

A bibliometric analysis of COVID-19 research in Latin America and the Caribbean

Un análisis bibliométrico de la investigación sobre COVID-19 en Latinoamérica y el Caribe

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Abstract

Introduction: Latin America and the Caribbean (LAC) is one of the regions most affected by the COVID-19 pandemic. Yet, there is scarce literature addressing the research strategies developed in LAC to face COVID-19.

Objective: To quantify and assess the production of scientific publications about COVID-19 in 32 countries of LAC between January 1 and July 31, 2020.

Materials and methods: Bibliometric study. Scientific papers on COVID-19 conducted in LAC or reporting data pertaining to LAC and published between January 1 to July 31, 2020, were searched in the Scopus, PubMed, and LILACS databases. A subgroup analysis including only original research articles was performed to determine the contribution of LAC countries to research on COVID-19, and standardization measures (# of articles per million people) were applied to compare the country-specific production of this type of articles.

Results: A total of 1 291 publications were retrieved. Overall, most of them were non-original research articles (81.72%), and the countries with the highest scientific production were Brazil (43.91%) and Mexico (9.14%). However, after applying the standardization measures, Chile was the country with the highest production of original articles (0.58 per million inhabitants). Regarding original studies (n=236), cross-sectional design was the most common (25.84%). Diagnosis and treatment of the disease was the main research focus (n=354; 27.42%). However, in the subgroup analysis (n=236), epidemiology and surveillance were the most prevalent research focus (n=57; 24.15%).

Conclusions: During the study period, non-original research articles were predominant in the scientific production of the LAC region, and interventional studies were scarce among original articles, while the cross-sectional design predominated. Further research with a better quality of evidence should be performed in these countries to contribute to the making of health policies aimed at easing the burden of COVID-19 in the region and preparing for future pandemics.

Keywords: COVID-19; Biomedical Research; Bibliometrics; Latin America; Caribbean Region (MeSH).

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Resumen

Introducción. Latinoamérica y el Caribe (LAC) es una de las regiones más afectadas por la pandemia por COVID-19. Sin embargo, hay poca literatura sobre las estrategias de investigación desarrolladas en la región para confrontar esta enfermedad.

Objetivo. Cuantificar y evaluar la producción de publicaciones científicas sobre COVID-19 en 32 países de LAC entre el 1 de enero y el 31 de julio del 2020.

Materiales y métodos. Estudio bibliométrico. Se realizó una búsqueda de artículos científicos sobre COVID-19 realizados en LAC o con datos de LAC, y publicados entre enero 1 y julio 31 de 2020 en Scopus, PubMed y LILACS. Se realizó un análisis de subgrupos en el que se incluyeron solo artículos de investigación original para determinar la contribución de los países de la región a la investigación sobre COVID-19; además, se utilizaron medidas de estandarización (# artículos por millón de habitantes) para comparar la producción de este tipo de artículos por país.

Resultados. Se identificaron 1 291 artículos. La mayoría no eran investigaciones originales (81.72%), y los países con más producción fueron Brasil (43.91%) y México (9.14%). Sin embargo, luego de aplicar las medidas de estandarización, Chile fue el país con mayor producción de artículos originales (0.58 por millón de habitantes). Respecto a los artículos originales (n=236), el tipo de diseño de estudio más común fue el transversal (25.84%). El diagnóstico y tratamiento de COVID-19 fue el tema más investigado en todas las publicaciones (n=354, 27.42%), pero en el análisis de subgrupo (n=236), el enfoque de investigación más frecuente fue epidemiología y vigilancia (n=57, 24.15%).

Conclusiones. En el periodo de estudio, los artículos no originales predominaron en la producción científica de LAC, y, entre las investigaciones originales, los estudios intervencionales escasearon, mientras que los transversales predominaron. Se requiere realizar más investigación con una mejor calidad de evidencia en los países de la región para contribuir en la formulación de políticas de salud dirigidas a aliviar la carga de la COVID-19 y para prepararse para futuras pandemias.

Palabras clave: COVID-19; Investigación biomédica; América Latina; Región del Caribe (DeCS).

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Introduction

On March 11, 2020, the World Health Organization (WHO) declared the Coronavirus Disease 2019 (COVID-19), caused by the infection with SARS-CoV2, a newly discovered coronavirus, a pandemic.¹ Since then, the rapid spread of the virus has affected many regions, including Latin America and the Caribbean (LAC), where, as of March 17, 2021, the number of confirmed cases reportedly exceeded 53 million.² In terms of confirmed COVID-19 cases, Brazil is the most affected country in the region, followed by Colombia, and Argentina.²

Although preventive strategies have been implemented, urgent attention to the health crisis derived from the COVID-19 outbreak is still required in LAC. Several research efforts have been carried out to achieve a clearer understanding of the disease, notably, through the accelerated growth in peer-reviewed and not peer-reviewed (preprints) articles.^{3,4} For instance, articles addressing COVID-19 or topics related to it have been made freely available online to the general public,⁵ while the usual time required for them to be accepted and published in academic journals has decreased significantly, with some papers reportedly undergoing a one-day peer review and publication process.⁶ However, it is essential that emerging research prioritizes quality over quantity for the progress of medical practice in the context of the COVID-19 pandemic.

In this context, bibliometric analysis allows for a comprehensive evaluation of trends and progress in scientific production,⁷ thus helping researchers and policy makers to develop disease-related public health initiatives.⁸ Bibliometric studies focused on COVID-19 articles published to date have shown descriptive patterns of worldwide COVID-19 research output by mapping international collaboration, evaluating the citation performance of different documents, and ascertaining the relative contribution of different research approaches to the total body of evidence.⁹ Though these studies have been conducted mostly by authors with Chinese affiliations, they have been primarily focused on global results.¹⁰

Currently, Latin America has become the new epicenter of the pandemic,¹¹ as this region surpasses the number of deaths in the United States alone, with over 530 000 deaths attributed to infection with SARS-CoV-2.² Nevertheless, despite the severity of the scenario, there is scarce literature addressing the research strategies developed in LAC to face COVID-19. In this regard, there are several bibliometric studies conducted in the region during the pandemic,¹²⁻¹⁴ but the present study broadens the bibliometric impact indicators provided and extends time interval analysis compared to these studies. A comprehensive evaluation of the current research production in LAC is essential to support the making of regional and national health policies, describe current and future research priorities, and plan interventions to tackle COVID-19 in the region.

Taking this into account, the objective of this paper was to quantify and assess the production of scientific publications about COVID-19 in 32 countries of LAC between January and July 2020.

Materials and methods

This is a cross-sectional study embedded in a bibliometric analysis. Research data were extracted from the PubMed,

Scopus, and LILACS electronic databases. PubMed and Scopus have a high coverage of English-based journals, whereas LILACS includes local journals in LAC published mostly in Spanish and Portuguese.

Search strategy and selection criteria

The search strategy was applied for two different time periods. The first period ranged from January 1 to June 6, 2020. The second search was conducted to increase the sample size and covered the period between June 5 and July 31, 2020. There were no language restrictions. The following search strategies were used in the PubMed, Scopus, and LILACS databases:

1. PubMed query equation:
((((((((((2019 novel coronavirus disease) OR COVID19) OR COVID-19 pandemic) OR SARS-CoV-2 infection) OR COVID-19 virus disease) OR 2019 novel coronavirus infection) OR 2019-nCoV infection) OR coronavirus disease 2019) OR coronavirus disease-19) OR 2019-nCoV disease) OR COVID-19 virus infection) AND Country [Affiliation])
2. Scopus query equation:
(TITLE-ABS-KEY (2019 novel AND coronavirus AND disease) OR TITLE-ABS-KEY (covid19) OR TITLE-ABS-KEY (covid-19 AND pandemic) OR TITLE-ABS-KEY (sars-cov-2 AND infection) OR TITLE-ABS-KEY (covid-19 AND virus AND disease) OR TITLE-ABS-KEY (2019 novel AND coronavirus AND infection) OR TITLE-ABS-KEY (2019-ncov AND infection) OR TITLE-ABS-KEY (coronavirus AND disease 2019) OR TITLE-ABS-KEY (coronavirus AND disease-19) OR TITLE-ABS-KEY (2019-ncov AND disease) OR TITLE-ABS-KEY (covid-19 AND virus AND infection) AND AFFILCOUNTRY (country))
3. In the case of LILACS, the aforementioned keywords were used in the search strategy to retrieve scientific output by country, but it was not possible to retrieve a specific query equation.

The list of American countries established by the WHO was taken into account to identify the LAC countries for the analysis, which were then categorized by income according to the World Bank.¹⁵ The extracted data was imported into a Microsoft Excel worksheet. Before screening, a training session was conducted to standardize definitions. Then, titles and abstracts were screened independently by three members of the research team. Articles considered eligible during the first phase were subjected to full-text analysis. The inclusion criteria were: (i) peer-reviewed articles related to health sciences areas; (ii) articles about COVID-19; (iii) articles conducted/executed locally, with the exception of authors with local affiliations reporting data from places outside LAC; (iv) publication date after January 1, 2020; and (v) articles that provided all the required bibliometric variables listed in the data collection section.

Data collection

To guarantee consistency in data collection, the research team was trained to use standardized definitions across all study variables. Discrepancies were resolved by the lead author. Data including title, first and last author affiliation, country, language, month of publication, and journal were directly obtained from the manual screening. Biblio-

metric indicators included: (i) "Affiliation" for the first and last author, categorized as university, hospital, or other; (ii) "Publication type," categorized as original, systematic review, commentary/letter/editorial, or case/series report; (iii) "Design type" for original articles only, categorized as ecological study, cross-sectional/prevalence/survey study, case-control study, cohort study, randomized controlled trial, meta-analysis, or other (including non-classical epidemiological study designs such as genomic, mathematical modelling, and lab-based studies); (iv) "Research focus" specific to COVID-19, categorized into epidemiology and surveillance system, biology research, early detection and prevention research, diagnosis and treatment research, provision of health services, psychosocial aspects, public policy, or other; and (v) "Journal quartile", obtained manually from the SCImago Journal and Country Rank websites, and categorized as Q1 (quartile), Q2, Q3, Q4, or not applicable. Furthermore, to fully associate a COVID-19 publication with a specific country, the authorship byline could not include any authors from a LAC country other than the one in which it was published, or from outside the LAC region; otherwise, this publication was categorized as a multiple collaboration. Data presented in this study are openly available in FigShare at: <https://figshare.com/s/b65b4737d6b635b38e9e>.

Statistical analysis

Baseline characteristics of the COVID-19 publications retrieved were summarized using descriptive statistics. Categorical variables (bibliometric indicators) were reported as frequencies and percentages. Chi-squared test was performed to compare categorical variables. To compare country-specific research production of original research articles, the number of articles per million individuals in the population was standardized. In addition, a subgroup analysis was performed including only original research articles to better ascertain the specific contribution of LAC countries to the body of research on COVID-19. All analyses were conducted using the R software v1.1.463. A two-tailed *p* value of <0.05 was considered statistically significant.

Results

The search strategy yielded a total of 3 686 papers in Scopus/PubMed/LILACS databases published between January 1 to July 31, 2020. After the screening process (Figure 1), 1 122 duplicate articles were excluded, and an additional 1 273 articles failed to fulfill the inclusion criteria. As a result, 1 291 (35%) studies were selected for the final review and statistical analysis.

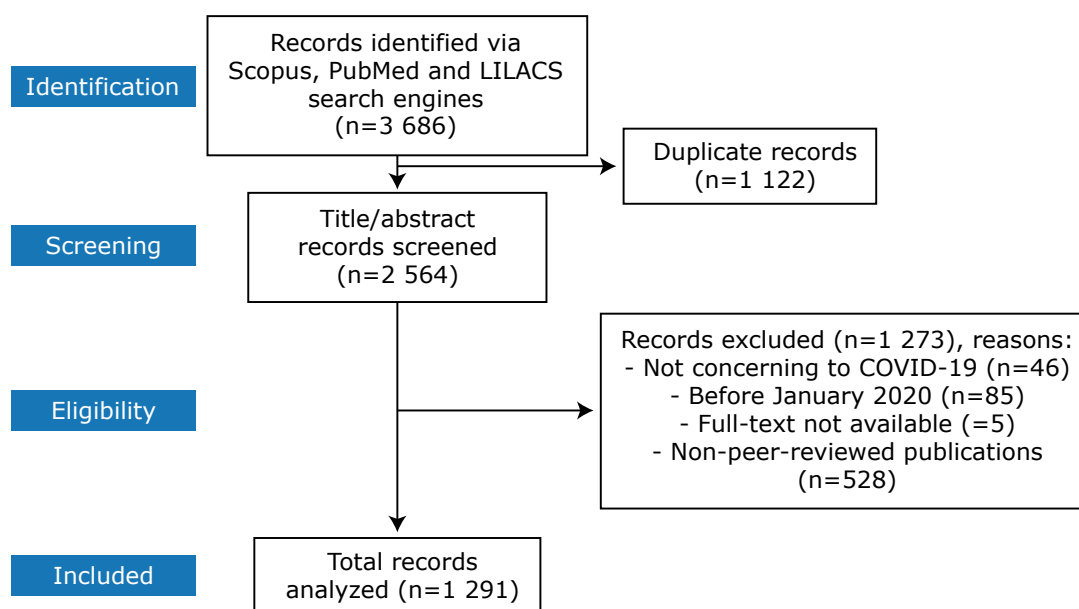


Figure 1. Screening and selection process of the records according to the PRISMA (Preferred Reporting Items for Reviews and meta-analysis) flowchart. Source: Own elaboration.

Characteristics of publications in LAC

Table 1 shows that LAC countries produced more non-original studies (81.72%) than original studies (18.28%) and that LAC researchers preferred to publish in English (79.71%) than in other languages. Regarding original articles (n=236), cross-sectional studies were the most common (25.84%); there were only 5 (2.12%) randomized

controlled trials (RCTs), and 15 (6.36%) meta-analyses. It is worth mentioning that original studies that were categorized as "other" designs obtained the highest output in the region (53.81%). These studies comprised several non-classical epidemiology designs, including genomic, mathematical modelling, and lab-based research papers.

Table 1. Baseline characteristics of Latin American and Caribbean publications related to COVID-19.

Characteristic		Total (n=1 291) n (%)
Publication type	Commentary/Letter/Editorial	770 (59.64)
	Original	236 (18.28)
	Systematic review	232 (17.97)
	Case/series report	53 (4.11)
Language	English	1029 (79.71)
	Spanish	144 (11.15)
	Portuguese	118 (9.14)
Study design *	Other †	127 (53.81)
	Cross-sectional/Prevalence/Survey	61 (25.84)
	Ecologic	19 (8.05)
	Meta-analysis	15 (6.36)
	Cohort	7 (2.97)
	Randomized controlled trial	5 (2.12)
	Case-control	2 (0.84)
Journal quartile	Q1	524 (40.59)
	Q2	350 (27.11)
	Q3	220 (17.04)
	Q4	103 (7.97)
	Not ranked	94 (7.28)
First author affiliation	University	808 (62.58)
	Other ‡	311 (24.09)
	Hospital	172 (13.32)
Last author affiliation **	University	719 (55.69)
	Other ‡	272 (21.11)
	Hospital	150 (11.62)

* Only original studies (n=236).

† Includes genomic, mathematical modelling and lab research studies.

‡ Other category means affiliation to a research institute, non-governmental organization (NGO), or other institutions.

** Percentages did not add up to 100 due to the presence of single-authored papers.

Source: Own elaboration.

Regarding the scientific influence of LAC publications, 40.6% of the studies were published in a Q1 journal. *Travel Medicine and Infectious Disease* (n=31) and *Cadernos de Saúde Pública* (n=26) journals published most of the contributions from the region (data not shown). Overall, academic institutions led the production of COVID-19-related publications in the region, with approximately 63% of the first and last author affiliations corresponding to a university-based institution (Table 1). Moreover, a steady increase in COVID-19 publications from LAC was observed. However, the scientific output decelerated in the last month of the study period, going from 366 to 268 indexed publications in June and July, respectively (data not shown).

Country-specific output of COVID-19-related publications

In general, the countries with the highest scientific production were Brazil (43.91%; 567/1 291), Mexico (9.14%; 118/1 291), and Colombia (7.97%; 103/1 291). Multiple collaboration was reported in 23.5% (303/1 291) of the articles. Countries located

in Central America and the Caribbean were the lowest producers (Table 2).

This trend persisted after performing the subgroup analysis assessing original contributions only. However, after standardizing research output by population, Chile produced the most (0.58 publications/per million population), while Peru produced the least (0.12 publications/per million population) (Table 3).

Primary research focus in Latin America and the Caribbean

Table 4 shows that disease diagnosis and treatment (n=354; 27.42%) and provision of health services (n=304; 23.55%) were the main research focus, while early detection and prevention research was the least common (n=61; 4.72%). In the subgroup analysis that only included original articles (n=236), however, epidemiology and surveillance (24.15%) was the most common research focus, followed by diagnosis and treatment (17.79%), while the "other" category was the least common (3.38%). Brazil produced the highest number of articles related to diagnosis and treatment (48%), followed by multiple collaborations (20.3%).

Table 2. Distribution of Latin American and Caribbean publications by publication type (n=1 291).

Country	Original study n=236 18.28%	Systematic review n=232 17.97%	Commentary/ Letter/ Editorial n=770 59.64%	Case/series report n=53 4.11%
Barbados	-	-	2 (0.26)	-
Trinidad and Tobago	-	-	1 (0.13)	1 (1.88)
Argentina	6 (2.54)	7 (3.02)	44 (5.71)	1 (1.88)
Brazil	96 (40.67)	87 (37.50)	359 (46.62)	25 (47.17)
Chile	11 (4.66)	12 (5.17)	32 (4.15)	2 (3.77)
Colombia	13 (5.51)	27 (11.64)	60 (7.79)	3 (5.66)
Cuba	-	-	2 (0.26)	-
Costa Rica	-	-	1 (0.13)	-
Dominican Republic	-	-	2 (0.26)	-
Ecuador	4 (1.69)	2 (0.86)	6 (0.77)	1 (1.88)
Grenada	-	1 (0.43)	-	-
Jamaica	-	-	1 (0.13)	-
Mexico	29 (12.28)	20 (8.62)	59 (7.66)	10 (18.87)
Panama	-	1 (0.43)	1 (0.13)	-
Peru	4 (1.69)	5 (2.16)	24 (3.12)	3 (5.66)
Uruguay	-	1 (0.43)	3 (0.4)	-
Venezuela	-	1 (0.43)	3 (0.38)	-
Bolivia	3 (1.27)	1 (0.43)	2 (0.26)	-
Guatemala	-	-	2 (0.26)	-
Nicaragua	-	-	1 (0.13)	-
Paraguay	-	1 (0.43)	2 (0.26)	-
El Salvador	-	2 (0.86)	-	-
Haiti	-	-	1 (0.13)	-
Multiple collaboration	70 (29.66)	64 (27.59)	162 (21.04)	7 (13.21)

Data are presented as n (%); (-) = missing data.

Source: Own elaboration.

Table 3. Standardized COVID-19-related original publications in LAC by population between January and July 2020.

Country	Number of original publications	Population *	Articles per 1 million population
Brazil	96	212559417	0.45
Mexico	29	129132739	0.22
Colombia	13	50882891	0.26
Chile	11	19116201	0.58
Argentina	6	45195774	0.13
Ecuador	4	17643054	0.23
Peru	4	32971854	0.12
Bolivia	3	11673021	0.26

* Data extracted from ¹⁶

Source: Own elaboration.

Table 4. Distribution of Latin American and Caribbean publications by specific research focus (n=1291).

Country		Epidemiology and surveillance n=124 9.6%	Biology research n=124 9.6%	Early detection and prevention research n=61 4.72%	Diagnosis and treatment n=354 27.42%	Provision of health services n=304 23.55%	Psychosocial aspects n=118 9.14%	Public policy n=132 10.22%	Other n=74 5.73%
High income	Barbados	-	-	-	-	-	1 (0.84)	1 (0.75)	-
	Trinidad and Tobago	-	-	-	1 (0.28)	-	-	1 (0.75)	-
Upper-middle income	Argentina	2 (1.61)	10 (8.06)	5 (8.19)	13 (3.67)	13 (4.27)	5 (4.23)	3 (2.27)	7 (9.45)
	Brazil	73 (58.87)	45 (36.29)	17 (27.87)	170 (48.02)	110 (36.18)	47 (39.83)	62 (46.96)	43 (58.11)
	Chile	5 (4.03)	6 (4.83)	1 (1.63)	17 (4.8)	20 (6.57)	6 (5.08)	2 (1.51)	-
	Colombia	8 (6.45)	14 (11.29)	6 (9.83)	20 (5.64)	34 (11.18)	8 (6.77)	5 (3.78)	8 (10.81)
	Cuba	-	1 (0.81)	1 (1.63)	-	-	-	-	-
	Costa Rica	-	-	-	-	-	1 (0.84)	-	-
	Dominican Republic	-	1 (0.81)	-	-	-	1 (0.84)	-	-
	Ecuador	-	1 (0.81)	1 (1.63)	4 (1.12)	3 (0.98)	4 (3.38)	-	-
	Grenada	-	-	-	1 (0.28)	-	-	-	-
	Jamaica	-	-	-	-	1 (0.32)	-	-	-
	Mexico	2 (1.61)	12 (9.67)	10 (16.39)	46 (12.99)	27 (8.88)	1 (0.84)	18 (13.63)	2 (2.7)
	Panama	1 (0.81)	-	1 (1.63)	-	-	-	-	-
	Peru	4 (3.22)	2 (1.61)	1 (1.63)	5 (1.41)	5 (1.64)	8 (6.77)	10 (7.57)	1 (1.35)
	Uruguay	-	-	1 (1.63)	2 (0.56)	-	1 (0.84)	-	-
Venezuela	-	2 (1.61)	1 (1.63)	1 (0.28)	-	-	-	-	
Lower-middle income	Bolivia	3 (2.42)	-	-	1 (0.28)	2 (0.65)	-	-	-
	Guatemala	-	-	-	-	2 (0.65)	-	-	-
	Nicaragua	-	-	-	-	-	-	1 (0.75)	-
	Paraguay	-	1 (0.81)	-	-	1 (0.32)	1 (0.84)	-	-
	El Salvador	-	1 (0.81)	-	1 (0.28)	-	-	-	-
Lower Income	Haiti	-	-	-	-	-	1 (0.84)	-	-
	Multiple collaboration	26 (20.96)	28 (22.58)	16 (26.22)	72 (20.33)	86 (28.28)	33 (27.96)	29 (21.96)	13 (17.6)

Data are presented as n (%).
Source: Own elaboration.

Original publications: overall trend, country-specific contribution, and impact

Regarding original research articles (n=236), most of them were published in Q1 journals (n=112; 47.46%), with most of these articles being classified as multiple collaborations (n=44; 39.28%). Brazil was the main producer of Q1 publications (n=39; 34.82%) across the region, but also had the largest number of publications in non-indexed journals (n=16; 66.67%). Figure 2 shows that among original publications, the most prevalent study design was the category "other" (53.81%), and the least common design was case-control (0.84%). Multiple collaboration produced more meta-analysis and cross-sectional publications compared to Brazil.

The focus of the different types of original articles (n=236) is summarized below:

Epidemiology and surveillance (24.15%)

Epidemiological research in the region was mostly dedicated to reporting the burden of COVID-19 (prevalence

and incidence), and addressing under-reporting in different geographical areas, primarily Brazil. Some papers reported modelling data and the impact of risk mitigation interventions at the population level. Risk factors such as other viral diseases (e.g., dengue) and determinants of health that predispose to the development of COVID-19 were reported as well. Few studies were dedicated to reporting the effective reproductive number in the region, and how it varies depending on the implementation of multifaceted public health interventions.

Diagnosis and treatment (17.8%)

Published literature in this category focused on reporting the most common underlying conditions, clinical symptoms, and laboratory/imaging findings among patients treated for COVID-19, as well as criteria for admission to intensive care units. Some studies investigated potential predictive tools to identify disease severity and lethality in patients. Other imaging-focused studies evaluated the utility of chest X-ray in the early diagnosis of COVID-19. Treatment options assessed in published research included

a variety of drugs such as glucocorticoids, convalescent plasma, lithium, famotidine, and sofosbuvir. Five randomized clinical trials (RCTs) were conducted in the region

and evaluated the following drugs: chloroquine diphosphate, ACEI/ARB, remdesivir, and hydroxychloroquine alone or in combination with azithromycin or nitazoxanide.

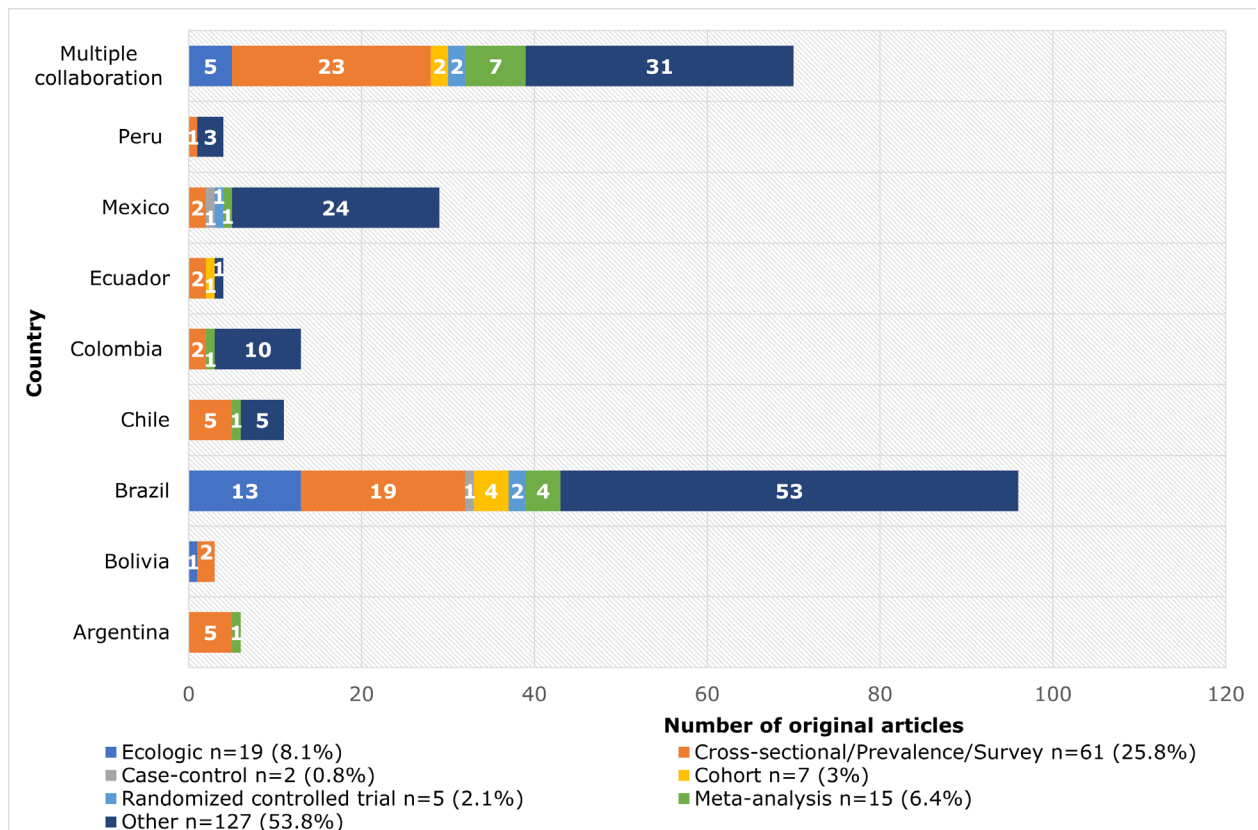


Figure 2. Distribution of original publications by study design in LAC (n=236). The bars represent the distribution of study designs (ecologic, cross-sectional/prevalence/survey, case-control, cohort, randomized controlled trial, meta-analysis, other) among original studies in Latin America and the Caribbean region. The category “others” includes genomic, mathematical modelling, and laboratory studies. Source: Own elaboration.

Provision of health services (16.1%)

In this category, the published evidence provided recommendations on safety measures for health care workers and their associated facilities, especially among surgeons and oncologists. Biosecurity measures required to resume the performance of elective procedures, as well as disease management and treatment options for cancer patients, were emphasized. Additionally, diabetes and ethical topics were discussed in terms of impact and health provision, respectively.

Biological research (12.3%)

Biological research in the region focused on three main topics. First, the phylogeographic characteristics of the virus and its relationship to known coronavirus strains were examined. For example, several studies undertook a phylogeographic reconstruction of SARS-CoV-2 and found a relationship with the bat SARS-like coronavirus. Two other studies focused on the tendency of South American genome sequences to be similar to European strains rather than Chinese strains, indicating positive selection and mutations taking place. Second, the pathophysiology of the virus was investigated, and researchers reported a relationship between the ACE2

receptor and symptom severity among patients with COVID-19. Investigations of different pathways for other symptoms like anosmia, hypoxemia, coagulation, and interstitial pneumonitis were also reported. Finally, various studies focused on molecular investigations aimed at targeted therapeutic approaches.

Public policy (10.2%)

Studies on public policies in the region primarily focused on determining the impact of partial lockdown and social isolation/distancing. Some of these studies combined epidemiology and surveillance data to model the implementation of public policies in LAC.

Psychosocial aspects (9.7%)

The studies aimed to address psychosocial issues associated with COVID-19, such as suicide during quarantine, perception of stress during the pandemic, emotional impact of the pandemic on caregivers, anxiety when scheduling medical appointments, and how personality differences may require tailored prevention strategies to cope with quarantine. Another important aspect assessed was the social impact of COVID-19, which included changes in lifestyle, eating habits, and physical

activity as a result of the confinement. Finally, some articles discussed the implications of online medical education.

Research on early detection and prevention (6.3%)

Most of the studies in this category mathematically modeled the impact of social distancing measures and the inefficiency of implementing "soft" quarantine measures. Some studies reported evidence regarding personal protection measures in the community and health care facilities. At the community level, one study assessed the impact of handwashing as a containment measure within a complicated community. At the health care facility level, another study reported on the use of plasma hydrogen peroxide for intrahospital disinfection.

Other (3.4%)

This category encompasses studies on environmental issues, media, and dietary habits during the lockdown. For example, one study analyzed ozone levels and air quality during partial lockdown in Brazil. Other studies investigated potential media misinformation, exaggeration, and excessive fear generated in relation to the COVID-19 pandemic.

Discussion

Opportunities to study COVID-19 and its various effects have increased dramatically during this unprecedented pandemic. Even though LAC is not a region known for producing a lot of research, it has made efforts to combat the pandemic, some of which are still ongoing. However, the first line of defense against a pandemic is information, which can only be obtained through research. The goal of the present study was to quantify and assess the output of LAC scientific literature specific to the COVID-19 crisis. The following were the main findings: (i) most articles in the region were non-original (81.6%), (ii) there was a lack of interventional studies among original articles, and (iii) epidemiology/surveillance was the main research focus (24.1%).

In many ways, the results obtained here greatly contribute to the current understanding of the production of COVID-19-related publications in LAC countries. First, we built upon previous bibliometric studies conducted in the region, which presented data until April and only included Latin American countries;¹²⁻¹⁴ the present study provides data until July and included Caribbean countries in the search. Second, a subgroup analysis of only original articles was performed to quantify and ascertain better the contributions made in LAC of COVID-19-related publications. Thus, it was possible to describe the publication trend of these contributions by country, study design, research focus, and journal ranking, whereas previous bibliometric research on COVID-19-related publications in the region primarily focused on production variables.¹²⁻¹⁴ For example, one analysis of COVID-19-related publications in LAC using several databases mostly provided general evidence by type and topic of local scientific production regarding COVID-19.¹³ In contrast, the present analysis provides a detailed overview of the COVID-19 publications conducted in the LAC region by categorizing them

by study design and eight different research focuses. Hence, the topics that were not covered in said study were included here, such as health-care delivery and public policy issues.

The fact that scientific production in LAC decelerated during the month of July is alarming, considering that COVID-19-related mortality continues to rise in the region. This may be due to a delay in the indexing process of databases in relation to the date of search. Another possible reason could be the economic repercussions of the pandemic, particularly if research budgets have been cut to supplement institutions that have been providing aid during the crisis.¹⁷

To maintain a consistent flow of scientific output, LAC must once again adapt to perform research efficiently with limited resources. Several countries across the region have implemented policies to provide financial aid for conducting research on the pandemic. Brazil, for instance, has allocated more than 100 million dollars to conduct research focused on diagnosis and prevention of SARS-CoV2 infection.¹⁸ However, investment does not always translate into a direct increase in scientific output to combat COVID-19. Governments in LAC have displayed a lack of awareness by failing to recognize the importance of generating knowledge, which ultimately benefits all members of society.¹⁷ The current crisis is an important opportunity for regional stakeholders to support the implementation of appropriate public health decisions and initiatives leading to an overall rapid recovery of the region from the negative effects of the pandemic.¹⁹

It is worth noting that a high output of scientific literature does not necessarily mean that a country is producing quality research; thus, other factors need to be assessed.²⁰ The majority of articles in our study (40.59%) were published in a Q1 journal, which is associated with a higher journal quality and prestige. This percentage increased to 47.45% when original publications were assessed alone. Compared to our findings, Gregorio-Chaviano *et al.* found that Latin American publications about COVID-19 were published mostly in Q2 and Q3 journals (30.28%).¹⁴ One possible explanation for this finding is that this analysis used a search strategy that retrieved research published up until April 23, 2020, resulting in a smaller sample size compared to our study. Overall, LAC researchers preferred to publish in the journal *Travel Medicine Infectious Disease* (n=31), as described in another study,¹⁴ followed by *Cadernos de Saúde Pública* (n=26). Nevertheless, a bibliometric study by Gallegos *et al.* that analyzed 117 articles indexed until May 2020 in regional scientific databases found that *Cadernos de Saúde Pública* was the most prevalent journal,²¹ which is not surprising considering that Brazil is the country with the largest scientific production of the region, ranking tenth in terms of COVID-19 research production worldwide with a total of 249 articles based only on first author information, compared with 96 studies we found.²²

Original articles involving multiple collaborations are more likely to be published in a Q1 journal than those written by authors from a single country (39.28% vs. 34.82%, p -value <0.05), demonstrating that collaborative research between developed and developing countries brings together the necessary skills and brainpower to maximize research efforts.^{23,24}

In general, there are more non-original articles (81.6%) than original articles (18.3%) in the region. In the non-original articles category, 59.6% articles are commentaries, letters to the editor or editorials, similar to what has been reported in other parts of the world,^{3,25} reflecting the rapid increase in scientific production at the beginning of the pandemic. One possible explanation for the increase in non-original articles could be that journals implemented a fast track for revisions of COVID-19-related articles, with a median time of acceptance of 2-6 days.⁵ Another reason why most research production from LAC at the time was non-original may be that, at the beginning of the pandemic, most of the disease burden fell on China and European countries (Spain and Italy), while LAC countries were preparing their healthcare systems to receive imported cases. Consequently, most of the COVID-19-related publications coming from LAC during the first trimester of 2020 reflected personal opinions on how containment efforts should be undertaken at the local, national, and regional levels.

In the present study, observational studies led the publication pattern in the region. Experiences such as Ebola in 2014 show that research on these topics is usually cross-sectional rather than longitudinal. This could be explained by the fact that health emergencies are alleviated faster with short-term benefit actions than with long-term observation.²⁶ However, the SARS-CoV-2 virus seems to behave differently than previous viruses such as MERS and SARS-CoV-1.²⁷ In 2003, the SARS epidemic was contained because most patients were symptomatic, and transmission from person to person was not as efficient as in the case of the SARS-CoV-2 virus.²⁸ Thus, COVID-19 continues to be a threat that requires both immediate and long-term attention.

During the study period, the production of studies in LAC with the quality of evidence required to support the formulation of health policies, such as cohorts, RCTs, and meta-analysis, is limited (2.97%, 2.12% and 6.36%, respectively). Unfortunately, despite a strong enrollment capacity, this is not the first time that LAC has struggled with clinical research.²⁹ One of the main reasons for this situation could be the lack of a proper research agenda, the lack of communication between researchers and policy-makers, and scarce funding in the region.^{18,30,31}

In LAC countries, the overall production of COVID-19-related publications focused on diagnosis/treatment (27.4%), which is in consistent with what has been described in previous bibliometric studies conducted in the region.¹²⁻¹⁴ However, in the subgroup analysis, where only original articles were assessed, the main area of research was actually epidemiology/surveillance (24.15%), which differs from the findings by Gianola *et al.*³ in a study addressing the characteristics COVID-19-related scientific publications worldwide, where the most common research area was COVID-19 prevention and control (26.1%). As the pandemic progresses, other areas such as early detection and prevention, diagnosis and treatment, and health care delivery should be prioritized, so that efforts to alleviate the crisis in the region are more directly informed.¹⁹

Our study has several strengths. The first is the comprehensive quantification and mapping of the research conducted in LAC, which is a well-defined worldwide as the epicenter of the COVID-19 pandemic. Our study also included the LILACS database, which is a region-

al search engine that includes publications that are not indexed in PubMed or Scopus, so the underreporting of COVID-19-related publications in LAC is less likely. In addition, excluding studies that did not use local data reduced the possibility of outcome misclassification bias, resulting in robust data to appropriately inform regional and national health policies.

Despite these strengths, some limitations should be mentioned, such as the fact that publications prior to January 2020 were excluded from this study; however, the first COVID-19 case in a LAC country was reported in February 2020, so the risk of misclassification is low. Moreover, bibliometric impact indicators, such as the H index or number of citations per article, were not evaluated and, instead, journal quartiles and specific research approaches were used to assess the impact of the contributions made in LAC.

Furthermore, only first and last author affiliations were included in the analysis, which may lead to an underrepresentation of LAC authors listed in other authorship positions, so future studies should evaluate all authorship bylines and their affiliations. Also, potential reliable evidence to inform clinical practice or evidence-based decision-making in the form of preprints could have been omitted from the present study; while we consider that preprints should be included in future studies, this type of non-peer-reviewed document should be approached with caution, as they could have an information bias, as previously reported.³²

Another shortcoming of the present study is that only three comprehensive databases (LILACS, PubMed and Scopus) were consulted to retrieve COVID-19-related publications conducted across the region, so eligible publications not indexed in these databases may have been omitted,^{33,34} however, it is expected that any missed publication may have little impact because Scopus alone covers more journals than PubMed and Web of Science.³⁵ Also, disaggregate data regarding international collaboration among the publications on COVID-19 that were analyzed was not presented here, so future analyses should provide this important information. Finally, the COVID-19 publication trend found during the first half of 2020 may not reflect current scientific production across LAC, thus, findings should be interpreted with caution.

Our study has important regional decision-making implications that can help strengthen public policies and contribute to the scientific community in LAC. In this context, regional and local leaders and stakeholders should pay attention to the region's lack of original articles, and the pandemic should be reframed as an opportunity to increase the volume of high-quality research. Given the high burden of COVID-19 in LAC, this region is likely eligible for conducting clinical studies that may provide a better understanding of the disease and its course.^{29,30} Therefore, local governments should also promote research by allocating funding and facilitating international and/or regional collaboration.

The pandemic is likely to continue in the long term, but there is limited literature on effective pharmacologic therapies; however, at the time of writing this manuscript, several vaccines for COVID-19 are already available under emergency use authorization, mostly in developed countries. Thus, besides increasing research in on the diagnosis and treatment of COVID-19, LAC countries should conduct more research on early detection and

prevention, health care service delivery to patients with the disease, and evaluation of national programs implemented to combat the pandemic. While most regional governments anticipate that developed countries will seek long-term solutions to the COVID-19 crisis, LAC countries may have access to opportunities and initiatives that could contribute vital and valuable knowledge, both regionally and globally.

Conclusions

COVID-19 remains a global threat that requires immediate research attention, particularly in epicenter areas such as the LAC region. Researchers in this region have shown great interest in disseminating information internationally through the publication of works in high-impact journals; however, during the study period, non-original research articles predominated in the scientific production of the region, and among original articles, interventional studies were scarce, while cross-sectional predominated.

Researchers and policymakers in these countries must adopt the mindset that, in times of emergency and uncertainty, high-quality information is the best defense we have to prepare the world for this pandemic and others to come. Consequently, further research with a better quality of evidence should be performed in these countries to contribute to the formulation of health policies aimed at easing the burden of COVID-19 in the region and preparing for future pandemics.

Conflicts of Interest

None stated by the authors.

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References

- Cucinotta D, Vanelli M. WHO declares COVID-19 a pandemic. *Acta Biomed.* 2020;91(1):157-60. <https://doi.org/ggq86h>.
- World Health Organization (WHO). WHO Coronavirus (COVID-19) Dashboard. New York: Who; 2021 [cited 2021 Mar 17]. Available from: <https://bit.ly/3DhSOY5>.
- Gianola S, Jesus TS, Barger S, Castellini G. Characteristics of academic publications, preprints, and registered clinical trials on the COVID-19 pandemic. *PLoS One.* 2020;15(10):e0240123. <https://doi.org/ghgdwx>.
- Brainard J. Scientists are drowning in COVID-19 papers. Can new tools keep them afloat? *Science.* 2020 [cited 2021 Jun 14]. Available from: <https://bit.ly/3gAEksC>.
- Viglione G. How scientific conferences will survive the coronavirus shock. *Nature.* 2020;582(7811):166-7. <https://doi.org/gsvr>.
- Kun Á. Time to acceptance of 3 days for papers about COVID-19. *Publications.* 2020;8(2):30. <https://doi.org/gg924h>.
- Durieux V, Gevenois PA. Bibliometric indicators: quality measurements of scientific publication. *Radiology.* 2010;255(2):342-51. <https://doi.org/d8b2vn>.
- Ortiz AP, Calo WA, Suárez-Balseiro C, Maura-Sardo M, Suárez E. Bibliometric assessment of cancer research in Puerto Rico, 1903-2005. *Rev Panam Salud Publica.* 2009;25(4):353-61. <https://doi.org/fswzv8>.
- Hamidah I, Sriyono S, Hudha MN. A Bibliometric Analysis of Covid-19 Research using VOSviewer. *Indones J Sci Technol.* 2020;5(2):209-16. <https://doi.org/gmbncm>.
- Fan J, Gao Y, Zhao N, Dai R, Zhang H, Feng X, et al. Bibliometric analysis on COVID-19: A comparison of research between English and Chinese studies. *Front Public Health.* 2020;8:477. <https://doi.org/gjpthh>.
- Reeves P, Kahn C. Latin America becomes A new epicenter of the Coronavirus pandemic. NPR. 2020 Jun 3 [cited 2021 Mar 17]. Available from: <https://n.pr/38eWf3p>.
- Forero-Peña DA, Carrión-Nessi FS, Camejo-Ávila NA, Forero-Peña MJ. COVID-19 en Latinoamérica: una revisión sistemática de la literatura y análisis bibliométrico. *Rev. salud publica.* 2020;22(2):1-7. <https://doi.org/gsrz>.
- Fiesco-Sepúlveda KY, Serrano-Bermúdez LM. Contributions of Latin American researchers in the understanding of the novel coronavirus outbreak: a literature review. *PeerJ.* 2020;8:e9332. <https://doi.org/gk7f4z>.
- Gregorio-Chaviano O, Limaymanta CH, López-Mesa EK. Análisis bibliométrico de la producción científica latinoamericana sobre COVID-19. *Biomedica.* 2020;40(Suppl 2):104-15. <https://doi.org/fmvv>.
- World Health Organization (WHO). Countries. New York: WHO; 2021 [cited 2021 Jun 20]. Available from: <https://bit.ly/2WnMpdg>.
- Worldometer. Latin America and the Caribbean Population. Worldometer; 2021 [cited 2021 Feb 15]. Available from: <https://bit.ly/3BggD0y>.
- Pérez-Ortega R. 'We're losing an entire generation of scientists.' COVID-19's economic toll hits Latin America hard. *Science.* 2020 Aug 12 [cited 2021 Mar 17]. Available from: <https://bit.ly/3gCJV16>.
- Rueda A. Pese a crisis, Latinoamérica financia investigación en COVID-19. *Scidev.net.* 2020 Jul 13 [cited 2021 Mar 17]. Available from: <https://bit.ly/3sOR08U>.
- Greer SL, King EJ, da Fonseca EM, Peralta-Santos A. The comparative politics of COVID-19: The need to understand government responses. *Glob Public Health.* 2020;15(9):1413-6. <https://doi.org/ghc7p6>.
- Liu W, Hu G, Gu M. The probability of publishing in first-quartile journals. *Scientometrics.* 2016;106(3):1273-6. <https://doi.org/f8ktds>.
- Gallegos M, Cervigni M, Consoli AJ, Caycho-Rodríguez T, Polanco FA, Martino P, et al. COVID-19 in Latin America: A bibliometric analysis of scientific publications in health. *Electron J Gen Med.* 2020;17(6):em261. <https://doi.org/gsv2>.
- Wang P, Tian D. Bibliometric analysis of global scientific research on COVID-19. *J Biosaf Biosecur.* 2021;3(1):4-9. <https://doi.org/gsv3>.
- Didegah F, Thelwall M. Which factors help authors produce the highest impact research? Collaboration, journal and document properties. *J Informetr.* 2013;7(4):861-73. <https://doi.org/f5jbpn>.
- Rahman MM, Ghoshal UC, Ragunath K, Jenkins G, Rahman M, Edwards C, et al. Biomedical research in developing countries: Opportunities, methods, and challenges. *Indian J Gastroenterol.* 2020;39(3):292-302. <https://doi.org/gh7294>.
- Guleid FH, Oyando R, Kabia E, Mumbi A, Akech S, Barasa E. A bibliometric analysis of COVID-19 research in Africa. *BMJ Glob Health.* 2021;6(5):e005690. <https://doi.org/gmb22q>.
- National Academies of Sciences Engineering and Medicine, Health and Medicine Division, Board on Health Sciences Policy, Board on Global Health, Committee on Clinical Trials During the 2014-2015 Ebola Outbreak. Integrating clinical research into epidemic response: The Ebola experience. Mancher M,

- Cuff P, Keusch G, editors. Washington D.C.: National Academies Press; 2017. <https://doi.org/gsv4>.
27. Rabaan AA, Al-Ahmed SH, Bazzi AM, Al-Tawfiq JA. Dynamics of scientific publications on the MERS-CoV outbreaks in Saudi Arabia. *J Infect Public Health*. 2017;10(6):702-10. <https://doi.org/gsv6>.
 28. COVID-19 is here. Now How Long Will It Last? New Haven: Yale School of Medicine; 2020 [cited 2021 Mar 17]. Available from: <https://bit.ly/2WuIzPq>.
 29. Malamud C, Núñez R. El COVID-19 en América Latina: desafíos políticos, retos para los sistemas sanitarios e incertidumbre económica. Oxford: University of Oxford; 2020 [cited 2021 Mar 17]. Available from: <https://bit.ly/3ktTmkW>.
 30. Coronel E, Halstead D, Fregni F. Clinical research in Latin America: obstacles and opportunities. *Clin Investig*. 2011;1(7):911-3. <https://doi.org/cf7txr>.
 31. Sisa I, Abad A, Espinosa I, Martinez-Cornejo I, Burbano-Santos P. A decade of Ecuador's efforts to raise its health research output: a bibliometric analysis. *Glob Health Action*. 2021;14(1):1855694. <https://doi.org/gsv9>.
 32. Smyth AR, Rawlinson C, Jenkins G. Preprint servers: a "rush to publish" or "just in time delivery" for science? *Thorax*. 2020;75(7):532-3. <https://doi.org/gg9242>.
 33. Mingers J, Leydesdorff L. A review of theory and practice in scientometrics. *Eur J Oper Res*. 2015;246(1):1-19. <https://doi.org/gcpndb>.
 34. Gasparyan AY. Bibliographic databases: some critical points. *J Korean Med Sci*. 2013;28(6):799-800. <https://doi.org/gswc>.
 35. AlRyalat SAS, Malkawi LW, Momani SM. Comparing bibliometric analysis using PubMed, Scopus, and Web of Science databases. *J Vis Exp*. 2019;(152):e58494. <https://doi.org/ghph9g>.