



Original Article

## The Pan African Thoracic Society Methods in Epidemiologic, Clinical and Operations Research Program: A story of success told through a history of publications

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### ABSTRACT

**Objectives:** Despite bearing a substantial burden of respiratory diseases, low- and middle-income countries in Africa contribute little to the research literature. Since 2007, the Pan African Thoracic Society's Methods in Epidemiologic, Clinical, and Operations Research (PATS-MECOR) program has been working to strengthen capacity in lung health research in Africa. The aim of this study was to assess the research productivity of previous PATS-MECOR participants.

**Materials and Methods:** A systematic review of publications attributed to past PATS-MECOR participants up until 2018 was carried out using a systematic search strategy based on their names on PubMed database.

**Results:** A total of 210 participants drawn from 21 African countries attended PATS-MECOR between 2007 and 2016, of which more than three-quarters (76.7%) had ever published. Of the total 1673 included publications, 303 (12.7%) had multiple course attendees as coauthors. The median publication per published participant was 5 (IQR 2–13) articles. The percentages of the first author, second authors, or last authors publications were 371 (22.2%), 239 (14.3%), and 99 (5.9%), respectively. The top three journals published in were PLOS One 108 (6.6%), Lancet 80 (4.9%), and the International Journal of Tuberculosis and Lung Disease 52 (3.2%). The median citation of their publications was 11 (4–26). There was approximately a double-fold rise in the publication output of participants in their 1<sup>st</sup> year following attendance to PATS-MECOR compared to the year before the course (123, 68.0% vs. 58, 32.0%).

**Conclusion:** The PATS-MECOR training program has been successful in research capacity building for African investigators as evidenced by a growing publication track record. There is a need to ensure sustainability and for increased collaboration and networking among the trained critical mass of researchers in the continent.

**Keywords:** Bibliometric, Medical education, Health research, Low- and middle-income countries, Publications

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## INTRODUCTION

Low- and middle-income countries (LMICs), especially in Africa, bear a substantial global burden of communicable and non-communicable diseases such as tuberculosis, pneumonia, asthma, HIV, and chronic obstructive pulmonary disease.<sup>[1-4]</sup> Despite this burden, there is a low research spending and a correspondingly limited contribution to the research literature.<sup>[5-9]</sup> Indeed, the Commission on Health Research had previously described the “10/90” gap which highlights the disparity in disease burden and research output from African countries.<sup>[10,11]</sup> Further, despite hosting 15% of the global population, African countries contribute only about 1.5% of the global health research publications, which emanate mostly from South Africa, Egypt, and Nigeria.<sup>[7,12,13]</sup> Limited research activities in LMIC have been strongly associated with the perpetuation of poverty and provide a basis for actions to improve research capacity and output in these regions.<sup>[12]</sup>

High-quality research conducted in relevant local contexts is critical for informing strategies to control some of the prevalent diseases and setting national health priorities toward meeting the sustainable development goals.<sup>[14-16]</sup> One factor that may have contributed to low research output in Africa and other LMIC is the very low number of well-trained researchers relative to the population compared to high-income countries that fall in the range of 5 versus 363 full-time researchers per million population.<sup>[17,18]</sup>

A review of 1593 articles on randomized controlled trials for HIV/AIDS, malaria, and tuberculosis in LMICs revealed that although there was significant year-to-year rise in published articles from the African continent, most were first authored by researchers from high-income countries.<sup>[15]</sup> This inequity is due to a wide range of issues ranging from inadequate funding, poor training and expertise, poor institutional support, and capacity to absent mentorship.<sup>[7,11,19,20]</sup>

Recognizing these problems, the American Thoracic Society in collaboration with the Pan African Thoracic Society (PATS) set up a research capability strengthening program – Methods in Epidemiologic, Clinical, and Operations Research (PATS-MECOR) program – which seeks to improve global lung health through the development of local research capacity in Africa. “PATS-MECOR” commenced in 2007 and is organized as a three-level training course such that attendees can progress from one level each year to completion. The process and method of running the program has been more adequately written about by Buist and Parry.<sup>[21]</sup> Over the years, the course has drawn participants from different African countries, however, the level of achievement of its core mandate of improving research capacity through publications by participants has not been assessed.

There is always a need for the evaluation of the effectiveness of public health programs including research capacity

building programs both as a learning and planning tool.<sup>[22]</sup> One approach is by evaluation of the publication history of participants using bibliometric methods that quantitatively and qualitatively evaluate published literature. This method has become a key part of modern assessment of academic productivity.<sup>[23,24]</sup> This study set out to objectively evaluate the research productivity of previous participants of the PATS-MECOR course through their publication history as a proxy measure of the effectiveness of the training program.

## MATERIALS AND METHODS

### Study design, period, and location

This is a bibliometric study that utilizes databases, dissertations, and theses, as the primary sources of information for analyses.<sup>[25]</sup> Using the names of the past PATS-MECOR students who attended the course from 2007 up until 2016, a systematic search was conducted on PubMed database. This search was limited to participants who had attended any level of the course on or before 2016 as it was assumed that the cohort would have had the opportunity to have completed the last level of their training by 2018.

For each paper retrieved, the name of the author was cross-checked by triangulation of the author name and affiliation and comparing it with other basic information obtained about the author from the PATS-MECOR official list and other sources of personal profiles such as ResearchGate, Google Scholar, or LinkedIn.

### Population or sample; inclusion and exclusion criteria

For each potential author, all publications attributed to the authors were retrieved and downloaded into Endnote and subsequently transferred into a Microsoft Excel sheet. Inclusion criteria were all papers published up until 2018 by the participants who had attended the course between 2007 and 2016. The search yielded 1677 articles, of which four were excluded as they were duplicates attributed to the same author, thereby leaving a total of 1673 articles that met the inclusion criteria. Thirty-nine of the included articles were published in French by nine of the participants. For any former PATS-MECOR participant whose name search on PubMed had no yield, we carried out a secondary search on Goggle, Google Scholar and on Researchgate. If Any articles are identified on this secondary search, the titles of such articles are then inputted into the PUB Med search engine to see if it is within its database for possible inclusion in the study.

### Statistical analysis

The analysis was carried out using both Microsoft Excel sheet and IBM Statistical Package for the Social Sciences version 20.

Categorical variables were presented as frequencies and percentages, and the data on numerical variables such as citations and publications were presented as mean and standard deviation or median and interquartile range (IQR 25–75%) depending on the distribution of data. The ranking of publication output derived from the absolute number of publications by all participants from each country was subsequently adjusted to take into cognizance the number of participants from each country and the gross domestic product of each country.

### Ethical approval

Ethical approvals are not needed for the study of this nature which uses publicly available data.

## RESULTS

### Profile of past PATS-MECOR participants

A total of 210 participants drawn from 21 African countries (seven low-income, 10 lower-middle-income, and four middle-income countries) had attended at least one level of the course [Table 1]. The average and standard deviation

**Table 1:** Distribution and country of origin of past PATS-MECOR participants 2007–2016,  $n=210$ .

Country of participants	Number of participants	Percentage
Low-income countries*		
Malawi	12	5.7
Ethiopia	9	4.3
Democratic Republic of Congo	5	2.4
Uganda	5	2.4
Sudan	2	1.0
Gambia	1	0.5
Guinea	1	0.5
Lower-middle-income countries*		
Nigeria	71	33.8
Kenya	41	19.5
Benin	11	5.2
Tanzania	6	2.9
Zambia	4	1.9
Zimbabwe	4	1.9
Cameroon	3	1.4
Cote d'Ivoire	2	1.0
Ghana	1	0.5
Lesotho	1	0.5
Upper-middle-income countries*		
Namibia	18	8.6
South Africa	8	3.8
Botswana	4	1.9
Gabon	1	0.5

\*=According to the World Bank classification (<https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>)

of the annual intake of new participants was  $20 \pm 5$ . Over two-thirds of the participants were male 144 (68.6%) with 61 (29.0%) completing all three levels of the training.

### Profile of publications

The 1673 retrieved articles that met the inclusion criteria were authored by 161 of 210 past participants (76.7%). Three hundred and three (12.7%) of the publications had multiple course participants as coauthors. Although participants were drawn from over 21 countries, only participants from 19 countries had articles attributed to them. [Table 2] shows the country distribution of the articles by the country of origin and domicile of the participants. Participants from Nigeria published the most papers (777; 46.4%) followed by Kenya (148; 8.8%) and Benin (142; 8.5%).

The median publication attributable to each author was 5 (IQR 2–13) with the lowest number of published articles by authors being 1 and the highest number being 131 in total. [Table 3] summarizes the frequency distribution of number of publications by PATS-MECOR students. Over half of the participants 85 (52.8%) had published 1–5 articles while over 10% of all the published participants and 24 (14.9%) had published more than 20 articles. Ninety-seven (60.2%) of those who had published articles had at least one first author position while 22 (13.6%) had at least as the second author position.

[Table 4] shows the frequency distribution of number of publications by PATS-MECOR students according to the

**Table 2:** Country distribution of publications of past PATS-MECOR participants 2007–2016,  $n=1673$ .

Country*	Number of publications	Percentage
Nigeria	777	46.4
Kenya	148	8.8
Benin	142	8.5
Uganda	140	8.4
Malawi	97	5.8
Tanzania	65	3.9
South Africa	70	4.2
Zambia	48	2.9
Gambia	37	2.2
Cameroon	27	1.6
DRC	23	1.4
Ethiopia	21	1.3
Namibia	18	1.1
Cote d'Ivoire	18	1.1
Zimbabwe	14	0.8
Gabon	10	0.6
Sudan	7	0.4
Botswana	7	0.4
Ghana	4	0.2

\*Countries were no author had at least one publication are Guinea and Lesotho

country of residence. Nigeria has the highest number of authors with at least 16 papers (8.7%) followed jointly by Benin (1.9%) and Uganda (1.9%).

### Average publication rate per country adjusted by number of participants and GDP

After adjusting for the number of participants from different countries [Table 5], the Gambia had the highest average publication rate by participants (37.0), followed by Uganda (28.0) and Benin (12.9), Zambia (12.0), and Nigeria (10.9). However, when adjusted by the 2020 GDP of the countries according to the World Bank, the top five countries in descending order were the Gambia, Malawi, Benin, Uganda, and Zambia.

### Journals choice

The articles were published in 402 different journals. The top 20 journals which accounted for most (40.4%) of the

publications are shown in [Table 6]. Twelve (60%) of these 20 journals were indexed in Clarivate analytics Web of Science and have an impact factor. The top five journals in which most of the articles were published were PLOS One 108 (6.5%), Lancet 80 (4.8%), the International Journal of Tuberculosis and Lung Disease 52 (3.1%), Clinical Infectious Diseases 46 (2.7%), and Pan African Medical Journal 46 (2.7%).

### Authorship position in all published articles

The percentages of articles where past attendees were the first author, second authors, or last authors were 371 (22.2%), 239 (14.3%), and 99 (5.9%), respectively. Slightly over half of the articles had the participants as middle authors 964 (57.6%). Of these, male participants had more articles attributed to them compared to their female counterparts (68.2% vs. 31.8%).

### Citation count

The median citation of the papers was 11 (4–26). The top 10 most-cited publication primarily led by one of the participants was published in the Lancet Infectious Diseases (262 citations);<sup>[26]</sup> New England Journal of Medicine (183 citations);<sup>[27]</sup> Nigeria Quarterly Journal of Hospital Medicine (137 citations);<sup>[28]</sup> BMC Health Services Research (104 citations);<sup>[29]</sup> BMC Health Services Research (91 citations);<sup>[30]</sup> Lancet Infectious Diseases (84 citations);<sup>[31]</sup> International Journal of Tuberculosis

**Table 3:** The frequency distribution of the number of publications by PATS-MECOR students,  $n=161$ .

Number of publications	Number of published participants	Percentage
1–5	85	52.8
6–10	26	16.1
11–15	18	11.2
16–20	8	5.0
21 and above	24	14.9

**Table 4:** The frequency distribution of number of publications by PATS-MECOR students according to country of residence,  $n=161$ .

Country	Number of publications per author								Total participants	% of total
	1–5	%	6–10	%	11–15	%	>16	%		
Nigeria	29	18.0	10	6.2	10	6.2	14	8.7	63	39.1
Kenya	17	10.6	5	3.1	3	1.9	1	0.6	26	16.1
Malawi	5	3.1	1	0.6	2	1.2	2	1.2	10	6.2
Benin	2	1.3	3	1.8	1	0.6	3	1.9	9	5.6
Ethiopia	9	5.6	0	0.0	0	0.0	0	0.0	9	5.6
South Africa	5	3.1	0	0.0	0	0.0	2	1.2	7	4.3
DRC	3	1.9	2	1.2	0	0.0	0	0.0	5	3.1
Tanzania	1	0.6	2	1.2	0	0.0	2	1.2	5	3.1
Uganda	2	1.2	0	0.0	0	0.0	3	1.9	5	3.1
Namibia	3	1.9	1	0.6	0	0.0	0	0.0	4	2.5
Zambia	1	0.6	0	0.0	1	0.6	2	1.2	4	2.5
Zimbabwe	2	1.2	0	0.0	1	0.6	0	0.0	3	1.9
Cameroon	0	0.0	1	0.6	0	0.0	1	0.6	2	1.2
Cote d'Ivoire	1	0.6	0	0.0	0	0.0	1	0.6	2	1.2
Sudan	2	1.2	0	0.0	0	0.0	0	0.0	2	1.2
Botswana	2	1.2	0	0.0	0	0.0	0	0.0	2	1.2
Gabon	0	0.0	1	0.6	0	0.0	0	0.0	1	0.6
Gambia	0	0.0	0	0.0	0	0.0	1	0.6	1	0.6
Ghana	1	0.6	0	0.0	0	0.0	0	0.0	1	0.6
Subtotal	85	52.8	26	16.1	18	11.2	32	19.9	161	100.0

**Table 5:** Average publication rate per country adjusted by the number of participants and GDP.

Country (number of published participants)	Total number of publications attributed to participants from the country	Median publication rate per participant (IQR)	Position based on absolute number of publication	Position adjusted for number of participants from country	Position adjusted for GDP per country of participants <sup>1</sup>
Nigeria	777	6 (3–15)	1	5	6
Kenya	148	3.5 (2–8)	2	14	7
Benin	142	6 (2.5–28)	3	3	3
Uganda	140	17 (4.5–57)	4	2	4
Malawi	97	4 (1.75–13.75)	5	11	2
South Africa	70	3 (2–20)	6	10	16
Tanzania	65	7 (4–25)	7	6	9
Zambia	48	14 (5.3–16.8)	8	4	5
Gambia	37	37 (37–37)	9	1	1
Cameroon	27	10.5 (8–10.5)	10	8	12
DRC	23	4 (2–7.5)	11	12	13
Ethiopia	21	3 (1–3.5)	12	17	17
Namibia	18	5 (2.75–5.75)	13	19	8
Cote d'Ivoire	18	2 (1–2)	13	8	18
Zimbabwe	14	2 (1–2)	15	15	10
Gabon	10	10 (10–10)	16	7	11
Sudan	7	3.5 (2–3.5)	17	15	15
Botswana	7	3.5 (2–3.5)	17	18	14
Ghana	4	4 (4–4)	19	13	19

<sup>1</sup>=GDP per capita (<https://data.worldbank.org/indicator/NY.GDP.PCAP.CD>)

**Table 6:** The top 20 choice journals where the participants published in

	Name of journal	n	%	Impact factor 2021 (TR)
1	PLOS One	108	6.5	3.2 (Q2)
2	Lancet	80	4.8	79.3 (Q1)
3	Int J Tuberc Lung Dis	52	3.1	2.4 (Q4)
4	Clin Infect Dis	46	2.7	9.1 (Q1)
5	Pan Afr Med J	46	2.7	-
6	Niger J Clin Pract	33	2.0	0.9 (Q4)
7	J Acquir Immune Defic Syndr	29	1.7	3.7 (Q2)
8	Lancet Infect Dis	29	1.7	25.1 (Q1)
9	Niger Med J	29	1.7	-
10	West Afr J Med	29	1.7	-
11	Afr Health Sci	23	1.4	0.9 (Q4)
12	Lancet Respir Med	23	1.4	30.7 (Q1)
13	BMC Health Serv Res	21	1.3	2.6 (Q3)
14	Eur Respir J	19	1.1	16.7 (Q1)
15	Int J Environ Res Public Health	19	1.1	-
16	Trop Med Int Health	19	1.1	2.6 (Q2)
17	Afr J Med Med Sci	18	1.1	-
18	BMC Res Notes	18	1.1	-
19	Niger Postgrad Med J	18	1.1	-
20	East Afr Med J	17	1.0	-
21–402	Others	997	59.6	

and Lung Diseases (82 citations);<sup>[32]</sup> Journal of Tropical Paediatrics (79 citations);<sup>[33]</sup> Annals of Ibadan Postgraduate Medicine (77 citations);<sup>[34]</sup> PLOS One (76 citations);<sup>[35]</sup> and anemia (76 citations).<sup>[36]</sup>

### Effect of PATS-MECOR training on publication

There was a doubling of the total publication output in the 1<sup>st</sup> year following PATS-MECOR training compared

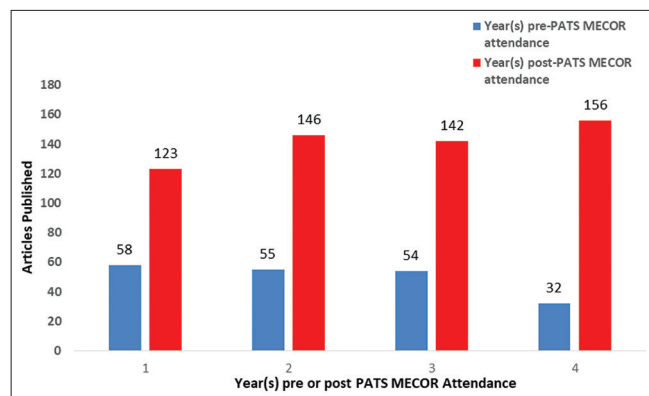
to the year before attending PATS-MECOR course (123 articles vs. 58 articles) among the 143 participants who had published within 4 years before or post attending PATS-MECOR training. This trend was sustained when matched to comparable years prior and post-exposure to the program as shown in [Figure 1].

Furthermore, the number of participants who had published in the 1<sup>st</sup> year following attendance of the PATS-MECOR program was about twice the number that had published 1 year before attending the course (62 vs. 34).

In the 4 consecutive years following training, participants published an average and standard deviation of  $0.84 \pm 1.46$  articles (1<sup>st</sup> year),  $0.99 \pm 1.61$  articles (2<sup>nd</sup> year),  $0.98 \pm 1.70$  articles (3<sup>rd</sup> year), and  $1.06 \pm 2.06$  articles (4<sup>th</sup> year). This rate was higher compared to their 4 years consecutive rate of publication before attending the course where they published an average and standard deviation of  $0.40 \pm 1.13$  articles in the 1<sup>st</sup> year,  $0.38 \pm 0.92$  in the 2<sup>nd</sup> year,  $0.37 \pm 1.29$  articles in the 3<sup>rd</sup> year, and  $0.21 \pm 0.89$  articles in the 4<sup>th</sup> year before attending the PATS-MECOR training. In the whole 4 years period following first exposure to PATS-MECOR training, the median (IQR) publication rate of participants 2 (1–4) was far higher compared to their median publication outputs 4 years before attending PATS-MECOR 0 (0–1).

## DISCUSSION

This study has demonstrated a significant success of the PATS-MECOR program in improving publication trends among attendees. A significant proportion (more than three-quarter) of the past attendees has published with slightly more than 20% being the first author in their publications. There is also a good median citation record of their publications and nearly half were published in top choice journals with impact factor. The number of publications per year increased in the years following attendance of PATS-MECOR.



**Figure 1:** Effect of exposure to PATS-MECOR training on publication by PATS-MECOR attendees ( $n = 143$ ).

Compared to the impact of similar courses on publication trend among attendees, our finding that more than three quarters of our participants had published at least a paper is higher than what was reported by the “The Structured Operational Research and Training Initiative (SORT-IT)” program organized by the International Union Against Tuberculosis and Lung Disease, MSE, and the World Health Organization (WHO) which was about 50%.<sup>[37]</sup> Furthermore, the publication output for PATS-MECOR participants for a comparable period of their assessment, 2007–2014, showed a higher publication output per year compared to the SORT-IT cohort. The publication output of PATS-MECOR attendees is likely to have contributed to the positive findings in a recent review that reports that Africans are now represented in about 49.9% of publications in the four most prominent general medicine and five most prominent general global health journals, respectively, based on impact factor.<sup>[9]</sup>

Author position on publications is recognized as a representative measure of participation and leadership in research. This study showed that more participants had a higher proportion who had served as the first authors or last authors in their studies compared to a study by Schneider and Maleka which found lower level of being the first authors and last authors at 14% and 11% for authors from low- and middle-income countries.<sup>[10]</sup> Furthermore, the proportion of first authorship in this present study was higher than found in the previous studies which sought to evaluate the scientific productivity primarily of country-based authors in Angola (19%)<sup>[38]</sup> and Malawi (20.9%).<sup>[39]</sup> The first authorship in our study is lower than that of a study evaluating global health research among LMIC affiliated authors which was over 50%.<sup>[10]</sup> This is not surprising considering that global health research is usually a global North-South collaboration and at present often led by authors from the global north who have more access to funding as has been alluded to Masekela *et al.*<sup>[40]</sup> More so, the study by Schneider and Maleka used institutional affiliations which may be misleading in representing the nationality of the authors, for example, in cases of temporary international mobility.

The last author position which usually denotes the most senior author in some settings is not high among our participants compared to that of authors with African institutional affiliation in a study assessing COVID-19 publications (53.5%).<sup>[41]</sup> This study by Guleid *et al.* evaluated the studies based on database from pre-print such as medRxiv, African Journals Online (AJOL), Collabovid, the WHO Global Research Database, and Google which are less restrictive compared to ours that used only PubMed database. Again, this depicts that attendees at the PATS-MECOR training are emerging and young investigators who are honing their skills in research and this meets the mandate of the program to build research capacity. Another dimension to the last author

position is that some African academic institutions do not give as much importance to the position for the purposes of academic progression and recognition, thus making it less attractive for young African investigators.

The finding that participants from Nigeria and Kenya produced more publications compared to other participants was in line with other studies that have evaluated publications of health research in African countries<sup>[7,41-45]</sup> However, the finding that when adjusted for GDP and the number of participants other countries, especially those from low-income countries such as Malawi and Uganda were in the top five, is consistent with other previous studies.<sup>[46]</sup> This may also be a proxy indicator of the effect of the training in aiding participants irrespective of their background to become more productive researchers.

The citation rate for the papers authored by the participants appears higher compared to the rates achieved by authors with LMIC institutional affiliation as described by Gonzalez-Alcaide *et al.* While in this study, the articles median citation was 11, the work by Gonzalez-Alcaide *et al.* was <8 depending on the position and coauthors institutional affiliation.<sup>[47]</sup> Thus, the finding that participant's publication has a good citation rate is indicative of the high quality of research conducted by the PATS-MECOR attendees.

The significant higher publication output by male participants compared to the female participants is in keeping with other studies that have pointed to gender differences in publications.<sup>[48,49]</sup> The reason for this may be due to the challenges females face in pursuing their career path early due to family considerations compared to their male counterparts. Given this situation, there may be need to be more deliberate in recruiting more females into the program and to encourage some of the outstanding ones to be mentors and serve as role models to encourage other females to become more active in pursuing research careers.

### Strength and weakness

One major strength of our study was the use of the names of authors who are confirmed to be from one of the African countries and who have African affiliations compared to other studies that use only the affiliations of the author without knowing if they are Africans or not. Another strength is the use of the PubMed database given its wide acceptance for bibliometric studies and stringent method of indexing articles which also make our findings comparable to the previous studies. The use of only one database (PubMed) may also be considered a limitation because it may have excluded some publications by PATS-MECOR attendees which may be found in less visible and regional based journals or repositories such as AJOL. AJOL is more likely to index local or national journals where authors from African countries

may publish given the challenges, they may face publishing in PubMed indexed journals as already highlighted by Nabyonga-Orem *et al.*<sup>[17]</sup> However, this approach in using only PubMed database may have enhanced the sensitivity to include high-quality publications. Another limitation is that we did not evaluate for involvement in the production of policy documents which may be another way participants may be involved in publications.

### CONCLUSION

The PATS-MECOR program is a valuable research capacity building training for emerging African investigators as evidenced by an increased publication rate in reputable journals with good citation and visibility. With improving research capacity among Africans, there is a need to encourage sustained collaboration and networking among the trained critical mass of researchers in the continent. This will engender multidisciplinary research with greater policy impact across the continent. Future assessments of this program should include mapping of the research partnership and funding streams of the participants as well as the use of qualitative methodology to deeply explore the effects of the program and challenges to productivity.

### Declaration of patient consent

Patient's consent not required as there are no patients in this study.

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### Conflicts of interest

There are no conflicts of interest.

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