Introduction

The interest in global health has expanded considerably in the last decades. Traditional and new actors have engaged in a range of initiatives including research and development (R&D), training, program implementation, and policy development. The goal is to contribute to reducing the burden of diseases that disproportionately affect low- and middle-income countries (LMIC). The global health scenario has evolved to encompass a multitude of organizations, strategies, and approaches that have offered new opportunities for the collaboration and engagement of LMIC in decision-making and management.¹ Multilateral, regional, and bilateral cooperation has focused on improving the capacity to prevent, control, or eliminate diseases and unfavorable health conditions.

Some public-private partnerships have been established with international resources to increase access to health technologies and to develop new drugs, vaccines, and diagnostics for neglected diseases.²³ Non-state actors such as philanthropic foundations, NGOs, and multinational corporations have substantially increased funding and donations to product R&D.⁴ Demographics and disease transitions, the health of migrating populations, and wealth inequalities are emerging challenges to global health. The United Nations’ Millennium Development Goals (MDGs) and the Sustainable Development Goals (SDGs) have provided the impetus, direction, and target for this dynamic movement.⁵ The World Health Organization (WHO) has reinforced its role in providing technical cooperation for the development and

Abstract

Introduction: The increasing number of global health initiatives have contributed to improving access to health services and building knowledge platforms. However, the distribution of activities and knowledge produced has been uneven. To scope the scientific output in global health, publications from 2008-2017 were reviewed to identify major players, assess the extent of involvement of low- and middle-income countries (LMIC), and map areas of research interest.

Methods: A total of 3153 Web of Science (WoS) publications were retrieved, of which 2423 were selected for this review. The country of origin, institutions involved, types of documents, language of publication, journal titles, content categories, authorship, themes, and characteristics of collaboration were examined.

Results: Over the years, the number of global health publications from both high-income countries (HIC) and LMIC has increased. Authors from LMIC were engaged in 19.3% of the publications, representing 10.3% of first authors and 9.7% of single-author articles. Collaboration across World Health Organization (WHO) regions ranged from 29.6% to 64.6%. Themes of greatest research interest were capacity development, health policy and systems, and disease control.

Conclusion: Global health research is experiencing rapid expansion, but LMIC authors continue to have limited involvement. The current study revealed diversity in publications, journals, and actors with a marked influence from developed countries. As north-south and south-south research partnerships are increasing across the world, it is important to ensure open collaboration between partners and alignment with public health research priorities and needs.

Keywords: Global Health, Research Collaboration, Research Networks, Bibliometric Review, Scoping Review

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strengthening of national health research systems and for the use of evidence in policy-making and advocating the principle of universal health coverage.

An increasing number of scientific articles and discussion papers have addressed different perspectives of global health, such as health services delivery, health economics, social determinants of health, and capacity development and equity in health, among others. However, there is fragmentation and even an overlap in the knowledge produced through international collaboration and no clear picture of the role and engagement of LMIC in setting priorities.

This article aimed to provide an overview of the field and actors in the global health arena through the analysis of publications indexed in the Web of Science (WoS) in the last 10 years. The review mapped authors, journals, institutions, countries and their connections and identified themes of more interest. The article further attempted to offer a perspective of the context in which global health knowledge is produced to inform researchers, health officials, and policymakers.

**Who Is Publishing in Global Health?**

**Methods**

Data on scientific publications was retrieved from the bibliometric database WoS filtering for articles containing the expression “global health” in the title and/or abstract during the period 2008–2017. The timeframe established intended to capture the more recent trend in the field. WoS is a structured database covering a large number of health-related academic journals. It provides complete information about authorship and content allowing different types of analysis. The data was imported into the data/text mining software VantagePoint (Search Technology Inc.) for cleaning, harmonization, removal of ambiguity, and analysis. The geographical distribution, types of documents, language of publication, WoS pre-defined categories, journals, and institutions involved were described.

**Results**

From a total of 3153 records on global health extracted, 2423 were selected, corresponding to original research articles (n = 1229), editorials (n = 1042) and reviews (n = 152). The remaining publications (reports of meetings, abstracts, book appraisals, letters, news, proceedings, and bibliographical material) were not included in the analysis. While academic articles accounted for 39% of the WoS records, one-third of the records were editorials, revealing to some extent that global health has been a topic of growing interest and discussion. There was a significant increase in the number of publications from high-income countries (HIC) and LMIC over the years (Figure 1). A total of 121 countries were involved in the 2,423 publications. USA investigators co-authored 53.1% of the publications, followed by the UK (18.0%), Canada (11.3%), Switzerland (5.8%) and Australia (5.0%). Authors from these five countries together accounted for 88.2% of all publications indexed. Two sub-Saharan African countries (Kenya and Uganda) and the countries of the group designated BRICS (Brazil, India, China, and South Africa) were among the top 20 countries publishing on global health (Table 1). One-third of the publications (32.9%) were single-authored, and 43% were co-authored internationally. Altogether, LMIC authors were engaged in 19.3% of the publications, representing 10.3% of first authors and 9.7% of the single author articles. There was a marked increase in the number of single-author publications, especially in editorials (Figure 2).

The publications involved 1,986 institutions, which reveals the broad interest in collaboration. Those academic institutions known for their engagement in global health research were more represented (Table 2). The publications were found in 742 journals, including traditional public health journals, and more recent titles focused on global health. The *Lancet* was the leading journal accounting for 7.4% of all published articles.
and statistical analysis of international research networks formed by linking the published authors. The VOSviewer software was used to generate maps and clusters of research terms estimating an “association strength” based on the number of co-occurrences of research terms. Terms that co-occurred frequently in the same publications were automatically positioned close to each other in the mapping, while weakly related terms were positioned further away.

Results

Figure 3 shows the pattern of global research collaboration for the top 5 countries with more international links based on the authors’ affiliations. Two countries are considered connected if their researchers shared the authorship of a paper. The thickness of the links indicates the frequency of collaboration between the two countries. Table 4 shows the frequency of collaborative research within and between WHO regions. Although all articles refer to global health issues with a focus on LMIC, the co-authorship pattern was predominately within a single WHO region rather than across regions. Interregional research collaboration ranged from 29.6% (Americas) to 64.6% (Eastern Mediterranean countries).

Based on the maps and clusters of related terms, it was possible to consolidate broad themes of interest. Analysis showed three major subject areas in the publications (Figure 4). It is possible to identify a cluster of terms associated with research capacity development mostly through training (in green), research policy and systems (in red), and disease-related terms (in blue).

Table 3. Number of Publications by Journal

| Rank | Journals (out of 742) | No. of publications | %* |
|------|----------------------|---------------------|----|
| 1    | The Lancet           | 180                 | 7.4 |
| 2    | Global Health        | 53                  | 2.2 |
| 3    | Global Public Health | 45                  | 1.9 |
| 4    | Annals of Global Health | 44              | 1.8 |
| 5    | Global Health Action | 43                  | 1.8 |
| 6    | Amer. Journal of Trop. Med. & Hygiene | 40 | 1.7 |
| 7    | Academic Medicine    | 39                  | 1.6 |
| 8    | PLoS Medicine       | 37                  | 1.5 |
| 9    | New England Journal of Medicine | 35 | 1.4 |
| 10   | Lancet Global Health | 32                  | 1.3 |
| 11   | Journal of Law, Medicine & Ethics | 30 | 1.2 |
| 12   | Health Policy Planning | 28              | 1.2 |
| 13   | Bulletin of the World Health Organization | 25 | 1.0 |
| 14   | International Health Policy Management. | 25 | 1.0 |
| 15   | Journal of the American Medical Assoc. | 24 | 1.0 |
| 16   | Infectious Dis. Clinics of North America | 23 | 0.9 |
| 17   | BMC Medical Education | 20              | 0.8 |
| 18   | Global Health Promotion | 20              | 0.8 |
| 19   | Journal of Global Health | 18              | 0.7 |
| 20   | Military Medicine    | 18                  | 0.7 |

* % in relation to 2423 publications.
Discussion

The concept and scope of what has been called “global health” have been debated. The understanding that “global health is public health for the public good” is based on the need to address determinants of health at national and global levels. The short definition “collaborative trans-national research and action for promoting health for all” suggests that research should contribute to public health activities. This has been the focus of the WHO’s work with member states promoting activities, processes, and capacity development for the use of research evidence in public health decision-making and action.

Global health has become commonly associated with many disciplines. It has been considered a component of foreign policy and a major philanthropic target. The concepts and actions under the labels “global health diplomacy” and “global health governance” have progressively been adopted by countries under the stewardship of international organizations. They involve the understanding, engagement, negotiation, and organizational aspects of dealing with public health issues requiring multinational approaches and coordination.

The international legislation, epidemiological risks, and operational aspects of public health can have political, social, and economic implications beyond borders. Global health security is a typical example in this area. It relates to the efforts required by countries, international organizations, communities, and NGOs to increase capacity to prevent, control, and eliminate infectious diseases that can spread internationally. The recent outbreaks of Ebola in West Africa and Zika in Brazil have highlighted the importance of international cooperation and health system preparedness to respond to such events.

The increasing number of global health initiatives (GHI) has raised concerns regarding their coherence and synergy. An analysis of twenty-six well-established initiatives showed that even though they have diverse objectives and operational aspects, there is room for collaboration and the integration of activities.

The production of local knowledge is essential to the improvement of global health. Results of the current study revealed that developed countries play a leading role in knowledge production, while most of the global health issues to be addressed - equity in access, good quality of services, and affordability - are typical of LMIC. The rising trend of research collaboration over time was noticeable based on networks and the engagement of institutions and countries, particularly LMIC. This is an indication of the relevance of the themes and demonstrates the commitment of developed and developing countries to tackling public health priority issues of developing countries. The importance of a broad engagement of LMIC researchers and stakeholders in developing a more equitable global research agenda has been exemplified for neglected tropical diseases of poverty.

Table 4. Collaborative Publications (%) Within and Between WHO Regions

|        | AMR | EUR | WPR | AFR | SEAR | EMR |
|--------|-----|-----|-----|-----|------|-----|
| AMR    | 70.4| 20.7| 22.3| 28.2| 24.2 | 18.9|
| EUR    | 12.4| 60.3| 15.7| 17.9| 15.5 | 13.4|
| WPR    | 5.5 | 6.4 | 48.3| 6.0 | 9.5  | 10.2|
| AFR    | 7.7 | 8.1 | 6.6 | 40.5| 10.6 | 12.6|
| SEAR   | 3.0 | 3.2 | 4.7 | 4.8 | 35.6 | 9.4 |
| EMR    | 1.1 | 1.3 | 2.5 | 2.7 | 4.5  | 35.4|

* Based on the authorship of 2423 global health publications.
The WHO has proposed essential areas for promoting evidence-based actions in global health. Most of them are of a structuring nature, including the strengthening of national and international health information systems and health indicators; the establishment of national health research systems and priority setting; and increasing the capacity of countries for developing evidence-informed policies.14

Summary of Evidence
A review of the WoS records of publications gave an insight into the major players and the direction of collaboration. Overall, there is a growing number of organizations engaged, and the significant scientific contributions that have come from high-income and upper-middle income countries are associated with a greater number of researchers and institutions from LMIC. International cooperation tended to be within geographical regions, but there is an important flow of collaboration between investigators from HIC and LMIC. The clusters of themes revealed broad areas of interest in the scientific community. Themes included (i) research capacity building, a key area of interest to many international development agencies.18 The goal is to develop human resources and institutional capacity for effective research targeted at key priorities; (ii) global health governance and strengthening national health research systems, a primary interest of the Council on Health Research for Development (COHRED);19,20 (iii) new strategies and action networks for disease control, which have received the support of academic organizations, international partnerships, and the WHO.21,22 Embedding research into health policy and practice has become the key objective of several GHL.23 Based on the thematic analysis, the current study showed an increasing interest in implementation research, an area that aims at bringing new strategies and interventions to practice by understanding barriers and facilitators of program implementation.

Conclusion
The current study highlighted that global health literature has expanded considerably in the last decade with a marked influence from researchers from developed countries, even though critical health issues are of particular interest to LMIC. As research partnerships are growing across the world, it is important to ensure that fair collaboration is established between unequal partners.24 The impact of the overall investment in capacity development and knowledge production in global health and its actual influence on the research profile of and public health conditions in LMIC deserve careful attention.

Limitations
The current article was structured following the 2018 PRISMA extension checklist for scoping reviews. The authors acknowledge that the search strategy used to retrieved publications and the inclusion criteria adopted may have missed a small proportion of records. However, considering the proposed focus, the authors believe that the study material was a good representation of reality. The use of network analysis and thematic clustering to map global health research activities proved to be useful in identifying trends, central organizations, and research subjects of greater interest.

Authors’ Contributions
FZ was responsible for the study concept and first draft of the manuscript. PA was responsible for data collection and analysis. FZ, BF, and PA were responsible for data interpretation and the final editing of the manuscript.

Conflict of Interest Disclosures
The authors declare that they have no conflicts of interest.

Ethical Approval
The current study did not require ethical review.

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