Cuban Scientific Production on Diabetes, 2000–2017: Peer-reviewed Publications, Collaboration and Impact

Ibraín E. Corrales-Reyes DDS, Yasmany Fornaris-Cedeño, Alberto J. Dorta-Contreras MS PhD, Christian R. Mejia MD MS PhD, Josmel Pacheco-Mendoza DVM MS, Ricardo Arencibia-Jorge PhD

ABSTRACT

INTRODUCTION The steadily increasing prevalence of diabetes globally has captured researchers' attention. Cuban production of scientific articles on diabetes has not been studied from a bibliometric perspective.

OBJECTIVE Characterize the production and impact of research and review articles on diabetes by Cuban authors in journals listed in the Scopus bibliographic database, as well as related collaboration among Cuban institutions and between Cuban and non-Cuban institutions.

METHODS A bibliometric analysis was conducted using 2000–2017 data from the Scopus database. The following search strategy was used: descriptor (diabetes), country (Cuba), publication source (journal), article type (original research, review article). Bibliographic indicators of production, visibility, impact and collaboration were examined.

RESULTS Cuba contributed 3.2% of Latin American production and 0.1% of global production related to diabetes. Within Cuba's scientific production (610 articles, 538 original research and 72 review), 85.9% had a Cuban corresponding author (Cuban leadership). In articles with international collaboration (22.9%), however, most (67.9%) had non-Cuban corresponding authors. A total of 47% (287) were articles involving a single institution. Only 11.1% were published in top-ranked journals, and 14.4% were cited >10 times. Cubans were lead authors on 0.3% of the most frequently cited (top 10%) articles on diabetes in Scopus. A total of 38.4% of this production appeared in low-impact journals and 57.9% in Cuban journals.

Articles published in English accounted for 30% of total and obtained higher impact in terms of citations than articles in Spanish. The strongest networks for scientific collaboration were those that connected Cuban and US researchers.

CONCLUSIONS Cuban scientists conduct research on diabetes, but their work is not highly visible in the peer-reviewed literature, particularly in top-ranked journals. The problem is not simply one of publishing more, but of knowing how and where to publish. It is urgent that Cuban universities training health professionals at all levels include instruction on scientific writing.

KEYWORDS Diabetes, health services research, scientific journals, bibliometrics, Cuba

INTRODUCTION

The term diabetes includes type 1 and type 2 diabetes mellitus (DM) (the most common), maturity onset diabetes of the young (of which seven types have been described), diabetes related to cystic fibrosis, medication-induced diabetes and gestational diabetes.[1] Due to its high mortality and morbidity, DM is a global public health problem of unquestionable importance.[2–4] It is characterized by insulin deficiency or resistance, or a combination of both.[5,6] Type 1 DM is a chronic autoimmune disease that primarily affects children and adolescents.[6,7] Type 2 DM is characterized by high blood sugar that can develop asymptomatically.[6] In general, independent of its classification, DM can cause chronic vascular damage, which produces many severe complications.[8]

According to the International Diabetes Federation, 451 million people worldwide aged 18–99 years suffered from diabetes in 2017 (and in some countries, as many as 1 in 2 diabetics is likely to be undiagnosed), the number expected to increase to 693 million by 2045.[9] The average prevalence of DM in South and Central America is 8%, with wide variations among and within countries.[10–15] In Cuba, prevalence was 6.2% of the total population (5.1% among men and 7.2% among women) in 2017. That same year, 2425 people died as a direct consequence of DM.[15]

IMPORTANCE This article is a wakeup call that one of the most important chronic conditions in Cuba, and Cuban strategies for addressing it, are not sufficiently reflected in the international literature.

Increases in diabetes morbidity, mortality and costs to individuals and health systems[10] demonstrate the need for research on this topic. Bibliometric analysis of publications on diabetes is useful in assessing the current state of research and contributions of researchers and countries, and can be a resource for those who lead research within a working group, an institution or a country.[16]

Bibliometric analysis of diabetes-specific scientific production has been carried out at the global level,[16–21] as well as for the Middle East, Iran, Nigeria, Argentina, Thailand, India, China, Brazil and Peru.[22–31] However, our literature review found no bibliometric studies of Cuban scientific production on diabetes.

This study aims to characterize production of original research and review articles on diabetes published by Cuban authors in journals included in the Scopus bibliographic database, and related collaboration among Cuban institutions and between Cuban and non-Cuban institutions.

METHODS

Design A bibliometric analysis was conducted using 2000–2017 data from the Scopus database.

Bibliometric indicators The following indicators were studied:

- number of articles with at least one author affiliated with a Cuban institution
- total number of citations received by articles
- total number of articles cited at least once
- mean number of citations for all articles retrieved
- percentage of articles involving collaboration
- type of collaboration—
  - none (article entirely produced within a single Cuban institution, regardless of number of authors or departments involved)
  - national (author affiliations include more than one Cuban institution)
  - international (author affiliations include institutions in at least one other country besides Cuba)
  - national and international (author affiliations include institutions from more than one Cuban institution and at least one other country)
- h-index. This considers both number of articles and number of citations. An author's h-index equals *x* if they have *x* articles cited at least *x* times.[32] May be applied to groups of authors, departments or countries, as well as individuals.
- growth rate (GR): percent change in number of articles published in a domain with respect to previous year, calculated as: $GR_n = [(Ndoc_n - Ndoc_{n-1})/Ndoc_{n-1}] * 100$, where *n* is the year[33]
- top ranked journals: in top 25% (Q1) of journals when ranked in descending order per SCImago Journal & Country Rank (SJR)[34]
- language of publication: Spanish, English, both
- scientific excellence: inclusion in 10% most frequently cited articles on diabetes indexed in Scopus[35]
- Cuban scientific leadership: corresponding author affiliated with Cuban institution[36]
- excellence with leadership: percentage of articles led (corresponding author) among 10% most-cited articles on diabetes indexed in Scopus[37]
- percentage of articles in Q1 journals where corresponding author is affiliated with a Cuban institution
- Cuban leadership: percentage of articles where author affiliations contain addresses in more than one country, and corresponding author is affiliated with a Cuban institution
- percentage of articles with Cuban corresponding author signed by authors in more than one Cuban institution and at least one in a non-Cuban institution

Data retrieval and processing On August 21, 2018, an advanced search was conducted in Scopus using filters by country (Cuba), journal type, article type (original research and review) and year of publication. The search term was "diabetes." The search strategy is displayed in Table 1. For data processing and analysis, records were exported to an ad hoc database using bibliographic reference management software (EndNote X7).

Articles in the 10% most cited articles on diabetes were obtained using Scival, a bibliographic analysis system from Elsevier. Using the same filters as previously described, Latin American scientific production was obtained for Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Puerto Rico, Uruguay and Venezuela. The SJR platform was used to categorize journal ranking by quartile. A bibliometric map of scientific cooperation networks among countries was created with VOSviewer v.1.6.5 software,[38] using the full-counting method.[39] Such maps display nodes representing collaborating countries and links connecting these nodes, with link width representing collaboration intensity determined by number of articles.

Table 1: Search strategy for articles on diabetes

Operator	Field	Search term
	AFFILCOUNTRY	Cuba
AND	SRCTYPE	j
AND	TITLE-ABS-KEY	diabetes
AND	PUBYEAR	≥1999
AND	LIMIT-T0	DOCTYPE, "ar" OR DOCTYPE, "re"
AND	EXCLUDE	PUBYEAR, 2018

RESULTS

Production and citation of original research and review articles The Scopus database included 610 articles (538 original research and 72 review articles) with at least 1 Cuban author over the 18-year period under study, with an annual average of 33.9. Annual number of publications grew through 2010, with 2017 production tripled that of 2000. Citations rose to 6243, for an annual average of 346.8. A total of 60% (366) of articles were cited at least once. The h-index overall for the study period was 34 (Table 2).

Type of article, language of publication and citations Articles in Spanish constituted 67.2% (410) and received 605 citations (1.5 per article), with an h-index of 8. Articles in English (183, 30%) were mostly (119, 65%) published in the final years of the period (2010–2017) and received 5610 citations, with an h-index of 34. The mean number of citations per article was 30.7. As of 2006, the database included publications appearing in both languages, representing 2.5% of the total (15), with 24 citations and an h-index of 5 (Table 2).

Original research articles The 538 original research articles received 5724 citations, with an average of 10.6 per article and an h-index of 32. A total of 201 original research articles received 1–5 citations; 40 received 6–10; 77 received >10; and the remaining 220 (40.9%) were not cited. In other words, 78.3% of articles received few or no citations. There were 370 (68.8%) articles published in Spanish, 153 (28.4%) in English and 13 (2.4%) in Spanish and English. A single article was published in Portuguese, receiving four citations. Another was published in English and Croatian and was not cited.

Among articles published in Spanish, 159 received 1–5 citations; 12 received 6–10; 5 received >10; and the remaining 194 (52.4%) were not not cited. Of articles published in English, 35 received 1–5 citations; 27 received 6–10; 72 received >10; and the remaining 19 (12.4%) were not cited. In summary, 95.4% of original research articles published in Spanish received few or no citations. The percentage of original research articles published in English and rarely or never cited was 35.3%.

Review articles The 72 review articles received 519 citations with an average of 7.2 per article, and an h-index of 9; 29 articles received 1–5 citations; 8 received 6–10 citations; 11 received >10 citations; and the remaining 24 (33%) were not cited. There

Table 2: Bibliometric indicators of Cuban scientific articles on diabetes (Scopus, 2000–2017)

Year	Articles n	Citations n	Articles cited n (%)	Spanish articles (CPA)	English articles (CPA)	English and Spanish	h-Index	Excellent[a] %	Cuban led[b] %	In Q1 journals %
2000	14	52	8 (57.1)	13 (1.9)	1 (27)	0	4	0.0	100	0.0
2001	21	153	15 (71.4)	18 (2.3)	3 (37.0)	0	5	0.0	100	4.8
2002	29	145	24 (82.8)	25 (2.8)	4 (18.6)	0	8	0.0	100	3.5
2003	9	1088[c]	7 (77.8)	5 (1.6)	4 (270.0)	0	5	11.1	77.8	22.2
2004	22	83	15 (68.2)	15 (1.9)	7 (7.7)	0	6	0.0	66.7	22.7
2005	20	702	16 (80.0)	8 (10.4)	12 (51.6)	0	11	10.0	85.0	25.0
2006	33	707	15 (45.4)	26 (0.7)	6 (114.8)	1	6	6.1	81.8	12.1
2007	30	280	18 (60.0)	23 (2.0)	7 (33.4)	0	7	3.3	80.0	3.3
2008	34	620	24 (70.6)	25 (1.6)	9 (64.6)	0	7	5.9	85.3	11.8
2009	40	491	27 (67.5)	29 (1.8)	11 (39.8)	0	8	5.0	77.5	7.5
2010	45	188	28 (62.2)	33 (1.1)	8 (18.4)	4	6	0.0	95.6	6.7
2011	38[d]	246	23 (60.5)	25 (1.7)	12 (16.7)	0	7	0.0	89.5	10.5
2012	50	159	30 (60.0)	36 (1.2)	12 (9.7)	2	6	0.0	90.0	8.0
2013	55	328	39 (70.9)	29 (1.3)	24 (12.0)	2	9	0.0	81.8	16.4
2014	43[d]	300	30 (69.8)	22 (1.0)	17 (5.9)	3	10	0.0	81.4	14.0
2015	49	335	22 (44.9)	33 (0.5)	16 (19.9)	0	5	2.0	83.7	6.1
2016	35	324	13 (37.1)	18 (0.1)	15 (21.5)	2	6	2.9	80.0	22.9
2017	43	42	12 (27.9)	27 (0.1)	15 (2.6)	1	4	0.0	88.4	11.3
Overall	610[d]	6243	366 (60.0)	410 (1.5)	183 (30.0)	15	34	2.0	85.9	11.1

[a]among 10% most frequently cited articles for topic [b]Cuban corresponding author
[c]A US clinical trial on hypertension with keyword "diabetes" accounts for spike in citations [d]articles in other languages not included in horizontal totals
CPA: citations per article

were 35 (48.6%) articles published in Spanish, 30 (41.7%) in English and 2 (2.8%) in both languages. Of articles published in Spanish, 14 received 1–5 citations; 3 received 6–10; and the remaining 18 (51.1%) were not cited. Of articles published in English, 11 received 1–5 citations; 5 received 6–10; 11 received >10; and 3 (10%) were not cited. A total of 91.4% of review articles in Spanish received no or very few citations, as did 46.7% of those published in English.

Scientific collaboration, excellence and leadership Scientific collaboration was analyzed with regard to production volume and article impact, expressed by number of citations (Table 2). Nearly half (287, 47%) of Cuba's scientific production on diabetes was from a single Cuban institution (i.e., without any external collaboration); these articles received 540 citations (8.6% of total). A total of 183 (30%) articles were published in collaborations involving authors from several Cuban institutions, most (116, 63.4%) in the final 8 years under study (2010–2017). Work conducted and published with international collaboration accounted for 22.3% of the total; 52.2% of articles had both Cuban and international collaboration; and 25.5% were produced by a single Cuban institution.

A total of 85.9% of articles named a Cuban as corresponding author. Cubans were corresponding authors in 32.1% (45/140) of articles published with international participation. Two articles (0.3%) deemed excellent (top 10% in citation frequency) had Cuban leadership; they were published in 2005 and 2015 (Table 2). The 94 articles published by a single Cuban institution in collaboration with non-Cuban institutions represented 15.4% of the total but received 64.8% of citations (4046). A total of 77.7% of these articles had a non-Cuban corresponding author. Works published by more than one Cuban institution and with international collaboration (46, 7.5%) received 12.6% of all citations; of these, 47.8% had a non-Cuban corresponding author (Table 3).

Cuban contributions to international production, rates of increase, h-index and publications in top-ranked journals The volume of global production on diabetes in Scopus during the period studied amounted to 457,681 articles. Scientific production from Latin America during the period totaled 19,268 articles, for an annual average of 1070.4. Cuba was responsible for 3.2% of Latin American and 0.1% of global production. Within Latin America, Cuba ranked 6th in number of articles published over the full period, surpassed by Brazil (9850, 51.1%), Mexico (3822, 19.8%), Argentina (1760, 9.1%), Chile (1235, 6.4%) and Colombia (745, 3.9%). Cuba ranked fifth in 2000–2008, and also in 2010. In 2008, Cuba shared the 5th-rank position with Colombia (34 articles). In 2009, Cuba was displaced from fifth to sixth by Colombia and stayed in that position in 2011–2015, and in 2017. In 2016, Cuba ranked seventh, after Peru. In terms of h-index values during the years studied, in Latin America, Cuba ranked 8th, along with Peru (h = 34), and behind Brazil (h = 159), Mexico (h = 116), Argentina (h = 98), Chile (h = 77), Colombia (h = 63), Venezuela (h = 39) and Puerto Rico (h = 38).

Over the 18 years covered by the study, global scientific production on diabetes increased steadily (with the exception of 2017), with an average annual growth rate of 8.3%. Annual production increased from 10,278 articles in 2000 to 38,238 in 2017. In Latin America, the 240 articles published in 2000 increased to 2019 by the year 2017, an average annual growth rate of 14.2%, which is much higher than the global average. In contrast to Latin America, where annual growth rates never dipped into negative values, in Cuba, the years 2000, 2003, 2005, 2007, 2011, 2014 and 2016 had negative growth rates (Figure 1).

Table 3: Articles by type of scientific collaboration and impact in citations (Scopus, 2000–2017)

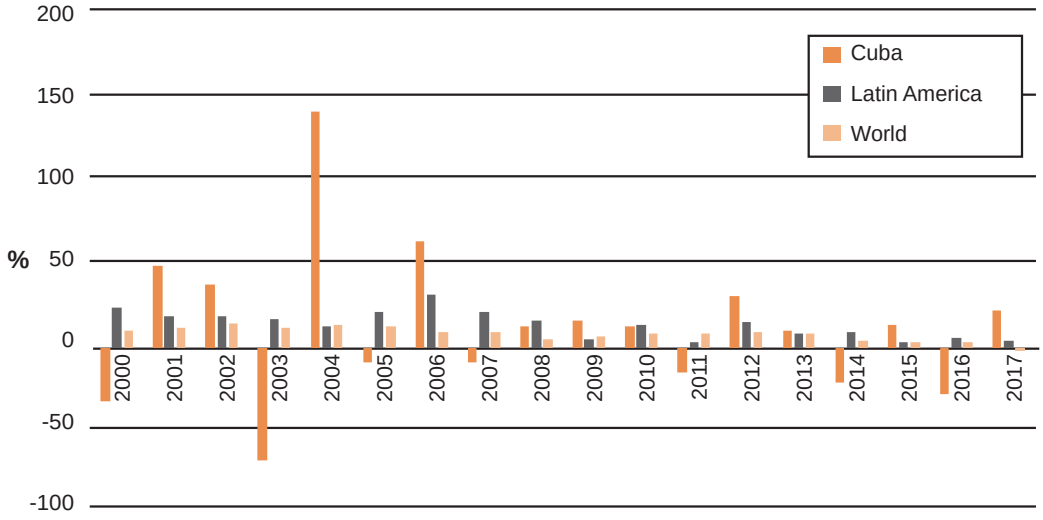
Year	No collaboration		National collaboration		International collaboration			International and national collaboration			Cuban led International and national + international*
	Articles n	Citations n	Articles n	Citations n	Articles n	Citations n	Cuban led* %	Articles n	Citations n	Cuban led* %	
2000	11	24	3	28	0	—	—	0	—	—	—
2001	16	81	4	11	0	—	—	1	61	100	100
2002	19	69	8	60	2	16	100	0	—	—	0.0
2003	4	8	2	22	2	1014	0.0	1	44	100	33.3
2004	8	17	6	26	8	40	12.5	0	—	—	12.5
2005	6	17	6	157	5	285	60.0	3	243	100	75.0
2006	21	17	5	40	6	635	0.0	1	15	100	14.3
2007	13	31	10	125	6	123	16.7	1	1	0.00	14.3
2008	19	25	8	41	5	456	20.0	2	98	50.0	28.6
2009	15	37	15	85	9	362	11.1	1	7	100	20.0
2010	26	28	15	58	2	101	0.0	2	1	100	50.0
2011	21	52	10	74	3	98	33.3	4	22	50.0	42.9
2012	17	17	24	41	7	54	42.9	2	47	50.0	44.4
2013	24	86	16	58	11	159	27.3	4	25	50.0	33.3
2014	15	18	13	26	8	127	37.5	7	129	42.9	40.0
2015	23	7	11	6	7	263	28.6	8	59	25.0	26.7
2016	12	0	10	11	10	304	20.0	3	9	33.3	23.1
2017	17	6	17	1	3	9	33.3	6	26	50.0	40.0
Overall	287	540	183	870	94	4046	22.3	46	787	52.2	32.1

*Cuban corresponding author

Some 11.1% (68) of Cuban-authored articles on diabetes were published in Q1 journals, 45 of them in 2009–2017 (Table 3). These articles received 4143 citations, representing 66.3% of all citations, for an average of 60.9 citations per article and an h-index of 26. All were published in English and 22 (32.4% of Cuban-authored articles in Q1) had a Cuban corresponding author. A total of 12.5% (76) of all articles were published in Q2 journals. These received 1104 citations, accounting for 17.7% of the total, with an average of 14.5 citations per article and an h-index of 19; 98.7% (75) of them were published in English. Some 232 (38%) were published in Q3 journals and received 642 citations, accounting for 10.3% of total citations, with an average of 2.8 citations per article and an h-index of 13. Of these, 20 articles (8.6%) were published in English. The remaining 234 articles (38.4%) were published in Q4 journals and received 354 citations (5.7% of all citations received), with an h-index of 7. Language of publication was English for 17 of these articles (7.3%).

Cuban authors were published in 174 journals, 12 of which published ≥10 articles on diabetes (1 in Q2, 6 in Q3, and 5 in Q4). Cuban journals accounted for 353 articles (57.9%), of which 170 were cited (414 citations) at least once. Articles published in Cuban journals received 6.6% of citations—more than half (183) were not cited—with an h-index of 8. The greatest volume of production (158) was found in *Revista Cubana de Medicina General Integral, Revista Cubana de Investigaciones Biomédicas* and *Revista Cubana de Medicina,* together accounting for 25.9% of all articles. Corresponding authors were Cuban for all articles in the 12 journals that published ≥10 research articles (Table 4).

Figure 1: Annual growth of global, Latin American and Cuban scientific production on diabetes (Scopus, 2000–2017)



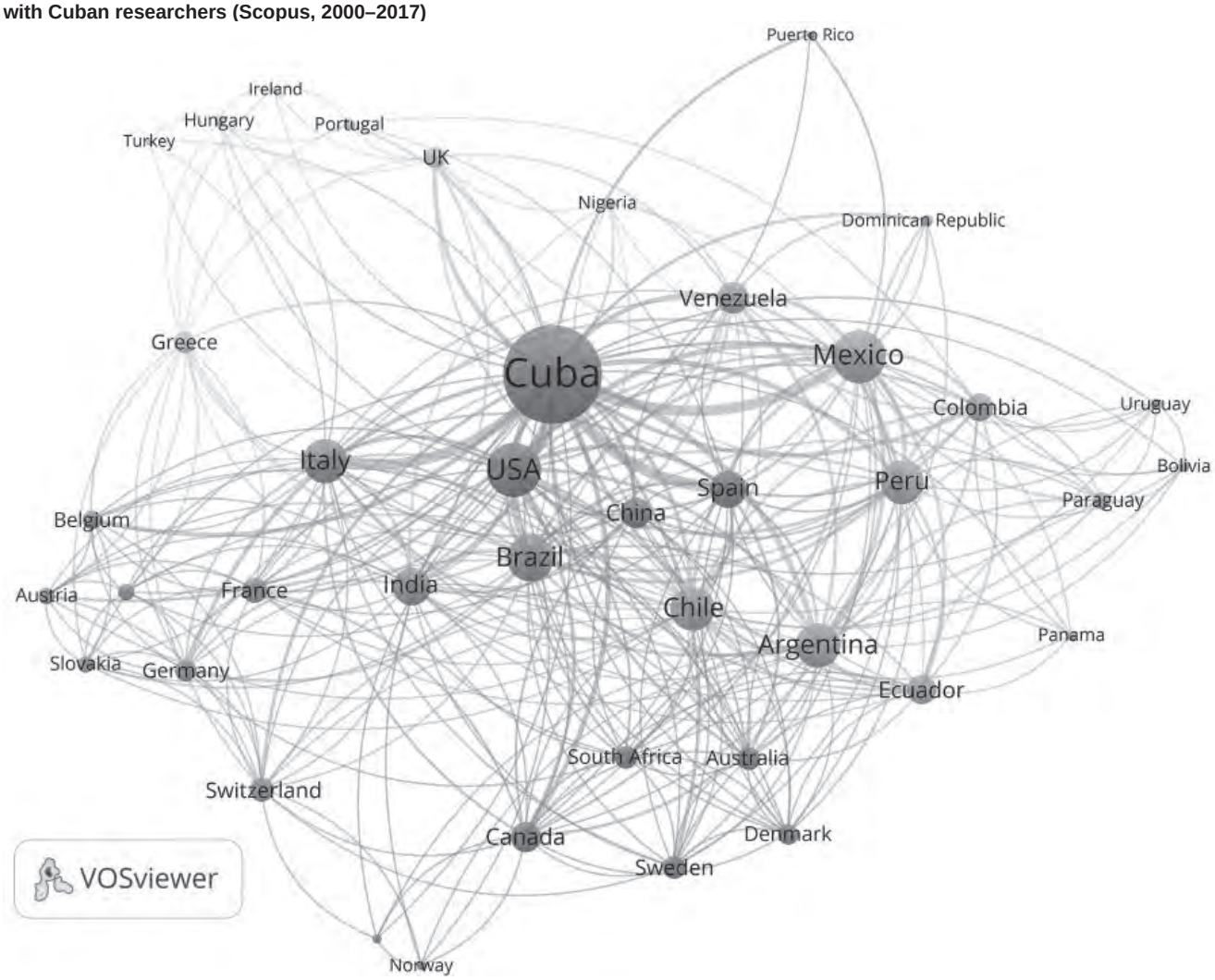
With regard to impact (in terms of citations) of articles in journals with ≥10 articles published, *MEDICC Review* was the journal with the greatest number of citations and highest h-index (346, 11.2 citations per article and h = 10) and the only non-Cuban journal with ≥10 articles retrieved. The highest percentage of scientific

Table 4: Journals publishing ≥10 Cuban-authored articles on diabetes (Scopus, 2000–2017)

Journal	Country	Quartile[a]	Articles n	Citations n	Articles cited n (%)	CPA	H-index	Collaboration[b] %	Cuban led[c] %
Revista Cubana de Medicina General Integral	Cuba	Q3	57	81	34 (59.7)	1.4	4	35.1	98.3
Revista Cubana de Investigaciones Biomédicas	Cuba	Q4	51	80	32 (62.7)	1.6	4	39.2	98.0
Revista Cubana de Medicina	Cuba	Q4	50	38	19 (38.0)	0.8	3	26.0	100
MEDICC Review	USA	Q2	31	346	25 (80.7)	11.2	10	71.0	90.3
Revista Habanera de Ciencias Médicas	Cuba	Q3	31	22	11 (35.5)	0.7	3	29.0	100
Revista Cubana de Medicina Militar	Cuba	Q3	30	19	9 (30.0)	0.6	3	10.0	100
Revista Cubana de Obstetricia y Ginecología	Cuba	Q3	26	30	13 (50.0)	1.2	3	38.5	100
Biotecnología Aplicada	Cuba	Q4	16	47	11 (68.8)	2.9	4	68.8	100
Revista Cubana de Salud Pública	Cuba	Q3	16	15	9 (56.2)	0.9	2	62.5	100
Revista Cubana de Cirugía	Cuba	Q4	14	5	4 (28.6)	0.4	1	14.3	100
Revista Cubana de Higiene y Epidemiología	Cuba	Q4	12	24	8 (66.7)	2.0	3	58.3	100
Revista Cubana de Pediatría	Cuba	Q3	10	20	4 (20.0)	2.0	3	70.0	100

[a]SCImago Journal & Country Rank[34] [b]manuscript produced in collaboration of any sort [c]Cuban corresponding author CPA: citations per article

Figure 2: Scientific collaboration networks among countries with ≥3 articles published with Cuban researchers (Scopus, 2000–2017)



(available in color online at www.mediccreview.org/cuban-scientific-production-on-diabetes-2000-2017)

collaboration of any type was found in *MEDICC Review* (71%), followed by the *Revista Cubana de Pediatría* (70%) (Table 4).

Production of articles deemed excellent was scant. In 10 of the 18 years under study, none was reported (Table 2). Works deemed excellent appeared in the following journals: *American Journal of Epidemiology, American Journal of Medicine, American Journal of Obstetrics and Gynecology, BMC Complementary and Alternative Medicine, Circulation Research, Journal of the American Medical Association, Journal of Physiology, The Lancet, Gastroenterology,* and *European Journal of Pharmacology.* Articles in the latter two journals had a Cuban corresponding author (excellence with Cuban leadership).

Collaboration networks Cuban authors published with researchers from 34 countries, most frequently the USA (36 articles), Spain (26), Italy (24), Mexico (24), Brazil (13), Argentina (10), and Peru (9). Figure 2 presents a bibliometric map of scientific collaboration networks among countries, with a threshold of three or more coauthored articles published. The diagram shows a central nucleus of densely connected countries surrounded by countries with fewer connections. The countries fall into five clusters. Cuba, USA, Spain, Italy and Mexico are the main nodes, with the greatest number of coauthored articles. The most prolific networks of scientific collaboration exist between Cuban and US researchers.

DISCUSSION

Critical analysis is key to interpreting bibliometric indicators. For example, the figures for Cuban leadership are redundant for articles entirely authored by Cubans but are of great interest when analyzing articles with international collaboration. Combined analysis of number of citations by publication language that simultaneously takes into account journal quartile and international collaboration is much more informative than the overall numbers yielded by the search. The study initially detected 115 articles published in Spanish and English. After critical examination, this number was reduced to 15. The overrepresentation was due to the fact that articles with abstracts in two languages were included in the database. The atypical number of citations in 2003 reflects a Cuban-authored article with keyword "diabetes" with content unrelated to the search topic—It was actually about a clinical trial on hypertension.

Production of Cuban articles in the medical sciences is lower than might be expected given the country's human capital and research capabilities and contains scarcely any articles from the primary health sector, the foundation of Cuba's universal health system.[40,41] For Benet, this poses cause for concern, as the residency in family medicine (the specialty of the majority of new medical graduates) requires a thesis.[42] Master's and doctoral degrees also require scientific publication. Given the 18-year period under analysis and the high number of Cuban health sciences students and professionals (totaling 192,596 in the 2017–2018 academic year, according to the 2017 Health Statistics Yearbook),[15] one could expect high productivity in terms of articles published in indexed scientific journals.

This study demonstrates shortcomings in Cuban medical publishing on diabetes in terms of visibility and impact. For scientific production on diabetes to reflect Cuban outcomes in prevention, diagnostics and treatment, Cuban researchers would need to publish in journals with greater visibility. For example, in years with the greatest number of publications on this topic, h-indexes were very low. Limited publication in Q1 journals is observed in other branches of Cuban science and is not specific to the health sciences.[33,40,41] The scientific literature does not yet adequately reflect the Cuban health system's strategies, research, product development or outcomes.

Cuban researchers and administrators are far from demonstrating the results of their daily work and research in top-ranked scientific publications.[43] It has been noted that low production of scientific articles might be influenced by the absence of a culture of publication, insufficient training in scientific writing, and the (understandable) existence of other priorities, such as teaching and patient care, which account for the greatest share of professional responsibilities and time.[41] We agree with Zacca-González, who notes the need for strategies to promote publication in top-ranked journals while seeking a balance between articles published in Cuban journals and those published in non-Cuban journals.[44]

Over the period, Cuban scientific production showed a tendency to stagnate, in contrast to global trends[16–21,27,29,45–47] and those of countries such as Nigeria,[26] China[30] and Peru.[31] The number of articles retrieved from Scopus increased when Cuban journals from SciELO were included, but the total number of citations decreased, as did the h-index.[44,48] Cuba ranks sixth in Latin America in number of articles published, which is impressive when taking into account the size of our population and the US embargo. But Cuba's position in term of its h-index is less satisfactory, and its eighth-place position in Latin America is difficult to explain.

We believe Cuban journals should redouble their efforts to recruit high-level international peer reviewers. External peer review by international experts can contribute substantially to article quality and is a free source of instruction and scientific debate that allows us to assess our research quality by international standards.

Authors from Cuba published as coauthors with researchers from 34 countries, with the USA leading the list. In recent decades, there has been a notable increase in scientific collaboration,[49] influenced by multidisciplinary and increasingly specialized research. This brings additional benefits in terms of citations and impact.[50] Among the obvious benefits of international collaboration is the possibility of participating in international research, with its access and contributions to the collective knowledge of key experts, state-of-the-art treatments and technologies, and ongoing research programs.[51]

As noted in other studies,[52,53] articles published with international collaboration achieved, on average, greater impact in terms of citations than those produced with only Cuban or no collaboration. The likely reasons for this are the increased number of informal and formal channels for dissemination, publication in the top-ranked journals, superior research quality (in some cases), or the importance beyond local horizons of its subject matter—factors of greater interest to the international scientific community. Narin found that publications by scientists affiliated with institutions connected to more than one country in the European Union were cited twice as often as articles written by scientists working in a single institution within a single country.

Narin concludes that national collaboration increases the volume of citations by a factor of 1.5, whereas international collaboration increases it by a factor of 2.5.[54] The extraterritorial nature of the US economic, financial and trade embargo in effect since 1962 has been an obstacle not only to greater bilateral research collaboration and publishing but has also limited contact with other countries' researchers.[55]

Cuban leadership in articles published with international collaboration was found to be low, perhaps because these are international research projects generated and led by non-Cuban entities. Involvement with international institutions in research areas led by Cuban entities strengthens our national capacity, particularly in activities involving training for human resources and the acquisition of technology.[56–58]

Many Cuban professors and specialists do collaborative medical work in other countries, especially in Latin America and Africa, but this extensive collaboration has not been translated into the production of scientific articles in this field.[48] Cuba is home to the Latin American School of Medicine, which to date has trained some 30,000 health professionals from around the world. These professionals could be a valuable source of publishable experiences, in collaboration with Cuban specialists or entities. It would make sense to include scientific writing and publishing in its curriculum, and to encourage students to undertake research projects linked to medical practice in their communities. We agree with Zacca-González,[44,48] who believes that conditions exist to create collaborative networks and achieve greater impact and visibility for Cuban scientific research.

Study limitations Samples obtained in this study might include articles without diabetes as a main topic, despite having the term "diabetes" in their descriptors. A more restrictive strategy, such as searching in indexed journals under the thematic category "Endocrinology, Diabetes and Metabolism" in the Scopus database, would have meant ignoring a great amount of diabetes research published in multidisciplinary journals or found in other thematic categories. Nor did the study characterize the main themes of scientific research on diabetes in Cuba. This could be the topic of future studies.

CONCLUSIONS

The volume of publications on diabetes by Cuban authors illustrates that diabetes motivates research by Cuban scientists and institutions but their work is insufficiently reflected in the peer-reviewed literature, particularly top-ranked journals. We urgently need to change this situation. The current problem is not simply one of publishing more, but of knowing how and where to publish. It is urgent that Cuban universities training professionals at all levels of health care include instruction on writing for publication in peer-reviewed journals.

REFERENCES

1. Carndarll J, Shamoon H. In: Goldman-Cecil, editor. Tratado de Medicina Interna. Madrid: Elsevier; 2017. Chapter 229, Diabetes mellitus; p.1527–48. Spanish.
2. Zhu M, Li J, Li Z, Luo W, Dai D, Weaver SR. Mortality rates and the causes of death related to diabetes mellitus in Shanghai Songjiang District: an 11-year retrospective analysis of death certificates. BMC Endocr Disord [Internet]. 2015 Sep 4 [cited 2018 Aug 24];15:45. Available from: http://dx.doi.org/10.1186/s12902-015-0042-1
3. Geiss LS, Wang J, Cheng YJ, Thompson TJ, Barker L, Li Y, et al. Prevalence and incidence trends for diagnosed diabetes among adults aged 20 to 79 years, United States, 1980–2012. JAMA [Internet]. 2014 Sep 24 [cited 2018 Aug 24];312(12):1218–26. Available from: https://jamanetwork.com/journals/jama/fullarticle/10.1001/jama.2014.11494
4. Tarekegne FE, Padyab M, Schröders J, Stewart J. Sociodemographic and behavioral characteristics associated with self-reported diagnosed diabetes mellitus in adults aged 50 years in Ghana and South Africa: results from the WHO-SAGE wave. BMJ Open Diabetes Res Care [Internet]. 2018 Feb 2 [cited 2018 Aug 24];6(1):e000449. Available from: http://dx.doi.org/10.1136/bmjdrc-2017-000449
5. Ghosh N, Katare R. Molecular mechanism of diabetic cardiomyopathy and modulation of microRNA function by synthetic oligonucleotides. Cardiovasc Diabetol [Internet]. 2018 Mar 22 [cited 2018 Aug 24];17(1):43. Available from: http://dx.doi.org/10.1186/s12933-018-0684-1
6. Ten Klooster JP, Sotiriou A, Boeren S, Vaessen S, Vervoort J, Pieters R. Type 2 diabetes-related proteins derived from an in vitro model of inflamed fat tissue. Arch Biochem Biophys [Internet]. 2018 Apr 15 [cited 2018 Aug 24];644:81–92. Available from: http://dx.doi.org/10.1016/j.abb.2018.03.003
7. Al-Ghamdi AH, Fureeh AA. Prevalence and clinical presentation at the onset of type 1 diabetes mellitus among children and adolescents in AL-Baha region, Saudi Arabia. J Pediatr Endocrinol Metab [Internet]. 2018 Mar 28 [cited 2018 Aug 24];31(3):269–73. Available from: http://dx.doi.org/10.1515/jpem-2017-0059
8. Forbes JM, Fotheringham, AK. Vascular complications in diabetes: old messages, new thoughts. Diabetologia [Internet]. 2017 Nov [cited 2018 Aug 24];60(11):2129–38. Available from: https://doi.org/10.1007/s00125-017-4360-x
9. Cho NH, Shaw JE, Karuranga S, Hung Y, da Rocha Fernandes JD, Ohlrogge Aw, et al. IDF Diabetes Atlas: global estimates of diabetes prevalence for 2017 and projections for 2045. Diabetes Res Clin Pract [Internet]. 2018 Apr [cited 2018 Sep 16];138:271–81. Available from: http://dx.doi.org/10.1016/j.diabres.2018.02.023
10. da Rocha Fernandes J, Ogurtsova K, Linnenkamp U, Guariguata L, Seuring T, Zhang P, et al. IDF Diabetes Atlas estimates of 2014 global health expenditures on diabetes. Diabetes Res Clin Pract [Internet]. 2016 Jul [cited 2018 Aug 24];117:48–54. Available from: http://dx.doi.org/10.1016/j.diabres.2016.04.016
11. Guariguata L, Whiting DR, Hambleton I, Beagley J, Linnenkamp U, Shaw JE. IDF Diabetes Atlas. Global estimates of diabetes prevalence for 2013 and projections for 2035. Diabetes Res Clin Prac [Internet]. 2014 Feb [cited 2018 Aug 20];103(2):137–49. Available from: http://dx.doi.org/10.1016/j.diabres.2013.11.002
12. Agudelo-Botero M, Dávila-Cervantes CA. Carga de la mortalidad por diabetes mellitus en América Latina 2000-2011: los casos de Argentina, Chile, Colombia y México. Gac Sanit. 2015 May–Jun [cited 2018 Aug 20];29(3):172–7. Available from: http://dx.doi.org/10.1016/j.gaceta.2015.01.015. Spanish.
13. Vargas-Uricoechea H, Casas-Figueroa LÁ. Epidemiología de la diabetes mellitus en Sudamérica: la experiencia de Colombia. Clín Investig Arterioscler [Internet]. 2016 Sep–Oct [cited 2018 Aug 24];28(5):245–56. Available from: https://doi.org/10.1016/j.arteri.2015.12.002. Spanish.
14. Sapunar J. Epidemiología de la diabetes mellitus en Chile. Rev Med Clin Condes [Internet]. 2016 Mar [cited 2018 Aug 20];27(2):146–51. Available from: https://www.sciencedirect.com/science/article/pii/S0716864016300037. Spanish.
15. National Health Statistics and Medical Records Division (CU). Anuario Estadístico de Salud 2017 [Internet]. Havana: Ministry of Public Health (CU); 2018 [cited 2018 Aug 24]. Available from: http://files.sld.cu/dne/files/2018/04/Anuario-Electronico-Espa%C3%B1ol-2017-ed-2018.pdf. Spanish.
16. Michán L, Muñoz-Velasco I. Cienciometría para ciencias médicas: definiciones, aplicaciones y perspectivas. Inv Ed Med [Internet]. 2013 Apr–Jun [cited 2018 Aug 24];2(6):100–6. Available from: http://www.scielo.org.mx/scielo.php?pid=S2007-50572013000200006&script=sci_arttext. Spanish.
17. Pu QH, Lyu QJ, Liu H, Fan KH. Bibliometric analysis of the top-cited articles on islet transplantation. Medicine (Baltimore) [Internet]. 2017 Nov [cited 2018 Aug 24];96(44):e8247. Available from: http://dx.doi.org/10.1097/MD.0000000000008247
18. Gao Y, Wang Y, Zhai X, He Y, Chen R, Zhou J, et al. Publication trends of research on diabetes mellitus and T cells (1997–2016): A 20-year bibliometric study. PLoS One [Internet]. 2017 Sep 19 [cited 2018 Aug 24];12(9):e0184869. Available from: http://dx.doi.org/10.1371/journal.pone.0184869
19. Tian J, Li M, Lian F, Tong X. The hundred most-cited publications in microbiota of diabetes research: a bibliometric analysis. Medicine (Baltimore) [Internet]. 2017 Nov [cited 2018 Aug 24];96(37):e7338. Available from: http://dx.doi.org/10.1097/MD.0000000000007338

20. Geaney F, Scutaru C, Kelly C, Glynn RW, Perry IJ. Type 2 diabetes research yield, 1951–2012: bibliometrics analysis and density-equalizing mapping. PLoS One [Internet]. 2015 Jul 24 [cited 2018 Aug 24];10(7):e0133009. Available from: https://doi.org/10.1371/journal.pone.0133009
21. Brüggmann D, Richter T, Klingelhöfer D, Gerber A, Bundschuh A, Jaque J, et al. Global architecture of gestational diabetes research: density-equalizing mapping studies and gender analysis. Nutr J [Internet]. 2016 Apr 4 [cited 2018 Aug 24];15:36. Available from: http://dx.doi.org/10.1186/s12937-016-0154-0
22. SweilehWM, Zyoud SH, Al-Jabi SW, Sawalha AF. Bibliometric analysis of diabetes mellitus research output from Middle Eastern Arab countries during the period (1996–2012). Scientometrics [Internet]. 2014 Oct [cited 2018 Aug 24];101(1):819–32. Available from: https://doi.org/10.1007/s11192-014-1361-0
23. Peykari N, Djalalinia S, Kasaeian A, Naderimagham S, Hasannia T, Larijani B, et al. Diabetes research in Middle East countries; a scientometrics study from 1990 to 2012. J Res Med Sci [Internet]. 2015 Mar [cited 2018 Aug 24];20(3):253. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4468230/
24. Rasolabadi M, Khaledi S, Ardalan M, Kalhor MM, Penjvini S, Gharib A. Diabetes research in Iran: a scientometric analysis of publications output. Acta Inform Med [Internet]. 2015 Jun [cited 2018 Aug 24];23(3):160–4. Available from: https://dx.doi.org/10.5455/aim.2015.23.160-164
25. Nasli-Esfahani E, Farzadfar F, Kouhnavard M, Ghodssi-Ghassemabadi R, Khajavi A, Peimani M, et al. Iran diabetes research roadmap (IDRR) study: a preliminary study on diabetes research in the world and Iran. J Diabetes Metab Disord [Internet]. 2017 Feb 17 [cited 2018 Aug 24];16:9. Available from: http://dx.doi.org/10.1186/s40200-017-0291-9
26. Harande YI. Exploring the literature of diabetes in Nigeria: a bibliometrics study. Afr J Diabetes Med [Internet]. 2011 Nov [cited 2018 Aug 24];19(2):8–11. Available from: http://www.africanjournalofdiabetesmedicine.com/articles/november_2011/Literature of diabetes.pdf
27. Harande YI, Alhaji IU. Basic literature of diabetes: a bibliometrics analysis of three countries in different world regions. J Lib Inf Sci [Internet]. 2014 [cited 2018 Aug 24];2(1):49–56. Available from: http://jlisnet.com/journals/jlis/Vol_2_No_1_March_2014/6.pdf
28. Bala A, Gupta BM. Diabetes research in India, China and Brazil: a comparative quantitative study, 2000–09. J Adv Lib Inf Sci [Internet]. 2012 Apr–Jun [cited 2018 Aug 24];1(2):69–78. Available from: https://jalis.in/pdf/pdf_27jun/20121204.pdf
29. Gupta BM, Kaur H, Bala A. Mapping of Indian diabetes research during 1999-2008: a scientometric analysis of publications output. DESIDOC J Library Inf Tech [Internet]. 2011 Mar [cited 2018 Aug 24];31(2):143–52. Available from: http://publications.drdo.gov.in/ojs/index.php/djlit/article/view/866
30. Zhao X, Guo L, Yuan M, He X, Lin Y, Gu C, et al. Growing trend of China's contribution to global diabetes research. A systematic literature review. Medicine [Internet]. 2016 May [cited 2018 Aug 24];95(18):e3517. Available from: http://dx.doi.org/10.1097/MD.0000000000003517
31. Taype-Rondan A, Huapaya-Huertas O, Bendezu-Quispe G, Pacheco-Mendoza J, Bryce-Alberti M. Producción científica en diabetes en Perú: un estudio bibliométrico. Rev Chil Nutr [Internet]. 2017 [cited 2018 Aug 24];44(2):153–60. Available from: http://dx.doi.org/10.4067/S0717-75182017000200006. Spanish.
32. Hirsch JE. An index to quantify an individual's scientific research output. Proc Natl Acad Sci USA [Internet]. 2005 Nov 15 [cited 2018 Aug 24];102(46):16569–72. Available from: http://dx.doi.org/10.1073/pnas.0507655102
33. Zacca González G. Producción científica latinoamericana en Salud Pública. Cuba en el contexto regional. Scopus 2003–2011 [Internet] [thesis]. [Granada]: Universidad de Granada; 2015 May [cited 2018 Aug 24]. 224 p. Available from: http://hdl.handle.net/10481/40902. Spanish.
34. González-Pereira B, Guerrero-Bote VP, de Moya-Anegón F. A new approach to the metric of journal's scientific prestige: The SJR indicator. J Informetr [Internet]. 2010 Jul [cited 2018 Aug 24];4(3):379–91. Available from: https://doi.org/10.1016/j.joi.2010.03.002
35. Bornmann L, de Moya-Anegón F, Leydesdorff L. The new excellence indicator in the World Report of the SCImago Institutions Rankings 2011. J Informetr [Internet]. 2012 [cited 2018 Aug 24];6(2):333–5. Available from: https://arxiv.org/abs/1110.2305
36. de Moya-Anegón F, Guerrero-Bote VP, Bortmann L, Moed HF. The research guarantors of scientific papers and the output counting: a promising new approach. Scientometrics [Internet]. 2013 Nov [cited 2018 Aug 24];97(2):421–34. Available from: https://doi.org/10.1007/s11192-013-1046-0
37. Jeremić V, Jovanović-Milenković M, Radojičić Z, Martić M. Excellence with leadership: the crown indicator of Scimago Institutions Rankings Iber Report. Prof Inf [Internet]. 2013 Sep–Oct [cited 2018 Aug 24];22(5):474–80. Available from: http://dx.doi.org/10.3145/epi.2013.sep.13
38. van Eck NJ, Waltman L. VOSviewer [Internet]. Leiden (NL): Leiden University; 2010 [cited 2017 Dec 8]. Available from: http://www.vosviewer.com
39. Perianes-Rodríguez A, Waltman L, Van Eck NJ. Constructing bibliometric networks: a comparison between full and fractional counting. J Informetr [Internet]. 2016 Nov [cited 2018 Aug 24];10(4):1178–95. Available from: http://dx.doi.org/10.1016/j.joi.2016.10.006
40. Chinchilla-Rodríguez Z, Zacca-González G, Vargas-Quesada B, de Moya-Anegón F. Latin American scientific output in Public Health: combined analysis of bibliometric, socioeconomics and health indicators. Scientometrics [Internet]. 2015 Jan [cited 2018 Aug 24];102(1):609–28. Available from: https://doi.org/10.1007/s11192-014-1349-9
41. Dorta-Contreras AJ. En defensa de nuestra producción científica. Acimed [Internet]. 2006 [cited 2018 Aug 24];14(3). Available from: http://scielo.sld.cu/pdf/aci/v14n3/aci15306.pdf. Spanish.
42. Benet M. Las publicaciones cubanas sobre la atención primaria de salud: una ausencia imperdonable. MEDICC Rev [Internet]. 2013 Apr [cited 2018 Aug 24];15(2). Available from: http://www.medicc.org/mediccreview/articles/mr_395_es.pdf. Spanish.
43. Silva Ayçaguer LC. Hacia un avance cualitativo en las revistas médicas cubanas. Rev Cubana Inf Cienc Salud [Internet]. 2013 [cited 2018 Aug 24];24(3). Available from: http://www.acimed.sld.cu/index.php/acimed/article/view/501/314. Spanish.
44. Zacca-González G, Chinchilla-Rodríguez Z, Vargas-Quesada B, de Moya-Anegón F. Patrones de comunicación e impacto de la producción científica cubana en salud pública. Rev Cubana Salud Pública [Internet]. 2015 [cited 2018 Aug 24];41(2):200–16. Available from: http://scielo.sld.cu/pdf/rcsp/v41n2/spu03215.pdf. Spanish.
45. Somogyi A, Schubert A. Short communication: correlation between national bibliometric and health indicators: the case of diabetes. Scientometrics [Internet]. 2005 Jan [cited 2018 Aug 24];62(2):285–92. Available from: http://dx.doi.org/10.1007/s11192-005-0021-9
46. Krishnamoorthy G, Ramakrishnan J, Devi S. Bibliometric analysis of literature on diabetes (1995–2004). Ann Lib Inf Stu [Internet]. 2009 Sep [cited 2018 Aug 24];56(3):150–5. Available from: http://nopr.niscair.res.in/bitstream/123456789/6569/4/ALIS%2056%283%29%20150-155.pdf
47. Caglar C, Demir E, Kucukler FK, Durmus M. A bibliometric analysis of academic publication on diabetic retinopathy disease trends during 1980–2014; a global and medical view. Int J Ophthalmol [Internet]. 2016 Nov 18 [cited 2018 Aug 24];9(11):1663–8. Available from: http://dx.doi/org/10.18240/ijo.2016.11.21
48. Zacca-González G, Vargas-Quesada B, Chinchilla-Rodríguez Z, de Moya-Anegón F. Producción científica cubana en medicina y salud pública: Scopus 2003–2011. TransInformação [Internet]. 2014 Sep–Dec [cited 2018 Aug 24];26(3):281–93. Available from: https://seer.sis.puc-campinas.edu.br/seer/index.php/transinfo/article/view/2632. Spanish.
49. Wagner CS, Leydesdorff L. Network structure, self-organization, and the growth of international collaboration in science. Res Policy [Internet]. 2005 Dec [cited 2018 Aug 24];34(10):1608–18. Available from: https://doi.org/10.1016/j.respol.2005.08.002
50. Huamaní C, González G, Curioso WH, Pacheco-Romero J. Redes de colaboración y producción científica sudamericana en medicina clínica, ISI Current Contents 2000–2009. Rev Med Chile [Internet]. 2012 Apr [cited 2018 Aug 24];140(4):466–75. Available from: http://dx.doi.org/10.4067/S0034-98872012000400007. Spanish.
51. Aleixandre Benavent R, González de Dios J, Alonso Arroyo A, Bolaños Pizarro M, Castelló Cogollos L, González Alcaide G, et al. Coautoría y redes de colaboración científica de la pediatría española (2006–2010). An Pediatr (Barc) [Internet]. 2013 Jun [cited 2018 Aug 24];78(6):410.e1–410.e11. Available from: http://dx.doi.org/10.1016/j.anpedi.2013.01.002. Spanish.
52. Lancho-Barrantes BS, Guerrero-Bote VP, de Moya-Anegón F. Citation increments between collaborating countries. Scientometrics [Internet]. 2013 Mar [cited 2018 Aug 24];94(3):817–31. Available from: https://doi.org/10.1007/s11192-012-0797-3
53. Lancho-Barrantes BS, Guerrero-Bote VP, Chinchilla-Rodríguez Z, de Moya-Anegón F. Citation flows in the zones of influence of scientific collaborations. JASIST [Internet]. 2012 Mar [cited 2018 Aug 24];63(3):481–9. Available from: https://doi.org/10.1002/asi.21682
54. Narin F, Stevens K, Whitlow ES. Scientific co-operation in Europe and the citation of multinationally authored papers. Scientometrics [Internet]. 1991 Jul [cited 2018 Aug 24];21(3):313–23. Available from: http://akademiai.com/doi/abs/10.1007/BF02093973
55. Ministry of External Affairs (CU). Necessity of ending the economic, commercial and financial blockade imposed by the United States of America against Cuba. Internet. Havana: Ministry of External Affairs (CU); 2016 [cited 2018 Dec 17]. Available from: http://misiones.minrex.gob.cu/en/articulo/cubas-report-2018-resolution-724-united-nations-general-assembly-entitled-necessity-ending
56. Hernández K, Cárdenas-de-Baños L, Fundora-Mirabal JA, Dorta-Contreras AJ. Científicos cubanos de la biomedicina más productivos

en el período 1996-2011 según Medline. Rev Cubana Inf Cienc Salud [Internet]. 2012 [cited 2018 Oct 1];23(4):362–79. Available from: http://www.acimed.sld.cu/index.php/acimed/article/view/295. Spanish.

57. Dorta-Contreras AJ, Fundora-Mirabal JA. Redes de colaboración entre España y Latinoamérica sobre esclerosis múltiple. Rev Neurol [Internet]. 2014 Feb [cited 2018 Oct 1];58(3):144. Available from: https://www.researchgate.net/profile/Alberto_Dorta-Contreras/publication/259957042_Networks_of_collaboration_between_Spain_and_Latin_America_on_sclerosis_multiple/links/551ad5940cf2bb7540785ba5.pdf. Spanish.
58. Dorta-Contreras AJ, Corrales-Reyes IE, Fornaris-Cedeño Y. Producción científica y colaboración internacional cubana en educación médica. Educ Med [Internet]. 2018 Apr 9 [cited 2018 Oct 1]. Available from: http://dx.doi.org/10.1016/j.edumed.2017.12.005. Spanish.

THE AUTHORS

Ibraín E. Corrales-Reyes (Corresponding author: iecorralesr@infomed.sld.cu), dentist. First-year resident in maxillofacial surgery, Medical University of Granma, Carlos Manuel de Céspedes General University Hospital, Bayamo, Cuba.

Yasmany Fornaris-Cedeño, sixth-year medical student, Medical University of Havana, Comandante Manual Fajardo Medical Faculty; intern, Cuban Neurology and Neurosurgery Institute, Havana, Cuba.

Alberto J. Dorta-Contreras, biochemist with a master's degree in social sciences and doctorate in health sciences. Full professor and senior researcher, Medical University of Havana, Dr Miguel Enríquez Medical Faculty; Central Cerebrospinal Fluid Laboratory, Havana, Cuba.

Christian R. Mejia, physician with master's degrees in epidemiologic research and occupational health and a doctorate in medical sciences, Continental University, Perú.

Josmel Pacheco-Mendoza, veterinarian with a master's degree in information and knowledge management, Bibliometric Research Unit, San Ignacio de Loyola University, Lima, Perú.

Ricardo Arencibia-Jorge, computer scientist with a doctorate in information sciences. Associate researcher, Information Technology, BioCubaFarma, Havana, Cuba.

Submitted: December 8, 2017
Approved for publication: December 15, 2018
Disclosures: None