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ORIGINAL RESEARCH

Fifty Years of Global Cardiovascular Research in Africa: A Scientometric Analysis, 1971 to 2021

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BACKGROUND: To analyze the quantity and impact of cardiovascular research done in Africa or coauthored by researchers based in Africa, their determinants, and the patterns of research collaboration.

METHODS AND RESULTS: We retrieved data from Web of Science and additional sources. We analyzed temporal trends from 1971 to 2021 and geographical distribution, research impact using country-level h-index, international research cooperation, and associations of research quantity and quality using linear regression. The annual volume of cardiovascular research from Africa has increased from 4 publications in 1971 to 3867 in 2020 and currently represents ~3% of the global cardiovascular research output. Authors from South Africa (28.1%) and Egypt (24.1%) accounted for more than half of all publications from African countries, and they had the highest h-index (209 and 111, respectively). Important collaborators outside Africa included the United States, United Kingdom, France, Germany, and Australia. The country's publication count was associated with larger population size (P<0.001), whereas the country's h-index was associated with larger population size (P=0.001) and higher human development index (P=0.023). International collaboration was dominated by the United States, South Africa, United Kingdom, Egypt, and Canada. The level of collaboration between African countries was lower than their collaboration with non-African countries.

CONCLUSIONS: Cardiovascular research output from African authors remains low, despite marked progress over the past 5 decades. These findings highlight the urgent need to improve the quantity and quality of cardiovascular research in Africa through increased investments, training of human resources, improved infrastructures, and expansion of collaborative research networks, particularly within Africa.

Key Words: Africa ■ bibliometric ■ cardiovascular research ■ h-index ■ scientometry

Africa, home to >1 billion people, is experiencing a surge in the burden of cardiovascular disease (CVD).[1] In 2019, >1 million deaths were attributable to CVD in sub-Saharan Africa alone.[2] It is estimated that CVD will overtake infectious diseases as the leading cause of death on the continent by 2030.[3] This rise in the prevalence of CVD represents a significant health and socioeconomic challenge for African countries. Health systems in Africa, especially in sub-Saharan Africa, which are still highly burdened by communicable, maternal, neonatal, and nutritional diseases,[1] are ill-prepared to cope with the CVD epidemic.[4] High-quality research is crucial to inform evidence-based strategies to curb the burden of CVD in Africa.

Although Africa carries the largest proportion of the global burden of disease,[1] it has the lowest contributions to medical progress as judged from biomedical publications.[5,6] There are several potential reasons for the limited health research output in African countries, including a limited number of trained researchers;

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CLINICAL PERSPECTIVE

What Is New?

- Cardiovascular research output from Africa has progressed over the past 50 years and currently represents ~3% of the global cardiovascular research output.
- Despite this progress, cardiovascular research output from Africa remains low and out of proportion to the increasing burden of cardiovascular disease on the continent.
- The extent of collaboration within Africa is much lower than the level of collaboration with non-African countries.

What Are the Clinical Implications?

- Efforts are needed to improve the quantity and impact of cardiovascular research in Africa.
- Increased resources to train cardiovascular health professionals and researchers, build infrastructures, and fund research on cardiovascular disease priorities for Africans are highly needed.
- Collaborative research networks within Africa should be created and expanded.

Nonstandard Abbreviations and Acronyms

GDP	gross domestic product
HDI	human development index

scarce and poorly-equipped research institutions; dearth of financial resources, investments, and incentives to pursue research; and a weak political willingness to build research capacities.

Over the past few decades, there has been a sharp increase in international research collaborations, because connecting with colleagues across geographic boundaries has become much easier than ever before.[7] These collaborations are an effective way to share and advance knowledge. In African countries, international collaborations, especially with overseas colleagues, represent an opportunity to overcome several local challenges by bringing research funding and sharing expertise. Researchers based in Africa also contribute to a global research agenda beyond their local health priorities. A previous report showed some progress in cardiovascular research productivity from African countries between 1999 and 2008, with the largest number of publications coming from South Africa, Egypt, Tunisia, and Nigeria.[8] However, the current contribution of Africa to the global cardiovascular research and its determinants are unknown. Therefore, this study aimed to (1) analyze the trends and geographic distribution of articles in cardiovascular research with contributions from Africa, either conducted in Africa or coauthored by researchers from Africa; (2) determine the factors associated with the quality and quantity of cardiovascular research output across countries; and (3) examine the patterns of research collaborations between researchers based in Africa and those outside Africa over the past 50 years.

METHODS

Availability of Data and Material

Most data generated or analyzed in this study are included in this article and its supplemental material. Additional information can be provided upon request to the corresponding author.

Registration and Ethical Approval

This project was registered with PROSPERO (international prospective register of systematic reviews, www.crd.york.ac.uk/prospero) (CRD42021260613). Because the project was based on published data, ethical approval was not sought nor required.

Data Search

We aimed to include all articles on CVD either from studies conducted in Africa or authored by researchers based in Africa, published between 1971 and 2021, and excluding animal studies. We searched Web of Science (Clarivate Analytics, Philadelphia, PA) to identify all relevant articles. Search strategies were developed based on terms related to the broad spectrum of CVD, the cardiovascular risk factors hypertension and dyslipidemia, and an African filter including the names of all African countries (Tables S1 through S3). Risk factors such as obesity, diabetes, or physical inactivity were not included because they are not specific to cardiovascular research and therefore could have reduced the precision of the searches. Searches were performed on September 16, 2021.

Data Acquisition and Management

Data were extracted from Web of Science and processed automatically using the web application SciPE (Science Performance Evaluation; Saarland University, Saarbrücken, Germany), which performs various scientometric analyses specified by the user, as described previously.[9] These data were used to set up an undirected multipartite graph with distinct partitioned sets of nodes, including countries, institutions, publications (categorized as general authorship, first authorship, and last authorship), citations, country- and author-level Hirsch (h)-indices, authors' first and last

names, and authors' sex. First and last authorships are related to the first and last author on a article, whereas general authorship corresponds to any position as co-author. Additional information for each African country was extracted manually from various sources. Data on the human development index (HDI) for the year 2020 were obtained from the United Nations Development Programme.[10] Data on adult literacy rate (percent of people aged 15 years and above) and physicians per 1000 people for the most recent available year, gross domestic product (GDP) per capita for the year 2020, health expenditure per capita for the most recent year, and total population for the year 2020 were obtained from the World Bank,[11] the number of universities in the country from UniRank,[12] and CVD mortality rate for 2019 from the Global Burden of Disease.[13]

The h-index, coined by the physicist Jorge E. Hirsch in 2005,[14] was used to measure the productivity and citation impact of the publications of authors and countries. It was calculated as the number of articles h published by a researcher (for author's h-index), or by researchers in a specific country (for country's h-index), that have at least h citations each. International collaborations were analyzed between the first author's country and the countries of all coauthors. Each country that was different from the first author's country accounted for 1 collaboration and was visualized in the chord diagram.

We examined the representation of selected cardiovascular research domains in the overall research output. These domains included specifically CVDs such as coronary artery disease, cardiomyopathies, endocarditis, pericardial disease, rheumatic heart disease, nonrheumatic valvular disease, congenital heart disease, arrhythmias, heart failure, pulmonary hypertension, peripheral artery disease, venous thromboembolism, and cerebrovascular disease. For each of these domains, we conducted a specific search on Web of Science (Table S3). Cardiovascular risk factors, such as hypertension, were not included as specific domains. The proportion of each domain was calculated as its specific search yield divided by the sum of yields of all domains and expressed in percentage.

We analyzed the characteristics of the top 200 CVD researchers from Africa. Several authors had publications with different names from various combinations of their first names, middle names, and last names. Such authors had their publications summed up and reported under a single name, which was performed manually by 1 author (J.J.N.). This could not be done for the h-index because of the potential inaccuracy that can emerge when attempting to resolve multiple h-indexes attributed to several names of the same author. For this reason, authors were ranked based on the total number of publications rather than the h-index.

Statistical Analysis

Categorical variables were summarized using frequency and percentage, and quantitative variables using median and interquartile range (IQR). Linear regression analysis was used to investigate the factors associated with each African country's number of publications and country's h-index (based on general authorship). Explanatory variables included the following country characteristics were: population size, number of universities, literacy rate, HDI, GDP per capita, health expenditure per capita, number of physicians per population, and CVD mortality rate. The strength of unadjusted and adjusted associations was measured with the β coefficient reported with a 95% CI. All variables were included in the multivariable regression model, except GDP per capita, literacy rate, and health expenditure per capita because of collinearity with HDI. These variables are represented in the HDI, which is a composite of index of life expectancy, education, and per capita income indicators. A 2-sided P value <0.05 was considered statistically significant without correction for multiple testing. A complete case analysis was performed. Data were analyzed using IBM SPSS Statistics version 27.0 (Armonk, NY). Figures were generated using SciPE and Microsoft Excel version 2019 for Windows (Redmond, WA).

RESULTS

Overall Output From Africa

We identified 35 368 publications in cardiovascular research done in Africa or coauthored by researchers based in Africa, representing 1.7% of the global cardiovascular research output from 1971 to 2021. The annual number of publications from Africa has increased over time from 4 publications in 1971 to 3867 in 2020 (Figure 1). The proportion of global CVD publications from Africa has also risen from 0.1% in 1971 to 3.1% in 2021, with an accelerated trend in the past decade (Figure S1).

Research Domains

The most common publications were related to coronary artery disease (22.6%), heart failure (19.1%), cerebrovascular disease (11.9%), cardiomyopathies (8.3%), arrhythmias (7.7%), and venous thromboembolism (7.0%) (Figure 2).

Nations' Publication Quantity

Cardiovascular research from Africa was authored by researchers both within and outside of Africa. The leading contributing countries by number of publications based on general authorship were South Africa (n=9055), Egypt (n=7777), United States (n=5559),

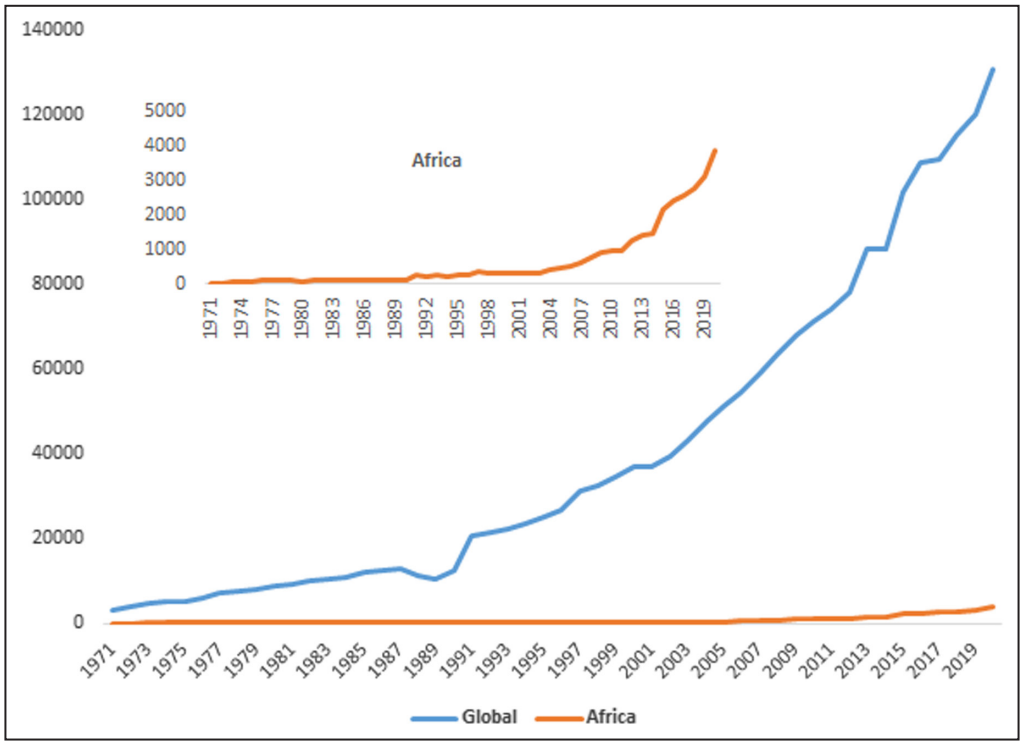

Figure 1. **Temporal trends in cardiovascular research output in Africa and worldwide.**

United Kingdom (n=3900), Nigeria (n=2824), Tunisia (n=2352), France (n=2041), Germany (n=1591), Morocco (n=1510), and Australia (n=1495) (Figure 3A). The overall pattern was similar for publications based on first and last authorships (Figures S2 and S3). In regard to specifically African countries, South Africa (28.1%) and Egypt (24.1%) accounted for more than one-half of the total number of publications based on

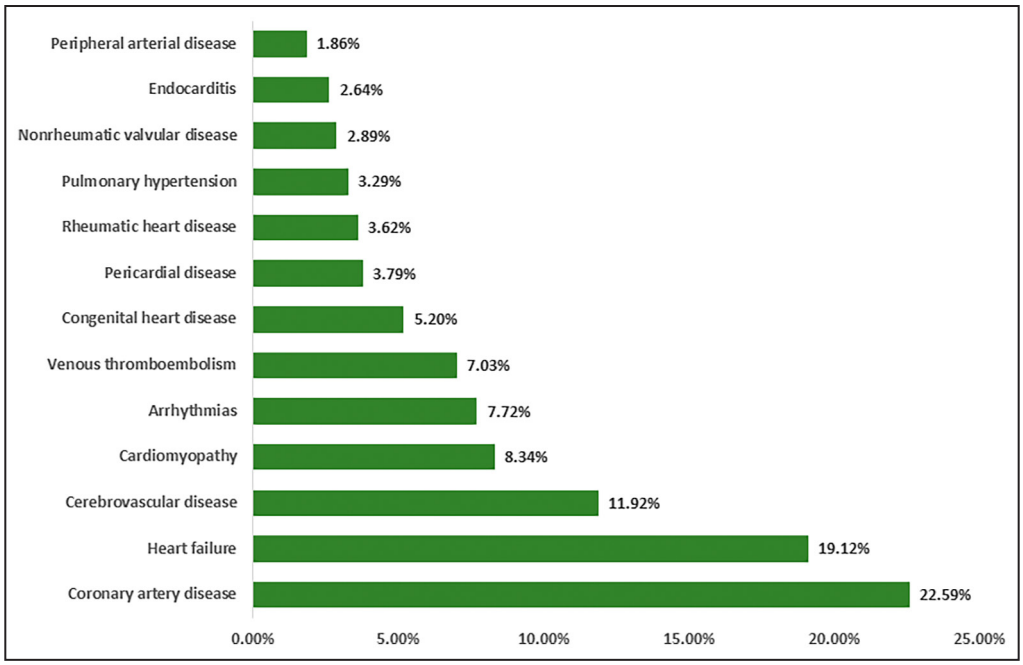

Figure 2. **Distribution of publications among selected research domains for cardiovascular diseases.**

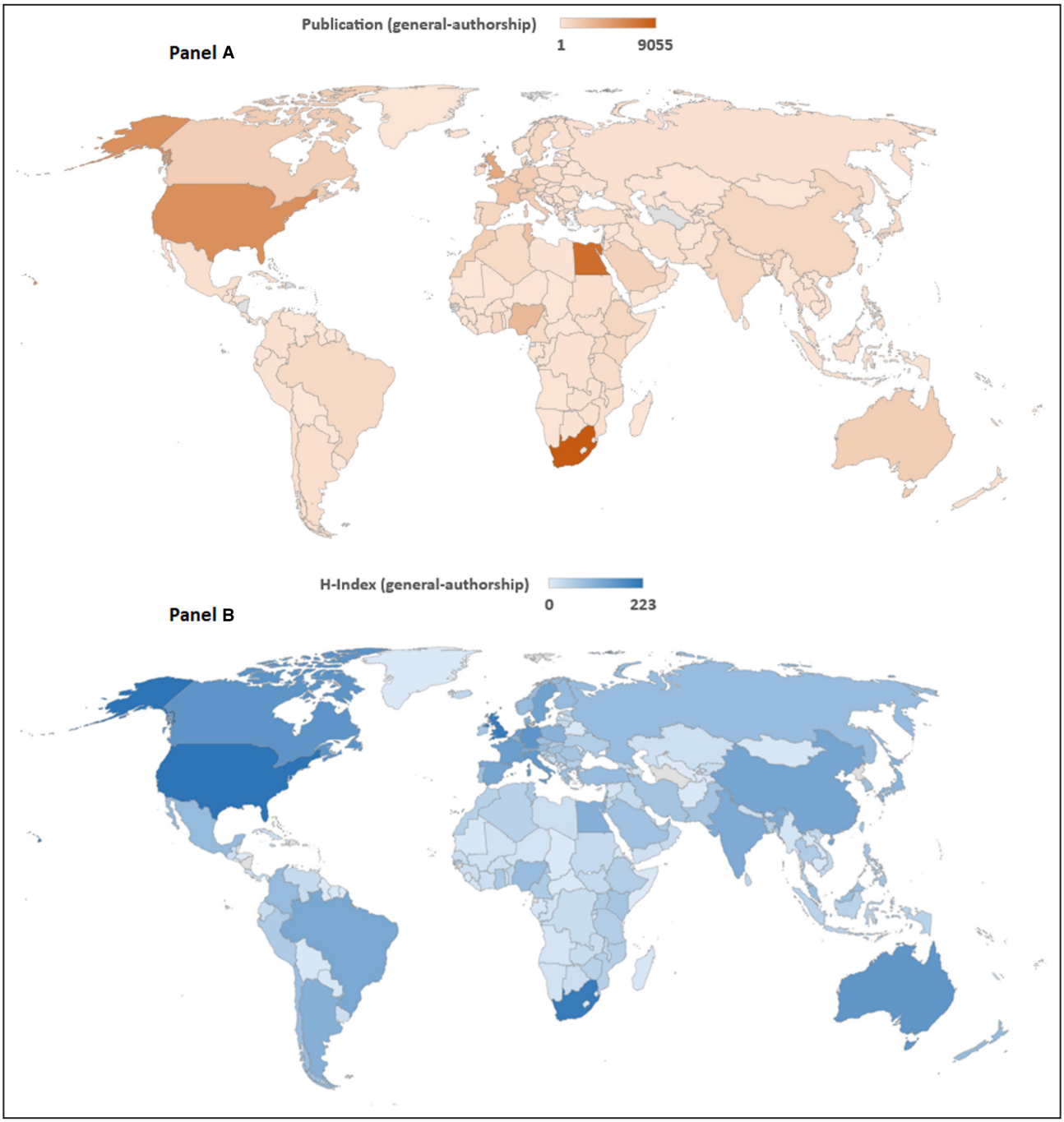

Figure 3. Geographical distribution of cardiovascular publications involving Africa (Panel A) and related country-level h-index (Panel B).

general authorship, followed by Nigeria (8.8%), Tunisia (7.3%), and Morocco (4.7%), which collectively accounted for nearly three-quarters of this total (Table 1 and Table S4). This distribution was similar for publications based on first authorship and last authorship (Table S5). At the regional level, most publications were from Northern Africa (42.3%) and Southern Africa (28.8%) (Table S6). When considering country's population size, Seychelles (n=731), Tunisia (n=199), South Africa (n=153), Mauritius (n=78), and Egypt (n=76) had the highest number of publications (based on general authorship) per 1 million population (Table S7).

Nations' Publication Quality

Countries with the highest h-index based on general authorship were the United States (h=223), South Africa (h=209), United Kingdom (h=209), Germany

Table 1. African Countries Ranked by the Total Number of Publications

Country	Publications	Country-level h-index	Citations	Universities	Population	GDP per capita	HDI	Literacy rate (%)	Physicians per 1000 population	Health expenditure per capita	CVD death rate
South Africa	9055	209	94404	25	59308690	5090.7	0.709	87	0.9	525.96	148.7
Egypt	7777	111	35449	54	102334400	3547.9	0.707	71	0.79	125.55	266.35
Nigeria	2824	87	15310	160	206139590	2097.1	0.539	62	0.4	83.75	76.11
Tunisia	2352	63	11885	71	11818620	3319.8	0.740	79	1.27	251.55	302.52
Morocco	1510	50	6543	37	36910560	3009.2	0.686	74	0.73	174.78	325.53
Ethiopia	984	55	4419	36	114963580	936.3	0.485	52	0.1	24.23	71.54
Ghana	829	63	3619	67	31072940	2328.5	0.611	79	0.18	77.91	125.73
Kenya	738	72	3211	62	53771300	1838.2	0.601	82	0.2	88.39	80.85
Algeria	679	47	2384	91	43851040	3310.4	0.748	81	1.83	255.87	234.02
Cameroon	673	61	3612	15	26545860	1499.4	0.563	77	0.08	54.14	91.03
Uganda	667	59	3036	47	45741000	817	0.544	77	0.09	43.14	68.46
Tanzania	519	55	2302	32	59734210	1076.5	0.529	78	0.04	36.82	96.04
Sudan	396	32	1011	52	43849270	595.5	0.510	61	0.41	60.17	182.24
Mozambique	316	52	878	11	31255440	448.6	0.456	61	0.07	40.26	107.33
Senegal	266	26	862	28	16743930	1487.8	0.512	52	0.07	58.9	105.6
Malawi	229	35	1142	22	19129960	625.3	0.483	62	0.02	35.5	84.86
Zimbabwe	226	47	838	18	14862930	1128.2	0.571	89	0.08	140.32	118.65
DRC	192	27	896	55	89561404	556.8	0.480	77	0.074	18.51	102.55
Burkina Faso	162	20	381	17	20903280	830.9	0.452	41	0.06	40.25	97.62
Rwanda	158	32	708	26	12952210	797.9	0.543	73	0.14	58.31	93.2
Benin	151	34	254	26	12123200	1291	0.545	42	0.16	30.94	90.15
Zambia	138	27	323	50	18383960	1050.9	0.584	87	0.09	75.99	99.56
Cote D'Ivoire	125	22	311	14	2637828	2325.7	0.538	47	0.23	71.88	85.5
Botswana	122	23	423	15	2351630	6711	0.735	87	0.37	482.96	150.47
Libya	111	23	549	29	6871290	3699.2	0.724	86	2.16	309.88	189.26
Guinea	105	20	687	1	13132790	11940	0.477	32	0.08	38.32	115.06
Mauritius	99	32	1993	5	1265740	8622.7	0.804	91	2.25	653.35	259.2
Congo	85	16	79	1	5518090	1972.5	0.574	80	0.165	47.52	134.76
Gambia	84	26	533	2	2416660	787	0.496	51	0.11	22.16	115.92
Angola	82	13	218	18	32866270	1895.8	0.581	66	0.21	87.62	85.35
Togo	73	16	109	4	8278740	915	0.515	64	0.05	41.84	105.55
Seychelles	72	25	128	1	98460	11425.1	0.796	96	0.95	833.08	236.72

(*Continued*)

Table 1. Continued

Country	Publications	Country-level h-index	Citations	Universities	Population	GDP per capita	HDI	Literacy rate (%)	Physicians per 1000 population	Health expenditure per capita	CVD death rate
Mali	60	17	79	10	20250830	858.9	0.434	35	0.14	34.95	89.06
Namibia	55	16	56	3	2540920	4211.1	0.646	92	0.6	471.49	155.92
Niger	51	14	155	2	24206640	565.1	0.394	35	0.05	30.36	73.84
Madagascar	45	8	109	6	27691020	465.5	0.528	75	0.18	22.05	132.62
Gabon	33	11	37	23	2225730	7005.9	0.703	85	0.36	218.37	145.21
Sierra Leone	33	10	28	7	7976980	484.5	0.452	43	0.02	85.78	108.74
Eritrea	21	10	174	7	3213970	642.5	0.459	77	0.06	23.79	99.24
Burundi	18	5	6	21	11890780	274	0.433	68	0.05	24.03	90.52
Liberia	17	9	4	4	5057680	583.3	0.480	48	0.04	45.42	89.76
Mauritania	17	7	0	4	4649660	1672.9	0.546	53	0.2	54.49	98.44
CAR	14	5	13	1	4829760	476.9	0.397	37	0.06	53.66	136.03
Swaziland	13	5	0	5	1160160	3415.5	0.611	88	0.08	271.14	132.97
Cape Verde	12	4	2	9	555990	3064.3	0.665	87	0.82	194.86	190.48
Somalia	11	4	29	33	15893220	309.4	NA	NA	0.02	NA	91.04
Chad	10	4	14	9	16425860	614.5	0.398	22	0.05	29.24	84.38
Lesotho	10	4	29	2	2142250	861	0.527	77	0.1	124.79	192.58
Comoros	7	3	0	NA	869600	1402.6	0.554	59	0.27	65.23	159.96
Djibouti	2	1	0	1	988000	3425.5	0.524	NA	0.22	70.86	103.11

HDI is a composite index of life expectancy, education, and per capita income indicators. CAR indicates Central African Republic; CVD, cardiovascular disease (deaths per 100000 people); DRC, Democratic Republic of Congo; GDP, gross domestic product (per capita in US dollars); HDI, human development index (health expenditure per capita in US dollars); and NA, not available.

(h=162), Canada (h=162), Australia (h=160), Italy (h=154), France (h=144), and the Netherlands (h=142) (Figure 3B). The overall picture was similar for the h-indices based on first and last authorship publications (Figures S4 and S5). In regard to African countries, the top 5 with the highest h-index were South Africa (h=209), Egypt (h=111), Nigeria (h=87), Kenya (h=72), and Tunisia (h=63) (Table S4). When adjusting for population size, Seychelles (h=254), Mauritius (h=25), The Gambia (h=11), Botswana (h=10), and Ivory Coast (h=8) had the highest h-index (based on general authorship) per million population (Table S7).

Factors Associated With Research Quantity and Quality Among African Countries

Multiple linear regression analysis revealed that every 1 million or larger population size was associated with 37.9 (95% CI, 19.3–56.4; *P*<0.001) more publications in the country's output. Furthermore, every 1 million or larger population size and every unit in HDI were associated with 0.6 (95% CI, 0.2–1.0; *P*=0.001) and 152.0 (95% CI, 22.2–281.7; *P*=0.023) higher country-level h-index, respectively. The number of universities, literacy rate, GDP per capita, health expenditure per capita, number of physicians per population, and cardiovascular disease mortality were not associated with either a country's number of publications or its h-index (Table 2).

International Collaborations

The chord diagrams (Figure 4A and 4B) depict the collaborations between the country of the first author and the countries of all coauthors. The width of each connecting line is proportional to the cooperation in terms of collaborative publications with the connected country. Among publications from research done in Africa or coauthored by researchers from Africa, the United States, South Africa, the United Kingdom, Egypt, and Canada had the most intensive research collaboration (Figure 4A). The level of international collaboration between African countries was lower than their collaboration with non-African countries (Figure 4A). South Africa, Nigeria, and Cameroon had the highest level of international collaboration among African countries (Figure 4B).

Characteristics of the Most Prolific Authors

The total number of publications (general authorship) of the top 200 researchers from Africa ranged from 26 to 376, with a median of 45.0 (IQR, 32.0–66.8). Men represented 72.5% (n=145) of the top researchers. They were mostly from South Africa (51.5%, n=103)

Table 2. Factors Associated With the Country's Number of Publications and h-Index Based on General Authorship Among African Countries

Factors	Country's no. of publications				Country's h-index			
	Unadjusted β coefficient (95% CI)	*P* value	Adjusted* β coefficient (95% CI)	*P* value	Unadjusted β coefficient (95% CI)	*P* value	Adjusted* β coefficient (95% CI)	*P* value
Population	22.98 (11.34 to 34.62)	<0.0001	37.85 (19.26 to 56.44)	<0.0001	0.54 (0.31 to 0.77)	<0.0001	0.63 (0.26 to 1.00)	0.001
GDP per capita	0.09 (−0.09 to 0.28)	0.319			0.002 (−0.002 to 0.005)	0.386		
HDI	5396.31 (971.65 to 9820.97)	0.018	4983.19 (−1477.64 to 11444.03)	0.127	113.77 (23.16 to 204.37)	0.015	152.01 (22.24 to 281.78)	0.023
Literacy rate, %	15.35 (−11.43 to 42.12)	0.255			0.49 (−0.05 to 1.02)	0.074		
No. of universities	20.43 (4.34 to 36.53)	0.014	−21.91 (−45.97 to 2.16)	0.73	0.57 (0.26 to 0.88)	0.001	−0.16 (−0.64 to 0.33)	0.520
No. of physicians	0.96 (−0.03 to 1.95)	0.056	−0.17 (−1.45 to 1.12)	0.792	0.02 (−0.003 to 0.038)	0.098	−0.001 (−0.027 to 0.025)	0.922
Health expenditure per capita	2.18 (−0.61 to 4.96)	0.122			0.05 (−0.01 to 0.10)	0.111		
Cardiovascular disease mortality	8.45 (0.80 to 16.09)	0.031	6.48 (−3.59 to 16.55)	0.201	0.10 (−0.07 to 0.26)	0.231	−0.04 (−0.25 to 0.16)	0.671

Number of publications and h-index are based on general authorship. Cardiovascular disease mortality represents the number of deaths per 100 000 people. Number of physicians per 100 000 people. Population in millions of people. GDP indicates gross domestic product (per capita in US dollars); and HDI, human development index (health expenditure per capita in US dollars).
*GDP per capital, literacy rate, and health expenditure per capita were not included in the multiple linear regression because of collinearity with HDI. Only HDI was included.

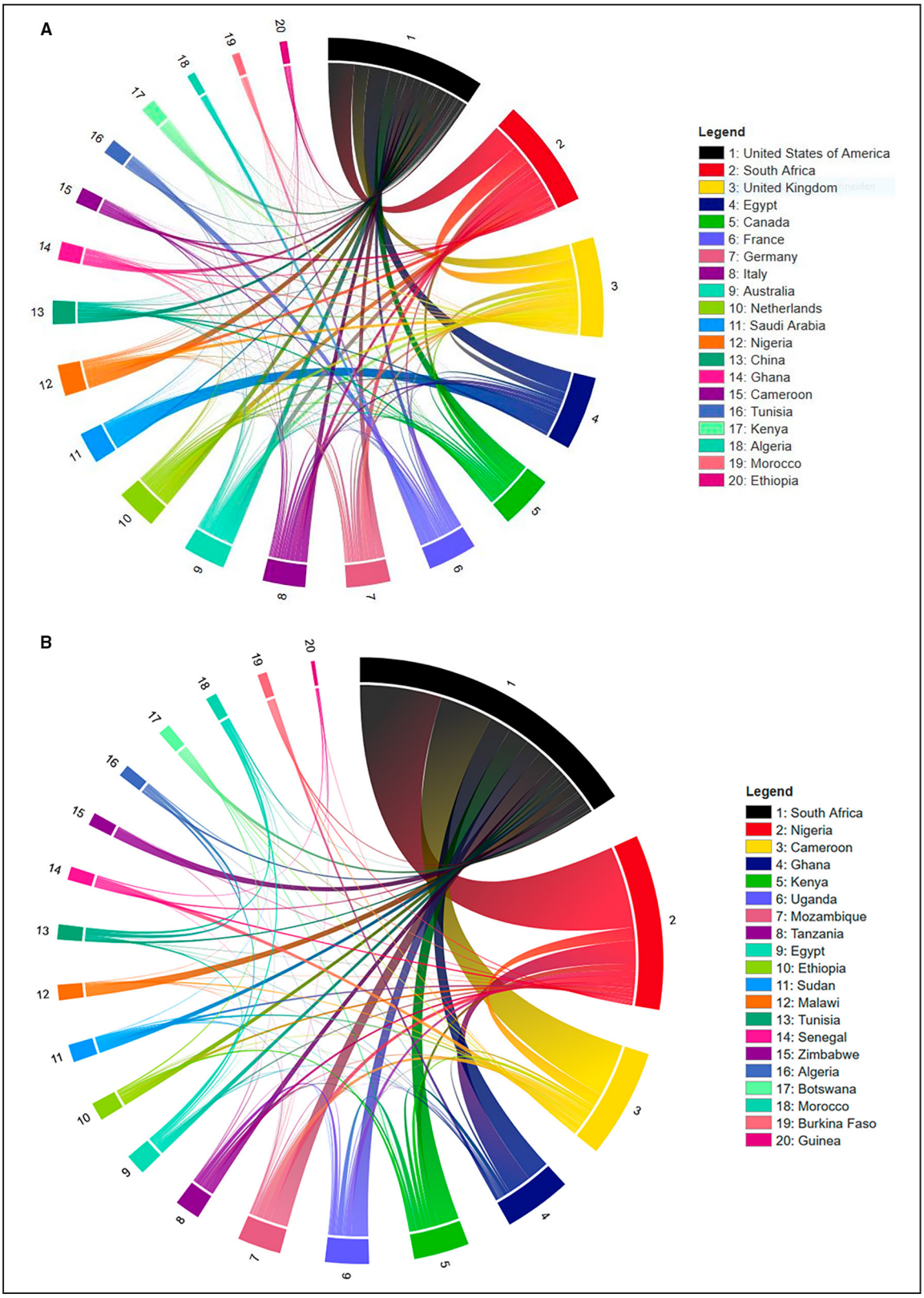

Figure 4. **Network of cardiovascular research collaboration among African countries and with non-African countries (Panel A) and among only African countries (Panel B).**

and Tunisia (19.0%, n=38). The University of Cape Town (15.0%, n=30), University of the Witwatersrand (13.5%, n=27), North-West University (7.0%, n=14) in South Africa, and the University of Monastir in Tunisia (6.5%, n=13) had the highest number of top researchers (Table S8).

DISCUSSION

This study analyzed the quantity and impact of cardiovascular research from Africa between 1971 and 2021, their determinants, and the patterns of research collaboration. We observed that cardiovascular research done in Africa or coauthored by researchers based in Africa has progressed over the past 50 years and currently represents ~3% of the global cardiovascular research output. South Africa and Egypt accounted for more than half of the total number of publications from African countries, and their research had the highest impact. The quantity and impact of research positively correlated with the country's population size and HDI. The level of international collaboration among African countries was lower than their collaboration with non-African countries.

Our study confirms and extends the data from 2 previous studies that analyzed data from 1999 to 2008 and showed a steady progression in cardiovascular research productivity in Africa[8] and globally.[6] We observed an accelerated publication output in the past decade, with the total number of publications that has quadrupled between 2010 and 2020. Similarly, the proportion of global CVD publications from Africa has risen from 0.1% in 1971 to 3.1% in 2021, with a substantially higher increase in the past decade. However, the cardiovascular research output from Africa remains low, especially in view of the current and projected CVD burden on the continent. Furthermore, this research output is highly skewed, with 5 countries (South Africa, Egypt, Nigeria, Tunisia, and Morocco) accounting for nearly three-quarters of the publication share in Africa. These disparities are not specific to cardiovascular research. Similar pictures were reported in an analysis of 1996 to 2005 PubMed articles from Africa[15] and in a bibliographic study of nephrology research in Africa between 1960 and 2017.[16]

Differences in population size are the major reasons for the differences in cardiovascular research output in Africa. Highly populated countries like Nigeria or Egypt have high publication counts. Linear regression analysis revealed that a country's population size has a substantial positive correlation not only with research quantity, but also with impact. Countries with larger populations are more likely to have a larger research workforce. We observed that HDI was associated with higher research impact, whereas literacy rate was associated with neither research quantity nor impact. HDI is a summary measure of average achievement in key dimensions of human development, including a long and healthy life, being knowledgeable, and having a decent standard of living.[17] Our findings highlight the importance of overall human development beyond education as a determinant of scientific research output. Furthermore, the number of universities within countries was not associated with research quantity and quality. This suggests that the quality of universities or research institutions might have higher impact on countries' research productivity than their quantity. The African countries with the highest number of publications and h-index, especially South Africa and Egypt, have the highest-rated universities on the continent (https://www.topuniversities.com/). More than one-quarter of the most prolific cardiovascular researchers in Africa were affiliated with the University of Cape Town and University of the Witwatersrand (South Africa), the 2 most highly rated universities in Africa.[18] South Africa has had increasing investments in biomedical research,[19] and research infrastructure in the country is highly supported by universities, the National Research Foundation of South Africa, and the Medical Research Council, as well as by private companies and foundations.[20] The country has established institutes dedicated to cardiovascular research, such as the Hatter Institute for Cardiovascular Research in Africa, located at the University of Cape Town, and several programs to address the rising burden of CVD have been developed.[20]

GDP per capita has been shown to be a major determinant of biomedical research productivity.[21] However, GDP per capita and health expenditure per capita were not associated with research quantity or impact in the current study, in keeping with another bibliographic analysis focusing on nephrology research.[16] This suggests that, in Africa, greater national economic wealth does not necessarily translate into investment in health and in medical research, though it is possible that there is a threshold or lag effect. National investment in health research has historically been low in most African countries.[19] In 2005, 15 years after the call of the Commission on Health Research for Development to governments in developing countries to devote 1% of national GDP to research, only South Africa had almost met this target.[19] In 2001, African Union heads of state committed in the Abuja Declaration to devote at least 15% of their annual national budget to the health sector.[22] Although many African countries have marginally increased health spending overall, in 2018, average government health spending hovered around 7.2% of the national budget, less than half of the target set in Abuja, with only 2 countries (Madagascar and Zimbabwe) having met the target.[23]

Expenditure on health research in Africa is not only low, but it is also unequally distributed and does

not match the burden of disease,[24] with most of the health expenditure allocated to infectious diseases.[25] Because CVD is set to overtake infectious diseases as the leading cause of death in Africa by 2030,[3] there is the need for larger resources to be allocated to cardiovascular research and subsequently health promotion and service provision activities.

This study shows extensive collaborations among African and non-African countries, with patterns that are consistent with previous studies on international collaborations clusters in biomedical research in Africa.[26,27] The top non-African countries involved in coauthorships in cardiovascular publications with African countries are the United States, United Kingdom, France, Germany, and Australia. These countries are leaders in research globally, especially in the cardiovascular field.[28] Collaboration clustering between African and non-African countries is highly influenced by colonial languages, as well as historical and political ties.[26,27] This was apparent in the current study; there are clusters of collaboration between France and French-speaking African countries such as Tunisia, Morocco, Algeria, and Cameroon; between the United Kingdom and United States, and English-speaking African countries such as South Africa, Nigeria, Egypt, Ghana, and Kenya; and between Arab countries, mainly Saudi Arabia and Egypt. Furthermore, countries like the United States and United Kingdom are important sources of public research funding for African countries through the National Institutes of Health, Wellcome Trust, and UK Medical Research Council, as well as private research funding such as the Bill and Melinda Gates Foundation, which has not invested heavily in cardiovascular research to date.

Research collaborations between African countries remains limited. However, there is an increasing number of pan-African research initiatives. Notable examples include CVD registries launched by the Pan-African Society,[29] the VALVAFRIC study,[30] the Sub-Saharan Africa Survey on Heart Failure,[31] Pan African Pulmonary Hypertension Cohort study,[32] cardiovascular studies within the H3 (Africa Human Heredity and Health in Africa) initiative,[33] and Investigation of the Management of Pericarditis and Comparison of Three Combination Therapies in Lowering Blood Pressure in Black Africans trials,[34,35] among others. Such pan-African projects have the potential to provide more robust scientific evidence for diseases that affect the continent, while sharing expertise on how to set up cardiovascular research in low-resource settings and how to maximize research funding for individual institutions. Recently, African cardiovascular researchers are taking the lead in multicountry global studies that have a focus on Africa but go far beyond the African continent such as the European Cardiac Society Global Peripartum Cardiomyopathy study[36] and the World Heart Federation Global Study on COVID-19 and Cardiovascular Disease.[37] The May Measurement Month is another initiative in which African researchers have been significantly involved.[38]

Brain drain, which is the emigration of skilled nationals, is considered a contributor to low-quantity and low-quality research in Africa. It has been estimated that 25% of African physicians and 10% of African nurses work in a high-income country.[39] Although brain drain remains a major challenge for developing sustainable research programs in Africa, this can be turned into an opportunity.[16] Cardiovascular researchers who have left Africa can be and have been recruited and incentivized to build partnerships between their host institutions abroad and African institutions for research training, collaborative research projects, joint applications for research grants, and knowledge sharing through scientific meetings.

Our study has some limitations. First, the analysis included only publications in journals indexed on Web of Science; therefore, publications in local African journals may be underrepresented. Second, the web application SciPE used to extract and process data from Web of Science could not appropriately differentiate some countries with similar names such as Sudan and South Sudan, or Guinea, Guinea-Bissau, and Equatorial Guinea. However, the nonrepresentation of some of these countries likely had a limited impact on the overall estimates. South Sudan is a young country (founded in 2011), and Guinea-Bissau and Equatorial Guinea are small countries with population sizes <4 million combined (https://data.worldbank.org/) and with low research output as previously reported.[8] Despite these limitations, the current study provides the most extensive and up-to-date report on cardiovascular research in Africa over the past 5 decades. Most importantly, this study is unique in that it is not focused on Africa as an isolated entity but presents the place of Africa in the global cardiovascular research community and the extent of contribution from non-African countries.

CONCLUSIONS

Cardiovascular research output from Africa is rising but remains low and out of proportion to the rising burden of CVD on the continent, despite some progress over the past 50 years. The extent of collaboration within Africa is much lower than the level of collaboration with non-African countries. These findings advocate for strategies to improve the quantity and impact of cardiovascular research, including increased resources to train cardiovascular health professionals and researchers, build infrastructures, and fund research on CVD priorities for Africans. Creating and expanding collaborative research networks within Africa will be pivotal to improve global cardiovascular health.

ARTICLE INFORMATION

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Supplemental Material

Tables S1–S8

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SUPPLEMENTAL MATERIAL

Table S1. Web of Science search terms-with Africa filter

Set	Concept	Search
5	Publication years	#4 AND PY=(1971-2021)
4	Combined search	(#1 AND #2) NOT #3
3	Excluded words	TI=(animal OR animals OR "african american*" OR "african ancestry" OR "african descent" OR "congo red" OR "aspergillus niger" OR animal model* OR animal stud* OR animal experiment* OR ape OR apes OR bat OR bats OR cats OR chimpanzee OR chimpanzees OR dogs OR "guinea pig" OR "guinea pigs" OR goats OR mice OR monkey OR monkeys OR pigs OR primate OR primates OR rabbits OR rat OR rats OR rodent* OR sheep OR sheeps) OR AB=("african american*" OR "african ancestry" OR "african descent" OR "congo red" OR "aspergillus niger" OR animal model* OR animal stud* OR animal experiment* OR ape OR apes OR bat OR bats OR cats OR chimpanzee OR chimpanzees OR dogs OR "guinea pig" OR "guinea pigs" OR goats OR mice OR monkey OR monkeys OR pigs OR primate OR primates OR rabbits OR rat OR rats OR rodent* OR sheep OR sheeps) OR AK=("african american*" OR "african ancestry" OR "african descent" OR "congo red" OR "aspergillus niger" OR animal model* OR animal stud* OR animal experiment* OR ape OR apes OR bat OR bats OR cats OR chimpanzee OR chimpanzees OR dogs OR "guinea pig" OR "guinea pigs" OR goats OR mice OR monkey OR monkeys OR pigs OR primate OR primates OR rabbits OR rat OR rats OR rodent* OR sheep OR sheeps) OR KP=("african american*" OR "african ancestry" OR "african descent" OR "congo red" OR "aspergillus niger" OR animal model* OR animal stud* OR animal experiment* OR ape OR apes OR bat OR bats OR cats OR chimpanzee OR chimpanzees OR dogs OR "guinea pig" OR "guinea pigs" OR goats OR mice OR monkey OR monkeys OR pigs OR primate OR primates OR rabbits OR rat OR rats OR rodent* OR sheep OR sheeps)
2	African countries	TI=(Africa OR African OR Algeria OR Angola OR Benin OR "Botswana" OR Burkina Faso OR Burundi OR "Cameroon" OR "Cape Verde" OR Chad OR Comoros OR Congo OR "Cote d$Ivoire" OR Djibouti OR Egypt OR Eritrea OR Eswatini OR Ethiopia OR Gabon OR Gambia OR Ghana OR Guinea OR "haute volta" OR "Ivory Coast" OR Jamahiriya OR Kenya OR Lesotho OR Liberia OR Libya OR Madagascar OR Malawi OR Mali OR Mauritania OR Mauritius OR Mayotte OR Morocco OR Mozambique OR Namibia OR Niger OR Nigeria OR Principe OR Rwanda OR "Sao Tome" OR Senegal OR Seychelles OR "Sierra Leone" OR Somalia OR St$Helena OR Sudan OR Swaziland OR Tanzania OR Togo OR Tunisia OR Uganda OR "upper volta" OR urundi OR "Western Sahara" OR Zaire OR Zambia OR Zimbabwe) OR AB=(Africa OR African OR Algeria OR Angola OR Benin OR "Botswana" OR Burkina Faso OR Burundi OR "Cameroon" OR "Cape Verde" OR Chad OR Comoros OR Congo OR "Cote d$Ivoire" OR Djibouti OR Egypt OR Eritrea OR Eswatini OR Ethiopia OR Gabon OR Gambia OR Ghana OR Guinea OR "haute volta" OR "Ivory Coast" OR Jamahiriya OR Kenya OR Lesotho OR Liberia OR Libya OR Madagascar OR Malawi OR Mali OR Mauritania OR Mauritius OR Mayotte OR Morocco OR Mozambique OR Namibia OR Niger OR Nigeria OR Principe OR Rwanda OR "Sao Tome" OR Senegal OR Seychelles OR "Sierra Leone" OR Somalia OR St$Helena OR Sudan OR Swaziland OR Tanzania OR Togo OR Tunisia OR Uganda OR "upper volta" OR urundi OR "Western Sahara" OR Zaire OR Zambia OR Zimbabwe) OR AK=(Africa OR African OR Algeria OR Angola OR Benin OR "Botswana" OR

		Burkina Faso OR Burundi OR "Cameroon" OR "Cape Verde" OR Chad OR Comoros OR Congo OR "Cote d$Ivoire" OR Djibouti OR Egypt OR Eritrea OR Eswatini OR Ethiopia OR Gabon OR Gambia OR Ghana OR Guinea OR "haute volta" OR "Ivory Coast" OR Jamahiriya OR Kenya OR Lesotho OR Liberia OR Libya OR Madagascar OR Malawi OR Mali OR Mauritania OR Mauritius OR Mayotte OR Morocco OR Mozambique OR Namibia OR Niger OR Nigeria OR Principe OR Rwanda OR "Sao Tome" OR Senegal OR Seychelles OR "Sierra Leone" OR Somalia OR St$Helena OR Sudan OR Swaziland OR Tanzania OR Togo OR Tunisia OR Uganda OR "upper volta" OR urundi OR "Western Sahara" OR Zaire OR Zambia OR Zimbabwe) OR KP=(Africa OR African OR Algeria OR Angola OR Benin OR "Botswana" OR Burkina Faso OR Burundi OR "Cameroon" OR "Cape Verde" OR Chad OR Comoros OR Congo OR "Cote d$Ivoire" OR Djibouti OR Egypt OR Eritrea OR Eswatini OR Ethiopia OR Gabon OR Gambia OR Ghana OR Guinea OR "haute volta" OR "Ivory Coast" OR Jamahiriya OR Kenya OR Lesotho OR Liberia OR Libya OR Madagascar OR Malawi OR Mali OR Mauritania OR Mauritius OR Mayotte OR Morocco OR Mozambique OR Namibia OR Niger OR Nigeria OR Principe OR Rwanda OR "Sao Tome" OR Senegal OR Seychelles OR "Sierra Leone" OR Somalia OR St$Helena OR Sudan OR Swaziland OR Tanzania OR Togo OR Tunisia OR Uganda OR "upper volta" OR urundi OR "Western Sahara" OR Zaire OR Zambia OR Zimbabwe) OR CU=(Africa OR African OR Algeria OR Angola OR Benin OR "Botswana" OR Burkina Faso OR Burundi OR "Cameroon" OR "Cape Verde" OR Chad OR Comoros OR Congo OR "Cote d$Ivoire" OR Djibouti OR Egypt OR Eritrea OR Eswatini OR Ethiopia OR Gabon OR Gambia OR Ghana OR Guinea OR "haute volta" OR "Ivory Coast" OR Jamahiriya OR Kenya OR Lesotho OR Liberia OR Libya OR Madagascar OR Malawi OR Mali OR Mauritania OR Mauritius OR Mayotte OR Morocco OR Mozambique OR Namibia OR Niger OR Nigeria OR Principe OR Rwanda OR "Sao Tome" OR Senegal OR Seychelles OR "Sierra Leone" OR Somalia OR St$Helena OR Sudan OR Swaziland OR Tanzania OR Togo OR Tunisia OR Uganda OR "upper volta" OR urundi OR "Western Sahara" OR Zaire OR Zambia OR Zimbabwe)
1	CVD	TI=("acute coronary" OR "anomalous pulmonary venous connection" OR "aorta coarctation" OR "aortic aneurysm*" OR "aortic atresia" OR "aortic disease*" OR "aortic dissection*" OR "aortic incompetence" OR "aortic insufficiency" OR "aortic regurgitation" OR "aortic stenoses" OR "aortic stenosis" OR "aortic valve disease*" OR "aortic valve disorder*" OR "aortic valve incompetence" OR "aortic valve insufficiency" OR "aorticopulmonary" OR "aortopulmonary" OR "apical balloon*" OR apople* OR "atherosclerosis" OR "atherosclerosis" OR "atrial defect*" OR "atrial fibrillation*" OR "atrial flutter*" OR "atrial septal defect" OR "atrioventricular dissociation*" OR "atrioventricular septal defect*" OR "auricular fibrillation*" OR "auricular flutter*" OR "bicuspid aortic valve" OR "bicuspid valve" OR "bradyarrhythmia*" OR bradycardia* OR "brain apoplex*" OR "brain emboli*" OR "brain infarct*" OR "brain isch$emi*" OR "brain thrombo*" OR "brain vascular accident*" OR "broken heart syndrome" OR "brugada syndrome" OR "cardiac abnormalit*" OR "cardiac arrhythmia*" OR "cardiac backward failure" OR "cardiac channelopathies" OR "cardiac channelopathy" OR "cardiac concussion*" OR "cardiac congestive failure" OR "cardiac defect*" OR "cardiac disease*" OR "cardiac disorder*" OR "cardiac edema" OR "cardiac failure" OR "cardiac incompetence" OR "cardiac insufficiency" OR "cardiac malformation*" OR "cardiac oedema" OR "cardiac syndrome*" OR "cardiac tamponade" OR "cardiac toxicities" OR "cardiac toxicity" OR "cardial abnormal*" OR "cardial decompensation" OR "cardial disease*" OR "cardial disorder*" OR "cardial insufficiency" OR "cardial malformation*" OR "cardial syndrome*" OR cardiomyopathies OR cardiomyopathy OR cardiotoxicities OR cardiotoxicity OR "cardiovascular abnormal*" OR "cardiovascular disease*" OR "cardiovascular disorder*" OR "cardiovascular malformation*" OR "cardiovascular syndrome*" OR "cerebellar* accident*" OR "cerebellar* apoplex*" OR "cerebellar* emboli*" OR "cerebellar* infarct*" OR "cerebellar* isch$emi*" OR "cerebellar* thrombo*" OR "cerebellar* vascular accident*" OR "cerebellum* accident*" OR "cerebellum* apoplex*" OR "cerebellum*

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		OR "aortic dissection*" OR "aortic incompetence" OR "aortic insufficiency" OR "aortic regurgitation" OR "aortic stenoses" OR "aortic stenosis" OR "aortic valve disease*" OR "aortic valve disorder*" OR "aortic valve incompetence" OR "aortic valve insufficiency" OR "aorticopulmonary" OR "aortopulmonary" OR "apical balloon*" OR apople* OR "atheroscleroses" OR "atherosclerosis" OR "atrial defect*" OR "atrial fibrillation*" OR "atrial flutter*" OR "atrial septal defect" OR "atrioventricular dissociation*" OR "atrioventricular septal defect*" OR "auricular fibrillation*" OR "auricular flutter*" OR "bicuspid aortic valve" OR "bicuspid valve" OR "bradyarrhythmia*" OR bradycardia* OR "brain apoplex*" OR "brain emboli*" OR "brain infarct*" OR "brain isch$emi*" OR "brain thrombo*" OR "brain vascular accident*" OR "broken heart syndrome" OR "brugada syndrome" OR "cardiac abnormalit*" OR "cardiac arrhythmia*" OR "cardiac backward failure" OR "cardiac channelopathies" OR "cardiac channelopathy" OR "cardiac concussion*" OR "cardiac congestive failure" OR "cardiac defect*" OR "cardiac disease*" OR "cardiac disorder*" OR "cardiac edema" OR "cardiac failure" OR "cardiac incompetence" OR "cardiac insufficiency" OR "cardiac malformation*" OR "cardiac oedema" OR "cardiac syndrome*" OR "cardiac tamponade" OR "cardiac toxicities" OR "cardiac toxicity" OR "cardial abnormal*" OR "cardial decompensation" OR "cardial disease*" OR "cardial disorder*" OR "cardial insufficiency" OR "cardial malformation*" OR "cardial syndrome*" OR cardiomyopathies OR cardiomyopathy OR cardiotoxicities OR cardiotoxicity OR "cardiovascular abnormal*" OR "cardiovascular disease*" OR "cardiovascular disorder*" OR "cardiovascular malformation*" OR "cardiovascular syndrome*" OR "cerebellar* accident*" OR "cerebellar* apoplex*" OR "cerebellar* emboli*" OR "cerebellar* infarct*" OR "cerebellar* isch$emi*" OR "cerebellar* thrombo*" OR "cerebellar* vascular accident*" OR "cerebellum* accident*" OR "cerebellum* apoplex*" OR "cerebellum* emboli*" OR "cerebellum* infarct*" OR "cerebellum* isch$emi*" OR "cerebellum* thrombo*" OR "cerebellum* vascular accident*" OR "cerebral accident*" OR "cerebral apoplex*" OR "cerebral emboli*" OR "cerebral haemorrhage*" OR "cerebral hemorrhage*" OR "cerebral infarct*" OR "cerebral isch$emi*" OR "cerebral thrombo*" OR "cerebral vascular accident*" OR "cerebrovascular accident*" OR "cerebrovascular apoplex*" OR "cerebrovascular emboli*" OR "cerebrovascular infarct*" OR "cerebrovascular isch$emi*" OR "cerebrovascular thrombo*" OR "cerebrovascular vascular accident*" OR chylopericardium* OR "commotio cordis" OR "congenital aorticopulmonary" OR "congenital aortopulmonary" OR "congenital atrial" OR "congenital cardiac*" OR "congenital cardiovascular" OR "congenital coronary" OR "congenital heart" OR "congenital intraventricular" OR "congenital septal*" OR "congenital ventricular" OR "coronary arterial disease*" OR "coronary arterioscleroses" OR "coronary arteriosclerosis" OR "coronary artery disease*" OR "coronary failure" OR "coronary insufficiency" OR "coronary vessel anomal*" OR "cvd" OR "cyanotic cardiac abnormalities" OR "cyanotic heart" OR "decompensatio cordis" OR "dextrocardia" OR "diastolic dysfunction" OR "dissecting aneurysm*" OR "double outlet right ventricle" OR "ebstein abnormality" OR "ebstein anomaly" OR "ebstein malformation" OR "ebstein$s anomaly" OR "ebstein$s malformation" OR "ebsteins abnormality" OR "ectopia cordis" OR "endocardial fibroelastoses" OR "endocardial fibroelastosis" OR "endocarditides" OR "endocarditis" OR "endomyocardial fibroses" OR "endomyocardial fibrosis" OR "extrasystoles" OR fallot OR "foramen ovale" OR "great arteries transposition" OR "great vessels transposition" OR "haemopericardium" OR "heart abnormal*" OR "heart arrhythmia*" OR "heart attack*" OR "heart backward failure" OR "heart block" OR "heart blocks" OR "heart decompensation" OR "heart decompression" OR "heart defect" OR "heart disease*" OR "heart disorder*" OR "heart edema" OR "heart failure" OR "heart incompetence" OR "heart insufficiency" OR "heart malformation*" OR "heart oedema" OR "heart overload" OR "heart syndrome*" OR "heart valve disease*" OR "heart ventricle failure" OR "hemopericardium" OR "hypoplastic heart" OR "insufficientia cardis" OR "insufficientia ventriculi" OR "intracerebral accident*" OR "intracerebral apoplex*" OR "intracerebral emboli*" OR "intracerebral infarct*" OR "intracerebral

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Table S2. Web of Science search terms-without Africa filter

Set	Concept	Search
4	Publication years	#3 AND PY=(1971-2021)
3	Combined search	#1 NOT #2
2	Excluded words	TI=(animal OR animals OR "congo red" OR "aspergillus niger" OR animal model* OR animal stud* OR animal experiment* OR ape OR apes OR bat OR bats OR cats OR chimpanzee OR chimpanzees OR dogs OR "guinea pig" OR "guinea pigs" OR goats OR mice OR monkey OR monkeys OR pigs OR primate OR primates OR rabbits OR rat OR rats OR rodent* OR sheep OR sheeps) OR AB=("congo red" OR "aspergillus niger" OR animal model* OR animal stud* OR animal experiment* OR ape OR apes OR bat OR bats OR cats OR chimpanzee OR chimpanzees OR dogs OR "guinea pig" OR "guinea pigs" OR goats OR mice OR monkey OR monkeys OR pigs OR primate OR primates OR rabbits OR rat OR rats OR rodent* OR sheep OR sheeps) OR AK=("congo red" OR "aspergillus niger" OR animal model* OR animal stud* OR animal experiment* OR ape OR apes OR bat OR bats OR cats OR chimpanzee OR chimpanzees OR dogs OR "guinea pig" OR "guinea pigs" OR goats OR mice OR monkey OR monkeys OR pigs OR primate OR primates OR rabbits OR rat OR rats OR rodent* OR sheep OR sheeps) OR KP=("congo red" OR "aspergillus niger" OR animal model* OR animal stud* OR animal experiment* OR ape OR apes OR bat OR bats OR cats OR chimpanzee OR chimpanzees OR dogs OR "guinea pig" OR "guinea pigs" OR goats OR mice OR monkey OR monkeys OR pigs OR primate OR primates OR rabbits OR rat OR rats OR rodent* OR sheep OR sheeps)
1	CVD	TI=("acute coronary" OR "anomalous pulmonary venous connection" OR "aorta coarctation" OR "aortic aneurysm*" OR "aortic atresia" OR "aortic disease*" OR "aortic dissection*" OR "aortic incompetence" OR "aortic insufficiency" OR "aortic regurgitation" OR "aortic stenoses" OR "aortic stenosis" OR "aortic valve disease*" OR "aortic valve disorder*" OR "aortic valve incompetence" OR "aortic valve insufficiency" OR "aorticopulmonary" OR "aortopulmonary" OR "apical balloon*" OR apople* OR "atherosclerosis" OR "atherosclerosis" OR "atrial defect*" OR "atrial fibrillation*" OR "atrial flutter*" OR "atrial septal defect" OR "atrioventricular dissociation*" OR "atrioventricular septal defect*" OR "auricular fibrillation*" OR "auricular flutter*" OR "bicuspid aortic valve" OR "bicuspid valve" OR "bradyarrhythmia*" OR bradycardia* OR "brain apoplex*" OR "brain emboli*" OR "brain infarct*" OR "brain isch$emi*" OR "brain thrombo*" OR "brain vascular accident*" OR "broken heart syndrome" OR "brugada syndrome" OR "cardiac abnormalit*" OR "cardiac arrhythmia*" OR "cardiac backward failure" OR "cardiac channelopathies" OR "cardiac channelopathy" OR "cardiac concussion*" OR "cardiac congestive failure" OR "cardiac defect*" OR "cardiac disease*" OR "cardiac disorder*" OR "cardiac edema" OR "cardiac failure" OR "cardiac incompetence" OR "cardiac insufficiency" OR "cardiac malformation*" OR "cardiac oedema" OR "cardiac syndrome*" OR "cardiac tamponade" OR "cardiac toxicities" OR "cardiac toxicity" OR "cardial abnormal*" OR "cardial decompensation" OR "cardial disease*" OR "cardial disorder*" OR "cardial insufficiency" OR "cardial malformation*" OR "cardial syndrome*" OR cardiomyopathies OR cardiomyopathy OR cardiotoxicities OR cardiotoxicity OR "cardiovascular abnormal*" OR "cardiovascular disease*" OR "cardiovascular disorder*" OR "cardiovascular malformation*" OR "cardiovascular syndrome*" OR

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		"heart ventricle failure" OR "hemopericardium" OR "hypoplastic heart" OR "insufficientia cardis" OR "insufficientia ventriculi" OR "intracerebral accident*" OR "intracerebral apoplex*" OR "intracerebral emboli*" OR "intracerebral infarct*" OR "intracerebral isch$emi*" OR "intracerebral thrombo*" OR "intracerebral vascular accident*" OR "intracranial accident*" OR "intracranial apoplex*" OR "intracranial emboli*" OR "intracranial infarct*" OR "intracranial isch$emi*" OR "intracranial thrombo*" OR "intracranial vascular accident*" OR "left main coronary disease" OR "left main disease*" OR "long qt syndrome" OR "mitral incompetence" OR "mitral insufficiency" OR "mitral stenoses" OR "mitral stenosis" OR "mitral valve prolapse*" OR "mitral valve stenoses" OR "mitral valve stenosis" OR "myocardial concussion*" OR "myocardial disease*" OR "myocardial failure" OR "myocardial infarct*" OR "myocardial infarction*" OR "myocardial insufficiency" OR "myocardial ischemia*" OR "myocardiopathy" OR "myocarditis" OR "nonrheumatic valvular disease*" OR "non-rheumatic valvular disease*" OR nstemi OR parasystole* OR "patent ductus arteriosus" OR "pericardial constriction" OR "pericardial disease*" OR "pericardial effusion" OR "pericardial tamponade" OR "pericardial toxicities" OR "pericardial toxicity" OR "pericarditis" OR "peripheral arterial disease*" OR "peripheral artery disease*" OR "persistent ductus arteriosus" OR "pleuropericarditis" OR "preexcitation syndrome*" OR "pre-excitation syndrome*" OR "pulmonary atresia" OR "pulmonary embolism*" OR "pulmonary incompetence" OR "pulmonary stenoses" OR "pulmonary stenosis" OR "pulmonary thromboembolism*" OR "pulmonic insufficiency" OR "pulmonic stenoses" OR "pulmonic stenosis" OR "pyopericardium" OR "reduced left ventricular function" OR "rheumatic aortic" OR "rheumatic mitral" OR "rheumatic pulmonary" OR "rheumatic tricuspid" OR "rheumatic valve disease*" OR "right bundle branch block" OR "septal defect" OR "single ventricle*" OR stemi OR stroke OR strokes OR "subarachnoid h$emorrhage*" OR "subcortical infarct*" OR "sudden cardiac death" OR "systolic dysfunction" OR tachyarrhythmia* OR takotsubo OR "tako-tsubo" OR "thromboembolism*" OR thromboses OR thrombosis OR "total anomalous pulmonary venous connection" OR "transient isch$emic attack*" OR "tricuspid atresia" OR "tricuspid incompetence" OR "tricuspid stenoses" OR "tricuspid stenosis" OR "tricuspid valve prolapse*" OR "tricuspid valve stenoses" OR "tricuspid valve stenosis" OR "truncus arteriosus" OR "univentricular heart " OR "unstable angina*" OR "valve atresia*" OR "vascular disease*" OR "venous thromboembolic disease*" OR "venous thromboembolism" OR "ventricle insufficiency" OR "ventricular arrhythmia*" OR "ventricular defect*" OR "ventricular dysfunction" OR "ventricular fibrillation*" OR "ventricular flutter*" OR "ventricular insufficiency" OR "ventricular septal defect*" OR "ventricular tachycardia" OR "hypertension" OR "dyslipidemia*" OR "dyslipoproteinaemia*" OR "dyslipoproteinemia*" OR "hypercholesterolaemia*" OR "hypercholesterolemia*" OR "hyperlipaemia*" OR "hyperlipemia*" OR "hyperlipidaemia*" OR "hyperlipidemia*" OR "hyperlipoproteinemia*" OR "hypertriglyceridaemia*" OR "hypertriglyceridemia*" OR "high blood pressure" OR "elevated blood pressure" OR "raised blood pressure") OR KP=("acute coronary" OR "anomalous pulmonary venous connection" OR "aorta coarctation" OR "aortic aneurysm*" OR "aortic atresia" OR "aortic disease*" OR "aortic dissection*" OR "aortic incompetence" OR "aortic insufficiency" OR "aortic regurgitation" OR "aortic stenoses" OR "aortic stenosis" OR "aortic valve disease*" OR "aortic valve disorder*" OR "aortic valve incompetence" OR "aortic valve insufficiency" OR "aorticopulmonary" OR "aortopulmonary" OR "apical balloon*" OR apople* OR "atheroscleroses" OR "atherosclerosis" OR "atrial defect*" OR "atrial fibrillation*" OR "atrial flutter*" OR "atrial septal defect" OR "atrioventricular dissociation*" OR "atrioventricular septal defect*" OR "auricular fibrillation*" OR "auricular flutter*" OR "bicuspid aortic valve" OR "bicuspid valve" OR "bradyarrhythmia*" OR bradycardia* OR "brain apoplex*" OR "brain emboli*" OR "brain infarct*" OR "brain isch$emi*" OR "brain thrombo*" OR "brain vascular accident*" OR "broken heart syndrome" OR "brugada syndrome" OR "cardiac abnormalit*" OR "cardiac arrhythmia*" OR "cardiac backward failure" OR "cardiac channelopathies" OR

		"cardiac channelopathy" OR "cardiac concussion*" OR "cardiac congestive failure" OR "cardiac defect*" OR "cardiac disease*" OR "cardiac disorder*" OR "cardiac edema" OR "cardiac failure" OR "cardiac incompetence" OR "cardiac insufficiency" OR "cardiac malformation*" OR "cardiac oedema" OR "cardiac syndrome*" OR "cardiac tamponade" OR "cardiac toxicities" OR "cardiac toxicity" OR "cardial abnormal*" OR "cardial decompensation" OR "cardial disease*" OR "cardial disorder*" OR "cardial insufficiency" OR "cardial malformation*" OR "cardial syndrome*" OR cardiomyopathies OR cardiomyopathy OR cardiotoxicities OR cardiotoxicity OR "cardiovascular abnormal*" OR "cardiovascular disease*" OR "cardiovascular disorder*" OR "cardiovascular malformation*" OR "cardiovascular syndrome*" OR "cerebellar* accident*" OR "cerebellar* apoplex*" OR "cerebellar* emboli*" OR "cerebellar* infarct*" OR "cerebellar* isch$emi*" OR "cerebellar* thrombo*" OR "cerebellar* vascular accident*" OR "cerebellum* accident*" OR "cerebellum* apoplex*" OR "cerebellum* emboli*" OR "cerebellum* infarct*" OR "cerebellum* isch$emi*" OR "cerebellum* thrombo*" OR "cerebellum* vascular accident*" OR "cerebral accident*" OR "cerebral apoplex*" OR "cerebral emboli*" OR "cerebral haemorrhage*" OR "cerebral hemorrhage*" OR "cerebral infarct*" OR "cerebral isch$emi*" OR "cerebral thrombo*" OR "cerebral vascular accident*" OR "cerebrovascular accident*" OR "cerebrovascular apoplex*" OR "cerebrovascular emboli*" OR "cerebrovascular infarct*" OR "cerebrovascular isch$emi*" OR "cerebrovascular thrombo*" OR "cerebrovascular vascular accident*" OR chylopericardium* OR "commotio cordis" OR "congenital aorticopulmonary" OR "congenital aortopulmonary" OR "congenital atrial" OR "congenital cardiac*" OR "congenital cardiovascular" OR "congenital coronary" OR "congenital heart" OR "congenital intraventricular" OR "congenital septal*" OR "congenital ventricular" OR "coronary arterial disease*" OR "coronary arterioscleroses" OR "coronary arteriosclerosis" OR "coronary artery disease*" OR "coronary failure" OR "coronary insufficiency" OR "coronary vessel anomal*" OR "cvd" OR "cyanotic cardiac abnormalities" OR "cyanotic heart" OR "decompensatio cordis" OR "dextrocardia" OR "diastolic dysfunction" OR "dissecting aneurysm*" OR "double outlet right ventricle" OR "ebstein abnormality" OR "ebstein anomaly" OR "ebstein malformation" OR "ebstein$s anomaly" OR "ebstein$s malformation" OR "ebsteins abnormality" OR "ectopia cordis" OR "endocardial fibroelastoses" OR "endocardial fibroelastosis" OR "endocarditides" OR "endocarditis" OR "endomyocardial fibroses" OR "endomyocardial fibrosis" OR "extrasystoles" OR fallot OR "foramen ovale" OR "great arteries transposition" OR "great vessels transposition" OR "haemopericardium" OR "heart abnormal*" OR "heart arrhythmia*" OR "heart attack*" OR "heart backward failure" OR "heart block" OR "heart blocks" OR "heart decompensation" OR "heart decompression" OR "heart defect" OR "heart disease*" OR "heart disorder*" OR "heart edema" OR "heart failure" OR "heart incompetence" OR "heart insufficiency" OR "heart malformation*" OR "heart oedema" OR "heart overload" OR "heart syndrome*" OR "heart valve disease*" OR "heart ventricle failure" OR "hemopericardium" OR "hypoplastic heart" OR "insufficientia cardis" OR "insufficientia ventriculi" OR "intracerebral accident*" OR "intracerebral apoplex*" OR "intracerebral emboli*" OR "intracerebral infarct*" OR "intracerebral isch$emi*" OR "intracerebral thrombo*" OR "intracerebral vascular accident*" OR "intracranial accident*" OR "intracranial apoplex*" OR "intracranial emboli*" OR "intracranial infarct*" OR "intracranial isch$emi*" OR "intracranial thrombo*" OR "intracranial vascular accident*" OR "left main coronary disease" OR "left main disease*" OR "long qt syndrome" OR "mitral incompetence" OR "mitral insufficiency" OR "mitral stenoses" OR "mitral stenosis" OR "mitral valve prolapse*" OR "mitral valve stenoses" OR "mitral valve stenosis" OR "myocardial concussion*" OR "myocardial disease*" OR "myocardial failure" OR "myocardial infarct*" OR "myocardial infarction*" OR "myocardial insufficiency" OR "myocardial ischemia*" OR "myocardiopathy" OR "myocarditis" OR "nonrheumatic valvular disease*" OR "non-rheumatic valvular disease*" OR nstemi OR parasystole* OR "patent ductus arteriosus" OR "pericardial constriction" OR "pericardial

		disease*" OR "pericardial effusion" OR "pericardial tamponade" OR "pericardial toxicities" OR "pericardial toxicity" OR "pericarditis" OR "peripheral arterial disease*" OR "peripheral artery disease*" OR "persistent ductus arteriosus" OR "pleuropericarditis" OR "preexcitation syndrome*" OR "pre-excitation syndrome*" OR "pulmonary atresia" OR "pulmonary embolism*" OR "pulmonary incompetence" OR "pulmonary stenoses" OR "pulmonary stenosis" OR "pulmonary thromboembolism*" OR "pulmonic insufficiency" OR "pulmonic stenoses" OR "pulmonic stenosis" OR "pyopericardium" OR "reduced left ventricular function" OR "rheumatic aortic" OR "rheumatic mitral" OR "rheumatic pulmonary" OR "rheumatic tricuspid" OR "rheumatic valve disease*" OR "right bundle branch block" OR "septal defect" OR "single ventricle*" OR stemi OR stroke OR strokes OR "subarachnoid h$emorrhage*" OR "subcortical infarct*" OR "sudden cardiac death" OR "systolic dysfunction" OR tachyarrhythmia* OR takotsubo OR "tako-tsubo" OR "thromboembolism*" OR thromboses OR thrombosis OR "total anomalous pulmonary venous connection" OR "transient isch$emic attack*" OR "tricuspid atresia" OR "tricuspid incompetence" OR "tricuspid stenoses" OR "tricuspid stenosis" OR "tricuspid valve prolapse*" OR "tricuspid valve stenoses" OR "tricuspid valve stenosis" OR "truncus arteriosus" OR "univentricular heart " OR "unstable angina*" OR "valve atresia*" OR "vascular disease*" OR "venous thromboembolic disease*" OR "venous thromboembolism" OR "ventricle insufficiency" OR "ventricular arrhythmia*" OR "ventricular defect*" OR "ventricular dysfunction" OR "ventricular fibrillation*" OR "ventricular flutter*" OR "ventricular insufficiency" OR "ventricular septal defect*" OR "ventricular tachycardia" OR "hypertension" OR "dyslipidemia*" OR "dyslipoproteinaemia*" OR "dyslipoproteinemia*" OR "hypercholesterolaemia*" OR "hypercholesterolemia*" OR "hyperlipaemia*" OR "hyperlipemia*" OR "hyperlipidaemia*" OR "hyperlipidemia*" OR "hyperlipoproteinemia*" OR "hypertriglyceridaemia*" OR "hypertriglyceridemia*" OR "high blood pressure" OR "elevated blood pressure" OR "raised blood pressure")

Table S3. Web of Science search strategies for selected cardiovascular research domains

Concept	Search
Filter	(TI=(Africa OR African OR Algeria OR Angola OR Benin OR "Botswana" OR Burkina Faso OR Burundi OR "Cameroon" OR "Cape Verde" OR Chad OR Comoros OR Congo OR "Cote d$Ivoire" OR Djibouti OR Egypt OR Eritrea OR Ethiopia OR Swaziland OR Eswatini OR Gambia OR Ghana OR Guinea OR "haute volta" OR "Ivory Coast" OR Jamahiriya OR Kenya OR Lesotho OR Liberia OR Libya OR Madagascar OR Malawi OR Mali OR Mauritania OR Mauritius OR Mayotte OR Morocco OR Mozambique OR Namibia OR Niger OR Nigeria OR Principe OR Rwanda OR "Sao Tome" OR Senegal OR Seychelles OR "Sierra Leone" OR Somalia OR St$Helena OR Sudan OR Swaziland OR Tanzania OR Togo OR Tunisia OR Uganda OR "upper volta" OR urundi OR "Western Sahara" OR Zaire OR Zambia OR Zimbabwe) OR AB=(Africa OR African OR Algeria OR Angola OR Benin OR "Botswana" OR Burkina Faso OR Burundi OR "Cameroon" OR "Cape Verde" OR Chad OR Comoros OR Congo OR "Cote d$Ivoire" OR Djibouti OR Egypt OR Eritrea OR Ethiopia OR Swaziland OR Eswatini OR Gambia OR Ghana OR Guinea OR "haute volta" OR "Ivory Coast" OR Jamahiriya OR Kenya OR Lesotho OR Liberia OR Libya OR Madagascar OR Malawi OR Mali OR Mauritania OR Mauritius OR Mayotte OR Morocco OR Mozambique OR Namibia OR Niger OR Nigeria OR Principe OR Rwanda OR "Sao Tome" OR Senegal OR Seychelles OR "Sierra Leone" OR Somalia OR St$Helena OR Sudan OR Swaziland OR Tanzania OR Togo OR Tunisia OR Uganda OR "upper volta" OR urundi OR "Western Sahara" OR Zaire OR Zambia OR Zimbabwe) OR AK=(Africa OR African OR Algeria OR Angola OR Benin OR "Botswana" OR Burkina Faso OR Burundi OR "Cameroon" OR "Cape Verde" OR Chad OR Comoros OR Congo OR "Cote d$Ivoire" OR Djibouti OR Egypt OR Eritrea OR Ethiopia OR Swaziland OR Eswatini OR Gambia OR Ghana OR Guinea OR "haute volta" OR "Ivory Coast" OR Jamahiriya OR Kenya OR Lesotho OR Liberia OR Libya OR Madagascar OR Malawi OR Mali OR Mauritania OR Mauritius OR Mayotte OR Morocco OR Mozambique OR Namibia OR Niger OR Nigeria OR Principe OR Rwanda OR "Sao Tome" OR Senegal OR Seychelles OR "Sierra Leone" OR Somalia OR St$Helena OR Sudan OR Swaziland OR Tanzania OR Togo OR Tunisia OR Uganda OR "upper volta" OR urundi OR "Western Sahara" OR Zaire OR Zambia OR Zimbabwe) OR KP=(Africa OR African OR Algeria OR Angola OR Benin OR "Botswana" OR Burkina Faso OR Burundi OR "Cameroon" OR "Cape Verde" OR Chad OR Comoros OR Congo OR "Cote d$Ivoire" OR Djibouti OR Egypt OR Eritrea OR Ethiopia OR Swaziland OR Eswatini OR Gambia OR Ghana OR Guinea OR "haute volta" OR "Ivory Coast" OR Jamahiriya OR Kenya OR Lesotho OR Liberia OR Libya OR Madagascar OR Malawi OR Mali OR Mauritania OR Mauritius OR Mayotte OR Morocco OR Mozambique OR Namibia OR Niger OR Nigeria OR Principe OR Rwanda OR "Sao Tome" OR Senegal OR Seychelles OR "Sierra Leone" OR Somalia OR St$Helena OR Sudan OR Swaziland OR Tanzania OR Togo OR Tunisia OR Uganda OR "upper volta" OR urundi OR "Western Sahara" OR Zaire OR Zambia OR Zimbabwe) OR CU=(Africa OR African OR Algeria OR Angola OR Benin OR "Botswana" OR Burkina Faso OR Burundi OR "Cameroon" OR "Cape Verde" OR Chad OR Comoros OR Congo OR "Cote d$Ivoire" OR Djibouti OR Egypt OR Eritrea OR Ethiopia OR Swaziland OR Eswatini OR Gambia OR Ghana OR Guinea OR "haute volta" OR "Ivory Coast" OR Jamahiriya OR Kenya OR Lesotho OR Liberia OR Libya OR Madagascar OR Malawi OR Mali OR Mauritania OR Mauritius OR Mayotte OR Morocco OR Mozambique OR Namibia OR Niger OR Nigeria OR Principe OR Rwanda OR "Sao Tome" OR Senegal OR Seychelles OR "Sierra Leone" OR Somalia OR St$Helena OR Sudan OR Swaziland OR Tanzania OR Togo OR Tunisia OR Uganda OR "upper volta" OR urundi OR "Western Sahara" OR Zaire OR Zambia OR Zimbabwe)) NOT (TI=(animal OR animals OR "african american*" OR "african ancestry" OR "african descent" OR "congo red" OR

	"aspergillus niger" OR animal model* OR animal stud* OR animal experiment* OR ape OR apes OR bat OR bats OR cats OR chimpanzee OR chimpanzees OR dogs OR "guinea pig" OR "guinea pigs" OR goats OR mice OR monkey OR monkeys OR pigs OR primate OR primates OR rabbits OR rat OR rats OR rodent* OR sheep OR sheeps) OR AB=("african american*" OR "african ancestry" OR "african descent" OR "congo red" OR "aspergillus niger" OR animal model* OR animal stud* OR animal experiment* OR ape OR apes OR bat OR bats OR cats OR chimpanzee OR chimpanzees OR dogs OR "guinea pig" OR "guinea pigs" OR goats OR mice OR monkey OR monkeys OR pigs OR primate OR primates OR rabbits OR rat OR rats OR rodent* OR sheep OR sheeps) OR AK=("african american*" OR "african ancestry" OR "african descent" OR "congo red" OR "aspergillus niger" OR animal model* OR animal stud* OR animal experiment* OR ape OR apes OR bat OR bats OR cats OR chimpanzee OR chimpanzees OR dogs OR "guinea pig" OR "guinea pigs" OR goats OR mice OR monkey OR monkeys OR pigs OR primate OR primates OR rabbits OR rat OR rats OR rodent* OR sheep OR sheeps) OR KP=("african american*" OR "african ancestry" OR "african descent" OR "congo red" OR "aspergillus niger" OR animal model* OR animal stud* OR animal experiment* OR ape OR apes OR bat OR bats OR cats OR chimpanzee OR chimpanzees OR dogs OR "guinea pig" OR "guinea pigs" OR goats OR mice OR monkey OR monkeys OR pigs OR primate OR primates OR rabbits OR rat OR rats OR rodent* OR sheep OR sheeps)) AND PY=(1971-2021)
Coronary artery disease	(TI=("acute coronary" OR "coronary arterial disease*" OR "coronary arterioscleroses" OR "coronary arteriosclerosis" OR "coronary artery disease*" OR "coronary atherosclerosis" OR "heart attack*" OR "ischaemic heart disease" OR "ischemic heart disease" OR "left main coronary disease" OR "left main disease*" OR "myocardial infarct*" OR "myocardial ischemia*"OR "myocardial infarction*" OR "NSTEMI" OR "STEMI" OR "unstable angina*") OR AB=("acute coronary" OR "coronary arterial disease*" OR "coronary arterioscleroses" OR "coronary arteriosclerosis" OR "coronary artery disease*" OR "coronary atherosclerosis" OR "heart attack*" OR "ischaemic heart disease" OR "ischemic heart disease" OR "left main coronary disease" OR "left main disease*" OR "myocardial infarct*" OR "myocardial ischemia*"OR "myocardial infarction*" OR "NSTEMI" OR "STEMI" OR "unstable angina*") OR AK=("acute coronary" OR "coronary arterial disease*" OR "coronary arterioscleroses" OR "coronary arteriosclerosis" OR "coronary artery disease*" OR "coronary atherosclerosis" OR "heart attack*" OR "ischaemic heart disease" OR "ischemic heart disease" OR "left main coronary disease" OR "left main disease*" OR "myocardial infarct*" OR "myocardial ischemia*"OR "myocardial infarction*" OR "NSTEMI" OR "STEMI" OR "unstable angina*") OR KP=("acute coronary" OR "coronary arterial disease*" OR "coronary arterioscleroses" OR "coronary arteriosclerosis" OR "coronary artery disease*" OR "coronary atherosclerosis" OR "heart attack*" OR "ischaemic heart disease" OR "ischemic heart disease" OR "left main coronary disease" OR "left main disease*" OR "myocardial infarct*" OR "myocardial ischemia*"OR "myocardial infarction*" OR "NSTEMI" OR "STEMI" OR "unstable angina*")) AND **Filter**
Stroke	(TI=("apople* OR "brain apoplex* OR "brain emboli* OR "brain infarct" OR "brain infarct* OR "brain isch$emi* OR "brain thrombo* OR "brain vascular accident* OR "cerebellar* accident* OR "cerebellar* apoplex* OR "cerebellar* emboli*" OR "cerebellar* infarct*" OR "cerebellar* isch$emi*" OR "cerebellar* thrombo*" OR "cerebellar* vascular accident*" OR "cerebellum* accident*" OR "cerebellum* apoplex*" OR "cerebellum* emboli*" OR "cerebellum* infarct*" OR "cerebellum* isch$emi*" OR "cerebellum* thrombo*" OR "cerebellum* vascular accident*" OR "cerebral accident*" OR "cerebral apoplex*" OR "cerebral emboli*" OR "cerebral haemorrhage*" OR "cerebral hemorrhage*" OR "cerebral infarct*" OR "cerebral infarct*" OR "cerebral isch$emi*" OR "cerebral thrombo*" OR "cerebral vascular accident*" OR "cerebrovascular accident*" OR "cerebrovascular apoplex*" OR "cerebrovascular emboli*" OR "cerebrovascular infarct*" OR "cerebrovascular isch$emi*" OR "cerebrovascular thrombo*" OR "cerebrovascular vascular accident*" OR "intracerebral accident*" OR

	“intracerebral apoplex*” OR “intracerebral emboli*” OR “intracerebral infarct*” OR “intracerebral isch$emi*” OR “intracerebral thrombo*” OR “intracerebral vascular accident*” OR “intracranial accident*” OR “intracranial apoplex*” OR “intracranial emboli*” OR “intracranial infarct*” OR “intracranial isch$emi*” OR “intracranial thrombo*” OR “intracranial vascular accident*” OR “stroke” OR “strokes” OR “subarachnoid h$emorrhage*” OR “subcortical infarct*” OR “transient isch$emic attack*”) OR AB=(“apople* OR “brain apoplex* OR “brain emboli* OR “brain infarct” OR “brain infarct* OR “brain isch$emi* OR “brain thrombo* OR “brain vascular accident* OR “cerebellar* accident* OR “cerebellar* apoplex* OR “cerebellar* emboli*” OR “cerebellar* infarct*” OR “cerebellar* isch$emi*” OR “cerebellar* thrombo*” OR “cerebellar* vascular accident*” OR “cerebellum* accident*” OR “cerebellum* apoplex*” OR “cerebellum* emboli*” OR “cerebellum* infarct*” OR “cerebellum* isch$emi*” OR “cerebellum* thrombo*” OR “cerebellum* vascular accident*” OR “cerebral accident*” OR “cerebral apoplex*” OR “cerebral emboli*” OR “cerebral haemorrhage*” OR “cerebral hemorrhage*” OR “cerebral infarct*” OR “cerebral infarct*” OR “cerebral isch$emi*” OR “cerebral thrombo*” OR “cerebral vascular accident*” OR “cerebrovascular accident*” OR “cerebrovascular apoplex*” OR “cerebrovascular emboli*” OR “cerebrovascular infarct*” OR “cerebrovascular isch$emi*” OR “cerebrovascular thrombo*” OR “cerebrovascular vascular accident*” OR “intracerebral accident*” OR “intracerebral apoplex*” OR “intracerebral emboli*” OR “intracerebral infarct*” OR “intracerebral isch$emi*” OR “intracerebral thrombo*” OR “intracerebral vascular accident*” OR “intracranial accident*” OR “intracranial apoplex*” OR “intracranial emboli*” OR “intracranial infarct*” OR “intracranial isch$emi*” OR “intracranial thrombo*” OR “intracranial vascular accident*” OR “stroke” OR “strokes” OR “subarachnoid h$emorrhage*” OR “subcortical infarct*” OR “transient isch$emic attack*”) OR AK=(“apople* OR “brain apoplex* OR “brain emboli* OR “brain infarct” OR “brain infarct* OR “brain isch$emi* OR “brain thrombo* OR “brain vascular accident* OR “cerebellar* accident* OR “cerebellar* apoplex* OR “cerebellar* emboli*” OR “cerebellar* infarct*” OR “cerebellar* isch$emi*” OR “cerebellar* thrombo*” OR “cerebellar* vascular accident*” OR “cerebellum* accident*” OR “cerebellum* apoplex*” OR “cerebellum* emboli*” OR “cerebellum* infarct*” OR “cerebellum* isch$emi*” OR “cerebellum* thrombo*” OR “cerebellum* vascular accident*” OR “cerebral accident*” OR “cerebral apoplex*” OR “cerebral emboli*” OR “cerebral haemorrhage*” OR “cerebral hemorrhage*” OR “cerebral infarct*” OR “cerebral infarct*” OR “cerebral isch$emi*” OR “cerebral thrombo*” OR “cerebral vascular accident*” OR “cerebrovascular accident*” OR “cerebrovascular apoplex*” OR “cerebrovascular emboli*” OR “cerebrovascular infarct*” OR “cerebrovascular isch$emi*” OR “cerebrovascular thrombo*” OR “cerebrovascular vascular accident*” OR “intracerebral accident*” OR “intracerebral apoplex*” OR “intracerebral emboli*” OR “intracerebral infarct*” OR “intracerebral isch$emi*” OR “intracerebral thrombo*” OR “intracerebral vascular accident*” OR “intracranial accident*” OR “intracranial apoplex*” OR “intracranial emboli*” OR “intracranial infarct*” OR “intracranial isch$emi*” OR “intracranial thrombo*” OR “intracranial vascular accident*” OR “stroke” OR “strokes” OR “subarachnoid h$emorrhage*” OR “subcortical infarct*” OR “transient isch$emic attack*”) OR KP=(“apople* OR “brain apoplex* OR “brain emboli* OR “brain infarct” OR “brain infarct* OR “brain isch$emi* OR “brain thrombo* OR “brain vascular accident* OR “cerebellar* accident* OR “cerebellar* apoplex* OR “cerebellar* emboli*” OR “cerebellar* infarct*” OR “cerebellar* isch$emi*” OR “cerebellar* thrombo*” OR “cerebellar* vascular accident*” OR “cerebellum* accident*” OR “cerebellum* apoplex*” OR “cerebellum* emboli*” OR “cerebellum* infarct*” OR “cerebellum* isch$emi*” OR “cerebellum* thrombo*” OR “cerebellum* vascular accident*” OR “cerebral accident*” OR “cerebral apoplex*” OR “cerebral emboli*” OR “cerebral haemorrhage*” OR “cerebral hemorrhage*” OR “cerebral infarct*” OR “cerebral infarct*” OR “cerebral isch$emi*” OR “cerebral thrombo*” OR “cerebral vascular accident*” OR “cerebrovascular accident*” OR “cerebrovascular apoplex*” OR “cerebrovascular emboli*” OR “cerebrovascular infarct*” OR “cerebrovascular isch$emi*” OR “cerebrovascular thrombo*” OR “cerebrovascular vascular accident*” OR

	“intracerebral accident*” OR “intracerebral apoplex*” OR “intracerebral emboli*” OR “intracerebral infarct*” OR “intracerebral isch$emi*” OR “intracerebral thrombo*” OR “intracerebral vascular accident*” OR “intracranial accident*” OR “intracranial apoplex*” OR “intracranial emboli*” OR “intracranial infarct*” OR “intracranial isch$emi*” OR “intracranial thrombo*” OR “intracranial vascular accident*” OR “stroke” OR “strokes” OR “subarachnoid h$emorrhage*” OR “subcortical infarct*” OR “transient isch$emic attack*”)) AND **Filter**
Heart failure	(TI=(“backward cardiac failure” OR “backward heart failure” OR “cardiac backward failure” OR “cardiac congestive failure” OR “cardiac edema” OR “cardiac failure” OR “cardiac incompetence” OR “cardiac insufficiency” OR “cardiac oedema” OR “cardial decompensation” OR “cardial insufficiency” OR “cardiomyopathy” OR “coronary failure” OR “coronary insufficiency” OR “decompensatio cordis” OR “diastolic dysfunction” OR “heart backward failure” OR “heart decompensation” OR “heart decompression” OR “heart edema” OR “heart failure” OR “heart incompetence” OR “heart insufficiency” OR “heart oedema” OR “heart overload” OR “heart ventricle failure” OR “insufficientia cardis” OR “insufficientia ventriculi” OR “myocardial failure” OR “myocardial insufficiency” OR “reduced left ventricular function” OR “systolic dysfunction” OR “ventricle insufficiency” OR “ventricular dysfunction” OR “ventricular insufficiency”) OR AB=(“backward cardiac failure” OR “backward heart failure” OR “cardiac backward failure” OR “cardiac congestive failure” OR “cardiac edema” OR “cardiac failure” OR “cardiac incompetence” OR “cardiac insufficiency” OR “cardiac oedema” OR “cardial decompensation” OR “cardial insufficiency” OR “cardiomyopathy” OR “coronary failure” OR “coronary insufficiency” OR “decompensatio cordis” OR “diastolic dysfunction” OR “heart backward failure” OR “heart decompensation” OR “heart decompression” OR “heart edema” OR “heart failure” OR “heart incompetence” OR “heart insufficiency” OR “heart oedema” OR “heart overload” OR “heart ventricle failure” OR “insufficientia cardis” OR “insufficientia ventriculi” OR “myocardial failure” OR “myocardial insufficiency” OR “reduced left ventricular function” OR “systolic dysfunction” OR “ventricle insufficiency” OR “ventricular dysfunction” OR “ventricular insufficiency”) OR AK=(“backward cardiac failure” OR “backward heart failure” OR “cardiac backward failure” OR “cardiac congestive failure” OR “cardiac edema” OR “cardiac failure” OR “cardiac incompetence” OR “cardiac insufficiency” OR “cardiac oedema” OR “cardial decompensation” OR “cardial insufficiency” OR “cardiomyopathy” OR “coronary failure” OR “coronary insufficiency” OR “decompensatio cordis” OR “diastolic dysfunction” OR “heart backward failure” OR “heart decompensation” OR “heart decompression” OR “heart edema” OR “heart failure” OR “heart incompetence” OR “heart insufficiency” OR “heart oedema” OR “heart overload” OR “heart ventricle failure” OR “insufficientia cardis” OR “insufficientia ventriculi” OR “myocardial failure” OR “myocardial insufficiency” OR “reduced left ventricular function” OR “systolic dysfunction” OR “ventricle insufficiency” OR “ventricular dysfunction” OR “ventricular insufficiency”) OR KP=(“backward cardiac failure” OR “backward heart failure” OR “cardiac backward failure” OR “cardiac congestive failure” OR “cardiac edema” OR “cardiac failure” OR “cardiac incompetence” OR “cardiac insufficiency” OR “cardiac oedema” OR “cardial decompensation” OR “cardial insufficiency” OR “cardiomyopathy” OR “coronary failure” OR “coronary insufficiency” OR “decompensatio cordis” OR “diastolic dysfunction” OR “heart backward failure” OR “heart decompensation” OR “heart decompression” OR “heart edema” OR “heart failure” OR “heart incompetence” OR “heart insufficiency” OR “heart oedema” OR “heart overload” OR “heart ventricle failure” OR “insufficientia cardis” OR “insufficientia ventriculi” OR “myocardial failure” OR “myocardial insufficiency” OR “reduced left ventricular function” OR “systolic dysfunction” OR “ventricle insufficiency” OR “ventricular dysfunction” OR “ventricular insufficiency”)) AND **Filter**
Cardiomyopathies and	(TI=(“apical balloon*” OR “broken heart syndrome” OR “cardiomyopathies” OR “cardiomyopathy” OR “endocardial” OR “fibroelastoses” OR “endocardial fibroelastosis” OR “endomyocardial fibroses” OR “endomyocardial fibrosis” OR “myocardial disease*” OR “myocardiopathy” OR “myocarditis” OR “tako-tsubo” OR “takotsubo”) OR AB=(“apical balloon*” OR “broken heart syndrome” OR

myocarditis	“cardiomyopathies” OR “cardiomyopathy” OR “endocardial” OR “fibroelastoses” OR “endocardial fibroelastosis” OR “endomyocardial fibroses” OR “endomyocardial fibrosis” OR “myocardial disease*” OR “myocardiopathy” OR “myocarditis” OR “tako-tsubo” OR “takotsubo”) OR AK=(“apical balloon*” OR “broken heart syndrome” OR “cardiomyopathies” OR “cardiomyopathy” OR “endocardial” OR “fibroelastoses” OR “endocardial fibroelastosis” OR “endomyocardial fibroses” OR “endomyocardial fibrosis” OR “myocardial disease*” OR “myocardiopathy” OR “myocarditis” OR “tako-tsubo” OR “takotsubo”) OR KP=(“apical balloon*” OR “broken heart syndrome” OR “cardiomyopathies” OR “cardiomyopathy” OR “endocardial” OR “fibroelastoses” OR “endocardial fibroelastosis” OR “endomyocardial fibroses” OR “endomyocardial fibrosis” OR “myocardial disease*” OR “myocardiopathy” OR “myocarditis” OR “tako-tsubo” OR “takotsubo”)) AND **Filter**
Pericardial diseases	(TI=(“cardiac tamponade” OR “cardiac toxicities” OR “cardiac toxicity” OR “cardiotoxicities” OR “cardiotoxicity” OR “chylopericardium” OR “chylopericardiums” OR “haemopericardium” OR “hemopericardium” OR “pericardial constriction” OR “pericardial disease*” OR “pericardial effusion” OR “pericardial tamponade” OR “pericardial toxicities” OR “pericardial toxicity” OR “pericarditis” OR “pleuropericarditis” OR “pyopericardium”) OR AB=(“cardiac tamponade” OR “cardiac toxicities” OR “cardiac toxicity” OR “cardiotoxicities” OR “cardiotoxicity” OR “chylopericardium” OR “chylopericardiums” OR “haemopericardium” OR “hemopericardium” OR “pericardial constriction” OR “pericardial disease*” OR “pericardial effusion” OR “pericardial tamponade” OR “pericardial toxicities” OR “pericardial toxicity” OR “pericarditis” OR “pleuropericarditis” OR “pyopericardium”) OR AK=(“cardiac tamponade” OR “cardiac toxicities” OR “cardiac toxicity” OR “cardiotoxicities” OR “cardiotoxicity” OR “chylopericardium” OR “chylopericardiums” OR “haemopericardium” OR “hemopericardium” OR “pericardial constriction” OR “pericardial disease*” OR “pericardial effusion” OR “pericardial tamponade” OR “pericardial toxicities” OR “pericardial toxicity” OR “pericarditis” OR “pleuropericarditis” OR “pyopericardium”) OR KP=(“cardiac tamponade” OR “cardiac toxicities” OR “cardiac toxicity” OR “cardiotoxicities” OR “cardiotoxicity” OR “chylopericardium” OR “chylopericardiums” OR “haemopericardium” OR “hemopericardium” OR “pericardial constriction” OR “pericardial disease*” OR “pericardial effusion” OR “pericardial tamponade” OR “pericardial toxicities” OR “pericardial toxicity” OR “pericarditis” OR “pleuropericarditis” OR “pyopericardium”)) AND **Filter**
Endocarditis	(TI=(“endocarditis” OR “endocarditides”) OR AB=(“endocarditis” OR “endocarditides”) OR AK=(“endocarditis” OR “endocarditides”) OR KP=(“endocarditis” OR “endocarditides”)) AND **Filter**
Rheumatic heart disease	(TI=(“rheumatic heart disease*” OR “rheumatic mitral” OR “rheumatic aortic” OR “rheumatic tricuspid” OR “rheumatic pulmonary” OR “rheumatic valve disease*” OR “tricuspid stenosis” OR “tricuspid stenoses” OR “tricuspid valve stenosis” OR “tricuspid valve stenoses”) OR AB=(“rheumatic heart disease*” OR “rheumatic mitral” OR “rheumatic aortic” OR “rheumatic tricuspid” OR “rheumatic pulmonary” OR “rheumatic valve disease*” OR “tricuspid stenosis” OR “tricuspid stenoses” OR “tricuspid valve stenosis” OR “tricuspid valve stenoses”) OR AK=(“rheumatic heart disease*” OR “rheumatic mitral” OR “rheumatic aortic” OR “rheumatic tricuspid” OR “rheumatic pulmonary” OR “rheumatic valve disease*” OR “tricuspid stenosis” OR “tricuspid stenoses” OR “tricuspid valve stenosis” OR “tricuspid valve stenoses”) OR KP=(“rheumatic heart disease*” OR “rheumatic mitral” OR “rheumatic aortic” OR “rheumatic tricuspid” OR “rheumatic pulmonary” OR “rheumatic valve disease*” OR “tricuspid stenosis” OR “tricuspid stenoses” OR “tricuspid valve stenosis” OR “tricuspid valve stenoses”)) AND **Filter**

Non-rheumatic valvular diseases	(TI=(“aortic insufficiency” OR “aortic stenosis” OR “aortic stenoses” OR “bicuspid valve” OR “mitral insufficiency” OR “mitral stenosis” OR “mitral stenoses” OR “mitral valve prolapse*” OR “pulmonic insufficiency” OR “pulmonic stenosis” OR “pulmonic stenoses” OR “tricuspid stenosis” OR “tricuspid stenoses” OR “aortic heart disease*” OR “aortic incompetence” OR “aortic regurgitation” OR “aortic valve disease*” OR “aortic valve disorder*” OR “aortic valve incompetence” OR “aortic valve insufficiency” OR “aortic valvular heart disease*” OR “aortic valvular heart disorder*” OR “mitral stenosis” OR “mitral stenoses” OR “mitral valve stenoses” OR “mitral valve stenosis” OR “nonrheumatic valvular disease*” OR “non-rheumatic valvular disease*” OR “tricuspid valve prolapse*”) OR AB=(“aortic insufficiency” OR “aortic stenosis” OR “aortic stenoses” OR “bicuspid valve” OR “mitral insufficiency” OR “mitral stenosis” OR “mitral stenoses” OR “mitral valve prolapse*” OR “pulmonic insufficiency” OR “pulmonic stenosis” OR “pulmonic stenoses” OR “tricuspid stenosis” OR “tricuspid stenoses” OR “aortic heart disease*” OR “aortic incompetence” OR “aortic regurgitation” OR “aortic valve disease*” OR “aortic valve disorder*” OR “aortic valve incompetence” OR “aortic valve insufficiency” OR “aortic valvular heart disease*” OR “aortic valvular heart disorder*” OR “mitral stenosis” OR “mitral stenoses” OR “mitral valve stenoses” OR “mitral valve stenosis” OR “nonrheumatic valvular disease*” OR “non-rheumatic valvular disease*” OR “tricuspid valve prolapse*”) OR AK=(“aortic insufficiency” OR “aortic stenosis” OR “aortic stenoses” OR “bicuspid valve” OR “mitral insufficiency” OR “mitral stenosis” OR “mitral stenoses” OR “mitral valve prolapse*” OR “pulmonic insufficiency” OR “pulmonic stenosis” OR “pulmonic stenoses” OR “tricuspid stenosis” OR “tricuspid stenoses” OR “aortic heart disease*” OR “aortic incompetence” OR “aortic regurgitation” OR “aortic valve disease*” OR “aortic valve disorder*” OR “aortic valve incompetence” OR “aortic valve insufficiency” OR “aortic valvular heart disease*” OR “aortic valvular heart disorder*” OR “mitral stenosis” OR “mitral stenoses” OR “mitral valve stenoses” OR “mitral valve stenosis” OR “nonrheumatic valvular disease*” OR “non-rheumatic valvular disease*” OR “tricuspid valve prolapse*”) OR KP=(“aortic insufficiency” OR “aortic stenosis” OR “aortic stenoses” OR “bicuspid valve” OR “mitral insufficiency” OR “mitral stenosis” OR “mitral stenoses” OR “mitral valve prolapse*” OR “pulmonic insufficiency” OR “pulmonic stenosis” OR “pulmonic stenoses” OR “tricuspid stenosis” OR “tricuspid stenoses” OR “aortic heart disease*” OR “aortic incompetence” OR “aortic regurgitation” OR “aortic valve disease*” OR “aortic valve disorder*” OR “aortic valve incompetence” OR “aortic valve insufficiency” OR “aortic valvular heart disease*” OR “aortic valvular heart disorder*” OR “mitral stenosis” OR “mitral stenoses” OR “mitral valve stenoses” OR “mitral valve stenosis” OR “nonrheumatic valvular disease*” OR “non-rheumatic valvular disease*” OR “tricuspid valve prolapse*”)) AND **Filter**
Congenital heart disease	(TI=(“anomalous pulmonary venous connection” OR “aorta coarctation” OR “aortic atresia” OR “aortic incompetence” OR “aortic stenoses” OR “aortic stenosis” OR “aorticopulmonary” OR “aortopulmonary” OR “atrial defect*” OR “atrial septal defect” OR “atrioventricular septal defect*” OR “bicuspid aortic valve” OR “cardiac abnormalit*” OR “cardiac anomal*” OR “cardiac defect*” OR “cardiac malformation*” OR “congenital aorticopulmonary” OR “congenital aortopulmonary” OR “congenital atrial” OR “congenital cardiac*” OR “congenital cardiovascular” OR “congenital coronary” OR “congenital heart” OR “congenital intraventricular” OR “congenital septal*” OR “congenital ventricular” OR “cyanotic cardiac abnormalities” OR “cyanotic heart” OR “dextrocardia” OR “double outlet right ventricle” OR “ebstein abnormality” OR “ebstein anomaly” OR “ebstein malformation” OR “ebstein$s anomaly” OR ebstein$s malformation” OR “ebsteins abnormality” OR “ectopia cordis” OR “fallot” OR “fallot tetralogy” OR “foramen ovale” OR “great arteries transposition” OR “great vessels transposition” OR “heart defect” OR “hypoplastic heart” OR “mitral incompetence” OR “mitral stenosis” OR “mitral stenoses” OR “patent ductus arteriosus” OR “persistent ductus arteriosus” OR “pulmonary atresia” OR “pulmonary incompetence” OR “pulmonary stenoses” OR “pulmonary stenosis” OR “septal defect” OR “single ventricle*” OR “total anomalous pulmonary venous connection” OR “tricuspid atresia” OR “tricuspid incompetence” OR “tricuspid stenosis” OR “tricuspid stenoses” OR “truncus arteriosus” OR “univentricular heart” OR “valve

	atresia*” OR “ventricular defect*” OR “ventricular septal defect*”) OR AB=(“anomalous pulmonary venous connection” OR “aorta coarctation” OR “aortic atresia” OR “aortic incompetence” OR “aortic stenoses” OR “aortic stenosis” OR “aorticopulmonary” OR “aortopulmonary” OR “atrial defect*” OR “atrial septal defect” OR “atrioventricular septal defect*” OR “bicuspid aortic valve” OR “cardiac abnormalit*” OR “cardiac anomal*” OR “cardiac defect*” OR “cardiac malformation*” OR “congenital aorticopulmonary” OR “congenital aortopulmonary” OR “congenital atrial” OR “congenital cardiac*” OR “congenital cardiovascular” OR “congenital coronary” OR “congenital heart” OR “congenital intraventricular” OR “congenital septal*” OR “congenital ventricular” OR “cyanotic cardiac abnormalities” OR “cyanotic heart” OR “dextrocardia” OR “double outlet right ventricle” OR “ebstein abnormality” OR “ebstein anomaly” OR “ebstein malformation” OR “ebstein$s anomaly” OR ebstein$s malformation” OR “ebsteins abnormality” OR “ectopia cordis” OR “fallot” OR “fallot tetralogy” OR “foramen ovale” OR “great arteries transposition” OR “great vessels transposition” OR “heart defect” OR “hypoplastic heart” OR “mitral incompetence” OR “mitral stenosis” OR “mitral stenoses” OR “patent ductus arteriosus” OR “persistent ductus arteriosus” OR “pulmonary atresia” OR “pulmonary incompetence” OR “pulmonary stenoses” OR “pulmonary stenosis” OR "septal defect” OR “single ventricle*” OR “total anomalous pulmonary venous connection” OR “tricuspid atresia” OR “tricuspid incompetence” OR “tricuspid stenosis” OR “tricuspid stenoses” OR “truncus arteriosus” OR “univentricular heart” OR “valve atresia*” OR “ventricular defect*” OR “ventricular septal defect*”) OR AK=(“anomalous pulmonary venous connection” OR “aorta coarctation” OR “aortic atresia” OR “aortic incompetence” OR “aortic stenoses” OR “aortic stenosis” OR “aorticopulmonary” OR “aortopulmonary” OR “atrial defect*” OR “atrial septal defect” OR “atrioventricular septal defect*” OR “bicuspid aortic valve” OR “cardiac abnormalit*” OR “cardiac anomal*” OR “cardiac defect*” OR “cardiac malformation*” OR “congenital aorticopulmonary” OR “congenital aortopulmonary” OR “congenital atrial” OR “congenital cardiac*” OR “congenital cardiovascular” OR “congenital coronary” OR “congenital heart” OR “congenital intraventricular” OR “congenital septal*” OR “congenital ventricular” OR “cyanotic cardiac abnormalities” OR “cyanotic heart” OR “dextrocardia” OR “double outlet right ventricle” OR “ebstein abnormality” OR “ebstein anomaly” OR “ebstein malformation” OR “ebstein$s anomaly” OR ebstein$s malformation” OR “ebsteins abnormality” OR “ectopia cordis” OR “fallot” OR “fallot tetralogy” OR “foramen ovale” OR “great arteries transposition” OR “great vessels transposition” OR “heart defect” OR “hypoplastic heart” OR “mitral incompetence” OR “mitral stenosis” OR “mitral stenoses” OR “patent ductus arteriosus” OR “persistent ductus arteriosus” OR “pulmonary atresia” OR “pulmonary incompetence” OR “pulmonary stenoses” OR “pulmonary stenosis” OR “septal defect” OR “single ventricle*” OR “total anomalous pulmonary venous connection” OR “tricuspid atresia” OR “tricuspid incompetence” OR “tricuspid stenosis” OR “tricuspid stenoses” OR “truncus arteriosus” OR “univentricular heart” OR “valve atresia*” OR “ventricular defect*” OR “ventricular septal defect*”) OR KP=(“anomalous pulmonary venous connection” OR “aorta coarctation” OR “aortic atresia” OR “aortic incompetence” OR “aortic stenoses” OR “aortic stenosis” OR “aorticopulmonary” OR “aortopulmonary” OR “atrial defect*” OR “atrial septal defect” OR “atrioventricular septal defect*” OR “bicuspid aortic valve” OR “cardiac abnormalit*” OR “cardiac anomal*” OR “cardiac defect*” OR “cardiac malformation*” OR “congenital aorticopulmonary” OR “congenital aortopulmonary” OR “congenital atrial” OR “congenital cardiac*” OR “congenital cardiovascular” OR “congenital coronary” OR “congenital heart” OR “congenital intraventricular” OR “congenital septal*” OR “congenital ventricular” OR “cyanotic cardiac abnormalities” OR “cyanotic heart” OR “dextrocardia” OR “double outlet right ventricle” OR “ebstein abnormality” OR “ebstein anomaly” OR “ebstein malformation” OR “ebstein$s anomaly” OR ebstein$s malformation” OR “ebsteins abnormality” OR “ectopia cordis” OR “fallot” OR “fallot tetralogy” OR “foramen ovale” OR “great arteries transposition” OR “great vessels transposition” OR “heart defect” OR “hypoplastic heart” OR “mitral incompetence” OR “mitral stenosis” OR “mitral stenoses” OR “patent ductus arteriosus” OR “persistent ductus arteriosus” OR

	“pulmonary atresia” OR “pulmonary incompetence” OR “pulmonary stenoses” OR “pulmonary stenosis” OR “septal defect” OR “single ventricle*” OR “total anomalous pulmonary venous connection” OR “tricuspid atresia” OR “tricuspid incompetence” OR “tricuspid stenosis” OR “tricuspid stenoses” OR “truncus arteriosus” OR “univentricular heart” OR “valve atresia*” OR “ventricular defect*” OR “ventricular septal defect*”)) AND **Filter**
Atrial fibrillation/flutter and other arrhythmias	(TI=(“atrial fibrillation*” OR “atrial flutter*” OR “auricular fibrillation*” OR “brugada syndrome” OR “cardiac arrhythmia*” OR “cardiac channelopathies” OR “long qt syndrome” OR “sudden cardiac death” OR “ventricular arrhythmias” OR “heart arrhythmia” OR “ventricular fibrillation*” OR “ventricular tachycardia” OR “auricular flutter*” OR “ventricular flutter*” OR “cardiac channelopathy” OR “heart block” OR “heart blocks” OR “atrioventricular dissociation*” OR “bradyarrhythmias” OR “bradyarrhythmia” OR “right bundle branch block” OR “extrasystoles” OR “commotio cordis” OR “myocardial concussion*” OR “cardiac concussion*” OR “parasystole*” OR “pre-excitation syndrome*” OR “preexcitation syndrome*” OR “tachyarrhythmia” OR “tachyarrhythmias”) OR AB=(“atrial fibrillation*” OR “atrial flutter*” OR “auricular fibrillation*” OR “brugada syndrome” OR “cardiac arrhythmia*” OR “cardiac channelopathies” OR “long qt syndrome” OR “sudden cardiac death” OR “ventricular arrhythmias” OR “heart arrhythmia” OR “ventricular fibrillation*” OR “ventricular tachycardia” OR “auricular flutter*” OR “ventricular flutter*” OR “cardiac channelopathy” OR “heart block” OR “heart blocks” OR “atrioventricular dissociation*” OR “bradyarrhythmias” OR “bradyarrhythmia” OR “right bundle branch block” OR “extrasystoles” OR “commotio cordis” OR “myocardial concussion*” OR “cardiac concussion*” OR “parasystole*” OR “pre-excitation syndrome*” OR “preexcitation syndrome*” OR “tachyarrhythmia” OR “tachyarrhythmias”) OR AK=(“atrial fibrillation*” OR “atrial flutter*” OR “auricular fibrillation*” OR “brugada syndrome” OR “cardiac arrhythmia*” OR “cardiac channelopathies” OR “long qt syndrome” OR “sudden cardiac death” OR “ventricular arrhythmias” OR “heart arrhythmia” OR “ventricular fibrillation*” OR “ventricular tachycardia” OR “auricular flutter*” OR “ventricular flutter*” OR “cardiac channelopathy” OR “heart block” OR “heart blocks” OR “atrioventricular dissociation*” OR “bradyarrhythmias” OR “bradyarrhythmia” OR “right bundle branch block” OR “extrasystoles” OR “commotio cordis” OR “myocardial concussion*” OR “cardiac concussion*” OR “parasystole*” OR “pre-excitation syndrome*” OR “preexcitation syndrome*” OR “tachyarrhythmia” OR “tachyarrhythmias”) OR KP=(“atrial fibrillation*” OR “atrial flutter*” OR “auricular fibrillation*” OR “brugada syndrome” OR “cardiac arrhythmia*” OR “cardiac channelopathies” OR “long qt syndrome” OR “sudden cardiac death” OR “ventricular arrhythmias” OR “heart arrhythmia” OR “ventricular fibrillation*” OR “ventricular tachycardia” OR “auricular flutter*” OR “ventricular flutter*” OR “cardiac channelopathy” OR “heart block” OR “heart blocks” OR “atrioventricular dissociation*” OR “bradyarrhythmias” OR “bradyarrhythmia” OR “right bundle branch block” OR “extrasystoles” OR “commotio cordis” OR “myocardial concussion*” OR “cardiac concussion*” OR “parasystole*” OR “pre-excitation syndrome*” OR “preexcitation syndrome*” OR “tachyarrhythmia” OR “tachyarrhythmias”)) AND **Filter**
Peripheral artery disease	(TI=(“aortic aneurysm*” OR “aortic dissection*” OR “aortitis” OR “aortic plaque” OR “aortic disease*” OR dissecting aneurysm*” OR “peripheral arterial disease*” OR “peripheral artery disease*” OR “peripheral vascular disease*” OR “intermittent claudication” OR “critical limb ischemia” OR “critical limb ischemia” OR “critical limb ischaemia” OR “limb revascularization” OR “arterial occlusive disease”) OR AB=(“aortic aneurysm*” OR “aortic dissection*” OR “aortitis” OR “aortic plaque” OR “aortic disease*” OR dissecting aneurysm*” OR “peripheral arterial disease*” OR “peripheral artery disease*” OR “peripheral vascular disease*” OR “intermittent claudication” OR “critical limb ischemia” OR “critical limb ischemia” OR “critical limb ischaemia” OR “limb revascularization” OR “arterial occlusive disease”) OR AK=(“aortic aneurysm*” OR “aortic dissection*” OR “aortitis” OR “aortic plaque” OR “aortic disease*” OR dissecting aneurysm*” OR “peripheral arterial disease*” OR “peripheral artery disease*” OR “peripheral vascular disease*” OR “intermittent claudication” OR “critical

	limb ischemia" OR "critical limb ischemia" OR "critical limb ischaemia" OR "limb revascularization" OR "arterial occlusive disease") OR KP=("aortic aneurysm*" OR "aortic dissection*" OR "aortitis" OR "aortic plaque" OR "aortic disease*" OR dissecting aneurysm*" OR "peripheral arterial disease*" OR "peripheral artery disease*" OR "peripheral vascular disease*" OR "intermittent claudication" OR "critical limb ischemia" OR "critical limb ischemia" OR "critical limb ischaemia" OR "limb revascularization" OR "arterial occlusive disease")) AND **Filter**
Venous thromboembolism	(TI=("deep vein thrombosis" OR "deep vein thromboses" OR "pulmonary embolism*" OR "pulmonary thromboembolism*" OR "thromboembolism*" OR "venous thromboembolic disease*" OR "venous thromboembolism" OR "venous thrombosis") OR AB=("deep vein thrombosis" OR "deep vein thromboses" OR "pulmonary embolism*" OR "pulmonary thromboembolism*" OR "thromboembolism*" OR "venous thromboembolic disease*" OR "venous thromboembolism" OR "venous thrombosis") OR AK=("deep vein thrombosis" OR "deep vein thromboses" OR "pulmonary embolism*" OR "pulmonary thromboembolism*" OR "thromboembolism*" OR "venous thromboembolic disease*" OR "venous thromboembolism" OR "venous thrombosis") OR KP=("deep vein thrombosis" OR "deep vein thromboses" OR "pulmonary embolism*" OR "pulmonary thromboembolism*" OR "thromboembolism*" OR "venous thromboembolic disease*" OR "venous thromboembolism" OR "venous thrombosis")) AND **Filter**
Pulmonary hypertension	(TI=("pulmonary hypertension" OR "pulmonary arterial hypertension") OR AB=("pulmonary hypertension" OR "pulmonary arterial hypertension") OR AK=("pulmonary hypertension" OR "pulmonary arterial hypertension") OR KP=("pulmonary hypertension" OR "pulmonary arterial hypertension")) AND **Filter**

Table S4. Ranking of African countries according to publications, citations and h-index (based on general authorship)

Rank	Countries	Publications		Countries	Citations		Countries	h-index
1	South Africa	9055		South Africa	94404		South Africa	209
2	Egypt	7777		Egypt	35449		Egypt	111
3	Nigeria	2824		Nigeria	15310		Nigeria	87
4	Tunisia	2352		Tunisia	11885		Kenya	72
5	Morocco	1510		Morocco	6543		Tunisia	63
6	Ethiopia	984		Ethiopia	4419		Ghana	63
7	Ghana	829		Ghana	3619		Cameroon	61
8	Kenya	738		Cameroon	3612		Uganda	59
9	Algeria	679		Kenya	3211		Ethiopia	55
10	Cameroon	673		Uganda	3036		Tanzania	55
11	Uganda	667		Algeria	2384		Mozambique	52
12	Tanzania	519		Tanzania	2302		Morocco	50
13	Sudan	396		Mauritius	1993		Algeria	47
14	Mozambique	316		Malawi	1142		Zimbabwe	47
15	Senegal	266		Sudan	1011		Malawi	35
16	Malawi	229		DRC	896		Benin	34
17	Zimbabwe	226		Mozambique	878		Mauritius	32
18	DRC	192		Senegal	862		Sudan	32
19	Burkina Faso	162		Zimbabwe	838		Rwanda	32
20	Rwanda	158		Rwanda	708		DRC	27
21	Benin	151		Guinea	687		Zambia	27
222	Zambia	138		Libya	549		Senegal	26
23	Cote D'Ivoire	125		Gambia	533		Gambia	26
24	Botswana	122		Botswana	423		Seychelles	25
25	Libya	111		Burkina Faso	381		Libya	23
26	Guinea	105		Zambia	323		Botswana	23
27	Mauritius	99		Cote D'Ivoire	311		Cote D'Ivoire	22
28	Congo	85		Benin	254		Guinea	20
29	Gambia	84		Angola	218		Burkina Faso	20
30	Angola	82		Eritrea	174		Mali	17
31	Togo	73		Niger	155		Togo	16
32	Seychelles	72		Seychelles	128		Congo	16
33	Mali	60		Togo	109		Namibia	16
34	Namibia	55		Madagascar	109		Niger	14
35	Niger	51		Congo	79		Angola	13
36	Madagascar	45		Mali	79		Gabon	11
37	Gabon	33		Namibia	56		Eritrea	10
38	Sierra Leone	33		Gabon	37		Sierra Leone	10
39	Eritrea	21		Somalia	29		Liberia	9
40	Burundi	18		Lesotho	29		Madagascar	8
41	Liberia	17		Sierra Leone	28		Mauritania	7
42	Mauritania	17		Chad	14		CAR	5
43	CAR	14		CAR	13		Burundi	5
44	Swaziland	13		Burundi	6		Swaziland	5
45	Cape Verde	12		Liberia	4		Somalia	4
46	Somalia	11		Cape Verde	2		Lesotho	4
47	Chad	10		Mauritania	0		Chad	4

48	Lesotho	10		Swaziland	0		Cape Verde	4
49	Comoros	7		Comoros	0		Comoros	3
50	Djibouti	2		Djibouti	0		Djibouti	1

CAR: Central African Republic; DRC: Democratic Republic of Congo

Table S5. Ranking of African countries according to publication as general author, first author, and last author

Rank	Countries	Publications as general author	Publications as first author	Publications as last author
1	South Africa	9055	6052	6511
2	Egypt	7777	5292	5276
3	Nigeria	2824	2020	1956
4	Tunisia	2352	1939	1950
5	Morocco	1510	1302	1291
6	Ethiopia	984	754	710
7	Ghana	829	381	355
8	Kenya	738	323	354
9	Algeria	679	501	449
10	Cameroon	673	384	347
11	Uganda	667	267	249
12	Tanzania	519	229	225
13	Sudan	396	213	193
14	Mozambique	316	78	92
15	Senegal	266	161	177
16	Malawi	229	79	94
17	Zimbabwe	226	77	108
18	DRC	192	111	88
19	Burkina Faso	162	81	79
20	Rwanda	158	45	41
21	Benin	151	48	50
222	Zambia	138	53	48
23	Cote D'Ivoire	125	67	69
24	Botswana	122	59	59
25	Libya	111	54	64
26	Guinea	105	51	49
27	Mauritius	99	40	48
28	Congo	85	38	40
29	Gambia	84	24	31
30	Angola	82	35	32
31	Togo	73	42	39
32	Seychelles	72	8	22
33	Mali	60	17	16
34	Namibia	55	12	9
35	Niger	51	22	26
36	Madagascar	45	30	32
37	Gabon	33	10	10
38	Sierra Leone	33	8	8
39	Eritrea	21	13	17
40	Burundi	18	5	4
41	Liberia	17	3	4
42	Mauritania	17	1	3
43	CAR	14	1	1
44	Swaziland	13	0	1
45	Cape Verde	12	2	2
46	Somalia	11	7	3

47	Chad	10	3	2
48	Lesotho	10	7	7
49	Comoros	7	0	0
50	Djibouti	2	0	1

CAR: Central African Republic; DRC: Democratic Republic of Congo

Table S6. Distribution of publications, citations and h-index per region in Africa

Regions	Population	Publication (first-authorship)	h-index (first-authorship)	Publication (general-authorship)	h-index (general-authorship)	Publication (last-authorship)	h-index (last-authorship)	Citations
Central Africa	97,367,710	389	52	771	120	339	67	2991
Eastern Africa	432,705,380	1277	180	2983	473	1311	233	13029
Northern Africa	245,635,180	7520	179	10514	305	7432	195	46356
Southern Africa	67,503,650	4662	120	7175	239	5010	143	74975
Western Africa	376,146,738	2048	132	3428	319	1958	164	14541

Table S7. Ranking of African countries according to publications, citations and h-index per million habitants (based on general authorship)

Rank	Countries	Publications per million population		Countries	Citations per million population		Countries	h-index per million population
1	Seychelles	731.26		South Africa	1591.74		Seychelles	253.91
2	Tunisia	199.01		Mauritius	1574.57		Mauritius	25.28
3	South Africa	152.68		Seychelles	1300.02		Gambia	10.76
4	Mauritius	78.22		Tunisia	1005.62		Botswana	9.78
5	Egypt	76.00		Egypt	346.40		Cote D'Ivoire	8.34
6	Botswana	51.88		Gambia	220.55		Cape Verde	7.19
7	Cote D'Ivoire	47.39		Botswana	179.88		Namibia	6.30
8	Morocco	40.91		Morocco	177.27		Tunisia	5.33
9	Gambia	34.76		Cameroon	136.07		Gabon	4.94
10	Ghana	26.68		Cote D'Ivoire	117.90		Swaziland	4.31
11	Cameroon	25.35		Ghana	116.47		South Africa	3.52
12	Namibia	21.65		Libya	79.90		Comoros	3.45
13	Cape Verde	21.58		Nigeria	74.27		Libya	3.35
14	Libya	16.15		Uganda	66.37		Zimbabwe	3.16
15	Senegal	15.89		Kenya	59.72		Eritrea	3.11
16	Algeria	15.48		Malawi	59.70		Congo	2.90
17	Congo	15.40		Zimbabwe	56.38		Benin	2.80
18	Zimbabwe	15.21		Rwanda	54.66		Rwanda	2.47
19	Gabon	14.83		Algeria	54.37		Cameroon	2.30
20	Uganda	14.58		Eritrea	54.14		Ghana	2.03
21	Kenya	13.72		Guinea	52.31		Togo	1.93
222	Nigeria	13.70		Senegal	51.48		Lesotho	1.87
23	Benin	12.46		Tanzania	38.54		Malawi	1.83
24	Rwanda	12.20		Ethiopia	38.44		Liberia	1.78
25	Malawi	11.97		Mozambique	28.09		Mozambique	1.66
26	Swaziland	11.21		Sudan	23.06		Senegal	1.55
27	Mozambique	10.11		Namibia	22.04		Guinea	1.52
28	Sudan	9.03		Benin	20.95		Mauritania	1.51
29	Togo	8.82		Burkina Faso	18.23		Zambia	1.47
30	Tanzania	8.69		Zambia	17.57		Morocco	1.35
31	Ethiopia	8.56		Gabon	16.62		Kenya	1.34
32	Comoros	8.05		Congo	14.32		Uganda	1.29
33	Guinea	8.00		Lesotho	13.54		Sierra Leone	1.25
34	Burkina Faso	7.75		Togo	13.17		Egypt	1.08
35	Zambia	7.51		DRC	10.00		Algeria	1.07
36	Eritrea	6.53		Angola	6.63		CAR	1.04
37	Lesotho	4.67		Niger	6.40		Djibouti	1.01
38	Sierra Leone	4.14		Madagascar	3.94		Burkina Faso	0.96
39	Mauritania	3.66		Mali	3.90		Tanzania	0.92
40	Liberia	3.36		Cape Verde	3.60		Mali	0.84
41	Mali	2.96		Sierra Leone	3.51		Sudan	0.73
42	CAR	2.90		CAR	2.69		Niger	0.58
43	Angola	2.49		Somalia	1.82		Ethiopia	0.48
44	DRC	2.14		Chad	0.85		Nigeria	0.42

45	Niger	2.11		Liberia	0.79		Burundi	0.42
46	Djibouti	2.02		Burundi	0.50		Angola	0.40
47	Madagascar	1.63		Mauritania	0.00		DRC	0.30
48	Burundi	1.51		Swaziland	0.00		Madagascar	0.29
49	Somalia	0.69		Comoros	0.00		Somalia	0.25
50	Chad	0.61		Djibouti	0.00		Chad	0.24

CAR: Central African Republic; DRC: Democratic Republic of Congo

Table S8. Characteristics of the 200 most prolific researchers from Africa

First Name	Last Name	Sex	Institutions	Country	Publications (general authorship)	Publications (first authorship)	Publications (last authorship)
Karen	Sliwa	Female	University of Cape Town	South Africa	376	79	135
Aletta E	Schutte	Female	North-West University	South Africa	271	36	84
Bongani M	Mayosi	Male	University of Cape Town	South Africa	267	34	114
Lionel H	Opie	Male	University of Cape Town	South Africa	261	137	174
Andre Pascal	Kengne	Male	University of Cape Town	South Africa	237	23	80
Frederick J	Raal	Male	University of the Witwatersrand	South Africa	184	50	49
Pinhas	Sareli	Male	University of the Witwatersrand	South Africa	146	4	80
Adrian David	Marais	Male	University of Cape Town	South Africa	139	24	39
Albertino	Damasceno	Male	Eduardo Mondlane University	Mozambique	138	14	11
Mayowa O	Owolabi	Male	University of Ibadan	Nigeria	136	38	40
Yaackob K	Seedat	Male	University of KwaZulu-Natal	South Africa	132	102	66
Krisela	Steyn	Female	University of Cape Town	South Africa	126	31	9
Angela J	Woodiwiss	Female	University of the Witwatersrand	South Africa	123	10	23
Gavin R	Norton	Male	University of the Witwatersrand	South Africa	122	7	31
Leone	Malan	Female	North-West University	South Africa	120	14	40
Naomi S	Levitt	Female	University of Cape Town	South Africa	114	6	35
Rachida	Habbal	Female	Ibn Rochd University Hospital	Morocco	113	9	80
Habib	Gamra	Male	University of Monastir	Tunisia	110	17	24
Ana Olga	Mocumbi	Female	Eduardo Mondlane University	Mozambique	105	30	23
Johannes M	Vanrooyen	Male	North-West University	South Africa	103	7	9
Jagidesa	Moodley	Male	University of KwaZulu-Natal	South Africa	102	25	37
Jean Jacques	Noubiap	Male	University of Cape Town	South Africa	101	31	33
Mohammed R	Essop	Male	University of the Witwatersrand	South Africa	101	23	46
Patrick H	Dessein	Male	University of the Witwatersrand	South Africa	99	56	24

Patrick J	Commerford	Male	University of Cape Town	South Africa	98	8	16
Fred Stephen	Sarfo	Male	Kwame Nkrumah University of Science and Technology	Ghana	97	53	7
Nicolaas T	Malan	Male	North-West University	South Africa	97	8	39
Anastase	Dzudie	Male	University of Yaounde 1	Cameroon	93	23	5
Samir	Kammoun	Male	Hedi Chaker Hospital	Tunisia	93	4	61
Hugo W	Huisman	Male	North-West University	South Africa	92	7	8
Mpiko	Ntsekhe	Male	University of Cape Town	South Africa	91	13	14
Faouzi	Maatouk	Male	University of Monastir	Tunisia	90	6	33
Kerstin	Klipstein-Grobusch	Female	University of the Witwatersrand	South Africa	89	1	31
Dirk J	Blom	Male	University of Cape Town	South Africa	89	25	16
Okechukwu S	Ogah	Male	University of Ibadan	Nigeria	87	21	14
Rudolph	Schutte	Male	North-West University	South Africa	85	12	10
Bruce M	Biccard	Male	University of Cape Town	South Africa	85	25	36
Liesl	Zuhlke	Female	University of Cape Town	South Africa	84	6	15
Arp	Walker	Male	University of the Witwatersrand	South Africa	80	68	43
Etheresia	Pretorius	Female	University of Pretoria	South Africa	78	25	51
Anthony J	Dalby	Male	Milpark Hospital	South Africa	77	7	3
Khaldoun	Benhamda	Male	University of Monastir	Tunisia	76	4	1
Brian	Rayner	Male	University of Cape Town	South Africa	74	25	35
Rufus	Akinyemi	Male	University of Ibadan	Nigeria	73	16	1
Emmy	Okello	Female	Uganda Heart Institute	Uganda	71	9	3
Maritha J	Kotze	Female	Stellenbosch University	South Africa	70	22	29
Faouzi	Addad	Male	CHU Fattouma Bourguiba	Tunisia	69	13	5
Elena	Libhaber	Female	University of the Witwatersrand	South Africa	68	3	1
Barry I	Joffe	Male	University of the Witwatersrand	South Africa	67	4	13
Leila	Abid	Female	Hedi Chaker Hospital	Tunisia	67	11	2
Jean-Claude	Mbanya	Male	University of Yaounde 1	Cameroon	66	5	28

Samuel	Kingue	Male	University of Yaounde 1	Cameroon	64	5	26
Ntobeko A B	Ntusi	Male	University of Cape Town	South Africa	63	19	21
Dike B	Ojji	Male	University of Abuja	Nigeria	62	15	6
Karl	Peltzer	Male	University of Limpopo	South Africa	62	23	37
Datshana Prakesh	Naidoo	Male	University of KwaZulu-Natal	South Africa	62	15	18
Ronald A	Asherson	Male	University of the Witwatersrand	South Africa	62	33	22
Catharina M C	Mels	Female	North-West University	South Africa	61	6	14
Charles	Mondo	Male	Mulago Hospital	Uganda	61	1	7
Adama	Kane	Female	Cheikh Anta Diop University	Senegal	60	8	11
Naziha	Kaabachi	Female	La Rabta University Hospital	Tunisia	60	0	45
Moncef	Feki	Male	La Rabta University Hospital	Tunisia	60	5	2
Ruan	Kruger	Male	North-West University	South Africa	59	11	18
H C	Seftel	Male	University of the Witwatersrand	South Africa	58	11	37
Mohamed	Hammami	Male	University of Monastir	Tunisia	58	1	31
Kamilu M	Karaye	Male	Bayero University	Nigeria	57	33	3
Carl J	Lombard	Male	South African Medical Research Council	South Africa	57	0	6
Paul A	Brink	Male	Stellenbosch University	South Africa	57	6	11
Carla M T	Fourie	Female	North-West University	South Africa	56	3	1
Peter	Lwabi	Male	Uganda Heart Institute	Uganda	56	0	10
Jephat	Chifamba	Male	University of Zimbabwe	Zimbabwe	56	1	1
Mahmoud U	Sani	Male	Bayero University	Nigeria	55	11	13
Pravin	Manga	Male	University of the Witwatersrand	South Africa	55	11	19
Mark E	Engel	Male	University of Cape Town	South Africa	54	4	10
Wail	Nammas	Male	Ain Shams University	Egypt	53	11	47
Jacob	Plange-Rhule	Male	Kwame Nkrumah University of Science and Technology	Ghana	53	3	7
Shane A	Norris	Male	University of the Witwatersrand	South Africa	53	0	23
Fethi	Betbout	Male	University of Monastir	Tunisia	53	0	4

Jobert Richie	Nansseu	Male	University of Yaounde 1	Cameroon	52	10	5
Marlien	Pieters	Female	North-West University	South Africa	52	14	18
Sandrine	Lecour	Female	University of Cape Town	South Africa	52	3	17
Timothy D	Noakes	Male	University of Cape Town	South Africa	52	27	27
Zohra	Dridi	Female	University of Monastir	Tunisia	52	0	2
Eugene	Sobngwi	Male	University of Yaounde 1	Cameroon	51	7	12
Wayne	Smith	Male	North-West University	South Africa	51	3	3
John	Anthony	Male	University of Cape Town	South Africa	51	7	9
Nigel J	Crowther	Male	University of the Witwatersrand	South Africa	51	2	14
Stephen	Tollman	Male	University of the Witwatersrand	South Africa	51	1	10
Touhami	Mahjoub	Male	University of Monastir	Tunisia	51	1	33
Hester H	Vorster	Female	North-West University	South Africa	50	15	12
Mohamed Sami	Mourali	Male	La Rabta University Hospital	Tunisia	50	0	12
Marwan	Saad	Male	Ain Shams University	Egypt	48	7	11
Foad	Abd-Allah	Male	Cairo University	Egypt	48	7	3
Rachid	Mechmeche	Male	La Rabta University Hospital	Tunisia	48	1	6
Ayodele O	Falase	Male	University of Ibadan	Nigeria	47	8	27
Charles Shey	Wiysonge	Male	Stellenbosch University	South Africa	46	12	8
Neil J	Coville	Male	University of the Witwatersrand	South Africa	46	0	39
Jean Joel	Bigna	Male	Centre Pasteur du Cameroon	Cameroon	45	8	13
Catherine	Kyobutungi	Female	African Population and Health Research Center	Kenya	45	1	21
Leila	Azzouzi	Female	Ibn Rochd University Hospital	Morocco	45	3	5
Ahmed	Bennis	Male	CHU Ibn Rochd	Morocco	45	22	7
J B	Barlow	Male	University of the Witwatersrand	South Africa	45	13	28
Johan B	Ubbink	Male	University of the Witwatersrand	South Africa	45	23	7
Nasheeta	Peer	Female	South African Medical Research Council	South Africa	44	19	2
Rajiv T	Erasmus	Male	Stellenbosch University	South Africa	44	6	10

Peter	Zilla	Male	University of Cape Town	South Africa	43	11	14
Daniel	Skudicky	Male	University of the Witwatersrand	South Africa	42	12	0
Ahmed	Solomon	Male	University of the Witwatersrand	South Africa	42	6	20
Daniel	Lemogoum	Male	University of Douala	Cameroon	41	20	6
Ayesha	Mitha	Female	University of KwaZulu-Natal	South Africa	41	1	18
J Z	Przybojewski	Male	Stellenbosch University	South Africa	41	36	15
Ferande	Peters	Male	University of the Witwatersrand	South Africa	41	11	4
W J H	Vermaak	Male	University of Pretoria	South Africa	41	9	14
Sonia	Hammami	Female	University of Monastir	Tunisia	41	5	2
Noha	Elouafi	Female	Mohamed First University	Morocco	40	0	21
Annamarie	Kruger	Female	North-West University	South Africa	40	0	9
Habiba	Benromdhane	Female	University of Tunis El Manar	Tunisia	40	5	8
Semir	Nouira	Male	University of Monastir	Tunisia	40	2	23
Saraladevi	Naicker	Female	University of the Witwatersrand	South Africa	39	8	26
F J	Milne	Male	University of the Witwatersrand	South Africa	39	6	14
Mohamed	Benfarhat	Male	CHU Fattouma Bourguiba	Tunisia	39	4	18
Imed	Benghorbel	Male	La Rabta University Hospital	Tunisia	39	9	1
Ragab A	Mahfouz	Male	Zagazig University Hospital	Egypt	38	36	2
Thandi	Puoane	Female	University of the Western Cape	South Africa	38	3	14
Hein J	Odendaal	Male	Stellenbosch University	South Africa	38	3	21
Abdelhedi	Miled	Female	University of Monastir	Tunisia	38	0	23
Tandi E	Matsha	Female	Cape Peninsula University of Technology	South Africa	37	9	11
Rehana	Essop	Female	University of the Witwatersrand	South Africa	37	1	15
Mohsen	Hassine	Male	University of Monastir	Tunisia	37	12	1
Abdallah	Almaghraby	Male	Alexandria University	Egypt	36	6	9
Ashraf	Reda	Male	Menoufia University	Egypt	36	16	2
Linda	Tsang	Female	University of the Witwatersrand	South Africa	36	0	0
John V	Robbs	Male	University of KwaZulu-Natal	South Africa	36	6	18

D P	Myburgh	Male	University of Pretoria	South Africa	36	12	17
Chokri	Mhiri	Male	Habib Bourguiba University Hospital	Tunisia	36	0	30
Riadh	Jemaa	Male	La Rabta University Hospital	Tunisia	36	13	0
Walid	Jomaa	Male	University of Monastir	Tunisia	36	15	0
Benjamin	Longo-Mbenza	Male	University of Kinshasa	DRC	35	21	4
Ashley	Chin	Male	University of Cape Town	South Africa	35	6	12
Benn	Sartorius	Male	University of KwaZulu-Natal	South Africa	35	0	3
Mounir	Lamloum	Male	La Rabta University Hospital	Tunisia	35	4	0
Abdelkrim	Berrah	Male	Hospital Center University Lamine Debaghine	Algeria	34	2	19
Yehia	Saleh	Male	Alexandria University	Egypt	34	4	3
Edward	Sturrock	Male	University of Cape Town	South Africa	34	0	11
Mohamed A	Ghoneim	Male	Mansoura University	Egypt	33	0	32
Albert	Akpalu	Male	University of Ghana	Ghana	33	2	2
Adesola	Ogunniyi	Male	University of Ibadan	Nigeria	33	1	10
Rhena	Delport	Female	University of Pretoria	South Africa	33	6	7
Sonia	Hamdi	Female	University of Monastir	Tunisia	33	3	0
Mohamed Z	Gad	Male	German University in Cairo	Egypt	32	5	25
Nabila	Ismaili	Female	Mohamed First University	Morocco	32	1	8
Beatriz	Ferreira	Female	Maputo Heart Institute	Mozambique	32	1	6
Dan J	Stein	Male	University of Cape Town	South Africa	32	2	6
Azeem	Latib	Male	University of Cape Town	South Africa	32	8	8
Rania	Hammami	Female	Hedi Chaker Hospital	Tunisia	32	8	0
Sana	Ouali	Female	Rabta Hospital	Tunisia	32	12	1
Imen	Trabelsi	Female	University of Monastir	Tunisia	32	4	0
Haitham	Badran	Male	Ain Shams University	Egypt	31	15	11
Serigne Abdou	Ba	Male	Cheikh Anta Diop University	Senegal	31	1	15
Anton F	Doubell	Male	Stellenbosch University	South Africa	31	0	20

Geoffrey	Candy	Male	University of the Witwatersrand	South Africa	31	1	0
Reitze N	Rodseth	Male	University of KwaZulu-Natal	South Africa	31	5	8
Salima	Ferchichi	Female	CHU Farhat Hached	Tunisia	31	0	8
Ahmed	Bendary	Male	Benha University	Egypt	30	17	1
Kolawole	Wahab	Male	University of Ilorin	Nigeria	30	3	4
Debbie	Bradshaw	Female	South African Medical Research Council	South Africa	30	4	10
Pieter L	Jooste	Male	South African Medical Research Council	South Africa	30	5	1
Dorra	Abid	Female	Hedi Chaker Hospital	Tunisia	30	3	0
Maboury	Diao	Male	Cheikh Anta Diop University	Senegal	29	2	1
Amani	Kallel	Female	La Rabta University Hospital	Tunisia	29	8	0
Mourad	Hentati	Male	Hedi Chaker Hospital	Tunisia	29	0	0
Twalib	Aliku	Male	Uganda Heart Institute	Uganda	29	1	1
Gershim	Asiki	Male	African Population and Health Research Center	Kenya	28	6	0
Johann C	Jerling	Male	North-West University	South Africa	28	2	8
Naresh	Ranjith	Male	University of KwaZulu-Natal	South Africa	28	6	1
Demetre	Labadarios	Male	Stellenbosch University	South Africa	28	3	9
Motasim	Badri	Male	University of Cape Town	South Africa	28	0	0
Mounir	Bouaziz	Male	Habib Bourguiba University Hospital	Tunisia	28	2	23
Mohamed	Hsairi	Male	Salah Azaiz Institute	Tunisia	28	0	0
Samson	Okello	Male	Mbarara University of Science and Technology	Uganda	28	12	4
Mohamed Fahmy	Elnoamany	Male	Menoufia University	Egypt	27	20	0
Jean M	Fourie	Female	South African Medical Research Council	South Africa	27	0	6
Ambroise	Wonkam	Male	University of Cape Town	South Africa	27	3	6
Alan	Bryer	Male	University of Cape Town	South Africa	27	8	10

John	Lawrenson	Male	University of the Western Cape	South Africa	27	3	6
Adel H	Allam	Male	Al-Azhar University	Egypt	26	4	0
Mohamed	Sobhy	Male	Alexandria University	Egypt	26	4	5
Arti	Singh	Female	Kwame Nkrumah University of Science and Technology	Ghana	26	2	0
Ama De-Graft	Aikins	Female	University of Ghana	Ghana	26	4	5
Amam	Mbakwem	Female	University of Lagos	Nigeria	26	8	0
Reginald	Obiako	Male	Ahmadu Bello University	Nigeria	26	0	0
Estelle V	Lambert	Female	University of Cape Town	South Africa	26	1	3
Julia H	Goedecke	Female	University of Cape Town	South Africa	26	2	14
George	Nel	Male	Stellenbosch University	South Africa	26	0	0
David A	Watkins	Male	University of Cape Town	South Africa	26	12	2
James	Ker	Male	University of Pretoria	South Africa	26	21	22
Thouraya	Bensalem	Female	La Rabta University Hospital	Tunisia	26	4	1
Salem	Kachboura	Male	Abderrahmane Mami Hosp	Tunisia	26	2	16
Riadh	Boukef	Male	Sahloul University Hospitak	Tunisia	26	0	0
Isaac	Ssinabulya	Male	Makerere University	Uganda	26	1	0

Figure S1. Trend in the contribution of Africa to the global cardiovascular research output (1971-2021)

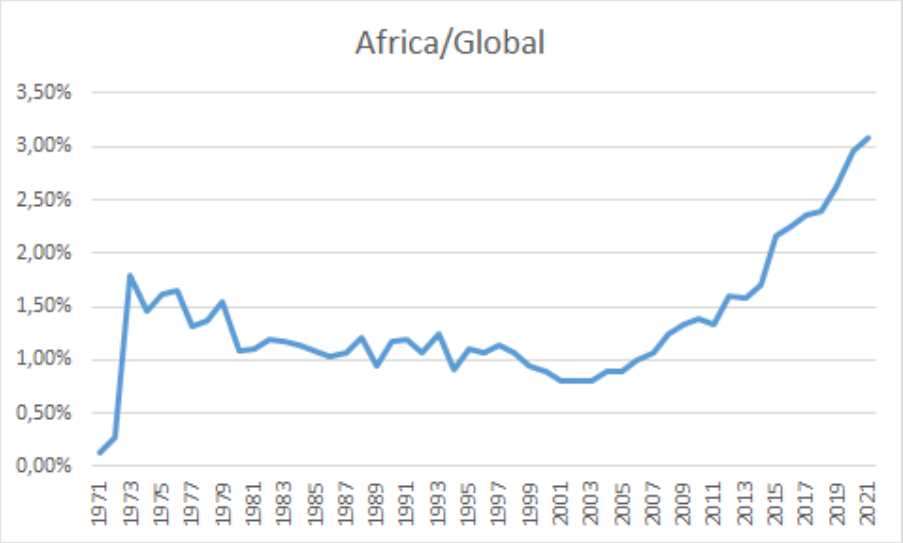

Figure S2. Geographical distribution of cardiovascular publications involving Africa (based on first authorship)

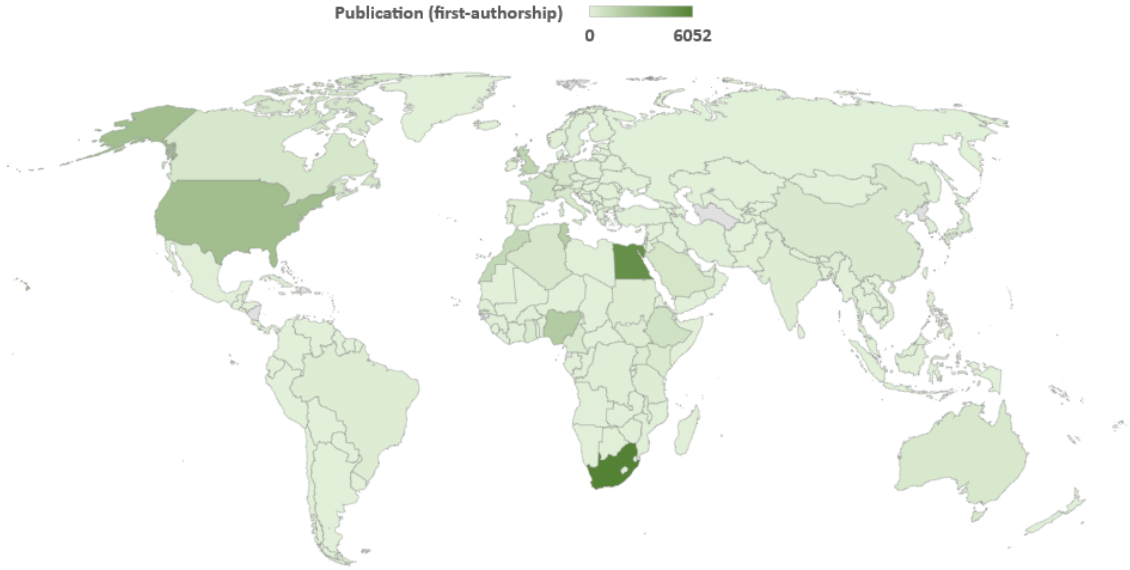

Figure S3. Geographical distribution of cardiovascular publications involving Africa (based on last authorship)

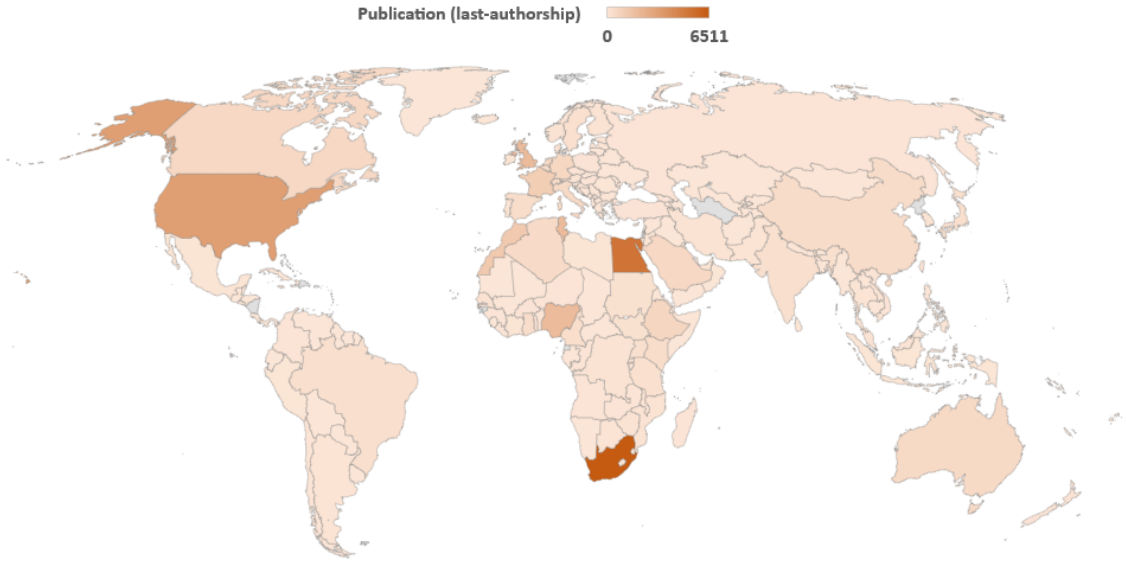

Figure S4. Distribution of countries' h-index (based on first authorship)

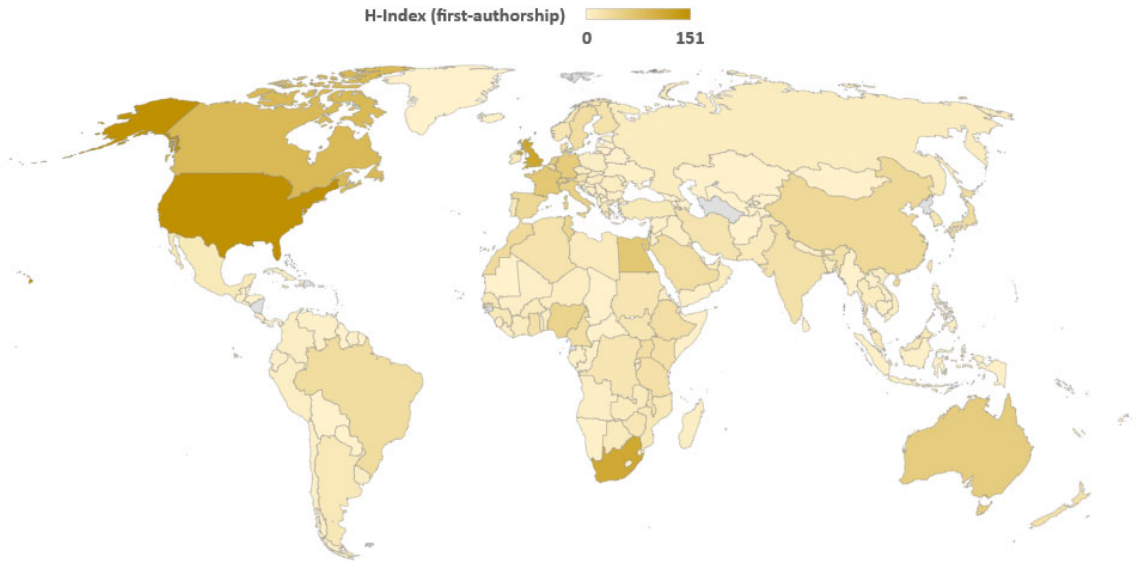

Figure S5. Distribution of countries' h-index (based on last authorship)