

Adoption of Telemedicine during the COVID-19 pandemic in Ibero-America: A Systematic Literature Review

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ABSTRACT

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The outbreak of COVID-19 caused a major international public health crisis and led to the imposition of social distancing measures to contain the spread of the virus. In this context, the use of telehealth skyrocketed as the only way to deliver healthcare to patients during a lockdown was remotely. The countries of Latin America and the Iberian Peninsula were severely hit by the pandemic and the prospects and challenges associated with widespread adoption of telehealth are unique. The goal of this systematic literature review is to explore how telehealth has been used during the pandemic to prevent, diagnose, treat and control diseases in Ibero-America. Thus, we sought to identify the main keywords, themes, theoretical frameworks and methodologies used by researchers in this area. We used several tools for bibliographic management like Rayyan, VOSViewer and NVIVO and followed the PRISMA protocol. Our analysis of themes showed the existence of 3 nodes within the literature: students, teachers and education. After searching in 6 databases, 1826 articles were found. After excluding the duplicates (231 articles), we screened and read the titles and abstracts of 1595 articles. Only 119 articles met the inclusion criteria. Finally, after a full-text analysis, a final sample of 106 articles was selected for analysis. Spain and Brazil are the countries who have produced the greatest volume of research in the region. The public sector is the largest funder of research on this topic by far especially at national level. Our findings show that the research output in the region of Ibero-America (Latin America and Iberia) on this topic is still relatively small when compared to regions like North America.

Keywords: Telemedicine, eHealth, Systematic Literature Review, COVID-19

INTRODUCTION

The motivation behind the choice of this topic of research relates to the growing importance of telemedicine in a post-pandemic world. By analyzing the existing literature on the adoption of telemedicine in Ibero-America, the goals of this SLR are:

- Identify the main research themes, keywords and topics;
- Reveal the main research methodologies;
- Highlight the most relevant authors, journals and countries

Telemedicine is the use of Information and communication technology (ICT) to deliver healthcare remotely (WHO Global Observatory for eHealth, 2010). Some systematic literature reviews following the PRISMA protocol on the topic of eHealth

have been written (Table 1). (Alonso et al., 2021) identified China and the United States as the two countries with the largest number of papers on the topic. The author also identified 10 different agencies that are supporting research on telemedicine and 35 different organizations that are involved in the application of telemedicine systems. The most prominent organizations that were researching telemedicine applied to COVID-19 were Huazhong University of Science Technology, the University of Queensland and the University of Southern Denmark. Telemedicine whose implementation requires a cross-domain research approach: 58% of the analyzed articles were published in health care sciences journals, 16% in medical informatics journals and 11% in the public and occupational health domain.

Table 1. Previous Systematic Literature Reviews about telemedicine during COVID-19 based on PRISMA

Study	Search Term	Databases	Papers
(Alonso et al., 2021) and	((coronavirus or COVID-19 or SARS-CoV-2)	Web of Science	85
(Bokolo Anthony Jnr., 2020)	Strings comprised of the terms: tele- health, telemedicine, COVID-19, coronavirus disease 2019, pandemic, digital health, remote care, hospital- at-home, digitalized health care, digitalized medical care, virtual health care, virtual medical care.	PubMed, Google scholar, Scopus, Web of science, ScienceDirect, ProQuest, Emerald, Taylor & Francis, Inderscience, Springer, Sage, ACM, Wiley, and IEEE Xplore	87
(Monaghesh and Hajizadeh, 2020)	Combination of keywords: COVID19, COVID-19, Coronavirus, Novel coronavirus, 2019-nCoV, Wuhan corona- virus, SARS-CoV-2, SARS2, Tele*, Telemedicine, Tele-medicine, Tele- health, Tele-health, Telecare, Mobile Health, mHealth, Electronic health, and ehealth	PubMed, Scopus, Embase, Web of Science, and Science Direct	142

(Monaghesh and Hajizadeh, 2020) concluded that the use of telehealth improves the provision of healthcare especially during the pandemic. It allows patients and healthcare workers who are self-isolating to reduce the risk of COVID-19 infection, morbidity and mortality during the pandemic. By using telecommunications tools for triaging (videoconference, phone call, etc...), assessing and caring for patients, the number of patients who receive face-to-face healthcare services can be reduced. Telehealth also can also provide mental online health services to isolated patients to help them cope with the stress, depression and anxiety of lockdown. Allergy and immunology services can also be rendered at a distance. There are many easy-to-set-up live video conferencing services that are useful for people who want consultation on COVID-19, medication checks, triage when telephone is not enough and patients that are particularly anxious about visiting the doctor. Another group that could potentially benefit from these technologies are the elderly. However, (Monaghesh and Hajizadeh, 2020) highlights that there are barriers to large scale use of telehealth that require further investigation namely the changes in billing and coordination of services.

Finally, (Bokolo Anthony Jnr., 2020) showed that telemedicine is nothing new and that this technology is now widely available, low-cost and accepted by healthcare workers and patients. In the context of the COVID-19 pandemic, the use of telemedicine became a necessity and exploded. The potential of this technology is that it allows to examine a patient's health, virtually educate patients and store health information of patients that is useful for future examination. (Bokolo Anthony Jnr., 2020) cites the US, China and Australia as success stories in using telemedicine and focuses on the guide- lines for the use of telemedicine and virtual applications. Privacy and consent laws vary widely among countries. As a result, physicians should understand the privacy and confidentiality policies that should be followed during online consultations. Physicians should dress professionally, make eye contact with the patients, be warm and friendly and ensure proper lighting in the examination positions. In addition, physicians should confirm that the patient has working microphones/camara, that telemedicine are covered by the patients' health insurance and , if necessary, help them use the virtual platform. To ensure privacy, the virtual consultation should be in a quiet place with a strong internet connection. However, the adoption of telemedicine is a disruptive process that still has many barriers related to the lack of infrastructure, inadequate funds and

inexperience. Another concern relates to patient privacy policies. Developing countries (like those of Latin America) may also not be able to fully adopt telemedical services in remote and rural areas where access to the Internet is limited and effective telemedicine regulation is lacking. Another challenge is reducing the financial burden of accessing telehealth during health crisis especially for low-income users. Improving the quality of internet access is also crucial as slow internet may hinder the use of videoconferencing.

METHODOLOGY

We conducted a systematic literature review following the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) framework of (Moher et al., 2014). PRISMA is an evidence-based minimum set of items for reporting in systematic reviews and meta-analyses.

We searched for articles in July of 2021 in five databases (SCOPUS, Jstor, Emerald, SciELO, Science Direct, IEEE) using the following terms: ("Telemedicine" OR "Telecare" OR "eHealth") AND ("COVID-19" OR "Coronavirus") AND ("Acceptance" OR "Adoption") AND DOCTYPE (ar) AND PUBYEAR>2019. In addition, to obtain more articles written in Ibero-America we also used the following search terms: ("Telemedicina" OR "Telessáude" OR "eHealth" OR "Telesalud") AND ("COVID-19" OR "Coronavirus") AND DOCTYPE (ar) AND PUBYEAR>2019.

We excluded duplicates, thesis, dissertations, monographies, books and other non- peer reviewed articles. Likewise, we only included articles published after 2019, written in Portuguese, English and Spanish that focus on telemedicine. Initially, 1826 articles were found. Endnote, a bibliographic-management software, was used to compile and manage the databases. Each citation included the abstract, keywords and the full text. After using Endnote to exclude the duplicates (231 articles), two reviewers screened the titles and abstracts of 1595 articles using Rayyan QCRI. All discrepancies were resolved by consensus between researchers. Only 122 articles met all the criteria for inclusion and were exported to a RIS. file containing the final sample that was made up of potentially relevant studies with their full texts. Articles without the full text and all papers whose full text did not focus on telemedicine in the region of Ibero-America were excluded. Finally, after reviewing the full texts, 106 articles were selected for a review and analysis (Figure 1).

We imported the RIS file containing this final sample of 106 articles to VOSviewer to visualize and create maps of the main keywords and author. Automatic coding was used to obtain a dendrogram that allows us to identify the most used terms. Finally, we also analyzed the citations to identify the most relevant authors and journals, as well as countries in Ibero-America where most research has been conducted.

DISCUSSION OF RESULTS

Research Keywords, Themes and Subthemes

In **Figure 2**, we can see a co-occurrence analysis of the keywords made using VOSviewer. Of the 466 keywords

detected, only 27 meet the minimum threshold of 4 and all of them were selected. 5 distinct clusters can be identified in red (12 items), green (8 items), blue (5 items), yellow (1 item) and purple (1 item). The 3 nodes with the greatest total link strength were telemedicine (190), telemedicina (164) and covid-19 (158).

NVIVO12 was used to make a dendrogram that shows in the relevance of each of the keywords (**Figure 3**). The 3 most mentioned themes were health (577 mentions), care (416) and patient (310). Telemedicine controversial subject, we carried out a sentiment analysis to see if the authors have a positive or negative outlook on this theme. Overall, the authors maintain a mostly neutral tone as one could expect from a scientific publication (**Figure 4**). However, there are more negative references (3998) than positive ones (2307).

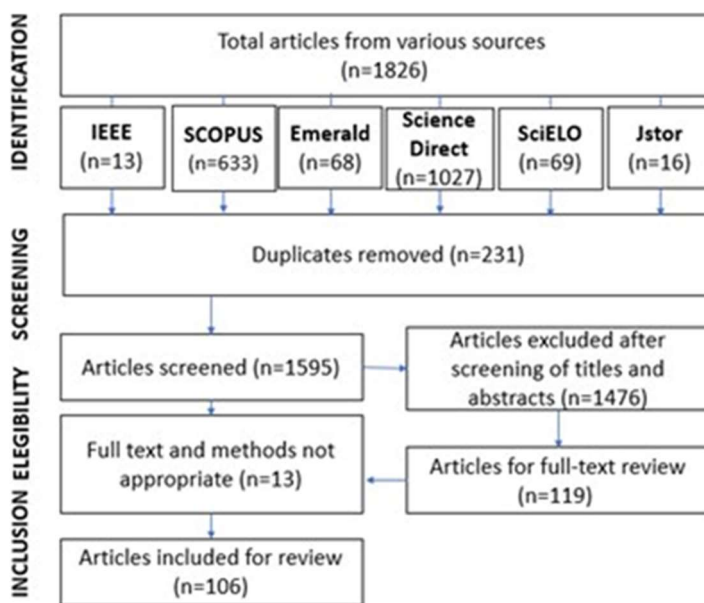


Figure 1. PRISMA Flow diagram

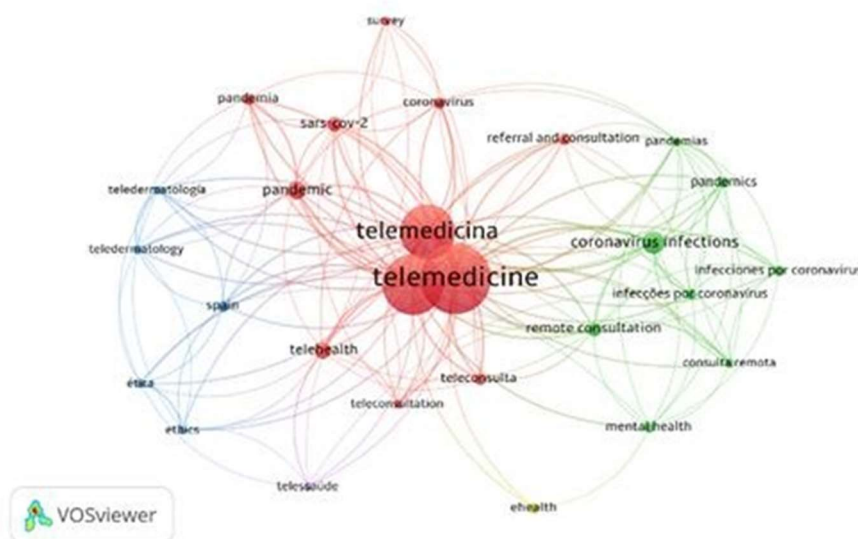


Figure 2. Network visualization of main keywords using VOSviewer¹

¹ Analysis conducted based on bibliographic data from a RIS file with the selected references for analysis (n=106). Full counting was used and a minimum threshold of 4 occurrences per keyword was set.

Research Methodologies

In terms of methodologies, qualitative studies make up over 55% of the final sample. Studies that used a mixed and quantitative methodologies make up 23% and 20% respectively. In qualitative studies, the most common types of articles are literature reviews (14 articles) and case study analysis. Many authors sought to review the literature on the use of telemedicine in managing a specific disease like Parkinson (Moreno López et al., 2020), pediatric epilepsy (Gómez et al., 2020) and chronic obstructive pulmonary disease (Barbosa et al., 2020).

The most studied stakeholders in telemedicine are patients (28 articles) followed by healthcare workers (13 articles). There are a few studies that analyze this complex phenomenon the

point of view of both patients and healthcare workers.

The most widely used data gathering instruments are online surveys/questionnaires (27 articles). Besides surveys, other data gathering instruments used were interviews and existing databases. In quantitative empirical studies, researchers used statistical software to analyze the data like SPSS. In mixed and quantitative studies, 19 articles used just descriptive statistics (distribution, dispersion and central tendency) to provide basic descriptions of data from a sample. However, in 16 articles, the authors use more advanced inferential statistics methods (ANOVA, *t*-square, Chi-Square). One article used Structural Equation Modeling (SEM) techniques. By far, the most common limitation of these studies relates to the size and representativeness of the sample (especially when samples of convenience are used).

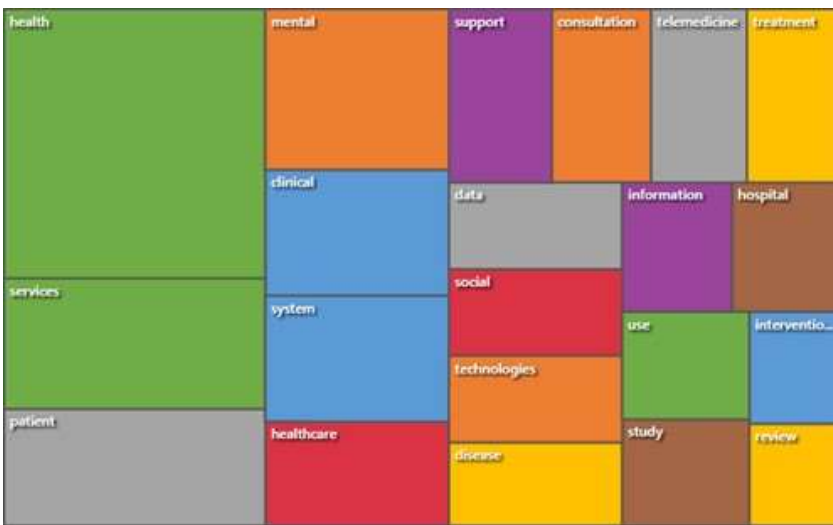


Figure 3. Network visualization of main keywords using VOSViewer²

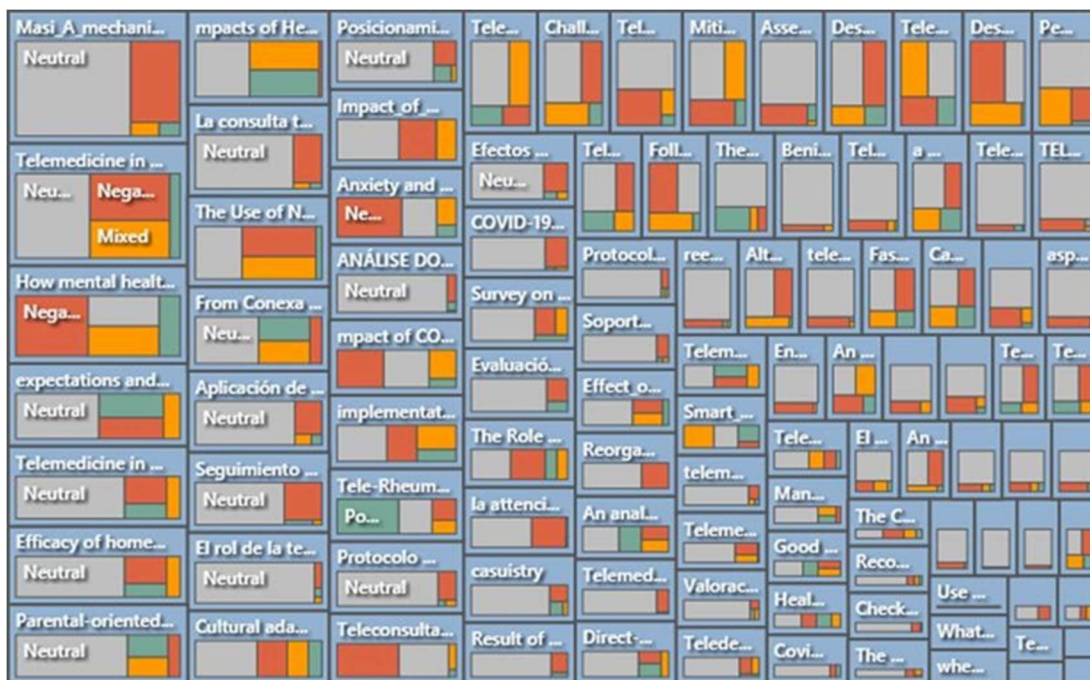


Figure 4. Sentiment Analysis using NVivo12³

² Analysis conducted based on the full texts of the final sample. NVivo screened every sentence of all texts. A few Spanish terms deemed redundant were excluded.

³ Analysis conducted based on the full texts of the final sample. NVivo screened every sentence of all texts.

Regarding funding, over 78% of authors declared no sources of funding. As for the articles that received funding, we can classify the funding organizations into several groups: universities; public institutions (at regional, national and EU levels) and private institutions. In Ibero-America, the public sector has been the most active in sponsoring research on this topic (17 out of 21 articles had, at least, one public sponsor), especially at national level. Universities and the private sector funded only 4 articles out of 21. It is also worth stressing that some articles were funded by more than one institution. However, of the 21 articles that received funding, 81% received funding from only one sponsor and no article had more than 3 sponsors.

Authors, Journals and Countries.

The most relevant journal was *Actas Dermo-Sifiliográficas* (4 articles). No other journal had more than 2 articles. We only included studies carried out in Latin America to form a group of nations that are culturally and geographically close, have similar levels of development and were hit by the pandemic at the same time. We also included Portugal and Spain due to their cultural proximity to Latin America. The countries in

Ibero- America with the most articles were Spain (42 articles), Brazil (28) and Colombia (8). In terms of languages, even though the research was conducted by native Portuguese or Spanish speaking authors from Ibero-America, the most widely used language remains English (circa 66% of articles in the final sample had a version in English), followed by Spanish (circa 50%) and Portuguese (circa 15%). It's also worth noting that many authors wrote several versions of their articles in more than one language: 23 were written in English and Spanish, 10 in English and Portuguese and 1 in Portuguese, Spanish and Portuguese. A possible source of bias derives from the fact that NVivo software was designed to analyze texts in English. Whenever possible we included the English version of the article, however some articles were only in Portuguese or Spanish meaning they may not have been properly analyzed. A co-authorship analysis made using VOSviewer (Figure 5). Of the 665 authors, only 8 met the minimum threshold of 2 articles. In the final sample, no scholar wrote more than 2 articles. The low levels of clustering shows that co-authorship between authors on this topic is relatively rare. The only was cluster composed of 6 Spanish authors (Belvís,r.; Garcíaazorín,d.; González-oria,c.; Latorre, g.;López-bravo, a.; Santos-lasaosa,s.) who published 2 articles together and have the highest link total link strength (10).

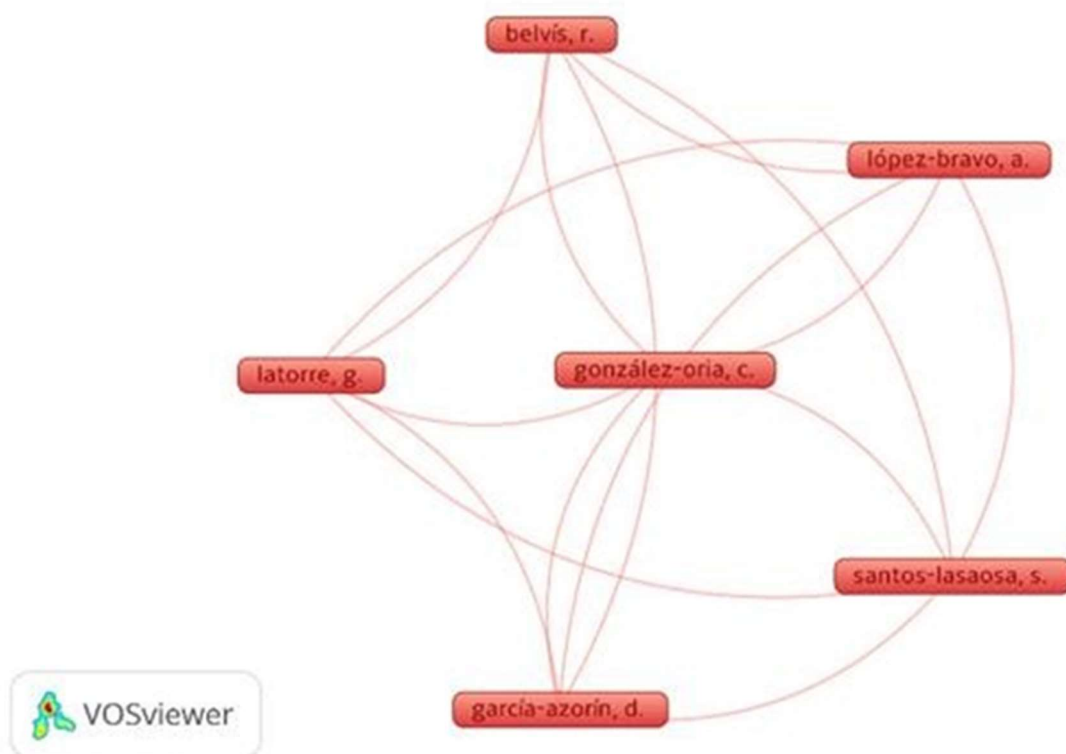


Figure 5. Co-authorship analysis using VOSViewer⁴

⁴ Analysis conducted based on bibliographic data from a RIS file with the selected references for analysis (n=106). Full counting was used and a minimum threshold of 2 documents per author was set.

CONCLUSIONS

The aim of this systematic review was to analyze the existing literature on telemedicine in Ibero-America during the COVID-19 pandemic. Most scholars who published on this topic, as one might expect, have a background in Medicine and Health sciences. However, scholars from other fields like Management, Psychology, Engineering and Information Systems have also contributed to research on this complex topic. Although several studies have been carried out in Ibero-America, research in Ibero-America on this topic lags behind other regions like Asia and North America.

Telemedicine has both pros and cons and has emerged as a key alternative to manage health care systems during a pandemic. In Ibero-America, there are specific challenges related to the regions legal, cultural and social context. Many of the developing nations of Ibero-America should develop a national strategy to expand the use of telemedicine and service providers should communicate the benefits of these technologies to consumer.

Finally, it is important to discuss some of the limitations of this review. Firstly, we could only include studies from a limited number of databases (6). Secondly, we only included studies conducted in Ibero-America, so caution needs to be taken before generalizing the findings to other contexts. Due to time constraints, the review protocol was not registered.

Since the topic of research is complex and very recent, further research is needed to stay up to date with the latest developments of the pandemic. Further research should also focus on the adoption and use of telemedicine by vulnerable and underserved populations namely those living in rural and remote locations, indigenous peoples, racial, sexual, and ethnic minorities.

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