

Exploring the Landscape: A Comprehensive Bibliometric Analysis of Ophthalmology and Optometry Research Fields in Africa

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Abstract

Purpose: To analyze the trends, patterns, and dynamics of ophthalmology and optometry research in Africa, focusing on publication trends, authorship patterns, collaborative networks, and citation analysis.

Methods: A comprehensive bibliometric analysis was conducted using the Scopus database to identify publications in ophthalmology and optometry from inception to 2023. Data on publication trends, most active source titles, research themes, geographic distribution, collaborative networks, funding sponsors, authorship patterns, and citation analysis were extracted and analyzed.

Results: The results revealed a steady increase in publications in ophthalmology and optometry research in Africa, with a notable acceleration observed from 2011 onwards. The British Journal of Ophthalmology emerged as the most active journal source, highlighting the dominance of international journals in African ophthalmic research. South Africa emerged as the leading contributor to research efforts, with significant contributions from international collaborations. Naidoo was found to be the most influential on the continent. However, a disparity in authorship representation was noted, with most influential non-African authors. Citation analysis highlighted the prominence of papers addressing global issues, raising questions about equitable attribution of citations to African researchers.

Conclusions: This study provides valuable insights into the landscape of ophthalmology and optometry research in Africa, highlighting both progress and challenges. While the increasing publication output reflects growing interest and recognition in the field, efforts are needed to address disparities in authorship representation and research funding. By fostering collaboration, promoting local capacity-building, and ensuring equitable recognition of African researchers, we can work towards a more inclusive and impactful research ecosystem that advances eye health outcomes for the continent's diverse populations.

Keywords: Africa, Bibliometric analysis, Citation analysis, Ophthalmology, Optometry, Research impact

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INTRODUCTION

Ophthalmology and optometry have undergone remarkable transformations driven by technological advancements and rigorous research efforts. Historically, ophthalmology dates to ancient Babylon, serving as a cornerstone of medical innovation. Conversely, optometry, though more recent, has rapidly

expanded, with increasing numbers of schools and an evolving scope of practice. These developments underscore the role of research in shaping clinical practices and advancing eye care.¹⁻⁶

Bibliometric analyses, employing statistical and mathematical tools, have become essential for evaluating research trends,

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publication outputs, and collaborative patterns in these fields.⁷⁻⁹ For instance, Nichols *et al.*¹⁰ examined key bibliometric indicators of ophthalmology journals, revealing that the United States led in both productivity and citation impact, while institutions such as Johns Hopkins and Harvard emerged as global leaders. Similarly, Yu *et al.*¹¹ analyzed publication trends in ophthalmology within Arab countries, identifying the most prolific authors and institutions. In optometry, Efron *et al.*¹² ranked the top 200 optometrists globally based on h-indices and citations, with Konrad Pesudovs leading in impact.

Despite the wealth of bibliometric research worldwide, African contributions remain underexplored. Previous studies have often overlooked the unique research priorities, challenges, and outputs within African contexts, resulting in skewed representations and a limited understanding of the continent's impact on global ophthalmology and optometry research.¹³ This gap is significant, given Africa's growing capacity in eye health research and the pressing need to address the continent's specific challenges effectively.

This study aims to bridge this gap by conducting a comprehensive bibliometric analysis of ophthalmology and optometry research in Africa. By applying citation analysis theory, the study evaluates research impact, identifies influential contributors, and highlights emerging trends. Citation analysis theory, which assumes that citations reflect the usage and influence of a work, serves as the conceptual framework for this analysis.¹⁴⁻¹⁹ While the theory has limitations, such as susceptibility to biases and self-citations, it remains a valuable tool for assessing scholarly impact.

Through this analysis, the study seeks to provide evidence-based insights that can inform strategies to address Africa's eye health challenges, contributing to the attainment of Sustainable Development Goals 3 (Good Health and Well-Being) and 10 (Reduced Inequalities).

METHODS

This study adopted a quantitative bibliometric research design to systematically analyze trends and patterns in ophthalmology and optometry research output from Africa, as indexed in the Scopus database. The analysis focused on identifying top research papers, assessing citation patterns, and exploring the distribution of publications across institutions, countries, and journals.

The data collection was conducted using the Scopus database, applying a carefully constructed search strategy. We utilized a combination of keywords, alternative terms, and Boolean operators to capture two core concepts: ophthalmology and optometry (Concept I) and Africa (Concept II). The search was performed across title, abstract, and keyword fields, ensuring comprehensive retrieval of relevant literature. The detailed search strategy, including specific terms, inclusion/exclusion criteria, and fields searched, is illustrated in Figure 1. The strategy was created without restriction to document type or language to maintain focus on the most relevant and accessible

literature. However, the year of publication was limited to the initial record year to December 2023 to maintain temporal consistency and relevance to the study period.

Given that Scopus is a highly curated database, issues such as duplicate records were avoided as the platform automatically resolves duplicates during indexing. Scopus also assigns unique identifiers, such as Scopus IDs and ORCID, to authors, ensuring consistent author name standardization across publications. In addition, Scopus provides mechanisms for authors to edit or request corrections to their profiles, further enhancing data accuracy and trustworthiness. This built-in feature of Scopus greatly reduced the need for manual data cleaning in our analysis.

We utilized VOSviewer (Version 1.6.20; Centre for Science and Technology Studies [CWTS], Leiden University, Leiden, South Holland, The Netherlands; available at <https://www.vosviewer.com/>) and Publish or Perish (Version 8; Harzing, com developed by Anne-Wil Harzing, London, Greater London, United Kingdom; available at <https://harzing.com/resources/publish-or-perish>) software for network and citation analysis, respectively. VOSviewer was used to generate co-authorship and keyword networks, using specific parameters such as the minimum number of citations per author and threshold values for keyword occurrence. These parameters were selected to focus on the most influential contributors and frequently researched topics, ensuring robust network visualizations. The parameters used in VOSviewer have been included in the figure legends for replication purposes. PoP 8 was employed to analyze citation metrics. The software allows seamless importation of external citation data from Scopus in Comma-separated values (CSV) and Research information systems (RIS) formats, enabling efficient citation metric generation and analysis without restrictions.

To ensure the reproducibility of our study, the full search strategy, data cleaning methods, and analysis parameters are detailed in this section and further illustrated in Figure 1, enabling other researchers to replicate the study or apply similar methods to different datasets.

RESULTS

A total of 242 documents were obtained from the search on Scopus. Out of these, 216 (86.36%) were research articles, 17 (7.03%) were reviews, 4 (1.65%) were notes, 3 (1.24%) were letters, 1 (0.41%) was a conference paper, and 1 (0.41%) was an erratum.

The graph in Figure 2 generally depicts a growth in the number of publications in the area of ophthalmology and optometry. The graph demonstrates that the highest number of publications was recorded in 2016, with a total of 29 publications, constituting 11.98% of the publications. The years 2023, 2019, and 2017 also saw relatively high publication counts, with 20, 19, and 17 publications, respectively. However, there are publications dating back as early as 1947, albeit with lower frequencies. This distribution provides a chronological overview of the evolution of published studies in the analyzed field.

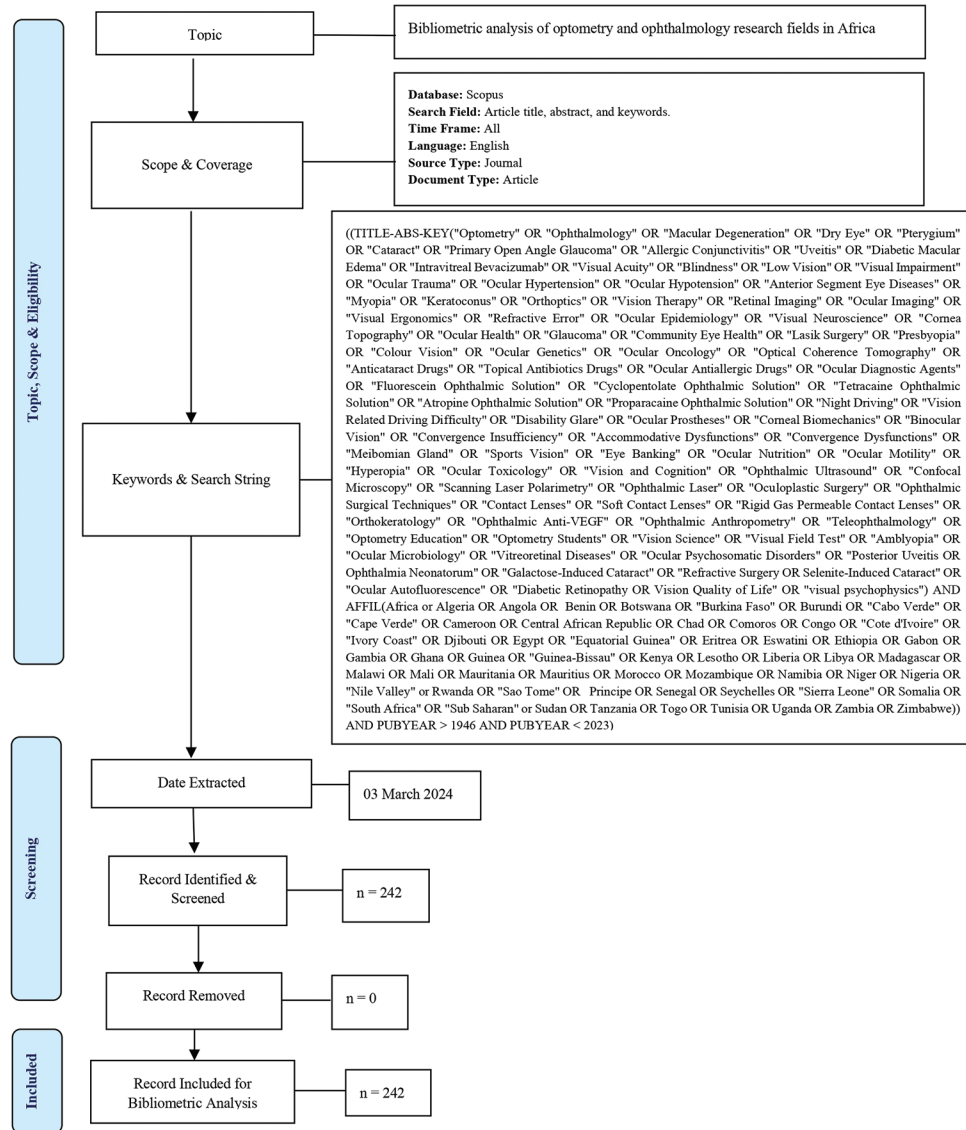


Figure 1: Flow diagram of the search strategy

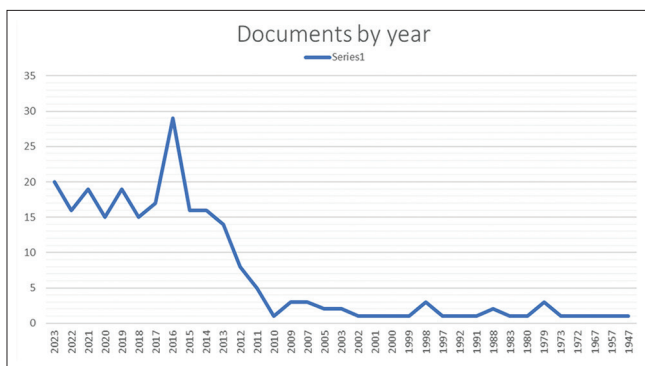


Figure 2: Document by year

The publications on the subject were found to be in three languages, with English being the most prevalent, accounting for 97.10% ($n = 235$), followed by French (2.5%, $n = 6$) and Spanish (0.4%, $n = 1$).

The top 10 journals of publication on the subject matter were identified in Table 1. The British Journal of Ophthalmology leads with 21 documents (8.68%), followed by African Vision and Eye Health (7.44%, $n = 18$) and Optometry and Vision Science (4.96%, $n = 12$). The subject area of Medicine dominates the publications, accounting for 77.7% of the total. Health Professions ($n = 48$, 19.8%) and Neuroscience ($n = 39$, 16.1%) follow as significant subject areas. Amongst the top 10, the International Journal of Environmental Research and Public Health represented the lowest percentage of 1.65%.

The keyword analysis highlights a strong focus on human-related topics, particularly demographic factors such as gender and age, as well as medical conditions like visual impairment and blindness. Among the author keywords identified from the search on Scopus, Human and Visual Acuity were the most prevalent, each appearing in 73.14% ($n = 177$) of the studies, followed by Humans in 61.57% ($n = 149$). Conversely, keywords such as

Cross-sectional study (14.05%, $n = 35$), Glaucoma (13.22%, $n = 32$), and Major Clinical Study (15.70%, $n = 38$) were less frequently used. VOSviewer output of the network visualization map of the author keywords is found in Figure 3a.

South Africa emerges as a significant contributor to the analyzed publications, followed by a diverse range of countries, including Australia, the United Kingdom, and the United States. This is

Table 1: Most active source title

Source title	Total publications (%)
<i>British Journal of Ophthalmology</i>	21 (8.68)
<i>African Vision and Eye Health</i>	18 (7.44)
<i>Optometry And Vision Science</i>	12 (4.96)
<i>Clinical And Experimental Optometry</i>	9 (3.72)
<i>Ophthalmology</i>	7 (2.89)
<i>Lancet</i>	6 (2.48)
<i>Investigative Ophthalmology and Visual Science</i>	5 (2.07)
<i>PLoS One</i>	5 (2.07)
<i>South African Medical Journal</i>	5 (2.07)
<i>International Journal of Environmental Research and Public Health</i>	4 (1.65)

shown in Table 2. The leading funding sponsor is the South African Medical Research Council ($n = 18$, 7.44%), followed by the National Research Foundation ($n = 12$, 4.96%) and the Brien Holden Vision Institute ($n = 10$, 4.13%). The Seventh Framework Programme is next, supporting 9 documents (3.72%), while the National Institutes of Health has funded 8 papers (3.31%). The Bill and Melinda Gates Foundation is noted for funding 7 documents (2.89%). Additionally, the Medical Research Council, University of Pretoria, and Wellcome Trust each supported 5 documents, corresponding to 2.07% each. Finally, the Eunice Kennedy Shriver National Institute of Child Health and Human Development is associated with 4 documents (1.65%).

The subject matter of ophthalmology and optometry research in Africa reveals several key authors contributing significantly, including Naidoo K, Loughman J, Resnikoff S, Pesudovs K, and Taylor HR, as evidenced in Table 3. A coauthorship network visualization based on country and authorship was generated using VOSviewer seen in Figure 3b-d. The analysis of the distribution of authorship across publications shows that single-author publications make up 3.72% of the dataset, with nine publications. The majority of the studies involve collaboration, with the highest number of publications involving four authors, accounting for 15.29% of the total (thirty-seven

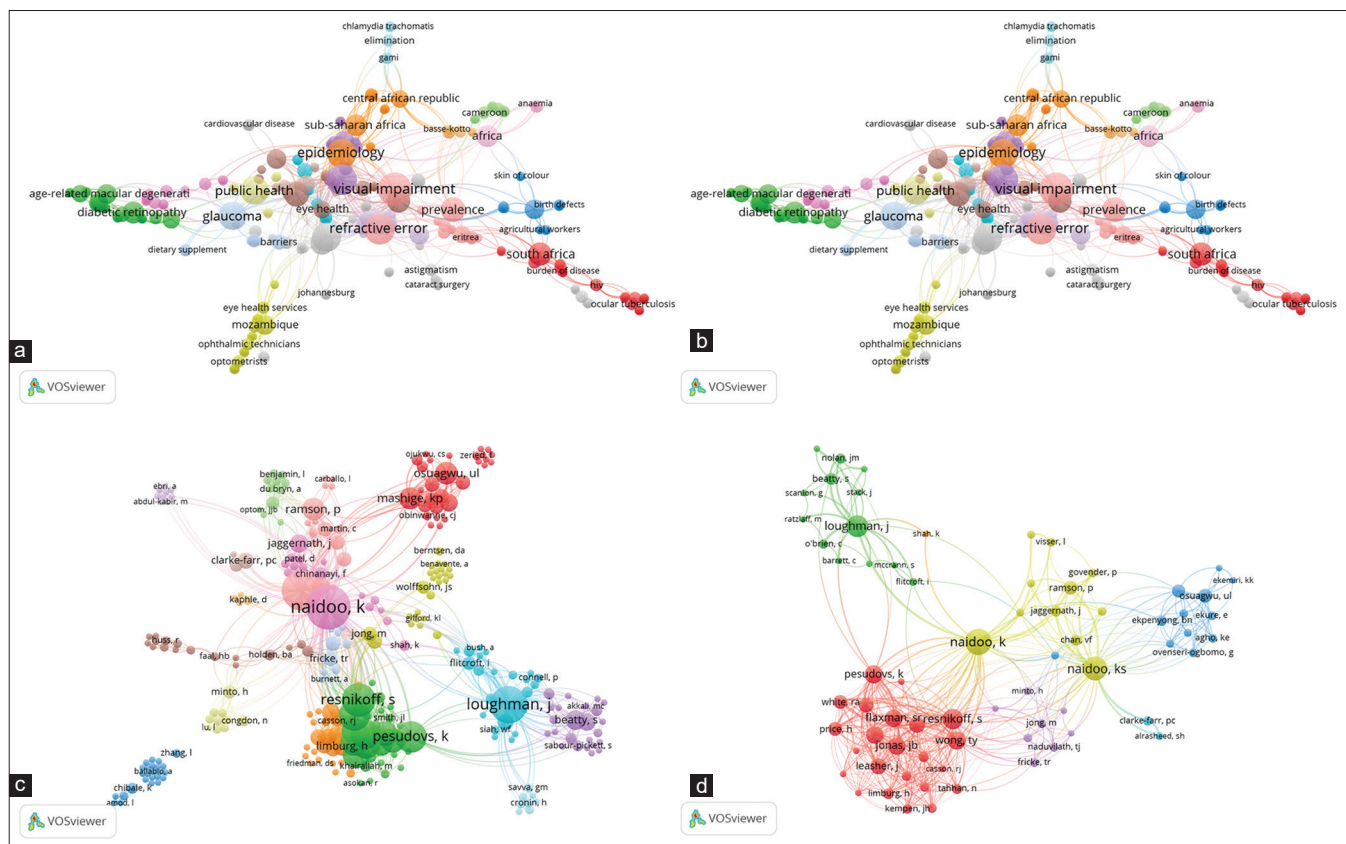


Figure 3: Network visualization map of author keywords and co-authorship (a) Network visualization map of the author keywords, (b) Network visualization map of the co-authorship (unit of analysis = countries; counting method: full counting; minimum number of documents of a country = 3; minimum number of citations of a country = 5), (c) Network visualization map of the co-authorship (unit of analysis = authors; counting method: fractional counting; minimum number of documents of an author = 3; minimum number of citations of an author = 3), (d) Network visualization map of the co-authorship (unit of analysis = authors; counting method: fractional counting; minimum number of documents of an author = 1; minimum number of citations of an author = 5)

publications). Publications with two and five authors represent 5.79% and 10.74%, respectively. Publications with seven or more authors show a significant decrease, although larger teams are still present, with the highest author count being 802 for one publication. Publications involving ten to thirteen authors also appear in the dataset, and there are a few notable outliers with extremely high author counts (99, 253, 640, 679, 727, and 802). Overall, team sizes of two to five authors are the most common.

The study also analyzed the most used text in ophthalmology and optometry research in Africa using VOSviewer. The VOSviewer term co-occurrence network based on title and abstract fields reveals several key findings [Figure 4]. The network contains numerous items grouped into clusters. The clusters are represented by different colors, with the terms linked by lines to show co-occurrences. The total link strength indicates the degree of connection between these terms.

In terms of frequency, the top three terms identified in the network are education, need, and child. These terms are large in size and part of the red cluster. The last three terms in terms of frequency are temporal trend, moderate and severe visual impairment, and trachoma, all located within the green cluster.

The network structure reflects these clusters and terms, with larger terms representing higher frequency and smaller terms indicating less frequent usage.

The University of KwaZulu-Natal emerged as the most influential in terms of research output on ophthalmology and optometry, with 124 (51.24%) publications. As shown in Table 4, Brien Holden Vision Institute, South African Medical Research Council, UNSW Sydney, and Technological University Dublin followed.

Citation metrics on documents on ophthalmology and optometry research fields were obtained from the data retrieved from Scopus using PoP 8. The citation metrics provided span the publication years from 1947 to 2023, with citation years covering a span of 77 years from 1947 to 2024. The total number of papers is recorded at 242. Cumulatively, these papers have garnered 30,953 citations. On average, there are 401.99 citations per year and 127.90 citations per paper. Furthermore, the average number of citations per author stands at 3573.70, and the average number of papers per author is noted as 56. In terms of indices, the h-index is reported at 45, while the g-index is significantly higher at 175. The most cited papers are summarized in Table 5. The highest h-index for the papers on the subject is 45. In Figure 5a, a network visualization map of the citations by country is shown [Figure 5]. Figure 5b and c also show a network visualization map of the citation by documents and a network visualization map of the citation by documents, respectively [Figure 5].

DISCUSSION

The findings demonstrate that English is the dominant language for scholarly communication in ophthalmology and optometry research in Africa, reaffirming its role as the primary medium for academic discourse in the field.

Table 2: Top 20 countries contributed to the publications

Country	Total publications (%)
South Africa	214 (88.43)
Australia	73 (30.17)
United Kingdom	69 (28.51)
United States	62 (25.62)
Ireland	38 (15.70)
Germany	34 (14.05)
India	32 (13.22)
Singapore	28 (11.57)
Netherlands	20 (8.26)
Nigeria	20 (8.26)

Table 3: Most productive authors

Author's name	Number of documents (%)
Naidoo K.	85 (35.12)
Loughman J.	31 (12.81)
Resnikoff S.	31 (12.81)
Pesudovs K.	28 (11.57)
Taylor H.R.	25 (10.33)
Jonas J.B.	24 (9.92)
Wong T.Y.	22 (9.09)
Bourne R.R.A.	20 (8.26)
Leasher J.	19 (7.85)
Keeffe J.	16 (6.61)
White R.A.	14 (5.79)
Flaxman S.R.	12 (4.96)
Osuagwu U.L.	12 (4.96)
Price H.	12 (4.96)
Ramson P.	12 (4.96)
Mashige K.P.	11 (4.55)
Wright C.Y.	11 (4.55)
Limburg H.	10 (4.13)
Beatty S.	9 (3.72)
Flaxman S.R.	9 (3.72)

Table 4: Most influential institutions

Affiliation	Total publications (%)
University of KwaZulu-Natal	124 (51.24)
Brien Holden Vision Institute	62 (25.62)
South African Medical Research Council	49 (20.25)
UNSW Sydney	34 (14.05)
Technological University Dublin	33 (13.64)
University of Cape Town	31 (12.81)
University of Melbourne	29 (11.98)
Nova Southeastern University	26 (10.74)
Melbourne School of Population and Global Health	26 (10.74)
Anglia Ruskin University	24 (9.92)

The steady growth in publications from 1947 to 2023, with a notable rise since 2011, highlights increasing interest in ophthalmic research and its prioritization within Africa. This trend mirrors similar findings by Yu *et al.*,¹¹ who noted progressive

Table 5: Highly cited articles

Authors	Title	Year	Cites	Cites per year
Vos <i>et al.</i>	Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990–2015: A systematic analysis for the Global Burden of Disease Study 2015	2016	5241	655.13
Vos <i>et al.</i>	Global, regional, and national incidence, prevalence, and years lived with disability for 328 diseases and injuries for 195 countries, 1990–2016: A systematic analysis for the Global Burden of Disease Study 2016	2017	5109	729.86
Vos <i>et al.</i>	Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990–2013: A systematic analysis for the Global Burden of Disease Study 2013	2015	4961	551.22
Holden <i>et al.</i>	Global prevalence of myopia and high myopia and temporal trends from 2000 through 2050	2016	2604	325.5
Flaxman <i>et al.</i>	Global causes of blindness and distance vision impairment 1990–2020: A systematic review and meta-analysis	2017	1965	280.71
Hay <i>et al.</i>	Global, regional, and national disability-adjusted life-years (DALYs) for 333 diseases and injuries and healthy life expectancy (HALE) for 195 countries and territories, 1990–2016: A systematic analysis for the Global Burden of Disease Study 2016	2017	1532	218.86
Bourne <i>et al.</i>	Magnitude, temporal trends, and projections of the global prevalence of blindness and distance and near vision impairment: A systematic review and meta-analysis	2017	1447	206.71
Bourne <i>et al.</i>	Causes of vision loss worldwide, 1990–2010: A systematic analysis	2013	1257	114.27
Stevens <i>et al.</i>	Global prevalence of vision impairment and blindness: Magnitude and temporal trends, 1990–2010	2013	422	38.36
Leasher <i>et al.</i>	Global estimates on the number of people blind or visually impaired by diabetic retinopathy: A meta-analysis from 1990 to 2010	2016	400	50
Fricke <i>et al.</i>	Global prevalence of presbyopia and vision impairment from uncorrected presbyopia: Systematic review, meta-analysis, and modelling	2018	291	48.5
Kassebaum <i>et al.</i>	Child and adolescent health from 1990 to 2015: Findings from the global burden of diseases, injuries, and risk factors 2015 study	2017	278	39.71
Khairallah <i>et al.</i>	Number of people blind or visually impaired by cataract worldwide and in world regions, 1990–2010	2015	264	29.33
Bourne <i>et al.</i>	Prevalence and causes of vision loss in high-income countries and Eastern and Central Europe: 1990–2010	2014	258	25.8
Naidoo <i>et al.</i>	Potential lost productivity resulting from the Global Burden of Myopia: Systematic review, meta-analysis, and modelling	2019	217	43.4
Fricke <i>et al.</i>	Global prevalence of visual impairment associated with myopic macular degeneration and temporal trends from 2000 through 2050: Systematic review, meta-analysis and modelling	2018	199	33.17
Bourne <i>et al.</i>	Prevalence and causes of vision loss in high-income countries and in Eastern and Central Europe in 2015: Magnitude, temporal trends and projections	2018	198	33
Bourne <i>et al.</i>	Number of people blind or visually impaired by glaucoma worldwide and in world regions 1990–2010: A meta-analysis	2016	161	20.13
Sullivan <i>et al.</i>	Mutations in a novel retina-specific gene cause autosomal dominant retinitis pigmentosa	1999	149	5.96
Naidoo <i>et al.</i>	Global vision impairment and blindness due to uncorrected refractive error, 1990–2010	2016	145	18.13

increases in ophthalmology research in Arab countries driven by advancements in education and research infrastructure.

The British Journal of Ophthalmology emerged as the most active source, followed by African Vision and Eye Health. This reflects the limited availability of regional ophthalmic journals, which impacts publication patterns. Research themes largely focus on medicine, health professions, and visual impairment. The VOSviewer analysis highlighted prevalent keywords like “refractive error”, “visual impairment”, and “prevalence” which align with local health priorities. Comparatively, studies in Spain⁸ and China²⁰ showed differing research focuses, underscoring variations in regional needs and resources.

South Africa leads in research output, with substantial contributions from external collaborators in Australia, the UK, and the US. This highlights the reliance on external funding and expertise, as observed in Caeon *et al.*¹³

Strengthening local research capacity through investments in infrastructure, training, and funding is critical to reducing dependence on foreign support and aligning research with African priorities.

Naidoo was identified as the most prolific author, with African authors being underrepresented among the top contributors. Collaboration is prevalent, with medium-sized teams being the norm. Large-scale projects involving extensive co-authorship indicate the increasing complexity of research. However, the dominance of foreign researchers in African ophthalmology underscores the need to foster local expertise.

Vos *et al.*²¹ received the highest citations, underscoring the influence of globally relevant studies that incorporate African data. Citation analysis theory supports the use of citation counts and h-index as measures of scholarly impact, but variations across databases and the collaborative nature of highly cited works pose challenges in attributing credit to African researchers. Efforts

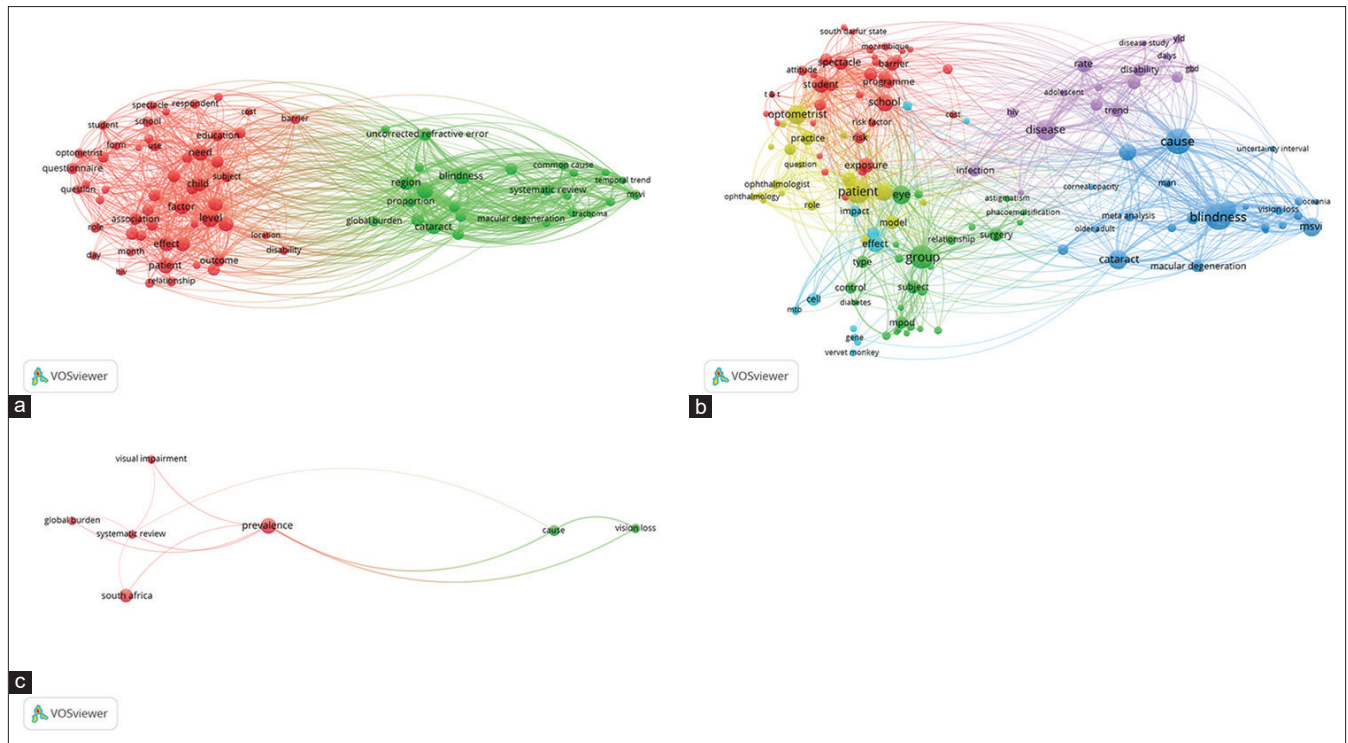


Figure 4: Network visualization map of text analysis (a) VOSviewer visualization of a term co-occurrence network based on title and abstract fields (binary counting), (b) VOSviewer visualization of a term co-occurrence network based on title and abstract fields (full counting), (c) VOSviewer visualization of a term co-occurrence network based on title fields (binary counting)

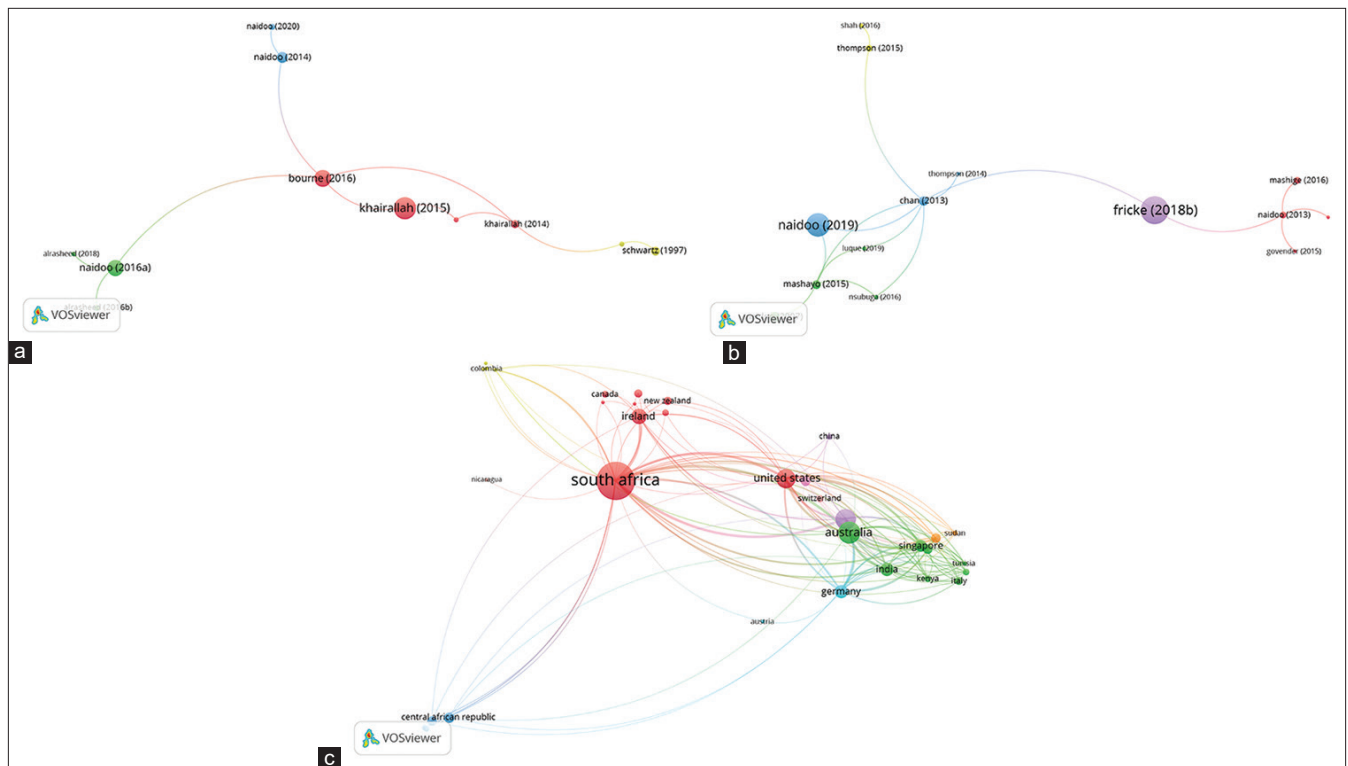


Figure 5: Network visualization maps (a) Network visualization map of the citation by country (minimum number of documents of an author = 1; minimum number of citations of an author = 5), (b) Network visualization map of the citation by documents (minimum number of citations of a document = 5), (c) Network visualization map of the citation by documents (minimum number of citations of a document = 10)

should focus on increasing the visibility and impact of locally led research through targeted capacity-building initiatives.

This study is subject to several limitations, particularly concerning the use of Scopus as the sole data source. While Scopus is a comprehensive and widely used database, it does have inherent biases. One such bias is the underrepresentation of non-English language publications, which may result in the exclusion of significant research published in languages other than English. In addition, Scopus may not index certain regional journals, particularly those from Africa, at the time of data extraction, potentially omitting important local research. This limitation is critical in assessing ophthalmology and optometry research in Africa, as it could result in an incomplete representation of the continent's scientific output.

Another limitation relates to the temporal scope of the study. The data used in this analysis covers publications up to 31 December 2023. As a result, any research published after this date is not included, and the dataset for 2023 may not fully capture all relevant publications, particularly those that were being indexed at the time of extraction. This temporal cut-off may affect the completeness of the data, especially for research outputs from the latter part of the year.

Finally, the generalizability of the findings should be considered. Although the study provides valuable insights into ophthalmology and optometry research in Africa, it may not fully represent the global landscape or even all research conducted in Africa. The reliance on Scopus as the primary data source means that certain research outputs, particularly those published in nonindexed regional or national journals, may not be reflected in the analysis. As a result, caution should be exercised when extrapolating these findings to a broader context.

In conclusion, the study provides a comprehensive overview of the landscape of ophthalmology and optometry research in Africa, spanning from publication trends to authorship patterns and citation analysis. The findings reveal a significant increase in scholarly output in these fields, underscoring the growing interest and recognition of eye health research within the continent. South Africa emerges as a key contributor to research efforts, reflecting its well-established research infrastructure and collaborative partnerships with international institutions. While the prominence of foreign countries in research contributions highlights the global interest in African ophthalmology and optometry research, it also raises questions about the equitable representation of African researchers and the distribution of research funding. Addressing these disparities will be essential in fostering local capacity-building and ensuring that research efforts align with the needs of African populations. The analysis of authorship patterns emphasizes the importance of fostering collaboration among researchers, both within Africa and with international partners. Encouraging diverse collaboration models, promoting mentorship programs, and

providing resources for capacity development can help bridge existing gaps and empower African researchers to take on leadership roles in shaping the future of eye health research on the continent. Finally, the citation analysis underscores the need for thoughtful attribution and recognition of African researchers contributing to publications addressing global issues. By acknowledging the contributions of all stakeholders, we can ensure a more inclusive and equitable research ecosystem that advances knowledge and improves eye health outcomes for all.

Future research on this matter should strive to incorporate a broader range of metrics for prominent authors and publications and should aim to encompass as many databases as feasible.

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Conflicts of interest

There are no conflicts of interest.

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