

Biomedically-focused research productivity by Namibian authors and institutions 1995-2010

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Abstract

Publications are the result of individual scientists or 'webs' of collaborators who present their scientific observations and share them with the scientific community. A study of authors and institutions who have published provides way to assess a country's research environment. Using PubMed and ISI Web of Science, this study identified Namibian authors and institutions which published biomedically-focused studies between 1995 and 2010. Results consisted of 150 different biomedically-oriented publications by a total of 190 different authors from 44 different institutions. 89% of the articles by Namibian authors were the results of collaboration, either foreign or Namibian-based. 47% of the papers were 1st authored and 11% were single authored by Namibian-based authors. The majority of Namibian authors (72%) only produced one article while 28% produced 2 or more papers. Further analysis indicated that there has been a negative trend in the number of publications since 1998 which contrasts with the increasing number of institutions which have published at least one article during that period. In total, these results indicate that the biomedical science environment in Namibia has potential to develop and expand. However, it needs support from a national biomedical research strategy based on Namibian-informed research priorities, investment in potential authors and institutions and empowered tertiary institutions taking the lead to equip and build capacity in local collaborators in order to reach its true potential.

Keywords: *Namibia, Biomedical Publications, PubMed, ISI Web of Science, Biomedical Research*

Introduction

Research publications are often used as proxies for the scientific progress and development of a particular country (Dandona [1], Benamer [2-3], Bissar-Tadmouri [4], Mohammadhassanzadeh [5]). They are the result of individual scientists or 'webs' of collaborators (Newman [6]), both foreign and local, who present their scientific observations and share them with the scientific community. Because publications are usually an outcome of research, the scientific analysis of research productivity called 'bibliometrics' is a popular way to assess a country's research strategy (Bakoush [7]).

Bibliometric studies, particularly those focused on regions or individual countries, are popular for a variety of reasons. Regional studies compare between countries and highlight which country is publishing the most and attempt to identify the reasons (Bissar-Tadmouri [4], Rosselli [8], Neves [9], Uthman [10], Hofman [11], Uthman [12]). Country-specific bibliometric studies focus on particular research topics (Dandona [1, 13]), the output of various medical schools (Benamer [3]), university faculties (Gulluoglu [14]; Dakik [15]) or biomedical publication patterns (Benamer [2], Mohammadhassanzadeh [5], Bakoush [7], Neves [9]). These country-specific studies reveal trends that reflect national strategies to encourage and build capacity in the institutions and personnel involved in tertiary education, research, and health services to do nationally important research (Benamer [2], Rosselli [8], Neves [9], Gulluoglu [14], Thompson [16], Nwagwu [17], Abramo [18]).

Research in Namibia has only been studied in a peripheral way since achieving independence in 1990. Nkwelo [19] indicated that Namibia published 480 papers between 2001 and 2007, mainly in the fields of space science, wildlife research, marine science and environmental science but only recorded the main publishing institutions. Focusing on biomedical research, recent publications have indicated that Namibia is publishing at a low but steady rate. In a general analysis of publication trends in Sub-Saharan Africa (SSA), Uthman [10] demonstrated the Namibia remains in the 4th tier (out of 5 being the lowest) in regards to biomedical publications with an average rate of 2-10 publications per year between 1996 and 2005. In their general assessment of SSA publication rates, Rahman & Fukui [20] indicated that Namibia produced 2.19 biomedical publications per million inhabitants per year between 1990-2000 with no sign of increase or decrease in trend. These studies only highlighted trends and did not analyze what is actually happening at the country level.

Therefore, as a means to analyze the biomedical research production in

Namibia, a bibliometric study was carried out using PubMed and ISI Web of Knowledge to identify Namibian authors and institutions which published biomedically-focused research between 1995-2009. The overall goal was to provide a baseline from which future studies can be compared.

Methods and materials

The study population consisted of all Namibian institutions and authors which published biomedically-focused research between January 1995 and July 2010. Two search engines were used to access the study population: 1) PubMed, a MEDLINE-linked search engine which provides access to 20 million citations for biomedical literature, and 2) ISI Web of Knowledge, a leading citation database with multidisciplinary coverage of over 10,000 high-impact journals in the sciences, social sciences, and arts and humanities. While PubMed is open to anyone, the author had access to the ISI Web of Knowledge through an adjunct position at a North American institution. The cut-off year of 1995 was chosen for two reasons: First, it created a convenient 15 year time frame on which to base the analysis. Secondly, it was sufficient time for Namibia to become independent from South Africa in 1990. Until 1990 and some years after, many studies done in Namibia were done by South African entities (Noden, unpublished data). This 5 year post-independence cut-off allowed for the evaluation of the productivity of Namibian institutions and mainly Namibia-based authors.

Inclusion/Exclusion criteria

An article was included in the analysis if it was found in PubMed and/or ISI Web of Science (part of the ISI Web of Knowledge) as distinctly biomedically-focused in subject. In general, PubMed included articles related to biomedical, clinical and basic medical subjects; but also including ecology, evolution, or systematics; public, occupational, or environmental health; social science (biomedical in focus); marine or environmental science and veterinary or animal science or zoology if they were remotely linked to biomedically-related subjects. Only original articles, review articles, and case reports were used.

ISI Web of Science, because of the width of its subject, was filtered with the goal to attain as many papers of biomedical importance as possible that would correspond closely with those chosen by PubMed. As such, articles in the following areas were chosen: parasitology, ecology, tropical medicine, pediatrics, marine and freshwater biology, genetics and heredity biology, zoology and plant science, infectious diseases, environmental sciences, biochemistry and molecular biology, veterinary sciences, immunology,

hematology, public, environmental and occupational health, mycology, biotechnology and applied microbiology, reproductive biology, entomology, virology, animal science, evolutionary biology, medicine, general and internal, environmental studies, health policy and services, food science and technology, oncology, microbiology, dentistry, oral surgery and medicine, and biomedically-orientated social sciences.

Determining Namibian authors and institutions was time consuming in an attempt to evaluate each paper individually. It was relatively simple to evaluate first authorship as that is the address used by PubMed and it could be confirmed by ISI Web of Science when applicable. However, for co-authors, it was more difficult as ISI Web of Science provides a listing of institutions for each author except before 2008, where no identification exists of which author belongs with which institution. Therefore, it was necessary to manually check each publication when an Namibian co-author was identified using either the link on the PubMed abstract page, the listing provided for the abstract in ISI Web of Science or by directly acquiring the paper via the author's access to WHO HINARI or a North American university library system. By evaluating as much information as possible about each article, mislabeled abstracts were filtered from those which were truly done by Namibian-based institutions. Once the Namibian institutions were identified, an internet search was carried out to find out if or how their names had changed in the past 15 years. Analysis was done using Microsoft Office Excel and EpiInfo Version 3.5.1. All figures were produced by Microsoft Office Excel 2007.

Results

After searching and confirmation of PubMed and ISI Web of Science, 150 biomedically-focused articles authored by 190 Namibian authors were identified between January 1995 and July 2010. Both search engines captured 72.9% of papers where at least one of the authors was from a Namibian organization with 18.6% and 8.5% found individually in PubMed or ISI Web of Science, respectively. Outside of the articles identified, 63 studies were identified using 'Namibia' as a keyword but were not used because they 1) involved studies from neighbouring countries, 2) were completed in other countries but labelled as Namibian studies, or 3) had authors based in Namibia at the time who had completed their research in another country. 2 articles identified in PubMed were double and triple referenced.

Number of articles published by Namibian authors

Of the 150 articles identified in PubMed and/or ISI Web of Science published by Namibian authors between 1995 and 2010, 71 (47%) were 1st authored by Namibia-based authors of which 19 (27%) were co-authored with only foreign-based co-authors and 52 (73%) with both Namibian and foreign co-authors (Fig 1 and 2). Sixteen (11%) were single authored by Namibia-based authors. The remaining 63 articles (42%) were written by foreign-based 1st authors and co-authored with Namibia-based authors. Of note, 89% of the articles by Namibian authors were the results of collaboration, either foreign or Namibia-based. Of the 16 sole authored papers, only 11 authors single-authored papers as one author had 3 three papers (in the same year) while 2 others had 2 each. Of the 16 single-authored papers, 10 were affiliated with University of Namibia. Sixty-three percent of the single authored papers were before 2005.

Interesting trends were observed in Figure 2. There was a noticeable downward trend in Namibian 1st authors with Namibian co-authored papers since 2004. On the other hand, there is an upward trend in Namibian co-authorship with foreign 1st authors since 2003. The other groups had too few publications to produce notable trends and it was too early to observe trends in 2010.

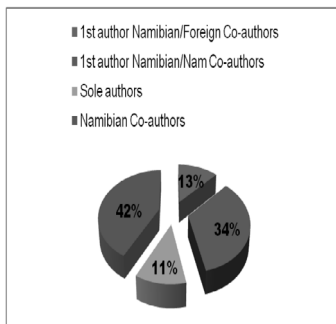


Figure 1: Authorship by Namibians of biomedical focused publications between 1995-2010

Figure 2 shows the number of publications by Namibian authors and the extent of collaboration/co-authorship with local and foreign researchers. The 2010 bar is provisional as the data were still developing when the project was closed.

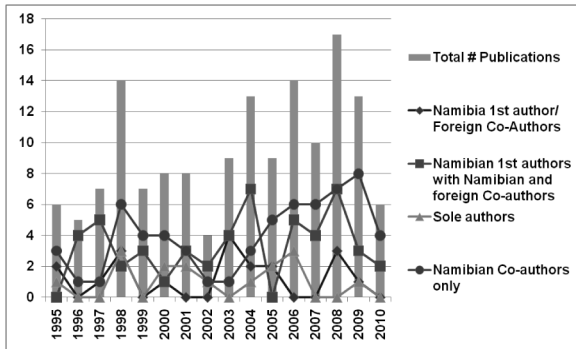


Figure 2: Number of publications by Namibian authors between 1995-2010

Authorship proportions

The majority of Namibian authors (72%) have only produced one article while 28% have produced 2 or more papers (Fig 3). When counting each time a Namibian author’s name has been published between 1995 and 2010, Namibian authors appeared 283 times including all first, single and co-authorships (Table 1). Of those 283 Namibian authorships, 68.5% were as co-authors (Table 1). Of note, the 28% of authors who produced 2 or more publications (Fig 3) became 52% of all cited Namibian authors in the last 15 years (Table 1).

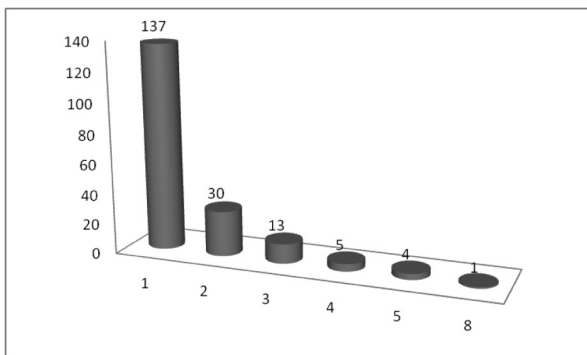


Figure 3: Publications by authors between 1995 and 2010.

The x-axis represents the number of papers by a single author. The y-axis indicates the number of authors.

Table 1: Namibian publications showing co-authored first authored, or sole

authored publication

# Publications Namibian authors	Co-authors	First Authors	Sole Author	Total (%)
1	103	26	7	136 (48%)
2	33	24	3	60 (21%)
3	29	9	1	39 (14%)
4	10	5	5	20 (7%)
5	13	4	3	20 (7%)
8	6	2	0	8 (3%)
Total	194	70	19	283

Namibian Institutions

Over the 15 year span analyzed, 44 different Namibian institutions have been involved in biomedically-related publications (Fig 4, Table 2). The majority of institutions (n=30) produced fewer than 4 publications during that 15 year period (Table 2). The contribution of the institutions that produced 4 or more papers is shown in Figure 4. At a glance, the University of Namibia clearly has dominated.

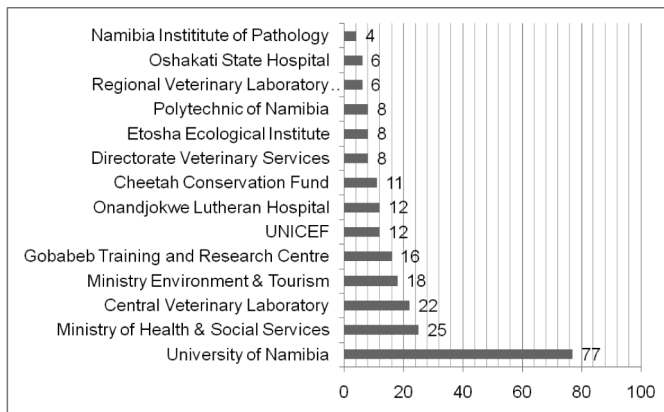


Figure 4: Author affiliations of Namibian institutions which have had 4 or more authors 1995-2010.

This figure details number of authors from Namibian institutions in the past 15 years and is not detailing publications per institution. For example, the Namibia Institute of Pathology (NIP) has published 2 papers in 15 years but those two papers included 4 authors from the NIP.

Table 2: Author affiliations of Namibian institutions which had 3 or fewer authors 1995-2010.

Namibian Institutions	First Author	Sole Author	Co-Author	Total
Ministry Agriculture Water & Rural Development			3	3
Natural Museum			3	3
Pharmaccess	1		2	3
EnviroScience	2	1		3
Ministry of Basic Education			2	2
National AIDS Control Program	1		1	2
National Botany Institute	1		1	2
Gobabis Veterinary Practice	2			2
Medical Rescue			2	2
Rossing Uranium			2	2
Ostrich Production Namibia	1		1	2
WWF			2	2
WHO Namibia	1		1	2
Meat Co Namibia	1		1	2
Neudamm Agricultural College			1	1
Directorate of Forestry			1	1
Geological Survey Namibia			1	1
Namibia Blood Transfusion Services			1	1
National STD and AIDS program	1			1
Rhino Park Veterinary Clinic			1	1
Omaruru Veterinary Practice			1	1
Namibia Business Coalition of AIDS			1	1
Rainbow project			1	1
AfriCat Foundation			1	1
Namibia Nature Foundation			1	1
Rare & Endangered Species Trust			1	1
Oxfam	1			1
SADC			1	1
UNAIDS			1	1
Individual author: ecologist		1		1
Individual author: Keetmanshoop		1		1

When evaluating the data (Table 1), it was striking that a relatively large number of Namibian institutions had at least one author who had published at least one article between 1995 and 2010. To analyze this further, the year in which a particular institution had first published was determined and plotted

in a cumulative graph (Fig 5). The x-axis is consecutive years and y-axis is increasing number of institutions. This graph shows that in 1995, there were 4 institutions publishing biomedically-focused papers whereas, 15 years later, the total number of publishing institutions had increased to 44. However, if the total number of annual publications is divided by the available number of institutions which could have published in any given year (Fig 6), then this publication ratio dramatically decreased from 1 to just above 0.2. The x-axis for Fig 6 is consecutive years and y-axis is publication/institution ratio. This graph indicates that Namibian institutions which have published at least one paper have either stopped publishing or publish less than 1 paper per year since 1999. It is notable that between 1995 and 1998, cumulative Namibian publishing institutions increased from 4 to 21 with per institution publication rates decreasing from 1 to 0.7. Between 1998 and 2003, there was basically no increase in cumulative Namibian publishing institutions (21 to 26) but there was another decrease in per institution publication rates from 0.7 to 0.3. Between 2003 and 2009, cumulative publishing institutions increased again from 26 to 44, yet per institution publication rates decreased again from 0.3 to 0.2. So, in total, the trend is showing a decrease in publications for past 15 years with little change since 1998.

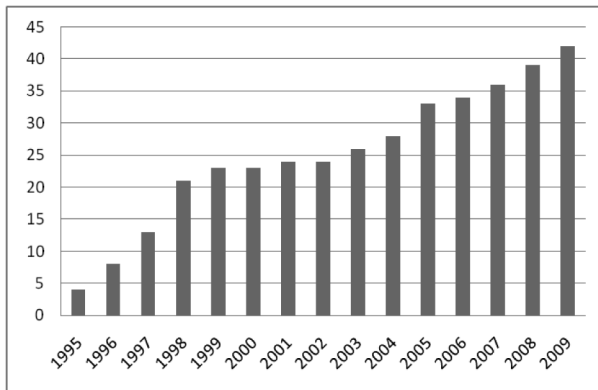


Figure 5: Number of institutions that have published one or more papers in the last 15 years in Namibia

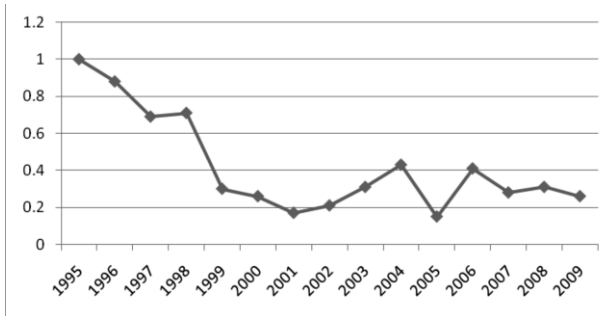


Figure 6: The average number of publications per entity/institute 1995-2009.

Discussion

The current situation on biomedical research in Namibia

Namibian institutions and authors are doing biomedically-related research and forming 'webs of collaboration' (Newman [6]) with foreign and local co-authors. The evidence consists of 150 different biomedically-oriented publications by a total of 190 different authors from 44 different institutions indicating that the biomedical science environment in Namibia has potential to develop and expand. The publication rate of Namibia is 'on average' with the rest of the continent (Hofman [11]) as well as the world (Perez-Iratxeta [21]), contributing 0.01% of the total number of biomedical publications in Sub Saharan Africa (SSA) (Hofman [11]). This publication rate is also in line with the Gross National Product (GNP) and total population of the country (Uthman [10]), one of the main predictors of biomedical research productivity in developing countries (Rahman [22]). The results also demonstrate that positive levels of collaboration exist and the trend that collaborative projects in Namibia are increasing.

While encouraging, the 15 year negative trend in publications/institution is a concern as institutions who have published in the past have not been encouraged to do more research. This could possibly reveal a lack of national strategic vision for the role of biomedical research and publications, even though the number of possible publishing institutions has increased. Most countries with low publication levels of publication (e.g. Namibia) also suffer from negative publication trends (Perez-Iratxeta [21]). In stark contrast to Namibia's negative publication trend, South Africa published 41.5% of the biomedically-focused studies identified in Sub-Saharan Africa between 1995

and 2004, far beyond their GNP / population levels (Hofman [11]). This is mainly due to government investment of Research and Development (R&D) expenditure and encouragement and fostering of a positive environment of private-public partnerships (Worldmapper [23]). The principle focus of biomedical research in Namibia has been 'systems research' with little to no focus on basic, applied, or clinical science (Tugwell [24]).

Additionally, while collaboration may be increasing, the trend of Namibian 1st authored papers is decreasing. First authorship usually indicates the person who conceptualized, directed, carried out, analyzed and wrote up the paper. When this trend decreases, it indicates a lack of capacity building to assist people in directing biomedically-oriented research. The lack of focus on training Namibians to conceptualize research questions pertinent for country-specific biomedical issues, poor or non-existent training in research methods and struggles in writing and language competency all work together to continue to rely on foreigners researchers to direct the research process (Uthman [10], Tugwell [24]).

What can be done to encourage biomedical research by Namibian institutions and authors?

Need for a National Research Strategy for Biomedical Health

There is a need for a practical, empowering national research strategy for biomedical health in Namibia. Currently, a strategy exists on paper (MOHSS [25]) but it needs to become a 'habit' for every biomedical researcher in the country. In addition to government ownership, particularly the Ministry Of Health and Social Services (MOHSS), this strategy needs to involve partnerships with all current and potential Namibian research institutions, both public and private. This way, biomedical health research becomes a means to create an evidence-based national health policy based on existing conditions and not based on the opinions of outside entities (Tugwell [24]). Encouragingly, this situation appears to be changing. The recent National Research Symposium (Sept 2010) brought together Namibian researchers from many disciplines to present their data, some of it biomedical in nature, and highlight what is happening in the Namibian research environment in addition to discussions concerning a national ethical policy for research. The Namibia Medical Society congress in November 2010 will also profile Namibian health professionals presenting primary data in an event seeking to 'unite doctors from all corners of Namibia'. These events do much to raise the profile of research in the country.

The obvious effect of this national research strategy would be to empower Namibian authors and institutions to do health-related research which directly addresses Namibian health needs. Building capacity in biomedical health means that the main stakeholders (government, tertiary institutions, research centers, and the medical community) together develop an objective-based needs assessment for critical areas in the national health program that need research (e.g. a public health strategy to reduce the high rates of suicides and unacceptable levels of drunk driving). An environment can then be created, where research is considered equally important as provision of service and teaching (Harris [26], Samadikuchsarai [27]). This focus has brought huge dividends in other developing countries. For example, South Africa accounts for one third of SSA's biomedical publications because the government invested in infrastructure and modern equipment to retain workers at universities, research labs and health institutions (Uthman [10]). A government-based research incentive program pays universities and researchers for each paper published in peer-reviewed journals.

Another incentive involves the possibility to patent biotechnological products from one's own research. When the institution or government 'owns' an invention with limited to no benefit to the researcher, there is no motivation to innovate. The researcher either will focus only on basic research or if they determine that their bio-technological invention is marketable, they will leave the institution before patenting and secure income from their invention at another institution that is more open to such innovative thinking.

Namibian tertiary institutions need to grow into their role as centers of research excellence.

To achieve this, centers of higher learning in Namibia need to foster a 'research culture' (Harris [26], Samadikuchsarai [27]) where 'researchese' is spoken on a regular basis.

First, Namibian universities need to continue expanding their faculty evaluation and promotion strategies to include research and not just teaching. This is a common situation in developing countries (Benamer [2], Bissar-Tadmouri [4], Samadikuchsarai [27]). Because the number of faculty in a department is usually determined by teaching loads or professional service rather than research projects, a strong priority develops for teaching at the expense of research. This, however, is counterproductive because it ignores the fact that high-quality research by faculty dramatically increases student training opportunities (Samadikuchsarai [27]). Additionally, the extra payment for teaching an extra-course is often higher than what is offered for research

projects. Teaching overload, then, becomes a 'research killer'. The remedy will only occur when universities improve their research strategies to become 'incubators of scientific research' (Samadikuchsarai [27]).

Secondly, these Namibian 'incubators of scientific research' need to bring a research focus into every biomedically-focused course curriculum. All scientific programs in tertiary level institutions in Namibia should have research methodology courses which are not only focused on teaching the research process but also basic data analysis and the mechanisms of writing and publishing their research. Team work, critical thinking, research management skills, literature review skills, and writing skills need to be taught to both students and faculty members (Harris [26], Samadikuchsarai [27]).

Thirdly, Universities need to encourage faculty to develop interests and offer incentives to pursue health issues of national importance – not just those thought to be important by foreign donors as has been the norm (Tugwell [24]). Grant writing to compete for foreign funding is enormously time-consuming. If institutions are to compete for international biomedical health funding, fundamental changes needs to occur on many different levels. Positively, in recent years, tertiary institutions in Namibia have been working to encourage research among their faculty. While the main focus remains teaching, policies are developing to link promotion not only with teaching and service but also with increasing one's professional degree and publishing papers. This will take time as a 'research culture' begins to develop within the schools and collaborations grow with local and foreign-based collaborators. Much like South Africa, offering incentives will promote more research among faculty members.

Finally, these research institutions need to establish their roles as the capacity builders of other Namibian institutions such as parastatals and health-related partners. The majority of Namibian authors and institutions have only produced 1 or 2 papers, demonstrating that publications are a by-product of an institution's work and not a priority. The remedy for this is for tertiary institutions to lead the way, create a research network among Namibian research institutions and train up cadres of researchers who know how to ask the right questions and follow a study to its completion. In addition to helping define research questions and analysis of data, this capacity building needs to include improving writing skills and provide relevant access to current scientific journals. The author has had several conversations with persons involved in health-related institutions, both private and public, who have the desire to publish their data but just don't know where to begin. Unpublished data is 'dead data'. Universities must step into this critical area

with their expertise and assist people to 'unlock' what they have.

Research institutions need to continue to focus on building collaborations

This study demonstrated the encouraging trend of co-authorship in Namibia in the last decade. This is much in line with developing global trend in co-authorship patterns in biomedical science as well as physical sciences (Bissar-Tadmouri [4]). Collaboration improves the quality of the research output as joint publications are usually found in journals with a higher impact factor and quality than those with single authors (Samadikuchsarai [27]). This aspect is directly related to institutions which look at authorship in their promotion schemes. Promotion scores based on what kind of author you are – single, first or co-author – is naïve and counterproductive. A rewarding of single authors above other authored papers not only decreases attainment of teamwork skills which are vital for today's scientist but also demonstrates that the University itself does not see the value of collaboration networks to truly make a project multi-disciplinary (Samadikuchsarai [27]). Instead, universities should evaluate a researchers 'collaboration web' to find out just how interconnected they are to both local and international research programs. This would encourage cross-pollination and not just building of individual empires which don't have contact with others.

Limitations

While limitations have tried to be avoided, it was not possible to completely cover all aspects. One potential limitation comes from using MedLine as a search engine in regards to authorship. Because MedLine only provides the address of the first author, it is not completely possible to ensure that all papers with Namibian authors were identified. While this limitation was addressed by trying to hand-search each reference, it was not always possible retrieve every paper and to identify the origins of all authors. Namibians continue to be trained by South African institutions so the publications generated by their studies are identified with their South African institutions, making it impossible to identify them. Another limitation was that this study only evaluated quantity of papers and did not use the normal indexes (impact factors) to evaluate quality as others have done (Benamer [3]). Finally, potential authorship and institutional information contained in the 'grey literature' in the archives of the MOHSS and other government and NGOs was not available on the internet and hence, lost to the parameters of the study.

Conclusions

The study identified that Namibian institutions and authors are doing biomedically-related research, forming 'webs of collaboration' with foreign and local co-authors, and publishing in international journals. However, due to a lack of national research strategy and investment in potential authors and institutions, biomedical research in Namibia is not achieving its potential to provide evidence-based research on which national health policy and programming can be based. Good quality publications will create the push for more research and exploration of new areas. This continuous process will allow the country to develop a research culture which can address its own biomedical research needs and have a direct involvement in the solving of health-related problems (Bakoush [7]). Until that change occurs, however, Namibia's researchers and centers of research excellence will never reach their true potential.

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