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**Use of a bibliometric literature review to assess medical research capacity in post-conflict and developing countries: Somaliland 1991-2013**

Ross Boyce<sup>1</sup><sup>6</sup>, Richard Rosch<sup>2,3</sup>, Alexander Finlayson<sup>2</sup>, Djibril Handuleh<sup>4</sup>, Said Ahmed Walhad<sup>5</sup>, Susannah Whitwell<sup>2</sup>, and Andy Leather<sup>2</sup>

<sup>1</sup>*Division of Infectious Diseases, University of North Carolina at Chapel Hill, Chapel Hill, USA*

<sup>2</sup>*Centre for Global Health, King's Health Partners, King's College London, London, UK*

<sup>3</sup>*Institute of Neurology, University College London, London, UK*

<sup>4</sup>*Department of Medicine, Amoud University School of Medicine, Borama, Somaliland*

<sup>5</sup>*College of Health Sciences, Amoud University, Borama, Somaliland*

**ABSTRACT**

**Objectives:** Effective health care systems require high quality research to guide evidence-based interventions and strategic planning. In low- and middle-income countries, especially those emerging from violent conflict, research capacity often lags behind other aspects of health systems development. Here we aim to bibliometrically review health-related research output in Somaliland, a post-conflict self-declared autonomous nation on the Horn of Africa, as a means of assessing research capacity.

**Methods:** We reviewed articles on health-related research conducted in Somaliland between 1991 and 2013 that included a description of the experimental design as evidenced by a methods and results section, and were published in either a peer-reviewed journal or as part of a scholarly program receiving formal review. We did not include policy or social science research that did not enroll or interact with subjects from Somaliland. Using online databases, all studies meeting minimum eligibility criteria were reviewed in regards to Somaliland-based co-authorship, topic of research and specific measures of quality.

**Results:** A total of 37 (42%) studies were included in this review. Of these only 19 (51%) included co-authorship by Somaliland-based researchers. Of the 21 studies reporting ethical approval, 16 (64%) received approval from the Somalia or Somaliland Ministry of Health, while five received approval from a university or national commission. More than two thirds of published research was limited to a few areas of investigation with most (19, 51%) following basic cross-sectional study designs. The number of articles published per year increased from 0-1 in the years 1991 – 2007 to a maximum of

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8 in 2013.

**Conclusions:** Research activity in Somaliland is extremely limited. Investigators from high income countries have largely directed research in Somaliland; only half of the included studies list co-authors from institutions in Somaliland. Leadership and governance of health research in Somaliland is required to define national priorities, promote scholarly activity and guide the responsible conduct of research. The methods used here to assess research capacity may be generalizable to other low and middle-income countries and post-conflict settings to measure the impact of research capacity building efforts.

**Keywords:** research; developing countries; ethics; global health; systematic review

## INTRODUCTION

Although the highest burden of disease is concentrated in low- and middle-income countries (LMICs), multiple studies have revealed significant disparities in scientific activity between industrialized and developing settings (1-5). Low medical research capacity severely limits the ability of clinicians and policymakers in LMICs to effectively utilize scarce resources and implement evidenced-based policies. Even with access to results from high-income countries (HICs), the generalizability of these findings to LMICs is constrained by differing epidemiological profiles and limited resources (2).

The reasons for low research capacity in LMICs are many. The most commonly cited factors include inadequate training in research methodology, a dearth of institutional support, poor laboratory infrastructure, issues of English language proficiency and scientific writing skills, limited access to scientific literature, and bias in the editorial boards of international journals (1, 3, 6). In response, a number of initiatives have been launched to improve research capacity in LMICs (7, 8). Developing local research capacity in collaboration with HIC institutions, however, is fraught with challenges. The most significant obstacle is the potential for power imbalances, with HIC investigators controlling funding sources and thus dictating the research agenda (6, 9, 10). This imbalance can lead to conflicting priorities, diversion of resources, neglect of national research networks, and even accusations of extractive practices sometimes referred to as “scientific colonialism” (11-13).

The disparities in research capacity are likely more pronounced in LMICs affected by violent conflict for a number of reasons such as death or migration of health research leaders during the period of conflict; the destruction of facilities for research; a focus on starting a basic package of health services for the population rather than research; limited health funding in the transition between humanitarian crisis and the post-conflict development phase; and on-going insecurity (14).

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One such country is Somaliland, a self-declared, independent state of approximately 3.5 million people, generally comprising the territory of the former British protectorate of the same name (15). After independence from Britain, the State of Somaliland united with the Trust Territory of Somalia in 1960 to form the Republic of Somalia. After a long civil war against the Siad Barre regime, the Northern Somali clans declared independence from Somalia in May 1991, and Somaliland was re-born. The conflict, however, displaced more than 500,000 people of Somaliland, mostly across the border into Ethiopia, and devastated existing infrastructure, including the healthcare system. Relative calm exists today, but health indicators for Somaliland remain among the worst in the world (14, 16, 17).

Like most post-conflict countries, the current state of research capacity in Somaliland is not well defined. Information to guide health systems development is scarce and existing data are of variable quality (18). As part of the rebuilding process, national leadership has included health research capacity building in the health sector strategic plan. The objective of this study, therefore, was to assess the state of medical research capacity within Somaliland using a bibliometric literature review.

## **METHODS**

### *Defining and Measuring Research Capacity*

The World Health Organization (WHO) defines the health research system as: ‘the people, institutions, and activities whose primary purpose is to generate high quality knowledge that can be used to promote, restore, and or maintain the health status of populations (22).’ Others have characterized health research capacity as the ability to define problems, set objectives, build sustainable institutions, and identify solutions to key national health problems (7, 21). Implicit in these descriptions is the recognition that there is significant overlap between health research and research in other fields, such as anthropology and economics. Given the nature of our institutional relationships, however, we chose to focus our study on clinical medicine. Therefore, for the purposes of this study, we define health research as, ‘research which was explicitly conducted for the purpose of directly improving individual or population health and which was identifiable through the standard health research indexing systems’.

Many conceptual frameworks for measuring research capacity have been developed. These frameworks highlight the individual researcher, the institution in which the research is conducted and the wider impact of the individual researcher and research institution. Here, we chose to use a model similar to that of Sewankambo et al, in which they attempted to assess changes in research capacity within their institutional partnership by examining the number of Ugandan graduated PhD students and the number of peer-reviewed articles with a Ugandan as first author (19). To un-

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dertake this national evaluation within a country where PhD graduate numbers are very low, we chose peer-reviewed publications as a more realistic way of assessing research capacity. To our knowledge, no similar national-level study has been undertaken as a means of assessing research capacity in any post-conflict setting.

#### *Eligibility Criteria*

This review follows the reporting guidelines set forth in the PRISMA Statement for systematic reviews and meta-analyses (20). The eligibility criteria for selected literature included the following: (1) medical health research conducted in Somaliland since independence in 1991, (2) a description of the experimental design, as evidenced by a methods and results section, and (3) publication in a peer-reviewed journal or as part of a scholarly program receiving formal review. Only literature in English was included. We did not include policy or other social science research that did not enroll or interact with subjects from Somaliland. Abstracts, letters, case reports, literature reviews, and NGO reports were also excluded. Publications that collected or analyzed primary data from Somaliland, even if part of a larger study of Somalia, were included.

#### *Search Strategy*

The literature search and analysis was developed and carried out in March 2014. The search strategy was intentionally broad, and did not incorporate disease, intervention, or outcome-specific terms. Instead, “Somaliland” was the only the search term used. The search strategy was applied to the following databases to locate peer-reviewed studies: PubMed, Embase, Web of Science, and the Cochrane Library. ELDIS, OpenGrey, and Google Scholar were used to search the grey literature. Because of the limited search options available in the grey literature databases, a search strategy using “Somaliland AND health” was employed. This process was then repeated by a second author to ensure the robustness of the search.

#### *Study Selection and Data Extraction*

Initial results were screened for duplicates by author, title, journal, and publication date. Studies were then assessed for possible inclusion based on the title and abstract. The full text of eligible studies with was then reviewed applying the above criteria. The reference section of each of the selected publications was examined to identify additional relevant studies. The final list was shared with local Somaliland authorities and researchers with extensive experience in Somaliland who reviewed the list for completeness.

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Relevant information, including author affiliations, field of investigation, study design, method of ethical review, and funding source was extracted from each of the studies. The affiliation of each author as reported in the publication was used to determine the presence or absence of a local co-author. Local co-authors were defined as those authors with a reported affiliation at an institution in Somaliland. A number of Somali authors were members of the diaspora and reported dual affiliations with a Somaliland institution as well as an institution outside the country. In these circumstances, the affiliation with the institution in Somaliland was given primacy. Study designs were classified according to the method of data collection, and divided into categories to include interviews, cross-sectional surveys, seroprevalence studies, clinical or educational interventions, or secondary analysis.

### *Analysis*

Because the primary objective of the review was to identify all published research from Somaliland, no studies were excluded for quality reasons if the eligibility criteria were met. Additionally, the majority of the included studies were non-randomized and thus it was not possible to utilize an existing, validated instrument for assessing risk of bias. The reporting of a sample size calculation and significance testing, when appropriate, was used of as a measure of scientific rigor.

## **RESULTS**

### *Study Selection*

After screening for duplicates, the literature search identified a total of 83 articles for assessment. Thirty-five articles met the eligibility criteria after screening by title and abstract, but four of these were excluded after full text review (23-53). The most common reasons for exclusion were: non-experimental reports (n = 16), social science and/or health policy studies without study subjects from Somaliland (n = 13), non-human or animal studies (n = 12), and abstracts or letters (n = 8). A review of the references cited in the thirty-one articles that met the eligibility criteria yielded five additional studies (54-58). A clinician with experience in Somaliland (SW) identified one additional article (59) giving a total of 37 articles for assessment. Figure 1 summarizes the selection process.

### *General Study Characteristics*

Thirty-five of the included studies were identified from medical journals, in addition to two masters theses. Twenty-nine studies (78%) were published in international medical journals, with six (16%) in regional journals, primarily the WHO's *Eastern Mediterranean Health Journal*. The majority (87%) of identified studies were published after 2007, with a peak of eight publications in 2013 (Figure 2). Be-

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tween 1991 and 2006, there were only 5 articles published: 3 examining tuberculosis prevalence and/or treatment, one examining the association of *khat* use and psychotic disorders, and a case series describing anti-personnel mine injuries in the Burao District. 28 (76%) of the identified studies collected data exclusively from Somaliland; 9 studies collected data from Somaliland as part of a wider investigation in Somalia. Communicable diseases such as tuberculosis, HIV, and malaria were the most common area of investigation with 12 publications (32%), followed by obstetrics and psychiatry, each with 8 (22%) (Table 1).

#### *Authorship and Funding*

Only 7 of the included studies (19%) were first-authored by investigators reporting affiliations with institutions in Somaliland. Of those 7 authors, 4 were affiliated with international organizations, primarily WHO in Hargeisa. The majority of the remaining thirty authors were affiliated with academic institutions in Europe. Among the publications first-authored by investigators from outside Somaliland, only 13 (43%) had local co-authors. In contrast, of the 5 studies first-authored by Somali investigators that listed additional co-authors, 4 (80%) had co-authors from international organizations and European academic institutions. All 25 publications that reported a funding source received funding from international organizations, including NGOs and academic institutions.

#### *Ethical Review*

Twenty-five of the identified studies (68%) provided some description of the ethical review and approval process. Of these, 21 studies (84%) reported receiving approval from a local authority. 16 studies (64%) reported receiving approval from the Somalia or Somaliland Ministry of Health while the remaining 5 received approval from a local university or national reconciliation commission. Two studies reported receiving approval from European-based academic institutions and NGOs, while another 2 studies described only the individual consent process.

#### *Study Methods*

Cross-sectional survey designs were the most commonly reported method of data collection, representing nineteen (51%) of the included studies. Eight of these publications (22%) collected human samples (blood, sputum, tuberculin response) and thus were classified as seroprevalence studies. Point-of-care tests were used in 4 of the seroprevalence studies (50%). Of those that collected samples for further laboratory analysis, two utilized laboratories in Somaliland, one in South Africa, while 2 studies did not report a location. Of the 19 surveys, 12 (63%) performed statistical significance testing, either by the calculation of confidence intervals or *p*-values. Few of the studies reported a

sample size calculation. Ten studies (27%) described clinical or educational interventions. None of the intervention studies used a control group. Instead, all reported pre- and post-intervention data from the target population. In addition, there were 3 studies employing qualitative interviews, 3 studies reporting secondary data analysis, 1 case-control study and 1 case-series.

## **DISCUSSION**

With only 37 studies meeting our inclusion criteria over the 23-year period, our results demonstrate that medical research in Somaliland is extremely limited. Unfortunately, this also suggests that the availability of locally relevant, empirical evidence to support clinical decision-making is poor. One encouraging trend is that nearly half of the included studies (18 of 37) were published in the last 3 years of the study period, indicating an increasing pace of investigation and publication.

### *Relevance of peer-reviewed publications as a measure health research capacity*

Different approaches have been developed to assess health research capacity in LMIC. Frameworks that offer a systems approach, where a hierarchy of interdependent factors is evaluated, allow for a comprehensive analysis and the development of an integrated capacity building strategy (62). These analyses are labor-intensive and necessitate considerable experience with both qualitative and quantitative methods.

Another approach, and the one that we have adopted here, is using the output of peer-reviewed publications as a surrogate measure of research capacity. Previous analyses have described the complex interaction of variables that result in peer-reviewed publications: ‘Publishing in peer-reviewed journals is not an end in itself, but rather a means of communicating research-generated knowledge which can be translated into health policies, operational guidelines or health products (63).’ In addition, peer-reviewed publications are essential for individual career progression, and access to research funding grants are often included as independent goals for research development funding schemes (64) and have been used in previous studies as measures of effective health research (61).

Thus, measuring peer-reviewed research publications allows us to efficiently review one marker for health research capacity expansion. In doing so, we are not only assessing the existing research activity, but also information literacy, academic writing, engagement with international research, and effective research dissemination. One of the benefits of this measurement approach is its easy applicability to a wide variety of contexts, and its reproducibility: although in itself, this approach will not help in resolving questions regarding specific barriers towards research capacity development, the metrics reported here can easily be tracked over time to evaluate the progress of health re-



search capacity in Somaliland.

#### *Local vs. international contributors to Somaliland's research output*

The majority (34 of 37) of included studies were directed by investigators from HICs and international NGOs. These results are in keeping with previous reports of limited representation of authors from LMIC in health research, which have shown that despite increase in overall publications, the number of lead authors from LMIC remains low (61).

The dominance of authors from HIC has a number of potential negative consequences including reduced relevance of the research topic, in particular the paucity of work in non-communicable diseases, which are thought to account for an increasing proportion of the global burden of disease (60); reduced impact in building sustainable research capacity; reduced impact in terms of promotion of relevant health policy and, ultimately, reduced potential to produce positive clinical or public health outcomes. We acknowledge that our own paper has only two of seven authors from Somaliland, but are pleased that this is progress in comparison with nearly half of the papers in this study that do not have a single author from Somaliland.

The finding that <10% (3/37) of studies had a lead author based at a Somaliland institution contributes to an on-going discussion regarding under-resourcing of health research tailored to the needs of LMIC – termed the 10/90 gap. The phrase was originally coined suggesting that less than 10% of global health research resources are applied to LMIC, where 90% of preventable deaths occurred (66).

However, as suggested by Adam et al (61), the limited contributions of local authors to the health research literature concerning LMIC may reflect another '10/90 gap'. In the data presented here approximately 90% (34/37) of lead authors of peer reviewed publications concerning Somaliland are affiliated with foreign or international institutions, suggesting less direct links of the study authors to local policy makers or to the local clinical environment. Thus influencing policy and resource allocation, or disseminating results in Somaliland are less likely to be effective. Yet it is exactly those aspects of research production that are most likely to benefit the health system of a LMIC like Somaliland (68, 69).

#### *Addressing research capacity needs in Somaliland*

While active conflict and security concerns restricted research activities in the period immediately following independence, Somaliland, like many LMIC and post-conflict nations, still suffers from a non-conducive research environment more than 20 years after declared independence (8). The lack of progress is magnified by the fact that Somaliland is still not recognized as an independent nation

by the international community (including the research community) who view the country through the lens of a failed state trapped in a prolonged humanitarian crisis. This international stance restricts funding to support institutional research capacity building.

Furthermore, the required leadership and governance framework needed to define national priorities and to guide the responsible conduct of research are not yet in place. In the absence of national policy, external priorities have dictated the research agenda. It is noteworthy that 16 of the 37 (43%) studies included in the review reported obtaining ethical approval from the Somaliland Ministry of Health's ethical review board, and yet the senior Ministry leadership was unaware of such a committee (personal communication). While there has been a great deal of turnover within the Ministry, this finding highlights the fragile nature of ethical oversight mechanisms in conflict and post-conflict settings (70).

The insufficient governance framework, lack of funding, and limited amount of research published under Somaliland institutional leadership compound each other's effects: the lack of peer-reviewed publications will reduce the visibility of Somaliland researchers for external funding, and research activity governed by international or foreign bodies does not always drive the development of adequate research infrastructures in country. In the emerging health care system in Somaliland, special attention therefore needs to be given to address this cycle: any proposed leadership and governance framework for research activity could put guidance in place that supports or requires local co-authorship.

North-South research collaborations can provide much needed experience with study design and scientific writing, but also help build the profile of local investigators. These research collaborations have been successful in other LMICs such as in Rwanda and Uganda (9, 19). In Uganda, a formal collaboration on providing a joint research degree at the doctoral level led to an increase in first-authored, peer-reviewed publications by Ugandan researchers.

#### *Study Limitations*

This bibliometric analysis has a number of limitations. The literature search was restricted to specific eligibility criteria, although we purposefully did not put quality restrictions on the publications included in our study. Studies that were presented only as abstracts or in summaries of conference proceedings, and articles published in languages other than English were excluded. We also did not consider the publications of NGOs or national health professional societies, which often lack rigorous peer-review. These eligibility criteria could have resulted in a selection bias favoring international outlets, which might underestimate research capacity in Somaliland. Our study also did not assess the current state of training programs in the health sciences. The relative increase in publications af-

ter 2008 may reflect emerging research capacity due to these programs that is not yet fully captured in our study. Thus, our work is a better measure of research capacity over the past two decades rather than future capacity.

The purpose of this study was to assess research capacity in Somaliland, a low-income, post-conflict state. To our knowledge, this is the first assessment in Somaliland, and may be the first such national-level research capacity study in a LMIC post-conflict country based on bibliographic measures. The relatively short history, small geographic area, and ready access to key stakeholders afforded us a number of opportunities that may have made such a study significantly more difficult in other nations. Yet, many of the findings presented here are likely to be generalizable to other low-income and post-conflict nations, and the relative ease of analysing research capacity through peer-reviewed publication output makes this approach amenable to longitudinal measurements and cross-country comparisons.

## **CONCLUSIONS**

This is the first study to use a bibliometric review as an assessment of research capacity in a post-conflict LMIC country. Our findings show that research activity in Somaliland is extremely limited. However, they further illustrate that investigators from HICs have largely directed research in Somaliland with only half of the included studies listing co-authors from institutions in Somaliland. Leadership and governance of health research in Somaliland is required to define national priorities, promote scholarly activity and guide the responsible conduct of research. Furthermore, international NGOs and academic health partnerships should promote research within capacity building programs in settings such as Somaliland and contribute to local research capacity building through effective collaborations with local partners. The methods used here to assess research capacity may be generalizable to other LMIC and post-conflict settings to measure the impact of research capacity building efforts.

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**Corresponding author:** Ross Boyce, Division of Infectious Diseases, University of North Carolina at Chapel Hill, 130 Mason Farm Road, Chapel Hill, NC 27599, USA. Email ross.boyce@unhealth.unc.edu

## Legends

**Figure 1:** Study selection flowchart.

**Figure 2:** Number of peer reviewed publications in international journals

**Table 1: Health Publications in Somaliland between 1991-2013**

Medical Field	Studies (n, %)	References
Communicable Diseases	12 (32)	
HIV	-	23, 24, 28, 43,
Tuberculosis	-	45, 50, 57, 59
Malaria	-	29, 46, 54, 58
Obstetrics/Gynecology	8 (22)	26, 27, 33, 34, 36, 37, 38, 53
Psychiatry	8 (22)	35, 44, 47, 48, 49, 52, 55, 56
Telemedicine	4 (11)	25, 30, 32, 41
Immunizations	2 (5)	39, 42,
Health Systems	1 (3)	40,
Tobacco	1 (3)	51
Surgery	1 (3)	31



