robustness check of the regression results for multicollinearity were conducted using variance inflation factors (VIFs). All variables showing VIF values below the commonly accepted threshold of 10 were included in the model, indicating that multicollinearity was not a significant concern among the predictor variables. Potential confounders identified were originating country/region of journal and health expenditure. The variables Country_region and GNI were highly positively correlated hence posed risk for multicollinearity if both were added in the multivariate analyses. A test for Variance Inflation Factor (VIF), generated a factor above 10 hence dropping of region of the country from the multivariate analyses. Health expenditure, being % of the GDP, was also tested for collinearity with GNI and Country region, and was also dropped in the multivariate analyses because it showed moderate to high multicollinearity. Thus, for multivariate analyses, we included 4 variables only; having international editorial board, international authorship affiliation, English language as main text or abstract of journal, and GNI classification of country.

4.3.2.1 Univariate and Multivariate analysis

The univariate analysis shown in Table 10 and Figure 12 below reveals that the odds of being indexed in WoS, Scopus and PubMed were significantly lower for African journals than they were for western European journals by 86.1 %, 85.1% and 81.3%, respectively. The only difference was that African journals were more likely to be indexed in PubMed than they would in WoS and Scopus. However, four of the other predictive variables, except GNI, were independently associated with higher odds for a journal being indexed in WoS, Scopus and PubMed. For GNI, journals from LMICs and LICs had a lower likelihood of being indexed in WoS, Scopus and PubMed than did journals from HICs. Furthermore, journals from LMICs show the lowest likelihood of being indexed when compared to journals from LICs. Additionally, there was a substantial difference among the three databases, with WoS and Scopus having the lowest likelihood when compared to PubMed. Besides, journals from LMICs had a moderately lower chance of being indexed in WoS, Scopus and PubMed unlike those from MICs and LICs. This

may be attributed to the smaller number of sample representation of journals from Africa in the LMICs category, hence a statistically negligible difference.

Table 10: Crude and Adjusted Odds Ratios

Crude Odds Ratios

	Web of Science			**Scopus**			**PubMed**		
Variables	**OR**	**P>|z|**	**[95% CI]**	**OR**	**P>|z|**	**[95% CI]**	**OR**	**P>|z|**	**[95% CI]**
Country_region (African)	0.139	<0.001	0.100—0.192	0.149	<0.001	0.106—0.209	0.187	<0.001	0.140—0.249
Editorial_International	4.178	<0.001	3.659—4.771	3.762	<0.001	3.286—4.307	4.228	<0.001	3.708—4.821
Author affiliation	6.655	<0.001	4.539—9.757	5.989	<0.001	4.041—8.876	5.391	<0.001	3.802—7.643
Language (English)	2.960	<0.001	2.605—3.363	2.471	<0.001	2.173—2.810	4.961	<0.001	4.329—5.685
GNI (Middle Income)	0.671	0.139	0.396—1.139	0.599	0.066	0.347—1.035	0.509	0.014	0.296—0.874
GNI (Lower Middle Income)	0.062	<0.001	0.037—0.102	0.074	<0.001	0.044—0.123	0.134	<0.001	0.093—0.192
GNI (Lower Income)	0.193	0.016	0.061—0.748	0.256	0.034	0.073—0.899	0.201	0.012	0.057—0.707
Health_Expenditure_2020_%GDP	1.272	<0.001	1.226—1.319	1.248	<0.001	1.203—1.294	1.265	<0.001	1.221—1.311

Adjusted Odds Ratios

Variables	**AOR**	**P>|z|**	**[95% CI]**	**AOR**	**P>|z|**	**[95% CI]**	**AOR**	**P>|z|**	**[95% CI]**
Country_region (Africa)									
Editorial_International	2.987	<0.001	2.588—3.448	2.816	<0.001	2.435—3.258	2.654	<0.001	2.298—3.066
Author affiliation	2.934	<0.001	1.957—4.399	2.848	<0.001	1.886—4.301	1.980	0.001	1.133—2.865
Language (English)	2.150	<0.001	1.869—2.473	1.787	<0.001	1.553—2.058	3.915	<0.001	3.312—4.439
GNI (MiddleIncome)	0.663	0.147	0.381—1.155	0.602	0.079	0.341—1.060	0.445	0.005	0.252—0.785
GNI (Lower Middle Income)	0.053	<0.001	0.032—0.089	0.067	<0.001	0.040—0.113	0.105	<0.001	0.072—0.153
GNI (Lower Income)	0.232	0.026	0.064—0.843	0.281	0.053	0.078—1.014	0.221	0.023	0.060—0.815
Health_Expenditure_2020_%GDP									

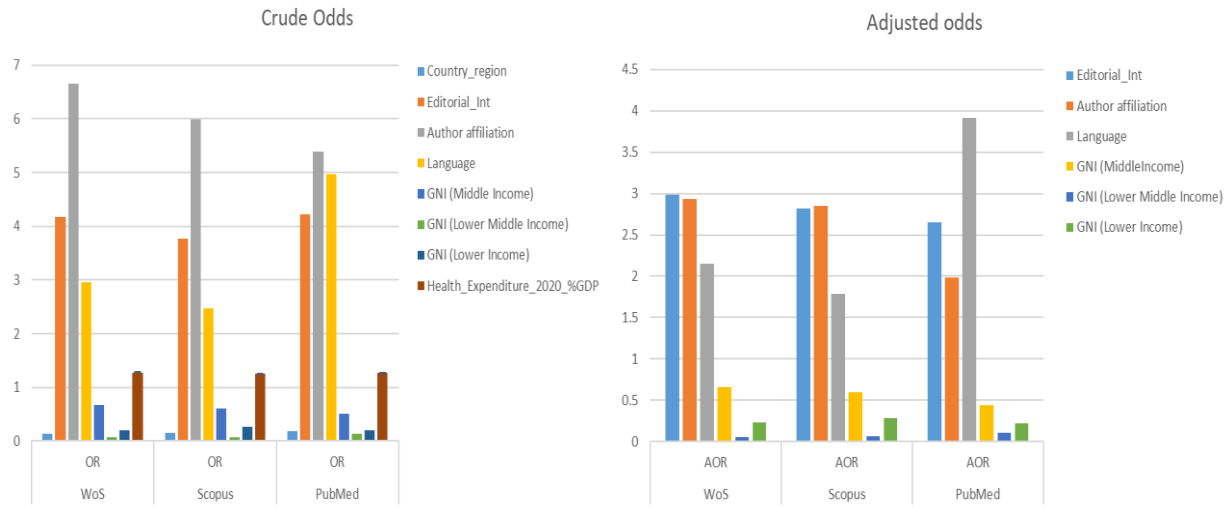


Figure 12: Crude and adjusted odds ratios for determinants of journal indexing in databases

In the multivariate model, the adjusted odds ratio (AOR) indicate that journals with international editorial board, international authorship affiliation and those using the English language had significantly higher odds of being indexed in the WoS, Scopus and PubMed. However, journals from LMICs and LICs were less likely to be indexed in WoS, Scopus and PubMed than were journals from HICs and MICs. Just as was the case with crude odds, substantial differences characterized LMIC journals, which had lower chances than LIC journals. Furthermore, PubMed was more likely to index journals from LMICs than was WoS and Scopus.

Notably, while the results highlight significant differences, they do not account for variables such as journal age or frequency of publication, which may also influence indexing outcomes. Future research should incorporate these factors to provide a more comprehensive understanding. The findings of objective 2 confirmed patterns observed in the scoping review and scientometric analysis on the journal coverage, barriers and enablers. For instance, they show limited journal coverage by WoS, Scopus, and PubMed and how factors such as economic status of country (capacity and funding), English language, availability of editorial expertise, local versus international authorship (differences in writing skills) affect Africa scholarship to produce high quality journals meeting indexing criteria for increased visibility and scientific impact.

4.4 Objective 3: To explore the barriers and facilitators to index African health science journals in international citation databases from Africa's journal editors' perspective.

Objective 3 sought to generate an in-depth understanding of barriers, facilitators and opportunities of Africa's health science journals from journal editors' perspective. The IDIs revealed a complex interplay of individual, institutional, and systemic factors influencing journal indexing. The key top barriers and facilitators were ambivalent factors, therefore, they have been presented together in the sections below. When an emerging theme is described, an explanation is offered, where applicable, regarding whether the theme is a barrier or a facilitator of journal indexing and scientific impact of African health research. The ambivalent factors are funding, research capacity and collaboration. These factors agree with results from the scoping review, scientometric analysis and analytical cross-sectional study. Under barriers, key findings were post-colonial influence and cultural attitude, whereas key facilitators were diversity and inclusivity, quality contextual standards, developments in ICTs, and local indexing services.

A majority of the participants were chief editors of the journals at the professorial rank within their institutions, and possessed PhDs in their specialty. The participants were from west, east and southern Africa; specifically, Nigeria, Ethiopia, Uganda, Kenya, Malawi, Rwanda and South Africa. Five of the editors had their journals indexed in all the major databases, including WoS (Emerging sources index), Scopus and PubMed. Three editors had their journals indexed in Scopus and PubMed only while 8 editors had their journals indexed in none of these databases.

In addition, 3 of the 8 participants with non-indexed journals had new journals that had existed for less than 10 years, and they were still trying to develop them and apply for indexing in these databases. The other editors were revamping old journals which stopped publishing or had very irregular publishing schedules. All, but four participants, had more than 10 years' work at editorial level accumulated from their current journals and other journals. Five of the editors were founding editors of the journals they were managing.

4.4.1 Emerging themes from the IDIs

As Table 11 shows, the study identified five major themes and 18 subthemes. The themes and subthemes were classified under three global themes depending on their level of occurrence,

namely individual barriers and facilitators, institutional barriers and facilitators, and systemic/structural barriers and facilitators.

4.4.2 Global theme 1: Individual barriers and facilitators

Two major themes and five subthemes were classified as individual level factors, with some not only occurring at two levels but also being highly influenced by the other two global themes although, practically, the classification was based only on their actual level of occurrence.

Table 11: Summary of Major themes and sub-themes

Global themes	Major themes	Subthemes
Individual barriers and facilitators	Sociocultural factors: the post-colonial influence	Decolonization of the mind: "Western is good" attitude
		"Free is cheap, expensive is good" attitude
		Promotion/tenure policies: Motivation for publishing
	Perception towards journal metrics	Value of metrics
		Limitations of metrics
Institutional barriers and facilitators	The effect of capacity	Funding and infrastructure: economic inequalities
		Lack of expertise
		Good collaboration and partnership
Systemic/structural barriers and facilitators	The politics of science: post-colonialism	Collaboration and partnership: exploitation
		Democratization of science: diversity and inclusiveness
	Indexing standards and the origin of indexing services	Identity: us versus them
		Dominance of the global north: bias claim & power
		Indexing standards as a quality assurance tool
		Indexing standards as a limiting factor
		Indexing standards and African contextual realities

4.4.2.1 Major theme: Sociocultural factors: the postcolonial influence

Three subthemes emerged under this major theme relating to individual attitudes and perceptions that influence individual's behavior or practices. These attitudes and perceptions were largely influenced by societal norms and culture, but were held and practiced at individual level considering that different people from the same society may have different attitude and perception and may act differently. These factors leaned more on authors' behaviors and practices than they did on editors, hence their categorization as participants' observations and perceptions.

Furthermore, some factors concerning the value and limitations of metrics possibly influenced editor's decisions on indexing and operations of their journals.

4.4.2.1.1 Subtheme 1: Decolonization of the mind: 'Western is good' attitude

The subtheme of decolonization of the mind emerged salient in the discussion as editors decried the attitude and actions of some African authors, who always regarded global north journals as better than African journals. This perception was said to be emanating from general attitude of local researchers or authors towards western services or products, even outside academia, which are usually seen as of better quality than African services or products. Participants reported that this attitude or perception translates into the practice of African authors or researchers preferring to submit their articles to western journals, and to read and cite articles published in western journals as compared to African journals. Furthermore, participants reported that they were concerned that African authors tended to submit their research to global north journals without caring much about the relevance of their work to the journal's audience because they erroneously think only global north journals are quality outlets. The editors thought that this perception was possibly influenced by the historical, political and socio-economic relations between Africa and global north countries which influenced Africans to perceive themselves as inferior to their former colonial masters. Some of the participants, for example, said this:

The majority of articles that are being quoted are external to one X university but also external to Y country, and external to Africa. The people are quoting from elsewhere because that's how we've always behaved, I don't know where it comes from but ah very unusual for us to be for us to be quoting each other because we also don't read each other. [Chief editor 1, Southern Africa]

"…we have well established researchers who they first, I mean, not that they don't submit to us in our local journals, but you can see that they do publish in a lot of international journals, you know, that would be the first in many ways where they would go to first… So yeah, there's clearly that in some ways, a preference, because those journals are seen as higher quality, higher index, you know, all of those sort of, yeah." [Chief editor,2 Southern Africa]

Ah the other issue I think is ah you know many African writers or researchers, authors ah maybe they are still colonized. you see postgraduate students, even undergrads, they are they when they quote literature they quote literature from not ah mostly within...even when we describe ourselves, whether it is behaviours, attitudes, social sciences we are reporting, in fact even the language

itself is for an external reader, because even the study setting people are describing identifier removed] is the largest that kind of thing Yah. If you get a paper from New York, Nobody describes the hospital as the largest hospital or something because they are writing for internal consumption. For us we are writing for external consumption. [Chief editor 1, Southern Africa]

One participant noted that this mentality was, similarly, prevalent among global north researchers:

So in a way you know the people talk about this decolonization of these and that but it it has never happened. That's why you know. That's why it continues to be a problem. So it's a colonial mentality, the publishing process the researching process. Everything you know we are better than you. That's what they tell you. We are better than you. We set the standard, so work hard to reach the standards and you never reach that standard that's why [Chief editor 2, East Africa]

Related to this attitude and practice, the participants also described this practice of researchers as a way of seeking validation and prestige by choosing to publish their works in high impact journals. They observed that while there was need to adhere to academic policies concerning publishing, publishing in high impact journals from global north tended to give researchers a sense of prestige. Other participants observed that sending manuscripts to global north journals, perceived to be superior, and being accepted for publication was considered as confirmation that the African researcher was doing good science. The participants were concerned that this practice tended to affect Africa's health research output because it meant that the researchers were being compelled to publish on topics that had a global focus or that would be acceptable to a global north audience at the expense of addressing local pressing needs and challenges. One participant gave an example of how this practice affects research done in Africa stressing that research that is of interest to Africa may not, necessarily, be of interest to non-Africans:

Secondly, editors, reviewers, who are not in Africa, may not be as interested in some research items from Africa. Let me give you an example. You are looking into areas that relate to the therapy from our plants that are localized in Africa. The way you are going to be interested in it, because you are in Africa, it is different from the way somebody who is not in Africa will be interested. So if you send that material to a journal, a foreign journal, we call it foreign, because they are outside Africa. They mean notes, they are so much interested in publishing that they will classify it as not

a sort of first class rated material. And as a result of that, they will give less prominence to it. [Chief editor 4, West Africa]

4.4.2.1.2 Subtheme 2: 'Free is cheap, expensive is good' attitude

Under this subtheme, participants deliberated a contemporary intrinsic cultural practice that considered 'free things' and expensive things synonymous with inferior quality and high value, respectively. The participants were of the view that the perception was affecting African journals negatively whenever they adopted the diamond open access model which, in an effort to increase article submissions and accessibility by readers and to increase journal impact, does not demand any payment from an author or a reader. This culture or attitude is independent of whether it comes from the west but generally expensive is equated to quality. In this diamond open access model, the costs are handled by the journals already struggling to survive due to limited funding. Contrastingly, majority of journal from global north adopt green open access model that requires author to pay so that readers accesses for free, and the APCs are high for an average African author or researcher. African editors argued that this diamond model was adopted based on contextual challenges African journals face but it seems to be backfiring. One of the reasons is that the researcher can hardly pay for APCs or rarely get support from parent institutions for publications hence it's a way of attracting more submission. Below are some of the quotations from participants:

So they said, okay, there was this argument that things in Africa when something is, it's free. (Interviewer comments saying "It's free, it is taken as low quality" and participant agrees). That we have that if it's free (not clear and participant laughs) you know, so that was the argument actually. They said, oh, if it's free, it's low quality. [Senior editor, East Africa]

…we operate in Africa where research is financially very constrained, no external support or usually the author will pay from their pocket. Yes, Yes you're in a situation where you cannot charge, you know, high article processing fees. So it's really a very delicate balance. How much do you charge, what other can pay, how much other are they willing to pay…[Chief editor, West Africa]

4.4.2.1.3 Subtheme 4: Promotion/tenure policies: motivation for publishing

Participants raised concern regarding how motivation for publishing in African scholarship was impacting African journals. They observed that the practice of minding more about promotion or tenure contract when conducting research tended to overshadow the drive to conduct research to

contribute new knowledge aimed at addressing local problems. The discussion, furthermore, tackled institutionalization of metrics whereby some academic policies and culture emphasized the need to publish in high impact journals while down playing audience relevance. While acknowledging the need to avoid predatory journals that undermine quality of research, they expressed concern that the practice tended to limit manuscript submission to developing journals, which were considered predatory or low impact, hence the hindrance of growth and impact of most African journals. One of the participants substantiated this point as follows:

Second aspect is that the aspect of promotion in most African universities is too much centered on that issue of the impact factor and citations that you have talked about. Without realizing the real aspect of what it means to the local community. And that is why in some universities, they are trying as much as possible to try to find out a balance in trying to assess people's work. [Chief editor 3, West Africa]

4.4.2.2 Major theme 2: Perception towards journal metrics

The theme of metrics and journal impact focused on how African journal editors perceived metrics such as impact factor, Scimago, and H-Index in relation to the value of the research published in their journals, and recognition of their journals, including what metrics meant to them. Two sub-themes emerged from this theme.

4.4.2.2.1 Subtheme 1: The value of metrics

Despite holding strong views against reliability of metrics some editors presented their positive views about the perceived proper place of metrics, namely showing utilization of journals, starting place to identify an important journal within its discipline, and influence of journal within its discipline. It is similar to one receiving feedback concerning the readership and utilization of their journal articles, providing insights into who is engaging with their publication.

Furthermore, when discussing the value of metrics, one participant suggested that journal metrics can indicate “quality” of a journal by looking at how people are citing it within its discipline:

It can help you get a sense of how often, how well cited a journal, a journal is, and that could be a good indicator of a journal, the quality of a journals content, how well, how well, how well it's regarded in its discipline. [Senior editor 2, East Africa]

However, some participants did not agree with the issue of quality, saying the role of metrics is simply to show visibility and accessibility of the journals considering that the metrics show usage of the journal as depicted by this comment:

Yeah, they can bring something, in fact, in the journal L, if you look at some of the articles published in the journal L, we have our internal metrics. So to just assess how widely the journal is accessed, we have a geo distribution of articles. If you go to the article published in [identifier removed] you see a map showing which part of the world are articles is accessed and what's the frequency of access over time. So these are important things I'm sure it gives authors a sense of how accessible or are important or how distributed the article is [Chief editor 5, West Africa]

While some indicated that they are concerned about metrics because their users, authors or researchers care more about metrics hence have to play by industry standards. This except below illustrates this point:

I think in terms of the journals, they are very important as I told you, you know our customers in a way are researchers and researchers value these measures, these indicators. So we strive to improve our indicators like H index and so on. … So I would say these are important measures and …those indicators are set by the industry itself … We strive to reach or meet those requirements, but I have problem with the requirements. They are set by Western standards and they have very little to say. You know, to reflect the reality in Africa and how research is done, published and so. [Chief editor, East Africa]

4.4.2.2.2 Subtheme 2: Limitations of metrics

While acknowledging the utility of and importance of journal metrics, the editors strongly discussed the shortfalls of metrics. On the one hand, some completely trashed the idea of journal metrics by referring to them as cheating, unreliable, manipulated, dishonest or rigged. On the other hand, others held a mild view towards metrics, acknowledging their role in the absence of a balanced measure:

"so ah one is ah many what people say that the impact factor is rigged so that's one of the things to think about ah that uhm aah at ahh is is is a problem." [Chief editor 1, Southern Africa]

Furthermore, some journal editors called for new measures that are balanced or holistic to measure actual aspects of quality, while others called for combining use of metrics with some qualitative assessment such as qualitative review of actual articles or completely relying on qualitative reviews. The extracts below substantiate this observation:

And also the second thing here we need more metrics. I don't think we need fewer. I think to be thinking more metrics to, I think it's space for metrics that. That provide a more holistic engagement. [Senior editor 2, East Africa]

In fact, I'm not a big believer matrix, I think there are ways to ensure that journals have manuscripts of good quality. Yeah, and one of them is just to be extremely rigorous with the review process [Chief editor 5, West Africa]

Some editors, despite showing doubt over reliability of metrics, accepted their use on an understanding that a reliable alternative was lacking. Additionally, other editors suggested that these were demands or expectations of the industry, e.g. authors, funders and academics; hence, they needed to simply comply with them as the following extract explains:

So that was it, we were happy to receive an impact factor, of course, because most of our authors have been asking for that. So good to have it, but we actually never worked specifically toward an impact factor. So we believe in those metrics but when it comes to an impact factor, it's important just because authors, funders, and academia, they get the importance that it has now. But if you look in, physically, it doesn't save much, the impact factor, for example, measures the journal itself, but what about the individual articles with journal, you see. [Chief editor 5, West Africa]

4.4.3 **Global theme 2: institutional barriers and facilitators**

Only one major theme and 5 subthemes emerged under institutional barriers and facilitators. The themes concerned themselves with issues that affected journals or journal-related institutions in Africa such as universities.

4.4.3.1 Major theme 1: the effect of resources and capacity on journal quality and impact

Participants deliberated the effect of the presence and lack of resources and capacity on western journals and African journals, respectively.

4.4.3.1.1 Subtheme 1: Funding and infrastructure: economic inequalities

Lack of financial support was a fundamental issue discussed by participants that impacted on several aspects of journal indexing and impact of African research at large. This lack ranged from funds to support journal operations, creating technological infrastructure to improve journal operations, build human capacity in terms of authors and editors or reviewers, to indexing fees. This affects article submissions and journals' ability to meet editorial standards for indexing in the major databases. Despite the fact that indexing in some databases is done at no charge the databases impose certain prohibitive requirements to some African journals just as high indexing fees which are unsustainable for some African journals. For instance, an editor of Journal Z reported an annual fee of $15,000, which they considered unsustainable for most African institutions:

When you want to do some subscriptions, they will grant African fee, some African free. So, those indexing services, you also consider that. Like Scopus, imagine you charging me $15,000. How much does the journal make?... It's the reality. So, it is not possible [Chief editor 7, West Africa].

On comparing capacity of African journals with that of European journals to meet indexing standards, one participant said:

There are a lot of, these are the long list of requirements and sometimes it's not in for African journals to meet some of these, because of factors such as ignorance or challenges linked to resources or capacities of those editors…But of course, it, it, it, it goes without saying that, you know, European American journals, they have a lot of resources there are extremely well made. So it's easier for them to meet those standards but African journals, we are very limited when it comes to resources. [Chief editor 5, West Africa]

This was, by far, said to be the prime influence to many challenges faced by African journals and researchers to meet indexing standards, sustain journals, train reviewers and authors, and produce high quality research and achieving impact. The point is summed up by the comment below:

Yeah, the poor editorial standards, they play a big role. In fact, it's not easy anyone can actually browse through some of the African journals to actually see that they are extremely limited quality

and when you have, when you don't have the resources, when you don't have full time staff, when you don't have a trained editorial office or a team, when you don't have the necessary quality infrastructure, when you have a lot of interference from the department, all these things collide to affect the quality of journals. [Chief editor 5, West Africa]

4.4.3.1.2 Subtheme 2: Lack of expertise

Participants reported lack of expertise to conduct high quality research, scientific writing (authorship), and editorship or reviewers for African journals. To some extent, this was considered a result of lack of funds and infrastructure. For instance, some participants bemoaned challenges to find subject experts to become members of editorial boards and reviewers while another lamented on the writing skills of African authors, as presented in the comments below:

Rejection rate is very high because we receive so many articles of very poor quality not because the concept is bad, it's just because authors, I think they have limited training in scientific writing. [Chief editor 5, West Africa]

Uh... it is not very easy for the editorial board to bring to, to, to bring someone you know an African or an African researcher who can join the board that's not easy to do because of lack of connection, you know network. [Chief editor 6, East Africa]

It was observed that the poor networking to identify international editors prevented Africa's journal to have diverse representation in its editorial boards. Additionally, the editors' lack of knowledge about indexing processes, including standards, affected Africa's ability to index its journals. Furthermore, the participants observed that difficulties in finding well-trained and experienced reviewers for journals affected the review process to publish high quality articles. Similarly, poor writing skills of some African authors were considered a significant contributing factor to Africa's tendency to generate poor quality manuscripts which, in turn, prevented her journals to publish high quality articles as well as regularly.

4.4.3.1.3 Subtheme 3: Collaboration and partnership

The importance of collaboration and partnership emerged as an important aspect of the discussion about resources and capacity. Participants acknowledged the current positive role played by collaboration and partnerships regarding the growth and success of journals from Africa, as well as research at large. The discussion around this theme also portrayed collaboration and partnership

as a major player in facilitating growth of African health research which later translates into publications. Good collaboration and partnership were also discussed as a great opportunity that could be explored to find ways to improve the current situation of African journals and African research. Good collaboration and partnership were collectively perceived as that which benefitted its concerned partners equally.

The participants, furthermore, discussed partnership between global north and global south institutions to build capacity and share resources in the growth of journals from the global south. For instance, one participant gave an example of an initiative partnering Africa's journals with global north ones to help in capacity building and sharing of resources such as technology. While this was already happening with some African journals, some participants saw room for expansion, and went a step further to suggest intra-Africa partnership to give African researchers an opportunity to learn from each other. The participants further suggested that African researchers should be given opportunity to seat on editorial boards of global north journals, and vice versa to gain outside the box experience that could greatly contribute to build capacity.

But what, yeah, but what is happening, there are some initiatives out there that are helping African journal to meet some of these basic standards and one of them, for example, is the African Journal Partnership Initiative ... So what the African Journal Partnership Initiative does, they provide some of these facilities to African journals and in the process, of course, help these journals meet some of these international standards that makes it easy for them to get in archive or index somewhere else [Chief editor 4, West Africa]

Because it's also about mentorship, we need to have an inclusive way of saying it's not just Africa, but we need to have all of us playing at all the Western countries playing at all and say can you come and head your boards and just train you and build capacity and mentor some of your people and how we do ours so we have more like an exchange program. It's good for some of our editors to seat in these international journals to learn, but also for exposure and we we cannot sit and wait for those global north to come and seat in our journals if they're not willing to. [Senior editor 1, East Africa]

Furthermore, there were calls that these partnerships and collaboration which are mostly international, should also be made within the region. The countries which are doing better can

mentor those that are struggling or just starting to develop. This excerpt from one participant substantiates this call:

So we, we have found ourselves in this place where I don't know if it's about ego or trying to outsmart each other. So you find that in Africa, South Africa is doing so well. But East Africa has accepted that look guys, we are struggling in on area, since South Africa is good at it. Why don't we tap into one to come here for six months, we invest in them come here for six months and an essential come teach us how to do these things here then when you go back, we have another Kenyan going down South and saying this is how we do it. [Senior editor, East Africa]

4.4.4 Global theme 3: Systemic/ structural barriers and facilitators

There were 2 major themes and 7 subthemes under this global theme. These were deep-rooted in the cultural norms and attitudes, economic systems, policies and other practices embedded in societies cutting across institutions, nations and the globe.

4.4.4.1 Major theme 1: Politics of science: neocolonialism

The theme entailed factors that seem to be influenced by the economic dominance of former colonial masters over their colonies. The economic privileges experienced by the former colonial masters gave them undue advantage over their former colonies in many things such as having an upper hand in partnerships and collaboration, owning indexing databases, well-funded and supported journals, and setting standards in the industry. This was reported as manifesting in several ways, particularly in terms of funding dependence from the west to African journals and research projects, editorial control (setting standards), research visibility considering that knowledge production and major indexing services were owned by western countries. In this light, for instance, African journals might feel compelled to prioritize research topics that align with donor interests at the expense of local knowledge generation needs.

4.4.4.1.1 Subtheme 1: Collaboration and partnerships: exploitation

While acknowledging the benefits of collaboration and partnership in development, growth and sustainability of African journals, participants held a different perspective concerning collaboration and partnership that disadvantages African science. The participants highlighted the need to bring justice or equity to collaboration and partnership by discussing “good’’ and “bad’’

collaboration and partnership. Good collaboration was conceptualized as what brings about good results that benefits both parties in the collaboration and partnership while bad collaboration was discussed as the one that gives an upper hand over the other in terms of benefits or exploiting the other partner.

Under this theme, participants discussed issues of power imbalance that came about during collaboration and partnership between the global north and African countries. This resulted in the global north partner, who normally bring funds, dictating the research agenda for the global south partners, as well as publishing avenues and authorship rules. The quote from one editor below articulates this point:

I can understand because of, you know, the resources that the the Westerners, the, the Western researchers bring in, they tend to buy our researchers, you know to do to do their will rather than you know. You know, advancing the interest of Africans and Africa itself. [Chief editor, East Africa]

Well, this is a hot topic. I'm sure you are aware, international researchers parachuting into countries like South Africa and Malawi, whoever in the rest of Africa is doing research, taking first authorship, publishing material and they're back in their own environments. That comes directly back to funding and that kind of thing because the researchers that they work with in the global South countries have local funding and the international authors generally often take the research back to global North journals [Chief editor 2, Southern Africa]

because the reason why they are publishing in the north or in the west is because the west is paying for the research that is ongoing and therefore by nature, naturally in a way, you are bound to their project. Your research agenda is not yours, then you are the one you are only there because you are part of me, you are my friend and you are part of me, you are of an area of interest and I also want to be seen as am doing International and global teacher because the money is being funded by World Bank or being funded by the USAID or they see that and all that and you won't be seen as if you're working across the continent but in the real sense is that the proposal itself is being crafted somewhere else. [Chief editor, East Africa]

4.4.4.1.2 Subtheme 2: Democratization of science: Diversity and inclusiveness

Participants called for need to democratize science which was currently dominated by the global north. They did this by reiterating the need to come up with standards that empower new journals and struggling journals to grow in order to achieve wider visibility and impact instead of barring them through the use of stringiest requirements. The understanding was that the global north dominated the indexing service business thereby unnecessarily controlling visibility and impact of Africa's research. They called for allowing different players in the journal publishing and journal indexing to be represented and considered based on their context. This could be achieved through deliberate policies or efforts such as cost of indexing fees to be exempted or reduced for developing countries; some standards such as publishing regularity and having international authors which sometimes are due to inherent challenges of having few authors/ research or low submissions rate (authors cannot pay for APCs) as compared to global north.

We need to think about inclusive it. I say this because I look at some of those international journals and I wonder how many African seat in those boards, or how many of those Western countries, are called to seat in Africa Journals…so I think they need to be a more of an inclusive way of promoting diversity and include both the authorship, the running of the editorial boards, and even the kind of content that these journals just see because they are that apply to us as Africans that may not apply to Western countries or their content that apply to Western Africa and so how do we have a way of including or of of having, let's say an exchange or including both ways so that we both benefit from this particular way of program[Senior editor 1, East Africa]

One participant explained how inclusivism could be achieved by giving an example of removing indexing fees for journals from resource-constraint countries:

I've already said that before. That's the truth. Okay. They should also consider the facts that these journals are in resource limited areas. Yes. If African journals want to be cited, is either they remove the concept of charging exponential fees to index African journals. And try to look at our situation. Even the World Bank and World Health Organization, they consider the economic status of the country. When you want to do some subscriptions, they will grant African fee, some African free. So, those indexing services, you also consider that. Like Scopus, imagine you charging me $15,000. How much does the journal make?... It's the reality. So, it is not possible… Not to reduce quality. No. And surely, quality is like that [Chief editor 7, West Africa].

I think on that, on that level, as you were talking, I suddenly realized that some of our other journals are not indexed because they don't publish frequently enough. And I do think that there would be a place for having a system that allowed less frequent publishing from journals, from the Global South, because we don't have the same volume of submissions as they as the Global North journals have…Yeah. [Managing editor, Southern Africa]

4.4.4.2 Major theme 2: Indexing standards and the origin of indexing services

Six subthemes emerged under the theme of indexing standards and the origin of indexing services. The participants discussed the role of indexing standards, largely in the context of their origin and the need to contextualize or develop African standards because some standards were either unable to respond to African journal's needs or to accommodate them.

4.4.4.2.1 Subtheme 1: Bias and Identity: "us" versus "them"

The theme of identity became salient in the discussions when editors sought to illustrate how the separation of the two worlds, namely the global north and south were having a major influence on how research was being conducted and communicated. The results showed that major differences existed between the global north and the global south as evidenced through participant's frequent use of terms that describe 'otherness' such as us, them, their, our, own, west, we, African, western, to describe indexing and journal services as well as indexing standards and research. The discussion about identity hinged on two major related issues; perceived bias against African research and journals by the global north, and superiority and inferiority complexes by the global north and the global south, respectively.

While acknowledging lack of empirical evidence and means to substantiate their claim, participants argued that there existed systemic bias against journals and researchers from Africa by the global north including the major indexing databases. They claimed that the bias even affected African scholarship in general. Others mentioned the presence of citation cartels evidenced through the tendency of global north authors citing each other at the expense of researchers from other regions, and to submit their works to western journals even when the research was conducted in Africa or was based on a topic related to Africa's health challenges. However, they also added that despite bias, there are also a lot of challenges faced by African

journals that would contribute to its absence in these popular indexing services. The extract below highlights this view:

Yeah, this feeling that, okay, if it's coming from the south, it's probably bad. So these biases, we know they exist, absolutely know they exist and how they impact, you know, in the accession of African journal, this, of course, is difficult to quantify because I'm not sure that you have actually conducted some research to quantify the impact of those of those biases. But I totally agree that they certainly exist if you look at the proportion of African journal and most of the indexes, it's extremely, it's extremely small. No, a lot of people claim that absolutely a lot out there can explain why this proportion is so small. Bias probably has something to do with it but of course, issues around the challenges faced by African journals, I think probably have a bigger role to play because operating a journal is not easy and this is the, we should keep it minus, totally not easy. [Chief editor 5, West Africa]

In addition, participants recommended that the proposed local databases should use localized indexing standards that responds to the unique contextual realities of African scholarship such as poor economy, low levels of education and lack of expertise, lack of research funding, and local health research challenges.

The only thing I would like to emphasize is I don't know how we do it. Who will do it? And so on. But we need to have our own standards in evaluating African journals in our setting for indexation… and we have to really do something about having, you know, a very good indexing service for African journals. With of course, good capacity, probably use AJOL as a starting point…[Chief editor, East Africa]

Some participants, however, thought the proposed creation of African indexing databases would not improve matters because it would undermine the concept of globalization of research. They argued that the creation of African indexing databases could only unnecessarily intensify the marginalization of African's health research. They, instead, called for improvements in quality of African journals by striving to meet those high standards required for indexing, while others recommended finding other ways of making their journals visible such as using effective marketing strategies including using social media strategically.

Yah so you know that science is international right, so because if you're like, OK, ah if we have to create ah an African database, then would be an Australian database, South African South American database, Central American database and the North America database. Then we'll have a Russian database ah the issue would be what problem do we want to solve? Just because that we can't ah we can't be part of the global community or like what would be the motive. I I would think that ah maybe one would say that if North Americans and Europeans have created a database then everybody else should be having their own database, then science, then everybody will be what accessing their own science, their own literature is that what we want?...[Chief editor 1,Southern Africa]

…if you want to be passive and maybe apologetic and then blame someone for our problems, then we would say OK, we are not being visible because we are being eclipsed by the north and so on, so that that one is an easy statement and it has got legitimacy to an extent, but the question is how do we ensure our own visibility here? Ah to what extent for instance, have we shared our results with the Community to which we belong. So the policymakers, the practitioners, the media, and so on. …Is it still the north responsible for that?..Ah We find that We've got a marketing department ah for the university. It does sometimes ah showcase our research, but it's not all the time and I'm not saying that it's their problem, but ah do we or are we waiting for the north to do that on our behalf? I mean, the Internet, Facebook, Twitter, LinkedIn, Google Scholar and other ResearchGate…[Chief editor 1,Southern Africa]

4.4.4.2.2 Subtheme 2: dominance of the global north

Related to the theme of perceived bias above, the matter about the origin of indexing service was linked to the dominance of the global north in the indexing and research impact industry. The origin was discussed in terms of historical and present origins of indexing databases and metrics which were perceived as influencing and maintaining the dominance of the global north in the industry. This was also demonstrated by the frequent use of terms that are used to describe "otherness" when referring to the databases or researchers from Africa or west. The participants, for example, preferred to describe as western as opposed to international the databases and their standards because they perceived them as majorly exerting western-biased influence on the topical focus of the databases, standards for indexing, and their business model. To them, the domination

was being exerted through their setting of standards in the industry, owning major indexing databases, and owning highest impact and reputable journals. One participant narrated the challenge as follows:

I mean when you look at Sage, Elsevier whatever, they are from the north, so they are created to serve in their environment. It wouldn't make sense for Sage to be or Elsevier to be is it in Netherlands and then it's servicing down there Zimbabwe or something like that ah its Europe ah largely, Sage and others so you start off like that [Chief editor 1, Southern Africa].

Addressing these perceived biases against African scholarship was seen as one of the crucial steps towards improving African research hence a call for developing African indexing bodies that may focus on African scholarship when designing their services.

The participants also deliberated their views about journal indexing and running African journals as a form of business aimed at covering administrating costs. Likewise, participants observed that African journals had unsustainable business models because of their heavy reliance on support from their parent institutions while they simultaneously published using diamond open access model unlike most journals from global north are run by commercial publishers and they rely on article processing fees to support some of their operations.

One of the study's West African participants had this to said regarding this matter:

Yes, Yeah and we operate in Africa where research financially very constrained, no external support or usually the author they will pay from their pocket. Yes, yes you're in a situation where you cannot charge, you know, high article processing fees. So it's really a very delicate balance. How much do you charge, what other can pay, how much other are willing to pay. [Chief editor 4, West Africa]

So it's like a kind of a competition, which when kind of what we get is like a monopoly now when we have other opportunities which are coming up, then it is becomes a competition and with the other competition like this one. Then even the some which were not being acceptable in other forums. To find them those forums looking for such instead of journals looking for them to asking to be indexed, those indexing bodies will be sending messages to specific channels to request them to accept to be accepted them, yes. [Chief editor, East Africa]

So, we need similar initiatives, such similar initiatives will be necessary because now the Journals will be visible. And even now, at some point, they will be acceptable, because of their visibility and the rating, whatever other ratings which will be there, which are not fairly strict, like when we go like Google Scholar and others which are open and we find now these African Journals they are featuring so widely to extent that other Journal indexers want them to index them. So it's like a kind of a competition, but the kind of what we get is like a monopoly now, when we have other opportunities which are coming up, then it becomes a competition… [Chief, editor 8, East Africa]

Some participants suggested coming up with an Afrocentric business model that would work for African journals based on the African scholarship and other contextual factors that influence the industry in Africa. The extract below captures this theme:

Our journals in Africa must sit down and find a financial or a business model that works for us. Now that we know our African culture in terms of we know our research culture. We know how our people, the people like readership, our readers may not buy African product and we say, and say, can we create awareness or how can we work this through and still have our generals make money to move on. Most of these things are money issue financial issues, you know, even having the best. [Senior editor 1, East Africa]

4.4.4.2.3 Subtheme 3: Indexing standards as quality assurance tool

While there existed claims concerning perceived bias against journals from Africa, editors were quick to acknowledge the importance of maintaining high quality editorial standards to ensure dissemination of high quality research. Thus, indexing standards required by the Western databases were perceived as a guide for best practices to improve growth of journal, quality of research, and sustainability of journals. Some standards were also seen as tools that ensured diversity, inclusiveness in the audience of journal readership, and credibility.

In the example given below, one participant, while commenting about metrics, said that the fact that journals may strive to meet criteria for indexing in order to receive journal metrics is good for them because it helps them to improve journal quality in that they feel compelled to follow best practices stipulated as requirements for indexing:

uh the use of metrics like this is very important. One of the things is that people when they are measuring here in improving quality. What they learned the same when we have the metric metrics to measure the quality of Journals people who put more effort improving their quality of their Journals because they are being changed using certain criteria, yeah. Yeah, so that they can have the best practices people who will try to get them best practices when even when they are [Chief editor 8, East Africa].

4.4.4.2.4 Subtheme 4: Indexing standards as limiting factors

While acknowledging the important role played by indexing standards, the editors highlighted another dimension played intentionally or unintentionally. Some standards were noted as impeding the visibility and impact of journals as well as the growth of new journals. These sentiments do not necessarily represent participant's effort to lower down standards but rather to find means for supporting growth of new and struggling journals while maintain high quality scientific standards. For instance, editorial requirement of achieving some impact factor was seen as a 'self-fulfilling prophecy', because one applied for indexing to gain visibility which, in turn, brings about impact factor, implying that denying one indexing was synonymous with denying them opportunity to achieve impact factor. Another editorial requirement that was perceived as a hindrance to growth of new journals was a journal's minimum age which was introduced as one of the best practices for ensuring sustainability and for preventing collusion to run a journal for personal gain.

Below are extracts from some of the participants who spoke about these issues:

Locally, you know, you know, I an African standard, which really I I'm not suggesting, you know, a substandard way of doing and publishing research for Africa. But rather it has to speak to the realities and we have to find a way to respond to the realities in Africa otherwise. [Chief editor 9, East Africa]

So we do one that will attract the... the standards should not be seen to block the people who wish to. The standards should be to attract them and encourage them, but also preventing also the bare minimum. I see the bare minimum that meets the threshold, the threshold should be something that is not at par with the international... because those have already been there for 50 or 100 years, but it should be at par with our understanding of quality [Chief editor 10, East Africa]

4.4.4.2.5 Subtheme 5: Indexing standards and African contextual realities

Participants also reflected on the balance between maintaining a local focus in journal content and adhering to international standards in indexing services. For instance, while acknowledging the importance of international representation of editors, reviewers and authorship, the participants reiterated the need to preserve local perspectives and priorities in research dissemination. In this light, participants lamented the challenges associated with identifying and recruiting international editors as well as getting international submissions for a journal with a local focus, and even this concerns an international African journal. Some noted that, when the journal in question was one with a local focus what matters most was representation of readership or audience and not international authorship, as express in the extract below:

But if it's a local journal, it also makes sense to have an editorial board that is less diverse. But of course, having diversity in an editorial board for countries is extremely, is extremely important because the more diverse you are, the more diverse the views and ideas you can. Yeah, but I, again, I'm not sure the, how diverse the diversity of the authorship is, is important. [Chief editor 5, West Africa]

This discussion stresses the complexity of the task of navigating between global standards and local relevance in the context of indexing and promoting African health research. Similarly, participants discussed the differences between western benchmarks and the context-specific challenges encountered by African researchers and journals, highlighting the need for a more tailored approach to evaluating research quality. For instance, there were issues concerning workload in universities, stemming from shortage of staff, expertise, inadequate funding which highlight the uniqueness context in which African journals operate. The extract below underscores these perspectives:

Unfortunately, there are problems. Because that's the second aspect of the question you asked. There are problems. The problem of funding is very jamming in terms of African journal publishing. I've already said that before. That's the truth. Okay. They should also consider the facts that these journals are in resource limited areas. Yes. If African journals want to be cited, is either they remove the concept of charging exorbitant fees to index African journals. And try to look at our situation. [Chief editor 6, West Africa]

As part of the solution to the perception that the western standards did not respond to Africa's contextual needs, some respondents suggested the development of African standards that respond to unique challenges faced by African journals or matches with the local research environment and African scholarship. However, this suggestion was regarded by some as lowering down research quality standards from the region. The understanding was that African journals needed to work towards achieving these requirements on an understanding that they would improve the quality of research that they publish and improve their journal's reputation.

…The challenge, we say it's common. What South Africans, Nigerians, Egyptians are facing is what Kenyans, Ugandans or Zambians are facing. So having that understanding then we say, can we have a way of rating ourselves, and we have our own service to index our journals. Then we have our own quality assurance people sit down and say let's let's have one to three, all our journals will have to be to have this time [Senior editor, East Africa]

The argument that creating local standards could mean lowering down standard for Africa's publications, was counteracted by a recommendation that African standards should adapt international by considering unique challenges faced by African journals while upholding standard for quality research. The extract below supports this view:

No, no, do you do your... they can do their standards that that's a respond to African challenges, because you see what happens also is that you don't have to copy and paste. You can pick the things and modify them to meet our target, because you're targeting our population, you're targeting an environment. [Chief editor 10, East Africa]

The IDIs provided deeper contextual understanding of patterns observed across the scoping review, scientometric analysis and analytical cross-section studies. Participants described how resource constraints including lack of local funding; lack of skills in writing, editorial and journal management; authorship hierarchies; dependence on foreign publishers; and collaboration influence African scholarship environment thereby contributing to journal indexing and scientific impact. Some of the issues explored during IDIs were also reflected in the DCE preferences such as credibility of journals and cost of indexing.

4.5 Objective 4: To assess Africa's journal editors' preference on indexing with regional citation databases over international citation databases.

The DCE explored journal editors' preferences by presenting them with hypothetical scenarios of indexing services, each varying in attributes like cost, visibility, and reputation. Editors were tasked to select the most appealing option. Data for the final experiment was initially analysed using complete case analysis. Further sensitivity analysis was done by imputing missing values for incomplete data using mode imputation. This method was selected because it was appropriate for categorical variable, and was simpler based on the purpose of our imputed data analysis. We conducted 2 multinomial logit models (MNL) and one mixed logit (ML) model. The two MNL models included one with cost variable as categorical and another one with a continuous variable. We chose to present results for the mixed logit model for a number of reasons. Firstly, the ML log likelihood was higher than that of the two MNL models, signifying superior model fit. Furthermore, the AIC and BIC values for the ML (AIC = 1010.398, BIC = 1110.023) were lower than those of the two MNL model [(Categorical Cost): AIC = 1164.797, BIC = 1204.723; (Continuous Cost): AIC = 1162.762, BIC = 1193.815], which suggest that ML model gave better balance between model fit and complexity. Finally, the ML provided preference heterogeneity, variability of preferences and additional parameters such as standard deviations that offer more context to understanding of preferences.

Mixed logit model

According to Tables 12, 13, and Figure 13 below, results for complete case analysis show that editors had a strong preference for higher visibility, higher reputation and availability of metrics, with coefficients of 1.197 ($p<0.001$; [CI: 0.665-1.729]), 0.862 ($p<0.001$; CI: 0.465-1.259]), 0.852 ($p<0.001$; [CI: 0.421-1.282]), respectively. Furthermore, there was significantly high likelihood of deciding to select Option A or Option B indexing service than not choosing an indexing service provided in the experiment ("Opt out"). Additionally, results show that higher costs decreased the likelihood of a choice of indexing service being made; as they have negative coefficients. International board membership does not show statistically significant results, possibly due to insufficient sample size, as results for imputed data showed statistically significant results for international editorial board.

Table 12: Summary results of the DCE showing journal editors preferences

Attribute	Complete case (Coef.)	Imputed Data (Coef.)	Significance
Visibility	1.197	1.700	Strong positive impact
Reputation	0.862	0.810	Positive impact
Cost (Highest)	-2.007	-2.827	Strong deterrent
Metrics availability	0.852	1.244	Positive impact
International editorial board	0.267	0.257	Minimal positive impact

The results for imputed data showed a similar trend to those for complete case analysis. However, the imputed data results revealed a larger coefficient for visibility attribute and cost indicating that accounting for missing data through data imputation revealed stronger preference for higher visibility, and more sensitivity to cost. Additionally, the requirement for international editorial board showed statistical significance. This suggests that addressing missing data provided additional insights on the strengths of preferences. Mode imputation was selected as a practical approach given the categorical nature of the data and the need for a simple, reproducible method. While this approach ensures data completeness and prevents loss of statistical power, it may introduce biases by over-representing the most common response. Unlike multiple imputation or full-information methods, mode imputation does not account for uncertainty in missing data, potentially underestimating variance and confidence intervals. Future studies may explore alternative imputation techniques to assess the robustness of these findings.

The standard deviations for both models show significant deviations from zero suggesting preference heterogeneity among editors on the attributes and indexing services. However, the study did not test differences in preference heterogeneity based on journals types, i.e., newly established journals versus well-established journals, region, availability of resources and institutional support. This was beyond scope of the study, and data was not collected on the same. The study, however, acknowledges that these factors may help explain preference heterogeneity revealed in the results. For instance, newly established journals may prioritize affordability and visibility, indicating a need for cost-effective indexing services that enhance discoverability. In contrast, well-established journals place greater importance on reputation and inclusion in high-impact databases, suggesting they are more concerned with prestige and long-term citation impact. These differences may highlight the need for tiered indexing solutions that cater to journals at different stages of development.

Table 13: Mixed logit results for complete case analysis and imputed data analysis

	Complete case analysis			*Mode imputed data analysis*		
choice	**Coef.**	**P>z**	**[95% Conf. Interval]**	**Coef.**	**P>z**	**[95% Conf. Interval]**
Mean						
Visibility_1	1.1974	<0.001	0.665 to 1.729	1.70	<0.001	1.283—2.118
Reputation_1	0.862	<0.001	0.465 to 1.259	0.810	<0.001	0.498—1.122
Cost_2	-0.572	0.017	-1.041 to -0.104	-1.463	<0.001	-1.841— -1.084
Cost_3	-0.71	0.005	-1.207 to -0.213	-1.464	<0.001	-1.830— -1.099
Cost_4	-2.007	<0.001	-2.714 to -1.3	-2.827	<0.001	-3.335— -2.318
Intl_board_2	0.267	0.173	-0.117 to 0.65	0.257	0.04	0.0123—0.502
Metrics_1	0.852	<0.001	0.421 to 1.282	1.244	<0.001	0.92—1.567
alt_2	1.27	<0.001	0.695to 1.845	1.305	<0.001	0.901—1.709
alt_3	1.227	<0.001	0.657 to 1.798	0.993	<0.001	0.598—1.387
Standard Deviation (SD)						
Visibility_1	2.125	<0.001	1.399 to 2.851	1.373	0	1.053—1.693
Reputation_1	0.997	<0.001	0.584 to 1.409	0.897	0	0.566—1.227
Cost_2	1.011	<0.001	0.549 to 1.474	0.805	0	0.357—1.252
Cost_3	0.825	0.001	0.321 to 1.328	0.514	0.009	0.131—0.897
Cost_4	1.1829	0.001	0.477 to 1.889	0.261	0.531	-0.554—1.076
Intl_board_2	1.021	<0.001	0.638to 1.405	0.744	0	0.456—1.031
Metrics_1	1.987	<0.001	1.351 to 2.623	1.131	0	0.809—1.452
alt_2	0.781	0.001	0.327 to 1.235	0.304	0.087	-0.044—0.652
alt_3	0.833	<0.001	0.405 to 1.262	-0.291	0.173	-0.71—0.128

For complete case analysis: Number of obs = 1,872, LR chi2(9) = 172.40, Log likelihood = -487.19878, Prob > chi2 =0.0000.Akaike's information criterion and Bayesian information criterion: Model N = 1,872, ll(null) = -573.3986, ll(model) = -487.1988, df = 18, AIC = 1010.398, BIC = 1110.023.

For imputed data analysis: Number of obs = 3,096, LR chi2(9) =153.44, Log likelihood = -781.01381 Prob > chi2 = 0.0000

Aike and Bayesian: N=3,096 ll(null)=-857.735 ll(model)=781.0138 df= 18 AIC=1598.028 BIC=1706.709

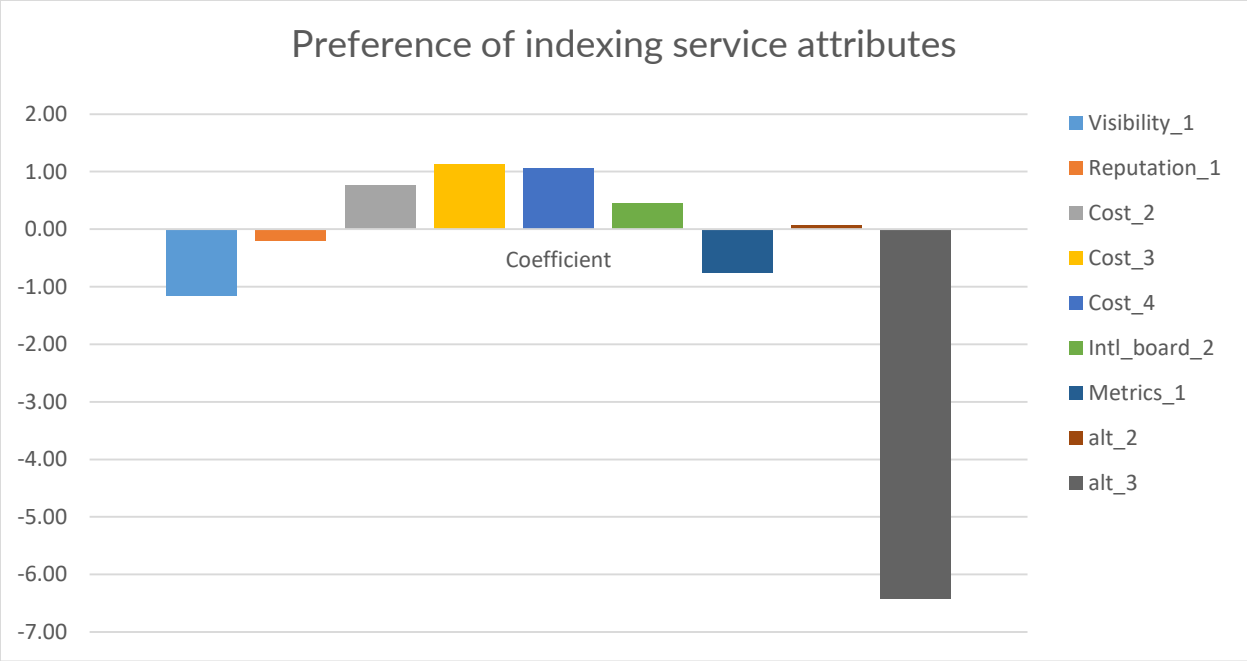


Figure 12: Preference of indexing service attributes based on imputed data

The DCE results strengthen patterns observed in the other components of this thesis especially on issues of indexing status and funding or resource capacity on visibility. The DCE results agreed with findings from IDIs on importance of visibility to editors as the major reason for indexing or choosing an indexing service. Additionally, DCE result on cost being a deterrent to indexing also aligns with issue availability of funds or resources and economic status of a country of originating journal from IDIs results and analytical cross-sectional study.

4.6 Conclusion

This chapter has presented results of the study based on the four objectives. The results were presented as five studies, namely a scoping review study, scientometric analysis study, cross-analytical study, IDIs (qualitative) study, and a DCE. The results focused on the current status of scholarly impact of Africa's health research, barriers, facilitators and opportunities to journal indexing and scientific impact of health science research. The next chapter discusses significant findings presented in this chapter by contextualizing it with related literature and theories.

Chapter 5: Discussion

5.1 Introduction

This chapter critically examines the findings from component studies of the thesis, as presented in Chapter 4, and contextualizes them within the broader body of existing literature, and theoretical/conceptual frameworks. For instance, Chapter 4 revealed significant disparities in journal indexing, with only 12% of African health journals indexed in WoS compared to 52% for journals from Western Europe. This chapter integrates these findings to discuss barriers, facilitators, and opportunities for improving the scientific impact of African health research. The chapter synthesizes and integrates the key findings organized as key themes in alignment with the study objectives. This prevents repetition and enables related themes across objectives to be discussed together. Table 14 below summarizes the structure of the discussion chapter.

The key findings are also discussed through the post-colonial theory lens to demonstrate structural inequalities inherited from colonial systems that perpetuate disparities in research visibility and accessibility in Africa. Furthermore, the Payback model provides a framework for discussing the key findings along the research impact pathway; focusing on inputs of research such as infrastructure (resource capacity), and measurable benefits such as scholarly impact (knowledge dissemination), policy influence, and societal benefits. Thereafter, Chapter 6 follows with actionable recommendations for practice, policy and research.

Table 14:Summary of discussion chapter arrangement linked to objectives of the study

Section	Key themes	Link to objectives
5.2 current scholarly impact of Africa's health sciences research	Geographical disparities, common data sources and research indicators	Objective 1: To establish current status of Africa's health science research scholarly impact
5.3 Factors associated with indexing coverage of journals	international editorial board, international authorship, English Language (abstract), economic status	Objective 2: To compare African and western European countries' journal indexing coverage in international citation databases by key objective editorial standards and selected contextual journal characteristics.
5.4 Barriers, facilitators, and opportunities	post-colonial influences	Objective 3: To explore the major barriers and facilitators to index African health science journals in international citation databases as perceived by African journal editors.
	Partnership and collaboration	Objective 3 (see above)
	Resource and training	Objective 3 (see above)
	Cost of indexing and APCs	Objective 3(see above) Objective 4: To assess Africa's health science journal editors' preference of indexing services.
	Indexing standards and editors' preferences	Objective 3(see above) Objective 4(see above).

5.2 The current scholarly impact of Africa's health sciences research

5.2.1 Geographical coverage disparities

This study established that there were more articles focused on regions such as Africa and SSA as compared to individual African countries, except for South Africa and Tunisia. The fewer number of articles on assessing research evidence from Africa indicate limited availability of evidence regionally and nationally on different subjects to inform future research direction, research performance of different research communities, funding allocation and return on investment, and to avoiding duplication of effort (Confraria & Godinho, 2015; Sooryamoorthy, 2020; Wenham et al., 2021). This result substantiates Confrarias and Godinho's observation that there exist limited studies that analyze science from Africa (Confraria & Godinho, 2015). They two further observed that most studies focus on countries with higher levels of scientific publications and impact globally, and rarely examine smaller ones, thereby missing out on insights of their performance

and reasons for underperforming (Confraria & Godinho, 2015). In order to avoid missing many African countries, which already rarely appear in global level studies, this study only focused on those studies that reported on African countries, excluding studies that combined African countries with non-African countries. This approach made some smaller countries salient on coverage and citation impact, and further revealed countries which are completely missing on coverage and impact studies.

In addition, WoS and Scopus have very limited coverage of African health science journals than does AJOL and AIM as shown from both the scientometric study and analytical cross-sectional study results of this thesis. For instance, this study found that only 12% of African journals were indexed in WoS, compared to 52% of Western European journals. This difference means that publications in African journals are less visible to the global WoS audience, hence are less likely to be cited, reducing their contributions to global citation metrics and, consequently, their perceived impact. Generally, the underrepresentation of African health science journals in major citation databases results in a skewed perception of global research productivity and impact.

These findings resonate with those of recent studies by Asubiaro and Onaolapo (2023) that reported WoS and Scopus covering less than 8% of all African journals, and Asubiaro (2023) which established that Scopus, WoS and MEDLINEMEDLINE cover nine, and seven each of the SSAs biomedical journals, respectively. Unlike Asubiaro's study, the present study focused on PubMed other than MEDLINE, and found slightly different results of indexing coverage of African journals; PubMed (26%), Scopus (16%) and WoS (12%). MEDLINE is a major subset of PubMed, making it bigger to MEDLINE hence the difference in results. The difference may also be attributed to geographical coverage considering that the present study focused on the whole of Africa, while Asubiaro study focused on SSA. Lastly, considering that journal inclusion is evaluated regularly, differences in journal coverages could exist as old journals are removed and new journals are being added.

In addition, this study found that 40 African countries did not have any health science journal indexed in WoS. This limited coverage revealed global inequities in knowledge dissemination that require urgent attention by all stakeholders. These inequities likely stem from historical and systemic barriers, including unequal access to resources, technical expertise, and international networks required for journal indexing. A detailed discussion of contributing factors is presented

below in section 5.4. The lack of indexed journals perpetuates the exclusion of these countries from global health research dialogues, affecting their influence on health policy and practice. Furthermore, the absence of African journals in WoS and Scopus underscore the importance of regional indexing systems, such as AJOL and AIM, in bridging the visibility gap for underrepresented regions.

Through the postcolonial lens, this exclusion can be interpreted as a continuation of historical marginalization; the global North dictates standards that the global South struggles to meet. Whilst within The Payback Model, it reveals the missed opportunities for societal, economic, and health benefits that could arise from improved visibility and utilization of research outputs from these countries. It further highlights the effect of unequal distribution of research resources, which are inputs in research to realize all other benefits.

5.2.2 Common data sources for research evaluation

Likewise, this study found that regional journal indexing services, namely AJOL and AIM, that index majority of African journals are rarely used as data sources for research evaluation of African health research. For instance, despite indexing 27.7 % of African health science journals, AJOL is underutilized due to the lack of citation data for scientometric analysis. The study found that PubMed, followed by WoS and Scopus, are the common data sources used for measuring research evidence from Africa. This rare usage of regional indexing services that cover majority of African health science journals has many implications on which evidence do practitioners, researchers and policy makers base their decisions on when they need African health science evidence, if not evidence published in African journals. This may mean that they depend on little visible evidence available through these major and popular databases, leaving out a wealth of evidence available through other sources.

Our findings agree with previous studies which also reported PubMed, WoS and Scopus as common data sources for bibliometric and scientometric studies for African health research (Asubiaro, 2023; Asubiaro & Onaolapo, 2023; Ezema & Onyancha, 2016; Ogunfolaji et al., 2022; Pranckutė, 2021; Selemani et al., 2023). One explanation for the rare usage of AJOL and AIM could be that they do not provide data in formats that are rendered bibliometric and scientometric analyses friendly, they do not support advanced structured searches, and they do not provide data that tracks research (Asubiaro, 2023; Selemani et al., 2023).

The study also established inequities in knowledge production and dissemination within Africa; Nigeria, South Africa, Egypt, Kenya dominated the number of journals covered in the databases under study. A number of countries were also completely missing; without a single journal in any of the databases. These findings resonate with those of a similar study by Asubiaro and Onaolapo (2023) which established that four countries contributed majority of the journals covered in Ulrich web directory and AJOL. They further reported that 14 African countries did not even have a single journal covered in these databases. In another similar study focusing on SSA and coverage of biomedical journals in AJOL, MEDLINE, AIM, WoS, Scopus, and EMBASE, it was reported that 23 countries did not have a single journal covered in these databases while the same countries except Egypt being replaced by Ghana (because Egypt is not in SSA), were the major contributors of journals (Asubiaro, 2023). Studies by Ogunfolanji, Ezema and Ochanya, Uthman report the very same few countries as dominating the arena of knowledge production and dissemination in Africa (Ezema & Onyancha, 2016; Ogunfolaji et al., 2022; Uthman et al., 2015).

Differences in economy, population, health research investments, and education levels were some of the suggested reasons for this dominance (Asubiaro, 2023; Asubiaro & Onaolapo, 2023; Ezema & Onyancha, 2016; Ogunfolaji et al., 2022; Uthman et al., 2015). This reveals similar inequities seen at global level within Africa in knowledge dissemination. Abimbola and Pai agree that there are also inequities or differences within Africa that need to be dealt with while making efforts of decolonizing global health, and bring equity in knowledge production and dissemination (Abimbola & Pai, 2020, 2021). Therefore, the effort to bring equity should not only be between global north and global south but also within global south. One possible way this could be achieved is through partnership and collaboration within global south countries.

5.2.3 **Scholarly impact and research indicators used**

Furthermore, the study established a gradual increase in productivity and scholarly impact of Africa's health science research, based on reports from reviewed studies. This is supported by a number of studies that report an increase in productivity and citation impact of Africa's research (Uthman et al 2015; Thelwall 2017; de Jager et al, 2020; Ezema & Ochanya, 2017; Chuang et al., 2011; Confraria & Godihno, 2015). Another key significant finding of this study is that the common research indicators or metrics reported in the studies reviewed were focused on research productivity, dominant research topics and collaboration networks, as compared to citation impact

and funding. There could be different reasons for this but one possible explanation would be due to absence of metrics, as few journals are covered by data sources which provide popular metrics such as JIF and Scimago. There were very few countries with journals indexed by WoS and Scopus, and there were also few journals that qualified to have metrics reported. Majority of the journals had H-Index by google scholar.

Proper selection of research indicators, description of indicators and use of multi-dimensional indicators are recommended as best practices in research evaluation studies (Cabezas-Clavijo & Torres-Salinas, 2021), hence its absence and limited coverage made it hard to make meaningful performance comparisons between countries and journals from Africa. Nevertheless, there were a number of studies that reported a gradual increase in research productivity from Africa at author level, institutional and country level. This lack of data on metrics due to poor coverage of African research in WoS and Scopus, may also under-report productivity and influence of African health science research at global level.

In the light of the Payback Model, limited coverage of African health science journals in major indexing services, and exclusion of African indexing services in evidence synthesis is a significant barrier that limits visibility of African health science research to realise different 'paybacks'. The absence of African journals means that reseach published in these journals or indexing services is invisible to policymakers and healthcare practitioners which, in turn, reduces its ability to influence policies and practice to achieve scientific and societal 'paybacks'. Additioanally, it limits its ability to contribute to global scientific discourse. It also limits capacity building 'payback' because research visibility and metrics raises profile, and attracts funding and collaboration. Generally, the lack of metrics limits ability to measure, evaluate or demostrate value and influence of African health science research.

Through the post colonial theory lens, the systematic exclusion of African health science journals from major indexing services perpetuates colonial epistemic hierachy and marginalisation of global south evidence (Abimbola & Pai, 2020; Diego Chavarro & Ràfols, 2017; Kulesa & Brantuo, 2021). The first perspective views global north research as valid and valuable, while the second perspective views global south research as "local" evidence, with global north evidence as international or global evidence (Khan, 2022). It unnecessarily positions the global south as a

passive receiver, that contributes nothing to global knowledge discourse, while global north voice matters in the public health discourse.

5.3 Factors associated with journal coverage in WoS, Scopus and PubMed

The study further established factors associated with indexing in WoS, Scopus and PubMed to test the claim of biases. It was found that having international editorial board, international authorship, title and abstract in English, were associated with a journal being indexed in these databases. Furthermore, the study found that journals from Africa had lower chance of being indexed by the three databases as compared to journals from western Europe. For instance, journals with international editorial boards were 3.5 times more likely to be indexed in WoS, while journals from LMICs had 40% lower odds of inclusion. This result agrees with a previous study by Chavarro et al. (2018), which found that similar standards (language, age, geographical location, meeting editorial standards, and scientific impact) were also associated with a Latin American, Spanish and Portuguese journal being indexed in WoS. Hence, they concluded that inclusion of journals in WoS may not completely be objective as both objective (universal standards) and contextual standards (particularistic or ascribed characteristics) were associated with a journal being indexed in WoS. Similarly, this study can neither confirm nor deny the assertions that inclusion is completely objective or biased based on geographical location and language considering that not all standards used were assessed. Additionally, some data are not publicly available to establish reasons for exclusion (Chavarro et al 2018). More importantly, it is because this study suggests an association, and not causality, between depend and independent variables.

However, the present study empirically contributes to evidence that there is adherence to these objective standards for inclusion as it established that an African health science journal had higher chances of being indexed by the three databases when they fulfilled the key editorial standards required for indexing as compared to those journals that did not fulfil these standards. This partly attests to the assertions that WoS and other major databases such as Scopus and PubMed apply rigorous high editorial standards to include a journal in its databases (Chavarro et al., 2019). Another question to be addressed, based on IDIs, is whether these standards are really about quality of science, or journal sustainability or business sustainability, and or are fair to different contexts of journals. The qualitative study explored the perceptions of African journals editors on the role of some of these standards. While agreeing with the crucial role played by some of these standards

to uphold quality of science, they questioned some standards' utility. They also called other standards as unfair to African scholarship environment, and very hard to meet due to contextual challenges.

Previous research has often questioned the transparency and consistency of indexing criteria used by international databases like Scopus and WoS (Chavarro et al., 2019; Ezema & Onyancha, 2016). Therefore, the present study contributes new empirical evidence that both supports or challenges these concerns by analyzing the credibility and application of these standards across African journals. Unlike prior studies that focus on single-country, non-discipline specific journals or Latin American context, this thesis provides an African region-specific analysis and discipline specific analysis that reveals discrepancies in how indexing standards are perceived and applied in African contexts. These findings suggest a need for clearer, context-sensitive indexing guidelines and raise critical questions about the potential for systemic bias in global journal evaluation.

The study also established that journals from lower economic status countries had lower likelihood of being indexed than those from HICs. The IDIs contextualized this problem demonstrating that countries with lower GNI face systemic challenges in fulfilling editorial standards. This was also demonstrated by the lack of indexed journals from 21 African nations. Previous studies report that a nations GDP was a major determinant of research productivity (Uthman et al., 2015), and African countries with better GDP had higher productivity and citation count (Bloomsfield et al., 2015). Perhaps, economic status is a significant factor that deters the majority of African journals to meet the key criteria for indexing. Furthermore, this may also explain the findings on geographical coverage bias, whereby countries from poor economies had limited coverage in these databases. There is no enough evidence from this study to make such conclusions but results are just suggesting an association. This finding concerning economic status should also be interpreted with caution because there was multicollinearity between country and economic status; all countries from western Europe were in the HICs category, and no country from Africa was in HICs category, with only few in MICs category, and with majority in LMICs category. Additionally, there was a big difference in sample sizes, with western European journals having more journals as compared to African journals, which may have affected statistical power to detect true difference.

This thesis also makes a novel contribution by introducing a comparative element that evaluates African journals alongside western European journals. This comparative approach is less common

in existing literature, which tends to treat African journals in isolation (Asubiaro & Isioma, 2022; Asubiaro & Onaolapo, 2023; Ezema & Onyancha, 2016; Ogunfolaji et al., 2022). The analysis highlights major differences in journal coverage by international databases between the two regions, suggesting systemic challenges facing African journals. This disparity challenges the universality of global knowledge by marginalizing context-specific insights from Africa. In addition, this major difference and underrepresentation of African journals in international databases has negative implications for African research. When African journals are not indexed, their research output may be perceived as less credible, regardless of actual quality. Consequently, the practice of African researchers prioritizing publishing in European journals will continue, thereby perpetuating underrepresentation of African journals and voice, and potentially shifting Africa's research agendas toward topics of interest to global audience rather than local audiences.

In addition, having a title and abstract in English clearly demonstrated language coverage bias as it showed to be a significant factor for indexing in both univariate and adjusted odds ratios. This is a requirement for inclusion in these databases claiming that its audience should be able to, at least, read the contents. However, there are different audiences for the databases that would still benefit from journals in other languages other than English. Multilingual abstracts, as seen in AJPP supported journals, can expand accessibility while retaining global relevance. Aside the justification of science communication, one may see this more as a business strategy than a standard to uphold scientific quality. Previous evidence shows that WoS, sometimes, make coverage decisions based on commercial interests to meet needs of its users (Testa, 2011).

Through the postcolonial lens, the major factors associated with indexing or exclusion, shows structural or systematic inequalities in systems that disadvantage the post-colonial settings. The dominance of global norths is seen as a result of colonial legacies that maintain a system which upholds supremacy of global north or HICs dominance in scientific and academic institutions, knowledge production and dissemination (Abimbola & Pai, 2021). For instance, the dominance of English language relates to the aspect of colonial discourse which analyzes the use of language to justify and perpetuate colonial dominance. By making this a requirement, African journals are forced to use English language to get indexed in the western originated indexes.

5.4 Barriers, facilitators and opportunities to journal indexing and scientific impact

The issue of barriers, facilitators and opportunities to journal indexing and scholarly impact of Africa's health science research is complex and multifaceted. Realizing that some factors are ambivalent, the discussion will follow major themes that categorize the factors and their relationships on how they affect other factors.

5.4.1 Post-colonial effects/influence

One of the significant findings of this study is the effect of post-colonial legacy as lens through which barriers and facilitators could be clearly seen. For instance, results showed collaboration patterns between Egypt and Middle Eastern countries, reflecting historical and linguistic ties, while Madagascar has no African collaborations, highlighting fragmentation. The study has established that the influence of post-colonial legacy affects many areas of African health science research including funding, collaboration, language, identity (us versus them), academic culture and values, attitude of researchers/authors, and setting research agenda. Confraria and Godihno (2015) observed that the legacy of colonial science affects partnership and collaboration of African researchers with the former colonial masters. This study observed that external funding of African health science research that comes through grants, partnerships and collaborations, affect African research through dominance in setting up research agenda, authorship rules, and publishing avenues. This finding agrees with a number of studies that report negative side effects of collaboration between global north and south in research (Voller et al., 2022; Confraria & Godihno,2015;). Through funding, Africa's health research agenda is driven by the call for grants and requirements of funders in subject areas or health challenges they (Grantor) are willing to fund. This trend sometimes affects local relevance of health research conducted in Africa which fails to address priority health challenges. As Abimbola and Pai (2020) observes that the savior/colonizer has the resources while the saved/colonized has the right information and insights on how to address their own problems, but the problem comes in when the colonizer devises the solutions alone.

In addition, one of the aspects of post-colonial theory is neocolonialism, which is the economic dominance of the former colonial masters over their former colonies. This is achieved through direct funding to governments and loans, and grants to researchers and institutions and even

governments, which sometimes come with conditions to be adhered to. The decolonization of African global health movement questions the power imbalances that come with this kind of relationship, and advocates for equity (Abimbola and Pai, 2020; Khan 2022; Kulesa and Brantuo,2021; Singla et al.2021). It aims at unmasking the deep- rooted inequities, biases, elitism and racism that scourge global health (Khan, 2022). This study finding agrees with previous studies in that the editors, just as global south researchers, prefer to be treated with mutual respect at the partnership table, and that each party's contribution be valued, not simply value the financial power and geographical location (Voller et al.2022; Molosi-France & Makuni,2020).

Therefore, decolonising indexing would require practical reforms that challenge these colonial legacies. Firstly, major indexing databases should adopt inclusive metrics that recognise local relevance, societal impact, and policy uptake alongside citation counts. Secondly, all these major databases should adopt multilingual model in abstracts, including African languages and French/Portuguese for Francophone and Lusophone countries so that English only research should not have an upper hand. Finally, regional-led indexing systems such as AJOL and AIM should be incorporated in these databases just like WoS includes other databases aside its core collection such as Korean database, MEDLINE, BIOSIS previews. This aims at improving visibility without trading local standards over western standards.

From the perspective of Post-Colonial Theory, investigating indexing criteria uncovers how epistemic hierarchies reinforce structural inequities in knowledge production, privileging Western standards while marginalising African scholarship. The proposed practical reforms such as multilingual recognition, inclusive metrics, and regionally defined standards, challenges these colonial legacies and advances decolonial alternatives. From the Payback Model, the reforms highlight the missed opportunities for societal and health benefits when locally relevant research remains invisible in global indexing systems. Improving inclusivity in journal evaluation would allow African research to yield greater "payback" not only in terms of academic citations but also through improved health policy, service delivery, and capacity-building outcomes.

Validation and prestige

This study also established that, beside economic legacies that colonial masters left, there exist sociocultural influences that affect the academy such as seeking validation from global north, and earning prestige when recognized by the global north or when one publishes with a global north

journal. Editors observed that African authors prefer publishing with and reading global north journals, and even citing global north literature over African health journals, despite African journals being of good quality too. This practice hampers growth of local journals and also prevents relevant research to be disseminated through the most relevant channels with the right audience. Perhaps one reason is the perceived high quality of global north journals as they are popular and are regarded high impact journals. The decolonization of global health literature calls this elitism and supremacy in knowledge production and dissemination by the global north (Abimbola and Pai,2021; Khan,2022). Science, especially in biomedical and health fields, is globally oriented causing researchers to live as a global community. However, there are unique health challenges faced locally that require research that informs decision making, policy and practice which may not be relevant to other regions such as global north. Additionally, it is the global north evidence that matters in the global health discourse due to their higher visibility and scientific impact.

Identity and Otherness

Furthermore, the issue of origin of indexing services, which is dominated by the global north creates identity factions: "Us" versus "Them". There were numerous mentions of indexing services, journals and researchers from global north as "them" while referring to African as "ours", "us" or "local". The "us" versus "them" mentality reflects the colonial legacies which maintains the global north as standard bearer of quality and impact, while research from Africa is marginalized and seen as peripheral (Abimbola & Pai, 2021). This finding reveals an underlying reality that despite calling major indexing services global or international, they are perceived as platforms that are systematically and structurally designed to serve a certain community, as they are said to be biased against non-western countries, non-English journals, and research from specific disciplines (Asubiaro & Isioma, 2022; Diego Chavarro & Ràfols, 2017).

However, this study established that the "us" versus "them" mentality offers opportunities to develop alternative forms of impacts, and indexing standards beyond the western-centric metrics and standards. This is because the current methods fail to measure other forms of impact that may be relevant or more common in other contexts (Diego Andrrs Chavarro et al., 2017; Diego Chavarro & Ràfols, 2017). For instance, an African journal may have a community impact or addressing local health outcomes even if it is not widely cited. Additionally, it also offers opportunity to develop more inclusive indexing services that prioritize journals from global south

to shift the power balance in knowledge production and dissemination. Along the research impact pathway, it also allows accounting for the other dimensions of impact beyond scientific impact domain. Through the post-colonial lens, it allows diversity and democratization of knowledge production and dissemination (pluriversalities), by allowing other forms of knowledge and impacts other than only the global north way (Adegbulu & Wynter, 2020).

5.4.2 Partnership and collaboration

The study established that partnership and collaboration is a multifaceted factor; the good side which is a facilitator, and the bad side which is a barrier. As a facilitator, this study finding agrees with evidence from literature that much of health research activity in Africa is thriving due to international collaboration through funding/grants, and resource sharing (Fonn et al., 2018). This partnership and collaboration extends to journal partnerships between global north and African countries, like the African Journal Partnership Programme (AJPP) (Bickton et al., 2019). The study found that projects such as AJPP and similar programmes have helped to improve quality of African journals to achieve indexing in major citation databases (AuthorAID, 2016; Bickton et al., 2019; Fonn et al., 2018;). From the payback model perspective, this partnership and collaboration is yielding "paybacks" of capacity building and scientific impact as immediate benefits, translating into long term societal benefits as skilled labor-force, and evidence that influences policy and practice of public health.

In addition, the study established that much of the collaboration is international, specifically between the global north and Africa as compared to within Africa. Perhaps due to funding issues, because most African governments do not invest much in research. The study also showed how colonial legacies shape research networks through collaboration. For instance, results showed that north African countries such as Egypt had strong ties with the Middle East countries, while South Africa, Kenya and Nigeria showed strong ties with European countries, perhaps due to the historical and linguistic ties. The historical ties left long lasting partnership regarding institutions such as universities, and hospitals that continue to partner with former colonial masters. This agrees with a study by Chuang et al.(2011) which reported international collaboration between African researchers and global north countries (north American and European countries), possibly due to African country's familiarity with European languages(French and English), proximity to Europe, and past colonial history.

A study in Ghana reported that the major reason for collaboration with "outsiders" (global north) by Ghanaian researchers was a source of research funding (Owusu-Nimo & Boshoff, 2017). Through the collaboration, African researchers also benefit by gaining knowledge and skills either through training, exchange visits or mentorship from the global north partners. This builds research capacity that may also translate to other domains of impact along the research impact continuum. Literature reports international collaboration as a determinant of scientific impact in the global south when African researchers partner with the global north researchers (Confraria et al., 2017). Some authors reported that international collaboration enable payment of APCs to publish in open access journals, hence a determinant of scientific impact (Breugelmans et al., 2015; McManus et al., 2023).

This also corroborates with a study by Akudinobi and Kilmarx (2022) that aimed at assessing capacity building in LMICs (specifically SSA) by measuring authorship position as indicator of equity in research partnerships in research funded by the Fogarty International Center (FIC) of the US National Institutes of Health. The FIC is an institution with a mission of training and capacity building in LMICs. The study reported an increase in first and last authorship for SSA authors between 2008 and 2020, suggesting an increase in equity in research activities, and also demonstrating an increase in building research capacity, and research impact in SSA.

However, the authors acknowledged that this may not be enough evidence to show that there is equity for several reasons. First, there were more first author positions than last author positions from SSA, and there were differences in authorship position significance between the US and SSA; first author position is important in SSAs while last position (senior authorship) is significant for US authors. Similarly, publications with highest impact (citations) still had US first author position which they attributed to several potential reasons: high impact journals biased towards US affiliated authors and against SSA authors, and perhaps that SSA authors may require additional training in writing and publishing in high impact English papers. They added that US authors, perhaps, published primary outcomes while SSA authors published secondary outcomes because the grants are usually given to US researchers, with SSA researchers just being sub-granted (Akudinobi & Kilmarx, 2022). More studies are required to determine underlying reasons for the increase in first and last authorship position, and determine if these types of collaborations yield the perceived 'paybacks'.

While sub-granting SSA researchers is helping in building research capacity in Africa, this practice has unequal power balance leading to barriers for African researchers and research as observed by Akudinobi and Kilmarx, and also established by this study. Findings from IDIs of this study reflected on this unequal power balance affecting research capacity, and research impact for African researchers. The editors perceived African researchers as being exploited or abused during these unequal partnerships or collaborations. This study revealed that the other side of collaboration has seen unequal partnership and collaboration, by which one partner is superior or dominant over the other. Usually, the funder or global north partner is the dominant partner as they are responsible for providing resources. As one participant called it, 'helicopter research' causes African researchers to be reduced to data collectors and the data is taken by the senior partner back to the global north.

Consequently, the dominant partner or collaborator influences avenues of research dissemination, narrative of research results, authorship, and research agenda. Senior or first authorship may also influence how the story is told or its narrative, which results in African voice being hushed or diluted. While this study acknowledges that partnership and collaboration, especially between global north and Africa, is facilitating journal indexing and scholarly impact of Africa's public health research on one hand, there is still a lot of work to be done in bringing equity in collaborations and partnerships. This will reap the benefits of collaboration and partnership while minimizing the negative effects.

Chu (2014) made several recommendations on what African researchers can do to maximize the benefits of collaboration, after seeing inequality in global health research collaboration. Some of the recommendations include: developing long-term, equitable partnerships with HIC institutions; implementing mentorship programs between twinned institutions to transfer skills and build trust; pairing HIC health care institutions with African counterparts to transfer clinical, teaching, and research skills; and strengthening local capacity through South-South collaborations and regional partnerships. During IDIs, this study also established south-south collaborations as one opportunity that needs to be explored. Editors suggested that African research and editorial regional hubs can enable resource-sharing and mentorship, reducing reliance on the global north. For instance, there are some successful journals from South Africa and Egypt with high quality editorial standards and better reputation, which other newly established or struggling journals can

benefit from. Based on the Post-colonial theory, the decolonization of global health literature recognizes the contribution of Africans in allowing the global north hold the position of supremacy in knowledge production and dissemination, hence calls for African researchers to stand against any form of exploitation from unequal partnership and collaboration.

5.4.3 Resources and training

The study established that the issue of lack of resources is a major challenge to journal indexing and scientific impact of African health science research (Akudinobi & Kilmarx, 2022; Arabi, 2021; Asfaw et al., 2021; Baobeid et al., 2022; Boyce et al., 2015; Dahdi et al., 2018; Denguir et al., 2018; Mouako et al., 2022; Mugomeri et al., 2017; Mwendera et al., 2017; Ogunfolaji et al., 2022; Trotter et al., 2014). Along the research impact payback model, resources determine the direction of 'paybacks' as they help build capacity. Availability of resources enables journals to achieve indexing and scholarly impact, while lack of resources deters attainment of standards and requirements to achieve journal indexing and scholarly impact (Ogunfolaji et al., 2022). This also includes attainment of all the other domains of paybacks. Thus, apart from knowledge production and dissemination in which journal indexing and scholarly impact falls, availability of resources also influences domains of research capacity building, policy, health, economic and societal benefits. For instance, availability of resources would enable journals build necessary infrastructure, train its editorial team and even potential authors to meet high editorial standards enabling them index with reputable indexing service, thereby increasing visibility and impact of their research. Reciprocally, journal indexing and scholarly impact increases credibility of research profile hence attracting more funding and investment in research.

Resources may include both monetary and non-monetary such as grants, direct funding to research and journals, knowledge and skills, exchange visits and journals partnerships, technological infrastructure (website, article submission and processing software), and access to electronic information resources for research (Trotter et al., 2014). The study established that most African journals underperform due to lack of capacity, including appropriate infrastructure such as article submission platforms, and dedicated operations office with dedicated editorial journal staff members. Usually, they rely on volunteers to review articles, editorial responsibilities, and basic editorial formatting, while some global north journals have dedicated full-time employed staff

members doing similar jobs. The study found that majority of African journals are sponsored by universities hence lack funding to run operations of the journal.

In addition, some contextual factors such as countries GNI, health expenditure budget can influence ability to conduct and fund high quality research that influence submission rates. Results from the cross-analytical study and IDIs revealed a relationship between journal indexing and some contextual factors. Without suggesting causality, this finding agrees with a study by Wenham (2021), which also established a strong correlation between GDP and health science research performance on different indicators across 54 African countries, Similarly, Uthman (2010), established a strong relationship between research productivity in HIV and country's GDP, suggesting that economic status of a country is an influencing factor. Furthermore, education level may have an influence as participants discussed differences in number and quality of scientist who can conduct research and submit quality papers. In addition to the few number of specialists in different fields, there is a challenge concerning skills for writing scientific papers (Bickton et al., 2019; Uthman, 2010; Uthman et al., 2015). Results of the study from the scoping review and IDIs established that the few that can contribute to research and publications, mostly in universities, have workload burden to teach, instead of conducting research coupled with low pay to survive, hence resort to focus on consultancies.

These factors just show systemic challenges that exist in LMICs that affect research capacity, journals capacity, and influence of African health science research. Some of these factors are beyond the capacity of the journals and researcher, hence a need for a holistic approach to address them, spanning several sectors of development (Trotter et al., 2014). These findings agree with a study by Igumbor et al. (2020) aimed at building research capacity in African institutions through PhD training. They reported higher research productivity by fellows from or affiliated to consortium from South Africa, Nigeria, and Kenya as compared to other participating countries; attributing economic development and education levels as possible influencing factors.

While acknowledging poor research writing skills among African researchers, some editors highlighted this as 'language bias', which corroborated with scoping review findings making it a barrier (Akhaddar, 2019a, 2019b; Akudinobi & Kilmarx, 2022; Arabi, 2021; Baobeid et al., 2022; Ben Saad, 2020; El Bairi et al., 2021; Onyeka & Chukwuneke, 2014; Uthman, 2010; Zoukal, Ben Abdelaziz, et al., 2019). They called for need to accommodate other languages by employing

language experts for journals and indexing services to either translate or review other languages. Even though some editors acknowledged English language as language of science, and the role it plays to communicate research findings, they also thought it is unfair to compare a native English speaker, with a non-native, hence a non-native may require assistance in writing skills, and not necessarily the science. This makes knowledge dissemination biased toward native English speakers as only their voice will be heard, while non-native will be challenged with writing in English.

From the post-colonial point of view, these study findings highlight the inequalities in resource distribution between global north and global south. For instance, the lack of financial resources for the global south limits their ability to index journals in prestigious indexing services, thereby limiting their ability to disseminate research findings globally, further perpetuating the marginalization and underrepresentation of global south health research. Similarly, the availability of resources in the global north enables them to have their research disseminated through prestigious indexing services which increases their visibility and influence. These two distinct sets of journals from global north and global south with huge resource inequalities are expected to meet same standards and compete on the same market. This results in imbalance in power dynamics in knowledge production and influence, as absence of research or journals from global south is seen as an indicator of lower quality research or peripheral research.

Furthermore, results from the scoping review and IDIs revealed that local research funding is a facilitator, and an opportunity to improve impact of African health science research. When research is funded locally, it addresses priority local health challenges, and it also deals with challenges on publishing avenues, authorship and local narrative of African health research. A number of studies have shown local research funding as a facilitator of research impact (Bloomfield et al., 2015; Dahdi et al., 2018; Denguir et al., 2018; Ezema & Onyancha, 2016; Marsh, 2019; Mouako et al., 2022; Musa et al., 2022; Mwendera et al., 2017). However, the investments in research by local governments are very limited, because of competing interests such as poverty, education, hunger (Fonn et al., 2018).

5.4.4 Cost of indexing and APCs

One more significant finding emerging from this study is that, due to complexity of the challenges faced by African health science journals, running an Open Access journal through the diamond

model is backfiring instead of attracting article submissions, facilitating visibility and impact of Africa's health research. While the model is implemented in good faith, considering local challenges faced by African authors to pay for APCs, the perception by authors is that 'free things are of poor quality' hence still resort to publish with journals that ask for a considerable amount of APC. African authors and journals already operate in resource constrained environments for them to pay for APCs and run operations, respectively (Bickton et al., 2019; Ogunfolaji et al., 2022). To balance the two, is the paradox to be solved.

The proliferation of predatory journals, which are not usually indexed by the major indexers included in this thesis has also contributed to this perception, to some extent (Bickton et al., 2019). There is growing fear of Open Access journals that ask authors to pay so that reader does not pay, to increase visibility and access. Predatory journals do not have a rigorous peer-review process hence they undermine quality and credibility of published research. Literature reports that many LMICs journals that do not meet indexing requirements due to capacity limitations and the fact that they are operating as OA, are erroneously lumped together with predatory journals (Bickton et al., 2019).

While some indexing services do not require direct indexing costs to include a journal, the costs incurred to meet the requirements hinder African journals to achieve indexing with globally recognizable indexing service that offer higher visibility. Results from the DCE agreed with IDIs on that higher cost of indexing was a deterrent to choosing an indexing service or ability to index. Perhaps, this justifies the suggestion from IDIs on the development of local indexing services that respond to local challenges or standards that appreciate challenges faced by African journals without compromising quality of science. The significant variability in preferences for cost and visibility suggests that indexing services must adopt flexible pricing models and tailored visibility strategies to accommodate diverse journal needs. In addition, the deterrent effect of cost underscores the financial constraints faced by many journal editors, particularly those managing low-resource journals. High indexing fees may prevent these journals from gaining visibility, reinforcing inequalities in scholarly communication. This finding highlights the need for affordable or subsidized indexing services to ensure equitable access to global research networks

Through the lens of post-colonial theory, financial limitations faced by African journals hinders their ability to index with Western-dominated indexing services thereby limiting visibility and

impact of African health science research. In addition, financial constraints faced by African countries affect their capacity building along the payback model impact pathway.

5.4.5 Indexing standards and indexing service preferences

Interviews and the DCE results addressed issues of indexing standards to achieve indexing with these popular indexing services, which are critical paths to visibility and research impact paybacks including immediate and long-term benefits. The study established that visibility of a journal is the most important attribute that editors consider to decide which indexing service to choose, followed by reputation and metrics. The DCE results corroborated with IDI results in which editors considered visibility as their major reason for indexing, while reputation and metrics played the role of attracting submissions from authors, and also readers. The prioritization of visibility over other attributes suggests that journal editors may perceive international indexing services as more credible than regional databases. During IDIs, one editor mentioned that this perception is driven by demands of authors as they perceive journals indexed in international databases as credible and of higher quality. This could reflect concerns about the limited recognition and impact of regional platforms like AJOL and African Index Medicus, which are often excluded from major academic rankings and funding requirements. As a result, editors may prioritize visibility in globally recognized databases (e.g., Web of Science, Scopus) to enhance their journal's reputation and attract high-quality submissions. Given the strong preference for visibility, regional databases like AJOL should prioritize strategies to enhance global discoverability, such as integration with international platforms like Scopus or WoS.

This aligns well with the payback model, demonstrating the importance of visibility at knowledge production and dissemination stage as a step to realize "paybacks" or impact. From the post-colonial theory lens, this is a critical barrier to African health sciences journals because Journals from Africa struggle to gain visibility, reputation and metrics in the global north dominated indexing services. Thus, the dominance of global north indexing services hinders the reach of public health research from Africa perpetuating inequities in addressing health science communication.

The preference heterogeneity shown from the DCE results suggest different choices or priorities of African editors based on their unique journal needs, backgrounds, or institutional contexts. Results from the IDIs also called for indexing services that meet unique needs of journals such as

those in Africa or those that are just beginning. Furthermore, giving these journals same requirements to compete with well-established journals or journals from global north with unequal distribution of resources was perceived to be unfair. Therefore, developing more indexing services with different standards, and services may help meet unique needs of journals that reflect their realities and goals. This may reflect different stages of the journals with different needs and strategies; new journals and well-established journals may have different emphasis. For instance, Chavarro (2016) recognized that local indexing services may act as building ground for new journals to grow, and fostering them to meet standards required by globally reputable indexing services like WoS and Scopus. The requirements and standards for these indexing services may differ from the major indexing services, but they should aim at improving quality of journals and research. African journals could adopt a phased approach, focusing on regional recognition initially and progressing to global benchmarks. Another option is what was adopted by WoS, creating Emerging Sources Index for new journals so that when they meet certain basic criteria, which is minus certain level of Journal Impact Factor. This aligns well with goals of post-colonial theory proponents to democratize science and provide equity to global health research.

In addition to developing new indexing services, there were also calls to develop alternative ways of measuring research that may respond to different contexts. This followed observations on the flaws of citation-based assessments and evaluations, and also that citation-based metrics were perceived as western-centric methods or giving advantage to the global north authors/institutions. For instance, although not highly cited or not published in high impact journal, an African research paper may have influenced health policy or practice locally but this would not be counted as impact, based on popular metrics. Perhaps the DCE results on reputation and metrics utility on determining choice of indexing service can be explained by IDIs perception that they are preferred because they help attract journal article submissions and readers. The metrics have become authoritative to the extent that they would still influence or affect someone in one way or the other, even if one does not agree with them (Beshyah, 2019; Le Roux, 2006; Roemer & Borchardt, 2015). This call agrees with literature on calls for alternative ways or methods for research assessment (Diego Chavarro & Ràfols, 2017; Greenhalgh et al., 2016; Milat et al., 2015). Chavarro and Rafols (2017) assert that uniform assessment of research based on western-centric metric does not account for socially, environmentally, and economically relevant research even if it is not cited or published in high impact journals.

On social media as an opportunity for alternative methods of research dissemination, the study established that their role is to complement the journal articles or promote the journal articles. This is perhaps due to the policies in universities that do not recognize altmetrics as impact measure. The IDIs established that motivation for publishing was usually to get promotion/tenure or get validation, respect or prestige, hence using other sources of outlets would not score high for authors in Africa. Social media counts are prone to same pitfalls of citation metrics because they also rely on mentions, reads or counts.

Chapter 6: Recommendations and Conclusions

This study's findings have practice, policy and research implications, which if considered by various stakeholders in a coordinated manner, may enable the achievement of equity in knowledge production and dissemination that could, in turn, help address health challenges based on visible and readily available relevant evidence.

6.1 Implications for practice

6.1.1 Encouraging African authors to publish in local channels through incentivizations:

African authors should be strongly encouraged to disseminate their research findings through local journals and platforms. This recommendation is unlikely to materialize unless it is complemented by change in university or academic policy that recognizes the contribution of local research and publications in academic tenure and promotion criteria. The study established that African researchers tend to prioritise publishing in western journals for three reasons, namely validation and prestige; their wrong attitude that western is synonymous with goodness; their wrong attitude that within the concept of fully OA journals, free is synonymous with non-expensive or cheap; and tenure/promotion policies that prioritise high prestige and internationally indexed journals. African researchers may be made to feel strongly encouraged to utilize local journals and platforms by creating structures for incentivizing them to do so e.g. by giving them awards and funding tied to local dissemination. A successful model is South Africa's research output policy through which the country's government incentivizes researchers to publish in accredited journals, which has also helped improve local journal quality. While publishing in international journals offers prestige and wider visibility, it is crucial to recognize the importance of communicating research to local audiences who are more likely to benefit from it, e.g. by applying the findings. With the increasing online presence of journals and indexing services, African research published in local journals can still gain global visibility. Moreover, publishing in local journals helps to strengthen the African research ecosystem, build local research capacity, and to ensure that research priorities are aligned with local needs.

6.1.2 Importance of consulting multiple databases when searching for evidence:

When conducting evidence synthesis or literature review, it is essential to consult a wide range of databases to ensure comprehensive coverage of relevant literature. Relying solely on major

international databases such as PubMed, Web of Science, or Scopus may result in missing important evidence from Africa as these databases have limited coverage of African journals. This study established that only 15.9% of African health science journals are indexed in Scopus,12.1% in WoS, 26.2% in PubMed, 27.7% in AJOL and 24% in AIM. Researchers should make deliberate effort to utilize regional databases, subject-specific databases, and open access platforms during their literature review to capture a more diverse and representative set of literature.

6.1.3 Inclusion of regional indexing services in evidence synthesis:

Building on point 6.1.2, it is crucial to specifically utilize regional indexing services such as AJOL and AIM when searching for evidence from Africa. These services provide valuable access to a wide range of African journals that may not be indexed in major international databases. By incorporating these regional services, researchers can gain a more comprehensive understanding of the African research landscape and ensure that important local knowledge is not overlooked.

6.1.4 Collaboration among African journal editors:

African journal editors should actively seek opportunities to collaborate, share experiences, and learn from each other. The study established regional disparities within Africa regarding journal indexing and journal performance. For instance, about 21 African countries did not have any journals indexed in all the databases under study, and countries such as Egypt, South Africa had more journals indexed in international databases. This implies that other countries can learn successful strategies from these better performing countries to improve their journal quality for international indexing purposes. The IDIs found that there was no regional collaboration to share expertise while the scientometric study noted that research collaborations between African countries and non-African countries outnumbered regional collaborations within Africa. Collaboration can take various forms such as forming regional editorial networks, organizing workshops or conferences, and establishing mentorship programs. By working together, editors can share best practices, address common challenges, and collectively advocate for the importance of African research. Collaboration may also involve resource sharing, capacity building, and the development of shared standards and guidelines for African journals.

6.1.5 Promoting national and regional journal indexers while maintaining standardization:

National and regional journal indexers play a vital role in increasing the visibility and discoverability of African research. Regional indexing systems such as AJOL and AIM provide a valuable alternative for enhancing the visibility of journals that do not meet the criteria of global indexing systems such as WoS. This study, for instance, found that only 12% of African journals are indexed in WoS and that as much as 40 countries do not have a health science journal in WoS. AJOL indexed 27.7 % of African journals, and had coverage of over 30 countries. However, 21 countries did not have any health science journals indexed by AJOL. There is need to actively promote and support these indexers in order to expand their coverage and impact while ensuring that these indexers maintain high standards of quality and adhere to international best practices in scholarly publishing. This can be achieved through collaboration with international indexing bodies, adoption of standardized metadata schemas, and implementation of rigorous evaluation criteria for journal inclusion.

6.1.6 Balancing local relevance and international standards in journal content and practices:

There is need for African journals to strive to strike a balance between maintaining local relevance and adhering to international standards. While it is important to address local research needs and priorities, journals should aim to meet global expectations for research quality, ethics, and reporting. This can be achieved by adopting internationally recognized guidelines such as COPE (Committee on Publication Ethics) standards, ICMJE (International Committee of Medical Journal Editors) recommendations, and discipline-specific reporting guidelines. African journals can enhance their credibility, attractiveness to authors, and impact on both local and global research communities by combining local insights with international best practices.

6.1.7 Integrate AI-Powered Indexing and Discovery Tools

African journals can do well to adopt AI-driven search and recommendation algorithms to improve the discoverability of African health journals in global databases. The present study established limited representation of African health science journals in international databases, which practically limits their visibility and accessibility. This AI driven approach will help promote discoverability of African health science journals regardless of their indexing status. In addition, African journals can collaborate with open-access repositories that utilize AI to categorize and

promote African research content. For instance, AI-based recommendation systems such as those used in Scopus and Research Gate can push African health research articles to researchers studying similar topics.

6.1.8 Utilise social media for knowledge dissemination and visibility

African journals need to be encouraged to develop active social media strategies to share newly published articles, engage with researchers, and increase readership. Promoting African health research through LinkedIn, Twitter, Research Gate, and Facebook, may ensure that findings easily reach global health professionals and policymakers.

6.2 Implications for policy

6.2.1 Enact deliberate policies to address post-colonial effects at global level

The study established that editors perceive the historical ties and unequal partnership and collaboration between Africa and the West as factors that perpetuate western dominance on Africa's research landscape. The need for deliberate policies that address post-colonial effects to change attitudes and practices of African researchers can thus, not be overemphasized. These policies should target the global level, beginning with international organisations such as WHO by letting African countries take lead in the prioritization of their health challenges. African governments and unions also need to develop deliberate policies that fund research locally and support and reward African efforts. Regional actors such as AJOL and AIM should deliberately enact journal accreditation policies that recognise local relevance such as malaria, HIV, or maternal health research as having same value with global standards such as journal metrics (citation impact). For instance, the path taken by AJOL could be expanded and scaled up to other research actors. AJOL has customised and contextually developed Journal Publishing Practices and Standards (JPPS) system, which rates journals on a scale from one to three stars to indicate quality. a model of such standards and they give stars recognising effort and developmental stage of the journal. Countries like South Africa and Egypt can pilot these policies such as local relevance of research. These could later be scaled up them up regionally.

6.2.2 Partnership and Collaboration policies

Related to the finding above, African governments and universities/research institutes need to develop policies that ably guide partnership and collaboration on matters related to data ownership,

authorship rules, and publication avenues. The policies, when properly designed, would act as guidelines for negotiating partnerships and collaborations between the global north and the global south to generate a power balance and equity concerning benefits accrued from partnerships or collaborations.

6.2.3 Tenure and Promotion Policies

The study suggests that university policies regarding the use of journal metrics or journal rankings should be revisited to judge the quality and impact of Africa's health science research during academic position recruitment, tenure and promotion decisions. This would possibly allow the development and subsequent utilisation of policies that encourage African authors to publish or disseminate their research output locally fruitfully. African universities also need to create deliberate policies that recognise publications in African journals. A handy example is the South Africa's Publishing Incentive Model which implemented a policy that rewards universities financially based on the number of articles published in accredited journals. This model has boosted the country's research output and it encourages local journals to pursue indexing in recognized databases such as Scopus and Web of Science.

6.2.4 Funding and Resource allocation policies

This study recommends establishing national and regional research funds for supporting journal operations, editorial training, and publication infrastructure. Such funds can successfully be created by encouraging Africa's governments and universities to dedicate some percentage of their research budgets to journal development. Other actors in this space include the African Development Bank, philanthropic donors such as the Wellcome Trust and Gates Foundation. Nigeria's National Research fund serves as a good model in this regard. Established by the Tertiary Education Trust Fund (TET Fund), the NRF provides grants for research projects and supports the development of academic journals to enhance the visibility and impact of Nigerian scholarship. Smaller countries such as Malawi or Uganda could integrate journal funding into existing health research budget lines. Governments and regional funding bodies should earmark at least 2–5% of research budgets to support the quality and sustainability of local journals, with a focus on strengthening digital infrastructure, peer-review systems, and compliance with international indexing standards.

6.3 Implications for future research

6.3.1 Explore the actual impact of incorporating regional indexers and not incorporating them in research studies

This thesis established limited coverage of African journals in major indexing databases when compared to AJOL and AIM. It did not go further to assess the actual impact of searching major indexing databases, leaving out regional indexers, on the results of a study. Future studies may, therefore, do well by comparing results of incorporating regional indexers and those of not incorporating them to measure the actual impact of findings of their study.

6.3.2 Exploring challenges faced by countries with underrepresented journals:

The underrepresentation of journals from certain African countries in both international and regional databases has been ably highlighted by the present study. Future research should delve deeper into understanding specific challenges and barriers faced by these countries in terms of journal indexing and research visibility to inform targeted interventions and support mechanisms to enhance the visibility and impact of research from these countries. This could involve conducting in-depth interviews with journal editors, researchers, and policymakers from these countries to identify the root causes of underrepresentation. By shedding light on these challenges, future studies can inform targeted interventions and support mechanisms to enhance the visibility and impact of research from these countries.

6.3.3 Investigating the impact of post-colonial influences on African research practices:

The findings of this study suggest that post-colonial influences continue to shape research practices and attitudes in Africa. Future research should, therefore, further investigate the mechanisms through which these influences operate and their impact on various aspects of the African research ecosystem. This could include examining how post-colonial legacies affect research agendas, funding priorities, collaboration patterns, and publication practices. By understanding the pervasive nature of these influences, researchers can develop strategies for addressing and mitigating their negative effects while leveraging their positive aspects to promote African research autonomy and self-determination.

6.3.4 Examining the effectiveness of collaborations and partnerships in promoting African research:

Collaborations and partnerships between African and global north institutions have been identified as both facilitators of and barriers to African research visibility and impact. Future studies should, hence, critically examine the dynamics and outcomes of these collaborations in an effort to identify best practices and potential pitfalls. This could involve conducting case studies of successful collaborations, analyzing power imbalances and inequities in partnership agreements, and assessing the long-term impacts of collaborative projects on African research capacity and autonomy. By generating evidence on what works and what doesn't, future research can guide the development of more equitable and mutually beneficial collaborations.

6.3.5 Assessing the role of local funding in strengthening African research capacity:

This study has clearly emphasized the importance of local funding in supporting African research activities and improving the quality and sustainability of African journals. What remains to be done is that future research should assess the current landscape of local research funding in Africa, including the sources, mechanisms, and priorities of funding agencies. The studies could also evaluate the impact of local funding initiatives on research output, quality, and translation into policy and practice. Demonstrating the value and effectiveness of local funding, can enable future research to provide governments, institutions, and philanthropic organizations with evidence for justifying increased investment in African research.

6.3.6 Evaluating the impact of national and regional indexing services on the visibility of African research:

The findings of this study highlight the crucial role played by national and regional indexing services such as AJOL and AIM in enhancing the visibility and discoverability of African research. Future studies would do well to undertake a comprehensive evaluation of these services, assessing their coverage, functionality, user experiences, and impact on research visibility and citation rates. Researchers could, similarly, explore the potential for expanding and integrating these services to create a more unified and accessible platform for African research. Future research can inform strategies for strengthening and sustaining them over the long term by generating evidence on the value and impact of the services.

6.4 Conclusions

This study has revealed the complex and interrelated challenges and opportunities for journal indexing and scholarly impact of Africa's health research. These challenges lead to limited coverage of African health science journals and research, hence limited visibility and impact of African research in addressing local and international public health challenges. The postcolonial effect was identified as one of the critical factors affecting growth and scientific impact of Africa's health science research. African health science journal editors tend to prioritize higher visibility provided by indexing services. Due to industry demands, the editors also find metrics and reputation useful for choosing an indexing service because they attract author submissions and readers. Furthermore, regional indexing services such as AJOL and AIM provide valuable coverage of African biomedical literature but they have limited capability to offer higher visibility, reputation, prestige and influence provided by the major abstract and citation databases.

This study contributes to knowledge by providing updated information coverage of African health science journal indexing, revealing insights regarding challenges faced by African journals, and confirming the use of objective criteria in assessing journals for inclusion in citation databases while acknowledging bias against African health science journals as perceived by African journal editors. The study has also revealed that indexing of health science journals in major citation databases is associated with geographical location, language and economic status. The findings have implications for research, policy, and practice, namely the need to acknowledge data source limitations, develop policies addressing post-colonial effects and promote local research, provide incentives for publishing in African journals, encourage collaboration among African researchers and journal editors, as well as strengthening local research funding.

In an effort to advance the impact and visibility of African health research, it is crucial that future studies should explore unique challenges faced by countries whose journals are underrepresented. Similarly, policies that prioritize local funding and promote local research dissemination should be developed, and African researchers and journal editors should actively collaborate and support national and regional indexing efforts while maintaining high quality and standardization standards.

The study results, conclusions and recommendations need to be understood in the context of the study limitations. Firstly, there is a potential selection bias in the journal sampling process, as the

analysis depended largely on journals already visible through global or regional indexing systems, potentially excluding emerging or less formalized outlets. Secondly, the reliance on data from editors actively engaged in regional discourse may have skewed perspectives toward more optimistic or institutionally aligned views, leaving out important perspectives from other stakeholders such as authors, journals of non-African journals. Thirdly, methodological limitations such as incomplete or inconsistent reporting of journal metrics, gaps in country-level data, and the descriptive scope of the scoping review itself limit the ability to quantify or compare scientific indicators across regions. These limitations should be considered when interpreting the findings, and they highlight the need for further research using mixed methods, wider sampling strategies, and triangulation with independent datasets.

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Appendices

Appendix I

Supplementary Table 2: Barriers of Africa's health research productivity, visibility and scientific impact

Barriers / Study ID	Editorial bias/topics not relevant in global few/north hence not cited	lack of skills in writing for publication/ inexperienced researchers	lack of official training in research methods	language barriers for francophone countries	unfair distribution of resources to institution at national level/ lack of logistic support and financial resources	research funding by global north/ sets research agenda/rules for publishing	Stringent authorship guidelines/ bias towards	heavy (clinical) workload/lack of devoted time to research	excessive private practice for financial profit/brain-drain	lack of motivation and incentives/ research	lack of interest in the research itself/no continuity plan	Lack of research infrastructure/strategies	Insufficient access to internet /databases/ high Subscription fees/APCs	Local journals not index by international indexers/limited visibility/print journals	Data discrepancies/incomplete data
Akhaddar 2019a		✓		✓											
Akhaddar 2019b		✓	✓	✓	✓			✓	✓	✓	✓				
Akudinobi 2022	✓	✓		✓		✓	✓								
Arabi 2021		✓		✓	✓			✓		✓	✓				
Asfaw 2021					✓			✓					✓		
Azondekon 2017															
Azzaza 2019															
Azzaza 2019															
Azzaza 2022															
Balogun 2021														✓	
Baobeid 2022				✓	✓			✓							
Benie-Bi 2013	✓	✓			✓					✓				✓	
BenSaad 2020				✓											
Bezzaoucha 2014										✓					
Bloomfield 2015									✓	✓					
Boyce 2015					✓	✓				✓				✓	
Dahdi 2018					✓				✓			✓			
Dele 2022															
Denguir 2018					✓				✓			✓			
El Din 2016					✓										

ElBairi 2021			✓	✓	✓					✓	
Ben Abdelaziz 2021			✓	✓							
Fonkou 2021				✓							
Guleid 2021											
Habtewold 2022 (limited collaboration)		✓			✓						
Hernandez-Villafuerte 2016											
Igwaran 2021											
Majiet 2021											
Marsh 2019(poster)											
Marsh 2020 (poor networking)									✓		
Mbuagbaw 2017											
Mouako 2022					✓						✓
Mugomeri 2017					✓						
Musa 2022											
Mwendera 2017	✓				✓						✓
Okaiyeto 2021											
Onyeka 2014		✓	✓					✓		✓	
Pan 2021					✓	✓		✓		✓	
Perryman 2021											
Phillips 2015											
Phoobane 2022											
Poreau 2018											✓
Rees 2021					✓						
Seivright 2021				✓							✓
Singh 2018											
Sooryamoorthy 2010					✓						
Talib 2019											
Uthman 2010		✓	✓	✓	✓						
Uthman 2015	✓	✓	✓		✓	✓					✓
Vargas 2021											✓
Wiysonge 2013											

Wonkam 2011				✓	✓						
Youssef 2018											
Zemni 2018				✓							
Zoukal 2019											
Ogunfolanji 2022				✓						✓	✓
Ezema 2016		✓							✓		
Enakrire 2021				✓				✓			
Nwagwu 2015			✓					✓		✓	✓
Wright 2017										✓	
Pillay 2013											✓
Anyanwu 2010				✓				✓			
Ahmed 2018				✓				✓			
Bennani 2021			✓								
Masukume 2012							✓				
Abu-Bonsrah 2022	✓										
Asubiaro 2023							✓				
Chuang 2011			✓								
Ajuwon 2011								✓		✓	
Nwagwu 2016							✓			✓	
Uwizeye 2020						✓					

Appendix II

Supplementary Table 3:Facilitators of Africa's health research productivity, visibility and scientific impact

Facilitators	developments in ICTs and internet access (improved access to e-resources and electronic online submission)	availability of resources or equipment for professional practice and for research/data/conducive research	training of professionals and increase in specialists in different professions/multidisciplinary	international exchange and collaboration or partnerships/local collaboration too	research funding by local governments	foreign research grants	huge population	topical relevance to community needs	Proficiency in English/articles written in English	open access publishing model/APC waivers	programmes designed to improve institutional capacity/incentives	training and capacity building in writing for publication/mentorship	Level of economic development	Growing interest in research (/among young people)	Publishing in high impact journals/no. of indexed journals	Equity in authorship	Political stability
Study ID																	
Akhaddar 2019a	✓	✓	✓	✓								✓					
Akhaddar 2019b	✓	✓	✓	✓								✓					
Akudinobi 2022											✓	✓				✓	
Arabi 2021	✓		✓	✓													
Asfaw 2021				✓													
Azondekon 2017				✓													
Azzaza 2019																	
Azzaza 2019																	
Azzaza 2022																	
Balogun 2021																	
Baobeid 2022																✓	
Benie-Bi 2013				✓		✓											
BenSaad 2020			✓									✓					
Bezzaoucha 2014			✓	✓					✓								
Bloomfield 2015				✓	✓								✓				
Boyce 2015																	
Dahdi 2018				✓	✓									✓			

Dele 2022		✓		✓										✓
Denguir 2018		✓		✓	✓								✓	
El Din 2016		✓												
ElBairi 2021				✓										✓
Ben abdelaziz 2021								✓						
Fonkou 2021	✓										✓			
Guleid 2021														
Habtewold 2022									✓					
Hernandez-Villafuerte 2016														
Igwaran 2021														
Majiet 2021														
Marsh 2019														
Marsh 2020					✓			✓						
Mbuagbaw 2017														
Mouako 2022				✓	✓									
Mugomeri 2017														
Musa 2022				✓	✓	✓	✓	✓						
Mwendera 2017		✓			✓	✓	✓							
Okaiyeto 2021				✓										
Onyeka 2014	✓								✓					
Pan 2021			✓	✓	✓					✓				
Perryman 2021														
Phillips 2015														
Phoobane 2022														
Poreau 2018														
Rees 2021				✓								✓		
Seivright 2021														
Singh 2018														
Sooryamoorthy 2010				✓		✓								
Talib 2019						✓								
Uthman 2010			✓	✓		✓	✓					✓		✓

Uthman 2015		✓	✓	✓		✓				✓			
Vargas 2021				✓									
Wiysonge 2013		✓											
Wonkam 2011	✓	✓											
Youssef 2018			✓										
Zemni 2018		✓					✓						
Zoukal 2019													
Ezema 2016					✓			✓					
Ogunfolanji 2022				✓							✓		
Enakrire 2021	✓	✓		✓									
Uwizeye 2020			✓	✓									
Igumbor 2020			✓							✓			
Nwagwu 2016	✓	✓		✓	✓								✓
Rotich 2016			✓	✓	✓						✓		
Ajuwon 2011		✓	✓					✓			✓		
Chuang 2011				✓	✓								
Asubiaro 2023		✓								✓			
Abu-Bonsrah 2022				✓									
Masukume 2012							✓						
Bennani 2021				✓			✓						
Ezema 2017								✓					
Pillay 2013					✓				✓				
Wright 2017			✓		✓								
Nwagwu 2015	✓							✓			✓		
Enakrire 2021	✓	✓		✓	✓								

Appendix III

Supplementary Table 4: Opportunities and recommendations for Africa's health research productivity, visibility and scientific impact

Opportunities	building capacity of SSA researchers such as training in medical writing and research methods	Strengthen local journals/local journals should seek international indexation	focusing on conducting systematic reviews and meta-analyses because they are inexpensive and less time-	funders engaging SSA researchers in setting research agenda/policies that set national research agenda	providing more direct funding to SSA researchers	setting up governance structures that ensure equity in authorship and other aspects of research partnership	setting up appropriate measures to limit the public-to-private brain drain	Strengthening collaboration	Publishing in English/high impact journals/	Strengthening research infrastructure/policies	Increase local research funding	ICTs e.g. e-prints/alternative outlets/Social media marketing	Publishing open access	National bibliographic database
Study ID														
Akhaddar 2019a	✓	✓	✓			✓		✓	✓					
Akhaddar 2019b	✓	✓	✓				✓	✓						
Akudinobi 2022				✓	✓	✓		✓						
Arabi 2021	✓							✓						
Asfaw 2021														
Azondekon 2017								✓						
Azzaza 2019a	✓													
Azzaza 2019														
Azzaza 2022	✓													
Balogun 2021									✓					
Baobeid 2022	✓													
Benie-Bi 2013		✓						✓						
BenSaad 2020														
Bezzaoucha 2014														
Bloomfield 2015														
Boyce 2015						✓		✓						
Dahdi 2018								✓		✓	✓			
Dele 2022														

Denguir 2018	✓					✓		✓	✓
El Din 2016									
ElBairi 2021	✓	✓				✓			
Ben Abdelaziz 2021	✓								
Fonkou 2021	✓							✓	
Guleid 2021									
Habtewold 2022						✓		✓	
Hernandez-Villafuerte 2016									
Igwaran 2021									
Majiet 2021									
Marsh 2019									
Marsh 2020	✓					✓	✓		
Mbuagbaw 2017									
Mouako 2022	✓					✓			✓
Mugomeri 2017	✓					✓			✓
Musa 2022									
Mwendera 2017		✓				✓			✓
Okaiyeto 2021									
Onyeka 2014	✓								
Pan 2021						✓		✓	
Perryman 2021									
Phillips 2015									
Phoobane 2022									
Poreau 2018						✓			
Rees 2021	✓		✓	✓					
Seivright 2021									
Singh 2018									
Sooryamoorthy 2010									
Talib 2019									
Uthman 2010									
Uthman 2015	✓		✓						✓
Vargas 2021									
Wiysonge 2013									

Wonkam 2011	✓			✓										
Youssef 2018														
Zemni 2018														
Zoukal 2019														
Ogunfolanji 2022	✓									✓	✓			
Ezema 2016										✓				
Enakrire 2021										✓				
Nwagwu 2015												✓		
Wright 2017							✓							
Anyanwu 2010	✓									✓	✓			
Ahmed 2018					✓		✓							
Bennani 2021					✓	✓								
Abu-Bonsrah 2022		✓			✓							✓		
Ajuwon 2011													✓	
Rotich 2016					✓						✓	✓		
Nwagwu 2016					✓		✓							
Igumbor 2020	✓									✓				

Appendix IV: **Search Strategy examples for Scoping review**

Date Run: 30/08/2022 14:43:22

Search strategy in Cochrane Library

ID	Search	Hits
#1	*public health*	*46055*
#2	*''research output'' OR ''research impact'' OR bibliometrics OR scientometrics*	*66665*
#3	*MeSH descriptor: [Africa] explode all trees*	*8275*
#4	*#1 AND #2 AND #3*	*271*

Search strategy in Embase Classic+Embase <1947 to 2022 September 12>

1	***(Africa or Algeria or Angola or Benin or Botswana or Burkina Faso or Burundi or Cameroon or Canary Islands or Cape Verde or Central African Republic or Chad or Comoros or Congo or Democratic Republic of Congo or Djibouti or Egypt or Equatorial Guinea or Eritrea or Ethiopia or Gabon or Gambia or Ghana or Guinea or Guinea Bissau or Ivory Coast or Cote dIvoire or Jamahiriya or Jamahiryia or Kenya or Lesotho or Liberia or Libya or Libia or Madagascar or Malawi or Mali or Mauritania or Mauritius or Mayotte or Morocco or Mozambique or Mocambique or Namibia or Niger or Nigeria or Principe or Reunion or Rwanda or Sao Tome or Senegal or Seychelles or Sierra Leone or Somalia or South Africa or St Helena or Sudan or Swaziland or Tanzania or Togo or Tunisia or Uganda or Western Sahara or Zaire or Zambia or Zimbabwe or Central Africa or Central African or West Africa or West African or Western Africa or Western African or East Africa or East African or Eastern Africa or Eastern African or North Africa or North African or Northern Africa or Northern African or South African or Southern Africa or Southern African or subSaharan Africa or subSaharan African or sub-Saharan Africa or sub-Saharan African).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]***	***756387***
2	*(''scientometric'' or ''bibliometric'' or ''citation analysis'' or ''informetric'' or ''altimetric'' or ''journal impact'' or ''author impact'' or ''H-Index'' or ''ScIMago'' or ''Source normalized impact per paper'' or ''research impact'' or ''scientific impact'' or ''citation impact'' or ''co-authorship'' or ''research collaboration'' or ''research network'' or ''citation count'' or ''journal metrics'' or ''research metrics'' or ''scholarly output'' or ''research output'' or ''research impact metrics'' or ''journal impact factor'' or ''g-index'' or ''Eigenfactor score'' or ''normalised impact factor'' or ''bibliographic coupling'' or ''co-citation analysis'' or ''Hirsch Index'' or ''research quality'').mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]*	*32270*
3	*1 and 2*	*850*

Appendix V: supplementary Table 5: Top 20 Journal rankings

Supplementary Table 15: Top 20 Journal rankings

serial	Title	Country	H5-Index	SNIP	JFI	JCI	Citescore
1	Journal of Advanced Research	Egypt	60	3.548	12.8		17.1
2	Journal of Genetic Engineering and Biotechnology	Egypt	37	1.448			4.3
3	Pan African Medical Journal	Nigeria	37	0.509			1
4	SAMJ South African Medical Journal	South Africa	34	0.625	2.12		2.4
5	Ethiopian Journal of Health Sciences	Ethiopia	31			0.39	2.1
6	Nigerian Journal of Clinical Practice	Nigeria	30	0.802	1.12	0.39	1.6
7	African Health Sciences	Uganda	30	0.581	1.108	0.4	2.1
8	Alexandria Journal of Medicine	Egypt	28			0.5	
9	International Journal of Health Sciences	Kenya	27			0.42	2.4
10	Eastern Mediterranean Health Journal	Egypt	26	0.901	2.087	0.49	2.3
11	African Journal of Disability	South Africa	25	0.962		0.41	2.2
12	International Journal of Africa Nursing Sciences	Nigeria	25	0.743			1.6
13	International Journal of Veterinary Science and Medicine	Egypt	24	1.571		1.03	6.8
14	SA Journal of Industrial Psychology	South Africa	24	0.778		0.5	2.4
15	African Journal of Traditional, Complementary and Alternative Medicines	Nigeria	23				
16	Arab Journal of Urology	Egypt	22	1.666		0.61	5.1
17	Malawi Medical Journal	Malawi	21	0.785	1.413	0.29	1.6
18	Euro-Mediterranean Journal for Environmental Integration	Tunisia	21			0.36	
19	African Journal of Reproductive Health	Nigeria	20	0.648	0.961	0.25	1.3
20	Egyptian Journal of Medical Human Genetics	Egypt	20	0.547		0.2	1.4
21	South African Family Practice	South Africa	20	0.396		0.2	1
22	Tropical Journal of Pharmaceutical Research	Nigeria	20	0.248	0.523	0.15	0.9
23	Curationis	South Africa	19				2.3
24	ONDERSTEPOORT Journal of Veterinary Research	South Africa	18	0.921	0.982	0.76	3
25	African Journal of Emergency Medicine	South Africa	18	0.907	1.451	1.306	1.8
26	Southern African Journal of HIV Medicine	South Africa	18	0.581	1.835	0.23	2.8

27	Cardiovascular Journal of Africa	South Africa	18	0.385	0.802	0.21	1.6
28	Journal of the Egyptian Public Health Association	Egypt	17	1.646			2.3
29	Libyan Journal of Medicine	Libya	17	0.964			2.8
30	Annals of African Medicine	Nigeria	17	0.796		0.27	1.8
31	African Journal of AIDS Research	South Africa	17	0.604	1.816	0.4	2
32	Health SA Gesondheid (Online)	South Africa	17	0.532			1
33	African Journal of Food, Agriculture, Nutrition and Development	Kenya	17	0.471			0.7
34	The Nigerian Postgraduate Medical Journal	Nigeria	17				1.2
35	Journal of Applied Sciences and Environmental Management	Nigeria	17				
36	South African Journal of Psychiatry	South Africa	16	0.934	1.242	0.3	1.8
37	The Egyptian Rheumatologist	Egypt	16	0.533			2
38	The Egyptian Journal of Neurology, Psychiatry and Neurosurgery	Egypt	16	0.458			1.1
39	Ghana Medical Journal	Ghana	16	0.419			1
40	Egyptian Journal of Radiology and Nuclear Medicine	Egypt	16	0.407		0.16	0.8
41	The Egyptian Journal of Hospital Medicine	Egypt	16	0.035			
42	African Journal of Microbiology Research	Nigeria	16		0.539		
43	International Journal of Biological and chemical Sciences	Cameroon	16				
44	South African Journal of Physiotherapy	South Africa	15	1.041		0.43	1.1
45	The Egyptian Heart Journal	Egypt	15	0.663			1.4
46	Journal of Public Health in Africa	Cameroon	15	0.434			1.5
47	Egyptian Journal of Chest Diseases and Tuberculosis	Egypt	15			0.05	
48	Future of Pharmaceutical Sciences	Egypt	15				
49	Journal of the South African Veterinary Association	South Africa	14	0.78	1.044	0.57	2
50	South African Journal of Communication Disorders	South Africa	14	0.776		0.43	
51	Journal of the Egyptian National Cancer Institute	Egypt	14	0.665		0.3	2.1
52	Ethiopian Journal of Health Development	Ethiopia	14	0.35	0.5	0.13	1
53	Annals of Medical and Health Sciences Research	Nigeria	14				

Appendix VI: Supplementary Table 1: Study title and period studied

Supplementary Table 16: Study title and period studied

S/N	Study ID	Title	Period studied
1	Akhaddar 2019	African contribution to the world neurosurgical literature during the past two decades (1999-2018) Using PubMed Database	1999-2018
2	Akhaddar 2019	Contribution of Moroccan neurosurgeons to the world neurosurgical data in PubMed: A bibliometric evaluation over time	1989 to 2018
3	Akudinobi 2022	Bibliometric analysis of sub-Saharan African and US authorship in publications about sub-Saharan Africa funded by the Fogarty International Center, 2008-2020.	2008-2020
4	Arabi 2021	Bibliometric evaluation of Moroccan physicians of physical medicine and rehabilitation publications in PubMed	until 2019
5	Asfaw 2021	Neurosurgery in Ethiopia: A new chapter and future prospects	2006-2020
6	Azondekon 2017	Scientific authorship and collaboration network analysis on malaria research in Benin: papers indexed in the web of science (1996-2016)	1996-2016
7	Azzaza 2019	Bibliometrics of Tunisian publications in "General Surgery" (MEDLINE, 2009-2018).	2009-2018
8	Azzaza 2019	Thirty years of tunisian publication of case reports in general surgery (1989-2018)	1989-2018
9	Azzaza 2022	Forty-year Tunisian bibliometrics of general surgery theses in the four national faculties of medicine (1980-2019)	1980-2019
10	Balogun 2021	Bibliometric profile of the African academy of sciences medical and health sciences fellows	1986-2018
11	Baobeid 2022	Gender equity in health research publishing in Africa	2014-2016
12	Benie-Bi 2013	Health needs and public health functions addressed in scientific publications in Francophone sub-Saharan Africa	2007
13	BenSaad 2020	La Tunisie Medicale: bibliometric analysis of the articles cites 10 times or more in the Scopus database	1949-2019
14	Bezzaoucha 2014	Algerian medical teachers' research output and its determinants during the 2000-2009 decade	2000-2009
15	Bloomfield 2015	Disparities in cardiovascular research output and citations from 52 African countries: a time-trend, bibliometric analysis (1999-2008).	1999-2008
16	Boyce 2015	Use of a bibliometric literature review to assess medical research capacity in post-conflict and developing countries: Somaliland 1991-2013	1991-2013
17	Dahdi 2018	Bibliometry of biomedical scientific publications in Mauritania (MEDLINE:1992-2016)	1992-2016
18	Dele 2022	Three-decade quantitative evaluation of cancer-related research in Nigeria from 1990-2019	1990-2019
19	Denguir 2018	Place of the "public health" in the Tunisian medical research on the cardiovascular diseases: A bibliometric study (MEDLINE: 1988-2017)	1988-2017
20	ElBairi 2021	Tracing ovarian cancer research in Morocco: A bibliometric analysis	1900-2018
21	El-Din 2016	Bibliometric analysis of Egyptian publications on Hepatitis C virus from PubMed using data mining of an in-house developed database (HCVDBegy)	until March 2013
22	Errafei 2021	Bibliometric profile of the doctoral thesis at the Faculty of Medicine of Sousse (Tunisia)	2001-2005

23	Fonkou 2021	Covid-19 pandemic related research in Africa: Bibliometric analysis of scholarly output, collaborations and scientific leadership	2019-2021
24	Guleid 2021	A bibliometric analysis of COVID-19 research in Africa	1 Dec 2019-3 Jan 2021
25	Habtewold 2022	Mapping publication outputs, collaboration networks, research hotspots, and most cited articles in systematic reviews and meta-analyses of medicine and health sciences in Ethiopia: Analyses of 20 years of scientific data	until 2021
26	Hernandez-Villafuerte 2016	Bibliometric trends of health economic evaluation in Sub-Saharan Africa.	
27	Igwaran 2021	Bibliometric analysis on tuberculosis and tuberculosis-related research trends in Africa: A decade-long study	2010-2019
28	Majiet 2021	Human vaccine and immunization research in South Africa: A bibliometric study	2007-2020
29	Marsh 2019	PMU137 A bibliometric analysis of south African health-related quality of life studies relevant to economic evaluations	1996-2018
30	Marsh 2020	Making connections and measuring performance: Bibliometric analysis of multi-attribute, preference-based health-related quality of life research in South Africa	1996-2018
31	Mbuagbaw 2017	Challenges and opportunities in country-specific research synthesis: A case study from Cameroon	2005-2014
32	Mouako 2022	Health research publications by South African authors from 1996 to 2015: a bibliometric analysis	1996-2015
33	Mugomeri 2017	A 30-year bibliometric analysis of research coverage on HIV and AIDS in Lesotho.	1985-2016
34	Musa 2022	Bibliometric analysis of the African Health Sciences' research indexed in Web of Science and Scopus	2008-2020, 2001-2020
35	Mwendera 2017	Malaria research in Malawi from 1984 to 2016: A literature review and bibliometric analysis	1984-2016
36	Okaiyeto 2021	Trends in diabetes research outputs in South Africa over 30Â years from 2010 to 2019: A bibliometric analysis.	2010-2019
37	Onyeka 2014	Pain research in Africa: A ten-year bibliometric survey	2002-2012
38	Pan 2021	Collaboration on evidence synthesis in Africa: a network study of growing research capacity.	2008-2019
39	Perryman 2021	A protocol for a scoping review comparative bibliometric analysis of infectious disease research in Africa	January 2019 – March 2021
40	Phillips 2015	The Astronomy of Africa's health systems literature during the MDG era: where are the systems clusters?	1990-2015
41	Phoobane 2022	Predicting infectious diseases: A bibliometric review on Africa	1996-2021
42	Poreau 2018	Prenatal diagnosis, care and management in Africa: Bibliometric analysis	1956-2015
43	Rees 2021	Where there is no local author: A network bibliometric analysis of authorship parasitism among research conducted in sub-Saharan Africa	2014-2018
44	Seivright 2021	Hidradenitis suppurativa research from Africa: a bibliometric analysis	2009-2019
45	Singh 2018	A bibliometric analysis of microbiology publications in sub - Saharan Africa during years 2000 to 2014	2000-2014
46	Sooryamoorthy 2010	The internationalisation of South African medical research; 1975-2005	1975-2005
47	Talib 2019	Postgraduate medical education in Sub-Saharan Africa: A scoping review spanning 26 years and lessons learned	1991-2016
48	Uthman 2010	Pattern and determinants of HIV research productivity in sub-Saharan Africa: bibliometric analysis of 1981 to 2009 PubMed papers.	1981-2009

49	Uthman 2015	Increasing the value of health research in the WHO African Region beyond 2015 - Reflecting on the past, celebrating the present and building the future: A bibliometric analysis	2000-2014
50	Vargas 2021	Funders and collaborators of cancer research in Kenya, 2007-2017: A bibliometric analysis	2007-2017
51	Wiysonge 2013	A bibliometric analysis of childhood immunization research productivity in Africa since the onset of the Expanded Program on Immunization in 1974.	1974-2010
52	Wonkam 2011	Ethics of human genetic studies in sub-Saharan Africa: the case of Cameroon through a bibliometric analysis.	1989 - 2009
53	Youssef 2018	Bibliometrics of Tunisian publications in preventive and community medicine, indexed in the MEDLINE database (1975-2014)	1975-2014
54	Zemni 2018	Bibliometric profile of Tunisian medical publications written in English and indexed in MEDLINE	2004-2014
55	Zoukal 2019	Bibliometric profile of medical publication at faculty of medicine of Casablanca (2008-2017)	2008-2017
56	Ezema 2016	A Bibliometric Analysis of Health and Medical Journals: Issues in Medical Scholarly Communication in Africa	
57	Ogunfolanji 2022	Profiling African Health Journals: a bibliometric study	
58	Uwizeye 2020	Increasing collaborative research output between early-career health researchers in Africa: lessons from the CARTA fellowship program	2011-2018
59	Nwagwu 2016	Ten years of biomedical research in West Africa (2005-2014): A study of the ten most productive countries	2005-2014
60	Rotich 2016	Trends and patterns of medical and health research at Moi University, Kenya, between 2002 and 2014: an informetrics study	2002-2014
61	Ajuwon 2011	Assessment of Scholarly Publications of Nigerian Health Sciences Researchers in MEDLINE/PubMed (1996-2007)	1996-2007
62	Chuang 2011	Bibliometric analysis of public health research in Africa: the overall trend and regional comparisons	1991-2005
63	Asubiaro 2023	Sub-saharan Africa's biomedical journal coverage in scholarly databases: a comparison of Web of science, Scopus, EMBASE,MEDLINE, African Index Medicus, and African Journals Online	-
64	Abu-Bonsrah 2022	Defining the contributors and scope of research in African health journals: a bibliometric analysis	Up to 2021
65	Masukume 2012	A 54 year old analysis of articles from Mpilo central hospital, Bulawayo, Zimbabwe-168 articles cited 999 times	1958-2011
66	Bennani 2021	Bibliometric study of African Publications in Dental Medicine in indexed journals between 2008 and 2018	2008-2018
67	Ezema 2017	Citation impact of health and medical journals in Africa: does open accessibility matter?	
68	Pillay 2013	Subject and discipline-specific publications trends in South Africa medical research,1996-2011: research article	1996-2011
69	Wright 2017	Bibliometric trends of South African environmental health articles between 1998 and 2015: making local research visible and retrievable	1998-2015
70	Nwagwu 2015	Penetration of Nigerian predatory biomedical open access journals 2007-2012: a bibliometric study	2007-2012
71	Enakrire 2021	Publishing patterns of health informatics in Africa: a bibliometric analysis	1987-2018
72	Anyanwu 2010	Medical education in Nigeria: status and travails of medical publications	
73	Ahmed 2018	Analysis of Biomedical Publications in Libya from 2003 to 2013	2003-2013
74	Klarenbeek 2018	Measuring multidisciplinary health research at South African universities: a comparative analysis based on co-authorships and journal subject categories	1978-2013
75	Igumbor 2020	CARTA fellow's scientific contribution to the African public and population health research agenda (2011 to 2018)	2011-2018
76	Obajemu 2014	Bibliometric/scientometric investigation of African Journal of Medicine and medical sciences between 2001-2020	2001-2010

77	Odede 2020	African Traditional medicine research between 1998 and 2018: an informetrics analysis in South Africa	1998-2018
78	Okoroiwu 2022	Thirty-five years (1986–2021) of HIV/AIDS in Nigeria: bibliometric and scoping analysis	1986-2021

Appendix VII: DCE Questionnaire

Journal editors' preference for an indexing service

Dear editor,

Welcome to this survey on "Journal Indexing and Scientific Impact of Africa's Public Health: Current Status, Barriers, Facilitators, and Opportunities." This research initiative aims to explore the landscape of public health research in Africa by focusing on the indexing of journals and assessing their scientific impact. I am, particularly, interested in generating an understanding of the current status of journal indexing in the context of African public health, identifying the barriers that may hinder the visibility and scientific impact of research, exploring facilitators that contribute to successful indexing, and pinpointing opportunities for improvement. Your valuable insights shall enable us gain a comprehensive understanding of challenges and potential advancements in the field, ultimately contributing to the enhancement of scientific communication and knowledge dissemination in Africa's public health sector. Thank you in advance for your participation in this important endeavor. The survey below is in two sections: discrete choice experiment and the demographic questions. The survey may take only 5 to 10 minutes for you to complete it. The experiment contains 14 questions beginning with two hypothetical scenarios of indexing services with 5 attributes with changing values. The scenarios are presented in a table with 3 options to choose from; Option A or Option B, and None of the above. None of the above means that you would not choose any of the scenarios given. These scenarios represent hypothetical indexing services that can be provided by different indexing services such as African Index Medicus, Directory of Open Access Journals, African Journals Online, PubMed, Scopus or Web of Science. Please select which option you would opt for to index your journal given the two scenarios as an editor. Your choices will help us understand which characteristics or attributes are most important to you if you were to choose an indexing service given these two scenarios. This information will help us and others in designing new indexing services or improve the current services, thereby improving visibility and impact of Africa's public health research. Section B contains only 6 questions and are about demographic profiles. The study obtained an ethical approval certificate, uses a study information sheet and a detailed informed consent form. By completing this study and submitting your responses, you will be considered to have expressed your informed consent to participate in the study.

Thank you!

Section A: Experiment

This section contains 14 questions, with each one question starting with two scenarios of indexing services and their characteristics, followed by a question below on which indexing service would you choose based on the characteristics presented for each. Please note that the attribute ''cost'' is per year (annually).

Set_1

Indexing service
Characteristics of indexing service

Option A

Option B

Visibility

Low

High

Reputation

Less Prestigious

Highly Prestigious

Cost

$1000

$3000

International editorial board

Not required

Required

Metrics

Available

Not available

1. Which indexing service would you choose?

◯ Option A
◯ Option B
◯ None of the above

Set 2 Indexing service

Characteristics of indexing service	Option A	Option B
Visibility	Low	High
Reputation	Less Prestigious	Highly Prestigious
Cost	Free	$2000
International editorial board	Required	Not required
Metrics		

Not available Available

2. Which indexing service would you choose?

◯ Option A
◯ Option B
◯ None of the above

Set 3 Indexing service

Characteristics of indexing service	Option A	Option B
Visibility		
	High	Low
Reputation		
	Less prestigious	Highly prestigious
Cost		
	$3000	$1000
International editorial board		
	Required	Not required
Metrics		
	Available	Not available

3. Which indexing service would you choose?

◯ Option A Option B
◯ None of the above
◯

Set 4 Indexing service

Characteristics of indexing service Option A Option B
Visibility

Low High
Reputation

Highly Prestigious Less Prestigious
Cost

$2000 Free
International editorial board

Not required Required
Metrics

Available Not available

4. Which indexing service would you choose?
○ Option A
○ Option B
○ None of the above

Set 5 Indexing service
Characteristics of indexing service Option A Option B
Visibility

High Low
Reputation

Less Prestigious Highly Prestigious
Cost

$1000 Free
International editorial board

Required Not required

Metrics

Available Not available

5. Which indexing service would you choose?

○ Option A
○ Option B
○ None of the above

Set 6 Indexing service

Characteristics of indexing service Option A Option B

Visibility

High High

Reputation

Highly Prestigious Less Prestigious

Cost

$1000 Free

International editorial board

Required Not required

Metrics

Not available Available

6. Which indexing service would you choose?

○ Option A
○ Option B
○ None of the above

Set 7 Indexing service

Characteristics of indexing service Option A Option B

Visibility

High Low
Reputation

Less Prestigious Highly Prestigious
Cost

$2000 $3000
International editorial board

Not required Required
Metrics

Not available Available

7. Which indexing service would you choose?
○ Option A
○ Option B
○ None of the above

Set 8 Indexing service

Characteristics of indexing service	Option A	Option B
Visibility		
	Low	High
Reputation		
	Highly Prestigious	Less Prestigious
Cost		
	Free	$1000
International editorial board		
	Required	Not required
Metrics		
	Available	Not available

8. Which indexing service would you choose?

- ○ Option A Option B
- ○ None of the above
- ○

Set 9 Indexing service

Characteristics of indexing service	Option A	Option B
Visibility		
	High	Low
Reputation		
	Less prestigious	Highly prestigious
Cost		
	$3000	$2000
International editorial board		
	Not required	Required
Metrics		
	Available	Not available

9. Which indexing service would you choose?

- ○ Option A
- ○ Option B
- ○ None of the above

Set 10 Indexing service

Characteristics of indexing service	Option A	Option B

Visibility

Low Low

Reputation

Highly prestigious Less prestigious

Cost

$3000 $2000

International editorial board

Not required Required

Metrics

Not available Available

10. Which indexing service would you choose?

◯ Option A
◯ Option B
◯ None of the above

Set 11 Indexing service

Characteristics of indexing service Option A Option B

Visibility

High Low

Reputation

Highly prestigious Less prestigious

Cost

$2000 $1000

International editorial board

Not required Required

Metrics

Not available Available

11. Which indexing service would you choose?

◯ Option A
◯ Option B
◯ None of the above

Set 12 Indexing service

Characteristics of indexing service	Option A	Option B
Visibility		
	Low	High
Reputation		
	Highly prestigious	Less prestigious
Cost		
	Free	$2000
International editorial board		
	Not required	Required
Metrics		
	Available	Not available

12. Which indexing service would you choose?

◯ Option A
◯ Option B
◯ None of the above

Set 13

Indexing service

Characteristics of indexing service

Option A

Option B

Visibility

Low

High

Reputation

Highly Prestigious

Less Prestigious

Cost

Free $2000

International editorial board

Not required

Required

Metrics

Available

Not available

13. Which indexing service would you choose?

○ Option A
○ Option B
○ None of the above

Set 14

Indexing service

Characteristics of indexing service

Option A Option B

Visibility

Low

High

Reputation

Less Prestigious

Highly Prestigious

Cost

$3000

Free

International editorial board

Not Required

Not required

Metrics

Not Available

Available

14.Which indexing service would you choose?

- ○ Option A Option B
- ○ None of the above

Section B: Demographic data This section has 6 questions.

15. Which role of journal editorship have you served or do you currently hold?you can select more that one.

☐ Chief editor
☐ Associate or deputy editor
☐ other member of editorial team
☐ managerial team

---

16. How long have you worked as journal editor, cumulatively?

○ 0-3years
○ 4-6years
○ 7-9 years
○ 10 years above

---

17. Which age category do you belong to?

○ 18-30years
○ 30-40years
○ 40-50years
○ 50 years above

18.what is your gender?

○ Female
○ Male
○ Other

---

19. What is your country of origin?

_____

20.What is your field of specialization?

_____

Appendix VIII: Data Extraction Tool for Objective 2 (Web scraping and Manual)

Title	Country	Start Year	Country_r	Age_of_jo	Index_Wo	Index_Sco	Index_Put	Editorial_I	author_af	Language	GDP	GDP_per_Capita	Total_Population	Health_Expenditur	Education_2021	RDInvestment_	Journal_Articles_2020
Sociology of Health and Illness	United Kin	1979	2	4	1	1	1	0	1	1	3.08907E+12	46125.25575	66971395	11.97759342	5.327368259	2.914760113	105564.47
International Review of Psychiatry	United Kin	1989	2	4	1	1	0	1	1	1	3.08907E+12	46125.25575	66971395	11.97759342	5.327368259	2.914760113	105564.47
Cytokine	United Kin	1989	2	4	1	1	1	1	1	1	3.08907E+12	46125.25575	66971395	11.97759342	5.327368259	2.914760113	105564.47
Current Opinion in Immunology	United Kin	1988	2	4	1	1	1	1	1	1	3.08907E+12	46125.25575	66971395	11.97759342	5.327368259	2.914760113	105564.47
Current Opinion in Cell Biology	United Kin	1989	2	4	1	1	1	1	1	1	3.08907E+12	46125.25575	66971395	11.97759342	5.327368259	2.914760113	105564.47
Current Opinion in Infectious Disea	United Kin	1988	2	4	1	1	1	1	1	1	3.08907E+12	46125.25575	66971395	11.97759342	5.327368259	2.914760113	105564.47
Development and Psychopathology	United Kin	1989	2	4	1	1	1	1	1	1	3.08907E+12	46125.25575	66971395	11.97759342	5.327368259	2.914760113	105564.47
Artificial Intelligence in Medicine	Netherlan	1989	2	4	1	1	1	1	1	1	1.0094E+12	57025.01246	17700982	11.1359272	5.135831356	2.308860064	33376.81
Flow Measurement and Instrument	United Kin	1990	2	4	1	1	1	1	1	1	3.08907E+12	46125.25575	66971395	11.97759342	5.327368259	2.914760113	105564.47
Dentomaxillofacial Radiology	United Kin	1997	2	4	1	1	0	1	1	1	3.08907E+12	46125.25575	66971395	11.97759342	5.327368259	2.914760113	105564.47
Journal of Autoimmunity	United Kin	1988	2	4	1	1	1	1	1	1	3.08907E+12	46125.25575	66971395	11.97759342	5.327368259	2.914760113	105564.47
International Immunology	United Kin	1989	2	4	1	1	1	1	1	1	3.08907E+12	46125.25575	66971395	11.97759342	5.327368259	2.914760113	105564.47
European Journal of Neuroscience	United Kin	1989	2	4	1	1	1	1	1	1	3.08907E+12	46125.25575	66971395	11.97759342	5.327368259	2.914760113	105564.47
Vascular Medicine	United Kin	1991	2	4	1	1	0	1	1	1	3.08907E+12	46125.25575	66971395	11.97759342	5.327368259	2.914760113	105564.47
European Journal of Epidemiology	Netherlan	1985	2	4	1	1	1	1	1	1	1.0094E+12	57025.01246	17700982	11.1359272	5.135831356	2.308860064	33376.81
Reading and Writing	Netherlan	1988	2	4	1	1	1	1	1	1	1.0094E+12	57025.01246	17700982	11.1359272	5.135831356	2.308860064	33376.81
Experimental Astronomy	Netherlan	1990	2	4	1	1	1	1	1	1	1.0094E+12	57025.01246	17700982	11.1359272	5.135831356	2.308860064	33376.81
Arthroskopie	Germany	1988	2	4	1	1	0	1	1	0	4.08247E+12	48717.99114	83797985	12.82248878	4.530963898	3.142460108	109378.75
Ethik in der Medizin	Germany	1989	2	4	1	1	1	1	1	0	4.08247E+12	48717.99114	83797985	12.82248878	4.530963898	3.142460108	109378.75
European Journal of Cardio-Thorac	Netherlan	1987	2	4	1	1	1	1	1	1	1.0094E+12	57025.01246	17700982	11.1359272	5.135831356	2.308860064	33376.81
Pediatric Surgery International	Germany	1986	2	4	1	1	1	1	1	1	4.08247E+12	48717.99114	83797985	12.82248878	4.530963898	3.142460108	109378.75
International Journal of Health Care	United Kin	1988	2	4	1	1	1	1	1	1	3.08907E+12	46125.25575	66971395	11.97759342	5.327368259	2.914760113	105564.47
Human Movement Science	Netherlan	1982	2	4	1	1	1	1	1	1	1.0094E+12	57025.01246	17700982	11.1359272	5.135831356	2.308860064	33376.81
Learning and Individual Differences	United Kin	1989	2	4	1	1	1	1	1	1	3.08907E+12	46125.25575	66971395	11.97759342	5.327368259	2.914760113	105564.47
Journal of Evolutionary Biology	United Kin	1988	2	4	1	1	1	1	1	1	3.08907E+12	46125.25575	66971395	11.97759342	5.327368259	2.914760113	105564.47
International Journal of Technology	United Kin	1985	2	4	1	1	1	1	1	1	3.08907E+12	46125.25575	66971395	11.97759342	5.327368259	2.914760113	105564.47
Medical Teacher	United Kin	1998	2	4	1	1	1	1	1	1	3.08907E+12	46125.25575	66971395	11.97759342	5.327368259	2.914760113	105564.47
Family Practice	United Kin	1997	2	4	1	1	1	1	1	1	3.08907E+12	46125.25575	66971395	11.97759342	5.327368259	2.914760113	105564.47
Mathematical Medicine and Biology	United Kin	1984	2	4	1	1	1	1	1	1	3.08907E+12	46125.25575	66971395	11.97759342	5.327368259	2.914760113	105564.47

Appendix IX: Ethical Clearance Certificate

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG

R49 Mr A Selemani

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M220925

NAME: (Principal Investigator)	Mr A Selemani
DEPARTMENT:	School of Public Health Medical School University
PROJECT TITLE:	*Journal indexing and scientific impact of Africa's public health research: current status, barriers, facilitators and opportunities*
DATE CONSIDERED:	2022/09/30
DECISION:	Approved unconditionally
CONDITIONS:	
NOTE:	If contact information regarding student study participants is required, please contact the Registrar's office - <Nicoleen.Potgieter@wits.ac.za>
SUPERVISOR:	Drs J Igumbor & K Wella; Profs Y-F Chen & O Uthman
APPROVED BY:	Dr CB Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	2022/11/28

This Clearance Certificate is valid for 5 years from the date of approval. An extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office secretariat on the 3rd floor, Phillip Tobias Building, Parktown, University of the Witwatersrand, Johannesburg.

I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated from the research protocol as approved, I/we undertake to submit details to the Committee. **I agree to submit a yearly progress report**. When a funder requires annual re-certification, the application date will be one year after the date when the study was initially reviewed. In this case, the study was initially reviewed in **September** and therefore reports and re-certification will be due in the month of **September** each year. Unreported changes to the study may invalidate the clearance given by the HREC (Medical).

Signature of Principal Investigator — Date: 29/11/2022

Appendix X: **Semi-Structured Interview Guide**

1. What do you think are the current issues regading scientific impact of Africa's public health journals? ○ Reflect on your experiences with your journal
    - What is your opinion on indexing African journals by web of science and other international citation databases?
    - To what extent do you agree with the claim that most African journals are excluded from being indexed by internal citation databases due to poor editorial standards?
    - What are your thoughts on each of the standards used to index journals?
        - Editorial
        - Age of journal
        - Scientific impact
        - Language
2. What are your thoughts on the following factors in relation to scientific impact of African public health research (including journals in particular)?
    a. Online publishing
    b. Open access
    c. Institutional repositories
    d. ICT developments
    e. International collaborations
    f. Mentorship
    g. Training
    h. Topics that target international readership
    i. Any other facilitators you would like to share?
3. What do you think should be done to promote scientific impact of African public health research?
    a. To what extent do you think a regional or national citation database would help improve scientific impact?
    b. What impact do you think it would have on science communication in general on studies from Africa?
    c. If a regional or national citation database were to be developed, what standards or criteria would you prefer to be used to include journals?

Appendix XI: Study Information Sheet

STUDY INFORMATION DOCUMENT

Study title:

Journal Indexing and Scientific Impact of Africa's Public Health Research: current status, barriers, facilitators and opportunities.

Greeting

Introduction:

My name is Apatsa Selemani, working as Assistant Librarian at Kamuzu University of Health Sciences (KUHeS) formerly College of Medicine and Kamuzu College of Nursing in Malawi. Currently I am pursuing Doctor of Philosophy (PhD) studies in Public Health at University of the Witwatersrand in South Africa.

I am conducting a research study in public health as a requirement for the PhD programme. The study aim is exploring barriers, facilitators and opportunities to improve scientific impact of Africa's public health research.

Invitation to Participate:

I would like to invite you to participate in the in-depth interviews to share your knowledge, experience and perceptions on barriers, facilitators and opportunities to increasing scientific impact of public health research from Africa. In-depth interview is a method of data collection where an individual interacts with an interviewer on a topic under study. The interview will be scheduled at your convenient time. The interviewer will book for the interview with the participant weeks before with reminders sent before the time for interview. The participants will be asked to be in a room that provides both audio and visual privacy.

You are invited to participate in this study because you work as (chief) editor for an African Journal that publishes health science research output. Participation in this study is strictly voluntary. Participation, or

refusal to participate in this study or any aspects of this study will have no impact on your job or relationship with the researcher or supervisors, if any.

What is involved in the study

If you choose to participate, you will be interviewed individually. With your permission, the discussion will be audio recorded, and in some cases, video recorded if permission is granted. No names of individuals will be used during the interview. The recording will not be shared with anyone outside the study team, thus the investigator and supervisors. If you agree to participate in this study and have the interview audio recorded, I kindly request you to read and sign the attached Declarations of Consent to participate and be audio recorded.

The interview is expected to take 20 to 30 minutes. The interview will be conducted in English. You will be provided with clarifications at any time when something is not clear. You are encouraged to speak freely and openly. The findings from this study will be presented at the University of Witwatersrand, national and international conferences; findings will also be published in my doctoral thesis and peer reviewed journals. No participant will be identified by name in any report or publication arising out of the study. As a participant, you will be given a summary of the results. The study is expected to take place between October, 2022 to October, 2023.

Risks of being involved in the study

No physical risks are anticipated in this study. However, participation in the IDIs cannot be anonymous but rather data will be de-identified and results will be presented anonymously.

How will these discomforts and risks be alleviated?

No individual names will be used during the interview. You will be allowed not to answer certain questions that you are not comfortable with and you will be free to ask for the audio tape to be turned off anytime or opt out of the interview at any point without giving a reason. In addition, the findings of this study will only be used to identify barriers, facilitators and opportunities to increasing scientific impact of Africa's public health research.

Benefits of being in the study

There may be no direct benefit to every participant of this study. However, it is expected that the findings of this study may inform formulation of public health research policies and research evaluation policies in African health research institutions and universities. It will also contribute evidence on visibility and discoverability of African health science research. In addition, the study will help to identify key potential entry points for interventions to promote public health research impact in Africa based on findings on barriers, facilitators, and opportunities. Furthermore, it will raise awareness on strengths and flaws of scientific metrics, and direct proper application of scientific metrics to public health research. Results of this study may also justify the need to or guide on the development of regional or national citation databases that use selection criteria that responds to the African context amidst inherent challenges. The findings of the study will also finally lead to the award of PhD qualification to the researcher.

Reimbursements for "out of pocket" expenses.

You are expected to incur internet expenses to attend the interview online. You will not be reimbursed for internet costs incurred.

Who to contact if you have been harmed or have any concerns

If you have any concerns about the research or feel that you have been harmed in any way by participating in this study, please contact my primary supervisor;

Prof Jude Igumbor, Email Jude.igumbor@wits.ac.za, Tel +27 (72) 7915927, 7 York road,

Parktown.2193, University of the Witwatersrand

OR

Prof. Clement Penny, Chairperson of the HREC (0117172301- or clement.penny@wits.ac.za) Research Office, Faculty of Health Sciences, Phillip Tobias Building, Offices 301-304, 3rd Floor, Cnr York Road & 29 Princess of Wales Terrace, Parktown, 2193.

Postal Address: Private Bag 3, Wits, 2050

OR

Ms. Z Ndlovu or Mr Rhulani Mkansi, Committee Secretariat, telephone nos.: 011 717 2700 or 1234, or by e-mail at: Zanele.Ndlovu@wits.ac.za or Rhulani.Mkansi@wits.ac.za.

Appendix XII: Consent forms

WITS UNIVERSITY

PARTICIPANT CONSENT SHEET

Journal Indexing and Scientific Impact of Africa's Public Health Research: current status, barriers, facilitators and opportunities.

1. I have been given a Participant Information Sheet which explains the nature and processes involved in this study, which is attached hereto;
2. I was given time to read it in the language I best understand;
3. I was given time to ask any questions I wanted to and found any answers given to me to be reasonable and satisfactory;
4. I believe I fully understand why the study is being conducted and what the intended outcomes will be;
5. I understand that there will be no immediate benefit to me, should I agree to participate, nor will I receive any payment; conversely, participation will cost me airtime for internet access and my time;
6. I understand that, even if I initially consent to take part in the study, I may subsequently withdraw at any time and would not be required to give any reasons; if that happened, any data collected about me for the purposes of the study would immediately be destroyed, unless I give consent for it to be retained.
7. I have been given a range of contact details, listed below. If I require further information or become concerned about any aspect of this study, I am free to speak to any of these contacts.

Contact details:

Apatsa Selemani, Principal Investigator, on Cell phone no. +265999133232, or by e-mail at aselemani@cartafrica.org or 2497336@students.wits.ac.za.

Prof. Jude Igumbor, Supervisor, on Cell phone no. +278, or by e-mail at Jude.Igumbor@wits.ac.za

Professor CB Penny, Chairperson of the Human Research Ethics Committee (Medical) at the University of Witwatersrand, on telephone no. 011 717 2301, or by e-mail at Clement.Penny@wits.ac.za.

Ms. Z Ndlovu or Mr Rhulani Mkansi, Committee Secretariat, telephone nos.: 011 717 2700 or 1234, or by e-mail at: Zanele.Ndlovu@wits.ac.za or Rhulani.Mkansi@wits.ac.za

Name of Participant: _____
Date: _____
Place: _____
Signature or mark _____

Witnessed by:

Name of Witness: _____
Signature: _____
Date: _____



CONSENT FORM FOR AUDIO RECORDING OF STUDY PARTICIPATION

Journal Indexing and Scientific Impact of Africa's Public Health Research: current status, barriers, facilitators and opportunities.

I hereby consent to audio recording of the interview,

.

I understand that:

- The recording will be stored in a secure location (a password protected computer) with restricted access to the researcher and the research supervisors.
- The recording will be transcribed and any information that could identify me will be removed.
- The recordings will be erased within either (a) two (2) years of the publication of the research findings, or (b) six (6) years, if no publications arise from this research.
- Anyone wishing to access this information in the future will first have to obtain the approval of the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg.
- Direct quotes from my interview, without any information that could identify me, may be cited in the research report or other write-ups of research.

Name of Participant: _____
Date: _____
Place: _____
Signature or mark _____

Witnessed by:

Name of Witness: _____
Signature: _____
Date: _____

Appendix XII: Published article

International Journal of Public Health
ORIGINAL ARTICLE
published: 15 January 2024
doi: 10.3389/ijph.2023.1606415

A Scientometric Analysis of Africa's Health Science Journals Indexed in International and Regional Databases: A Comparative Analysis

Apatsa Selemani[1,2]*, *Kondwani Wella*[1], *Yen-Fu Chen*[3], *Marta Vicente-Crespo*[2,4], *Olalekan Uthman*[3] *and Jude Igumbor*[2]

[1]KUHES Libraries, Kamuzu University of Health Sciences, Blantyre, Malawi, [2]School of Public Health, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa, [3]Medical School, Warwick University, Coventry, United Kingdom, [4]African Population and Health Research Center (APHRC), Nairobi, Kenya

Objectives: This study aimed to compare the geographic coverage, citation impact, subject trends and authorship collaboration pattern of African health science journals indexed in international and regional databases.

Methods: Data was collected from Ulrichs web serials directory, Web of Science (WoS), Scopus, PubMed, Google scholar, African Index Medicus (AIM) and African Journals Online (AJOL) between February 2023 and May 2023. Data was analysed using summary descriptive statistics such as percentages and interquartile ranges, and through network visualisation.

Results: More than 40 African countries had no any health science journal indexed in WoS, whereas 20 African countries did not have any health science journal indexed in AJOL and AIM. The Journal of Advanced research was the top performing journal on almost all journal metric lists such as Google scholar's H5-Index, SNIP, Journal Impact Factor, and Citescore, except Journal Citation indicator.

Conclusion: The coverage of African health science journals by international citation databases is still limited which result in low scientific impact of many African health science journals. Authorship collaboration is related to historical ties among countries.

Keywords: research impact, African journals, scholarly communication, research evaluation, research metrics

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INTRODUCTION

A number of studies indicate that, compared to other parts of the world, African health sciences research has had little scientific impact [1, 2]. This is mostly because there are few African journals included in the international citation databases [1, 3, 4], which reduces the visibility of the continent's health science research. Several studies have reported an increase in scientific impact following indexing of journals in international and regional citation databases as it increases visibility [5–8]. Likewise, indexing status of a journal is one of the factors that influences author's selection of journal to publish with. Hence, authors from Africa prefer publishing in journals from global north whose majority are indexed in popular international indexers.

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However, this practice limits impact of local journals. Some authors also observed that it disadvantages local research as authors are forced to conduct research required by the global north journals [9, 10]. Additionally, international topical coverage is said to hinder growth of new fields of study and localisation of research as researcher's are forced to focus on global issues at the expense of addressing local challenges [9, 11].

Scientometric analysis is the study of measuring and analysing science using quantitative approaches [12]. It is similar with bibliometrics, but differ on that bibliometric analysis focuses on quantitative analysis of bibliographic materials such as books, articles and conference papers. Scientometrics is one way of understanding scientific research activity, impact, collaboration and funding through proxies of publications, citation patterns, co-authorship and funding activity. The objects of measurement include scientific research articles, scientific journals, science authors, institutions, and countries [13]. This paper focuses on scientific journal's coverage and impact, and scientific research collaboration by country. The journal metrics selected include Journal Impact Factor (JIF) and Journal Citation Indicator (JCI) by Web of Science (WoS), Source Normalised Impact per Paper (SNIP) and Citescore by Scopus, Hirsch Index (H5-Index) by Google scholar. This scientometric analysis followed the structure shown in **Supplementary Figure S1**.

These citation-based journal metrics have become a popular way to judge or evaluate journals and research published in them. They have gained acceptance and authority to the point where they are influencing the course of research [14]. They are used for evaluating research, hiring academic staff, making decisions about promotions and tenure, allocating funding for health research, ranking universities, choosing which journals to publish in, and informing readers or decision-makers about where to find evidence for reviews or evidence synthesis [14–16]. These choices unquestionably influence the production and direction of health research, and some have a direct impact on health interventions and policy.

One major issue that underlies many of these inherent challenges is the data source used to calculate metrics. For instance, some studies have reported that despite being a multidisciplinary database, Web of Science and Scopus under-represent some disciplines in their coverage, such as humanities and social sciences [17]. Whereas PubMed is a discipline-specific database focusing on biomedical literature hence may be more appropriate to be consulted as the data source for biomedical research evaluation.

There is limited evidence that compares scientific impact and research landscape of African journals based on their indexing status. Studies done previously either used one data source such as WoS or AJOL only or compared only two data sources [18, 19]. The main objective of this study was to compare the scientific impact of Africa's health science journals indexed in international citation databases and regional databases.

METHODS

Selection of Journals

We used web scraping, a data mining technique, to extract a list of African medical and health Sciences journals from Ulrichsweb global directory of serials. Ulrichsweb is one of the largest and key serials directories in the world and provides data with the level of detail required in this study [20]. We selected journals whose status was indicated as active. Ulrichsweb categorizes health related journals under medical and health science journals. We then manually searched WoS, Scopus, PubMed, African Journals Online (AJOL), African Index Medicus (AIM) for additional health science journals which are from Africa but were not on our list. We selected WoS, Scopus and PubMed because they represent the largest journals indexers while AJOL and AIM represent African region indexers. Additionally, WoS and Scopus are the common data sources used [21], and are criticised to be biased against journals from developing countries [22]. The search process is shown in **Supplementary Figure S2** as PRISMA diagram.

Collecting Data on Journal Metrics

We manually searched for journals metrics from Web of Science (JIF and JCI), Scopus (SNIP and Citescore), and Google scholar (H5-Index). We collected data between February and May 2023. We entered the journal metrics data in Microsoft Excel. We also downloaded bibliographic and citation data files from PubMed, WoS and Scopus to run analyses for author collaborations, and topical coverage in African health sciences journals. Unfortunately, AJOL and AIM do not provide citation data files in a format suitable for topical coverage and author collaboration analyses.

The journal metrics selected for this study are all dependent on time period; 2, 3, and 4 years and also are calculated differently hence comparison of journal impact was made within each metric and not across or against each other. The study aim was also to establish current status hence we did not compare the impact trends over a period of time. Definitions of journal metrics used in the present study include the following:

- H5-index is the number of articles (h) published in the report year and the preceding 4 years that have each been cited at least h times [23].
- The Journal Impact Factor (JIF by ISIS) is "a measure of the total number of citations for each of the papers published in that particular journal during the previous 2 years divided by the total number of eligible articles within that particular period" [24].
- The Journal Citation Indicator (JCI) is the "average Category Normalized Citation Impact (CNCI) of citable items (articles and reviews) published by a journal over a recent 3 years period" [24].
- Source Normalised Impact per Paper (SNIP) is the "ratio of the journal's citation count per paper and the citation potential in its subject field" [25].
- Citescore is the number of citations received by "a journal in 1 year to documents published in the three previous years, divided by the number of documents indexed in Scopus published in those same 3 years" [25].

Data Analysis and Visualisation

We used STATA version 16 [26] and Microsoft Excel version [27] to run summary descriptive statistics. We analysed topical focus

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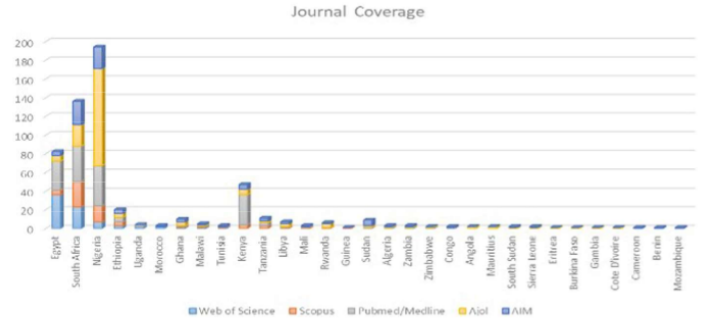


FIGURE 1 | Health Science Journal geographical distribution disaggregated by indexing status (Impact of African health journals, 2023).

coverage using VoSviewer software [28] based on all keywords co-occurrence (author keywords and MeSH keywords) mapping instead of term co-occurrence. Keywords were preferred because they define or represent the main subject matter of the article whereas terms may not necessarily represent the main subject matter of the publication or article. Co-occurrence mapping shows how many times keywords or terms appear in more than one publication. In terms of authorship collaboration, we used Vosviewer to visualise co-authorship across countries to show collaboration patterns. However, PubMed database files did not provide data on country affiliation hence we could not run co-authorship based on country names. We therefore used organisation or institutional affiliations to determine the nationality of authors for country authorship collaboration visualisations.

RESULTS

A total of 624 active African health sciences journals were identified, 422 from web scrapping and 202 from additional manual search. We then removed two journals whose origins were European and one Indian, hence we remained with a final list of 622 journals. However, for journal metric analyses, the study considered 221 journals because they had journal metric values collected. For country collaboration analysis, we considered 57 journals from Web of Science and 98 journals from Scopus because they could provide data in a format that would allow such analysis unlike PubMed. It is important to note that there were duplicates; some journals found in Web of Science were also indexed in Scopus or PubMed. For instance, there were 41 journals which were indexed by both Web of Science and Scopus.

Health Science Journal Geographical Distribution Based on Indexing Status

Out of the 622 health sciences journals from Africa, 99 (15.9%) are indexed in Scopus, and 75 (12.1%) in WoS, while PubMed and AJOL list 163 (26.2%) and 172 (27.7%) journals, respectively. The African Index Medicus, which is a dedicated African region medical and health sciences journals indexer, indexes 149 (24%) of the journals. There is also an overlap where some journals are indexed by multiple databases.

Considering the country in which the journals are based (**Figure 1** and **Supplementary Figure S3**), Egypt had the highest number of journals indexed in WoS (36, 48%) while South Africa had the highest number of journals indexed in Scopus 36 (36%). Nigeria had the highest number of journals indexed in PubMed (43, 26%) and AJOL (104, 60%), while South Africa had the highest number of journals in AIM (25, 17%). About 21 African countries did not have any health sciences journal indexed in any of the international (WoS, Scopus, PubMed) and regional (AJOL, AIM) indexers under study. More than 40 countries did not have any health science journals indexed in WoS.

Citation Scores of Journals Based on Indexing Status

Top Performing Journals by Country Using Interquartile Ranges

We first analysed our data using Interquartile Ranges (IQR) to show top performing journals disaggregated by country, and how the metrics of journals from different data sources are distributed per country. IQR depicts the variability of data without much influence from the outliers and skewed values. Tunisia had the highest median H5-Index with half of its journals having a median of 16 (11, 21), while Egyptian journals had highest JIF median value of 7.4 (2.1, 12.8). Similarly, Egyptian journals had the highest median values on Citescore 1.5 (0.5, 2.3), and discipline-specific metric SNIP 0.54 (0.2705, 1.1745), while South African journals had highest JCI median values 0.28 (0.16, 0.43). The countries shaded in grey had only one journal, hence had same value appearing for median, lower quartile and upper quartile. These shaded countries could not be compared with other countries with more than one journal as the median would not be statistically meaningful.

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TABLE 1 | Summary statistics (Median, lower and upper quartile) of journal metrics by Country of Origin (Impact of African health journals, 2023).

Country	H5-index	JIF	JCI	Cite score	SNIP
Egypt	8 (5, 15)	7.4435 (2.087, 12.8)	0.2 (0.14, 0.49)	1.5 (0.5, 2.3)	0.54 (0.2705, 1.1745)
South Africa	9 (7, 16)	1.242 (0.982, 1.816)	0.28 (0.16, 0.43)	1.1 (0.65, 2.25)	0.532 (0.283, 0.907)
Nigeria	9 (5, 12)	0.839 (0.539, 0.961)	0.145 (0.105, 0.26)	0.6 (0.3, 1.2)	0.269 (0.1785, 0.6085)
Kenya	8.5 (4, 17)		0.42 (0.42, 0.42)	0.7 (0.5, 2.4)	0.257 (0.062, 0.471)
Uganda	30 (30, 30)	1.108 (1.108, 1.108)	0.4 (0.4, 0.4)	2.1 (2.1, 2.1)	0.581 (0.581, 0.581)
Ethiopia	10 (10, 14)	0.314 (0.128, 0.5)	0.26 (0.13, 0.39)	1 (0.8, 2.1)	0.26 (0.17, 0.35)
Libya	17 (17, 17)			2.8 (2.8, 2.8)	0.964 (0.964, 0.964)
Malawi	21 (21, 21)	1.413 (1.413, 1.413)	0.29 (0.29, 0.29)	1.6 (1.6, 1.6)	0.785 (0.785, 0.785)
Rwanda	6 (6, 6)			0.4 (0.4, 0.4)	0.147 (0.147, 0.147)
Ghana	16 (16, 16)			1 (1, 1)	0.419 (0.419, 0.419)
Morocco	4 (4, 5)				
Tanzania	13 (13, 13)			1.2 (1.2, 1.2)	0.499 (0.499, 0.499)
Zambia	6 (6, 6)				
Cameroon	15 (6, 16)			1.5 (1.5, 1.5)	0.434 (0.434, 0.434)
Benin	6 (6, 6)			0.3 (0.3, 0.3)	0.361 (0.361, 0.361)
Mali	3 (3, 3)			0.2 (0.2, 0.2)	
Tunisia	16 (11, 21)		0.36 (0.36, 0.36)	0.8 (0.8, 0.8)	0.268 (0.268, 0.268)
Sudan	7 (7, 9)				
Congo	3 (3, 3)				
Burkina Faso	2 (2, 2)				
Algeria	6 (6, 6)				
Total	9 (6, 14)	1.076 (0.6705, 1.6335)	0.26 (0.14, 0.41)	1.1 (0.5, 2)	0.471 (0.254, 0.776)

TABLE 2 | Top 10 African health science journals ranked by H5-index (Impact of African health journals, 2023).

Title	Country	H5-index	SNIP	JFI	JCI	Citescore
Journal of Advanced Research	Egypt	1	1	1		1
Journal of Genetic Engineering and Biotechnology	Egypt	2	5			4
Pan African Medical Journal	Kenya[a]	3	39			21
South African Medical Journal	South Africa	4	30	2	12	9
Ethiopian Journal of Health Sciences	Ethiopia	5			11	12
Nigerian Journal of Clinical Practice	Nigeria	6	17	9	11	15
African Health Sciences	Uganda	6	32	10	10	12
Alexandria Journal of Medicine	Egypt	7			6	
Eastern Mediterranean Health Journal	Egypt	8	16	3	7	10
African Journal of Disability	South Africa	9	12		9	11
International Journal of Africa Nursing Sciences	Nigeria	9	23			15
International Journal of Veterinary Science and Medicine	Egypt	10	4		2	2
SA Journal of Industrial Psychology	South Africa	10	21		6	9

[a]*This information is according to the data source used, however, this journal is affiliated to a number of African countries such as Uganda, Cameroon and Kenya.*

Table 1 summary statistics (Median, lower and upper quartile) of journal metrics disaggregated by country of origin. **Table 1** below presents the middle 50% quartile when the metric values for journals per each country are ordered from lowest to highest. Together with the median (50%) values, are presented the lower quartile (25%) and upper quartile (75%) values in brackets **Table 1** shows metrics on H5-Index, JIF and JCI, Citescore and SNIP whose data sources were Google scholar, WoS and Scopus, respectively.

Top 10 and Top 20 African Health Science Journals With Highest H5-Index, JIF, Citescore, SNIP, JCI

As shown in **Table 2**, and **Table 3**, The Journal of Advanced Research from Egypt is ranked number 1 on almost all metrics regardless of data source except JCI, indicator that was not available for this journal. Thereafter, positions 2 to 10 or to 20 are occupied by different journal titles under each metric list. Also journals occupied different positions on each list, thus, a journal would be on one position on one list, and appear on another position on another list. For instance, journals such as Pan African Medical Journal and African Health Sciences have moved from positions 3 and 7 on Google scholar H5-Index to positions 39 and 32 on the SNIP list. Also, some journals (showing shaded grey boxes) do not have values for some metrics because they are not covered by the data source that was used to calculate the metrics. For some, like Scopus and WoS, had their coverage discontinued or have been newly included hence could not find recent values for metrics as the metrics are calculated for a specific period.

In terms of countries, Egypt (15) and South Africa (15) had same number of journals, followed by Nigeria (8), on the top 20 list of journals with highest Google scholar H5-Index **Table 3**.

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TABLE 3 | Top 20 African health sciences journals sorted by Google scholar H5-Index (Impact of African Health Journals, 2023).

Serial	Title	Country	H5-Index	SNIP	JFI	JCI	Citescore
1	Journal of Advanced Research	Egypt	60	3.548	12.8		17.1
2	Journal of Genetic Engineering and Biotechnology	Egypt	37	1.448			4.3
3	Pan African Medical Journal	Kenya[a]	37	0.509			1
4	SAMJ South African Medical Journal	South Africa	34	0.625	2.12		2.4
5	Ethiopian Journal of Health Sciences	Ethiopia	31			0.39	2.1
6	Nigerian Journal of Clinical Practice	Nigeria	30	0.802	1.12	0.39	1.6
7	African Health Sciences	Uganda	30	0.581	1.108	0.4	2.1
8	Alexandria Journal of Medicine	Egypt	28			0.5	
9	International Journal of Health Sciences	Kenya	27			0.42	2.4
10	Eastern Mediterranean Health Journal	Egypt	26	0.901	2.087	0.49	2.3
11	African Journal of Disability	South Africa	25	0.962		0.41	2.2
12	International Journal of Africa Nursing Sciences	Nigeria	25	0.743			1.6
13	International Journal of Veterinary Science and Medicine	Egypt	24	1.571		1.03	6.8
14	SA Journal of Industrial Psychology	South Africa	24	0.778		0.5	2.4
15	African Journal of Traditional, Complementary and Alternative Medicines	Nigeria	23				
16	Arab Journal of Urology	Egypt	22	1.666		0.61	5.1
17	Malawi Medical Journal	Malawi	21	0.785	1.413	0.29	1.6
18	Euro-Mediterranean Journal for Environmental Integration	Tunisia	21			0.36	
19	African Journal of Reproductive Health	Nigeria	20	0.648	0.961	0.25	1.3
20	Egyptian Journal of Medical Human Genetics	Egypt	20	0.547		0.2	1.4
21	South African Family Practice	South Africa	20	0.396		0.2	1
22	Tropical Journal of Pharmaceutical Research	Nigeria	20	0.248	0.523	0.15	0.9
23	Curationis	South Africa	19				2.3
24	ONDERSTEPOORT Journal of Veterinary Research	South Africa	18	0.921	0.982	0.76	3
25	African Journal of Emergency Medicine	South Africa	18	0.907	1.451	1.306	1.8
26	Southern African Journal of HIV Medicine	South Africa	18	0.581	1.835	0.23	2.8
27	Cardiovascular Journal of Africa	South Africa	18	0.385	0.802	0.21	1.6
28	Journal of the Egyptian Public Health Association	Egypt	17	1.646			2.3
29	Libyan Journal of Medicine	Libya	17	0.964			2.8
30	Annals of African Medicine	Nigeria	17	0.796		0.27	1.8
31	African Journal of AIDS Research	South Africa	17	0.604	1.816	0.4	2
32	Health SA Gesondheid (Online)	South Africa	17	0.532			1
33	African Journal of Food, Agriculture, Nutrition and Development	Kenya	17	0.471			0.7
34	The Nigerian Postgraduate Medical Journal	Nigeria	17				1.2
35	Journal of Applied Sciences and Environmental Management	Nigeria	17				
36	South African Journal of Psychiatry	South Africa	16	0.934	1.242	0.3	1.8
37	The Egyptian Rheumatologist	Egypt	16	0.533			2
38	The Egyptian Journal of Neurology, Psychiatry and Neurosurgery	Egypt	16	0.458			1.1
39	Ghana Medical Journal	Ghana	16	0.419			1
40	Egyptian Journal of Radiology and Nuclear Medicine	Egypt	16	0.407		0.16	0.8
41	The Egyptian Journal of Hospital Medicine	Egypt	16	0.035			
42	African Journal of Microbiology Research	Nigeria	16		0.539		
43	International Journal of Biological and chemical Sciences	Cameroon	16				
44	South African Journal of Physiotherapy	South Africa	15	1.041		0.43	1.1
45	The Egyptian Heart Journal	Egypt	15	0.663			1.4
46	Journal of Public Health in Africa	Cameroon	15	0.434			1.5
47	Egyptian Journal of Chest Diseases and Tuberculosis	Egypt	15			0.05	
48	Future of Pharmaceutical Sciences	Egypt	15				
49	Journal of the South African Veterinary Association	South Africa	14	0.78	1.044	0.57	2
50	South African Journal of Communication Disorders	South Africa	14	0.776		0.43	
51	JOURNAL OF THE EGYPTIAN NATIONAL CANCER INSTITUTE	Egypt	14	0.665		0.3	2.1
52	Ethiopian Journal of Health Development	Ethiopia	14	0.35	0.5	0.13	1
53	Annals of Medical and Health Sciences Research	Nigeria	14				

[a]*This information is according to the data source used, however, this journal is affiliated to a number of African countries such as Uganda, Cameroon and Kenya.*

Only 19 health sciences journals from Africa have their JIF calculated for 2022. Among the list, South Africa has more journals (9), followed by Nigeria (4), Egypt (2) and Ethiopia (2). Other countries like Kenya, Uganda and Malawi finish the list with one journal each.

Table 3 presents top 20 African health sciences journals sorted by Google scholar H5-Index. The table has been sorted by Google scholar H5-Index because we have more journals with Google scholar H5-Index as compared to journals with metrics calculated from WoS and Scopus data.

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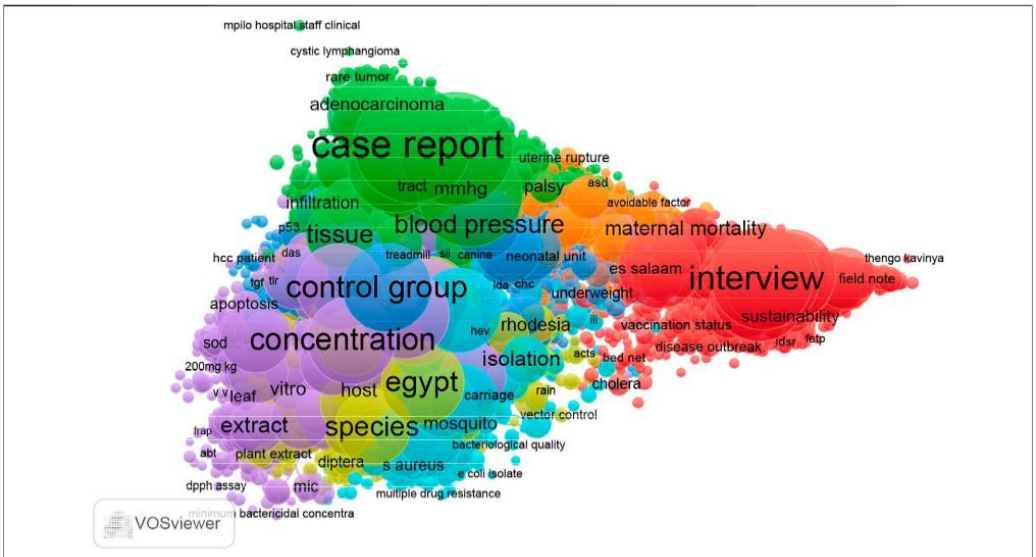


FIGURE 2 | Visualisation of topical focus (PubMed Journals). It shows the most frequent keyword terms used which suggest subject focus. The size of the nodes show how frequent a keyword appeared while the colour represents clusters to which the keyword belongs to (Impact of African health journals, 2023).

Topical Focus of Journals in Different Indexing Sites

We compared topical coverage of the journals based on their indexing database. Default parameters were used for clustering which were minimum values; resolution of 1 and minimum cluster size 1. This was done to get the most studied "subjects" or "topics". For Web of Science, 16 clusters were created with the following items in each cluster: cluster 1 (1,335), cluster 2 (1,074), cluster 3 (793), cluster 4 (748), cluster 5 (671), cluster 6 (614), cluster 7 (558), cluster 8 (466), cluster 9 (392), cluster 10 (247), cluster 11 (192), cluster 12 (167), cluster 13 (73), cluster 14 (48), cluster 15 (2), cluster 16 (1). For Scopus, nine clusters were created with the following number of items in each cluster: cluster 1 (6,277), cluster 2 (4,778), cluster 3 (2,203), cluster 4 (2,165), cluster 5 (1,978), cluster 6 (1,808), cluster 7 (1,300), cluster 8 (154), cluster 9 (21). For PubMed, nine clusters were also created with the following items under each cluster: cluster 1 (2,738), cluster 2 (2,501), cluster 3 (1,519), cluster 4 (1,031), cluster 5 (764), cluster 6 (610), cluster 7 (254), cluster 8 (67), cluster 9 (30).

The visualisation map of PubMed data (refer **Figure 2**) shows three types of research methods dominating which include, qualitative research, laboratory experimental studies, Randomised Control Trials and case reports. In terms of topics, infectious diseases, non-communicable diseases/chronic illnesses, maternal and child health, sexual and adolescent health, malnutrition and communicable diseases appear to be the frequently studied topics.

According to **Figure 3**, the visualisation map of Scopus data shows that the frequently studied topics were maternal and reproductive health, surgical conditions, physiology, chemistry and microbiology. Additionally, **Figure 4** shows the visualisation map of WoS data, with three frequently studied topics which include microbiology, health systems and parasitology.

Authorship Patterns and Collaboration of Journals in Different Indexing Sites

The network visualisations do not show observable differences in their author collaboration pattern based on database (**Figures 3**, **4**). The results show that Egypt collaborated more with Saudi Arabia and middle east countries. In Africa, Egypt mostly collaborated with North African countries, and also with South Africa, Nigeria, Ghana, Kenya and Congo. Similarly, other North African countries such as Tunisia, Morocco, Algeria collaborate with other North African countries.

Similarly, the results suggest that countries from Southern Africa collaborated more with Southern African countries. Some countries like Lesotho and Swaziland appeared to have collaborated with South Africa and United States only. On the other hand, the data showed that Madagascar did not collaborate with any African country. Since the distance between the nodes signifies close collaborations, the maps demonstrate that Egypt is close to Middle East countries while Nigeria is very close to United Kingdom. The map shows collaboration in publications, hence availability of non-African countries and their clusters too.

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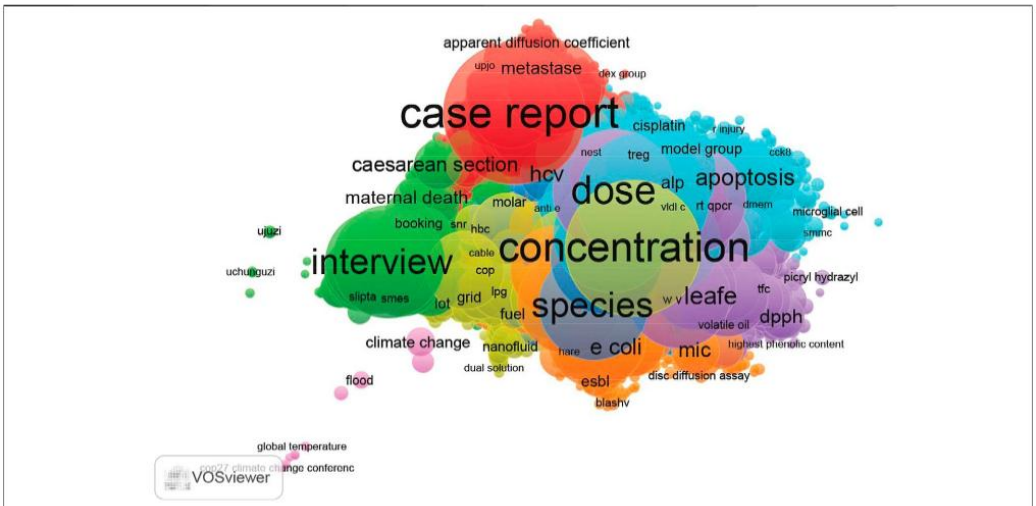


FIGURE 3 | Visualisation of topical focus (Scopus journals) (Impact of African health journals, 2023).

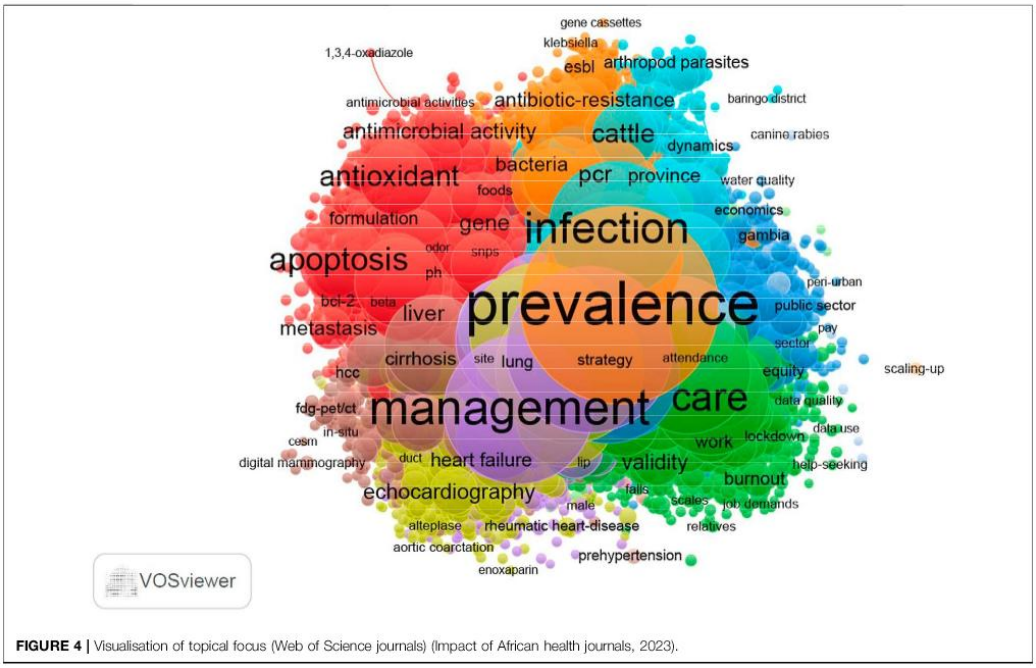


FIGURE 4 | Visualisation of topical focus (Web of Science journals) (Impact of African health journals, 2023).

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DISCUSSION

The present study aimed to analyze the research landscape of health sciences journals in Africa. It sought to determine the coverage of African health sciences journals by international and regional indexers, examine the citation metrics of these journals based on their indexing status, visualize and compare public health topics in African health sciences journals, and assess authorship and collaboration patterns in these journals.

The study confirmed that the two major international indexers, Web of Science (WoS) and Scopus, cover less than a quarter of the total number of health sciences journals from Africa. This aligns with previous studies that cited reasons such as high editorial requirements [9], lack of capacity, and editorial bias [10, 19] for the limited inclusion of African journals in these indexes [19, 24]. However, PubMed, the major indexer for biomedical literature, indexes a majority of African health sciences journals, thus increasing their visibility and influence. Additionally, regional indexers like AJOL and AIM also cover a significant number of African health sciences journals, although the relatively low count of active indexed journals raises concerns about sustainability of local journals and visibility of local health research. This result corroborates with previous findings by Ogunfolaj et al. [18] which reported a relatively low count of 173 journals indexed by AJOL. Although a study like ours could not exhaustively review all indexing databases, the ones covered in the present study were some of the major and popular databases that offer visibility to the most important health science research around the globe [10, 19, 29]. This study still recognises that these journals may be indexed elsewhere and may still be visible and influential.

The study revealed that over half of the African countries had no health sciences journals indexed in WoS, Scopus, or PubMed, indicating limited visibility of public health science research from these countries. This lack of visibility may be attributed to factors such as the limited capacity to manage journals, journals only available in print format [1]. The dominance of countries like South Africa, Egypt, and Nigeria, which have higher research productivity and impact may be attributed to high economy and population. The present study corroborated with findings from previous studies [19] on that South Africa, Egypt and Nigeria are the most productive African countries in research, which by extension high research impact. Furthermore, the study has highlighted the limited number of African health sciences journals with Journal impact factor and Citescore, which may be due to discontinued coverage, lack of funding to meet indexing costs, or the overall struggle of African journals to secure funding [1].

The study also compared the impact of African countries based on different data sources. While Egypt, South Africa, and Nigeria consistently ranked high in traditional metrics provided by WoS and Scopus, other countries like Tunisia, Ethiopia, Kenya, and Uganda showed better performance based on Google Scholar H5-Index. This indicates that quality and not just quantity plays a role in making an impact. Furthermore, the study has revealed the discrepancies between data sources, with same journals occupying different positions on different metrics lists such as Google Scholar H5-Index compared to Scopus metrics as well as compared to JIF metrics. This underscores the importance of considering multiple data sources when assessing journal impact as there are differences in how they are calculated [10, 18, 19, 30].

Generally, results of this study have highlighted low levels of impact on different journal metrics. Since authors consider visibility and citation impact of journals when selecting a journal to publish, it implies that many local authors will consider publishing with journals with high impact from elsewhere [31] and a few African health science journals, leaving out a majority of local journals. This may limit the impact of local journals that normally focus on publishing local research that addresses local health research needs. Some authors also observed that it destroys local research as authors are forced to conduct research required by the global north journals [10].

However, the issue of measuring scientific impact is a contested one with some arguing that they cannot be relied upon due to its many inherent challenges [32]. Several other authors also suggest exercising caution when applying scientific impact metrics to measure research quality [15, 33–35]. They argue that it has a number of flaws including the different ways they are calculated, its dependence on many factors such as article types, discipline of study, source of data used to calculate metrics, and that they can also be manipulated or influenced by editorial policy. These, among other reasons, may also perhaps explain the differences in metrics in the present study.

Furthermore, the historical background of the databases may help understand its focus in terms of discipline, geographical and language coverage [30]. It is reported that Web of Science, included several journals in its collection in 2005 at the emergence of Scopus in 2004, for commercial purposes just to match the competition disregarding its previous strict quality assurance requirements [9, 36]. Some studies have even reported coverage bias towards the global north research by Web of Science and Scopus as they are originated in the global north, and significantly under-represent research from global south [22, 37]. Therefore, if one wants to judge research or calculate metrics, an understanding of data sources is essential. Considering these limitations, it is therefore important to know and consider these factors to appropriately apply the metrics to the right contexts.

Furthermore, the results of this study are also consistent with those of other studies which suggest that WoS and Scopus topical coverage lean more towards pure sciences and social sciences, respectively as compared to PubMed [9, 37]. This result can be explained by the nature of the databases. WoS and Scopus are multidisciplinary databases whereas PubMed discipline-specific databases, thus a biomedical database. The present study has shown that topical coverage for WoS and Scopus is more of natural sciences such as physics, and chemistry while PubMed has more of health-related topics such as medical conditions, public health and nursing.

In addition, previous studies have also explained that the historical nature of WoS may explain the reason it covers more natural sciences than other disciplines. For instance, Chavarro [30] asserts that WoS started with chemistry and health before humanities and social

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sciences journals in its collection hence has more coverage on the initial topics. He further adds that high coverage of US journals also is perhaps evidence of its origins, which is United States, and receiving support from US government indirectly at the onset of the project to compete with Russia's scientific communication system. These differences should also be taken into account when measuring the quality and influence of a journal based on its inclusion in WoS and Scopus, as well as when using its metrics such as JIF and Citescore.

This also supports the notion of use of several data sources when assessing the visibility and impact of public health journals. For instance, this study would suggest, in addition to other multidisciplinary data sources such as Web of Science and Scopus/EMBASE, using PubMed/Medline or other discipline focused databases which have more journals in Public health. Furthermore, considering that AJOL and AIM cover a majority of African health science journals, they would be the most important data sources to base analysis on hence need for these indexers to upgrade and provide citation data for analysis.

Regarding authorship collaboration, the study found no observable differences based on the indexing database. It confirmed the pattern of collaboration based on historical colonial relationships and language, with African countries often collaborating with former colonial powers [17]. This study has established that many African countries collaborate with European countries with the exception of north African countries which have relations with the middle east. For instance, the collaboration among Anglophone countries, and also collaboration among Francophone countries. Additionally, even research funding or assistance is given to African countries based on former colonial relationships. This creates power imbalances in research agendas, where African countries are underrepresented and research priorities are influenced by the global north [38]. The findings of this study also agree with a study by Hernandez-Villafuerte [39] on that there is less collaboration among authors from African countries.

Study Limitations

The study acknowledged its limitations, including the possibility of missing some African health sciences journals not indexed in the searched data sources. Other analyses which did not use data from AJOL and AIM may also under represent the scientific impact of the journals from Africa. It also focused on journals with online presence only, excluding print-only journals.

Conclusion

Visibility of African health science journals is still a challenge that needs to be addressed to increase access to Africa's health science research, and its impact on public health policy and practice. The low coverage, including complete absence of health sciences journals by some African countries perhaps point towards inequalities in our health systems that require comprehensive and sustainable solutions. It has also revealed gaps in regional indexers, which cannot provide citation data for analysis despite indexing majority of African health science journals. In addition, the findings of this study have added evidence and significance to the assertions that several data sources and metrics need to be consulted when assessing journal quality and research impact. This also applies to a researcher, institution and country's research productivity and impact. Caution should be exercised in applying research metrics, considering contextual factors and limitations such as purpose for doing assessment, choice of appropriate metrics, interpretation and also data sources used. The purpose for doing assessment will determine the appropriate metrics to use and data sources to consult based on contextual factors such as region, language, discipline and countries level of development. It is also important to highlight limitations together with the presentation of the results or metrics for contextual understanding and appropriate application to policy and practice.

Implication for Research

These findings call for further research to explore barriers and facilitators for indexing African health sciences journals and increasing collaboration between African countries.

Implication for Policy and Practice

This study emphasizes the importance of understanding and applying research metrics appropriately in policy and practice, considering contextual factors and exercising caution. Researchers need to consult several research databases for their research needs and answers such as selection of journal to publish and research evidence for practice. Discipline of study also needs to be considered when choosing which databases to consult when searching for research evidence. When formulating research evaluation policies such as promotions and tenure decisions in universities, there is need for proper understanding of research impact assessment, and also several contextual factors need to be considered and applied with caution.

AUTHOR CONTRIBUTIONS

AS conceived the study concept collected data and drafted the manuscript. KW, Y-FC, MV-C, OU, and JI reviewed, made comments and edited the manuscript. KW, Y-FC, OU, and JI also supervised the work as it will contribute to an academic degree for AS. All authors contributed to the article and approved the submitted version.

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Science in Africa (DELTAS Africa) programme. The statements made and views expressed are solely the responsibility of the Fellow.

CONFLICT OF INTEREST

The authors declare that they do not have any conflicts of interest.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.ssph-journal.org/articles/10.3389/ijph.2023.1606415/full#supplementary-material

Supplementary Figure S1 | Scientometric analysis process (Impact of African health journals, 2023).

Supplementary Figure S2 | Search process PRISMA flow diagram (Impact of African Health Journals, 2023).

Supplementary Figure S3 | Map of Africa showing journal coverage for each database by country (Impact of African health journals, 2023).

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