SAJLIS 2017

by Omwoyo Bosire Onyancha

FILE	ROTICH_ONYANCHA_MANUSCRIPT_SAJLIS_2017.DOCX (2.1M)		
TIME SUBMITTED	12-JAN-2017 03:28PM	WORD COUNT	7284
SUBMISSION ID	758488793	CHARACTER COUNT	38122

Trends and patterns of medical and health research at Moi University, Kenya, between 2002 and 2014: an informetrics study

Abstract

Research productivity and visibility is increasingly becoming important in the individual researcher's pursuit to build his or her research reputation, be promoted to the next academic rank within an institution and gain national and international recognition among peers. This paper analyses research the trends and patterns of the academic staff of the College of Health Sciences (CHS) at Moi University in Kenya between 2002 and 2014 to gauge their research productivity and visibility. The names of the academic staff of the CHS and who were in employment at the end of 2012 were listed and subjected to a visibility search using the Publish or Perish software that uses Google Scholar (GS) as its data source. The findings on output reveal the following: the trend of publication has shown un upward growth since 2007 and is projected to continue to grow as it approaches linearity, until 2025; the School of Medicine was the most prolific and visible; approximately one third ($^1/_3$) of the publications in the CHS originated in the departments of epidemiology and medicine; full professors' performance exceeded that of the other ranks; researchers at the CHS heavily rely on a locally published journal (i.e. *East African Medical Journal*) to publish their research; slightly over two-thirds ($^2/_3$) of the publications were singly authored; international collaborations were prominently visible; and most medical and health research conducted at the CHS focused on Western Kenya, where Moi University is located. For high productivity and wide visibility of the CHS research, we recommend additional funding; publication of the research in a variety of avenues, including open-access journals and the dissemination of the publications through social media platforms; and strengthening of the international collaboration networks, among others. For purposes of further research, we propose a study that will investigate the medical and health research visibility and impact across several institutions in Kenya.

Keywords: Research, medical and health research, research collaboration, Moi University, Kenya

1. Conceptual setting

Research productivity and visibility is increasingly becoming important in the individual researcher's pursuit to build his or her research reputation, be promoted to next academic rank within an institution and also gain recognition nationally and internationally among peers (Ocholla, Mostert & Rotich, 2016). As per measuring productivity and visibility, the global rankings count papers published in journals that are indexed in main global indices – such as the Science Citation Index, Web of Science or Scopus, or their equivalents for other disciplines. Research productivity in academia has therefore been generally regarded in terms of the number of publications produced and published in peer-refereed journals per researcher. Publication in high-status refereed journals and majorly published in English have become a major criteria of academic success in the competitive environment of global higher education (Altbach, 2014). Nicholas and Ritchie (1978) and Hertzel (1987) refer to the studies that assess the productivity of researchers as descriptive bibliometrics (sometimes

called productivity count studies), where a description of the characteristics or features of a literature is the main focus (Nicholas & Ritchie, 1978:10). Productivity count or descriptive bibliometrics can be used to study the number of publications in a given field, or productivity of literature in the field for the purpose of comparing the amount of research in different countries, the amount produced during different periods, or the amount produced in different subdivisions of the field by individual researchers (Steve[illegible], as cited in Hertzel, 1987:156). Hertzel (1987) observes that the method relies on the count of papers, books and other writings in the field, or often a count of those writings which have been abstracted in a specialised abstracting journal. Bibliometric and informetric studies are widely used to inform policies and decisions in political, economic, social and technological domains that affect the information flow and utilisation patterns within, between and outside institutions and countries.

Although Library and Information Science (LIS) studies of this nature solve problems in Africa related to collection development, information retrieval, systems design, user studies, management, knowledge organisation, and research evaluation, to name a few, bibliometric studies are limited, and those focusing on research output in the continent are even more so. The exceptions are a few studies reported on LIS research output in Africa by West African scholars such as Aina and Mabawonku (1997), Aina and Mooko (1999), Alemna and Badu (1994), Alemna (1996; 2001), Kadiri (2001) and Mabawonku (2001). Some studies on LIS research have also emerged from Southern Africa in the last 23 years, creating an awareness of the overall research output from within the Library and Information Science discipline in Southern Africa and East Africa, which is largely based on the publication count and citation analysis of peer-refereed articles appearing in national and international LIS journals. These studies include Ocholla (2000, 2001); Ingwersen and Jacobs (2002); Onyancha (2002, 2007) Onyancha and Ocholla (2005, 2006, 2009); Ocholla and Ocholla (2007; Sitienei and Ocholla (2010); Lwoga and Sife (2014); and Ocholla, Ocholla and Onyancha (2013).

2. Background to and problem statement of the study

Africa suffers from a myriad of medical and health challenges, including weak public health leadership and management; inadequate health-related legislations and their enforcements; limited community participation; extreme shortages of health workers; rampant corruption in medical products and technologies in procurement systems; a dearth of information and communication technologies; poor health financing; and lack of effective organisation and management of health services (Kirigia & Barry, 2008). It is not surprising therefore to note that Africa is home to a heavy burden of both communicable and non-communicable diseases. These, and several other factors, have led to the prioritisation of research in medical and life sciences in many African countries (Narvaez-Berthelemont, Russell, Arvanitis, Waast & Gailard, 2002; Tijssen, 2007). In their study on science in Africa, Narvaez-Berthelemont, Russell, Arvanitis, Waast & Gailard (2002) observed that Africa's total contributions were mainly in the fields of clinical medicine, which accounted for 36%, chemistry (14%), and biomedical research (12%).

In Kenya, as in many other African countries, disease was identified as one of the enemies of economic development as independence (Ndege, 2005). The Republic of Kenya has taken a number of steps to deal with the challenges associated with health and medical services in the country. Addressing the public during one of the national days in Kenya, the Kenyan President said:

> *Fifty years ago, healthcare was inaccessible to most of our people. Health facilities were few, far between and thousands of our people died from treatable medical conditions. Today, the situation is remarkably different. Not only do we have thousands of health workers, but also services are much closer to the people as health facilities are now spread across all parts of the country. We have also achieved notable success in the areas of child and maternal health* (Kenyatta, 2013).

Biomedical and health research in Kenya seems to have followed suit in terms of the volume of publications in the research field. For instance, Tijssen (2007) observed that Kenya's research output, between 2001 and 2004, was the highest in medical and life sciences followed by natural sciences, social sciences and engineering sciences. Similarly, (Narvaez-Berthelemont, Russell, Arvanitis, Waast & Gailard (2002) observed that Kenya (among other African countries such as Nigeria) was strong in the fields of clinical medicine and biology in a study that investigated science in Africa between 1991 and 1997. In a recent study that compared the productivity and visibility of researchers in Moi University and the University of Zululand, Ocholla, Mostert & Rotich (2016) discovered that Moi University's research output was concentrated in health sciences and/or medicine, where medicine topped the list of subject categories with the highest number of publications (i.e. 339), accounting for 35.1% of the total number of publications published by academic staff of Moi University. The study however did not delve into the patterns and nature of research in Moi University's health and medical sciences research. This paper is a follow-up on Ocholla, Mostert and Rotich's paper and aims to assess the productivity and visibility of researchers in the College of Health Sciences (CHS) at Moi University. The paper seeks to:

- examine the trend of publication of health and medical sciences research
- identify the most prolific authors, departments and schools within the CHS
- determine the most commonly used journals to disseminate the health and medical sciences research
- examine the level of collaboration among the authors engaged in CHS' medical and health sciences research
- identify the most-researched topics in health and medical sciences research at the CHS

3. Research method and procedure

A list of academic staff in the four (4) schools of the College of Health Sciences (CHS) at Moi University was obtained from the University's human resources department. The schools that comprise the CHS at Moi University (MU) are Dentistry, Medicine, Nursing, and Public Health. A total of two hundred and eleven (211) academic staff members were targeted for the study. At Moi University, there are seven levels of academic ranks: Graduate Assistant / Research Assistant / Tutorial Fellow / Junior Research Fellow, Assistant Lecturer, Lecturer / Research Fellow, Senior Lecturer / Senior Research Fellow, Associate Professor / Associate

Research Professor, and Professor / Research Professor (Moi University, 2012). The names of the academic staff were used to search for publications in Google Scholar using an advanced search strategy in the Publish or Perish (PoP) software. The PoP software program, introduced by Anne Harzing in 2006, "uses Google Scholar queries to obtain citation information, which is then analysed and converted to a number of statistics" (Harzing, 2011). The PoP software allows one to conduct searches on and analyses of author impact, journal impact and general citations of publications. The author impact platform is most suited when one is searching for publications authored by a given author while the journal impact offers the searcher an opportunity to search and analyse a particular journal. The citation analysis search platform offers several strategies with which one can conduct a search through the software program. The platform can be considered as equivalent to an advanced search strategy found in many bibliographic databases. Through the *citation analysis*, one can search Google Scholar by *author name, publication, journal ISSN, words (in title or text), or year of publication*. A combination of search queries can be conducted at the same time.

We adopted the *author impact* search platform to conduct searches using the names of authors who are affiliated with the departments in the CHS. The searches were limited to the period that has been defined in this research as between 2002 and 2014. The approach was adopted in order to extract only those publications that could represent research output of the CHS and its affiliate departments. Different variations of the authors' names were used to extract the data, which was then saved in worksheets prepared using Microsoft Excel software. The results from the searches were subjected to further editing to remove duplications of co-authored publications and those with similar names outside medical and health sciences fields.

Data analysis took different formats depending on the variable that was under investigation. Once the trend or pattern of the growth of publications in the CHS was determined, we sought to forecast the growth of the publications beyond the period under study in this paper, by subjecting the data to time series analysis using the ARIMA model. The SPSS package was used to access the ARIMA model to forecast future trends in publications growth.

VosViewer software was used to map research collaboration. The *Text* file that contained the names of the authors was subjected to analysis using VosViewer by setting the number of publications threshold per author at two papers. A total of 454 authors met the threshold. The analysis yielded a total of 90 clusters of two or more authors each, 3 507 links and total link strength value of 7 644. The software was also used to analyse the publication titles in order to determine the most researched topics in medical and health sciences at the CHS. Again, the word occurrence threshold was set to at least two papers. A total of 1 568 terms met the threshold. Upon the removal of terms that were considered as "noise" (e.g. stop words), a total of 313 terms were obtained for mapping. Figure 5 provides the network map of the 313 terms which were the most common in the titles of publications published by CHS authors at Moi University.

4. Results and discussion

Figure 1 shows that the CHS at Moi University has experienced a steady growth in the number of publications. There was however a turbulent period between 2004 and 2007, after which the upward movement has continued to manifest itself. From only three (0.59%) papers in 2002, the number of papers has grown to reach 107 (20.89%) in 2014. The upward trend of growth exhibited in figure 1 can be attributed to a number of factors including an increase in the number of researchers in the CHS and the availability of research funds, among other issues. From the graph in figure 1, the rate of linear growth is 80% ($R^2 = 0.8005$), which implies that the growth of publications is approaching lineality. This trend of publication is likely to continue, as showed in table 1 and figure 2. As mentioned in the methodology section, an ARIMA model analysis was conducted to forecast the trend of growth of the publications for the next 11 years, i.e. 2015 to 2025. Table 1 and figure 2 reveal that the number of papers will grow at a lineal rate from about 126 in 2015 to approximately 354 papers in 2025. Table 1 provides two other scenarios of growth, namely the upper control limit (UCL) and lower control limit (LCL).

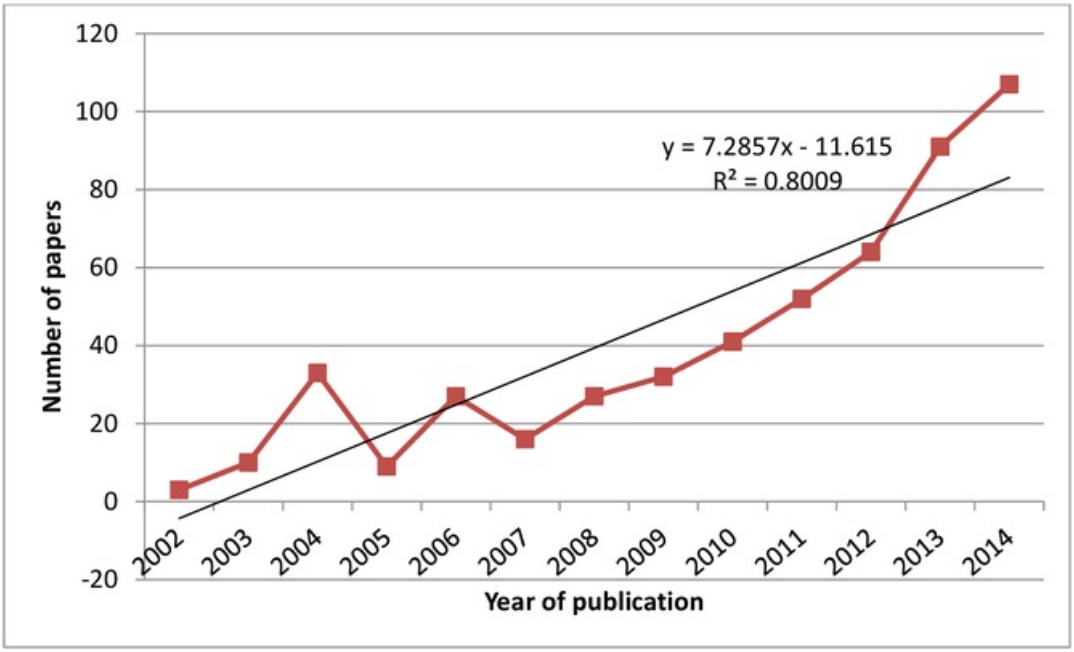

Figure 1: Trend of papers of medical and health research publications at Moi University, Kenya

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Forecast	126.54	149.30	172.05	194.80	217.56	240.31	263.06	285.82	308.57	331.32	354.08
UCL	154.45	185.04	221.04	261.09	304.23	349.85	397.63	447.34	498.80	551.90	606.55
LCL	98.64	113.56	123.06	128.51	130.89	130.77	128.49	124.30	118.34	110.74	101.60

Table 1: Forecasting the growth of papers at the CHS, Moi University, Kenya

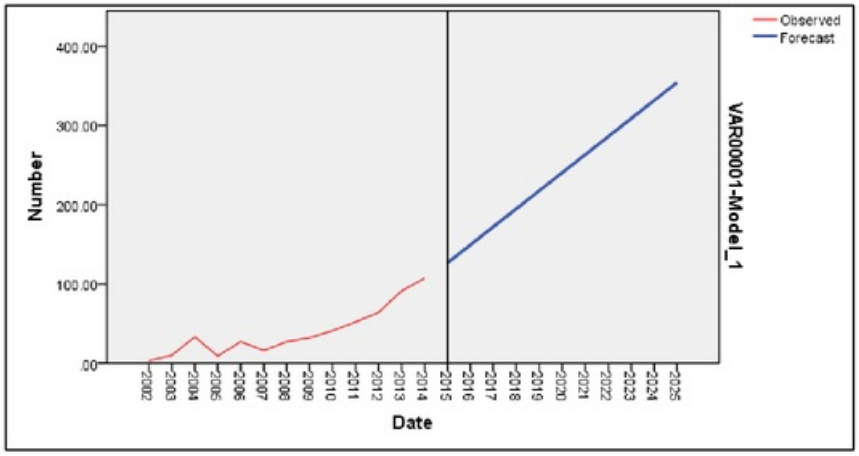

Figure 2: Forecasting the growth of papers at the CHS, Moi University, Kenya

In terms of the distribution of the papers according to the schools in the CHS, the School of Medicine produced the largest number of papers (i.e. 390) accounting for 76% of the total number of papers produced in the College. The School of Public Health produced less than half the number of papers produced by the School of Medicine (i.e. 104 or 20%) while the School of Nursing and the School of Dentistry published 16 (3%) and 2 (1%) papers respectively. This pattern of publication may be attributed to several factors, among them the number of researchers in each School, research area/s focused on most in the CHS, research funding and international collaborations, and the national preferences as far as research in medicine and health is concerned.

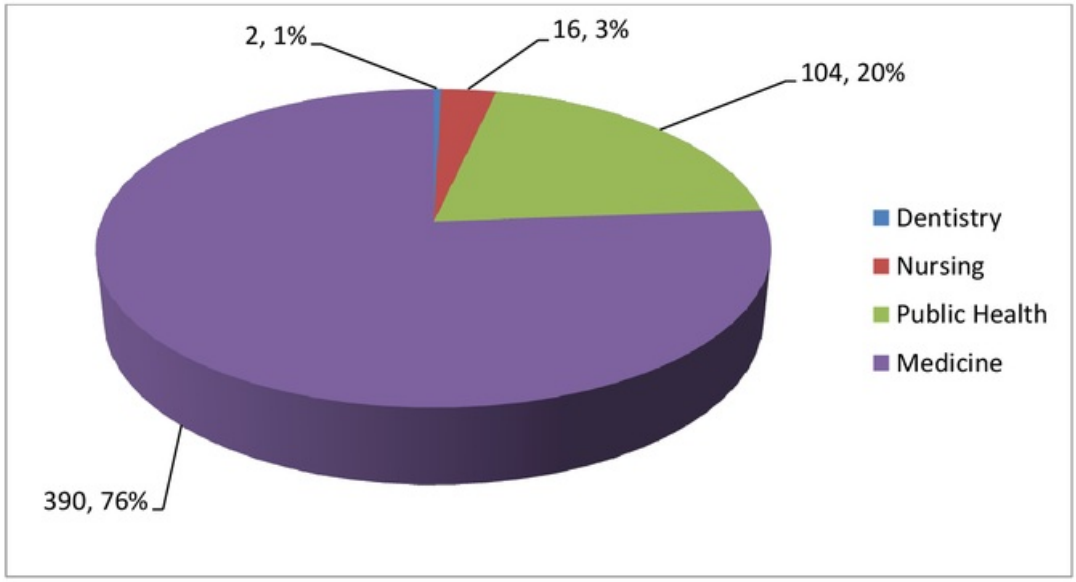

Figure 3: Schools contribution to health research in Moi University

There are twenty-five departments that comprise the CHS. The most prolific department was Epidemiology and Nutrition which yielded a total of 88 (17.19%) papers followed by

Medicine (80 or 15.63%), Child health and Paediatrics (55 or 10.74%), and Surgery and Anaesthesiology (44, 8.59%). The rest of the departments produced less than 25 papers each, with three of them (i.e. Conservative Dentistry and Prosthetics, Human Pathology and Forensic Medicine and Maxillofacial Surgery, Oral Medicine/Pathology and Radiology) publishing only one article each between 2002 and 2014. It is noteworthy that the research areas that are focused on by most researchers seem to becoming clearer as one moves from the analysis of the publications according to Schools to Departments. If the names of the Schools reflect the sub-disciplines or fields of study and research, then it is safe to say that issues around epidemiology and nutrition, child health and paediatrics, surgery, and reproductive health have taken centre stage in the research conducted at the CHS, Moi University. An analysis of the topics of research as reflected in the titles of the papers is provided in figure 5.

NUMBER	RANK	DEPARTMENT	No. of papers	%
1	1	Epidemiology and Nutrition	88	17.19
2	2	Medicine	80	15.63
3	3	Child Health and Paediatrics	55	10.74
4	4	Surgery and Anaesthesiology	44	8.59
5	5	Reproductive Health	29	5.66
6	6	Behavioural Sciences	28	5.47
7	7	Pharmacology and Toxicology	24	4.69
8	8	Medical Education	23	4.49
9	9	Family Medicine	22	4.30
10	10	Mental Health	21	4.10
11	11	Medical Biochemistry	15	2.93
12	12	Medical Microbiology and Parasitology	14	2.73
13	13	Immunology	10	1.95
14	14	Environmental Health	9	1.76
15	15	Haematology and Blood Transfusion	8	1.56
16	15	Orthopaedics and Rehabilitation	8	1.56
17	16	Health Policy and Management	7	1.37
18	17	Medical Physiology	6	1.17
19	17	Midwifery and Gender	6	1.17
20	18	Child, Adult and Mental Health	5	0.98
21	19	Community Health, Nursing Administration and Education	5	0.98
22	20	Radiology and Imaging	2	0.39
23	21	Conservative Dentistry and Prosthetics	1	0.20
24	21	Human Pathology and Forensic Medicine	1	0.20
25	21	Maxillofacial Surgery, Oral Medicine/Pathology and Radiology	1	0.20
		TOTAL	512	100.00

Table 2: Research output of the CHS by Department

The most prolific authors are listed in table 3. There were a total of 1 427 authors who contributed to health and medical sciences research at Moi University. The CHS at Moi

University consists of a total of eighty-nine (89) academic staff members who rank between graduate assistant to full profess[14] Of these, S Kimaiyo authored the most number of papers (i.e. 53), accounting for 10.35% of the total number of papers (i.e. 512) published by the CHS between 2002 and 2014. F Esamai was placed in the second position with 48 (9.38%) papers while S Ayaya closes the list of CHS staff members who produced at least 40 papers in the period under investigation. There were a number of authors from outside Moi University who have collaborated with the CHS scholars. The most prolific among these were R Vreeman, K Wools-Kaloustian and P Braitstein who published 41 (8.01), 40 (7.81%) and 38 (7.42%) papers respectively.

No.	Rank	Author	No. of papers	Percentage
1	1	KIMAIYO, S	53	10.35
2	2	ESAMAI, F	48	9.38
3	3	AYAYA, S	45	8.79
4	4	VREEMAN, R	41	8.01
5	5	WOOLS-KALOUSTIAN, K	40	7.81
6	6	BRAITSTEIN, P	38	7.42
7	7	SIIKA, A	33	6.45
8	7	AYUKU, D	32	6.25
9	9	NYANDIKO, WM	30	5.86
10	9	MWANGI, A	25	4.88
11	11	ATWOLI, L	24	4.69
12	12	ROTICH, J	22	4.30
13	12	KUREMU, R	20	3.91
14	14	SIDLE, JE	19	3.71
15	15	MUSICK, B	19	3.71
16	15	AYUO, P	18	3.52
17	17	MENYA, D	18	3.52
18	17	CARTER, J	18	3.52
19	17	DIERO, L	18	3.52
20	17	YIANNOUTSOS, C	17	3.32
21	21	BUZIBA, N	16	3.13
22	21	LIECHTY, E	16	3.13
23	23	GISORE, P	16	3.13
24	23	ETTYANG, G	16	3.13
25	23	NDEGE, S	15	2.93

Table 2: 25 most productive authors

When the papers were distributed according to the position or rank of individual authors, it was observed that the seven Full Professors (simply hereinafter referred to as Professors or P) working in the CHS collectively produced 139 papers, averaging 19.86 papers per head. Associate professors (AP) who numbered eleven published a total of 186 papers, thereby accounting for an average of 16.91 papers per person. Senior lecturers (SL) (19) produced an average of 11.11 papers per head based on their total research output of 211 while the

average number of publications per person in the category of lecturers (L), who were the largest in number (i.e. 44), was 5.64 based on their collective total research output of 248 papers. There were only four assistant lecturers (AL) who produced a total of 18 papers, thereby averaging 4.50 papers per person. In the final category of staff members the three tutorial fellows (TF) published eight papers, thereby yielding an average score of 2.67 papers per person. It therefore follows that, on average, the category of professors was the most prolific followed by associate professors, senior lecturers, lecturers, assistant lecturers and tutorial fellows. This pattern is in line with the ranking order of positions at the University. The lowest academic rank at Moi University is graduate assistant (GA), who is a holder of a bachelor's degree from a recognised university with at least second class upper division, however none of the research outputs was visible in this study. For one to be appointed to the position of TF, he/she must have a bachelor's degree and a master's degree from a recognised/accredited university and must demonstrate potential for teaching or research during the appointment interview. This position is on contract – renewable annually based on the holder registering for a doctoral degree and research output during the contract period. The holder of an AL position must have the same qualification as a TF (as specified above), however, this position is on permanent (tenure) terms (this position was scrapped in 2015). Appointment to the position of lecturer is based on the number of publications in addition to the holder having obtained a doctorate degree or its equivalent from a recognised/accredited university, in CHS, in the schools of Dentistry or Medicine, holders of a master's degree (M.Med/MDS) with three years' teaching experience and the required number of publications are appointed to lecturer position. Promotion from the position of senior lecturer to professor is based on the research output, teaching experience, supervision of postgraduate students and attraction of research funds (Moi University 2015). Table 2, which provides the top 25 authors, contains names of authors in the higher ranks in the academic ladder. These include S Kimaiyo (AP), F Esamai (P), S Ayaya (P), A Siika (SL), D Ayuku (AP), WM Nyandiko (AP), and A Mwangi (SL).

In terms of the number of n^a authors who have published n^p number of papers each, Table 3 illustrates that the majority of authors (i.e. 973, 68.19%) published one article each between 2002 and 2014. Those authors who published two papers each were 206 (14.44%); three papers each were 73 (5.12%); four papers each were 45 (3.15%); five papers each 26 (1.82%); and six papers each totaled 20 (1.40%). This pattern seems to follow the theoretical basis for Lotka's law of author productivity which states that "for any body of literature, there will be a substantial number of authors who have each contributed only one publication, a small number of authors who have each contributed a small number of publications, and a very small group of authors who have each contributed a substantial number of publications" (Wallace, 1989: 10). Although this law seems to apply to authorship patterns depicted in table 3, which consists of all authors who contributed to health and medical sciences research conducted by at least one person affiliated with the CHS at Moi University, the law may also apply to the author productivity when assessed by their academic ranks/positions. A very small number of authors in the categories of AP and P published a substantive number of publications each, while a large number of authors in the lower categories produced a smaller number of papers each.

No of papers	Number of authors	Percentage	No of papers	Number of authors	Percentage
1	973	68.19	16	3	0.21
2	206	14.44	17	3	0.21
3	73	5.12	18	2	0.14
4	45	3.15	19	1	0.07
5	26	1.82	20	2	0.14
6	20	1.40	22	1	0.07
7	11	0.77	24	1	0.07
8	17	1.19	26	1	0.07
9	13	0.91	30	2	0.14
10	8	0.56	39	1	0.07
11	2	0.14	40	1	0.07
12	1	0.07	41	1	0.07
13	4	0.28	44	1	0.07
14	4	0.28	48	1	0.07
15	2	0.14	53	1	0.07

Table 3: Author productivity index in health sciences research (N = 1427)

An analysis of the journals through which the authors disseminate health and medical sciences research conducted at the CHS at Moi University reveals that a high number of papers is published in journals that are either published in Africa or simply bear the name of the continent. At the top of the list of journals with the largest number of papers was the *East African Medical Journal* which published a total of 91 (17.77%) papers. This is a local journal (i.e. published in Kenya) and sponsored by the Kenya Medical Association. The journal is archived in the African Journals Online (AJOL), a non-profit organisation dedicated to improving online visibility and access to the published scholarly research of African-based academics. Other journals, among the top 15 journals, in which authors based in the CHS mostly publish, include *PLOS One*, which yielded 19 (3.71%). *PLOS One* is a multidisciplinary, peer-reviewed open-access (OA) journal and therefore not necessarily dedicated to the field of health and medical sciences. Its preference by staff members in the CHS is perhaps testimony to the acceptance of OA scholarly publishing among some researchers in the College. In the third position is the *East African Journal of Public Health*, which publishes primary research in a range of topics including community medicine, epidemiology, nutrition, behavioural sciences, health promotion, health education, communicable and non-communicable disease. The journal published 16 (3.13%) papers emanating from the CHS. The next three journals listed in table 4 publish research on the broad area of HIV/AIDS. Collectively, the journals published a total of 32 papers, accounting for 6.25% of the total number of papers published by the CHS between 2002 and 2014.

All in all, the CHS research was published in 225 sources, covering various diverse topics in health and medical sciences.

No.	Rank	Journal/source name	No. of papers	Percentage
1	1	EAST AFRICAN MEDICAL JOURNAL	91	17.77
2	2	PLOS ONE	19	3.71
3	3	EAST AFRICAN JOURNAL OF PUBLIC HEALTH	16	3.13
4	4	JOURNAL OF ACQUIRED IMMUNE DEFICIENCY SYNDROMES (JAIDS)	14	2.73
5	5	JOURNAL OF THE INTERNATIONAL AIDS SOCIETY	11	2.15
6	6	AIDS	7	1.37
7	6	AFRICAN HEALTH SCIENCES	7	1.37
8	6	FOOD & NUTRITION BULLETIN	7	1.37
9	6	PUBLIC HEALTH ACTION	7	1.37
10	7	EAST AND CENTRAL AFRICAN JOURNAL OF SURGERY	6	1.17
11	7	THE PEDIATRIC INFECTIOUS DISEASE JOURNAL	6	1.17
12	7	INDIAN JOURNAL OF PALLIATIVE CARE	6	1.17
13	7	ANNALS OF AFRICAN SURGERY	6	1.17
14	8	JOURNAL OF BIOCHEMICAL AND MOLECULAR TOXICOLOGY	5	0.98
15	8	JOURNAL OF BIOLOGY, AGRICULTURE AND HEALTH CARE	5	0.98

Table 4: Sources publishing health sciences research

Figure 4 and table 5 present the findings on author collaboration, which is often considered in bibliometrics circles as the proxy to measure research collaboration among researchers (see Diodato, 1994: 4; Laudel, 2001: 369; Glazel, 2002; Gauthier, 1998). The colours of the nodes depict the authors who belong to the same cluster. The larger the author's label or name and node in figure 4, the higher the weight of his/her research collaboration. The weight of collaboration is clearly shown in table 5. Figure 4 consists of a total of 454 authors who contributed at least two papers each, while table 5 provides a glimpse of the extent or weight of research collaboration of the authors who collaborated with at least 40 authors. It was found that S Kimaiyo collaborated the most, registering a weight link score of 108, implying that he collaborated with 108 authors, followed by K Wools-Kaloustian (103), and F Esamai (100). An interesting finding in the assessment of the top research collaborators is the presence of authors who are not employees of the CHS at MU, a situation that implies external research collaboration or at best, international collaboration. The cluster analysis reveals that there were 87 clusters of at least two authors each. The distribution of names according to the clusters that contained 10 or more names of authors was as follows:

Cluster one (31 names): S Esamai, C Tenge, H Mabeya, E Liechty, I Marete, D Hibberd, J Moore, K Hambidge, R Goldenberg, S Goudar, E McClure, A Patel, L Wright, N Krebs, O Pasha, W Carlo, R Derman, B Kodkany, E Chomba, A Garces, M Koso-Thomas, F Althabe, S Saleem, J Belizan, D Wallace, P Buekens, A Jobe, C Bose, A Manasyan, S Stalls and J Simba.

Cluster two (15 names): R Vreeman, P Braitstein, S Ayaya, P Gisore, W Nyandiko, D Ayuku, L Atwoli, A Kamanda, J Koech, L Embleton, S Wish, E Kamaara, M Turissini, R Kengthe and C Otieno.

Cluster three (17 names): J Carter, N Busakhala, R Strother, F Njuguna, P Loehrer, AM Kryzanowsk, J Skiles, G Kasper, S Mostert, B Rosen, F Asirwa A Griest, A Mega, E Njiru, E Orango, and S Washington.

Cluster four (14 names): S Kimaiyo, K Wools-Kaloustian, A Siika, A Mwangi, JE Sidle, L Diero, B Musick, J Rotich, C Yiannoutsos, E Sang, R Einterz, J Mamlin, C Shen, and WM Tierney.

Cluster five (15 names): A Tshefu, G Darmstadt, E Adejuyigbe, A Ayede, A Baqui, S Wall, R Wammanda, A Zaidi, R Bahl, C Engmann, E Longombe, S Qazi, S Saha and N Rollins.

Cluster six (15 names): D Shaffer, E Hogg, F Sawe, A Asmelash, L Mohapi, RM Hosseinipour, J Hakim, S Lockman, T Chipato, Y Zheng, J McIntyre, J Rooney, E Stringer, J Currier, and M Highes.

Cluster seven (15 names): D Menya, P Ayuo, C Simiyu, A Obala, B Khwa-Otsyula, D Odhiambo, W Omeara, R Downing, D Chelagat, P Chege, J Demaeseneer, E Mwaliko, J Armstrong, P Masibo and A Githeko.

Cluster eight (**12 names**): W Owino-Ongor, JB Baliddawa, C Justice, K Bryant, S Martino, R Papas, K Carroll, S Maisto, M Mwaniki, O Omolo, R Songole, and BN Gakinya.

It was observed that all the clusters above have international representation, implying that most research in medical and health sciences at Moi University is conducted through international collaboration. This pattern follows the trend observed by Tijssen (2007) in a study on Afri[illegible]s contribution to the worldwide research literature. Then, Tijssen (2007: 314) noted thus: "Kenya is the only one of the more highly developed African countries with a strong concentration of international research within medical and life sciences". The author associated the heavy reliance of international collaboration in research to foreign research funding, which may dictate terms of collaboration, and the need of African researchers to publish their research in foreign-based journals. The clusters are based on the research themes within the CHS and AMPATH areas of interest research that may be dictated by the funders. The researchers have grouped themselves according to areas that they will do research on; the groups are composed of researchers of diverse specialisations.

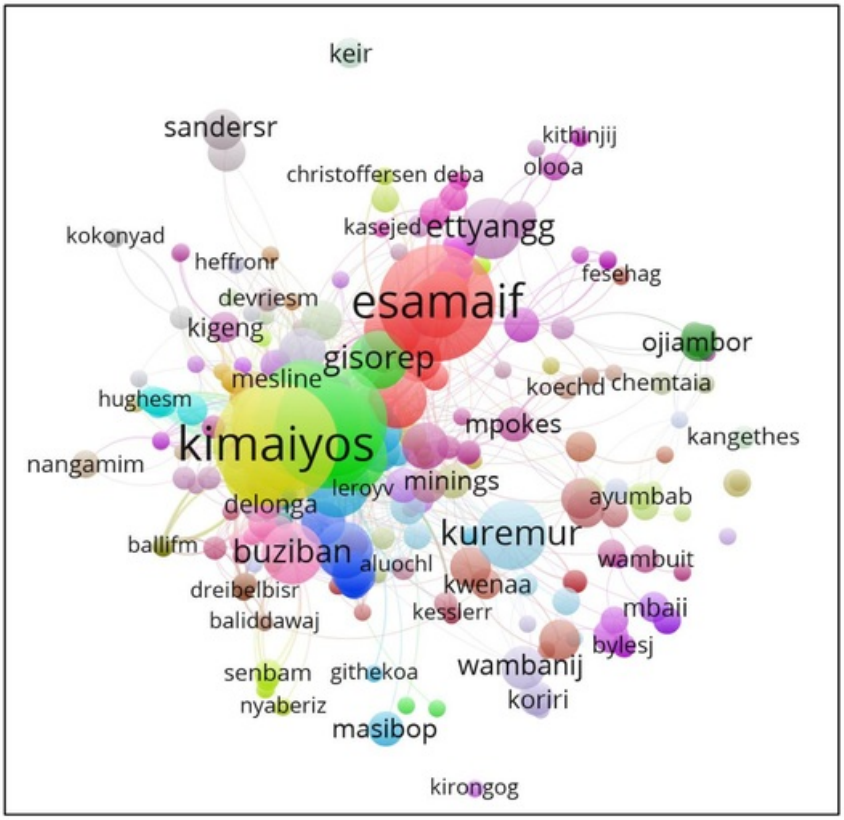

Figure 4: Author collaboration in health and medical sciences research at the CHS

Label	Cluster	Weight<Links>	Weight<Total link strength>
Kimaiyo, S	4	108	307
Wools-Kaloustian, K	4	103	267
Esamai, F	1	100	339
Siika, A	4	73	177
Mwangi, A	4	69	143
Sidle, J	4	67	134
Vreeman, R	2	66	220
Tenge, C	1	62	100
Braitstein, P	2	61	233
Ayaya, S	2	59	214
Hogan, J	35	59	99
Diero, L	4	57	111
Mabeya, H	1	57	102
Menya, D	7	56	97
Gisore, P	2	54	105
Musick, B	4	52	125
Sidlej, E	4	52	88
Ayuo, P	7	51	92
Buziba, N	10	50	86

Liechty, E	1	50	210
Carter, J	3	49	90
Nyandiko, W	2	48	156
Rotich, J	4	48	82
Yiannoutso, SC	4	48	115
Naanyu, V	33	48	70
Ayuku, D	2	47	142
Marete, I	1	47	73
Busakhala, N	3	44	92
Sang, E	4	43	88
Tshefu, A	5	42	86
Hibberd, P	1	41	149

Table 5: Strength of collaboration among top health and medical science researchers at CHS

The topics of the research focus, drawn from the titles of papers published by authors in the CHS, are provided in figure 5. There were 313 terms (and phrases) that met the frequency of occurrence threshold and which were considered to be reflective research topics. Of these research topics (terms in titles), Kenya was the most common with a occurrence frequency of 128, followed by Western Kenya (120), child (50), HIV (48), Eldoret (37), Patient (37), Referral hospital (31), Moi teaching (25), community (21), prevalence (19), treatment (19), and infection (18).

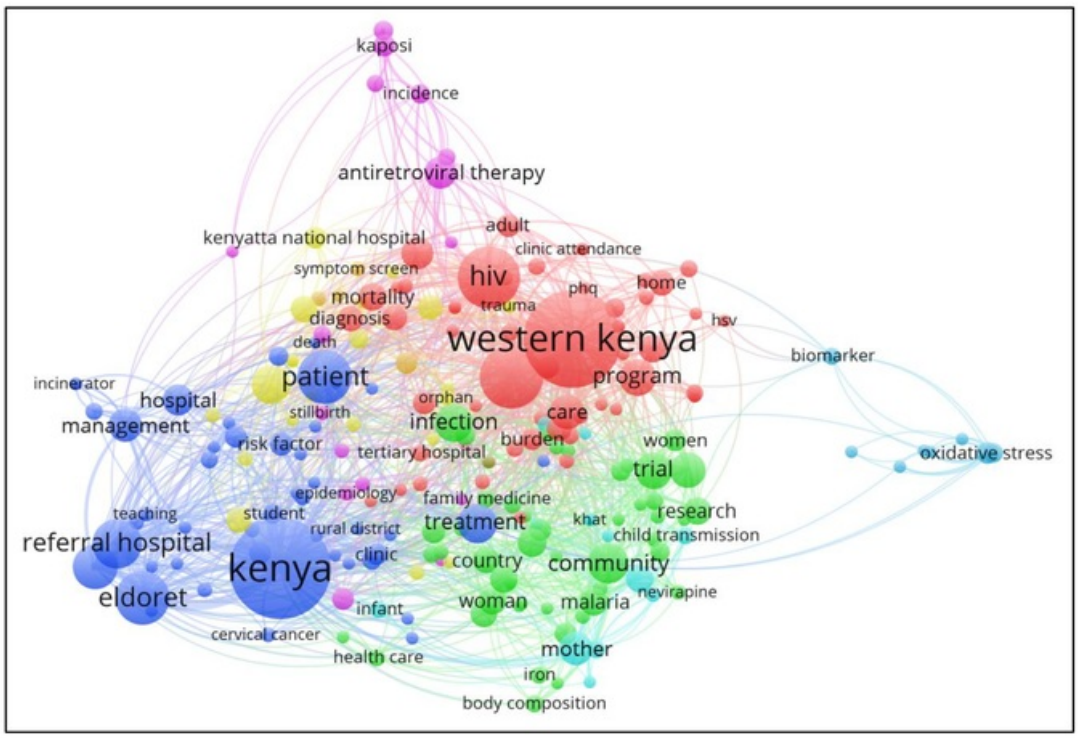

Figure 5: Map of most common title terms in health and medical research publications produced by CHS researchers

The same terms had the most number of links, in descending order, as follows: Kenya (117), Western Kenya (114), HIV (65), child (67), Eldoret (48), patient (48), prevalence (47), referral hospital (40), community (40), and infection (39). The two analyses of the most common terms in the titles (i.e. frequency of occurrence and weight of links) reveal that staff members at the CHS largely conduct research on a variety of topics but more specifically on child health care and HIV/AIDS in Western Kenya or Kenya at large. The other contextual setting relates to the institutional context of research, namely the Moi University Referral Hospital in Eldoret.

5. Conclusions and recommendations

The study sought to investigate the productivity and visibility of CHS academics or researchers. The findings have revealed that research at the CHS has witnessed an upward trend in the number of publications as shown in figure 1. The number of publications visible in 2002 was three (3), rising to 33 in 2004 but fell to 16 in 2007, followed by a steady rise to 107 in 2014. This steady rise could have been because of a number of factors including more research being done at CHS, increase in the number of researchers, and availability of research funds, among other issues. The projections after the year 2014 reveal that the trend is likely to continue at a lineal pattern until 2025, particularly if the same conditions persist. It has been further noted that academic staff members at CHS have higher productivity as they rise in the academic ladder. Those in higher ranks of senior lecturer to professor had a hig 30 number of publications and were more visible. This is in agreement with the requirements set out in the appointment and promotion guidelines of Moi University that for one to be promoted to the next level, they must have published a certain number of journal articles. Promotion and appointment in Moi University to any academic rank above lecturer position require that one must have published at least five journal articles apart from meeting other requirements that include teaching experience, community engagement and conference attendance (Moi University, 2012).

The research areas that are prominent in the findings among academic staff at CHS are Kenya (117), Western Kenya (114), HIV (65), child (67), Eldoret (48), patient (48), prevalence (47), referral hospital (40), community (40), and infection (39). Moi University is situated in the western region of Kenya and home to the only HIV/AIDS research facility in Africa, namely the Academic Model Providing Access to Healthcare (AMPATH). AMPATH is the centre of research on issues of HIV/AIDS and related topics. The Centre brings together both developing and established researchers from across several countries in the world, a situation that explains the collaboration patterns reflected in the collaboration map in figure 4. Researchers at Moi Univ 29 ty collaborate with other researchers from other countries, mostly a number of universities in the United States of America and Canada. AMPATH was created in 2001, as a joint partnership between Moi University and Indiana University as a comprehensive and effective HIV/AIDS control system in response to the deadliest pandemic in human history, and it is currently one of Africa's largest research consortia.

The study also indicated research collaboration among the academic staff of CHS 28 within the university and outside the country. A numb 27 f collaboration clusters were identified to be inclined to a number of research areas (see figure 4 and figure 5). The number of authors in some journal articles was as high as 15 authors, which exhibit the high level of collaborations in some topical areas. In medical research, there is always a need for collaboration due to the nature of research being undertaken – some may require field and laboratory investigations at the same time. The high number of co-authorship among the academics in CHS is healthy and a way of improving research in the area of health sciences. However, this kind of

research is being discouraged as per the new, reviewed academic staff appointment and promotion policy of Moi University that has been harmonised with the Commission for University Education in Kenya (CUE 2014). The point system in the new regulation in determining the suitability of one to be promoted to the next rank of academic level may end up being a deterrent to the progression of academic staff.

The research output was published in 225 sources; those with more frequency are published regionally. The majority of research output from CHS is published in journals from the region or those that bear the African name, with a sizeable number of journals from other regions publishing at least one journal article. The number of journals and the spread in terms of place of publication is a strong indication that the outputs from CHS are globally accessible, hence they can have a global impact.

The availability of research funding through AMPATH as well as the collaboration of research in CHS within Moi University and internationally have greatly contributed to the high number of research output among the academic staff of CHS. This is in agreement with the findings of Ocholla, Mostert & Rotich (2016), which showed more signs of research from medicine. This indicates that if the academic staff members access research funds and develop research clusters for collaborations, it will result in more productivity. We therefore recommend that universities make research funds available to academic staff if they have to publish more journal articles to boost the reputation of the university in global rankings. Further research is however needed to ascertain the role that funding plays in research productivity.

This study is limited in that the impact of the health and medical sciences research at the CHS was not determined, hence a strong recommendation to investigate the matter. Equally important is a study to benchmark this research against those of other countries in Africa, such as South Africa which is said to have established research incentives in place (Pouris & Richter, 2000).

References

Aina, LO & Mabawonku, I. 1997. The literature of the information profession in Anglophone Africa: Characteristics, trends and future. *Journal of Information Science, 32(4)*: 321–326

Aina, LO & Mooko NP. 1999. Research and Publication Patterns in Library and Information Science. *Information Development, 15(2):* 114–119

Alemna, AA. 1996. The periodical literature of library and information in Africa: 1990–1995. *International Information and Library Review*, 28(2): 93–103.

Alemna, AA. 2001. The periodical literature of library and information in Africa: 1996–2000. *Information Development*, 17(14): 257–261.

Alemna, AA & Badu, E. 1994. The nature and trends in research and journal literature in English speaking Africa. *International Information & Library Review*, 26(1): 19–30.

Altbach, PG. 2014. What counts for academic productivity in research universities? *Univerity World News. Issue 329*. Accessed 21 November 2016, from http://www.universityworldnews.com/article.php?story=20140715105656393.

Commission for University Education. 2014. Harmonized Criteria and Guidelines for Appointment and Promotion of Academic Staff in Universities in Kenya.

Diodato, V. 1994. *Dictionary of Bibliometrics*. New York: Haworth.

Gauthier, E. 1998. Bibliometric analysis of scientific and technological research: A user's guide to the methodology. Accessed 16 November 2016, from http://publications.gc.ca/Collection/Statcan/88F0006X/88F0006XIE1998008.pdf.

Glazel, W. 2002. Co-authorship patterns and trends in the sciences (1980–1998): A bibliometric study with implications for database indexing and search strategies. *Library Trends,* 50(3): 461–473.

Harzing, A. 2011. The public or perish book: your guide to effective and responsible citation analysis. Melbourne: Tarma Software Research Pty Ltd.

Hertzel, D. 1987. Bibliometrics, history of the development of ideas in: statistical bibliography or bibliometrics? *Encyclopaedia of Library and Information Science*, 42, 144-219.

Ingwersen P & Jacobs D. 2002. South African research in selected scientific areas: status 1981–2000. *Scientometrics*, 59(3): 405–423.

Kadiri, J. 2001. Library literature in Ghana 1950–1995. *African Journal of Library, Archives and Information Science*, 11(2): 158–166

Kenyatta, UM. 2013. Speech by his Excellency, Uhuru Kenyatta, during the 2013 Jamhuri Day 50th Anniversary celebrations at Safaricom Stadium, Kasarani, Nairobi, on 12 December 2013.

Kirigia, JM & Barry, SP. 2008. Health challenges in Africa and the way forward. *International Arch Med,* DOI: 10.1186/1755-7682-1-27.

Laudel, G. (2001). What do we measure by co-authorships? In: M Davis & C. S. Wilson (eds.). *Proceedings of the 8th International Conference on Scientometrics and Informetrics,* Sydney, July, 16–20, 2, 469–476.

Lwoga, ET & Sife A. 2014. Publication productivity and scholarly impact of academic libraries in Tanzania: A scientometric analysis. *New Library World*, 115(11/12): 527–541. DOI 10.1108/NLW-04-2014-0038.

Mabawonku, I (2001). Trends in Library and Information science research in Africa, 1991–2000. *African Journal of Library, Archives and Information Science, 11(2)*: 79–88

Moi University (2012). Academic Staff Appointment and Promotion Policy. Office of DVC Academic, Research and Extension.

Moi University (2015). Academic Staff Appointment and Promotion Policy. Office of DVC Academic, Research and Extension.

Narvaez-Berthelemont, N., Russell, JM., Arvanitis, R., Waast, R & Gailard, J. 2002. Science in Africa: an overview of mainstream scientific output. *Scientometrics,* 54(2): 229–241.

Ndege, GO. 2005. Kenya: independence to the present. In: Kevin Shillington (ed). Encyclopedia of African history. New York: Fitzroy Dearborn, pp 755–760.

Ocholla, D. N. 2000. *Research capacity in Library and Information Science in South Africa – an overview*. Paper delivered at the 66th IFLA Council and General Conference, Jerusalem, Israel, 13th-18th August 2000. http://www.ifla.org/IV/ifla66/papers/054-127e.htm (accessed 4 April 4, 2017)

Ocholla, D. N. 2001. An informetric study of the publication pattern in Library and Information Science in South Africa: 1993-2001. In: Davis, M. & Wilson, C. S., (eds.). *Proceedings of the 8th International Conference on Scientometrics and Informetrics,* Sydney, 16-20 July 2001, 2, 861-864.

Ocholla, DN, Mostert, J & Rotich DC. 2016. Visibility of University of Zululand and Moi University Researchers in Web of Science and Scopus from 2003 to 2013. *African Journal of Libraries Archives & Information Science, Vol. 26, No. 1* (April 2016) 3–15.

Ocholla, DN, Ocholla, L. & Onyancha, OB. 2013. Insight into research publication output of academic librarians in Southern African Public Universities from 2002–2011. *African Journal of Libraries Archives & Information Science,* 23(1): 5–22

Ocholla DN & Onyancha OB. 2009. The marginalized knowledge: an informetric analysis of indigenous knowledge publications (1990–2004). *South African Journal of Libraries & Information Science*, 71(3): 247–258.

Onyancha, OB & Ocholla, DN. 2009. Is HIV/AIDS in Africa distinct? What can we learn from an analysis of the literature? *Scientometrics*. 79(2): 277–296

Pouris, A& Richter, L. 2000. Investigation into state-funded research journals in South Africa. *South African Journal of Science*, 96: 98–104.

Sitienei, G & Ocholla, DN. 2010. A comparison of the research and publication patterns and output of academic librarians in Eastern and Southern Africa from 1990–2006: a preliminary study. *South African Journal of Libraries & Information Science*, 76(1): 36–48.

Tijssen, RJW. 2007. Africa's contribution to the worldwide research literature: new analytical perspectives, trends, and performance indicators. *Scientometrics,* 71(2): 303–327.

Wallace, D. P. 1989. Bibliometrics and citation analysis. *Principles and Applications of Information Science for Library Professionals*. Chicago: American Library Association, 10-26.

SAJLIS 2017

ORIGINALITY REPORT

%13	%10	%8	%2
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	www.lis.uzulu.ac.za Internet Source	%2
2	Aslib Proceedings, Volume 64, Issue 5 (2012-09-22) Publication	%2
3	koreapost.com Internet Source	%1
4	sajlis.journals.ac.za Internet Source	%1
5	"Chapter 1 The Grants Register", Springer Nature, 2015 Publication	%1
6	www.novelwall.org Internet Source	%1
7	Joses Kirigia. "Health challenges in Africa and the way forward", International Archives of Medicine, 2008 Publication	<%1
8	www.freejournalarticles.net Internet Source	<%1

9	lisstudycircle.blogspot.com Internet Source	<%1
10	www.springerlink.com Internet Source	<%1
11	ajol.info Internet Source	<%1
12	www.arts.uzulu.ac.za Internet Source	<%1
13	www.carlosmello.unifei.edu.br Internet Source	<%1
14	uzspace.uzulu.ac.za Internet Source	<%1
15	trend.asia.edu.tw Internet Source	<%1
16	msu.ac.zw Internet Source	<%1
17	Submitted to University of Alabama at Birmingham Student Paper	<%1
18	Agrawal, Alpna Bloom, Shelah S. Suchindran, Chirayath Curtis, Sian Angeles, Gustavo. "Gender-based power and couples' HIV risk in Uttar Pradesh and Uttarakhand, North India. (Report)", International Perspectives on Sexual and Reproductive Health, Dec 2014 Issue Publication	<%1

19	www.uonbi.ac.ke Internet Source	<%1
20	Luo, Jingyuan, and Kirstin R. W. Matthews. "Globalization of Stem Cell Science: An Examination of Current and Past Collaborative Research Networks", PLoS ONE, 2013. Publication	<%1
21	www.rand.org Internet Source	<%1
22	www.ku.ac.ke Internet Source	<%1
23	www.forschungsinfo.de Internet Source	<%1
24	Sweileh, Waleed M., Sa'ed H. Zyoud, Samah W. Al-Jabi, Ansam F. Sawalha, and Suleiman Al Khalil. "Research Output from Palestine (1995–2012): A Bibliometric Study", The International Information & Library Review, 2014. Publication	<%1
25	cdn.intechopen.com Internet Source	<%1
26	www.researchgate.net Internet Source	<%1
27	dione.lib.unipi.gr Internet Source	<%1

28	R. Sooryamoorthy. "Transforming Science in South Africa", Springer Nature, 2015 Publication	<%1
29	en.unionpedia.org Internet Source	<%1
30	www.hec.gov.rw Internet Source	<%1
31	www4.rgu.ac.uk Internet Source	<%1
32	Radhamany Sooryamoorthy. "Collaboration and publication: How collaborative are scientists in South Africa?", Scientometrics, 04/16/2009 Publication	<%1
33	diginole.lib.fsu.edu Internet Source	<%1
34	www.issi2013.org Internet Source	<%1
35	www.redbcm.com.br Internet Source	<%1
36	Onyancha, Omwoyo Bosire. "SUBJECT CONTENT ANALYSIS OF HIV/AIDS RESEARCH IN EASTERN AND SOUTHERN AFRICA, 1980-2005", Mousaion/00272639, 20091001 Publication	<%1

37	www.ajol.info Internet Source	<%1
38	favl.org Internet Source	<%1
39	Carmen Osuna. "Overturning some assumptions about the effects of evaluation systems on publication performance", Scientometrics, 11/11/2010 Publication	<%1
40	Onyancha, Omwoyo Bosire. "ASSESSING RESEARCHERS' PERFORMANCE IN DEVELOPING COUNTRIES: IS GOOGLE SCHOLAR AN ALTERNATIVE?", Mousaion/00272639, 20090401 Publication	<%1
41	Gupta, Sushma. "Structure of African Psychological Literature: 1827–1987", The International Information & Library Review, 1995. Publication	<%1
42	Omwoyo Bosire Onyancha. "Growth, productivity, and scientific impact of sources of HIV/AIDS research information, with a focus on eastern and southern Africa", African Journal of AIDS Research, 05/01/2008 Publication	<%1

EXCLUDE QUOTES	OFF	EXCLUDE MATCHES	OFF
EXCLUDE BIBLIOGRAPHY	ON		