

Disparity in biomedical publication trends in the CARICOM countries: Is there a need for a more vibrant research culture in the region?

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Abstract

Background: Biomedical research and publications provide evidence-based information about the extent and burden of health-related problems of a country and help to formulate strategic and operational plans to tackle the problems.

Purpose: To determine the biomedical publication rates of CARICOM full member countries.

Methods: Biomedical publications of full member CARICOM countries were retrieved using PubMed (1990–2015) and SCImago Journal & Country Rank (1996–2015) databases. CARICOM countries having >50 publications in the PubMed (1990–2015) database were subject to further analysis, whereby publications of each country were adjusted by total population (million population), gross domestic product (billion-dollar), and Internet usage rate (hundred thousand population).

Results: Total publications by all countries were 7281 and 8378 in PubMed and SCImago Journal & Country Rank, respectively. Jamaica produced highest number of publications (PubMed: 3928 (53.9%); SCImago Journal & Country Rank: 2850 (34.0%)). In both databases, Grenada had the highest research publications when adjusted with per million population (4721 and 10,633), per billion gross domestic product (803 and 1651), and per hundred thousand Internet users (1487 and 3387). Trend analysis revealed Jamaica produced the highest number of additional PubMed listed publications each year, averaging 4.8/year, followed by Trinidad and Tobago (4.4). According to SCImago Journal & Country Rank, Jamaica also had the highest number of citations (42,311) and h-index (76), followed by Trinidad and Tobago (29,152 and 71). Barbados had the highest number of citations per document (24.9), followed by Haiti (18.4). The publication rates determined by PubMed and SCImago Journal & Country Rank databases were significantly correlated ($p < 0.001$). Most publications (68% SCImago Journal & Country Rank and 85% PubMed) can be attributed to authors affiliated with Barbados, Jamaica, and Trinidad.

Conclusion: Publication and citation rates varied markedly between CARICOM countries and were in general low. Most publications could be attributed to researchers affiliated with The University of the West Indies. More universities valuing biomedical research are needed in the region, and more resources needed to improve publication rates.

Keywords

Biomedical publications, research productivity, disparity, PubMed, SCImago Journal & Country Rank, CARICOM countries

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Introduction

The Caribbean Community (CARICOM) consists of 15 full member countries and 5 associate member states with a total population of about 18 million.¹ These countries have many similarities and dissimilarities: relatively small size and high vulnerability to environmental disasters versus diverse population, language, skills, and levels of economic and social development.^{2–4} The Caribbean region has made significant

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progress in the last decades in health and efforts are ongoing to strengthen the research and development (R&D) systems for health.^{5–7} The challenge now is to sustain the current health status and continuously improve the health of the population in countries of small size and small economies with limited resources and investments in healthcare.^{4,8} Like other resource-constrained regions in the world, CARICOM countries have been experiencing marked disparities and low attention in research in biomedical sciences and healthcare.^{4–6,8,9} The region has also been facing a number of challenges in relation to R&D – limited resources, low participation, insufficient infrastructure, and low visibility of research findings.¹⁰ Furthermore, ‘significant gaps in knowledge about, and minimal engagement with open-access as a publication modality’ compound these challenges faced by Caribbean academics.^{11,12} Published evidence from high-quality research output is necessary to formulate research-based policies and is a key source in attaining health development and economic growth of Caribbean countries.⁷

Biomedical research and publications provide evidence-based information about the extent and burden of health-related problems of a country and help with the formulation of strategic and operational plans to tackle the problem.^{13–15} A positive trend of scientific publications in all Caribbean countries has been observed in the last few decades.¹⁶ The inclusion of regional journals in Thomson Reuter’s and Elsevier’s main indexing services, and Web of Science and Scopus databases has increased with time.¹⁰ These databases index the best professional journals and publications, thus playing an important role in the dissemination of reliable, high-quality information to the scientific community.

PubMed is a free and public search engine of publications in the life sciences and biomedical fields which was developed and is maintained by the National Center for Biotechnology Information (NCBI), which is a part of the US National Library of Medicine (NLM), located at the National Institutes of Health (NIH).¹⁷ PubMed comprises over 29 million citations for biomedical literature from MEDLINE, life science journals, and online books. PubMed citations and abstracts include the fields of biomedicine and health, covering portions of the life sciences, behavioural sciences, chemical sciences, and bioengineering. Prompt updates, easy accessibility for retrieving relevant data, diverse functionality, and its widespread usage by the research community makes PubMed a predominant biomedical search platform.^{18,19} Another free search engine, the ‘SCImago Journal & Country Rank’ (SJR), is a portal that includes the journals and country scientific indicators developed from the information contained in the Scopus® database (Elsevier BV).^{19,20} These indicators can be used to assess and analyse scientific domains. The platform has been developed by SCImago from the widely known algorithm Google PageRank™ and is the most widely calculated performance indicator by Google Scholar.^{18,19}

PubMed is the ‘most frequently used resource for information in the biomedical field’ and provides evidence-based

information to clinicians and researchers.²¹ SJR (Scopus) includes a larger number of publications than those of Web of Science.^{19,22,23} Falagas et al. found that Scopus covered about 20% more when compared with Web of Science for citation analysis.²¹ Another widely used search engine, Google Scholar, provided results of inconsistent accuracy.²³

Against this background, we aimed to determine the biomedical publication rate of CARICOM full member countries using the PubMed (1990–2015) and SJR (1996–2015) databases and adjust these rates for population size, gross domestic product (GDP), and the number of Internet users.

Methodology

We used the two well-established databases which are popular among medical and healthcare researchers.^{22,24} Biomedical publication output of the 15 full member CARICOM countries was determined using the PubMed (1990–2015) and SJR databases (1996–2017) during the first week of November 2018. Detailed search procedures were as discussed in two previous publications by one of the authors.^{14,15} Only countries with ≥ 50 publications in PubMed between 1990 and 2015 were included in further analysis for both of the databases. For these countries, publication rates were adjusted by per million population,²⁵ GDP per billion population,²⁵ and the Internet usage rate per hundred thousand population.²⁶

For PubMed

PubMed publications were retrieved by selecting the ‘advanced search’ option, entering the country name in the ‘affiliation’ field, searching and then restricting the search dates to between 01 January 1990 and 31 December 2015 (for example: (“Barbados”[Affiliation]) AND (“01/01/1990”[Date - Create]: “2015/12/31”[Date - Create])). This search process was repeated independently for all 15 countries. Results were sorted by the ‘Publication Date’ on a yearly basis.

For SJR

A search of the SJR was performed for publications in the field of ‘medicine’. The data were retrieved for ranking among the world and CARICOM countries for total documents, total citations, self-citations, citations per document, and h-index from 1996 to 2017.

Statistical analysis

For both PubMed and SJR databases, the percentage contribution of each country within the CARICOM region was calculated and further trend analysis conducted for PubMed data to predict the publication rate for the time period studied. Paired samples correlations were calculated to determine the relationship between publication rates of both databases with respect to raw and adjusted publication (population size, GDP, and Internet usage).

Table 1. Total and adjusted publications in CARICOM countries: 1990–2015 (PubMed).

Country	Total (1990–2015) (% of total)	Publications per million population ²⁵ (adjusted)	Publications per billion GDP ²⁵ (adjusted)	Publications per 100,000 Internet users ²⁶ (adjusted)
Jamaica	3928 (53.9%)	1468	402	435
Trinidad and Tobago	1774 (24.4%)	1377	131	442
Barbados	487 (6.7%)	1789	160	370
Grenada	482 (6.6%)	4721	803	1487
Haiti	283 (3.9%)	32	57	46
Bahamas	90 (1.2%)	283	15	61
Guyana	84 (1.1%)	111	63	10
Dominica	81 (1.1 %)	1138	229	387
Suriname	72 (0.9%)	149	33	72
Total ^a	7281	490	174	230

CARICOM: Caribbean Community; GDP: gross domestic product.

Data from World Bank.²⁵ Data from Internet World Stats.²⁶

^aNine countries listed in the table.

Results

Six CARICOM countries (Antigua and Barbuda, Belize, Montserrat, Saint Kitts and Nevis, Saint Lucia, and Saint Vincent and the Grenadines) had less than 50 publications indexed in PubMed between 1990 and 2015. Further analysis on publication rates was not done for these countries. Nine countries had ≥ 50 publications. These were the Bahamas, Barbados, Dominica, Grenada, Guyana, Haiti, Jamaica, Suriname, and Trinidad and Tobago. Further analysis was undertaken for these countries only.

PubMed publications

Publication output of CARICOM countries

There was a total of 7281 publications (Table 1) retrieved from PubMed for the nine CARICOM countries at an overall average publication rate of 291 papers per year for the 25-year period spanning 1990 to 2015. The total number of the unique publications was 7208, with only 73 publications having authors from more than one of the nine countries. Authors affiliated with Jamaica were responsible for the majority of the 7208 publications, with 3928 (53.9%) of these papers being attributed to them at an average of 157 papers per year. Trinidad and Tobago was second with 1774 (24.4%) publications at an average of 71 publications per year, followed by Barbados with 487 (6.7%, average 19), Grenada with 482 (6.6%, average 19), and Haiti with 283 (3.9%, average 11). The Bahamas, Guyana, Dominica, and Suriname each generated less than 2% of the publications.

PubMed publication trends

Figure 1 shows a trend graph of the five countries (Barbados, Grenada, Haiti, Jamaica, and Trinidad and Tobago) with the

highest raw publication rates. The trend line for Jamaica shows that on average, the number of publications per year has been increasing by approximately 4.8 each year over the 25-year period. Trinidad and Tobago, Grenada, Haiti, and Barbados showed trend line slopes around 4.4, 2.9, 1.4, and 1.1, respectively.

Publication rates adjusted for population, GDP, and Internet usage

When the retrieved publications were adjusted by population (per million), GDP (per billion), and Internet users (per hundred thousand) (Table 1 and Figure 2), Grenada had the highest publication rates in all categories. For all categories, the rates for Grenada were 2–3 times higher than Jamaica.

When publications were adjusted by population size, Grenada had a publication rate of 4721 publications per million population. Barbados was second with 1789 publications per million population (37.8% of the rate of Grenada), followed by Jamaica with 1468 (31.5% of the rate of Grenada), and Trinidad and Tobago with 1377 (29.2% of the rate of Grenada).

When publications were adjusted per billion average yearly GDP in US dollars over the 25 years, Grenada had the highest rate of 803 publications per billion GDP. Jamaica was second with 402 publications per billion GDP (50.1% of the rate of Grenada), Dominica was third with 229 (28.5% of the rate of Grenada), and Barbados stood fourth with 160 (19.9% of the rate of Grenada).

When publications were adjusted per 100,000 Internet users, Grenada had the highest rate of 1487 publications per 100,000 Internet users, followed by Jamaica with 435 (29.2% of the rate of Grenada), Trinidad and Tobago with 442 (29.7% of the rate of Grenada), and Dominica was fourth with 387 (26.0% of the rate of Grenada).

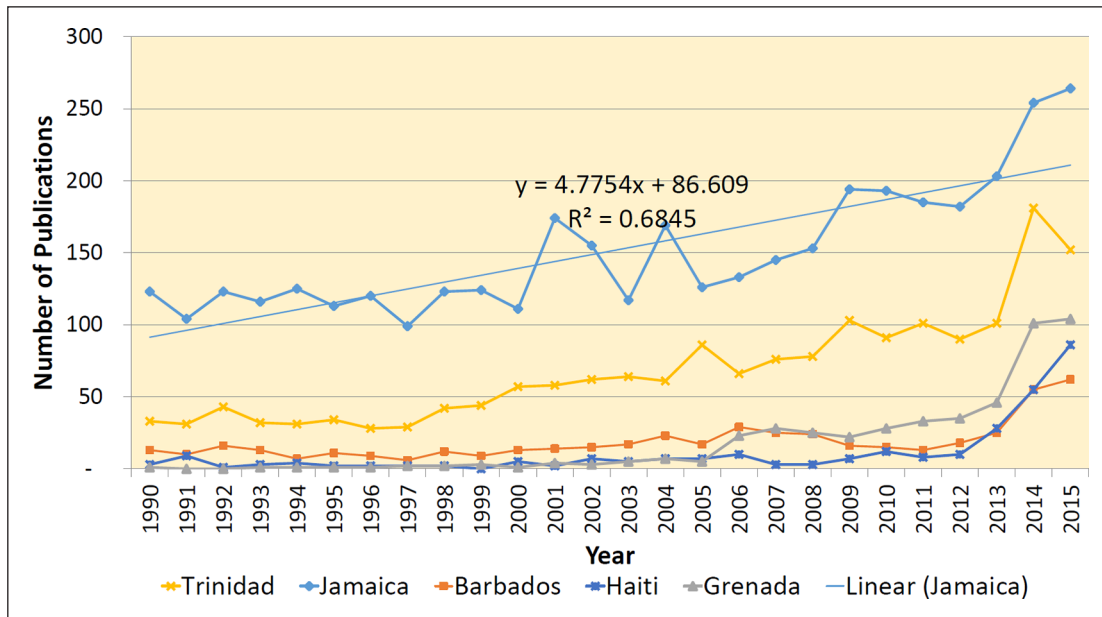


Figure 1. Publication trends for five CARICOM countries with the most publications: 1990–2015 (PubMed).

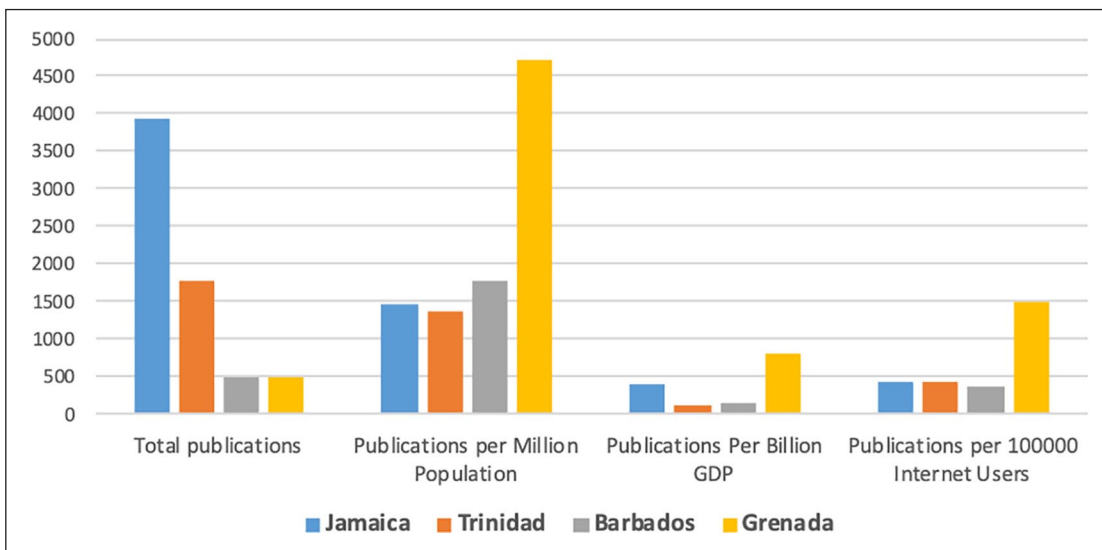


Figure 2. Total and adjusted publications of the four countries with the most publications: 1990–2015 (PubMed).

SJR publications

Ranking

Authors affiliated with Jamaican institutions published the highest number of publications among the selected CARICOM countries (1996–2017), ranking 98th worldwide, and 13th in the Latin America and Caribbean (LAC) region (Tables 2 and 3).

Publication output of CARICOM countries

There was a total of 8378 publications (Table 2 and 3) retrieved from SJR in the field of Medicine from the nine

CARICOM countries, at an overall average publication rate of 381 papers per year over the 22-year period between 1996 and 2017. Authors affiliated with Jamaica were responsible for the highest number of publications, with 2850 (34.0%) of these papers being attributed to them at an average of 129 papers per year. Trinidad and Tobago was second with 2062 (24.6%) at an average of 94 publications per year, followed by Grenada with 1098 (13.1%, average 50), Barbados with 811 (9.7%, average 37), and Haiti with 767 (9.1%, average 35). Guyana, Bahamas, Dominica, and Suriname each generated less than 3% of the publications.

Table 2. Research productivity of selected CARICOM countries: 1996–2017 (SJR).

World ranking	LAC region ranking	Country	Total documents	Total citations	Self-citations	Citations per document	h-index ^a
98	13	Jamaica	2850	42,311	4182	14.8	76
105	14	Trinidad and Tobago	2062	29,152	1865	14.1	71
126	18	Grenada	1098	8916	474	8.1	39
136	20	Barbados	811	20,221	767	24.9	57
137	21	Haiti	767	14,103	1472	18.4	53
174	31	Guyana	209	2268	69	10.8	25
178	34	Bahamas	182	2421	132	13.3	23
176	33	Dominica	192	1891	27	9.8	22
175	32	Suriname	207	2664	199	12.9	29
Total			8378	123,947	9187	–	–

CARICOM: Caribbean Community; SJR: SCImago Journal & Country Rank; LAC: Latin America and Caribbean.

^aThe h-index is defined as the maximum value of h such that the given author/journal has published h papers that have each been cited at least h times.²⁷

Adjusted with population, GDP, and Internet usage

When the retrieved publications were adjusted by population (per million), GDP (per billion), and Internet users (per hundred thousand) (Table 3 and Figure 3), Grenada had the highest publication rates in all categories. For all categories, the rates for Grenada were about three times higher than Jamaica.

When the publications were adjusted by the population size, Grenada had the highest publication rate with 10,633 publications per million population (Table 3, Figure 3). Barbados was in second position with 2954 publications (27.8% of the rate of Grenada) followed by Dominica with 2695 (25.3% of the rate of Grenada) and Trinidad and Tobago with 1584 (14.9% of the rate of Grenada).

When publications were adjusted per billion average yearly GDP in US dollars over the 22 years (Table 3, Figure 3), Grenada had the highest rate of 1651 publications per billion GDP. Dominica was second with 490 publications per billion GDP (29.7% of the rate of Grenada), Jamaica was third with 263 (15.9% of the rate of Grenada), and Barbados stood fourth with 249 (15.1% of the rate of Grenada).

When publications were adjusted per 100,000 Internet users, Grenada had the highest rate of 3387 publications per 100,000 Internet users, followed by Dominica with 918 (27.1% of the rate of Grenada), Barbados with 616 (18.2% of the rate of Grenada), and Trinidad and Tobago was fourth with 514 (15.2% of the rate of Grenada).

Citation rates on SJR

Table 2 also shows the research productivity of the nine CARICOM countries as indexed by SJR. Papers by authors affiliated with Jamaica had the highest number of citations (42,311), followed by Trinidad and Tobago (29,152) and Barbados (20,221), as shown in Table 2. Jamaica also had the highest h-index (76), followed by Trinidad (71) and Barbados (57). For citation per document, Barbados had the

highest citations (24.9), followed by Jamaica (14.8) and Trinidad (14.1).

Publications: PubMed versus SJR

Paired samples correlations were used to examine the relationship between publications of PubMed and SJR databases among the studied countries. All the correlations were found to be statistically significant, as shown in Table 4.

Discussion

This study found that researchers affiliated to institutions within four CARICOM countries (Jamaica, Trinidad and Tobago, Barbados, and Grenada) were responsible for the vast majority of the region's publications listed in the PubMed and SJR databases. Barbados, Jamaica, and Trinidad and Tobago, all of which are home to campuses of The University of the West Indies (UWI), a regional indigenous university, together accounted for 85% and 68% of raw publications retrieved from PubMed and SJR, respectively. Grenada, which is the home of St. George's University (SGU), a large offshore medical school catering largely for students from outside the region, accounted for 7% and 13% of PubMed- and SJR-indexed raw publications, respectively. The UWI territories and Haiti had the highest number of citations per document and the highest h-indices. Haiti, primarily a French-speaking country, is home to six public and private medical Universities.²⁸ Many of the articles from Haiti are published in collaboration with authors from the United States and Canada.^{29–31}

Disparity in biomedical publication rates among CARICOM countries

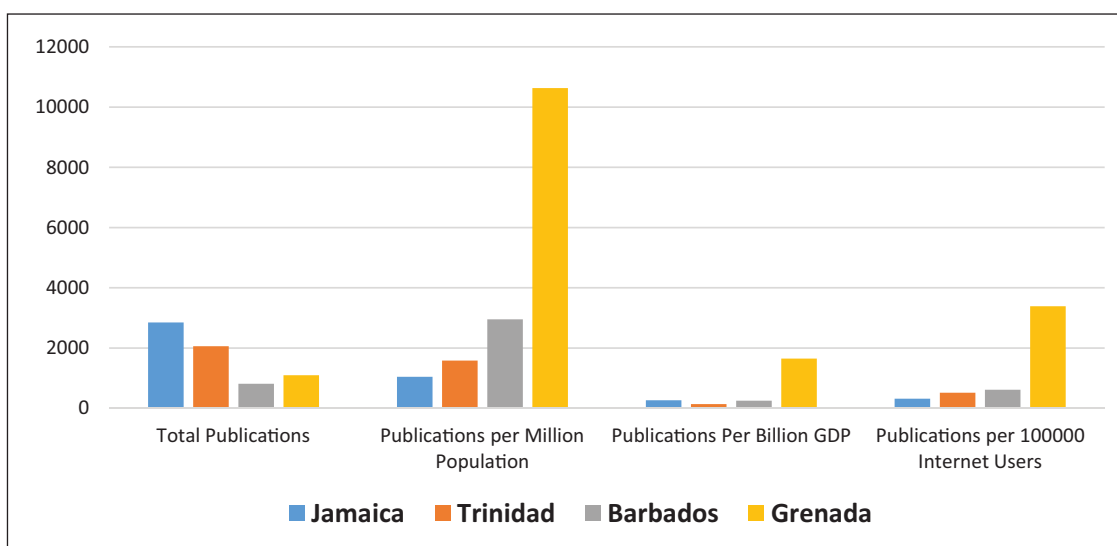
The disparity in publication rates among the CARICOM countries in this study is in keeping with the findings of other studies.^{5,32–34} The nine countries studied with a combined

Table 3. Total and adjusted publications in CARICOM countries: 1996–2017 (SJR).

Country	Total (1996–2017) (percentage of total)	Publications per million population ²⁵ (adjusted)	Publication per billion GDP ²⁵ (adjusted)	Publication per 100,000 Internet users ²⁶ (adjusted)
Jamaica	2850 (34.0%)	1046	263	316
Trinidad and Tobago	2062 (24.6%)	1584	136	514
Grenada	1098 (13.1%)	10,633	1651	3387
Barbados	811 (9.7%)	2954	249	616
Haiti	767 (9.1%)	83	145	126
Guyana	209 (2.5%)	276	138	25
Bahamas	182 (2.2%)	550	28	124
Dominica	192 (2.3%)	2695	490	918
Suriname	207 (2.5%)	415	82	206
Total ^a	8378	546	181	264

CARICOM: Caribbean Community; SJR: SClmago Journal & Country Rank; GDP: gross domestic product. Data from World Bank.²⁵ Data from Internet World Stats.²⁶

^aNine countries listed in the table.

**Figure 3.** Total and adjusted publications of the four countries with the most publications: 1996–2017 (SJR).**Table 4.** Paired samples correlations of publications of PubMed and SJR databases.

	Publications	Correlation	Sig.
Pair 1	PubMed and SJR – total raw publications	0.951	p < 0.001
Pair 2	PubMed and SJR – adjusted publications with per million population	0.965	p < 0.001
Pair 3	PubMed and SJR – adjusted publications with per billion GDP	0.932	p < 0.001
Pair 4	PubMed and SJR – adjusted publications with per 100,000 Internet usage	0.968	p < 0.001

SJR: SClmago Journal & Country Rank; GDP: gross domestic product.

population of more than 15 million people had a publication rate of only 490 papers per million population (PubMed 1990–2015) in comparison to 969, 14,212, and 11,472 papers per million population published by Brazil (population 191 million), Canada (population 33 million), and United States (population 303 million), respectively. Another study of

publication rates of 17 small countries in Latin America/Caribbean (including 6 CARICOM countries included in the present study: Bahamas, Barbados, Guyana, Jamaica, Suriname, and Trinidad and Tobago) also demonstrated that most of these countries produce relatively low levels of research as measured by various publication metrics.³² There

were only 73 collaborative research papers among CARICOM countries in our study, which indicates a low level of intraregional collaboration.³⁴ While underinvestment in R&D within CARICOM may contribute to the low publication output,³² the lack of critical mass³⁵ may be a factor in the smaller islands. In the case of Grenada, SGU has provided the critical mass and resources necessary for increased publication output.³⁴ The existing challenges in the region have been exacerbated by the continuing aftermath of global recession, fragility of the Caribbean tourism industry, reduced influx of remittances, a weakening economy, and rising unemployment.^{33,36} These factors potentially pose a challenge to countries that remain vulnerable to the vagaries of nature, which lack sufficient funding, human resources and infrastructure, and are always under pressure to align their research productivity with the internationally recognized research institutions in the developed countries with set research agendas.³⁷ Moreover, the regional biomedical journals are not listed in PubMed and Scopus; for example, the West Indian Medical Journal is the only Scopus-indexed journal among CARICOM countries.²⁰

Publications of Barbados, Jamaica, and Trinidad and Tobago

The finding of the present study – that 68%–85% of CARICOM publications can be attributed to authors affiliated to institutions in Barbados, Jamaica, and Trinidad and Tobago (which represent 25% of the total CARICOM population) – is mainly due to the contribution of the UWI. The UWI established a medical school in 1948 in Jamaica and later in Trinidad and Barbados.³⁸ It also has a clinical school in the Bahamas. UWI was established on the principles of social accountability to train doctors for the Caribbean and address national and regional health and educational challenges.³⁹ The UWI, in addition to its Faculty of Medical Sciences, has the Tropical Medicine Research Institute (TMRI) in Jamaica and the George Alleyne Chronic Disease Research Centre in Barbados. These research studies focused institutes/centres, although small, generate research aimed at influencing national policies and impacting regional communities. They also succeed in publishing in high impact journals such as *Science*, *Nature*, and *Lancet*, with resultant high citation rates.³⁴

Despite having more than 50 offshore medical schools in the CARICOM region,⁴⁰ most of the publications could be attributed to researchers affiliated with the UWI.³⁴ The United Nations Educational, Scientific and Cultural Organization (UNESCO) previously reported that 82% of the refereed articles (Web of Science, 2001–2013) by Caribbean scientists were contributed by the UWI researchers.³⁴ The present study found Jamaica had the most PubMed and SJR indexed publications within CARICOM, while Barbados had the highest citations per document. A study conducted in relatively small countries in LAC also showed that Barbados topped the countries of study and exceeded the LAC average in terms of

publication per GDP and per capita basis.³² Barbados also ranked first in epidemiological publication rates per million population in LAC region in 1990–2010.⁵

Publications of Grenada

While Grenada produced only 7%–13% of the publications in this study, its publication rates adjusted by population, GDP, and Internet use were greater than the other CARICOM countries. Most of these publications (87.6%) were contributed by the researchers affiliated to SGU. The UNESCO Science Report (2015) reported that approximately 94% of Grenada's publications in the Thomson Reuters Web of Science database were contributed by SGU researchers. The report also highlighted that the publication rate for Grenada per 100,000 population was higher than the other CARICOM countries.³⁴ Most, but not all, of these publications were biomedical.³³ It has been estimated that 80% of articles from Grenada were co-authored with US-affiliated researchers.³⁴ It was also noted that 532 papers were written in collaboration with authors attached to US-based institutions (Web of Science; 2008–2014).³⁴ In comparison, Jamaica (282) and Trinidad and Tobago (251) had 533 publications co-authored by US collaborators.

Publications of other countries

This study found that Haiti, Dominica, Guyana, Bahamas, and Suriname have a low research output. Haiti, classified as a low-income country²⁵ and having about 60% of the region's population, accounted for 4% and 9% of the PubMed and SJR publications, respectively, and secured the fifth place in both databases. In the UNESCO 2105 Report, Haiti was also listed fifth among CARICOM countries (Web of Science; 2008–2014) with 49% (107/218) of the publications being health-related.³⁴

Guyana, Bahamas, Dominica, and Suriname each accounted for approximately 1% of the publications indexed in PubMed and less than 3% of the SJR publications. Dominica, Guyana, and Suriname are considered upper-middle-income countries, while Bahamas is a high-income country.²⁵ These countries, with the exception of Dominica, have indigenous medical schools and all have offshore medical schools. For Dominica, the majority of the PubMed indexed papers published between 1990 and 2015 were by authors affiliated with Ross University School of Medicine. Since this university has recently relocated from Dominica, the publication rate for Dominica is likely to fall in the future. Many of the publications of Bahamas, Guyana, and Suriname would have been produced by the indigenous medical schools. Guyana and Suriname have experienced a problem which affects the research productivity of their universities: 'unattractive and uncompetitive' salaries in the higher education 'making it difficult to recruit high quality staff and, consequently, to mount competitive postgraduate programs and

create an enabling research environment'.³³ The 2010 UNESCO Report recommended that the governments of both countries need to allocate more resources to their national universities to increase their research productivity. Most private and for-profit offshore institutions in the Caribbean (currently there are over 50 schools) have failed 'to meet the traditional social obligations of medical schools . . . to train local doctors and to address local health challenges'.⁴⁰ Many of these schools have minimal involvement with the health systems of the Caribbean countries and, with few exceptions put less emphasis on research and publication.⁴¹

We also noticed a low contribution of these countries (with the exception of Guyana) in the June 2019 Caribbean Public Health Agency (CARPHA) Annual Scientific Conference held in Trinidad.⁴² Guyana had 29% (46 out of 160) of the total oral and poster presentations in the conference, which was the highest among all the participating countries, followed by Trinidad and Tobago (24%), Barbados (19%), and Jamaica (10%). Dominica and Haiti had no first author in oral or poster presentations. In addition to scientific productivity, cost and distance of travel may have been a factor affecting participation. There have been more than 4200 presentations at this annual conference over the last six decades (1956–2015).⁴³ However, there has been a surprisingly low conversion rate of those presentations to full publications⁴⁴ despite the 'effectiveness of the West Indian Medical Journal in nurturing research and publication skills'.³³ An important strategy to widen the publications by the CARICOM researchers is use of the 'Open Access Platinum' route,⁴⁵ which is a voluntary, collaborative, and independent, no charge model for publication.⁴⁶ This could present a solution, as many researchers are struggling with their publications due to increasing publication costs.⁴⁷ Regional government and non-government agencies, private foundations, professional societies, and universities should adopt mandates and policies to support an open access publication model.⁴⁸

Lack of scientific data in the Caribbean countries

Scientific evidence from high-quality research studies is important for improving regional health and reducing the burden of disease.⁴⁹ We experienced some challenges during our research due to paucity of relevant health indicators for the CARICOM countries, for example, in World Bank and World Health Organization (WHO) databanks; similar experiences were mentioned by other researchers^{5,7,9,32} that raised 'concerns with regards to methodology and data accuracy'.⁷ We used total population, GDP, and Internet usage rate to adjust the data. Other indicators such as adult illiteracy rate and secondary school enrolment ratio were not considered due to the unavailability of data for some of the studied countries. The Sub-regional Office for the Caribbean of the United Nations' Economic Commission for Latin America and the Caribbean (ECLAC) also highlighted the lack of Science, Technology and Innovation (STI) indicators for the Caribbean as far back

as 2003, which causes problems in developing policies 'to assess and deal effectively with challenges requiring innovative application of STI'.³⁴ There is an urgent need to collect country (or region)-specific data that reflects the true activity of research and the alignment of research investments and outputs with the current burden of disease.

Limitations

There are a number of limitations of this study, as was the case in previous studies of this nature.^{13,14} Research findings published in local/regional journals may not appear in PubMed and SJR. We were unable to use indicators such as adult illiteracy rate and secondary school enrolment ratio to adjust the findings due to the non-availability of data for some of the studied countries. Moreover, reports published by public, private organizations/academic institutes are not indexed by these databases. The actual number of publications and research productivity would be different if these publications are also added. This study could not assess the relevance and impact of published studies to regional needs except that increased citations may reflect the importance of a publication. Furthermore, the present study did not consider the Web of Science, one of the powerful research engines, to identify the CARICOM publications. As a result, some publications of the region may be missed. The authors have a plan to conduct a follow-up study using the Web of Science to identify the most prolific researchers, top research institutions, and most popular journals used by the researchers.

Conclusion

This study found that publication and citation rates varied markedly among CARICOM countries and were generally low. Despite the plethora of offshore medical schools in the region, most of the publications could be attributed to researchers affiliated with UWI, a regional indigenous university. More universities that value biomedical research are needed in the region, policymakers need to pay more attention to research, and more resources need to be made available if publication rates and research productivity are to improve.

Authors' contributions

M.A.A.M. conceived and designed the study; K.S. and M.A.A.M. led data collection. All authors (B.S., O.P.A., M.A.A.M., S.G., U.G., K.S.) were involved in analysing and interpreting the data. The manuscript was drafted by M.A.A.M. and K.S. with notable input from O.P.A., B.S., S.G., and U.G. All authors reviewed and approved the final version and have agreed to be accountable for all aspects of the work including any issues related to accuracy or integrity.

Availability of data and materials

The datasets of the current study are available from the corresponding authors on reasonable request.

Declaration of conflicting interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: All the authors are full-time faculty and affiliated to the Faculty of Medical Sciences, The University of the West Indies.

Ethical approval

Ethical approval was not needed as the study only consulted PubMed and SJR databases.

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