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

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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 asymptptomatically.[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, 2,425 people died as a direct consequence of DM.[15]

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)
- percentage of articles with Cuban corresponding author signed
- Cuban leadership: percentage of articles where author affiliation is with a Cuban institution
- percentage of articles in Q1 journals where corresponding author is affiliated with a Cuban institution
- 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 non-Cuban institution
- language of publication: Spanish, English, both
- scientific excellence: inclusion in 10% most frequently cited articles on diabetes indexed in Scopus
- Cuban scientific leadership: corresponding author affiliated with Cuban institution
- excellence with leadership: percentage of articles led (corresponding author) among 10% most-cited articles on diabetes indexed in Scopus
- 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
- 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. 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: $GR_n = \left( \frac{N_{docn} - N_{docn-1}}{N_{docn-1}} \right) * 100$, where $n$ is the year
- top ranked journals: in top 25% (Q1) of journals when ranked in descending order per SCImago Journal & Country Rank (SJR)
- language of publication: Spanish, English, both
- scientific excellence: inclusion in 10% most frequently cited articles on diabetes indexed in Scopus
- Cuban scientific leadership: corresponding author affiliated with Cuban institution
- excellence with leadership: percentage of articles led (corresponding author) among 10% most-cited articles on diabetes indexed in Scopus
- 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 using the full-counting method. 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

<table>
<thead>
<tr>
<th>Operator</th>
<th>Field</th>
<th>Search term</th>
</tr>
</thead>
<tbody>
<tr>
<td>AND</td>
<td>SRCTYPE</td>
<td>j</td>
</tr>
<tr>
<td>AND</td>
<td>TITLE-ABS-KEY</td>
<td>diabetes</td>
</tr>
<tr>
<td>AND</td>
<td>PUBYEAR</td>
<td>≥1999</td>
</tr>
<tr>
<td>AND</td>
<td>LIMIT-T0</td>
<td>DOCTYPE, “ar” OR DOCTYPE, “re”</td>
</tr>
<tr>
<td>AND</td>
<td>EXCLUDE</td>
<td>PUBYEAR, 2018</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Articles</th>
<th>Citations</th>
<th>Articles cited (n (%))</th>
<th>Spanish articles (CPA)</th>
<th>English articles (CPA)</th>
<th>English and Spanish h-Index</th>
<th>Excellent articles</th>
<th>Cuban led</th>
<th>In Q1 journals</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>14</td>
<td>52</td>
<td>8 (57.1)</td>
<td>13 (1.9)</td>
<td>1 (27)</td>
<td>0</td>
<td>4</td>
<td>0.0</td>
<td>100</td>
</tr>
<tr>
<td>2001</td>
<td>21</td>
<td>153</td>
<td>15 (71.4)</td>
<td>18 (2.3)</td>
<td>3 (37.0)</td>
<td>0</td>
<td>5</td>
<td>0.0</td>
<td>100</td>
</tr>
<tr>
<td>2002</td>
<td>29</td>
<td>145</td>
<td>24 (82.8)</td>
<td>25 (2.8)</td>
<td>4 (18.6)</td>
<td>0</td>
<td>8</td>
<td>0.0</td>
<td>100</td>
</tr>
<tr>
<td>2003</td>
<td>9</td>
<td>1088*</td>
<td>7 (77.8)</td>
<td>5 (1.6)</td>
<td>4 (270.0)</td>
<td>0</td>
<td>5</td>
<td>11.1</td>
<td>77.8</td>
</tr>
<tr>
<td>2004</td>
<td>22</td>
<td>83</td>
<td>15 (68.2)</td>
<td>15 (1.9)</td>
<td>7 (7.7)</td>
<td>0</td>
<td>6</td>
<td>0.0</td>
<td>66.7</td>
</tr>
<tr>
<td>2005</td>
<td>20</td>
<td>702</td>
<td>16 (80.0)</td>
<td>10 (4.0)</td>
<td>12 (51.6)</td>
<td>0</td>
<td>11</td>
<td>10.0</td>
<td>85.0</td>
</tr>
<tr>
<td>2006</td>
<td>33</td>
<td>707</td>
<td>15 (45.4)</td>
<td>24 (7.0)</td>
<td>6 (114.8)</td>
<td>1</td>
<td>6</td>
<td>6.1</td>
<td>81.8</td>
</tr>
<tr>
<td>2007</td>
<td>30</td>
<td>280</td>
<td>18 (60.0)</td>
<td>23 (2.0)</td>
<td>7 (33.4)</td>
<td>0</td>
<td>7</td>
<td>3.3</td>
<td>80.0</td>
</tr>
<tr>
<td>2008</td>
<td>34</td>
<td>620</td>
<td>24 (70.6)</td>
<td>25 (1.6)</td>
<td>9 (64.6)</td>
<td>0</td>
<td>7</td>
<td>5.9</td>
<td>85.3</td>
</tr>
<tr>
<td>2009</td>
<td>40</td>
<td>491</td>
<td>27 (67.5)</td>
<td>29 (1.8)</td>
<td>11 (39.8)</td>
<td>0</td>
<td>8</td>
<td>5.0</td>
<td>77.5</td>
</tr>
<tr>
<td>2010</td>
<td>45</td>
<td>188</td>
<td>26 (62.2)</td>
<td>33 (1.1)</td>
<td>8 (18.4)</td>
<td>4</td>
<td>6</td>
<td>0.0</td>
<td>95.6</td>
</tr>
<tr>
<td>2011</td>
<td>38*</td>
<td>246</td>
<td>23 (60.5)</td>
<td>25 (1.7)</td>
<td>12 (16.7)</td>
<td>0</td>
<td>7</td>
<td>0.0</td>
<td>89.5</td>
</tr>
<tr>
<td>2012</td>
<td>50</td>
<td>159</td>
<td>30 (60.0)</td>
<td>36 (1.2)</td>
<td>12 (9.7)</td>
<td>2</td>
<td>6</td>
<td>0.0</td>
<td>90.0</td>
</tr>
<tr>
<td>2013</td>
<td>55</td>
<td>328</td>
<td>39 (70.9)</td>
<td>29 (1.3)</td>
<td>24 (12.0)</td>
<td>2</td>
<td>9</td>
<td>0.0</td>
<td>81.8</td>
</tr>
<tr>
<td>2014</td>
<td>43*</td>
<td>300</td>
<td>30 (69.8)</td>
<td>22 (1.0)</td>
<td>17 (5.9)</td>
<td>3</td>
<td>10</td>
<td>0.0</td>
<td>81.4</td>
</tr>
<tr>
<td>2015</td>
<td>49</td>
<td>335</td>
<td>22 (44.9)</td>
<td>33 (0.5)</td>
<td>16 (19.9)</td>
<td>0</td>
<td>5</td>
<td>2.0</td>
<td>83.7</td>
</tr>
<tr>
<td>2016</td>
<td>35</td>
<td>324</td>
<td>13 (37.1)</td>
<td>18 (0.1)</td>
<td>15 (21.5)</td>
<td>2</td>
<td>6</td>
<td>2.9</td>
<td>80.0</td>
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<tr>
<td>2017</td>
<td>43</td>
<td>42</td>
<td>12 (27.9)</td>
<td>27 (0.1)</td>
<td>15 (2.6)</td>
<td>1</td>
<td>4</td>
<td>0.0</td>
<td>88.4</td>
</tr>
<tr>
<td>Overall</td>
<td>610*</td>
<td>6243</td>
<td>366 (60.0)</td>
<td>410 (1.5)</td>
<td>183 (30.0)</td>
<td>15</td>
<td>34</td>
<td>2.0</td>
<td>85.9</td>
</tr>
</tbody>
</table>

*among 10% most frequently cited articles for topic
a Cuban corresponding author
A US clinical trial on hypertension with keyword “diabetes” accounts for spike in citations
darticles in other languages not included in horizontal totals
CPA: citations per article

(*) CPA: citations per article.
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).

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)

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

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

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

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 Pharmaco logy. 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 Zaccá-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.

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**REFERENCES**


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