

# Telemedicine in Latin America: a bibliometric analysis

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## Abstract

**Introduction:** Telemedicine revolutionizes health care by removing geographic barriers and improving access. Although it faces challenges such as privacy and equity of access, bibliometric studies are crucial to understanding its impact and guiding future research.

**Methods:** The study used a descriptive bibliometric methodology based on the Scopus database to analyze telemedicine research in Latin America over the last ten years, resulting in 2105 academic articles. Tools such as SciVal and VOSviewer were used to perform quantitative and visual analyses of the publications, including creating bibliometric maps.

**Result:** From 2013–2022, 2105 academic articles on telemedicine were published in Latin America, with a significant impact on the health field. A particular focus is observed on topics such as psychological support, COVID-19, imaging diagnosis and cancer treatment, highlighting the relevance of telemedicine in these contexts. In addition, international collaboration was associated with a more significant impact. Brazil produced articles, and the importance of collaboration between academia and the corporate sector in this field was highlighted.

**Conclusions:** Telemedicine has grown in Latin America, especially during the pandemic, offering benefits such as psychological support and expedited diagnosis and treatment; however, it faces challenges such as a lack of equitable access to technology and concerns about data privacy. Brazil leads scientific production in this field.

**Keywords:** Telemedicine, mHealth, Bibliometric Analysis, Scientific Publication Indicators.

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## 1. Introduction

At its core, telemedicine represents a revolution in how we understand and experience medical care (1) (2) (3) (4). It is defined as a modality of medical practice that harnesses the power of information and communication technologies to provide health care and education services at a distance (5) (6) (7) (8) (9) (10). This concept has become a mainstay in the healthcare world, allowing patients and healthcare professionals to effectively connect, collaborate and share

information without the constraint of physical distance (11) (12) (13).

Its ability to overcome geographic and temporal barriers makes it genuinely transformative (14). Patients are no longer limited by the location of a doctor's office or hospital; instead, they can access care from the comfort of their homes or remote locations. Physicians and specialists, in turn, can provide diagnosis, treatment and follow-up care to patients anywhere, greatly expanding their reach and capacity for care (15) (16) (17).

It is a response to the changing demands of modern society. With the advancement of technology, the growing need for

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medical care, and the search for more accessible and convenient solutions, telemedicine has become a valuable means of improving medical care. It allows for more timely care, better management of chronic diseases, improved access to specialists and, ultimately, greater control over the health of individuals (18) (19).

However, this new discipline and the ICT integration has its challenges (20) (21). Privacy and security of medical data are critical concerns, and it is essential to ensure robust measures are in place to protect patient information. In addition, not all patients have access to the technology necessary to participate in virtual consultations, raising issues of equity in care (22) (23).

One of the most glaring challenges is equitable access. While this promises to improve accessibility to medical care, the reality is that not all patients have an equal opportunity to take advantage of it (24) (25). Lack of access to digital devices and a reliable Internet connection creates a significant gap (1) (26) (27) (28). This can result in excluding rural, disadvantaged, or resource-constrained communities that need access to online healthcare services (29) (30). Addressing this challenge requires efforts to provide affordable access to technology and ensure outreach to all (31) (32).

Privacy and data security are critical concerns in telemedicine. The transmission and storage of sensitive medical information online pose significant risks. Establishing robust safeguards to protect patient information and comply with privacy regulations is vital. Lack of security can undermine patient confidence and deter patients from using these services (33) (34).

To the above challenges, we can add quality of care, regulation and standards, education and training of professionals, interoperability of systems, patient acceptance and excess demand. Overcoming these challenges is essential to fulfill its potential and improve modern healthcare. Collaboration between healthcare professionals, regulators, technologists and patients will be crucial to address these challenges effectively (35) (36) (37).

Bibliometric studies, which analyze scientific and scholarly output in a specific field, are crucial in understanding and advancing knowledge (38) (39) (40). In the case of telemedicine, conducting a bibliometric study becomes essential due to the growing importance and rapid evolution of this discipline in healthcare (41) (42) (43). This study type is a fundamental tool for understanding and advancing this ever-evolving discipline. As telemedicine has gained prominence in global health care, its bibliometric study offers a panoramic view of its scientific impact, the amount of research developed and its influence on medical practice.

The main objective of this bibliometric study in telemedicine is to analyze the scientific production in the field and evaluate its impact through metrics such as the number of publications and citations in Latin America. In addition, we seek to identify emerging trends in research, evaluate the quality of studies, and promote international collaboration in telemedicine. The results of this study will

be used to guide resource allocation, foster global research and increase public awareness of the benefits of telemedicine.

## 2. Methods

The present study was based on a descriptive bibliometric analysis of telemedicine in Latin America. The Scopus database was used as a data source. The bibliometric review focuses on different methods to analyze quantitative, qualitative, and structural changes in scientific research and the set of publications related to a specific topic (44) (45) (46). For the document search, an advanced search was performed using the following search strategy:

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TITLE-ABS-KEY(telemedicine) AND
(AFFILCOUNTRY(Brazil) OR
AFFILCOUNTRY(Mexico) OR
AFFILCOUNTRY(Argentina) OR
AFFILCOUNTRY(Chile) OR
AFFILCOUNTRY(Colombia) OR
AFFILCOUNTRY(Venezuela) OR
AFFILCOUNTRY(Cuba) OR AFFILCOUNTRY(Peru)
OR AFFILCOUNTRY(Uruguay) OR
AFFILCOUNTRY(Puerto Rico) OR
AFFILCOUNTRY(Ecuador) OR
AFFILCOUNTRY(Costa Rica) OR
AFFILCOUNTRY(Panama) OR
AFFILCOUNTRY(Trinidad and Tobago) OR
AFFILCOUNTRY(Jamaica) OR
AFFILCOUNTRY(Bolivia) OR
AFFILCOUNTRY(Guatemala) OR
AFFILCOUNTRY(Barbados) OR
AFFILCOUNTRY(Paraguay) OR
AFFILCOUNTRY(Guadeloupe) OR
AFFILCOUNTRY(Nicaragua) OR AFFILCOUNTRY(EI
Salvador) OR AFFILCOUNTRY(Dominican Republic)
OR AFFILCOUNTRY(Grenada) OR
AFFILCOUNTRY(Honduras) OR
AFFILCOUNTRY(French Guiana) OR
AFFILCOUNTRY(Haiti) OR
AFFILCOUNTRY(Martinique) OR
AFFILCOUNTRY(Bermuda) OR
AFFILCOUNTRY(Guyana) OR AFFILCOUNTRY(Saint
Kitts and Nevis) OR AFFILCOUNTRY(Bahamas) OR
AFFILCOUNTRY(Netherlands Antilles) OR
AFFILCOUNTRY(Falkland Islands) OR
AFFILCOUNTRY(Malvinas) OR
AFFILCOUNTRY(Belize) OR
AFFILCOUNTRY(Suriname) OR
AFFILCOUNTRY(Dominica) OR
AFFILCOUNTRY(Cayman Islands) OR
AFFILCOUNTRY(Virgin Islands) OR
AFFILCOUNTRY(Antigua and Barbuda) OR
AFFILCOUNTRY(Virgin Islands) OR
AFFILCOUNTRY(Saint Lucia) OR
AFFILCOUNTRY(Aruba) OR
AFFILCOUNTRY(Montserrat) OR
AFFILCOUNTRY(Saint Vincent and the Grenadines) OR
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AFFILCOUNTRY(Turks and Caicos Islands) OR  
 AFFILCOUNTRY(Anguilla) OR  
 AFFILCOUNTRY(South Georgia and the South Sandwich  
 Islands))

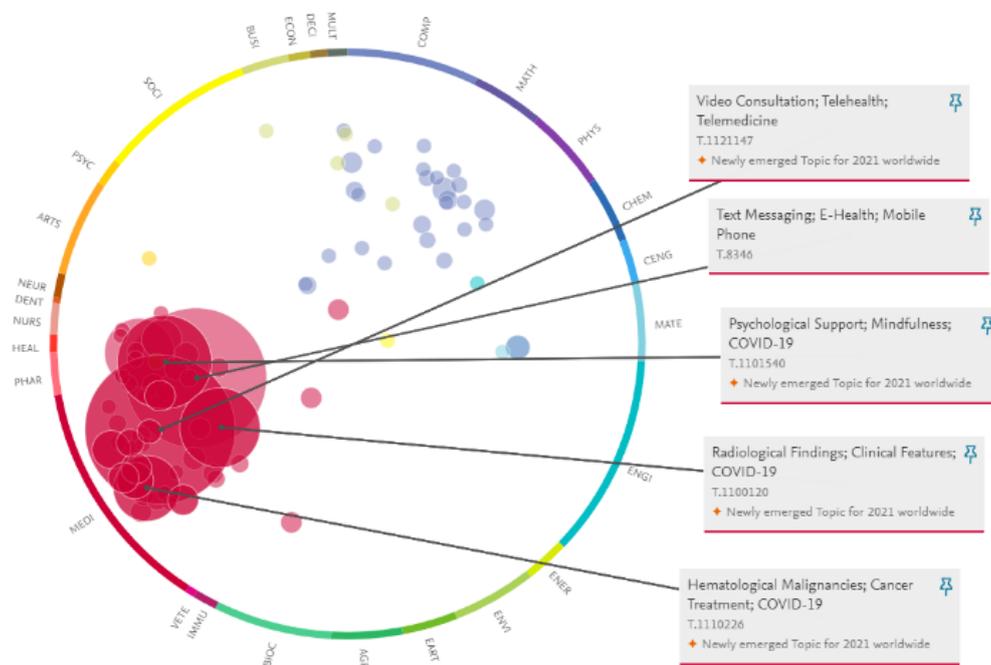
Studies from the last ten years (2013-2022) were analyzed without language limitations. A total of 2105 academic articles were obtained.

Primary data were acquired in the VOSviewer program to examine the results, which requires CSV or TXT files for graphical representation. The SciVal analysis tool was employed, using its built-in analytical capabilities. First, a descriptive analysis was performed using SciVal functions, and then Excel was used. Tables and graphs were created to provide quantitative data. In addition, VOSviewer software version 1.6.18 was used to perform a quantitative and visual analysis of the selected publications, using co-occurrence methods and creating bibliometric coupling maps.

### 3. Results

For 2013-2022, the publication of 2105 academic articles in their different modalities stands out. They gathered 12 990 authors with a field-weighted citation impact 1.31 and 13.2 citations per publication.

The thematic areas of most significant contribution within the 1% of greatest prominence are video consultations, text messaging, psychological support, COVID-19 and others linked to imaging diagnosis and cancer treatment. Most of these are linked to health sciences, to a lesser extent, those linked to computer sciences and mathematics. Of the five areas highlighted in Figure 1, the one of most significant interest is the one linked to psychological support, with a 3.71 weighted citation impact.



**Figure 1.** Topics and topic groups of articles with telemedicine-related topics in Latin America (topics within the top 1% of world prominence). 2013-2022.

Table 1 illustrates collaboration and the indicators by which it can be measured. It should be noted that the studies

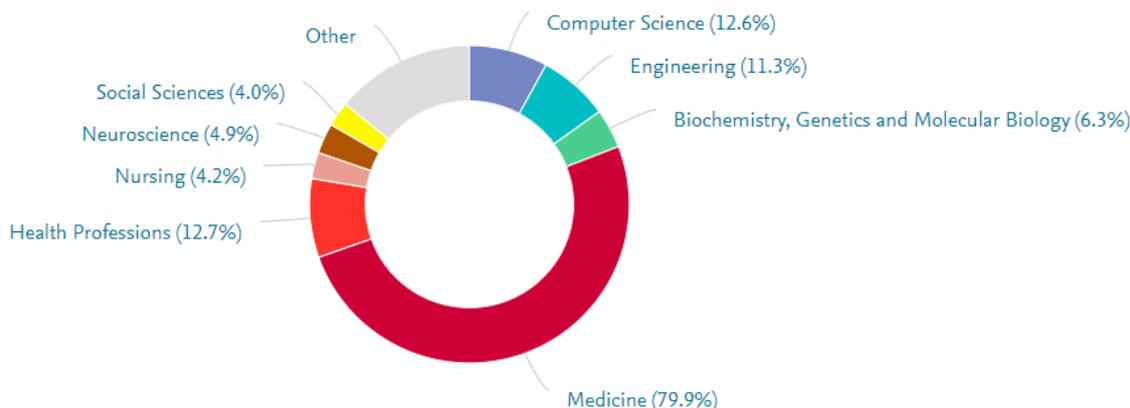
developed with international collaboration have the highest weighted impact.

**Table 1.** International, national, and institutional collaboration. Telemedicine in Latin America. 2013-2022.

Metric	Percentage	Number of documents	Number of citations	Citations per document	Field-Weighted Citation Impact
<b>International collaboration</b>	43.7	920	19 369	21.1	1.93
<b>National collaboration only</b>	26.9	567	4702	8.3	0.92
<b>Institutional collaboration only</b>	24.9	523	3446	6.6	0.74
<b>No collaboration</b>	4.5	95	340	3.6	0.86

Collaboration between the academic and corporate sectors was present in 1.8% of the studies published.

The most represented area was medicine, with 79.9%, and other health professions, with 12.7%; the third area was computer sciences, with 12.6% of the studies.



**Figure 2.** Publications by subject area. Telemedicine in Latin America. 2013-2022.

When studying the number of articles published in 10% of the most prominent journals according to the SCImago Journal Rank, we found that the best year was 2020, with 21% of the articles and 2021, with 18.6%. The year 2022 behaves within the historical range (8.1%-15.1%) with 12.2%.

The thematic study received 2020 the highest number of views per article at 114.1 and with a 5.18 weighted citation impact. Historically, 39.3% of the articles have been published in Q1 journals (SCImago Journal Rank).

The most cited article with the highest weighted impact corresponds to Moreno et al. on mental health and its changes due to the COVID-19 pandemic (901 citations with 28.9 weighted impact) (47).

Table 2 shows the most productive authors in the subject studied. Nine of the ten most outstanding authors belong to institutions based in Brazil and one in Argentina.

**Table 2.** Ten most productive authors in the area of telemedicine in Latin America. 2013-2022.

Author	Country	Article	Citation	H Index
Ribeiro, Antonio L.	Brazil	39	1337	55
Marcolino, Milena Soriano	Brazil	35	1062	24
Alkmim, Maria Beatriz Moreira	Brazil	22	867	12
Harzheim, Erno	Brazil	20	238	17
Cordioli, Eduardo	Brazil	19	130	15
von Wangenheim, Aldo V.	Brazil	18	105	16
Gonçalves, Marcelo Rodrigues	Brazil	17	243	13
Nascimento, Bruno Ramos	Brazil	15	279	35
Luna, Daniel Roberto	Argentina	15	101	15
Novaes, Magdala De Araujo	Brazil	14	95	6

The institutions with the most published articles on the subject are Universidade de São Paulo, Universidade Federal do Rio Grande do Sul and Universidade Federal de Minas Gerais.

The Latin American countries with the most articles are Brazil with 1038, Mexico with 257, Colombia with 252 and Argentina with 198.

The journals that receive the most articles are Telemedicine Journal and e-Health, Studies in Health Technology and Informatics and Arquivos Brasileiros de Cardiologia.

Figure 3 shows a word cloud with importance according to the size of the most essential keywords according to SciVal mentioned in telemedicine articles in Latin America.





visiting a clinic, resulting in more convenient and accessible care (60) (61) (62).

In addition, the COVID-19 pandemic has generated unprecedented demand for remote medical care. Telemedicine has been used to triage patients with COVID-19 symptoms, follow-up of quarantined patients, delivery of non-COVID-19 medical care, and consultation with specialists. In addition, telemedicine research during the pandemic has generated significant interest in this area and has increased the production of scientific articles (63) (64) (65).

With cancer and its complications being the second leading cause of death worldwide, it is understandable that cancer imaging and treatment often require the interpretation of medical images and collaboration between specialized healthcare teams. Telemedicine facilitates the review of radiological images, such as CT and MRI scans, by experts in different geographic locations. This streamlines the cancer diagnosis and treatment process, enabling faster and more accurate care (66) (67).

As a technological tool, video consultations are essential to telemedicine, as they allow real-time communication between physicians and patients through videoconferencing. This is especially important in regions where geographic distance can make access to medical care difficult. Telemedicine through video consultations has proven to be effective in patient evaluation, emergency care and consultation with specialists, making it relevant and valuable in telemedicine (68).

Text messaging is also an effective communication tool for medical appointment reminders, patient follow-up and health education (69). It can efficiently maintain contact with patients, provide them with important information, and encourage treatment adherence. It can be used for communication between patients and healthcare providers, making it an essential telemedicine component (70).

International collaboration is almost necessary to achieve the highest standards, such as citation-to-document ratio and weighted impact, signs of the importance and consumption of scholarly information.

Collaboration between the academic and corporate sectors needs to be deeper. Collaboration between the academic and corporate sectors offers several significant advantages. This synergy can drive innovation by accelerating research and development of new technologies and products. It facilitates the transfer of knowledge and expertise between academics and industry professionals, enriching research and its practical applicability. In addition, it enables real-world problems to be addressed and concrete solutions to be found, which positively impacts society. Companies can also provide additional financial and technical resources for research projects, which benefits academic institutions and can accelerate scientific and technological progress.

For several reasons, Brazil has achieved superior prominence in telemedicine compared to other Latin American countries. Its immense size and population generate significant demand for healthcare services, stimulating investment and interest in telemedicine technologies. In addition, it has a relatively developed

healthcare infrastructure, which facilitates the implementation of telemedicine services. The country has invested in research and development in this field and promoted collaboration between academic institutions and the private sector to drive innovation. These results coincide with similar results shown by previous studies (71) (72) (73) (74) (75) (76).

Favourable telemedicine regulations have provided a solid legal framework for adoption, and the government has promoted public health initiatives that include telemedicine to expand access to healthcare in remote areas. In addition, Brazil has participated in international collaborations in this field, and its academic community has demonstrated a significant commitment to telemedicine research. Together, these factors have consolidated its position as a leader in adopting and developing this technology (77) (78).

Six clusters can be highlighted when studying the different groupings of words according to the co-occurrence analysis. In cluster 1, terms such as "global health," "health care access," "health care cost," "health care delivery," and "health care quality" stand out. These terms indicate a concern for global healthcare access, the costs associated with healthcare, and the quality of healthcare. In addition, the presence of "telecommunication" suggests a possible exploration of technological solutions in health care delivery.

Cluster 2 focuses on chronic disease issues such as "Chronic Disease," "Depression," and "Diabetes mellitus." Aspects related to medical research are also mentioned, such as "clinical trial" and "randomized controlled trial," indicating a focus on evaluating and treating these conditions. In addition, "mHealth" and "Text Messaging" suggest an interest in using technology to improve patient monitoring and self-management of health.

Cluster 3 focuses on telemedicine and remote medical care, with terms such as "teleconsultation," "telehealth," and "telemedicine." These terms indicate a focus on delivering healthcare services remotely, which could have significant implications for improving healthcare accessibility and expanding healthcare services in remote areas.

Cluster 4 relates primarily to pediatric care and child and adolescent research, with terms such as "Adolescent," "cardiovascular disease," "child," and "pediatrics." In addition, "Retrospective Studies" suggests an analysis of historical data in the context of child health.

Cluster 5 is related to the COVID-19 pandemic, with terms such as "coronavirus disease 2019," "COVID-19," and "Pandemics." In addition, "Pregnancy" and "Prenatal Care" are mentioned, suggesting an interest in the care of pregnant women during the pandemic. Cluster 6 highlights terms related to artificial intelligence in healthcare, such as "artificial intelligence" and "cohort analysis." This indicates a focus on applying artificial intelligence technology in medical research and clinical data analysis.

## 5. Limitations

There are restrictions on the findings of this study. Bibliometrics focused on quantitative publication data is not a substitute for qualitative assessment of scientific content. This review provides an overview and establishes a basis for more comprehensive research in the future. Furthermore, interpreting the generated maps is subjective, indicating the importance of conducting additional qualitative analyses in the future.

## 6. Conclusions

In conclusion, telemedicine has experienced significant growth in Latin America in the last decade, and its importance has been further highlighted during the COVID-19 pandemic. This discipline has demonstrated its ability to provide psychological support, expedite cancer diagnosis and treatment, improve chronic disease care, and facilitate communication between physicians and patients through video consultations and text messaging. However, despite its potential, telemedicine also faces significant challenges, such as a need for more equitable access to technology and concerns about the privacy and security of medical data.

This bibliometric study has revealed that Brazil leads in scientific production in telemedicine in the region, driven by its size, healthcare infrastructure and international collaborations. Collaboration between academics and industry is limited but could accelerate innovation in the field. The most prominent thematic areas include psychological care, chronic disease management, telemedicine and medical technology, pediatrics, and the response to the COVID-19 pandemic.

Ultimately, telemedicine has the potential to transform healthcare in Latin America and around the world. However, it is essential to address the challenges mentioned earlier and ensure collaboration between different sectors to advance this discipline. This study provides a detailed overview of telemedicine research in the region and can serve as a basis for future advances in this crucial area of modern health care.

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