


# Bibliometric analysis of sub-Saharan African and US authorship in publications about sub-Saharan Africa funded by the Fogarty International Center, 2008–2020

Ezinne A Akudinobi, Peter H Kilmarx 

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## ABSTRACT

**Background** Authorship and author order have been used as one measure to characterise equity in research partnerships. First and last (senior) authorships often denote scientific merit as well as potential for research career advancement. A previous analysis found that only about 20%–25% of publications about Africa with coauthors from top-ranking US universities had a first or last author from the topic country. In this bibliometric analysis, we evaluated authorship of publications about sub-Saharan Africa (SSA) funded by the Fogarty International Center (FIC) of the US National Institutes of Health, an institution with a mission of training and capacity building in low-income and middle-income countries.

**Methods** We analysed publications from PubMed and Web of Science that were funded by FIC, about SSA, and published between 2008 and 2020. Relative citation ratio (RCR) data from iCite were used to compare group citation impact measures using the Wilcoxon rank sum test.

**Results** A total of 3446 publications met the inclusion criteria, with annual number increasing from 114 in 2008 to 352 in 2020. SSA-affiliated first authors increased from 53 (47%) in 2008 to 224 (63%) in 2020. SSA-affiliated last authors increased from 32 (28%) to 166 (47%). For both first and last authorships, the median RCR value of publications with SSA-affiliated authors was lower than for US-affiliated authors (first authors: 0.84 vs 0.95,  $p=0.0021$ ; last authors: 0.88 vs 0.91,  $p=0.010$ ).

**Conclusion** The increase in first and last authorships by SSA-affiliated authors of publications about SSA suggests increasing equity in research activities funded by FIC. Further investigation and actions are needed to establish how authorship reflects other aspects of equity, the implication of the lower RCR in papers with SSA-affiliated first and last authors and what policies and practices are needed to further promote equity in global health research.

## INTRODUCTION

Relative to other regions, participation of scientists from sub-Saharan Africa (SSA) in health research is very limited. While SSA

## WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Previous analyses of health-related papers from sub-Saharan Africa (SSA) found that authors from the region were under-represented as first or last (senior) authors, which may be an indicator of a lack of equity in health research partnerships.

## WHAT THIS STUDY ADDS

⇒ We analysed the affiliations of authors of publications about SSA that were funded by the Fogarty International Center (FIC) of the US National Institutes of Health, which has a mission of training and capacity building in low-income and middle-income countries. We found that the number and percentage of SSA-affiliated first and last authors increased over time. However, under half of the publications had SSA-affiliated last authors, and the relative citation ratio, a measure of scientific impact, was lower for papers with SSA-affiliated first and last authors compared with US-affiliated first and last authors.

## HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ The increase in first and last authorships by SSA-affiliated authors suggests increasing equity in research activities funded by FIC, but additional investigation and actions are needed to address persisting imbalances. Other funders may find it useful to conduct similar analyses to inform their initiatives to build capacity and promote equity.

makes up 12.5% of the global population, only 1.1% of the world's researchers are based in the region.<sup>1</sup> Moreover, in international partnerships, SSA researchers are often subordinated to researchers from high-income countries (HICs).<sup>2,3</sup>

Disseminating information and scientific discoveries accelerates scientific discussion and improvements in health. Authorship is critical to communicating findings and building dynamic and equitable research



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John E. Fogarty International Center, National Institutes of Health, Bethesda, Maryland, USA

**Correspondence to**  
Dr Peter H Kilmarx;  
peter.kilmarx@nih.gov

partnerships.<sup>4,5</sup> Also, authorship and publication metrics are substantial measures of scientific merit and career progression. First and last authorships often indicate the primary contributors of the scientific research.<sup>6</sup> Therefore, inclusion and especially first and last authorships by researchers from low-income and middle-income countries (LMICs) may be important indicators that these investigators are appropriately engaged and leading health research conducted in their communities.

In an analysis of health research publications about SSA, Hedt-Gauthier *et al* found that only about half of the papers' first and last (senior) authors were from the country of the papers' focus.<sup>7</sup> That decreased when SSA authors collaborated with authors with affiliations in top-ranking US universities; only 20%–25% of publications about SSA with coauthors from top US universities had a first or last author from the topic country. Other such authorship analyses have had similar results.<sup>8</sup>

We sought to characterise the participation of US-affiliated and SSA-affiliated authors and author order in publications about SSA funded by the Fogarty International Center (FIC) at the US National Institutes of Health (NIH) as a possible indicator of equity in FIC-funded programmes. FIC supports research training and capacity building in LMIC and is committed to promoting equity in global health research but does not have a specific policy on authorship and country affiliation.<sup>9</sup> Most of FIC's extramural funding is dedicated to research training and capacity building with the explicit role of supporting LMIC researchers. In contrast, many other funders of international research are primarily focused on conducting research with capacity building as a less common goal or a secondary objective.

## METHODS

### Search strategy

Publications were initially identified in PubMed using the following criteria: funding by FIC, about SSA and published between 2008 and 2020. FIC was identified by the standard NIH abbreviation ('FIC') and two-letter grant code ('TW') and by the first word of the Center name ('Fogarty'). SSA was defined according to World Bank regional classifications. In PubMed, the Medical Subject Heading (MeSH) for SSA is 'Africa South of the Sahara'. Comoros, Madagascar, Mauritius and Seychelles are included in the World Bank classification but not in the MeSH heading; therefore, those countries were added as search string for geographical region. We included papers published between 2008 and 2020 because Web of Science funding information is less complete prior to 2008. The specific search string was: (fic[gr] OR tw[gr] OR fogarty[gr]) AND (Africa South of the Sahara[mh] OR Comoros[mh] OR Madagascar[mh] OR Mauritius[mh] OR Seychelles[mh]) AND (2008:2020[dp]).

The resulting PubMed Identifiers (PMIDs) were then consolidated into a search strategy for Web of Science using the MEDLINE database. PMIDs were also

consolidated into a search strategy in iCite for citation analysis.

### Data collection

Authorship data were cleaned using Sci2 and Open Refine and refined and extracted into Excel (Version 2202). Authorship position was extracted from the sequential list of authors for each publication. The number of authors per publication were calculated in Excel. First and last authors' institutional affiliation was matched to research addresses in the Web of Science database for each publication. Each paper's first author and last author were assigned to four groups based on institutional affiliation if an author listed at least one affiliation: (1) SSA (and not USA), (2) USA (and not SSA), (3) SSA and USA and (4) neither SSA nor USA.

Relative citation ratio (RCR) values, which measure the scientific influence of each paper by field and time adjusting the citations it has received, and benchmarking to the median for NIH publications, the value of which is set at 1.0, were curated and collected from iCite.<sup>10</sup> For the citation analysis, publications published between 2008 and 2019 were analysed. Publications from 2020 were excluded from the RCR analysis because of the lag in citation analysis.

### Analysis

Data were not normally distributed. As a result, descriptive statistics such as proportion, count and median data were used for authorship position, affiliation measures and RCR, respectively. For the RCR, median, IQR and total ranges were collected. RCR data were used to compare group citation impact measures using the Wilcoxon rank sum test in RStudio V.4.04.

### Patient and public involvement

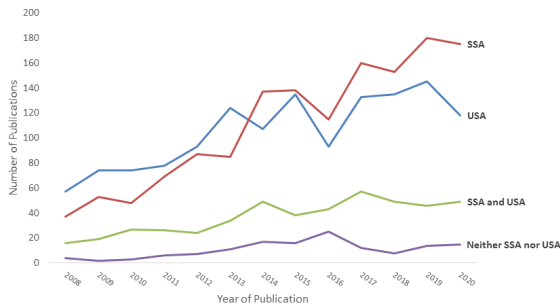
Patients were not involved in this bibliometric analysis.

## RESULTS

### Bibliometric characteristics

A total of 3889 articles were included in the initial search in PubMed. Of these, 160 publications (4.1%) were not retrieved in the Web of Science database and additional 283 publications (7.3%) were excluded from the bibliometric analysis dataset for reasons including not being funded by FIC (228), publication year out of range (22) and incomplete author information (14). The final bibliometric analysis dataset included 3446 publications.

The annual number of publications of FIC-funded publications about SSA increased from 177 in 2008 to 357 in 2020. According to Web of Science, most publications (3259, 93%) were classified as articles. The top three subject categories were infectious diseases (1055, 31%), public, environmental and occupational health (702, 20%) and immunology (652, 19%). The top three journals were *PLoS One* (327, 9.5%), *Journal of Acquired Immune Deficiency Syndromes* (166, 4.8%) and *AIDS* (126, 3.7%).

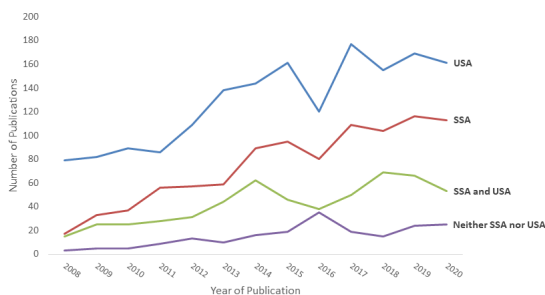


**Figure 1** The number of publications about SSA funded by the FIC, 2008–2020, by first author affiliation. FIC, Fogarty International Center; SSA, sub-Saharan Africa.

A total of 31 202 authors contributed to the 3446 publications. The minimum author number per publication was 1, the maximum was 159 and the median was 8 authors, with an IQR of 6–11. Thirty papers with one author were counted with a first author but with no last author.

### Authorship position

The number (and percentage) of first authors with SSA-only affiliations or SSA-plus-USA affiliations increased from 53 (47%) in 2008 to 224 (63%) in 2020 (figure 1). During the same period, the number (and percentage) of last (senior) authors with SSA-only affiliations or SSA-plus-USA affiliations increased from 32 (28%) to 166 (47%) (figure 2). These changes were mainly due to increases in the numbers and percentages of authors with SSA-only affiliations. For first authors, this increased from 37 (32%) in 2008 to 175 (49%) in 2020. For last authors, SSA-only affiliations increased from 17 (15%) in 2008 to 113 (32%) in 2020. The percentages of those with both SSA and USA affiliations (about 15%) or with neither SSA nor USA affiliations (about 5%) were largely unchanged.



**Figure 2** The number of publications about SSA funded by the FIC, 2008–2020, by last author affiliation. FIC, Fogarty International Center; SSA, sub-Saharan Africa.

### SSA affiliation countries

Authors with at least 1 SSA affiliation represented 25 countries in SSA, while last authors represented 27 countries in SSA. In descending order, affiliations for both first and last authors were from the following subregions: Southern Africa, Eastern Africa, Western Africa and Central Africa. The top 3 countries for 1st authors were South Africa (463), Uganda (392) and Kenya (198), and for last authors were South Africa (479), Uganda (267) and Malawi (119). There were no francophone countries in the top 10.

### Relative citation ratio

In the citation analysis of 3089 publications from 2008 to 2019, the maximum RCR value was found in a publication that had both US-affiliated first and last authors (RCR: 66.7) (table 1). The overall median RCR for FIC-funded publications about SSA was 0.9 (IQR: 0.46–1.63). The RCR of publications with SSA-affiliated first author (median: 0.84) or last author (median: 0.88) was significantly below that of publications with US-affiliated first author (median: 0.95) or last author (median: 0.91).

### DISCUSSION

We assessed affiliations of first and last (senior) authors of publications about SSA funded by FIC as a potential indicator of equity in research partnerships. The annual number of these publications and the number and percentage of SSA-affiliated first and last authors increased from 2008 to 2020. By 2020, 63% of first authors (up from 47%) and 47% of last authors (up from 28%) had an SSA affiliation.

This increase may reflect growing capacity of SSA-affiliated researchers over this period. FIC and other funders have devoted substantial resources to training and capacity building in SSA, beginning in the late 1980s for FIC, with a focus of developing careers of LMIC scientists as independent researchers and leaders.<sup>11</sup> There have also been new FIC programmes with direct funding to SSA institutions with the intent of building institutional capacity and independence, such as the Medical Education Partnership Initiative, which started in 2010.<sup>12</sup> The increase may also indicate growing equity in research partnerships, as authorship and author order have been identified as important outcomes and indicators of equity.<sup>4,5</sup>

Of the 20 US universities with the highest number of FIC awards, 18 were ranked in the top 20 for public health or medicine research.<sup>13</sup> Accordingly, our results may be compared with those of Hedt-Gauthier *et al*, who found that about only 20%–25% of publications about SSA with coauthors from top US universities had a first or last author from the topic country.<sup>7</sup> However, our analysis counted all publications (not just those with US-affiliated coauthors) and any SSA affiliation (not just those from the topic country). A separate analysis of authorship of maternal health interventional research in LMICs from

**Table 1** RCR of publications about SSA funded by the FIC, 2008–2019, by first and last authors' affiliation

Author position	Author affiliation	N publications	Range	Median (IQR)	P value*
First	USA	1248	0–66.7	0.95 (0.49–1.65)	0.0021
	SSA	1262	0–13.3	0.84 (0.43–1.54)	Ref.
	USA and SSA	428	0–63.4	0.98 (0.50–1.69)	0.021
	Neither USA nor SSA	125	0–11.2	0.91 (0.49–1.62)	0.065
Last	USA	1509	0–66.7	0.91 (0.49–1.62)	0.010
	SSA	852	0–13.6	0.88 (0.45–1.59)	Ref.
	USA and SSA	499	0–12.6	0.95 (0.47–1.65)	0.81
	Neither USA nor SSA	173	0–11.2	0.99 (0.41–2.16)	0.13
Total		3089	0–66.7	0.9 (0.46–1.63)	

\*Wilcoxon rank sum test.

FIC, Fogarty International Center; RCR, relative citation ratio; Ref., reference; SSA, sub-Saharan Africa.

2000 to 2012 found that 54% of papers from SSA had a local first author, the lowest among the world regions.<sup>14</sup> In that study, which was from a somewhat earlier period than the current analysis, 60% of publications from all LMICs that were funded by the NIH had an HIC lead author. Rees and colleagues examined PubMed publications about SSA during 2014–2018 and found that 15% had no local coauthor.<sup>15</sup> This was most common when the authors were from the USA but was less common in studies funded by the US government compared with private foundation funding or those with no funding source listed. In an analysis of publications from January 2020 to September 2020 about Africa and COVID-19 in 10 select journals, 41% had an African first author and 19% had an African last author.<sup>16</sup>

We found that the percentage of SSA-affiliated last authors lagged that of first authors. This may be because most NIH-funded research, including FIC-funded research, in SSA is performed through grant awards to US institutions that have collaborations with and make subawards to SSA institutions. This means the principal investigators, who are often the senior authors, have US affiliations. Of note, however, a 2019 study found that first authorship was reported to be more important for career advancement by LMIC authors, while last authorship was reported to be more important more frequently by authors from HICs.<sup>17</sup> Nonetheless, to truly promote equity and improve health outcomes, changes are needed to allow senior African investigators to mobilise and control resources, set research agendas and lead research collaborations. First and last authorships by these researchers could be seen as one measure that such changes are taking place.

We also found that the median RCR of publications by first or last author with SSA-only affiliations was lower than those of publications by first or last author with USA-only affiliations. This may reflect unequal assignment of authorship for the highest-impact results in a collaboration. US-affiliated authors may publish primary outcomes, while SSA-affiliated authors publish secondary

analyses. SSA-affiliated authors may also need additional training and support in writing and publishing higher-impact papers. In addition, the review process of higher-impact journals may be biased to favour publishing submissions from US-affiliated authors. Bhakuni and Abimbola have called attention to the ‘credibility deficit’ and ‘interpretive marginalisation’ seen in the biases of editors and peer reviewers of elite journal against research conducted by LMIC researchers.<sup>18</sup> Additional analysis is needed to assess the real-world significance of lower RCR and how to address it.

Should there be a target percentage of first and last authors from SSA on papers about SSA with funding from HICs? If so, what should it be? Many HIC researchers also want to have lead roles and successful careers addressing global health issues. Part of the solution may be in the rising number of publications overall. It is not a zero-sum game. The numbers of both US-affiliated and SSA-affiliated first and last authors increased during the study period.

Authorship is not only an important part of a researcher's career, but also an important part of scientific communication. First and last authorships indicate scientific leadership in conducting and sharing research activities. Ideally, African authorship will increasingly reflect Africans setting research agendas and writing about African issues for African audiences.<sup>3</sup> If efforts to decolonise global health research are to succeed, researchers must not only reflect on policies and programmes but also implement systematic change. If the global health research community is to promote and communicate global health research and improve health outcomes on the local level to global level, we must investigate what barriers are keeping SSA authors from lead roles. These could include stringent authorship guidelines, research ethics, language barriers and editorial bias. Perpetuating such barriers will only hinder scientific research. There is more at stake than publish or perish.<sup>4,5</sup> Research funders, including FIC, can do more to promote equity by engaging sub-Saharan Africans in setting research



agendas, building the capacity of SSA researchers, providing more direct funding to SSA researchers and requiring governance structures that ensure equity in authorship and other aspects of research partnerships.<sup>19</sup>

### Limitations

There were several limitations in this bibliometric analysis. First, while PubMed indexes databases outside of the MEDLINE bibliographic database, PMIDs in Web of Science are only indexed using the MEDLINE database. As a result, some studies were lost during transfer between databases. Second, while authors are encouraged to report funding sources, the information is incomplete. Some of the increase in the annual number of papers may be attributable to more complete reporting of funding information over time. Third, we relied on the author order listed in Web of Science; information about shared first or last co-authorship was not available. Fourth, we used author affiliation as a proxy for nationality and could not identify African authors with US affiliations or vice versa. Nor could we determine the nationality of those with both SSA and US affiliations. Fifth, this bibliometric analysis of author order and citation rates is but one approach to assessing research capacity and power balances in global health partnerships. Broader assessments and additional goals are needed to strengthen science and scholarship in Africa and equity in HIC-LMIC in collaborations. Lastly, the authors are affiliated with FIC. While we have aimed to be objective, our affiliation may have biased our analysis and interpretation of the results.

### CONCLUSIONS

In analysing publications about SSA funded by FIC from 2008 to 2020, we found an increase in the number and percentage of first and last authors with SSA affiliations, suggesting an increase in the research capacity of SSA collaborators and in equity in their partnerships with US counterparts. We also found that citation rates for publications with SSA-affiliated first and last authors were lower than for those with US affiliations, affirming that additional inquiry and action are needed. This analysis was helpful to FIC for benchmarking and assessing gaps and priorities for future efforts. Other funders of global health research partnerships may find it useful to conduct similar analyses to inform their initiatives to build capacity and promote equity.

**Twitter** Peter H Kilmarx @PeterKilmarx

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### ORCID iD

Peter H Kilmarx <http://orcid.org/0000-0001-6464-3345>

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