

A review article

A bibliometric analysis of the traditional African dental practice of infant oral mutilation

Balraj Shukla^{1*}, Anup Panda¹

¹ Department of Pediatric and Preventive Dentistry, College of Dental Sciences and Research Centre, Gujarat University, Ahmedabad, India

*Corresponding author: balrajshukla@hotmail.com

Abstract

Background: Infant Oral Mutilation (IOM) is a deleterious form of germectomy that can cause irreversible damage to oral health and is capable of instigating systemic complications. It has often been reported as a part of African traditional medicine and continues to be reported in developed countries.

Methods: Publications on IOM were retrieved from PubMed, LENS.org, ScienceDirect, and Semantic Scholar. Rayyan was used to deduplicate the articles, and the Bibliometrix software generated data and visualizations on publication indicators, collaboration networks, conceptual networks, and citation analysis.

Results: 62 articles were included for the final data analysis after deduplication. These articles were published between 1969 and 2024 across 41 different journals. The United Kingdom and Uganda have published the most articles on IOM. The most reliable sources are the International Journal of Pediatric Dentistry, BMC Oral Health, and the British Dental Journal. The most active affiliations are the University of Nairobi, the School of Health and Medical Sciences, and the Hadassah School of Dental Medicine. Co-occurrence analysis, keyword mapping, and clustering revealed a strong connection between canine bud removal, infant, African traditional medicine, tooth germ, and tooth extraction.

Conclusion: This bibliometric analysis reveals a fluctuating publication trend for IOM and the need to address this topic more frequently in the scientific literature. It provides insight into top contributors in the form of authors, affiliations, countries, and journals who can be best relied on to understand and counter IOM.

Keywords: Infant Oral Mutilation, African Traditional Medicine, Bibliometric Analysis, Pediatric Dentistry, Rituals, Teething, Harmful Traditional Practices.

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Background

Infant Oral Mutilation (IOM) is a harmful traditional practice of removing an infant's unerupted teeth or tooth buds with unsterilized tools and without anesthesia. False teeth, nylon teeth, deciduous/primary canine buds enucleation, canine/tooth extirpation, Ebinyo/Ebiino/Ebino, plastic teeth, canine/tooth bud gouging, vinyl teeth, Lugbara teeth, Lawalawa, Bino, Ikela/Icela/, Gidog, Lake jo marak, Two lak, Meno ya plastiki are the various terms that have been used to describe IOM (1).

'Haifat' was the term used to describe a Sudanese practice wherein locals used a sharp, heated instrument to lance the swollen alveolar process over the unerupted primary canines until bleeding occurred (2). The earliest report of such dental modification in the literature was by the Nilotic people of Sudan in 1932. The act known as haifat originated in 1575, when Ambrose Paire incised the gingiva with a lancet to relieve pain during teething. In 1668, Francois Mauricaeau reportedly used knives and coins to incise the gingiva during teething. The practice was further encouraged by Joseph Hurlock in the 18th century. By the 20th century, African tribes routinely practiced IOM. The customary practice proliferated in the 1960s, with the first scholarly document on the subject, a case report by Pindborg in 1969 (3).

Multiple tales from different African tribes give insight into the reason behind the practice of IOM. Some believe it is done to fulfill the

desire to resemble an ox. Others believe that when bovine calves have their canines removed, they no longer suffer from diarrhoea or febrile diseases. This theory, in particular, has made the traditional healers believe that primary tooth buds are 'tooth worms' that must be removed. For some groups, IOM is a way to relieve a locked jaw and create additional space for feeding and the airway. Another tale suggests that the ritual extraction of primary teeth increases the force with which poisoned darts are fired from blowpipes. At the turn of the 20th century, a few researchers also postulated that Western colonizers introduced this practice to the African population (3,4).

Multiple reports published in the 21st century suggest that IOM continues to be practiced in Africa. Notably, migration has led to a rising prevalence of the heinous ritual in developed countries (5). IOM is performed in infants aged 4 to 18 months and is most often performed bilaterally, with three times as many procedures on the mandible (6). It is performed by family members, traditional midwives, school teachers, local priests, imams, or traditional healers. Germectomy of canines and lateral incisors is most common. The first step of IOM begins a week before performing the procedure. This step is called 'silencing,' and it involves applying 'healing' concoctions such as herbs, charcoal powder, herb ash, lizard feces, sulfur capsules, sodium bicarbonate, mustard, garlic, and crushed

antibiotics. A week later, mutilation is done using a sharp, heated instrument without anesthesia until bleeding occurs. This instrument can be screws, knives, coins, blades, nails, glass, bicycle spokes, sharp stones, and hot needles. The removal of the entire tooth bud follows germectomy. Post-mutilation, herbs or honey are rubbed and pushed into the extraction socket to promote healing (4).

IOM can lead to a range of short-term and long-term complications. Short-term systemic complications include tetanus, osteomyelitis, septicemia, upper respiratory tract infections, meningitis, otitis media, convulsions, malaria, pneumonia, or gastroenteritis. Short-term dental complications are pain, hemorrhage, trismus, submandibular abscess, and tissue laceration. Long-term systemic complications include HIV/AIDS, noma, and malnutrition. Long-term dental complications are dental hypoplasia, dilaceration, ectopic eruption, midline shift, malocclusion, malformed teeth, and odontoma-like malformations (3,6).

Scholarly literature has mentioned the practice of IOM since the early 20th century. Given the number of synonymous terms for IOM and its demographic spread in the 21st century, an in-

tellectual structure on the topic can lead vigilant researchers and countries that have worked on IOM. Thus, we decided to perform a bibliometric analysis to answer the following research questions:

1. What is the quantitative global research output on IOM?
2. Which countries, affiliations, and journals have been the most influential in increasing our understanding of IOM?
3. Which conceptual themes can be inferred based on the co-occurrence of keywords?

Materials and methods

The reporting of this study was based on the framework proposed by Ozturk et al. for bibliometric research (7). The initial search for scholarly literature on IOM was done in November 2024 by three independent researchers across the following databases: PubMed, LENS, Semantic Scholar, and ScienceDirect. The search strategy was database-specific, due to heterogeneity in search capabilities and indexing structures. Necessary truncations/wildcards and Boolean operators were used to refine our search (Table 1).

Table 1: Search strategy and databases

Data-base	Search strategy	Limits/filters
PubMed	(“infant oral mutilation”[tiab]) OR (“canine gouging”[tiab]) OR (“ebino”[tiab]) OR (“ebinyo”[tiab]) OR (“ebiino”[tiab])) OR (“tooth bud gouging”[tiab]) OR (“vinyl tooth”[tiab]) OR (“vinyl teeth”[tiab])) OR (“lugbara”[tiab]) OR (“lawalawa”[tiab]) OR (“bino”[tiab]) OR (“ikela”[tiab]) OR (“icela”[tiab])) OR (“gidog”[tiab]) OR (“lake jo marak”[tiab]) OR (“two lak”[tiab]) OR (“meno ya plastiki”[tiab])	Language: English Species: Humans
LENS.org	title:("infant oral mutilation") OR (canine gouging*) OR (ebiino) OR (ebinyo) OR (ebino) OR (bino) OR ("tooth bud gouging") OR ("vinyl tooth") OR ("vinyl teeth") OR (lugbara) OR (lawalawa) OR (ikela) OR (icela) OR (gidog) OR ("lake jo marak") OR ("two lak") OR ("meno ya plastiki") abstract:("infant oral mutilation") OR (canine gouging*) OR (ebiino) OR (ebinyo) OR (ebino) OR (bino) OR ("tooth bud gouging") OR ("vinyl tooth") OR ("vinyl teeth") OR (lugbara) OR (lawalawa) OR (ikela) OR (icela) OR (gidog) OR ("lake jo marak") OR ("two lak") OR ("meno ya plastiki")	Date Range: Published till 2024 Document Type: Journal Articles Subject (based on ISSN descriptions): General Medicine, Infectious Diseases, Public Health, Environmental and Occupational Health, Gen- eral Dentistry, Multidisciplinary, Immunology Field of Study: Medicine, Public Health, Biol- ogy, Internal Medicine, Dentistry, Health Care, AIDS, Infectious Diseases, Infant Oral Mutila- tion Keywords: Pediatrics, Infant Oral Mutilation, Global Health, Medicine, Epidemiology, Afri- ca, HIV, Infant, Prevention, Public Health, De- veloping Countries, Diagnosis, Children, Bio- chemistry, Hematology, Endocrinology, Ther- moregulation, Environmental Sciences
Sci- enceDir ect	• Infant oral mutilation • Canine Gouging • Ebinyo *Each term entered was scanned across the title, abstract, & keywords	Year(s): Till 2024 Article Type: Research Articles
Seman- tic Scholar	• “infant oral mutilation” • “ebinyo” • “canine gouging”	Field of Study: Medicine Date Range: Till 2024

After exporting our results from each database, we deduplicated them in Rayyan (SaaS application). Rayyan was also used to remove articles that did not meet the inclusion criteria. Articles with a lack of information on corresponding authors, co-authors, keywords, authors' affiliations, and source/publisher's information were excluded. Moreover, articles that were editorials, letters to the editor, opinion pieces, posters, news pieces, oral presentations, and conference proceedings were excluded. The resulting tabulated data was then imported into Bibliometrix (version 4.1).

Based on the initial evaluation of the Bibliometrix software, data cleaning was performed by adding relevant field tags, updating meta-field tags, unifying multiple abbreviations for the same author, and creating a separate file for synonymous keywords, which were then fed into the co-occurrence analysis.

After data cleaning, the bibliometrix file was again imported. The following science mapping and performance analyses were conducted: co-author analysis for collaboration net-

works, co-word analysis for conceptual networks, publication impact analysis, and co-citation analysis.

Results

124 articles were identified across the different search strategies. Following deduplication and initial screening, 62 met the inclusion criteria. After data cleaning, Biblioshiny generated science-mapping and performance-analysis results for the 62 articles. Based on the research questions, the results are interpreted below using quantitative evaluations of metrics and qualitative visualizations.

Publication and impact indicators

The 62 articles were published between 1969 and 2024 across 41 different journals. The most common research designs were cross-sectional studies, case reports, and case series (Figure 1). Each document has had an average of 3.42 authors. Singular authorship was observed in seven published papers. Regarding authorship, 180 authors were identified across the 62 documents, with an international co-authorship rate of 16.13%.

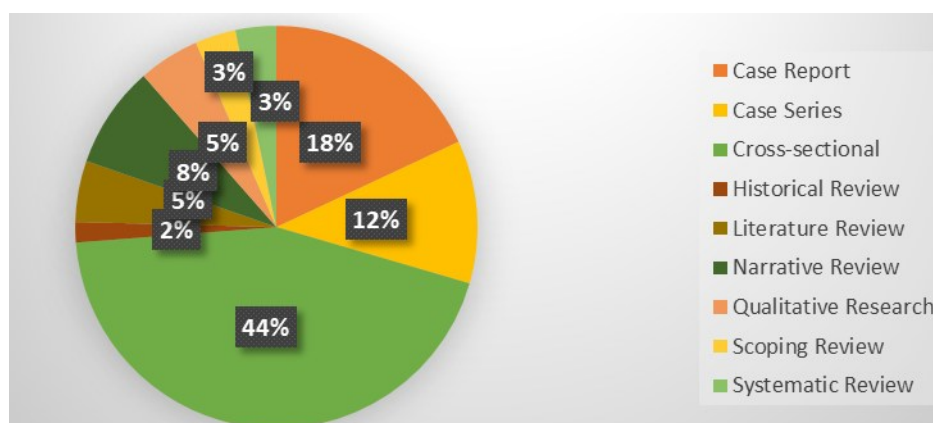


Figure 1: Type of Research on IOM

Publication trends on IOM can be described in three phases: an inconsistent, low level of interest in the topic between 1969-2012, a sharp rise in publications between 2013-2019, and a rapid decline from 2020.

Figure 2(a) shows that the countries with the most publications on IOM were the United Kingdom (n=10), Uganda (n=8), Kenya (n=6), Sweden (n=5), and Tanzania (n=5). The United Kingdom also tops the list of countries with the

most citations to IOM documents, with 179. Though Uganda and Kenya have the second and third-most documents on IOM, Denmark and the USA have the next-best citation scores of 126 and 122, respectively. The top three institutes with the most published documents on IOM are the University of Nairobi, Kenya (n=5), the School of Health and Medical Sciences, Sweden (n=4), and the Hadassah School of Dental Medicine, Israel (n=3).

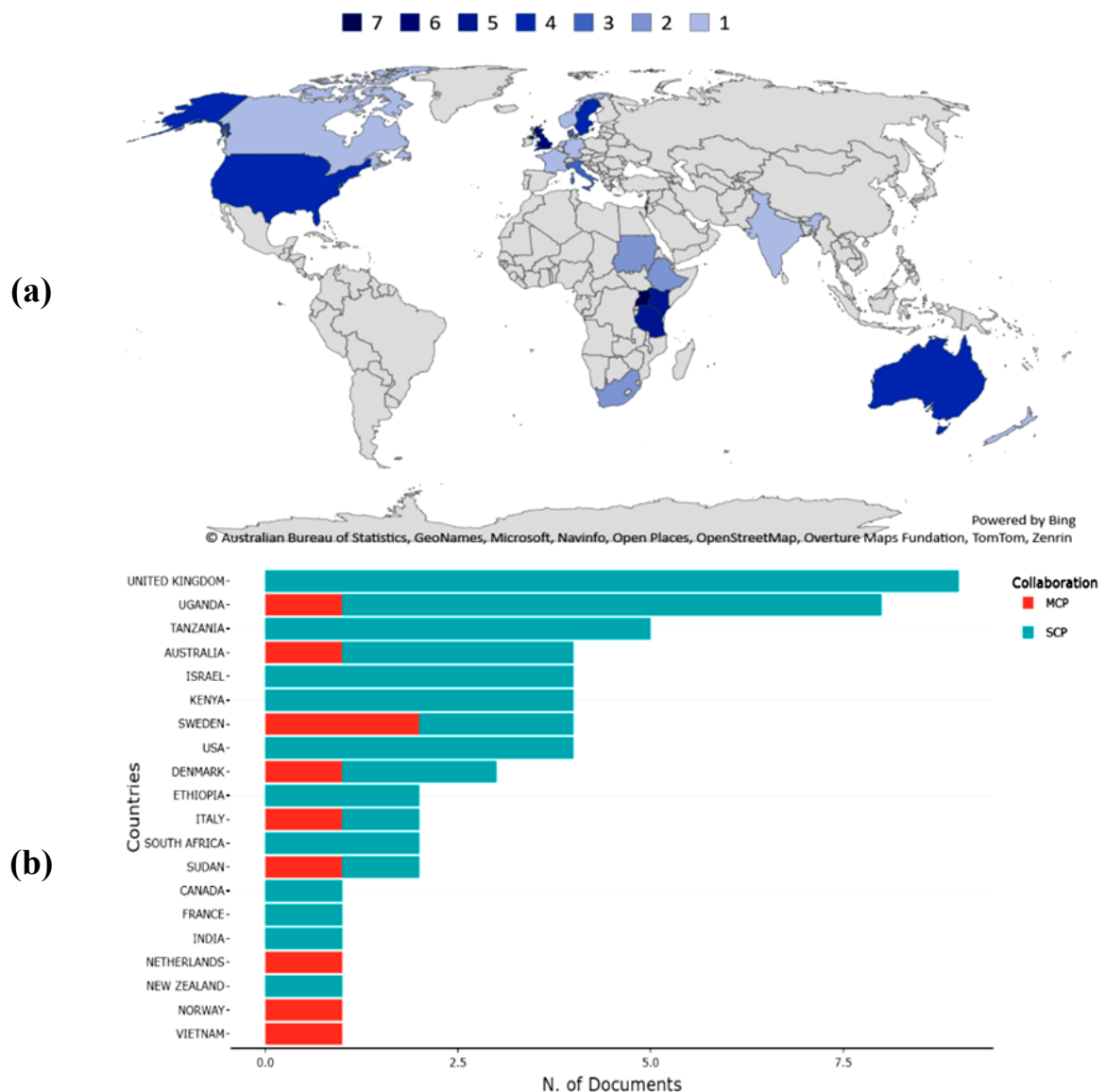


Figure 2: (a) Countries with the most publications on IOM (b) Single Country Publications (SCP) and Multiple Country Publications (MCP)

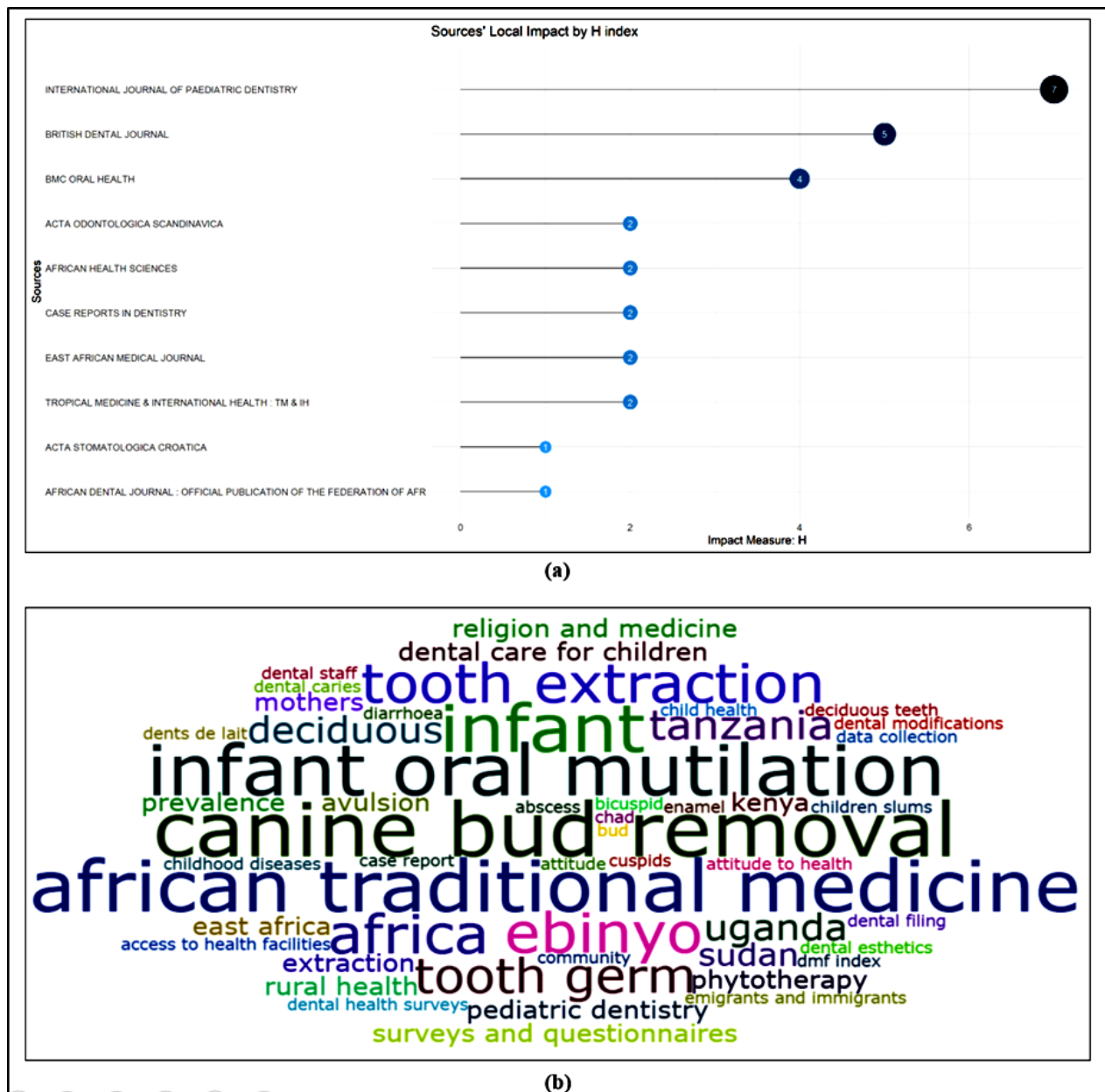


Figure 3: (a) Most impactful journals for IOM (b) Keywords highlighted by word count, wherein their size corresponds directly to their frequency

Arthur Kemoli (h-index: 16) from the University of Nairobi is a part of five published manuscripts on IOM. Jir Barzangi (h-index: 3), Lennart Unnell (h-index: 27), Kristina Arnrup (h-index: 20) from the School of Health and Medical Sciences, and Emil Kikwilu (h-index: 16) from the Muhimbili University have each published four papers on IOM. Regarding au-

thor productions, Emil Kikwilu's four articles have been published across a wider timespan (1992-2016), whereas Arthur Kemoli's five articles have been published between 2016-2024 [Figure 5(a)].

The most common journals featuring scholarly literature on IOM were the International Journal of Pediatric Dentistry (IJPd) (n=8),

British Dental Journal (BDJ) (n=6), and BMC Oral Health (BMCOH) (n=5) [Figure 3(a)].

Russell SL's historical review of IOM, published in Dental Clinics of North America (DCNA) in 2013, has been the most globally cited manuscript (84 citations), followed by JJ Pindborg's first report on IOM in 1969 (72 citations) (8,9) [(Figure 4(a)]. While globally cited documents represent the total citations a paper

has received across all publications in a database, locally cited documents are those mentioned only in a specific collection or niche topic, for example, a paper cited in a systematic review. In this regard, EN Kikwilu and JF Hiza's study on the prevalence of IOM and JJ Pindborg's maiden case report on IOM have received the most local citations (28 citations each) [Figure 4(b)].

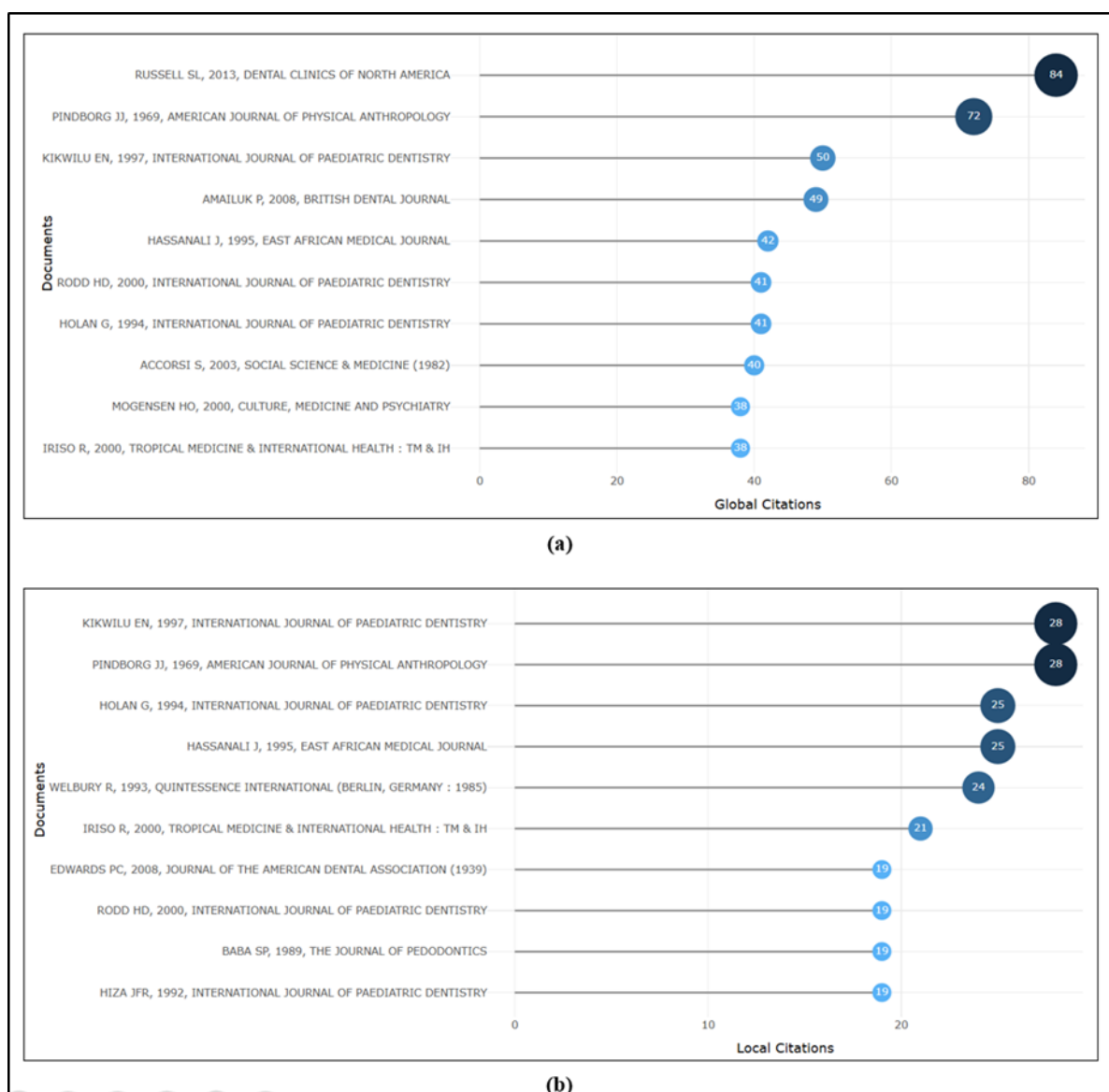


Figure 4: (a) Most Global citations and (b) Most local citations for an article

Science Mapping

Collaboration network

To understand the collaboration network, co-author analysis reveals that Jir Barzangi, Lenart Unnell, and Kristina Arnrup have the strongest link, as indicated in Figure 5(b). The collaborative network of these three researchers

is reflected in Sweden, with papers co-authored with researchers from other countries. Though the United Kingdom has the most papers on IOM, all its publications are intra-country publications. A more precise visualization of each nation's single-country publications (SCP) and multiple-country publications (MCP) is shown in Figure 2(b).

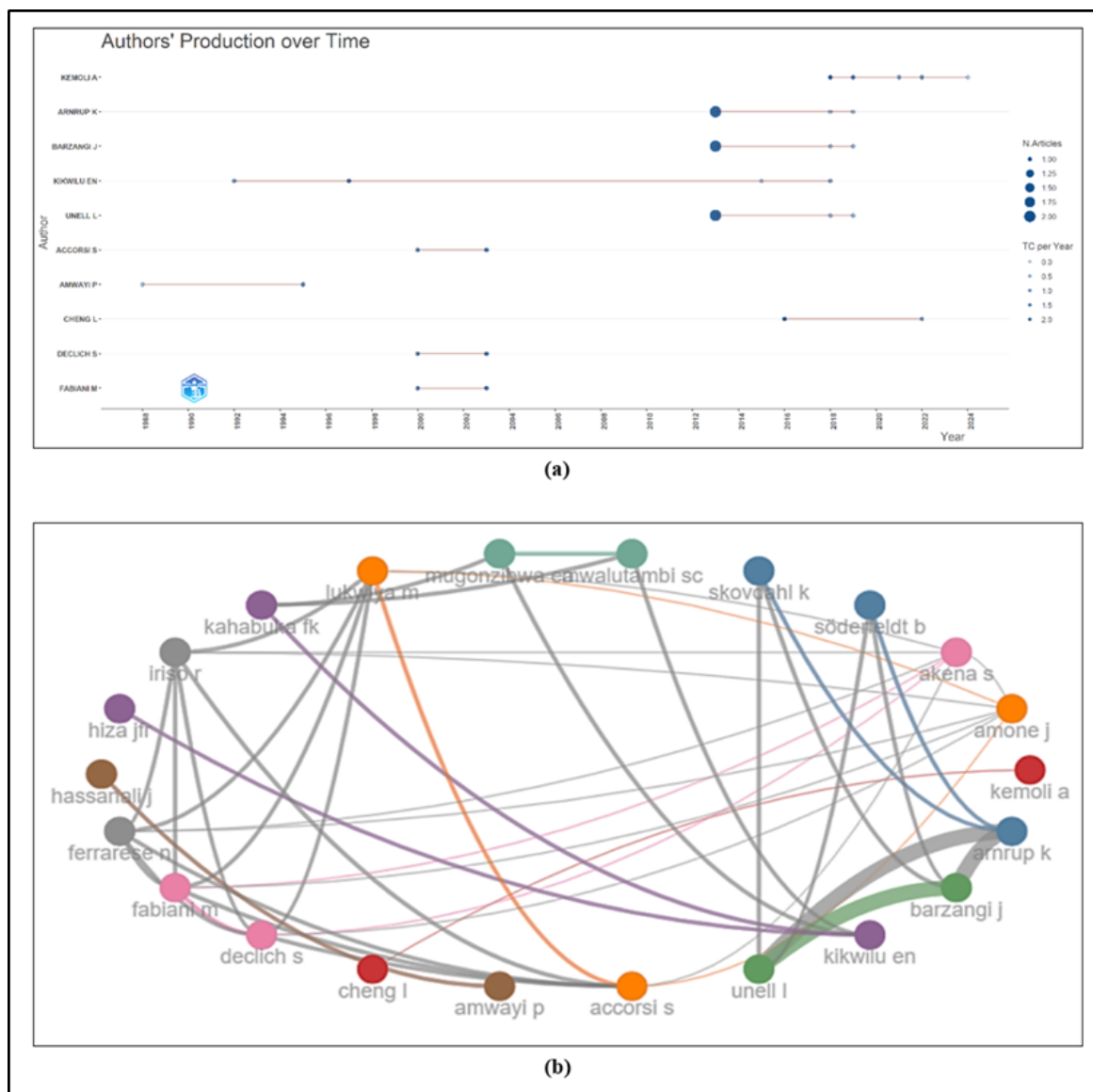


Figure 5: (a) Authors' production over time (b) Collaboration network of authors

Conceptual network

Co-occurrence of the most commonly used words across all manuscripts and thematic mapping of concepts through keywords in each document help to understand the various aspects of IOM. Co-occurrence analysis reveals that 'canine bud removal', 'African traditional

medicine', 'infant', 'infant oral mutilation', 'tooth germ', and 'tooth extraction' have co-occurred more often than other related terms. Thematic mapping using walkstrap confirms this, which identified the same concepts linking the various publications related to IOM [(Figure 6(a) & Figure 6(b))].

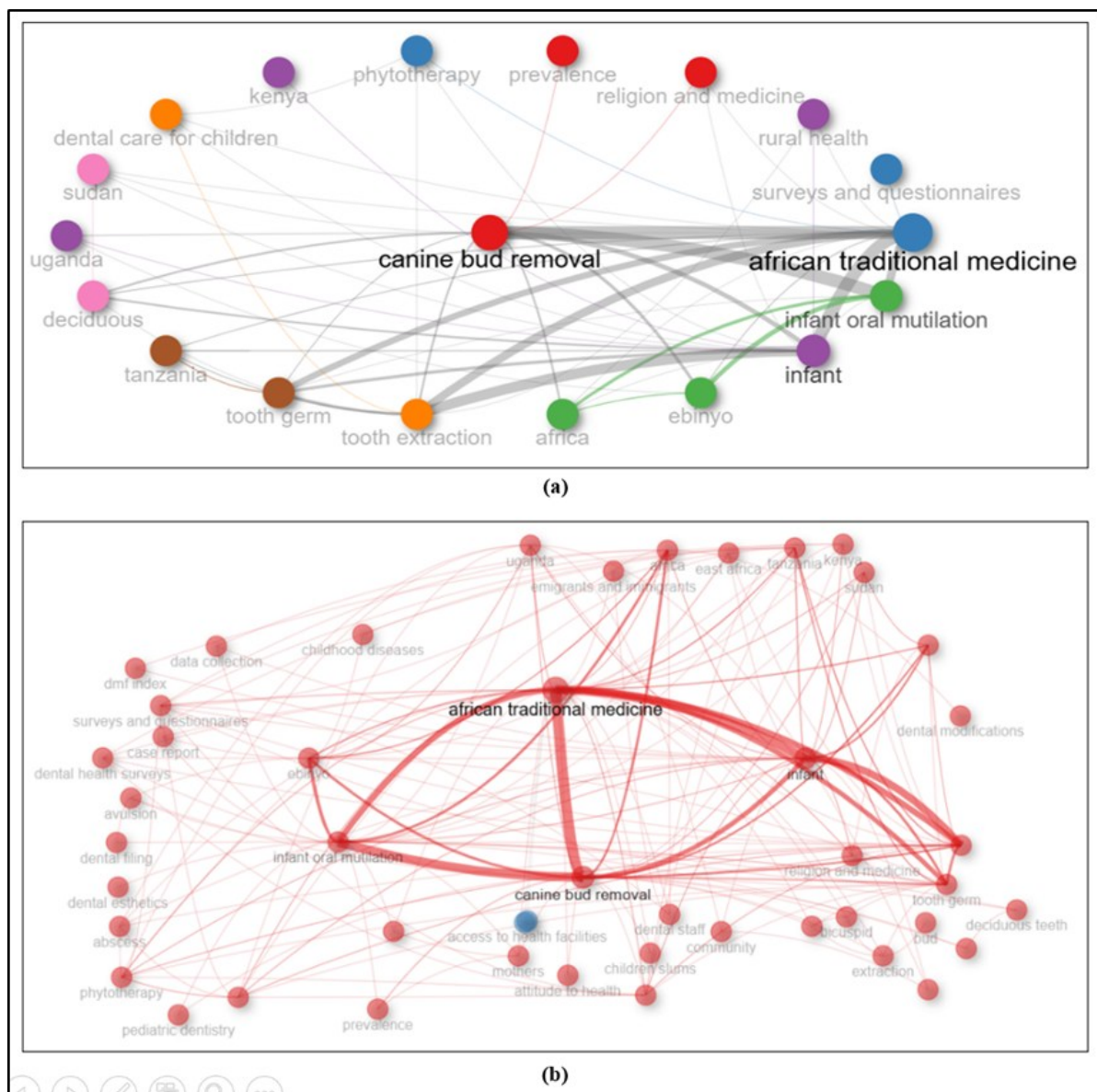


Figure 6 (a) Co-occurrence analysis (b) Clustering

Discussion

A bibliometric analysis is a technique to understand a topic's intellectual structure. It is executed by understanding the evolution of a field over time and by drawing a network of the authors, their affiliations, and publications that have contributed to the literature on the topic of interest. When presented as a review, a bibliometric review nullifies the interpretation bias often observed in a systematic review (7).

Bibliometrix is one of the many software programs used for bibliometric analysis. It is advantageous because it can analyze files from multiple databases simultaneously, allows user customization, and displays data through impactful metrics (e.g., h-index). The concept of sensemaking in bibliometric analysis includes scanning, sensing, and substantiating the results. We shall now utilize this triad to make our results sentient (10).

IOM is a historical topic that continues to be reported in developed countries in the 21st century. Since its first published report in 1969, the maximum number of articles published in a given year never exceeded the count of two till 1991. A notable increase in publication frequency on IOM has been observed since 2004. This can also be attributed to the advent of open-access publishing, which better disseminated knowledge about IOM. The topics most frequently addressed are IOM, African traditional medicine, canine bud removal, tooth germ, Ebinyo, Africa, infant, and tooth extraction. This is deciphered by observing the word

cloud in Figure 3(b) based on the keywords' frequency.

Based on our results, the first published paper on IOM by Pindborg in the *American Journal of Physical Anthropology* remains the most cited paper on the topic. The following papers are among the best-cited in the IJPD (11,12). These papers, published in the mid-1990s, were cross-sectional studies aimed at understanding the prevalence of IOM in Tanzania and Ethiopia.

Scimago Journal Rank (SJR) is a reliable tool for assessing a journal's prestige and influence within a particular field of study. These journals are categorized by quartiles: Q1 journals are among the Top 25% in a given field, Q2 represents the Top 50%, and so on. The IJPD has been a Q1 journal in dentistry since 2009, whereas the BMC Oral Health has been in the Q1 since 2009 (the only exception being 2014, when it was a Q2 journal). Thus, these two journals can be considered definitive sources for published works on IOM. DCNA has appeared in Q1 and Q2 journals 5 times each in the last 5 years (till 2023), whereas the BDJ has remained a Q2 journal in 23 of the previous 25 years. Thus, DCNA and BDJ are IOM's other prominent sources (13).

A cartogram depiction reveals that the African continent has published the most scholarly literature on IOM. Uganda, Tanzania, Kenya, Ethiopia, and Sudan have contributed to our understanding of IOM. Moreover, these

countries are also involved in initiatives such as the Call to Action (2018) and the Addis Ababa Declaration (2019) to raise awareness of the detrimental effects of IOM and to plan to eradicate this practice through law enforcement (5,14).

Two systematic reviews on IOM (the highest level of evidence among the included papers) give insight into how traditional healing methods affect infants' oral health. When healers, herbalists, and diviners practice IOM, they irreversibly damage the infant's oral cavity (15,16). Moreover, since IOM is done in an unhygienic environment, the infant will always be at risk of fatal systemic conditions. Arthur Kemoli's 2021 publication is the only paper to have reported the death of an infant due to IOM (3).

As a research topic, from a global context, the diverse study designs opted by researchers to disseminate their work on IOM imply the intrigue behind this facet of migration health. Cross-sectional studies dominate in this regard, given the extensive reporting of IOM prevalence and associations in specific geographical areas. It is safe to assume that this research design will continue to be the most optimal for calculating epidemiological data on IOM. A bird's-eye view of the articles in our data synthesis shows that, despite the elimination of editorials, e-posters, opinion pieces, and news pieces, the level of evidence on IOM remains narrow and requires upgradation in future studies.

Though Africa has been vigilant in reporting

these studies, isolated case reports from other parts of the globe lead to a skewed interpretation of published literature. It thus becomes a contested point as to whether IOM is underreported in non-African countries.

The results of this bibliometric review suggest that, despite a topic of multinational interest, there is a dearth of collaborative networking. Pediatric dentists, along with pediatricians, sociologists, and anthropologists, can team up to better understand the sociocultural context of IOM and its implications for infant health.

The effect of IOM on future malocclusion, orofacial functioning, and quality of life is a knowledge gap that can only be addressed through longitudinal studies or retrospective analyses of existing data. Furthermore, evidence-based guidelines grounded solely in biological principles need to be published under the aegis of an international collaboration, which could be of medicolegal value to healthcare professionals.

Strengths & limitations

This is arguably the first-ever bibliometric review on IOM. Given that the evidence base for articles on IOM has primarily consisted of cross-sectional studies and case reports, a bibliometric review of existing publications is more appropriate than a scoping or systematic review. Our results highlight the need for stronger cross-country networking and depict various clusters through which IOM can

be organized. Our study also emphasizes that work on IOM has been of keen interest to developed countries. Through citation analysis, we also understand which sources are most sought after in the literature on IOM. Clustering and co-occurrence analysis of keywords can guide the keen reader to know the multifaceted nature of IOM.

The articles included in our review are extracted from PubMed, LENS, Semantic Scholar, and ScienceDirect. While each database we had access to is specific to the biomedical literature, including articles from other databases can make a more comprehensive bibliometric analysis. Another possible limitation of our review is the plethora of names with which IOM is known (17). This is likely to exclude articles that use African words to describe IOM in their titles or abstracts. Thus, non-English articles can be a future expansion of bibliometric works on IOM. Finally, bibliometric analysis can also be enhanced by adding Altmetric data for each article, a relatively recent metric that captures each article's online social impact.

Conclusion

This bibliometric analysis provides insight into current trends in IOM research. The intellectual structure outlined provides keen researchers with a foundation for their primary references on the topic, the key research topics associated with IOM, and the geographical areas they can seek for collaborative work to combat the practice of IOM. Finally, given the fragmented data on IOM, our bibliometric analysis unified the

most essential components through co-occurrence and network analysis to provide a perspective on IOM as a key topic for improving migration health.

Though IOM is a practice that has a detrimental effect on the health of an impact, any research on this topic must be undertaken with caution. Since IOM carries a strong cultural belief, field researchers must undertake any intervention with caution. It is essential to engage respectfully and simultaneously implement community-based interventions.

Declarations

Ethical Consideration: Not applicable

Authors contribution

BS: Conceptualization, Data Curation, Formal Analysis, Software, Investigation, Methodology, Writing – Original Draft; **AP:** Supervision, Validation, Visualization, Project Administration, Resources, Writing – Review & Editing

Conflict of interest

The authors declare no conflicts of interest.

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References

1. Musinguzi N, Kemoli A, Okullo I. Prevalence and dental effects of infant oral mutilation or Ebiino among 3–5 year-old children from a rural district in Uganda. *BMC Oral Health*. 2019 Dec;19(1):204. DOI: 10.1186/s12903-019-0890-6.

2. Elgamri AI, Ahmed AT, Haj-Siddig OE, Chin JR. Infant oral mutilation (IOM) related to traditional practices among inner city pre-school children in Sudan. *Afr Health Sci* [Internet]. 2018 Jun 22 [cited 2024 Nov 16];18(2). DOI: 10.4314/ahs.v18i2.21
3. Kemoli AM, Opondo IA. A Fatal Case of Infant Oral Mutilation Practice. *Contemp Clin Dent*. 2021 Jan;12(1):76–80. DOI: 10.4103/ccd.ccd_319_20
4. Noman AV, Wong F, Pawar RR. Canine Gouging: A Taboo Resurfacing in Migrant Urban Population. *Case Rep Dent*. 2015;2015:1–5. DOI: 10.1155/2015/727286
5. Wordley V, Bedi R. Infant oral mutilation in East Africa: eradication within ten years. *Br Dent J*. 2019 Jan 11;226(1):14–5. DOI: 10.1038/sj.bdj.2019.1
6. Anjum Z, Bridge G, Bedi R. Infant oral mutilation: data collection, clinical management and public health guidelines. *Br Dent J*. 2022 Dec 16;233(12):1042–6. DOI: 10.1038/s41415-022-5317-0
7. Öztürk O, Kocaman R, Kanbach DK. How to design bibliometric research: an overview and a framework proposal. *Rev Manag Sci*. 2024 Nov 1;18(11):3333–61. DOI: 10.1007/s11846-024-00738-0
8. Russell SL, Gordon S, Lukacs JR, Kaste LM. Sex/Gender Differences in Tooth Loss and Edentulism. *Dent Clin North Am*. 2013 Apr;57(2):317–37. DOI: 10.1016/j.cden.2013.02.006
9. Pindborg JJ. Dental mutilation and associated abnormalities in Uganda. *Am J Phys Anthropol*. 1969 Nov;31(3):383–9. DOI: 10.1002/ajpa.1330310313
10. Arruda H, Silva ER, Lessa M, Proença D, Bartholo R. VOSviewer and Bibliometrix. *J Med Libr Assoc JMLA*. 2022 Jul 1;110(3):392–5. DOI: 10.5195/jmla.2022.1434
11. Kikwilu EN, Hiza JFR. Tooth bud extraction and rubbing of herbs by traditional healers in Tanzania: prevalence, and sociological and environmental factors influencing the practices. *Int J Paediatr Dent*. 1997;7(1):19–24. DOI: 10.1111/j.1365-263X.1997.tb00268.x
12. Rodd H d., Davidson L e. 'Ilko dacowo:' canine enucleation and dental sequelae in Somali children. *Int J Paediatr Dent*. 2000;10(4):290–7. DOI: 10.1046/j.1365-263x.2000.00213.x
13. Scimago Journal & Country Rank [Internet]. [cited 2024 Dec 05]. Available from: <https://www.scimagojr.com/>
14. Wordley V, Bedi R. The Addis Ababa Declaration to end infant oral mutilation. *Br Dent J*. 2019 Nov;227(10):863–4. DOI: 10.1038/s41415-019-0891-5
15. Pinchi V, Barbieri P, Pradella F, Focardi M, Bartolini V, Norelli GA. Dental Ritual Mutilations and Forensic Odontologist Practice: a Review of the Literature. *Acta Stomatol Croat*. 2015 Mar 15;49(1):3–13. DOI: 10.15644/asc49/1/1

16. Agbor AM, Naidoo S. A review of the role of African traditional medicine in the management of oral diseases. *Afr J Tradit Complement Altern Med*. 2016 Feb 19;13(2):133. DOI:10.4314/ajtcam.v13i2.16
17. Patel V. Infant Oral Mutilation [Internet]. *The Quadrant*; 2023 [cited 2024 Dec 4]. Available from: http://archive.org/details/infant-oral-mutilation_202401