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Information Management as a Nexus to Promote the use of Indigenous Medicine and Enhance Public Healthcare Delivery: A Bibliometric Analysis

Patrick Ajibade (PhD)
Information Studies Programme, University of KwaZulu-Natal, South Africa, AjibadeP1@ukzn.ac.za

Stephen M. Mutula Prof.
Information Studies Programme, University of KwaZulu-Natal, South Africa, MutulaSM@ukzn.ac.za

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Patrick Ajibade[1] & Stephen M. Mutula (Prof)[2]

Information Studies Programme
University of KwaZulu-Natal, South Africa
AjibadeP1@ukzn.ac.za[1];& MutulaSM@ukzn.ac.za[2]
ajibadep.sa@gmail.com[1]
http://orcid.org/0000-0002-8608-8378

Abstract

This paper uses a bibliometric analysis to explore the citations trend in ethnomedicine and information management. A text mining algorithm of a total number of 8, 333 publications (*n* = 8,333) was conducted based on the title, abstract and keywords to find co-occurrence of key terms in indigenous medicine and information management. The first objective was to analyze the authorship, outputs and citation trends and establish if researchers have been able to establish a nexus between indigenous herbal use and the role of information management in promoting such use. Secondly, the study sought to establish if there is already a link in information management research through collaboration as a nexus to promote indigenous use of herbal medicine and enhance public healthcare delivery systems on the African continent. A computation synthesis of the data was performed using R programming statistical analysis and bibliometric software to visualize the analyzed data. Based on the R programming output, the total author sample size was 35,970 (n = 35,970), and their total publications output was n= 8,333, while the total outputs parameters was as follows: Min = 5.00 Max = 71.00, μ = 10.59. The average citation per items was 4.74 (ACP = 4.74) *h*-index=60, sum of times cited (STC = 39,572), citing articles (CA = 32,749) without self-citations (*n* =36,042) and citing articles (CA= 30,777). The findings suggest that researchers have yet to establish the nexus between information management and its impact in promoting indigenous use of natural remedies within public healthcare to promote its efficacy.

Keywords: Biodiversity, Ethnomedicine, Herbs, Indigenous Knowledge Systems, Information Management, Information Packaging and Dissemination

Introduction

A bibliometric analysis of publications and research outputs was conducted to determine if there is an established connection between information management, Library and Information Science (LIS) and ethnomedicine. Several studies have suggested that African indigenous plants can be used to treat or cure many infections and diseases (Nwidu, Elmorsy & Carter, 2016; Williams & Whiting, 2016). For example, indigenous plants have been found to be efficacious in preventing infant respiratory infections (Etim, Obande, Aleruchi & Bassey, 2016), as anti-fungi agents and in preventing bacterial infections (Ogbole, Ayeni & Ajaiyeoba, 2018) as well as other illnesses (Attah, Hellinger, Sonibare, Moody, Arrowsmith, Wray & Gruber, 2016). Nigeria is still ravaged by malaria and several medicinal plants have been identified that prevent or cure this disease. These include Alstonia boonei, and Azadirachta indica, amongst other indigenous plants (Odugbemi, Akinsulire, Aibinu & Fabeku, 2007; Asnake, Teklehaymanot, Hymete, Erko & Giday,

2016). These examples notwithstanding, many of the benefits, uses, and potencies of Africa's rich biodiversity are not known, and most people still rely on synthetic drugs for therapeutic purposes. One of the reasons is the lack of proper and professional information packaging and dissemination to promote indigenous healthcare management using potent natural herbs. Ajibade (2018) found that many vendors that sell herbs to members of the public could not provide useful information about toxicity and dosage. This suggests that professionals could be engaged to assist in classifying and providing information on potent and abundant African natural herbs. Collaboration with scholars in other biodiversity and ethnomedical fields could result in information management and dissemination strategies to promote the use of these herbs. It is against this background that a bibliometric analysis was conducted to explore the citations and publications trends of articles on ethnomedicine (cf. the methodology section for search strategies). Due to the vast amount of data collected, we employed R programming computation tools with the capability to explore and analyze big data to summarize the critical metrics of the output.

Review of Literature

One of the advantages of a bibliometric study in this era of knowledge-intensive research activities within the knowledge economy is the ability to leverage the use and adoption of an algorithm and computational analysis to summarize big data. Hence, the use of big data analytics allows scientist to curate large data from different platforms or sources, organize this knowledge and present it in a meaningful form through data visualization to assist in making informed decisions. Therefore, it has been argued that manual review of literature is an arduous task because of a limited number of articles that could be manually synthesized and debated. Therefore, Ram and Paul-Anbu (2014), suggested that the use of bibliometric could help researchers to overcome challenges associated with traditional literature review by using the bibliometric analysis. In the field of Information Studies, bibliographies are used to study knowledge production and trend in scientific outputs in various disciplines. For example, the pattern and outputs trajectories could be evaluated by conducting a bibliometric study of such trends and knowledge growth. Depending on what is being studied, different metrics could be employed. For this study we applied the bibliometric equations proposed and debated by Waltman and van Eck, 2010; 2014; 2016) to present synthesis and visualization of authorship pattern, co-occurrences, and network clusters of trends of the outputs.

Objectives

The study's objectives were to:

1. Examine the co-citation trend by authors and institutions,
2. Examine if there is an established nexus between ethno medicine publications and information management,
3. Identify the most frequently cited outputs and their collaboration network,
4. Examine the summarized metric/indicators of the most prominent outputs,
5. Assess the relevance score and weight of outputs to examine the research trends in these subject areas.

Methodology

We performed advanced search and used the combined search strings in the Web of Science database to retrieve the data used based on the following search queries/strings. TS=("ethnomedicine use") OR TS= ("indigenous plant") OR TS=("indigenous medical practic?e") OR TS= ("antimalarial ethnomedicine") OR TS= ("information management") OR TS= ("information processing") AND CU=(South Africa) OR CU=(Nigeria) Timespan: 2014-2018. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI. (TS=("ethnomedicine use") OR TS= ("indigenous plant") OR TS=("indigenous medical practic?e") OR TS= ("antimalarial ethnomedicine") OR TS= ("information management") AND CU=(South Africa) OR CU=(Nigeria) AND LANGUAGE: (English) AND DOCUMENT TYPES: (Article) Refined by: Organizations-Enhanced: (University of Ibadan OR University of Cape Town OR University of Nigeria OR Obafemi Awolowo University OR Ahmadu Bello University OR University of Lagos OR University of Ilorin OR Stellenbosch University OR University of Benin OR Nigerian Institute of Medical Research OR International Institute of Tropical Agriculture OR University of Calabar OR University of Pretoria OR University College Hospital Ibadan OR North West University South Africa OR Covenant University OR Ekiti State University OR University of Johannesburg OR Tshwane University of Technology OR University College Ibadan Hospital OR University of Fort Hare OR University of KwaZulu-Natal OR University of South Africa) AND PUBLICATION YEARS: (2018 OR 2017 OR 2016 OR 2015 OR 2014) AND COUNTRIES/REGIONS: (Nigeria OR South Africa) AND [excluding] RESEARCH AREAS: (Engineering OR Science Technology Other Topics OR Chemistry OR Materials Science OR Geology OR Mathematics OR Energy Fuels OR Physics OR Psychiatry). The timespan searched was 1990-2018. The searches were conducted using the following databases within the Web of Science Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, and ESCI. For the clustering techniques adopted for this paper data are denoted as follows; ci represent assigned nodes, δ (ci, cj), function = 1 if ci = Cj and 0 other, and γ denotes the resolution parameter that determines the details of the clustering, meaning the value of γ, determines the level of clustering details; hence, the model is expressed as (Van Eck & Waltman, 2014):

$$V\left(c_i,\ldots,c_n\right)=\sum_{i<j}\delta\left(c_i,c_j\right)\left(s_{ij}-\gamma\right) \quad (1)$$

$$s_{ij}=\frac{2\,m a_{ij}}{k_i k_j} \quad \text{where } a_{ij}=a_{ji}, \quad (2)$$

$$k_i=\sum_j a_{ij}\ ,\ m=\frac{1}{2}\sum_i k_i \quad (3)$$

Whereby, the normalization of the weights of the constructs' strength (cf.2) of the network nodes edges i and j, Kj (Kj). In addition, S_{ij} denotes similarity of i and j nodes which represents the total weight of nodes i (node j) and *m* denotes the total weight of the network (Van Eck & Waltman, 2009; 2011; 2014; 2016).

Findings and Discussion

The results are presented based on the study's objectives.

Co-Citation Analysis

This section presents the co-citation analysis based on the fractional counting method, and the unit of analysis (n = 113,524), cited references. We set the minimum citation of the cited references to

five, meaning that those with less than five citations were not included. For this reason (n = 557) cited references co-citation analysis is presented below, and the top 500 with a total strength of the co-citation links are displayed in Figure 1. Surprisingly, only the Library Philosophy and Practice, and the MIS Quarterly and Communication Journal were the major Library and Information Sciences journal sources linked to microscopic studies in all these clusters. However, the Journal of Social Science and Mediterranean Journal of Social Sciences were within the eight clusters consisting of 32,049 links and a total link strength of 16,101.76 in the network visualization.

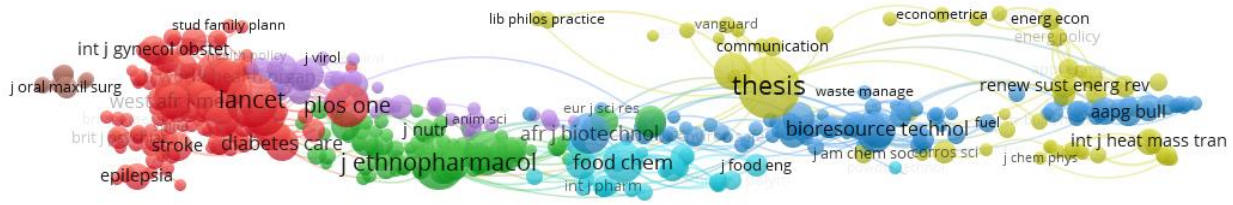

Figure 1: Co-citation based on cited sources

Authorship Pattern

Table 1 illustrates the prominence and visibility of the most prolific authors in this field and the total link strength (TLS) of their outputs. The outputs indicate that South African scholars were among the prominent scholars with higher visibility in the respective fields under analysis (cf. the methodology section) as authorities in their niche study area.

Table 1: Co-citations and TLS of the most prolific scholars in ethnomedicine and other search strings used (cf. methodology). The display is arranged based on the citations rather than the TLS to show the prominence of the outputs' visibility

Author	(∑) of citations	(%) of citations	total link strength (TLS)	(%) of TLS
Singh, J	171	12.2	111.09	11.1
Farombi, EO	127	9.1	105.53	10.6
Jha, BK	108	7.7	60.29	6.0
Igwe, O	82	5.8	60.07	6.0
Misra, HP	80	5.7	80	8.0
Gureje, O	77	5.5	54.61	5.5
Sheikholeslami, M	74	5.3	37.58	3.8
Osinubi, KJ	72	5.1	32.85	3.3
Folayan, Mo	59	4.2	27.4	2.7
Habig, WH	56	4.0	56	5.6
Iorio, L	56	4.0	41.73	4.2
Lowry, OH	55	3.9	51	5.1
Sharma, RK	53	3.8	46.05	4.6
Adedara, IA	52	3.7	46.24	4.6
Onwujekwe, O	52	3.7	21.14	2.1
Oyedeji, GA	51	3.6	27	2.7
Iwu, MM	45	3.2	39.66	4.0
Araoye, MO	45	3.2	31.33	3.1
Lorke, D	44	3.1	41	4.1
Attama, AA	44	3.1	27.63	2.8

∑ =	**1,403**	**100.0**	**998.2**	**100.0**

Furthermore, we conducted a co-citation analysis based on cited authors and the fractional counting method using the VOS bibliometric tool. The minimum number of citations threshold per author was set at ten, meaning that those with less than ten citations were not included. Of the total number of authors (n = 84,753), many articles had a considerable number of authors. Only 643 authors had more than ten citations. This low citation trend seems to validate the study's assumption that information dissemination about the usefulness of these outputs is very low. It is thus important to engage information professionals to assist scholars working on ethnomedicine and indigenous plant/herbs with the classification, knowledge organization, indexing, information packaging and dissemination strategies to promote the use of ethnomedicinal breakthroughs and potent herbal products that may be useful in enhancing public health systems.

World Health Organization (WHO) citations had the highest total link strength of 321.46 of 440 citations based on the co-citations analysis, making articles from this organization the most prominent outputs on the subject in our search. The second and third strongest TLS were also from authors associated with the WHO with 324 citations, TLS =258.19 and 173 citations, TLS =144.68. This is perhaps due to the different research areas covered.

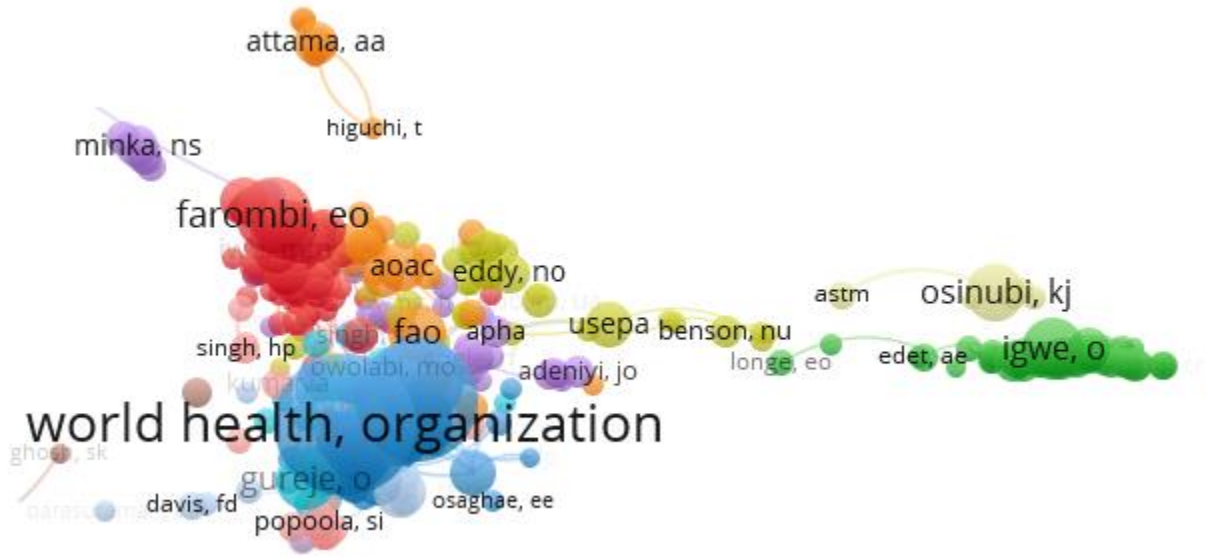

Figure 2: Co-citation and Total Links Strength of institutional co-citations

Most Prolific Authors

A bibliometric analysis of author within field of specialization is important as it reflects the growth of knowledge and the major contributors. Co-authorship and its importance in bibliometric analysis have been well documented in the literature (Heerden, Chan, Ghazisaeedi, Halvorson & Steyn, 2011; Zitt, Bassecoulard & Okubo, 2000). Beside the fact that it reveals the prolific authorities in a research field, it is important to measure the prominence and visibility of an author in a particular field of study. In the case of this study, a focus on co-authorship visualization could suggest how many authors in LIS and ethnomedicine have co-authored an article. Thus, this type

of analysis could be used as an indicator to predict whether the role of information management (IM) in promoting ethnomedicine is understood by scholars in the fields of natural medicine, ethnomedicine and biodiversity. It also reflects the prolific authorship trends and further synthesis could show each author's focus and research niche area. If this information is properly analyzed, it could help such scholars in research grants applications and assist institutions to make informed decisions about promotions. The findings may be also useful for aspirant postgraduate students who could examine summaries of a scholar's bibliographies and areas of research in order to decide who might be a better mentor. Furthermore, libraries could use the bibliometric results as summaries of authorship to request expert opinion from scholars that are authorities in a particular field to offer recommendations for additions to existing library collections or building new ones.

Table 2: Outputs by Institutions. The colors show the relatedness and co-authorship patterns based on their output

Authors	Record Count	% of 8,333	Bar
Jonas JB	71	0.852 %	
Murray CJL	69	0.828 %	
Yonemoto N	69	0.828 %	
Qorbani M	67	0.804 %	
Kasaeian A	66	0.792 %	
Vos T	66	0.792 %	
Malekzadeh R	64	0.768 %	
Naghavi M	64	0.768 %	
Ukwaja KN	64	0.768 %	
Farombi EO	63	0.756 %	
Sepanlou SG	63	0.756 %	
Hay SI	62	0.744 %	
Mokdad AH	61	0.732 %	
Khader YS	60	0.720 %	
Khang YH	60	0.720 %	
Rafay A	58	0.696 %	
Sartorius B	57	0.684 %	
Rai RK	56	0.672 %	
Fischer F	54	0.648 %	
Topor-Madry R	54	0.648 %	
Uthman OA	54	0.648 %	
Folayan MO	53	0.636 %	
Miller TR	53	0.636 %	
Bedi N	52	0.624 %	
Gupta R	52	0.624 %	

Note: (35,970 Authors value(s) were outside the display options.)

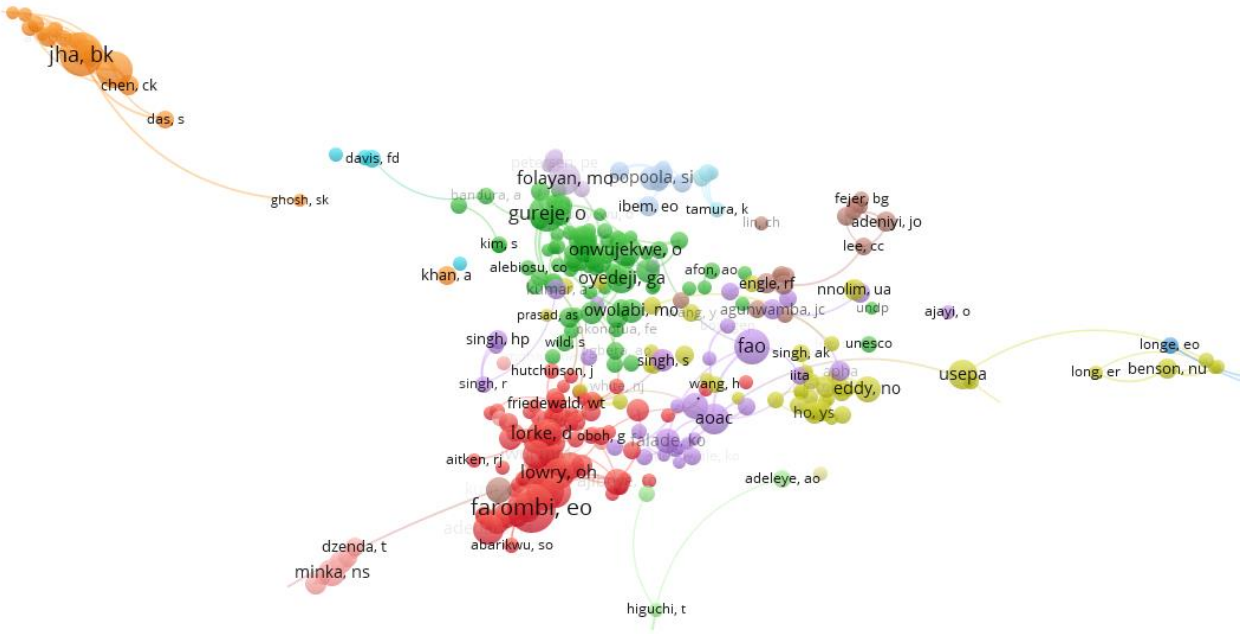

Figure 3: Co-citation network visualization of the top cited authors. The colors reflect authors whose works have enjoyed citation from two or three more authors within the clusters

Outputs by Subject Areas

The analysis shows that output in the field of Library and Information was ranked 23rd out of the top 25 top subject areas although Social Sciences was listed in 20th place. Had strong collaborative co-authorship existed across these major disciplines and research areas with colleagues in information studies, the co-citations (see figure 4) would have reflected this trend in the visualization. Furthermore, the margin of the outputs vis-à-vis the percentage of total contribution among the top five outputs in ethnomedicine and the 23rd position of LIS in table 2 and its research focus, suggest a lack of collaboration between these two fields to promote African biodiversity.

Table 3: Distribution of Output Trends base on Research Outputs

Research Areas	Record Count	% of 8,333	Bar Chart
General Internal Medicine	801	9.612 %	
Public Environmental Occupational Health	**714**	**8.568 %**	
Pharmacology Pharmacy	689	8.268 %	
Agriculture	**550**	**6.600 %**	
Environmental Sciences Ecology	534	6.408 %	
Food Science Technology	**329**	**3.948 %**	
Business Economics	303	3.636 %	
Plant Sciences	**302**	**3.624 %**	
Health Care Sciences Services	258	3.096 %	
Infectious Diseases	**256**	**3.072 %**	
Veterinary Sciences	203	2.436 %	
Neurosciences Neurology	**200**	**2.400 %**	
Toxicology	196	2.352 %	

Pediatrics	**185**	**2.220 %**	
Tropical Medicine	184	2.208 %	
Microbiology	**177**	**2.124 %**	
Biochemistry Molecular Biology	169	2.028 %	
Obstetrics Gynecology	**169**	**2.028 %**	
Integrative Complementary Medicine	159	1.908 %	
Social Sciences Other Topics	**152**	**1.824 %**	
Endocrinology Metabolism	149	1.788 %	
Biotechnology Applied Microbiology	**144**	**1.728 %**	
Information Science Library Science	144	1.728 %	
Cardiovascular System Cardiology	**128**	**1.536 %**	
Dentistry Oral Surgery Medicine	120	1.440 %	

Note: (112 Research Areas value(s) outside display options), and (1 record (0.012%) do not contain data in the field analyzed)

Outputs by Institutions

The outputs by the institutions are presented based on co-authorship as this shows not only the quantity of outputs produced by each organization, but the relationship between one author and one institution as well as the number of research outputs. Due to the large data set, we chose organizations with at least five articles, and 105 out of 690 institutions were selected. Nigerian institutions were the predominant contributing organizations base on total outputs and co-authorship. This suggests that there is a higher likelihood of collaboration within Nigeria institutions than among South African institutions.

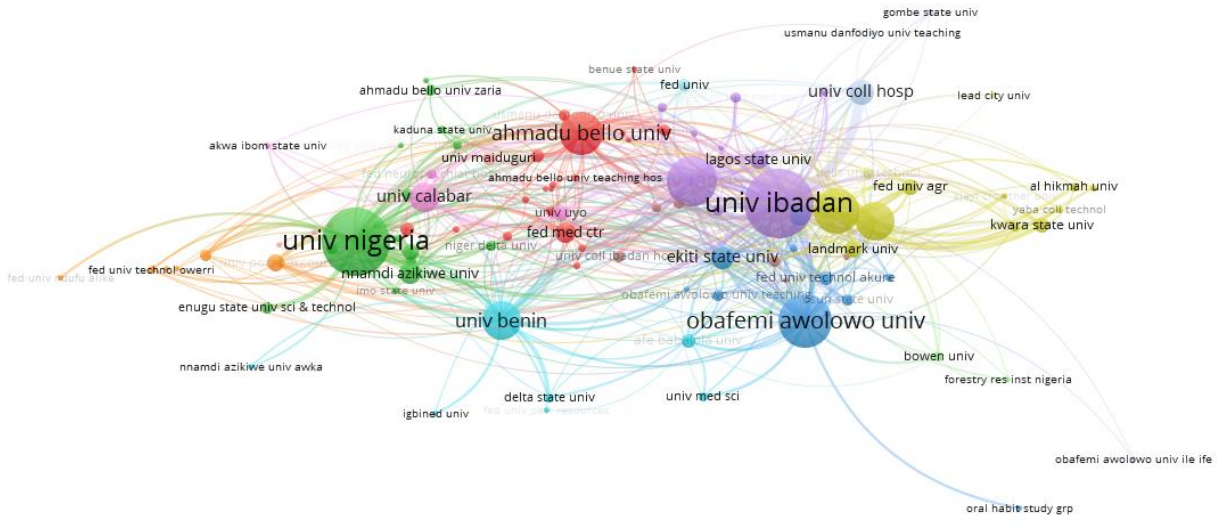

Figure 4: Network Visualization of outputs by institutions: The color showed collaborative networks between the institutions

Terms Co-occurrence based on Title and Abstracts

We created a network map based on the co-occurrence of all keywords in the entire text. This system employed the text-mining capabilities of the VOS algorithm to generate the visualization, and for items to be selected, the terms must have appeared at least eight times. Of 17,149 keywords (n = 17,149), only 520 occurred at least eight times, and the top 500 keywords with the strongest co-occurrence link were selected for analysis. The co-occurrence is useful in showing the number of outputs or journals in which two terms co-occurred (cf. Figure 5).

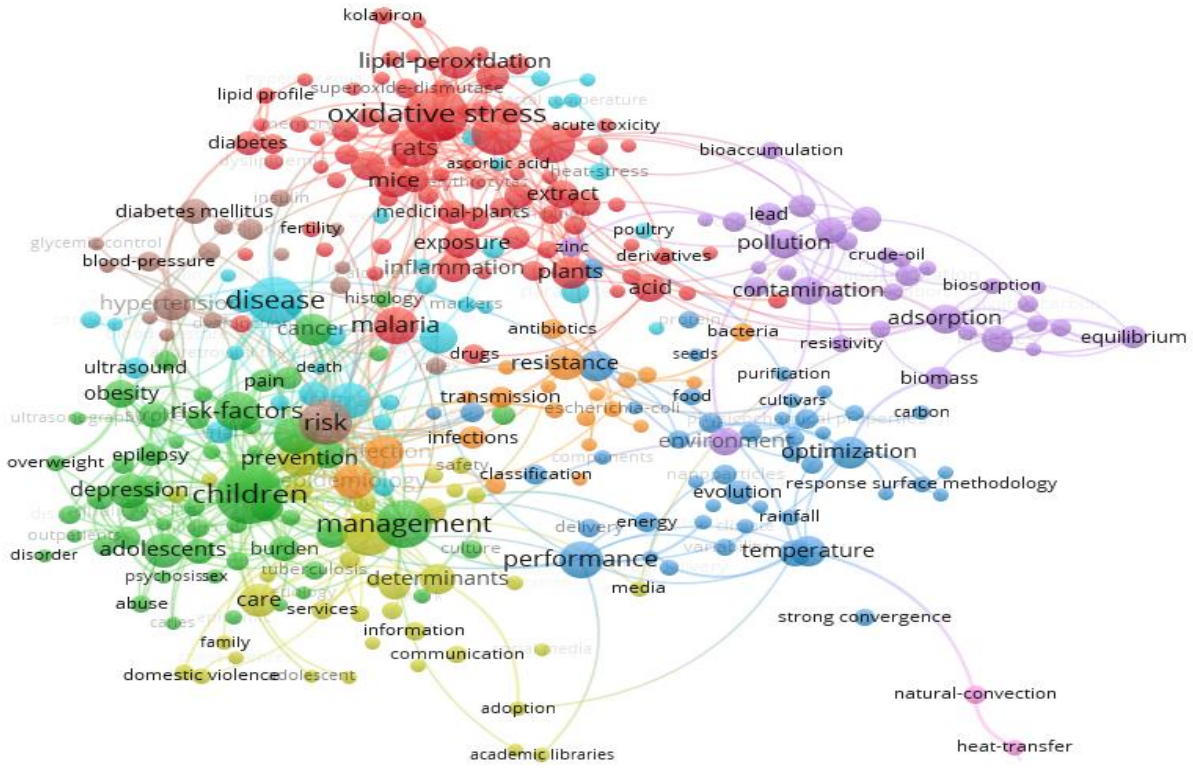

Figure 5: Co-occurrence of Terms. The color shows the relatedness of terms within the cluster and relationships in the network

Implications of the findings

The first implication of these findings is the apparent lack of synergy between information professionals and scholars in the fields of ethnomedicine practice, ethnomedicine, indigenous knowledge management systems, and information science. Library and information science could assist in indexing, ontology development, classification and knowledge organization of crucial discoveries in these fields and help to disseminate these findings and information to various audiences. The second implication is that, a lack of understanding of the importance or contribution of information management in promoting indigenous herbal products could result in little collaboration among scholars across the different fields of natural and social sciences, especially natural and medicinal studies and information science. As noted previously, natural remedies could represent an important resource to manage or cure diseases that are widespread in Africa. However, much of this knowledge might be lost in the absence of proper documentation of the process and procedures, and migration of the data hardware and storage platforms may not be handled appropriately.

Conclusion and Recommendations

The study showed that there are no established trends between information management and practices, and ethnomedicine. The tools and technical prowess of information management professionals could be harnessed to aggregate, classify and organize the knowledge generated by ethnomedicine. If indigenous knowledge is to make a positive contribution to healthcare delivery, it needs to be promoted through appropriate information packaging and dissemination. It is thus recommended that collaboration and partnerships be cultivated between Information Studies and Library Science and those in the areas of indigenous and ethnomedicine to enhance appreciation of Africa's rich biodiversity. Furthermore, South African institutions should increase their level of collaboration and co-authorship in order to enhance their visibility and prominence beyond the current level.

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