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Telehealth and chronic diseases in Brazil and the United States: a scoping review

João Kasprowicz [1], *Halan Germano Bacca* [1], *Gabriela Machado Silva* [1], *Luis Perdona* [1], *Ricardo Reichenbach* [1], *Ana Graziela Alvarez* [1], *Grace Dal Sasso* [1]

1. Universidade Federal de Santa Catarina, Florianópolis/SC, Brasil.

Abstract

This study aimed to map scientific evidence on the use of telehealth in the management of chronic diseases in Brazil and the United States. It is a scoping review conducted following the Joanna Briggs Institute guidelines and the PRISMA-ScR. The search strategy was applied to the MEDLINE/PubMed, Embase, Scopus, CINAHL, Cochrane Library, Web of Science, BDENF, LILACS, and SciELO databases, yielding 772 studies. Articles available in full, in English or Brazilian Portuguese, and published from 2019 to 2024 were selected. After screening, 38 studies were included and analyzed. The results revealed benefits such as expanded access to care and remote patient monitoring, but also challenges related to unequal access to technology and infrastructure. The studies highlight the need to expand telehealth service coverage and invest in the development of more accessible and effective telemonitoring technologies.

Keywords: Telemedicine. Chronic Disease. United States. Brazil.

Resumo

Telessaúde e doenças crônicas no Brasil e nos Estados Unidos: revisão de escopo

Este estudo teve como objetivo mapear evidências científicas da utilização da telessaúde no gerenciamento de doenças crônicas no Brasil e nos Estados Unidos. Trata-se de uma revisão de escopo conduzida conforme as diretrizes do Instituto Joanna Briggs e do PRISMA-ScR. A estratégia de busca foi aplicada nas bases Medline/PubMed, Embase, Scopus, CINAHL, Cochrane Library, Web of Science, BDENF, LILACS e SciELO e resultou em 772 estudos. Foram selecionados artigos disponíveis na íntegra, em inglês ou português, publicados entre 2019 e 2024. Após a triagem, 38 estudos foram incluídos e analisados. Os resultados revelaram benefícios como ampliação do acesso ao cuidado e monitoramento remoto de pacientes, mas também desafios relacionados à desigualdade no acesso a tecnologia e infraestrutura. Os estudos evidenciam a necessidade de ampliar a cobertura dos serviços de telessaúde e de investir no desenvolvimento de tecnologias de telemonitoramento mais acessíveis e eficazes.

Palavras-chave: Telemedicina. Doença crônica. Estados Unidos. Brasil.

Resumen

Telesalud y enfermedades crónicas en Brasil y en Estados Unidos: revisión del alcance

Este estudio pretendió recopilar evidencia científica sobre el uso de la telesalud en el manejo de enfermedades crónicas en Brasil y Estados Unidos. Esta es una revisión del alcance según las pautas del Instituto Joanna Briggs y del PRISMA-ScR. La búsqueda se realizó en las bases de datos MEDLINE/PubMed, Embase, Scopus, CINAHL, Cochrane Library, Web of Science, BDENF, LILACS y SciELO, y dio como resultado 772 estudios. Se seleccionaron artículos disponibles en texto completo, en inglés o portugués, publicados entre 2019 y 2024. Tras la selección, se incluyeron 38 estudios para el análisis. Se observan ventajas como un mayor acceso a la atención y el monitoreo remoto de los pacientes, y también desafíos relacionados con el acceso desigual a la tecnología y la infraestructura. Es necesario ampliar la cobertura de los servicios de telesalud e invertir en el desarrollo de tecnologías de telemonitoreo más accesibles y eficaces.

Palabras clave: Telemedicina. Enfermedad crónica. Estados Unidos. Brasil.

The authors declare no conflict of interest.

Research

The Centers for Disease Control and Prevention (CDC) in Brazil defines Noncommunicable Diseases (NCD) as conditions that last a year or more, requiring continuous medical follow-up and/or limiting daily activities [1]. Examples include diabetes mellitus, cardiovascular diseases, cerebrovascular accidents (CVA), and cancer, which are among the main global causes of morbidity and mortality [2]. As life expectancy increases and population health patterns change, the prevalence of NCDs continues to rise. It is projected that by 2030, the economic cost associated with these diseases will reach US$47 trillion globally [3]. This scenario presents significant challenges to health systems, which must develop innovative strategies to ensure continuous, effective, and accessible care [3].

During the COVID-19 pandemic, in light of restrictions on in-person care, telehealth gained even greater relevance, becoming one of the main modes of service delivery. In Brazil, the use of telehealth can be traced to milestones such as telemetry in space missions in the 1960s, the creation of the National Education and Research Network (RNP) in 1989, and the formulation of the National Policy on Health Information and Informatics (PNIIS) in 2003. Initiatives such as the Telehealth Brazil Program, launched in 2007, and the digitalization of primary health care units (UBS) in 2010 consolidated its integration into the public health system. The pandemic accelerated regulation of the sector by the Federal Council of Medicine (CFM) and the National Supplementary Health Agency (ANS), which strengthened the role of telehealth in the national context. Despite these advances, challenges remain in establishing a robust legal framework, overcoming professional resistance, and ensuring information security [4,5].

In the United States, approximately 76% of hospitals use telehealth services to connect with patients. The technology was initially developed by the National Aeronautics and Space Administration (NASA) in the 1960s to monitor astronauts on space missions, and in 1966 it received 42 million dollars in funding. Today, it is widely applied in specialties such as neurology, radiology, and psychiatry, contributing to increased access to specialized care, particularly in rural areas. Nevertheless, barriers to consolidating telehealth within the U.S. health system remain, including issues related to reimbursement, interstate professional licensing, data privacy, and the need for public policies, infrastructure, and education [6].

Given the growing impact of chronic diseases and the consolidation of telehealth as a viable alternative for their management, this scoping review aimed to map the available scientific evidence on the use of telehealth in the management of chronic diseases in Brazil and the United States.

Method

This scoping review was conducted in accordance with the guidelines of the Joanna Briggs Institute (JBI) [7] and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist. This type of review aims to map the main concepts related to the topic, identify gaps in the literature, and synthesize evidence in a comprehensive manner.

The research question was developed based on the population–concept–context (PCC) strategy, in which the population consisted of individuals with chronic diseases in Brazil and the United States, the concept concerned the use of telehealth for the management of these conditions, and the geographical context was limited to the two countries mentioned. Based on this, the following guiding question was defined: What scientific evidence exists on the effectiveness and challenges of using telehealth in the management of chronic diseases in Brazil and the United States?

The following inclusion criteria were applied: year (2019-2024); language (Portuguese, English, and Spanish); context (telehealth and chronic diseases); countries (Brazil and the United States). The exclusion criteria were: studies in the project phase or without results, gray literature, and studies that were inaccessible even through institutional remote access (VPN).

The search was conducted in July 2024 in the databases PubMed/Medline, Embase, Scopus, CINAHL, Cochrane Library, Web of Science, LILACS, BDENF, and SciELO. Descriptors in Portuguese,

English, and Spanish were used, extracted from the DeCS and MeSH vocabularies, and combined with the Boolean operators "and" and "or." The databases were selected for their broad coverage of health publications. The review protocol and search strategy were registered on the Open Science Framework (OSF) platform, available under DOI 10.17605/OSF.IO/HK4EU.

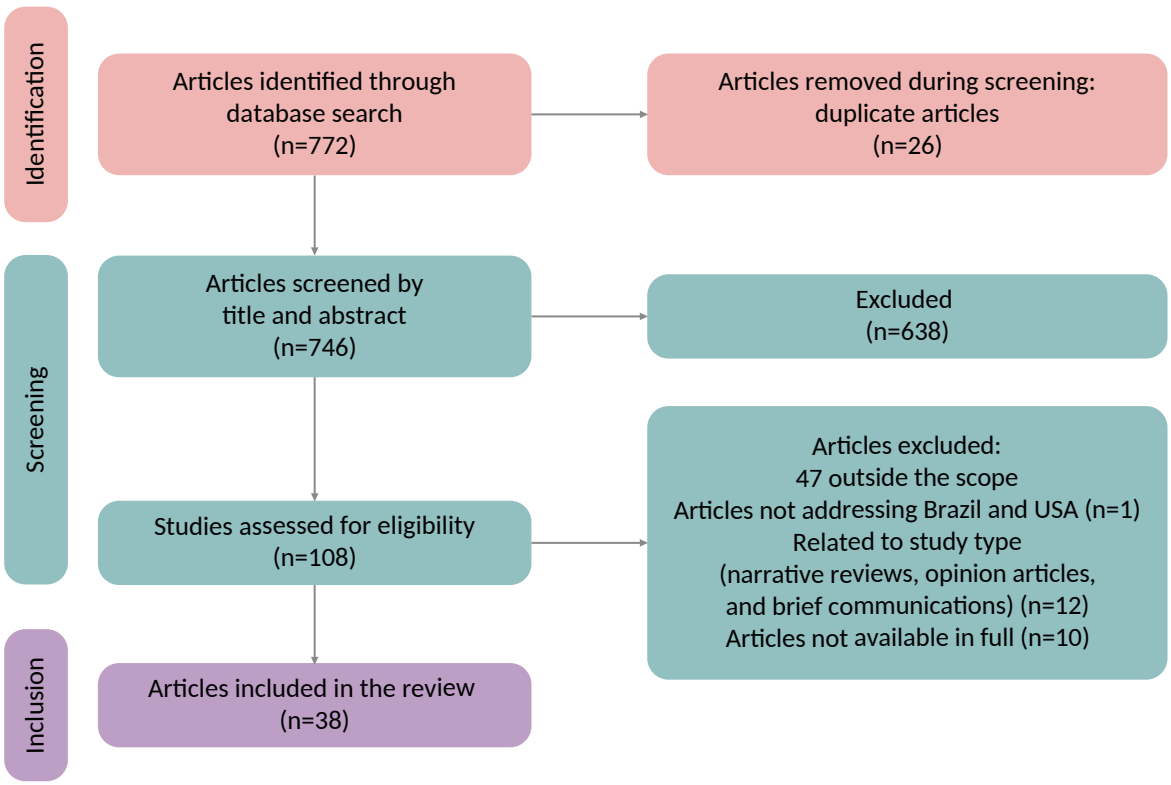
The study selection followed the steps recommended by PRISMA-ScR: identification, screening, eligibility, and inclusion. The search results were first exported to a Microsoft Excel spreadsheet, where duplicates were removed. Next, three independent reviewers analyzed the titles and abstracts based on the inclusion criteria. Potentially relevant studies were subjected to the review of extended abstracts, introductions, and conclusions, and finally, full texts were assessed for final inclusion [8].

Data were extracted using an instrument adapted from the JBI manual, which includes author, country, journal, title, objectives, study type, type of technology used, main findings, clinical applicability, and limitations. The information was organized into tables and described narratively in the body of the article.

Results

A total of 772 studies were identified, distributed across the following databases: Medline/PubMed (n=129), Embase (Elsevier) (n=77), Scopus (Elsevier) (n=318), CINAHL (EBSCO) (n=13), Cochrane Library (n=39), Web of Science (n=119), BDENF (n=16), LILACS (n=57), and SciELO (n=4). The search and selection procedure for the studies included in this review is presented in Figure 1.

Figure 1. Search flowchart, according to recommendations, adapted from PRISMA-ScR. Florianópolis/SC, Brazil. 2024



In total, 26 studies were excluded due to duplication, leaving 746 for title and abstract screening. Of these, 638 were excluded for not meeting the inclusion criteria, resulting in 108 articles selected for full-text review. Among these, 47 were excluded for being outside the scope of

the topic, 10 for not being available in full, 1 for not addressing the two selected countries, 1 for being a descriptive report, 2 for being brief communications, 2 for being opinion or perspective articles, 3 for being narrative reviews, and 4 for being integrative reviews, leaving 38 articles included in the final analysis.

The selected articles were saved in PDF format for complete analysis. During the full-text reading, the study field, results, discussion, and conclusion of each article were considered.

Regarding the origin of the 38 studies included in this review, 35 (92.10%) were conducted in the USA and only 3 (7.89%) in Brazil. Out of the total, 35 (97.36%) studies were in English, and only 1 (2.63%) was in Portuguese. As for the year of publication, 3 (7.89%) were published in 2019, 3 (7.89%) in 2020, 4 (10.52%) in 2021, 7 (18.42%) in 2022, 9 (23.68%) in 2023, and 12 (31.57%) in 2024. A detailed description of the studies can be found in Chart 1.

Chart 1. Characteristics of studies included in the scoping review

Id	Title	Authorship	Year	Country	Type of study	Journal
A1	Advanced telemedicine training and clinical outcomes in type II diabetes: a pilot study [9]	Merrill and collaborators	2022	USA	Pilot study	*Telemedicine Reports*
A2	Telemonitoring to manage chronic obstructive pulmonary disease: systematic literature review [10]	Kruse and collaborators	2019	USA	Systematic review	*JMIR Medical Informatics*
A3	Sociodemographics, social vulnerabilities, and health factors associated with telemedicine unreadiness among US adults [11]	Wray and collaborators	2021	USA	Cross-sectional study	*Journal Of General Internal Medicine*
A4	Influence of synchronous primary care telemedicine versus in-person visits on diabetes, hypertension, and hyperlipidemia outcomes: a systematic review [12]	Mabeza, Maynard, Tarn	2022	USA	Systematic review	*BMC Primary Care*
A5	Telemonitoring and business dynamics in health: challenges and opportunities for the Brazilian Unified Health System [13]	Paula, Maldonado, Gadelha	2020	Brazil	Quali-quantitative exploratory study	*Revista Saúde Pública*
A6	Racial and ethnic disparities in telehealth use before and after California's stay-at-home order [14]	Bustamante and collaborators	2023	USA	Quantitative study with logistic regression model	*Frontiers In Public Health*
A7	Telehealth and outpatient visits among individuals with chronic conditions by socioeconomic status in the first year of the covid-19 pandemic: observational cohort study [15]	Gordon, Kim	2023	USA	Observational cohort study	*Telemedicine and e-Health*
A8	Outcomes of an asynchronous care model for chronic conditions in a diverse population: 12-month retrospective chart review study [16]	Hofner and collaborators	2024	USA	Observational, retrospective, non-randomized cohort study	*JMIR Diabetes*

continues...

Chart 1. Continuation

Id	Title	Authorship	Year	Country	Type of study	Journal
A9	Access to dermatological care with an innovative online model for psoriasis management: results from a randomized controlled trial [17]	Ford and collaborators	2019	USA	Randomized clinical trial	*Telemedicine Journal and e-Health*
A10	Optimizing telehealth for diabetes management in the deep south of the United States: qualitative study of barriers and facilitators on the patient and clinician Journey [18]	Bazzano and collaborators	2024	USA	Qualitative study	*Journal of Medical Internet Research*
A11	A culturally adapted, telehealth, community health worker intervention on blood pressure control among South Asian immigrants with type II diabetes: results from the DREAM Atlanta intervention [19]	Shah and collaborators	2024	USA	Randomized clinical trial	*Journal of General Internal Medicine*
A12	Design and rationale of the cardiometabolic health program linked with community health workers and mobile health telemonitoring to reduce health disparities (LINKED-HEARTS) program [20]	Commodore-Mensah and collaborators	2024	USA	Cluster randomized trial	*American Heart Journal*
A13	Continuity of care among postmenopausal women with cardiometabolic diseases in the United States early during the covid-19 pandemic: findings from the women's health initiative [21]	Wong and collaborators	2022	USA	Retrospective cross-sectional study	*The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*
A14	Psychometric properties of performance-based measures of physical function administered via telehealth among people with chronic conditions: a systematic review [22]	Barry Walsh and collaborators	2022	USA	Systematic review	*PLOS ONE*
A15	Effectiveness of mobile phone and web-based interventions for diabetes and obesity among African American and Hispanic adults in the United States: systematic review [23]	Enyioha and collaborators	2022	USA	Systematic review	*JMIR Public Health and Surveillance*
A16	Description of e-health initiatives to reduce chronic non-communicable disease burden on Brazilian health system [24]	Rodrigues and collaborators	2021	Brazil	Prospective and descriptive study	*International Journal of Environmental Research and Public Health*

continues...

Chart 1. Continuation

Id	Title	Authorship	Year	Country	Type of study	Journal
A17	Mobile health technologies for the management of systemic lupus erythematosus: a systematic review [25]	Dantas and collaborators	2020	USA	Systematic review	*Lupus*
A18	Virtual versus usual in-office care for multiple sclerosis: the VIRTUAL-MS multi-site randomized clinical trial study protocol [26]	McGinley and collaborators	2024	USA	Randomized clinical trial	*Contemporary Clinical Trials*
A19	The association of mobile health applications with self-management behaviors among adults with chronic conditions in the United States [27]	Wang and collaborators	2021	USA	Observational cross-sectional study	*International Journal of Environmental Research and Public Health*
A20	Where virtual care was already a reality: experiences of a nationwide telehealth service provider during the covid-19 pandemic [28]	Uscher-Pines and collaborators	2020	USA	Descriptive study	*Journal of Medical Internet Research*
A21	Telehealth for chronic disease management among vulnerable populations [4]	Williams, Shang	2023	USA	Linear and logistic regression analysis	*Journal Of Racial And Ethnic Health Disparities*
A22	Telehealth utilization and associations in the United States during the third year of the covid-19 pandemic: population-based survey study in 2022 [29]	Kim and collaborators	2024	USA	Cross-sectional study	*JMIR Public Health and Surveillance*
A23	Racial and socioeconomic characteristics associated with the use of telehealth services among adults with ambulatory sensitive conditions [30]	Chumbler and collaborators	2023	USA	Retrospective cohort study	*Health Services Research And Managerial Epidemiology*
A24	"I am hesitant to visit the doctor unless absolutely necessary": a qualitative study of delayed care, avoidance of care, and telehealth experiences during the covid-19 pandemic [31]	Moore and collaborators	2022	USA	Descriptive qualitative study	*Medicine*
A25	Clinical and sociodemographic factors associated with telemedicine engagement in an urban community health center cohort during the covid-19 pandemic [32]	Molina and collaborators	2023	USA	Retrospective cohort study	*Telemedicine And E-Health*
A26	Economic evaluation and costs of remote patient monitoring for cardiovascular disease in the United States: a systematic review [33]	Zhang and collaborators	2023	USA	Systematic review	*International Journal Of Technology Assessment In Health Care*

continues...

Chart 1. Continuation

Id	Title	Authorship	Year	Country	Type of study	Journal
A27	Factors associated with internet use and health information technology use among older people with multi-morbidity in the United States: findings from the national health interview survey 2018 [34]	He and collaborators	2022	USA	Descriptive cross-sectional study	*BMC Geriatrics*
A28	Continuidade da atenção às doenças crônicas no estado de São Paulo durante a pandemia de covid-19 [35]	Duarte and collaborators	2021	Brazil	Cross-sectional study	*Saúde em Debate*
A29	Electronic health behaviors among US adults with chronic disease: cross-sectional survey [36]	Madrigal, Escoffery	2019	USA	Cross-sectional study	*Journal of Medical Internet Research*
A30	Inflammatory bowel disease hospitalizations are similar for patients receiving televisit-delivered outpatient care and those receiving traditional in-person care [37]	Cohen-Mekelburg and collaborators	2024	USA	Observational case-control study	*American Journal Of Gastroenterology*
A31	Can telehealth expansion boost health care utilization specifically for patients with substance use disorders relative to patients with other types of chronic disease? [38]	Tilhou and collaborators	2024	USA	Cohort study	*Plos One*
A32	Remote evidence-based health promotion programs during covid: a national evaluation of reach and implementation for older adult health equity [39]	Steinman and collaborators	2024	USA	Cross-sectional cohort study	*Health Promotion Practice*
A33	Patient characteristics and telemedicine use in the US, 2022 [40]	Chang, Penfold, Berkman	2024	USA	Cross-sectional study	*Jama Network Open*
A34	Prevalence and disparities in telehealth use among US adults following the covid-19 pandemic: national cross-sectional survey [41]	Spaulding and collaborators	2024	USA	Cross-sectional study	*Journal Of Medical Internet Research*
A35	The Association of eHealth Literacy Skills and mHealth application use among US Adults with obesity: analysis of health information national trends survey data [42]	Shaw and collaborators	2024	USA	Weighted logistic regression	*Jmir Mhealth And e-health*
A36	Effect of chronic disease home telehealth monitoring in the veterans health administration on healthcare utilization and mortality [43]	Mohr and collaborators	2023	USA	Comparative effectiveness matched cohort study	*Journal Of General Internal Medicine*

continues...

Chart 1. Continuation

Id	Title	Authorship	Year	Country	Type of study	Journal
A37	Trends and disparities in telehealth use among Louisiana medicaid beneficiaries with type 2 diabetes [44]	Shao Y and collaborators	2023	USA	Retrospective quasi-experimental interrupted time series	*Diabetes, Obesity And Metabolism*
A38	Factors associated with telehealth utilization among older African Americans in south Los Angeles during the covid-19 Pandemic [45]	Ekwegh and collaborators	2023	EUA	Cross-sectional study	*International Journal Of Environmental Research And Public Health*

Discussion

The implementation of telehealth in the management of chronic diseases is a promising strategy, especially in contexts in which geographical barriers and an overloaded health system hinder access to continuous care. However, the literature reviewed reveals considerable heterogeneity across studies, making direct comparisons between interventions involving telemonitoring, wearable devices, and real-time data transmission difficult [12].

Despite a robust search strategy, registered on the Open Science Framework (OSF) and applied across nine databases, there was a scarcity of Brazilian studies on the topic. This limitation does not indicate methodological flaws, but a real gap in national scientific production, a bias that should be considered in the interpretation of results that highlights the need to strengthen research in the Brazilian context.

Telehealth technologies have the potential to increase the efficiency and convenience of care by eliminating physical barriers [17]. However, important challenges persist. Advanced age, for example, still represents a barrier: only 60% of older adults in the US reported using the internet in 2018, and of these, only 38.9% used electronic health services, numbers still far from the Healthy People 2030 goal of 87.3%. Additionally, the remote assessment of functional capacity, strength, and balance is still limited compared to in-person methods [22,34,46].

On the other hand, patients with chronic diseases tend to be more proactive, monitoring health indicators and seeking information online [36]. A case-control study with patients with inflammatory bowel disease (IBD) seen by the US veteran health system showed that the expanded use of teleconsultations reduced hospitalizations compared to in-person care, a result that indicates the potential of telehealth in IBD care. However, the authors emphasize the need for new studies to define the ideal frequency of consultations and identify the patient profiles who would benefit most [37].

Despite this evidence, structural and social barriers limit the use of telehealth. Lower access was observed among ethnic minorities, rural residents, older adults, people with comorbidities, low education, food insecurity, and those who are socially isolated, while individuals with higher purchasing power showed greater usability of the technologies [11,15,34,44]. An example is the difference between beneficiaries of the Medicaid and Medicare systems in the US. Only 49% of Medicaid patients had at least one telehealth consultation, with the lowest adherence among those with chronic obstructive pulmonary disease (COPD) and heart failure, in contrast to diabetic patients [4]. It was also observed that older adults in poor health, without both private insurance and specialist consultations in the last year were less likely to use the internet and telehealth services [34].

Technological infrastructure also contributes to inequalities. A study conducted in Louisiana highlighted marked discrepancies in the use of telehealth between urban and rural areas, reinforcing the influence of the socio-spatial context on the effectiveness of digital interventions [44].

The use of telehealth in managing COPD has proven promising. Telemonitoring can contribute

to improving clinical outcomes, strengthening the bond between patient and professional, reducing the need for in-person consultations, and providing greater convenience for the user [10]. However, studies still present conflicting results: some research points to a reduction in hospitalization rates, and others do not identify significant differences.

A study with US veterans even indicated an increase in hospitalization and mortality rates among COPD patients enrolled in a home telehealth program, though it was an observational analysis based on administrative data, which may contain selection bias and does not allow for a causal inference [43]. In a systematic review on digital interventions for COPD, facilitators (such as a reduction in in-person visits and better disease management) were identified, but so were barriers such as low-quality data and an increased workload for health professionals [10].

In the control of type 2 diabetes, telehealth has stood out for its impact on glycated hemoglobin (HbA1c) levels. There is evidence that the number of telehealth consultations is inversely related to HbA1c, with results similar to those observed in in-person care [9,16]. Studies indicate a significant reduction in HbA1c after six months of telehealth follow-up, although there are no sustained changes after 12 months [12]. However, not all findings are positive. A study by Mohr and collaborators, also with US veterans, found no association between telehealth use and a reduction in hospitalizations in patients with type 2 diabetes [43], a result that reinforces the need to carefully evaluate implementation methods and patient profiles to best take advantage of digital resources. Additionally, a systematic review of mobile and online interventions for diabetes and obesity in African American and Hispanic adults evaluated seven randomized controlled studies; the results indicated the effectiveness of mobile device interventions for weight loss, but the evidence for glycemic control remains inconclusive, highlighting the need for more studies focused on minority populations [23].

The effects of telehealth on systemic arterial hypertension (SAH) are also ambiguous. In some studies, no significant differences in blood pressure levels were observed between patients seen in person and those virtually followed [12]. However, another study revealed reductions in systolic and diastolic pressure in hypertensive patients followed by an asynchronous virtual model, although it had selection bias, since the participants volunteered for the study, which may indicate greater commitment and predisposition for lifestyle changes [16].

Among specific populations, a culturally adapted study with Asian immigrants in Atlanta, Georgia, is noteworthy. It indicated improvements in blood pressure control, body weight reduction, medication adherence, physical activity, and dietary control. Telehealth, in this context, was crucial for overcoming barriers related to transportation, language, and scheduling inflexibility, proving to be an important tool for addressing socioeconomic and cultural inequalities [19].

The COVID-19 pandemic accelerated the adoption of telehealth in several countries due to fear of contagion and delays in medical care, which led many patients to avoid or postpone treatment. Telehealth emerged as a viable solution, valued for its convenience and accessibility, although some patients reported dissatisfaction due to the lack of in-person contact and the limitations of performing physical exams [31]. In the United States, studies showed that the use of telehealth was more frequent among individuals with a higher socioeconomic status, a fact that highlights disparities in access to this technology and the need for policies aimed at including vulnerable populations [15].

Despite the advantages, unequal access to digital technology and the degree of familiarity with its use remain important barriers, especially for older adults [32,39]. Factors such as age, internet access, and attitudes towards the pandemic significantly influenced the use of telehealth, with particular challenges observed among African American patients with chronic diseases. This data reinforces the importance of strategies that promote digital inclusion, such as the expansion of wireless internet and training for the use of health technologies [45].

Data indicate that the use of telehealth increased substantially during the pandemic:

in 2022, 39.3% of US adults used this technology, mostly for medical recommendations and convenience [29,41]. The majority of virtual consultations were for acute and chronic diseases, with expressive growth in behavioral health, especially in rural areas [18,44]. In many cases, telehealth represented the only viable alternative for patients facing geographical access difficulties, such as residents in remote regions [28,30]. In this context, an increase in use was also observed among patients with substance use disorders, who traditionally face additional barriers to accessing medical care. Even so, telehealth was not enough to eliminate access disparities, which indicates the need for specific strategies to ensure the continuous engagement of these patients [38].

In Brazil, the impact of the pandemic was also significant. In São Paulo, for example, 95.7% of municipalities reported interruptions in health services, especially in NCD care, a fact that contributed to an increase in mortality and lethality rates. In this scenario, telehealth was seen as an alternative to mitigate the effects of the health crisis, by enabling the continuity of clinical follow-up even with mobility restrictions [35]. Furthermore, there was an increase in the use of mobile health technologies. Between 2017 and 2019, the number of individuals with chronic diseases who used health apps increased significantly, reaching 59.8%, which suggests an advance in health self-management through digital resources [27].

The use of health apps has also been influenced by social determinants. A 2024 study focused on obese adults in the US revealed that factors such as age, marital status, education, and ethnicity directly affect adherence to these applications. Individuals with higher education are more likely to use them, which accentuates inequalities in access to digital health. The study therefore highlights the urgency of actions to promote digital literacy and equity in the use of these technologies, especially among more vulnerable groups [42].

The use of health apps has gained prominence in the management of specific conditions, such as systemic lupus erythematosus (SLE). However, a systematic review revealed that most applications aimed at this condition have limited functionality and low quality. The main tools available involve education, symptom monitoring, and online community support. The lack of robust studies that evaluate the effectiveness of these applications reinforces the need to develop user-centered solutions, with collaboration among health professionals, patients, and developers [25].

Issues related to privacy and security are also central in the context of telehealth. Studies show that patients who opt for audio-only consultations demonstrate greater concern for privacy than those who use video, as the format prevents visualization of the patient's environment and increases the feeling of confidentiality. Still, the protection of medical data must be a priority and requires strict protocols that ensure confidentiality and security in transmissions [25,40].

From an economic perspective, remote patient monitoring appears promising. A 2023 systematic review that evaluated the approach in the treatment of cardiovascular diseases concluded that it can be cost-effective in the long term, despite involving initial costs with equipment, supplies, and staff training. The reduction in hospitalizations and the use of in-person services represents significant savings for health systems, but more studies are needed to comprehensively evaluate its economic viability [33]. In addition to reducing logistical and hospitalization costs, telehealth can expand access to specialized care, especially in underserved regions [10,13,18,24,26].

In Brazil, NCDs represent approximately 75% of the expenses of the Unified Health System (SUS) and are related to about 72% of deaths. Despite the potential of telehealth to reduce costs and improve the quality of care, there is a scarcity of public initiatives for its implementation, which contrasts with the growing interest from the private sector. The adoption of telemonitoring in the SUS could decrease the demand for in-person appointments, reduce transportation costs and work absences, expanding access to continuous and equitable care [13].

In this regard, the work of the *Hospital Alemão Oswaldo Cruz* is noteworthy. In partnership with the Ministry of Health and through the Program

to Support the Institutional Development of the SUS (Proadi-SUS), it developed three projects focused on telehealth between 2018 and 2021: the *Projeto Brasil Redes*, the *Regula Mais Brasil Colaborativo*, and the *Teleconsulta Diabetes*. These projects demonstrate that collaboration between the public sector and reference hospitals can boost the development of innovative and sustainable telehealth solutions in Brazil [24].

Another relevant challenge lies in the standardization of data collection and monitoring protocols. The LINKED-HEARTS program, focused on underprivileged populations, represents an example of a multifaceted approach by integrating community-clinical support and remote monitoring of blood pressure and glycemia via an app, with the goal of reducing disparities in hypertension and diabetes care [20]. Complementarily, an ongoing study is following 120 patients with multiple sclerosis for 24 months to compare in-person and telehealth modalities. The results should contribute evidence on effectiveness, cost-effectiveness, and patient satisfaction and could influence the care of other chronic conditions requiring multidisciplinary approaches [26].

Final considerations

According to the results of this research, telehealth has a great potential for the management of chronic diseases in Brazil and the United States. It offers benefits such as greater access to health services, especially for patients in rural areas or those facing socioeconomic barriers; improved management of chronic diseases; reduced costs related to transportation, waiting times, and hospitalizations; and increased convenience for patients and professionals. However, important challenges persist, including inequalities in access to technology and digital literacy; the need to develop more accessible and advanced technologies for telemonitoring; and the assurance of patient data security and privacy. In addition, there is a notable scarcity of studies on the use of telehealth in Brazil, as evidenced by the fact that only three of the 38 selected articles addressed its application in the Brazilian health system. In conclusion, telehealth presents a great transformative potential in healthcare, especially in the management of chronic diseases. However, challenges must be overcome to achieve its benefits in an equitable and sustainable manner.

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João Kasprowicz – Graduate – joao.kasprowicz@univali.br
0009-0002-1703-8630

Halan Germano Bacca – Graduate – halanbacca@outlook.com
0000-0001-7694-1390

Gabriela Machado Silva – Graduate – machadogabrielauf@gmail.com
0000-0001-9409-1916

Luis Perdona – Graduate – perdona.unica@gmail.com
0009-0002-4603-4954

Ricardo Reichenbach – Graduate – ricardoreichenbach@icloud.com
0000-0001-8255-3650

Ana Graziela Alvarez – PhD – a.graziela@ufsc.br
0000-0002-3943-9884

Grace Dal Sasso – PhD – grace.sasso@ufsc.br
0000-0003-3763-0375

Correspondence
João Kasprowicz – Univali Campus Itajaí. Rua Uruguai, 458, bloco E1, sala 106, Centro. CEP 88302-901. Itajaí/SC, Brasil.

Participation of the authors
João Kasprowicz, Halan Germano Bacca, and Gabriela Machado Silva participated in the study conception, methodological design, investigation, data collection, processing, and analysis, in addition to contributing to the writing of the manuscript. Luis Perdona and Ricardo Reichenbach also collaborated in the writing and refinement of the text. João Kasprowicz, Halan Germano Bacca, Gabriela Machado Silva, Luis Perdona, Ricardo Reichenbach, Ana Graziela Alvarez, and Grace Dal Sasso performed the critical review of the content, to ensure the scientific quality and coherence of the final work.

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