International collaboration among medical societies is an effective way to boost Latin American production of articles on tuberculosis

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ABSTRACT

Objective: Most studies of tuberculosis originate from high-income countries with a low incidence of tuberculosis. A review of the scientific production on tuberculosis in Latin American countries, most of which are low- or middle-income countries (some with high or intermediate tuberculosis incidence rates), would improve the understanding of public health challenges, clinical needs, and research priorities. The aims of this systematic review were to determine what has been published recently in Latin America, to identify the leading authors involved, and to quantify the impact of international collaborations.

Methods: We used PubMed to identify relevant manuscripts on pulmonary tuberculosis (PTB), drug-resistant tuberculosis (DR-TB), or multidrug-resistant tuberculosis (MDR-TB), published between 2013 and 2018. We selected only studies conducted in countries with an annual tuberculosis incidence of ≥ 10,000 reported cases and an annual MDR-TB incidence of ≥ 300 estimated cases, including Brazil, Peru, Mexico, Colombia, and Argentina. Articles were stratified by country, type, and topic. Results: We identified as eligible 395 studies on PTB and 188 studies on DR/MDR-TB—of which 96.4% and 96.8%, respectively, were original studies; 35.5% and 32.4%, respectively, had an epidemiological focus; and 52.7% and 36.2%, respectively, were conducted in Brazil. The recent Latin American Thoracic Association/European Respiratory Society/Brazilian Thoracic Association collaborative project boosted the production of high-quality articles on PTB and DR/MDR-TB in Latin America. Conclusions: Most of the recent Latin American studies on tuberculosis were conducted in Brazil, Mexico, or Peru. Collaboration among medical societies facilitates the production of scientific papers on tuberculosis. Such initiatives are in support of the World Health Organization call for intensified research and innovation in tuberculosis.

Keywords: Tuberculosis, pulmonary; Tuberculosis, multidrug-resistant; Latin America.

INTRODUCTION

The World Health Organization (WHO) has estimated that, in 2017, there were 9.0–11.1 million new cases of active tuberculosis and 1.2–1.4 million tuberculosis-related deaths, indicating that tuberculosis is now the leading cause of infection-related death worldwide and is among the ten leading causes of death from any cause.1,4 The WHO Region of the Americas, which is managed by the Pan American Health Organization, includes the United States and Canada, both of which have a low incidence of tuberculosis, whereas the incidence of tuberculosis ranges from low to high in Latin American and Caribbean countries, which are mainly low- to middle-income countries with limited resources allocated to health care and research.1,2 Scientific societies such as the Asociación Latinoamericana de Tórax (ALAT, Latin American Thoracic Association) and the Sociedade Brasileira de Pneumologia e Tisiologia (SBPT, Brazilian Thoracic Association) are both active in promoting training, continued medical education, and research that is useful in the fight against tuberculosis. The influence of those societies reaches most of the countries in Latin America. Recently, they have joined forces with the European Respiratory Society (ERS) to develop initiatives against tuberculosis in several fields, including research.3,4 Such initiatives are collectively known as the ALAT/ERS/SBPT project. Because no specific funds were otherwise available for the task, the project included data collection, the creation of new databases, the ordering of existing databases, and the design of studies, as well as the writing/translation of the articles produced and the facilitation of their submission to peer-reviewed journals.

As clearly mentioned by the WHO and included in Pillar 3 of its “End TB Strategy”,5,6 research is crucial to promoting better clinical and public health initiatives.

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By reviewing who and what has recently been published in Latin America on the subject of active tuberculosis and measuring the impact of international collaboration on the production of scientific evidence, we could gain a better understanding of what aspects should be targeted in order to address the WHO recommendations.

For the purposes of this article, we included five of the six Latin American countries that report more than 10,000 cases of tuberculosis annually. Those countries are, in decreasing order of tuberculosis incidence, Brazil, Peru, Mexico, Colombia, and Argentina. Collectively, they reported a total of 160,683 cases in 2016, as shown in Table S1 of the supplementary file (available online at http://jornaldepneumologia.com.br/detalhe_anexo.asp?id=60). Countries approaching the goal of tuberculosis elimination (defined as less than 1 case per million population) need to focus on specific interventions such as managing latent tuberculosis infection, and countries with a higher tuberculosis incidence need tuberculosis control activities focused on active pulmonary tuberculosis (PTB).

Therefore, we decided to limit our review to articles dealing with active tuberculosis.

The epidemiological diversity of Latin American countries was recently captured in two important documents related to the region, both published jointly by the Pan American Health Organization and the WHO: the 2013 Strategic Plan of the Pan American Health Organization; and the 2014 Plan of Action for the Prevention and Control of Tuberculosis. It is expected that research priorities will be aligned with the priorities and resources available in each country. The Brazilian National Plan to End Tuberculosis as a Public Health Problem is an example of that. Further new information emerging from local studies is needed in order to increase the overall scientific production in Latin America.

The primary aim of this review was to identify the main areas of tuberculosis research conducted in the Latin American countries with the highest rates of active PTB, drug resistant-tuberculosis (DR-TB), and multidrug-resistant tuberculosis (MDR-TB). Secondary aims were to identify the Latin American researchers leading the production of tuberculosis research and to evaluate the impact that recent international collaborations among medical societies have had on the overall scientific output in the region.

**METHODS**

This study focused on the local scientific contributions of Brazil, Peru, Mexico, Colombia, and Argentina related to PTB and MDR-TB. Those five countries, all of which are middle-income countries, have the highest scientific production rates in Latin America. In each of those countries, the annual tuberculosis incidence is ≥ 10,000 reported cases and the annual MDR-TB incidence is ≥ 300 estimated cases, as shown in Table S1 of the supplementary file (available online at http://jornaldepneumologia.com.br/detalhe_anexo.asp?id=60). Those are also the only countries that have participated in the ALAT/ERS/SBPT project.

Although Haiti ranks fourth in Latin America in terms of the incidence of tuberculosis, we decided not to include it in the regional analysis of this review, for a number of reasons. As a low-income country, Haiti receives long-term external financial support for research (mainly from United States government agencies). In addition, Haiti has not been involved in any studies related to the ALAT/ERS/SBPT project. Those two conditions would make it difficult to evaluate the spontaneous research contribution of the country.

**Inclusion criteria**

We selected peer-reviewed articles written in English, Spanish, or Portuguese by authors (corresponding authors or not) working in any of the five Latin American countries under study (Brazil, Peru, Mexico, Colombia, and Argentina). We used PubMed to identify any relevant manuscripts, published between January 1, 2013 and April 19, 2018, authored by Latin American researchers. To attribute a given article to a given country, the first selection criterion was the country of the corresponding author, followed by that of the first author and then that of each of the other authors, based on the affiliations as they appeared in the original manuscript. Manuscripts with authors whose main affiliation was in a high-income country (e.g., the United States, Canada, or a country in Europe) were not considered if no Latin American affiliations were listed.

We performed our searches in two steps, using the following search terms: "pulmonary tuberculosis" OR "pulmonary TB", to retrieve articles related to PTB (step 1); and "multidrug-resistant tuberculosis" OR "multidrug-resistant TB" OR "MDR-TB" OR "drug-resistant tuberculosis" OR "drug-resistant TB", to retrieve articles specifically focused on DR/MDR-TB (step 2). Most of the MDR-TB-related manuscripts were retrieved in the first step. Articles related to extrapulmonary tuberculosis were excluded, because the focus of this review was to identify the scientific production related to the transmissible form of tuberculosis (drug-susceptible or drug-resistant PTB).

We included full-text original articles, review articles, editorials, letters, correspondence containing original data, and case reports containing new information. To ensure the quality of the publication, we included only articles that were published in journals that had an impact factor in the year of publication. Basic research studies were included if they involved patients with PTB. Case reports containing no new information were excluded, as were editorials/letters containing no original data.

Studies that were not related to the ALAT/ERS/SBPT collaborative project were analyzed separately. We then drew comparisons between the articles that were related to the project and those that were not,
those comparisons being limited to articles published in 2016, 2017, or the first quarter of 2018.

Data analysis

The articles were first separated into two groups: those related to PTB; and those related to DR/MDR-TB. They were then stratified by country and type of manuscript—articles containing original data (full manuscripts, short reports, or letters), editorials, and review articles—as well as by topic (epidemiology/research, biochemistry/diagnosis, treatment/outcomes, or genetics/immunology/vaccines). Two of the authors, working independently, evaluated the manuscripts. Any disagreements were resolved by consensus.

For each country, the authors publishing the most articles, either on PTB or on DR/MDR-TB, were identified. For each of those authors, a complete bibliometric analysis was performed, including the overall number of publications, the h-index, and the number of citations. The articles related to the ALAT/ERS/SBPT project (and therefore their authors) were not considered in the main analysis, although they were considered in the comparative analysis. The study was conducted in accordance with the 2009 Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines.(13)

RESULTS

For the period from January 2013 to April 2018, a total of 803 manuscripts were identified (Figure 1): 532 on PTB and 271 on DR/MDR-TB. Of those 803 manuscripts, 583 were deemed eligible for further analysis: 395 on PTB and 188 on DR/MDR-TB.

Of the 395 articles on PTB, 137 were excluded, for the following reasons (Figure 1A): being a case report or letter containing no new information (n = 45); being authored by individuals not working in one of the Latin American countries specified (n = 34); not focusing on tuberculosis (n = 25); and having been published in a journal that had no impact factor in the year of publication (n = 33). The annual number of articles on PTB unrelated to the ALAT/ERS/SBPT project was rather stable (Table 1): 32 in 2016; 41 in 2017; and 10 in the first quarter of 2018. As can be seen in Figure 2B, Brazil was the country contributing the greatest number of articles on DR/MDR-TB, accounting for 68 (36.2%) of the 188 articles, followed by Peru, with 53 (28.2%), Mexico, with 33 (17.6%), Argentina, with 20 (10.6%), and Colombia, with 14 (7.4%). Table 2 shows that the largest proportion of articles on DR/MDR-TB were original studies, which accounted for 96.8% (182 articles). In terms of topics, the most common was epidemiology/research (in 32.4%), followed by treatment/outcomes (in 30.9%), biochemistry/diagnosis (in 27.1%), and genetics/immunology/vaccines (in 9.6%).

The bibliometric analysis of the top authors per country for the PTB and DR/MDR-TB categories are summarized in Table 3. For both categories, it is evident that the Brazilian Tuberculosis Research Network plays a leading role in Brazil,(14-19) whereas the Peruvian Partners in Health Research Network and Harvard University play major roles in Peru.(20-23) In Argentina, Mexico, and Colombia, most of the basic research studies are conducted at a few high-level institutions, often in collaboration with other countries within and outside of Latin America.

Table 4 presents the comparative analysis of studies related and unrelated to the ALAT/ERS/SBPT project. A total of 289 articles were published in the comparison period (2016-2018). Studies related to the ALAT/ERS/SBPT project accounted for 13.5% of those articles overall, specifically accounting for 9.7% of the articles on PTB and 20.1% of the articles on DR/MDR-TB (Figure 3). All of those articles were published in journals with an impact factor. The contributions of the authors who published within the ALAT/ERS/SBPT project are summarized in Table 5.

DISCUSSION

The aims of this systematic review were to determine which were the main areas of research on PTB and DR/MDR-TB conducted recently in Brazil, Peru, Mexico, Colombia, and Argentina, to identify the Latin American authors involved in that research, and to quantify the impact of collaboration among international medical societies. It is difficult to evaluate the quantity and quality of the scientific production of the selected countries, because there is no benchmark or gold standard comparator.

In a recent bibliometric analysis, Sweileh et al.(24) evaluated the studies on MDR-TB published worldwide
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Panel A) Pulmonary TB manuscripts

Records identified through Pubmed searching (n = 532)

Additional records identified through other sources (n = 0)

Records screened at title and abstract level (after duplicates removed) (n = 532)

Records excluded at title and abstract level (n = 67)
- Journal without IF: (n = 33)
- Papers published by AA not working in the selected Countries: (n = 34)

Records assessed for eligibility at full-text level (n = 465)

Records excluded at full-text level for the following reasons:
- Case report ≤ 4 cases: (n = 43)
- Correspondence without original data: (n = 2)
- Papers not specifically on TB: (n = 25)

Records included in the review (n = 395)

Panel B) DR/MDR-TB manuscripts

Records identified through Pubmed searching (n = 271)

Additional records identified through other sources (n = 0)

Records screened at title and abstract level (after duplicates removed) (n = 532)

Records excluded at title and abstract level (n = 40)
- Journal without IF: (n = 12)
- Papers published by AA not working in the selected Countries: (n = 28)

Records assessed for eligibility at full-text level (n = 231)

Records excluded at full-text level for the following reasons:
- Case report ≤ 4 cases: (n = 9)
- Correspondence without original data: (n = 1)
- Papers not specifically on DR/MDR-TB: (n = 32)

Records included in the review (n = 188)

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses 2009 flow diagram of the process of selecting manuscripts on pulmonary tuberculosis (TB, panel A) and on drug-resistant/multidrug-resistant tuberculosis (DR/MDR-TB, panel B) unrelated to the Latin American Thoracic Association/European Respiratory Society/Brazilian Thoracic Association collaborative project and authored by researchers working in Brazil, Mexico, Peru, Colombia, or Argentina. IF: impact factor.
between 2006 and 2015. The authors found that the number of studies on tuberculosis and MDR-TB increased from 4,460 and 279, respectively, in 2013 to 4,711 and 342, respectively, in 2016. They also ranked countries by their level of scientific production on the topic of MDR-TB: Peru ranked 13th, with 69 articles; Brazil ranked 18th, with 51; Mexico ranked 24th, with 36; Argentina ranked 31st, with 29; and Colombia ranked 37th, with 14. In the worldwide bibliometric analysis, original articles accounted for 71.3% of the articles, whereas review articles accounted for 9.6% and editorials accounted for 3.8%. Despite the methodological differences between that study and ours (the former having used the Scopus database, having focused on MDR-TB, and not having limited the searches to journals with an impact factor), the overall production in the Latin American countries included in our study is quantitatively consistent with that reported by those authors. Given the continuous increase in the number of articles published over time, the number of articles published per year is comparable between the two studies. In terms of the types of articles, our findings were also similar: original articles were the most common type of articles, followed by review articles and editorials. One difference was related to the proportional distribution of the article types, original articles accounting for 96.5% of the articles identified in our study, compared with only 71.3% in the study conducted by Sweileh et al.(24) In the latter study, one Latin American author (Becerra MC, from Peru) was among the top 20 authors publishing research on MDR-TB, having authored 29 articles during the period evaluated. That same author also ranked highly in our study. Nine of the top-ranked authors from the five countries we studied had an h-index ≥ 20 (50 being the highest), confirming that high-quality research groups are active in the region. However, it should be borne in mind that some of the most highly ranked authors conduct research on a wide spectrum of tropical diseases other than tuberculosis and that their h-indices therefore reflect their overall scientific production.

In the present study, we considered the articles in which at least one of the authors had an affiliation in one of the five Latin American countries selected. Therefore, articles in which the affiliation was outside those countries (e.g., Harvard University rather than the Peruvian Partners in Health Research Network for studies conducted in Peru) were not counted. As previously mentioned, we did not consider studies conducted in Haiti, because research projects in

Table 1. Articles unrelated to the Latin American Thoracic Association/European Respiratory Society/Brazilian Thoracic Association collaborative project, 2013-2018.

| Year | Pulmonary TB | DR/MDR-TB | Total |
|------|--------------|-----------|-------|
| 2013 | 75           | 33        | 108   |
| 2014 | 86           | 32        | 118   |
| 2015 | 67           | 40        | 107   |
| 2016 | 90           | 32        | 132   |
| 2017 | 60           | 41        | 114   |
| 2018*| 17           | 10        | 44    |
| Total| 395          | 188       | 583   |

TB: tuberculosis; and DR/MDR-TB: drug-resistant/multidrug-resistant tuberculosis. *Only articles published in the first quarter of 2018.

Figure 2. Results of the searches for manuscripts on pulmonary tuberculosis (TB, panel A) and on drug-resistant/multidrug-resistant tuberculosis (DR/MDR-TB, panel B) unrelated to the Latin American Thoracic Association/European Respiratory Society/Brazilian Thoracic Association collaborative project, by country.
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Table 2. Manuscript types and topics of the articles unrelated to the Latin American Thoracic Association/European Respiratory Society/Brazilian Thoracic Association collaborative project, 2013-2018.

| Manuscript characteristic | Pulmonary TB | DR/MDR-TB |
|---------------------------|--------------|-----------|
| Type                      | n | % | n | % |
| Original article          | 381 | 96.5 | 182 | 96.8 |
| Review article            | 11 | 2.8 | 4 | 2.1 |
| Editorial                 | 3 | 0.8 | 2 | 1.1 |
| Total                     | 395 | 100 | 188 | 100 |

| Topic                      | Pulmonary TB | DR/MDR-TB |
|---------------------------|--------------|-----------|
| Epidemiology/research     | 140 | 35.4 | 61 | 32.4 |
| Biochemistry/diagnosis    | 93 | 23.5 | 51 | 27.1 |
| Treatment/outcomes        | 44 | 11.1 | 58 | 30.9 |
| Genetics/immunology/vaccines | 118 | 29.9 | 18 | 9.6 |
| Total                     | 395 | 100 | 188 | 100 |

TB: tuberculosis; and DR/MDR-TB: drug-resistant/multidrug-resistant tuberculosis. aIncluded only the first quarter of 2018. bIncluded all articles containing original data (full manuscripts, short reports, and letters).

Table 3. Top authors, in each country, of articles on pulmonary tuberculosis or drug-resistant/multidrug-resistant tuberculosis that were unrelated to the Latin American Thoracic Association/European Respiratory Society/Brazilian Thoracic Association collaborative project, as determined in the bibliometric analysis.

| Country | Author                        | Articles on pulmonary TB or DR/MDR-TB | H-index* | Cited documents* |
|---------|-------------------------------|--------------------------------------|---------|------------------|
| Argentina | Bottasso, Oscar A               | 11                                   | 22      | 158              |
|         | Ritacco, Viviana               | 11                                   | 26      | 94               |
|         | López, Beatriz                 | 10                                   | 15      | 43               |
|         | Sasiain, María del Carmen      | 9                                    | 17      | 68               |
|         | Bay, María Luisa               | 8                                    | 14      | 40               |
| Brazil | Kritski, Afrânio Lineu         | 27                                   | 28      | 186              |
|         | Maciel, Ethel Leonor Noia      | 16                                   | 17      | 98               |
|         | Rossetti, Maria Lúcia Rosa     | 15                                   | 20      | 86               |
|         | Dietze, Reynaldo               | 14                                   | 35      | 133              |
|         | Trajman, Anete                 | 14                                   | 17      | 77               |
| Colombia | Marín, Diana                   | 8                                    | 4       | 17               |
|         | Robledo, Jaime                 | 8                                    | 18      | 70               |
|         | Arbeláez, Maria Patricia       | 6                                    | 11      | 34               |
|         | Barrera, Luis Fernando         | 5                                    | 15      | 32               |
|         | García, Luis Fernando          | 5                                    | 28      | 108              |
| Mexico | Hernández-Pando, Rogelio       | 32                                   | 50      | 312              |
|         | Mata-Espinosa, Dulce           | 20                                   | 9       | 32               |
|         | Marquina-Castillo, Brenda      | 14                                   | 9       | 27               |
|         | Barrios-Payán, Jorge           | 12                                   | 8       | 26               |
|         | García-García, Lourdes         | 11                                   | 28      | 115              |
|         | Zenteno-Cuevas, Roberto        | 11                                   | 8       | 32               |
| Peru   | Contreras, Carmen              | 20                                   | 12      | 46               |
|         | Lecca, Leonid                  | 19                                   | 8       | 38               |
|         | Becerra, Mercedes C            | 18                                   | 31      | 112              |
|         | Coronel, Jorge                 | 16                                   | 12      | 39               |
|         | Calderon, Roger                | 12                                   | 6       | 18               |
|         | Gotuzzo, Eduardo               | 12                                   | 52      | 401              |
|         | Seas, Ramos Carlos             | 12                                   | 22      | 117              |

TB: tuberculosis; and DR/MDR-TB: drug-resistant/multidrug-resistant tuberculosis. *Data from the Scopus citation database.
An indirect way of evaluating the quality of studies is by looking at the number and proportion of articles accepted in peer-reviewed journals with an impact factor. In the present study, articles were excluded if they were published in journals without an impact factor, as was the case for only 33 (7.7%) of 428 articles on PTB and only 12 (6.0%) of 200 articles on DR/MDR-TB. That suggests that the vast majority of such articles produced in Latin America have been published in high-quality journals.

The results of our study show how international collaborations are able to boost the quality and quantity of scientific production in Latin America. Examples of such collaborations are that between the Partners in Health initiative of Harvard University and the Peruvian National TB Program consortium,(20-23) as well as the internal collaboration in Brazil within the Brazilian Tuberculosis Research Network, which has allowed several international collaborations to be developed on the foundation of a well-designed national research plan.(14-19)

The ALAT/ERS/SBPT project allowed a research network involving five Latin American countries and Italy to be established in collaboration with the Maugeri Scientific Institute (Tradate, Italy). Particularly relevant are the scientific collaborations within this project involving four institutions in Mexico—the National Institute of Respiratory Diseases, in Mexico City; the Center for the Investigation, Prevention, and Treatment of Respiratory Infections, at the University Hospital of Monterrey; the Autonomous University of Nuevo León, in San Nicolás de los Garza; and the Mexican National TB Program—as well as four institutions in Brazil—the Oswaldo Cruz Foundation, in the city of Rio de Janeiro; the Federal University of Rio Grande do Sul, in Porto Alegre; the Brazilian Tuberculosis Research Network; and the Brazilian National Tuberculosis Control Program. Thus, the ALAT/ERS/SBPT project not only involved three scientific medical associations but also worked with three universities and two national tuberculosis programs, with no funding at all.

Table 4. Comparative table showing studies related and unrelated to the Latin American Thoracic Association/European Respiratory Society/Brazilian Thoracic Association collaborative project.

| Year | PTB Total | PTB ALAT/ERS/SBPT | DR/MDR-TB Total | DR/MDR-TB ALAT/ERS/SBPT | PTB and DR/MDR-TB Total | PTB and DR/MDR-TB ALAT/ERS/SBPT |
|------|-----------|------------------|----------------|------------------------|------------------------|-------------------------------|
| 2016 | 92        | 90 (9.7%)        | 40             | 32 (8%)                | 132                    | 10 (7.5%)                    |
| 2017 | 63        | 60 (9.7%)        | 50             | 41 (8.2%)              | 113                    | 12 (10.6%)                   |
| 2018a| 30        | 17 (56.7%)       | 14             | 10 (71.4%)             | 44                     | 17 (38.6%)                   |
| Total| 185       | 167 (89.7%)      | 104            | 83 (80.6%)             | 289                    | 39 (13.5%)                   |

PTB: pulmonary tuberculosis; DR/MDR-TB: drug-resistant/multidrug-resistant tuberculosis; ALAT: Asociación Latino Americana de Tórax (Latin American Thoracic Association); ERS: European Respiratory Society; and SBPT: Sociedade Brasileira de Pneumologia e Tisiologia (Brazilian Thoracic Association). *Only articles published in the first quarter of 2018.
International collaboration among medical societies is an effective way to boost Latin American production of articles on tuberculosis. According to Sweileh et al., the Harvard University Partners in Health initiative and the Maugeri Scientific Institute are both in the top 10 most active institutions worldwide in terms of the number of published articles on MDR-TB. Additional examples of scientific collaboration identified in our study are those on basic research involving leading institutions in Mexico, Argentina, and Colombia, which are often funded by other international partners.

It is noteworthy that the ALAT/ERS/SBPT project not only boosted the quality and quantity of scientific production in Latin America but also encouraged young investigators to publish for the first time (improving their academic records) while consolidating the publication records of several senior experts. Furthermore, a direct comparison between the manuscripts that were related to the ALAT/ERS/SBPT project and those that were not was formally possible only for those dealing with DR/MDR-TB. Moreover, although the main collaborations were described and the essential bibliometric analysis was performed, a detailed analysis of the scientific collaborations and of the citation counts of the articles identified was outside the scope of our study.

In conclusion, although we have shown that the scientific production in Latin America is of high quality, the number of publications seems low in comparison with that reported for other regions. We find it surprising that the national tuberculosis programs in the countries evaluated, despite having access to a large amount of data, have sponsored few published articles. More support is necessary in order to scale-up the existing research efforts in Latin America, which would strengthen the capacity of national tuberculosis programs to use their data to improve the prevention, diagnosis, and treatment of drug-susceptible and drug-resistant PTB in the respective countries, as well as to overcome the funding limitations and the language barriers.

International collaboration among medical societies should be promoted as a proven effective way to boost scientific production in the field of tuberculosis in Latin America. Despite a lack of funding, such collaborations

Table 5. Summary of all of the authors publishing studies related to the Latin American Thoracic Association/European Respiratory Society/Brazilian Thoracic Association collaborative project between 2016 and 2018.

| Country | Author(s) | n |
|---------|-----------|---|
| Argentina | Palmero DJ | 2 |
| | González Montaner P | 1 |
| Brazil | Arbex MA, Dalcomlo M | 8 |
| | Silva DR | 7 |
| | Mello FCQ | 6 |
| | Bonini EH, Carvalho ACC | 5 |
| | Kritski AL | 3 |
| | Alves TG, Borga L, Braga JU, Dockhorn F, Fandinho F, Rabahi MF, Rocha JL | 2 |
| | Arakaki-Sanchez D, Arbex FF, Augusto WM, Barbosa MS, Beraldi-Magalhães F, Cardoso CAA, Cordeiro-Santos M, Dias NJD, Ferreira MD, Galesi VM, Kawakame Pirolla G, Martire TM, Neves CPD, Pereira GR, Sant’Anna CC, Sanchez DA, Souza AB | 1 |
| Colombia | Torres-Duque CA | 4 |
| | Fuentes Z | 2 |
| Mexico | Rendon A | 12 |
| | Muñoz-Torrico M | 11 |
| | Salazar-Lezama MA | 6 |
| | Pérez-Padilla R | 3 |
| | Carrillo-Alduenda JL, Flores-Vergara H, García-Sancho C, Gayoso R, Martínez-Mendoza D, Torres-Cruz A, Villareal-Velarde H | 2 |
| | Martínez-Orozco JA, Millán MJM, Narváez-Díaz LA, Saavedra Herrera N, Segura Del Pilar M | 1 |
| Peru | Alarcón VA | 4 |
| | Alarcón E, Manga S, Varga-Vasquez D | 3 |
| | Bayona J, Becerra MC, Perales R, Reaño M | 1 |

*Included only the first quarter of 2018.*
could support Pillar 3 (the intensified research and innovation portion) of the WHO “End TB Strategy”.

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