

# **Digital health opportunities to improve Primary Health Care in the context of COVID-19: A Scoping Review**

Cícera Renata Diniz Vieira Silva, Rayssa Horacio Lopes, Osvaldo de Goes Bay Jr, Claudia Santos Martiniano, Miguel Fuentealba-Torres, Ricardo Alexandre Arcêncio, Luís Velez Lapão, Sonia Dias, Severina Alice da Costa Uchoa

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## Abstract

**Background:** The COVID-19 pandemic brought social, economic, and health impacts, requiring fast adaptation of health systems. Although information and communication technologies were essential for achieving this objective, the extent to which health systems incorporated this technology is unknown.

**Objective:** To map the use of digital health strategies in primary health care worldwide and their impact on quality of care during the COVID-19 pandemic.

**Methods:** We conducted a scoping review based on the Joanna Briggs Institute manual and guided by PRISMA Extension for Scoping Reviews. A systematic and comprehensive three-step search was performed in June and July 2021 in multidisciplinary health science databases and gray literature. Data extraction and eligibility were performed by two independent authors and interpreted using thematic analysis.

**Results:** Forty-four studies were included, and six thematic groups were identified: characterization and geographic distribution of studies; nomenclatures of digital strategies adopted; types of information and communication technologies; characteristics of digital strategies in primary health care; impacts on quality of care; and benefits, limitations, and challenges of digital strategies in primary health care. The impacts on organization of quality of care were investigated by most studies and strengthened (1) continuity of care; (2) economic, social, geographical, time, and cultural accessibility; (3) coordination of care; (4) access; (5) integrality of care; (6) optimization of appointment time; (7) and efficiency. Negative impacts were also observed in the same dimension, such as reduced access to services and increased inequity and unequal use of services offered, digital exclusion of part of the population, lack of planning for defining the role of professionals, disarticulation of actions with real needs of the population, fragile articulation between remote and face-to-face modalities, and unpreparedness of professionals to meet demands using of technologies.

**Conclusions:** Results showed the positive and negative impacts of remote strategies on quality of care in primary care and the inability to take advantage of the potential of technologies. This may demonstrate differences in organization of fast and urgent implementation of digital strategies in primary health care worldwide. Primary health care must strengthen its response capacity,

expand the use of information and communication technologies, and manage challenges using scientific evidence since digital health is important and must be integrated into public service.

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## Original Manuscript

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**Keywords:** Digital health; Telehealth; Telemedicine; Primary health care; Quality of care; COVID-19; Pandemic; Science database; Gray literature.

## Introduction

Quality in healthcare is a multidimensional concept related to how offered services increase the probability of desired health outcomes. It also permeates correct care at the right time and in a coordinated manner, responding to needs and preferences of service users and reducing damage and wasted resources through a continuous and dynamic process [1]. Quality of care approximates health services to the population and has three dimensions: technical (accuracy of actions and the way they are performed); interpersonal (social and psychological relationships between care providers and users); and organizational (conditions in which services are offered, including globalization and continuity of care, coverage, coordination of actions, access, and accessibility to services) [2–4].

The COVID-19 pandemic led to immediate and profound social, economic, and health impacts and required fast adaptation of health systems focusing on quality. Health systems, particularly primary health care (PHC), were pushed to maintain care routines and required changes to maintain access and continuous management of health problems. This was possible due to creativity and innovation of professionals and managers, who introduced or expanded the use of information and communication technologies (ICT) in the critical initial phase of the pandemic - where lack of coordination has negatively influenced access to health care [5].

ICT use has digital health as great exponent in remote care strategies. This term is historically addressed as telemedicine or telehealth and refers to communication and interaction tools between health care professionals and patients that provide remote health services and care as alternative to face-to-face appointments [6–8].

The use of telephones to answer doubts of patients, videos or text messages through mobile applications, and social media are helpful strategies for expanding the scope of health care by enabling population access. ICT also reduce distance between patient and health professionals (e.g., rural areas lacking health professionals) and facilitate appointment scheduling and renewal of prescriptions, changing professional-patient relationship and expanding personal health management [6,7,9–11].

The COVID-19 pandemic became a catalyst for this expanding ICT worldwide [12]. Although digital health was recommended by the World Health Organization (WHO) [13–15] to reduce geographic barriers, its use increased only during the pandemic to maintain or increase access to health care, fight the pandemic, minimize economic impacts, and enable continuity of remote care [16,17].

Technological evolution may accelerate health care and improve access in the context of

public health preparedness and response to outbreaks and emergencies. However, despite these advances, the pandemic was challenging for health systems, mainly due to the lack of integration of technologies [17,18]. Considering the relevance of the topic for health and the wide use of ICT in PHC during the pandemic, we sought to gather knowledge about quality of care in PHC using digital technologies. Therefore, this study aimed to map the use of digital health strategies in PHC worldwide and their impact on quality of care in the context of the COVID-19 pandemic.

## Methods

This scoping review was conducted based on the Joanna Briggs Institute (JBI) manual [19] and guided by PRISMA Extension for Scoping Reviews (PRISMA-ScR) [20]. It also followed the steps proposed by Arksey and O'Malley [21] and Levac et al. [22]: formulation of research questions, identification of relevant studies, study selection, data extraction and coding, analysis and interpretation of results, and consultation with stakeholders.

The study was approved by the research ethics committee of the Faculty of Health Sciences of Trairí, Federal University of Rio Grande do Norte (CAAE: 47473121.3 .0000.5568), and direct participation of people in the study occurred only during consultation with stakeholders. The methodology used was previously reported in a protocol [23]. The term telemedicine used in the protocol [23] was replaced by digital health in this scope review since it is more appropriated to the broad scope of the study.

## Formulation of research questions

Study questions were defined by consensus among authors and formulated using PCC mnemonic (Population, Concept, and Context) and respective results of interest [19]:

- 1) Which countries used digital health in PHC in response to the COVID-19 pandemic?
- 2) **What options of ICT** were used in PHC in the context of the COVID-19 pandemic?
- 3) What is the impact of digital health on **quality of health care delivery** in PHC in the context of the COVID-19 pandemic?

## Identification of relevant studies

The following multidisciplinary health science databases were used: MEDLINE/PubMed, Scopus, Web of Science, CINAHL, Embase, and LILACS. For gray literature, we consulted Google Scholar, WHO Global Research on Coronavirus Disease, PAHO Technical Documents and Research Evidence on COVID-19, Cochrane Library, medRxiv, SciELO Preprints, preprints.org, Open Grey, and Grey Literature Report.

The following types of study and documents that answered research questions, focused on the use of remote strategies in PHC during the COVID-19 pandemic, and available in full-text were included: primary studies with quantitative, qualitative, or mixed approach; experience reports; case reports; intervention studies; preprints; guidelines; manuals; reports; and government documents. No date or language filters were applied. Duplicate studies, protocols, literature reviews, opinion letters, and editorials were excluded.

## Study selection

The search was conducted between June 14 and July 14, 2021, using a three-step search strategy [24]: (1) exploratory search in two databases to identify descriptors and keywords, followed by construction of the search strategy - improved by a librarian using the Extraction, Conversion, Combination, Construction and Use model [25]; (2) definition and search in all databases; and (3) manual search for additional sources in references of selected studies. Search strategies are presented in Multimedia Appendix 1.

Study selection followed the steps of the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA-P) [26]: identification, screening, eligibility, and inclusion. A pilot study was independently conducted by CRDVS and RHL using Rayyan software [27] to verify blinding, exclusion of duplicates, and selection of studies by titles and abstracts. Then, full-texts and reference lists of included studies were analyzed. In case studies did not meet inclusion criteria, a third author (SACU) was consulted.

## Data extraction and coding

Data extraction and coding ensured consistency and reliability of results. CRDVS and RHL independently extracted all relevant data using an extraction form, based on JBI template [24] and adapted by authors, containing the following information: characterization of studies (first author, year, journal, country, type of study, participants); names of digital strategies adopted; types of ICT; characteristics of digital strategies in PHC; impacts on quality of care; and benefits, limitations, and challenges of digital strategies in PHC.

The database was organized in Microsoft Excel 2016 and is available for consultation in Multimedia Appendix 2.

## Analysis and interpretation of results

Data were analyzed qualitatively (narrative analysis) and quantitatively (absolute and relative frequencies). Thematic analysis [28] was structured based on familiarization with data, generation of

initial codes, search for topics, review of topics, definition and naming of topics, and implications of studies. Results and narrative analyses were reported in tables and figures.

## Consultation with stakeholders

Results of this review were presented to five stakeholders (i.e., researchers with experience in digital health, ICT in health, and PHC) to fulfill the following objectives recommended by Levac et al. [22]: preliminary sharing of study findings, considered a mechanism for transferring and exchanging knowledge, and development of effective dissemination strategies and ideas for future studies. The form questions are in the Multimedia Appendix 3.

## Results

A total of 2,179 publications were identified (1,692 peer-reviewed articles and 487 gray literature documents). After excluding duplicates, analysis of titles and abstracts, and full-text reading, 38 studies were included. The manual search of reference lists added six studies, totaling 44 publications (Figure 1). All included studies demonstrated the impacts of remote strategies on quality of care in PHC in the context of COVID-19.

## Characterization and geographic distribution of studies

Studies included were mostly published during 2021 (63.6%). **Twenty-seven articles (61.4%) used a cross-sectional design, six (13.6%) used qualitative investigation, six (13.6%) used mixed methods, two (4.5%) were cohort studies, one experience report (2.3%), one case report (2.3%), and one intervention study (2.3%).** The sample consisted mainly of patients (19; 43.2%), health professionals (13; 29.5%), medical or consultation records (9; 20.5%), and documents interviews with patients or health professionals (3; 6.8%).

Studies covered 18 countries that used digital strategies in PHC: 18 studies in North America (United States [29–43] and Canada [44–46]), 4 studies in South America (Brazil [47–50]), 14 studies in Europe (England [51–53], United Kingdom [54,55], Spain [56,57], Belgium [58,59], Norway [60], Portugal [61], Romania [62], Germany [63], and Poland [64]), 4 studies in Asia (Israel [65], Oman [66], Saudi Arabia [67], and Iran [68]), and 4 studies in Oceania (Australia [69–71] and New Zealand [72]). Characteristics of studies and distribution of countries that used digital strategies in PHC are described in Table 1 and Figure 2, respectively.

## 1 – Characteristics of the included studies.

First author	Year	Source	Country	Study Design	Participants / Sample
Alexander et al. [29]	2020	JAMA Network Open	USA	Cross-sectional	National audit of consultations (n = 117,9 million)
Schweiberger et al. [30]	2020	Journal of Medical Internet Research	USA	Cross-sectional	Electronic medical records (n = 45) and physicians (n = 121)
Olayiwola et al. [31]	2020	JMIR Public Health Surveillance	USA	Cross-sectional	Consultation records (n = 3617)
Atherly et al. [32]	2020	JMIR Public Health Surveillance	USA	Cross-sectional	Patients (n = 1694)
Judson et al. [33]	2020	Journal of the American Medical Informatics Association	USA	Cross-sectional	Consultation records (n = 1129)
Mills et al. [34]	2021	Journal of the American Hearth Association	USA	Cross-sectional	Patients (n = 587)
Tarn et al. [35]	2021	Journal of the American Board of Family Medicine	USA	Cross-sectional	Medical records (n = 202)
Adepoju et al. [36]	2021	Journal of Health Care for the Poor and Underserved	USA	Cross-sectional	Health workers (n = 1344)
Ritchie et al. [37]	2021	Journal of the American Medical Directors Association	USA	Mixed methods	Health workers (n = 79)
Drerup et al. [38]	2021	Telemedicine Journal and e-Health	USA	Cross-sectional	Patients (n = 65)
Kalicki et al. [39]	2021	Journal of the American Geriatrics Society	USA	Cross-sectional	Medical records (n = 873)
Chang et al. [40]	2021	Milbank Quarterly	USA	Cross-sectional	Health workers (n = 918)
Thies et al. [41]	2021	Journal of Primary Care & Community Health	USA	Cross-sectional	Health workers (n = 655)
Godfrey et al. [42]	2021	Contraception	USA	Cross-sectional	Medical records (n = 534)
Juarez-Reyes et al. [43]	2021	Therapeutic Advances in Chronic Disease	USA	Qualitative investigation	Patients (n = 6)
Bui et al. [44]	2020	HAMILTON FAMILY HEALTH TEAM	Canada	Cross-sectional	Clinicians (n = 126) and nurses (n = 6)
Mohammed et al. [45]	2021	PLOS ONE	Canada	Cross-sectional	Clinicians (n = 163) and nurses (n = 37)
Donnelly et al. [46]	2021	BMC Family Practice	Canada	Mixed methods	Health workers (n = 473)
Castro et al. [47]	2020	Revista Brasileira de Medicina da Família e da Comunidade	Brazil	Cross-sectional	Consultation records (n = 329)
Dimer et al. [48]	2020	CoDAS	Brazil	Experience report	Consultation records (n = 17)
Queiroz et al. [49]	2020	Acta Diabetologica	Brazil	Cohort	Patients (n = 627)
Silva et al. [50]	2021	Ciência e Saúde Coletiva	Brazil	Cross-sectional	Clinicians and nurses (n = 7054)
Sahni et al. [51]	2021	Cureus	England	Cross-sectional	Clinicians (n = 312)
Leung et al. [52]	2021	BMJ Open Quality	England	Intervention study	Patients (n = 12)
Tuijt et al. [53]	2021	British Journal of General Practice	England	Qualitative investigation	Patients (n = 30) and caregivers (n = 31)
Salisbury et al. [54]	2020	Journal of Medical Internet Research	United Kingdom	Mixed methods	Patients (n = 1452) and health workers (n = 12)
Murphy et al. [55]	2021	British Journal of General Practice	United Kingdom	Mixed methods	Medical records (n = 350966) and health workers (n = 87)
Llamosas et al. [56]	2021	Physiotherapy	Spain	Case report	Patients (n = 1)

Coronado-Vázquez et al. [57]	2021	Journal of Personalized Medicine	Spain	Cohort	Patients (n = 166)
Morreel et al. [58]	2020	PLOS ONE	Belgium	Cross-sectional	Home visit records (n = 15655)
Verhoeven et al. [59]	2020	BMJ Open	Belgium	Qualitative investigation	Patients (n = 132)
Johnsen et al. [60]	2021	Journal of Medical Internet Research	Norway	Cross-sectional	Clinicians (n = 1237)
Lapão et al. [61]	2021	Journal of Medical Internet Research	Portugal	Mixed methods	Patients (n = 35)
Florea et al. [62]	2021	International Journal of General Medicine	Romania	Cross-sectional	Clinicians (n = 108)
Mueller et al. [63]	2020	JMIR Medical Informatics	Germany	Qualitative investigation	Patients (n = 20)
Kludacz-Alessandri et al. [64]	2021	PLOS ONE	Poland	Cross-sectional	Patients (n = 100)
Zeltzer et al. [65]	2021	National Bureau of Economic Research/NBER Working Paper Series	Israel	Cross-sectional	Records from clinicians (n= 4293) and patients (n= 3.7 million)
Hasani et al. [66]	2020	Journal of Primary care & Community Health	Oman	Qualitative investigation	Clinicians (n = 22)
Alharbi et al. [67]	2021	Journal of Family and Community Medicine	Saudi Arabia	Cross-sectional	Patients (n = 439)
Jannati et al. [68]	2021	International Journal of Medical Informatics	Iran	Cross-sectional	Patients (n = 400)
Isautier et al. [69]	2020	Journal of Medical Internet Research	Australia	Cross-sectional	Patients (n = 596)
Javanparast et al. [70]	2021	BMC Family Practice	Australia	Qualitative investigation	Patients (n= 30)
Ervin et al. [71]	2021	Australian Journal of Primary Health	Australia	Cross-sectional	Clinicians (n = 24)
Imlach et al. [72]	2020	BMC Family Practice	New Zealand	Mixed methods	Patients (n = 1010)

## Nomenclatures of adopted digital strategies

Nomenclatures regarding remote care strategies varied considerably among studies, and telehealth [30,33,36,44,45,47,54,55,60,63,64,67,68,69,72] and telemedicine [29,31,32,38,39,46,47,51,59,61,63,69,71] were the most frequent. The following terms were also mentioned: teleconsultation [40,58,71], virtual visit [41,48,58], virtual health / e-health [35,51], remote consultation [37,50,56,65], electronic consultation [35,62], telephone follow-up [35,66], video visit [35,70], video consultation [34,49], online consultation [69], virtual care [53], web-based video-consultation [69], digital monitoring [72], non-presential consultation [52], and remote self-monitoring [43]. Figure 3 shows the word cloud with most used nomenclatures.

## Types of information and communication technologies

A total of 39 studies (88.6%) mentioned the types of ICT used in PHC. Telephone calls had the highest number of records (74.3%) [30,31,33–38,40,44–48,50,52,53,55–60,62,65,66,69,70,72], followed by video calls (64.1%) [30,31,33–41,43–48,55,60,62–65,69,72], patient portal (28.2%) [31,33,35–37,40,42,44,58,61,72], smartphone applications (12.8%) [44,49,52,54,68], text messages (7.6%) [35,46,60], e-mail (7.6%) [46,62,72], electronic medical record (5.1%) [31,72], and social networks (2.5%) [46]. We highlight that many studies used more than one type of technology, mainly phone and video calls.

Moreover, the following electronic platforms and application were used to conduct services: WhatsApp®, Updox®, Epic MyChart®, Doximity®, Facetime®, Skype®, Zoom®, Telegram®, iCARE-DATA®, Babylon GP at Hand (BGPaH)®, EyerCloud, DRiQ®, Aid Access®, Telus PS Suite®, eVisit Ontario Telemedicine Network®, and Multimorbidity Management Health Information System®.

## Characteristics of digital strategies in PHC

We analyzed the target audience, professionals involved, direction, synchronicity, and modality and model of actions in PHC (Figure 4).

Actions were mostly directed to the general public (i.e., any health status or characteristic) [29,31,32,34–36,38,40–42,44,46,48,49,51,53,55,56,58–60,63,67,71]. Regarding professionals who conducted actions, most were clinicians [29,30,31,34,36–38,42,44,45,46,49,50,51,54,55,57,58,60,63–66,69,71,72] and nurses [35,39,41,43,47,48,56,70,72]. Actions were directed to people with and without COVID-19 [31,32,34,36,38,40,42,44,49,51,53,54–56,58–63,65,67,68,70,71,72]. Synchronous interaction [31–33,40,42,44–46,51,52,54,63–66,68,70,71] was the most reported.

Clinical modality was the most reported [29-31,33,36-38,40-46,48-52,54,58-60,63,65-67,69,71,72] and referred to the following actions: consultations, renewal of medical prescriptions, exams, follow-up, health guidelines, issuance of certificates, treatments, screening, monitoring, diagnosis, management of chronic conditions, referrals, clinical self-monitoring, and risk classification. Remote associated with in-person actions were the most prevalent model [29-32,34-38,40,42-46,49,51,53,54,56,57,60-64,67].

## Impacts on quality of care

Studies reported the impacts of remote strategies on technical, interpersonal, or organizational dimensions of quality of care. Positive impacts were highlighted in 19 (43.2%) studies [31,33,34,38,41,42,45,47-50,52,56,57,60,62,64,65,70], negative impacts in 6 (13.6%) [36,40,51,53,63,69], and positive and negative impacts were mentioned in 19 (43.2%) studies [29,30,32,35,37,39,43,44,46,54,55,58,59,61,66-68,71,72].

Technical [29-31,33-40,42-44,46,47,49-69,71,72] and organizational [29-43,45-50,52-61,64,65,67-72] dimensions were the most cited, followed by interpersonal dimension [31,35-43,46-48,52,53,55,59,64,65,67-70,72]. More than one dimension of quality of care was directly or indirectly addressed in most studies.

**Table 2** shows positive and negative impacts on dimensions of quality of care evidenced in the studies.

**Table 2** – Impacts on dimensions of quality of care.

QUALITY OF CARE DIMENSIONS		
TECHNICAL	INTERPERSONAL	ORGANIZATIONAL
Positive	Positive	Positive
<ul style="list-style-type: none"> <li>- Security in care provision [31,33,35,37,38,42,43,46,49,52,55,57-59,61,64,66,67,71,72]</li> <li>- Technical quality of information and communication technology [31,34,49,52,57,60,62,68]</li> <li>- Technical accuracy [42,44,47,49,52,58,67]</li> <li>- <b>Resolvability</b> [33,35,43,55,64,72]</li> <li>- Support for clinical decision-making [50,65]</li> <li>- Reliability [64,68]</li> <li>- Utility [30]</li> <li>- Attendance [56]</li> <li>- Privacy [31]</li> </ul>	<ul style="list-style-type: none"> <li>- Trust and bond with professionals improved adherence [43,47,48,65,67,68,70,72]</li> <li>- Ease loneliness [39,46,52,59,64,70,72]</li> <li>- Professional respect [31,42,43,64,68]</li> <li>- Active listening [38,47,59]</li> <li>- Positive interpersonal communication [38,41,64]</li> <li>- Humanization of care [31]</li> </ul>	<ul style="list-style-type: none"> <li>- Continuous care [32-34,38,39,42,43,47,48,54-57,59,60,65,67,68,70]</li> <li>- Economic, social, geographical, time, and cultural accessibility [29,31,34,38,42,52,54,55,57,67,70-72]</li> <li>- Coordination of care [31,33,34,47,49,50,52,57-59,64]</li> <li>- Access [42,43,45-47,54,58,65,72]</li> <li>- Integrality of care [31,38,42,57,67,71]</li> <li>- Optimization of consultation time [15,38,43,52,55,61,64]</li> <li>- Economic efficiency [33,38,52,57,64]</li> <li>- Organization of the work process [31,41,64]</li> <li>- Increased demand for assistance [38,64,72]</li> </ul>

		<ul style="list-style-type: none"> <li>- Planning of quality improvement [31,41]</li> <li>- User-friendly technologies [33]</li> <li>- Community engagement [37]</li> </ul>
<p>Negative</p> <ul style="list-style-type: none"> <li>- Technical inaccuracy / inaccuracy [36,37,46,53,55,59,61,69,72]</li> <li>- Low quality of consultations [33,36,51,63,69]</li> <li>- Lack of assessment of vital signs and physical exams [29,59,63,69]</li> <li>- <b>Selective resolvability</b> [39,40,53,54]</li> <li>- Insecurity of data privacy [36,54,61,67]</li> <li>- Discrepancy between professional conducts [66]</li> </ul>	<p>Negative</p> <ul style="list-style-type: none"> <li>- Loss of non-verbal communication; lack of eye contact or touch [36,43,53,55,59,68,69,72]</li> <li>- Interpersonal communication hampered by technology, speed of consultation, or memory difficulties of patients [39,40,53,59,69]</li> <li>- Great emotional burden and stress [40,55]</li> <li>- Fear of not being resolute compared with face-to-face modality; insecurity [35,37]</li> </ul>	<p>Negative</p> <ul style="list-style-type: none"> <li>- Reduced access; evidence of inequity [32,35–37,39,40,54,55,59,69]</li> <li>- Reduced integrality of care [36,37,40,46,53,54,59,69]</li> <li>- Digital exclusion [35–37,39,40,54,68,69]</li> <li>- Lack of planning in defining the role of the team; disarticulation between actions and needs of the population [37,46,53,55,59,69,71]</li> <li>- Reduced training of professionals using information and communication technology [37,53,54,59,61,69]</li> <li>- Reduced continuity of care [30,36,40,54,58]</li> <li>- Reduced coordination of care; fragile remote-presential articulation [37,46,54,55,68]</li> <li>- Lack of professionals; high turnover [37,54,59]</li> <li>- Reduced accessibility [30,32,53]</li> <li>- Lack of support in internet technologies [36,69,71]</li> <li>- Reduced active search in the community [53]</li> </ul>

## Benefits, limitations, and challenges of digital strategies in primary health care

The following benefits of digital strategies in PHC were highlighted in the studies: (1) acceptability and patient satisfaction [29,31,34,36,38,43–45,47,52,54,56–58,62–64,67,68]; (2) great possibility of sustainability in the post-pandemic period [31,32,38,40,43,54,55,58,62,64,68–72]; (3) increased frequency of people seeking care in PHC, especially in remote areas with difficult access and little face-to-face demand [29,34–36,41,46,49,50,53,55,59,70–72]; (4) great safety against contamination with COVID-19 [33,35,38,42,47,54,55,57–59,61,66,71,72]; (5) time and cost savings with geographic displacements [33,34,36,38,43,49,55,63,68,70,72]; (6) organization of work process and scheduling of face-to-face and remote demands [31,39,41,47,48,53,54,63]; (7) faster service [33,52–54,61,66–68]; (8) reduced need for referrals to secondary care and hospitalizations [33,35,44,50,52,57,65]; (9) great comfort and practicality [34,36,42,43,68,72]; (10) optimization of training, meetings, and education of professionals [31,33,41,49,59]; (11) opportunity to be present in patients' lives, which benefits emotional health [30,32,43,44]; (12) fast home screening in cases of clinical changes [31,44,57]; (13) better communication with patients [46,64]; (14) great facility of use of technological tools and opportunity to overcome technological limitations [52,64]; (15) advantage of video calls over other tools [39,63]; (16) possibility of choosing the attendance modality [54]; (17) anonymity in situations that generate stigma, such as abortion care [42]; and (18) increased possibility of contacting inaccessible patients [61].

On the other hand, the following limitations and challenges of digital strategies in PHC were identified: (1) difficulty in accessing internet, poor connectivity, digital division (i.e., more people with access to telephones and less to video calls), or digital desert (i.e., people without access to technologies) [32–36,38–40,42,45–47,54,55,59,64,67,68,72]; (2) increased need for training professionals and population regarding digital health [36,37,39–41,44–47,50,51,55,59,61,66,69–71]; (3) great diagnostic imprecision and professional misconduct due to absence of physical examinations [39,43,52,54–56,59–61,65,68,69,72]; (4) inconsistent platforms, with errors in data storage or limited resources or both [31,33,38,41,43,45,58,60,64,68,71]; (5) difficult communication with elderly, children, and people with disabilities or dementia [37–39,46,48,53,55,59,69]; (6) lack of planning regarding management of services [40,41,46,52,54,55,61,71]; (7) uncertainty about privacy and confidentiality of personal data [35,36,41,61,63,66,67]; (8) rapid implementation of remote services without prior guarantee of equitable access [30,42,55,63,71,72]; (9) poor support from information technology professionals [31,36,41,43,66,71]; (10) great need for good articulation between remote and face-to-face modalities to meet demands [39,40,60,63,70]; (11) mental stress in

health workers [37,43,46,55,59]; (12) lack of health professionals or high turnover of professionals or both [37,54,57,59,67]; (13) possible increase of chronic conditions (e.g., certain groups of people who stopped seeking services) and side effects due to excessive self-medication [53,55,58,59]; (14) telephone calls are used but not resolute [34,35,53,64]; (15) low acceptability of professionals towards new remote workflows [46,51,55]; (16) difficult clinical monitoring of patients at home [51,57,64]; (17) difficulty regarding early identification of more complex health demands [31,59,69]; (18) delayed administrative tasks of health teams due to increased care demands [47,59]; (19) fast and urgent care [53,54]; (20) difficult articulation between professionals to meet more complex demands [44,54]; (21) difficulty regarding referral to other services [46]; (22) poor resolution in situations of risk at home (i.e., domestic violence) [72]; (23) reduced supply of services [32]; and (24) difficulty in long-term follow-up of patients [49].

## Discussion

### Main findings and how they relate to the literature

This scoping review demonstrated that the COVID-19 pandemic impacted healthcare in PHC worldwide (i.e., fast implementation or increased use of remote care strategies or both) to mitigate the pandemic and ensure continuity of activities [73]. Various terms to refer to remote strategies were found in the literature [8,74]. Beyond concepts, technologies and tools are important components for healthcare systems, supporting the interaction among healthcare professionals or between healthcare professionals and patients [9]. The WHO [13,14] suggests telemedicine or telehealth to define distance care using ICT, whose purpose is to provide health care services in situations where distance or geographic barriers hinder the provision of care. Recently, digital health was introduced as an umbrella term, covering the use of electronic and mobile technologies (e.g., advanced computer science, artificial intelligence, and big data) to support health and emerging health care areas [75].

The WHO and other studies [75,76] highlight the importance of digital technologies for achieving sustainable development goals and the advance of universal health coverage as opportunities to face challenges of health systems (i.e., delayed provision of care and reduced demand, adherence, and geographic accessibility) and increase coverage, accessibility, and quality of actions.

Telephone and video consultations are efficient tools for offering digital health [77,78]. Although telephone may increase follow-up contact and is more accessible than tools that need

internet connection, the assessment of severity and health status is compromised due to the absence of eye contact [79].

Telephone and audio consultations were recognized as telehealth modalities during the COVID-19 to support social distancing [80]. Although video consultations were rare in many locations before the pandemic [77], they are superior to phone calls, mainly due to eye contact and better communication for building bonds. Nevertheless, technical problems are more frequent when using digital strategies, and people need a stable connection to internet, which may raise questions about the relationship between equity and type of technology used [81–84]. For greater benefits, the literature indicates that the use of technology should be simple, consistent with local workflows, convenient for users, offer advantages over face-to-face consultations [76,85,86], and complement other existing technologies.

Results of this study corroborate with Breton et al. [87], in which phone calls and video calls were the most used, especially in the first months of the pandemic. We highlight that communication between health services and users and professionals, mainly regarding platforms that ensure safety and reliability in the context of health care [88], is an important measure to be adopted due to the increased offer of newly developed applications.

The results of this scoping review also revealed positive and negative impacts of remote strategies on quality of care in PHC worldwide, suggesting different organization (e.g., fast or urgent implementation) of digital strategies. Safe offer of care, technical quality and accuracy, and **resolvability** were the positive impacts most reported in the technical dimension. On the other hand, technical inaccuracy or imprecision, consultations with poor quality, lack of detailed physical examination, and selective solving of problems were also observed.

The interpersonal dimension was characterized by trust and bond with professionals that facilitated adherence to technologies, increased the possibility of talking to someone, alleviated loneliness caused by isolation, and improved respect between professionals and patients. From another perspective, we also found loss of non-verbal communication, lack of physical contact, difficult communication aggravated by technologies, and negative and stressful emotional load among professionals.

The impacts in the organizational dimension were the most found in studies; however, they strengthened continuity of care; economic, social, geographical, time, and cultural accessibility; coordination of care; access; integrality of care; and optimization of appointment time and efficiency. On the other hand, negative impacts were also observed in this dimension, such as reduced access to services, inequity, and unequal use of services offered; digital exclusion of part of the population due

to lack of technologies, connectivity, or knowledge regarding use; reduced integrality of care; lack of planning for defining the role of professionals; disarticulation of actions with real needs of the population; impaired continuity of care; reduced coordination of care; fragile articulation between remote and face-to-face modalities; and unpreparedness of professionals to meet demands mediated by ICT.

One study [89] that verified how the pandemic impacted primary care services suggested digital health as an inflection point for PHC and the only alternative for restructuring the workflow of healthcare providers during the pandemic. The latter may have also contributed to impaired quality of health care, especially for the elderly and people with pre-existing health conditions (i.e., psychological problems, addictions, or victims of domestic violence).

Issues limiting technological barriers and ethics in the use of information might be linked to work organization, health financing, and lack of familiarity of professionals and patients [6]. When properly available, patients considered digital health satisfactory and safe and felt comfortable when trusting relationships with professionals and person-centered practices were present.

In PHC, pre-existing virtual solutions to COVID-19 served as opportunities to support public health responses in combating the pandemic and minimizing the risk of exposure [90, 91, 92, 93]. The adaptation of health systems based on PHC and training of professionals regarding the use of digital tools to fulfill clinical responsibilities, which previously required face-to-face contact, were also useful [90]. Studies also highlighted the relevance of digital strategies in preventive and health promotion actions, such as remote monitoring of clinical signs, management of chronic diseases and medication, and guidance on healthy lifestyle, exercises, and eating habits [94,95].

Studies conducted before the COVID-19 pandemic demonstrated the importance of digital health in expanding access in PHC [82,96,97], even though face-to-face care was preferred [98]. Positive experiences were associated with planning according to health needs of the population [99–101], whereas health professionals complained about insufficient remuneration, unavailability of technologies, and lack of standardization [102,103]. Based on these pre-pandemic experiences, digital strategies in PHC were an option to mitigate barriers and increase access for hard-to-reach populations. During periods of greater restriction and social isolation due to the COVID-19 pandemic, the reality of virtual assistance was extrapolated beyond populations with difficulties in accessing services. This fact allowed us to observe different results regarding the strengthening of digital health or predominance of persistent problems that depended on decision-making factors of governance to provide broad coverage of technologies (complementary or alternative) to populations. In fact, in most situations, digital health was adopted without support of a national strategy.

The results of this study emphasized benefits, limitations, and challenges of remote strategies in PHC and served as lessons during a global public health crisis. In this sense, quality of care in PHC can still be improved with consolidation and advances in digital health.

## Implications for practice and research

According to the Pan American Health Organization [104], ICT are essential to increase access of citizens to high-quality PHC, regardless of distance from large urban centers. Technologies are becoming the primary method in which people, governments, and health institutions work, communicate, and generate and exchange knowledge. In this context, we must reflect on how remote technologies and strategies can support and strengthen essential characteristics of PHC since this is the first point of contact for people and offers comprehensive, accessible, and community-based health care. PHC also offers health promotion and prevention, treatment of acute and infectious diseases, control of chronic diseases, palliative care, and rehabilitation to individuals, families, and communities [105].

This study demonstrated that the fast transition and expansion of digital health impacted access and quality of care in PHC worldwide, even considering that health needs, policies, management, and financing differ between countries. PHC must take advantage of lessons learned from the COVID-19 pandemic, strengthen its response capacity, balance the offer of new modalities of care with expanded use of technologies, and be more equitable and accessible. In contrast, equity of health care supply is beyond the power of action of health professionals or management of local services since it is a larger and structural problem that depends on integrated actions and engagement of public and social policies.

PHC services must be aligned with needs and satisfaction of the population, while efforts must be made to perform self-assessments and improve quality of in-person and remote processes. Planning and intersectoral articulation at management level and investment in financial and human resources are essential to improve cost-effectiveness of remote care. Furthermore, technical and operational infrastructure is imperative for using technologies, strengthening security and protection of patient and professional data.

Studies [106,107] demonstrate that services and actions exceeding needs increase costs and do not improve results regarding patient-centered care and needs. In contrast, health outcomes are worse, and costs are high when care is not based on the needs of the population. For digital health strategies in PHC, Lillrank et al. recommend planning actions by homogeneous groups with similar health needs and organizing supply of care considering demand, severity, and duration of needs,

according to demand and supply-based operating modes [108]. This organization could also facilitate continuity of care and optimize the work process using remote strategies.

The identification of gaps in the literature is expected in scoping reviews. As COVID-19 pandemic changed the provision of services at all levels of care worldwide (e.g., expansion of remote care strategies), directions for future research are challenging because long-term impacts are unknown. Based on observed in this scoping review, we recommend the following primary studies focused on remote strategies in PHC, especially in countries that did not investigate the topics discussed here: (1) assess implementation and differences between health systems (either public and private or with different forms of management and financing) based on principles of universality and universal coverage; (2) assess effectiveness and safety of remote strategies between users, professionals, and health managers; (3) monitor the impacts of remote strategies on quality of care and investigate how to enhance quality; and (4) perform intervention studies to investigate innovative strategies or approaches to improve clinical practice. Moreover, two systematic reviews with meta-analysis could be performed to (1) assess the impact of remote strategies on clinical outcomes in vulnerable populations and (2) follow-up patients with COVID-19 complications using ICT.

## Consultation with stakeholder

In the consultation stage, stakeholders were asked about ideas for future research, applicability of results, and dissemination strategies. For participants, this scoping review stimulates development agencies to finance ICT in PHC; reflect on cost-effectiveness of digital health to achieve greater adherence to therapeutic plans, reduce disease transmission, and prevent injuries; demonstrate benefits of using digital health for monitoring indicators, goals and indices in PHC, and health surveillance; and support health professionals with lessons learned for improving care in remote mode.

Regarding possibilities of disseminating results, the following suggestions were discussed: scientific dissemination (indexed journals, conferences, and workshops); disclosure by health secretariats; creation of networks with interested social agents; linking of agents to research groups to approximate academia from health services and general population; meetings and debates with local and national health managers; and adaptation of dissemination of results according to local culture, choosing the most accessible means of communication (i.e., social networks).

When asked about ideas for future research, the following were suggested: action research with health managers and professionals focusing on solutions for digital inclusion of vulnerable

populations; sectorial studies inserted in PHC (e.g., sectional and intervention researches regarding digital pharmaceutical and oral health care); studies investigating the acceptability of remote strategies by specific groups and its associated factors (e.g., age, gender, socioeconomic status, pre-existing health conditions, and beliefs); and long-term follow-up of patients using remote monitoring in PHC.

## Strengths and limitations of the study

This scoping review is the first to broadly map evidence regarding the use of remote strategies in PHC and its impacts on quality of care in the context of COVID-19. The study met criteria for scoping reviews [24,109] and followed methodological references, checklists, and published protocols [23].

We did not conduct a meta-analysis [23] or assess quality of studies. However, these steps are not essential due to the exploratory and descriptive nature of a scoping review. The search was performed to reach the highest number of publications regarding the topic, rather than focusing on studies with highest standards of scientific rigor. Even though databases for peer-reviewed publications and gray literature were included with no filter limits and a high-sensitivity search strategy was performed, we do not know to what extent relevant studies and important databases were included.

## Conclusion

This review provided information on the use of digital strategies in PHC and its impacts on quality of care during COVID-19 pandemic. Confronting a public health situation of such proportions sheds light on realities not so evidenced before. Given the importance of digital health in the current global health situation and the possibility of integrating and advancing this strategy after the pandemic, primary care must strengthen its response capacity, expand ICT use, and manage challenges using scientific evidence.

The number of digital health initiatives launched worldwide without a scientific basis during the pandemic had its foundation in the health crisis. Digital health needs to be improved and expanded to strengthen primary care and health systems.

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## Abbreviations

PHC: Primary Health Care

COVID-19: Coronavirus disease 2019

JBI: Joanna Briggs Institute

WHO: World Health Organization

PRISMA – P: Preferred Reporting Items for Systematic review and Meta-Analysis Protocols.

PRISMA – ScR: PRISMA Extension for Scoping Reviews

ICT: Information and communication technologies

## Authors' contributions

SACU, CRDVS, RHL, and MFT planned the study. CRDVS and RHL performed study selection and data extraction, and SACU was the third reviewer. CRDVS, RHL, OGBJ, and CSM performed analysis and synthesis of results. CRDVS conducted consultation with stakeholders. All authors contributed to writing the manuscript. SACU, MFT, RAA, LVL, and SD critically reviewed the manuscript. All authors approved the final version of the manuscript.

## Conflicts of interest

None declared.

## Multimedia Appendix

Multimedia Appendix 1: Search

Multimedia Appendix 2: Data extraction

Multimedia Appendix 3: Stakeholders consultation guide

## References

1. Institute of Medicine (U.S.). Committee on Quality of Health Care in America. Crossing the quality chasm : a new health system for the 21st century. National Academy Press; 2001. ISBN:0309511933
2. Donabedian A. An introduction to quality assurance in health care. Epigenomics. New York: Oxford University Press; 2002.
3. Champagne F, Hartz Z, Brousselle A. A apreciação normativa. In: Brousselle A, Champagne F, Contandriopoulos AP, Hartz Z, editors. Avaliação: conceitos e métodos Rio de Janeiro: Editora Fiocruz ; 2011. p. 77–94.
4. Donabedian A. Explorations in Quality Assessment and Monitoring: The definition of quality and approaches to its assessment. Ann Arbor: Health Administration Press; 1980.
5. Rawaf S, Allen LN, Stigler FL, Kringos D, Quezada Yamamoto H, van Weel C. Lessons on the COVID-19 pandemic, for and by primary care professionals worldwide. Eur J Gen Pract; 2020 Dec 16;26(1):129–133. PMID:32985278
6. Garattini L, Badinella Martini M, Mannucci PM. Improving primary care in Europe beyond COVID-19: from telemedicine to organizational reforms. Intern Emerg Med. 2021 Mar 1;16(2):255–258. PMID:33196973
7. Colbert GB, Venegas-Vera AV, Lerma E v. Utility of telemedicine in the COVID-19 era. Rev Cardiovasc Med. 2020. p. 583–587. PMID:33388002
8. Waqas A, Teoh SH, Lapão LV, Messina LA, Correia JC. Harnessing telemedicine for the provision of health care: Bibliometric and scientometric analysis. J Med Internet Res. 2020 Oct 2;22(10). PMID:33006571
9. Tuckson R v., Edmund M, Hodgkins ML. Telehealth. N Engl J Med. 2017 Oct 19;377(16):1585–1592. doi: 10.1056/NEJMs1503323.
10. Stefos T, Carey K, Shen M-L, Poe S, Oh DH, Moran E. The Effect of Telehealth Services on Provider Productivity [Internet]. 2021. Available from: [www.lww-medicalcare.com](http://www.lww-medicalcare.com) [accessed Nov 20, 2021]
11. Snoswell CL, Taylor ML, Comans TA, Smith AC, Gray LC, Caffery LJ. Determining if Telehealth Can Reduce Health System Costs: Scoping Review. J Med Internet Res. 2020. PMID:33074157
12. Wosik J, Fudim M, Cameron B, Gellad ZF, Cho A, Phinney D, Curtis S, Roman M, Poon EG, Ferranti J, Katz JN, Tcheng J. Telehealth transformation: COVID-19 and the rise of virtual care. J Am Med Inform Assoc. 2020. p. 957–962. PMID:32311034
13. World Health Organization. Telemedicine : opportunities and developments in member states : report on the second Global survey on eHealth. World Health Organization; 2010. ISBN:9789241564144
14. World Health Organization. A Health Telematics Policy. Geneva; 1997 [Internet]. Available from: <https://apps.who.int/iris/handle/10665/63857> [accessed Nov 20, 2021]
15. World Health Organization. ESTRATEGIA MUNDIAL SOBRE SAUDE DIGITAL 2020-2025 [Internet]. 2020. Available from: [https://www.paho.org/hq/index.php?option=com\\_docman&view=download&category\\_slug=56-directing-council-spanish-](https://www.paho.org/hq/index.php?option=com_docman&view=download&category_slug=56-directing-council-spanish-) [accessed Nov 20, 2021]
16. Mann DM, Chen J, Chunara R, Testa PA, Nov O. COVID-19 transforms health care through telemedicine: Evidence from the field. J Am Med Inform Assoc. 2020 Jul 1;27(7):1132–1135. PMID:32324855
17. Bhaskar S, Bradley S, Sakhamuri S, Moguilner S, Chattu VK, Pandya S, Schroeder S, Ray D, Banach M. Designing Futuristic Telemedicine Using Artificial Intelligence and Robotics in the COVID-19 Era. Front Public Health. 2020 Nov 2;8. doi: 10.3389/fpubh.2020.556789
18. Webster P. Virtual health care in the era of COVID-19. Lancet . 2020 Apr 11;395(10231):1180–1181. doi: 10.1016/S0140-6736(20)30818-7
19. Peters MDJ, Godfrey C, McInerney P, Munn Z, Tricco AC, Khalil H. Chapter 11: Scoping reviews. In: Aromataris E, Munn Z, editors. JBI Manual for Evidence Synthesis [Internet] Version 2020. 2020. Available from: <https://synthesismanual.jbi.global/> [accessed Sep 24, 2021]
20. Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, Moher D, Peters MDJ, Horsley

- T, Weeks L, Hempel S, Akl EA, Chang C, McGowan J, Stewart L, Hartling L, Aldcroft A, Wilson MG, Garritty C, Lewin S, Godfrey CM, MacDonald MT, Langlois E v., Soares-Weiser K, Moriarty J, Clifford T, Tunçalp Ö, Straus SE. PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation. *Annals of Intern Med*. 2018 p. 467–473. PMID:30178033
21. Arksey H, O'Malley L. Scoping studies: Towards a methodological framework. *Int Social Res Methodol: Theory and Practice*. 2005 Feb;8(1):19–32. doi: 10.1080/1364557032000119616
  22. Levac D, Colquhoun H, O'brien KK. Scoping studies: advancing the methodology [Internet]. 2010. <http://www.cihr-irsc.ca> [accessed Nov 20, 2021].
  23. Silva CRDV, Lopes RH, Júnior ODGB, Fuentealba-Torres M, Arcêncio RA, da Costa Uchôa SA. Telemedicine in primary healthcare for the quality of care in times of COVID-19: A scoping review protocol. *BMJ Open*. 2021. PMID:34253666
  24. Peters MDJ, Marnie C, Tricco AC, Pollock D, Munn Z, Alexander L, McInerney P, Godfrey CM, Khalil H. Updated methodological guidance for the conduct of scoping reviews. *JBIM Evid Synth*. 2020 Oct 1;18(10):2119–2126. PMID:33038124
  25. Araújo WCO. Recuperação da informação em saúde: construção, modelos e estratégias. *ConCI: Convergências em Ciência da Informação*. 2020 3(2):100–134. doi.org/10.33467/conci.v3i2.13447
  26. Shamseer L, Moher D, Clarke M, Ghera D, Liberati A, Petticrew M, Shekelle P, Stewart LA, Altman DG, Booth A, Chan AW, Chang S, Clifford T, Dickersin K, Egger M, Gøtzsche PC, Grimshaw JM, Groves T, Helfand M, Higgins J, Lasserson T, Lau J, Lohr K, McGowan J, Mulrow C, Norton M, Page M, Sampson M, Schünemann H, Simera I, Summerskill W, Tetzlaff J, Trkalinos TA, Tovey D, Turner L, Whitlock E. Preferred reporting items for systematic review and meta-analysis protocols (prisma-p) 2015: Elaboration and explanation. *BMJ*; 2015. PMID:25555855
  27. Ouzzani M, Hammady H, Fedorowicz Z, Elmagarmid A. Rayyan-a web and mobile app for systematic reviews. *Syst Rev*. 2016 Dec 5;5(1). PMID:27919275
  28. Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol*. 2006 3(2):77–101. doi: 10.1191/1478088706qp063oa
  29. Alexander GC, Tajanlangit M, Heyward J, Mansour O, Qato DM, Stafford RS. Use and Content of Primary Care Office-Based vs Telemedicine Care Visits during the COVID-19 Pandemic in the US. *JAMA*. 2020 Oct 2;3(10). PMID:33006622
  30. Schweiberger K, Hoberman A, Iagnemma J, Schoemer P, Squire J, Taormina J, Wolfson D, Ray KN. Practice-level variation in telemedicine use in a pediatric primary care network during the COVID-19 pandemic: Retrospective analysis and survey study. *J Med Internet Res*. 2020. PMID:33290244
  31. Olayiwola JN, Magaña C, Harmon A, Nair S, Esposito E, Harsh C, Forrest LA, Wexler R. Telehealth as a bright spot of the COVID-19 pandemic: Recommendations from the virtual frontlines (“frontweb”). *JMIR Public Health Surveill*. 2020 Apr 1;6(2). doi: 10.2196/19045
  32. Atherly A, van den Broek-Altenburg E, Hart V, Gleason K, Carney J. Consumer reported care deferrals due to the COVID-19 pandemic, and the role and potential of telemedicine: Cross-sectional analysis *JMIR Public Health Surveill*. 2020 Jul 1;6(3). doi: 10.2196/21607
  33. Judson TJ, Odisho AY, Neinstein AB, Chao J, Williams A, Miller C, Moriarty T, Gleason N, Intinarelli G, Gonzales R. Rapid design and implementation of an integrated patient self-triage and self-scheduling tool for COVID-19. *J Am Med Inform*. 2020 Jun 1;27(6):860–866. PMID:32267928
  34. Mills KT, Peacock E, Chen J, Zimmerman A, He H, Cyprian A, Davis G, Fuqua SR, Gilliam DS, Greer A, Gray-Winfrey L, Williams S, Wiltz GM, Winfrey KL, Whelton PK, Krousel-Wood M, He J. Experiences and beliefs of low-income patients with hypertension in louisiana and mississippi during the covid-19 pandemic. *J Am Heart Assoc*. 2021 Feb 2;10(3):1–13. PMID:33267723
  35. Tarn DM, Hintz C, Mendez-Hernandez E, Sawlani SP, Bholat MA. Using Virtual Visits to Care for Primary Care Patients with COVID-19 Symptoms. *J Am Board Fam Med*. 2021 Feb;34(Suppl):S147-S151. doi: 10.3122/jabfm.2021.S1.200241
  36. Adepoju O, Liaw W, Chae M, Ojinnaka C, Britton E, Reves S, Etz R. Covid-19 and telehealth operations in texas primary care clinics: Disparities in medically underserved area clinics. *J Health*

- Care Poor Underserved. 2021;32(2):948–957. PMID:34120986
37. Ritchie CS, Gallopyn N, Sheehan OC, Sharieff SA, Franzosa E, Gorbenko K, Ornstein KA, Federman AD, Brody AA, Leff B. COVID Challenges and Adaptations Among Home-Based Primary Care Practices: Lessons for an Ongoing Pandemic from a National Survey. *J Am Med Dir Assoc*. 2021 Jul 1;22(7):1338–1344. PMID:34111388
  38. Drerup B, Espenschied J, Wiedemer J, Hamilton L. Reduced No-Show Rates and Sustained Patient Satisfaction of Telehealth During the COVID-19 Pandemic. *Telemed J e-Health*. 2021 Mar 4; PMID:33661708
  39. Kalicki A v., Moody KA, Franzosa E, Gliatto PM, Ornstein KA. Barriers to telehealth access among homebound older adults. *J Am Geriatr Soc*. 2021 Sep 1;69(9):2404–2411. PMID:33848360
  40. Chang JE, Lai AY, Gupta A, Nguyen AM, Berry CA, Shelley DR. Rapid Transition to Telehealth and the Digital Divide: Implications for Primary Care Access and Equity in a Post-COVID Era. *Milbank Q*. 2021;99(2):340–368.
  41. Thies KM, Gonzalez M, Porto A, Ashley KL, Korman S, Lamb M. Project ECHO COVID-19: Vulnerable Populations and Telehealth Early in the Pandemic. *J Prim Care Community Health*. 2021;12. PMID:34036832
  42. Godfrey EM, Thayer EK, Fiastro AE, Aiken ARA, Gomperts R. Family medicine provision of online medication abortion in three US states during COVID-19. *Contraception*. 2021 Jul 1;104(1):54–60. PMID:33939985
  43. Juarez-Reyes M, Mui HZ, Kling SMR, Brown-Johnson C. Accessing behavioral health care during COVID: rapid transition from in-person to teleconferencing medical group visits. *Ther Adv Chronic Dis*. 2021;12. doi: 10.1177/2040622321990269
  44. Bui V, Ackerman S. Hamilton Primary Care Virtual Care Survey Analysis [Internet]. 2020. Available from: [http://health.gov.on.ca/en/pro/programs/publichealth/coronavirus/docs/2019\\_primary\\_care\\_guidance.pdf](http://health.gov.on.ca/en/pro/programs/publichealth/coronavirus/docs/2019_primary_care_guidance.pdf) [accessed Nov 20, 2021].
  45. Mohammed HT, Hyseni L, Bui V, Gerritsen B, Fuller K, Sung J, Alarakhia M. Exploring the use and challenges of implementing virtual visits during COVID-19 in primary care and lessons for sustained use. *PLoS ONE*. 2021 Jun 1;16. PMID:34166441
  46. Donnelly C, Ashcroft R, Bobbette N, Mills C, Mofina A, Tran T, Vader K, Williams A, Gill S, Miller J. Interprofessional primary care during COVID-19: a survey of the provider perspective. *BMC Family Pract*. 2021 Dec 1;22(1). PMID:33535973
  47. Castro FAG, Oliveira dos Santos Á, Valadares Labanca Reis G, Brandão Viveiros L, Hespanhol Torres M, de Oliveira Junior PP. Telemedicina rural e COVID-19. *Rev Brasi Med Família e Comun*. 2020 Jun 24;15(42):2484. doi: 10.5712/rbmfc15(42)2484
  48. Dimer NA, do Canto-Soares N, dos Santos-Teixeira L, de Goulart BNG. The COVID-19 pandemic and the implementation of telehealth in speech-language and hearing therapy for patients at home: An experience report. *CODAS Revista Pro-Fono*. 2020;32(3). PMID:32578694
  49. Queiroz MS, de Carvalho JX, Bortoto SF, de Matos MR, das Graças Dias Cavalcante C, Andrade EAS, Correa-Giannella ML, Malerbi FK. Diabetic retinopathy screening in urban primary care setting with a handheld smartphone-based retinal camera. *Acta Diabetol*. 2020 Dec 1;57(12):1493–1499. PMID:32748176
  50. da Silva RS, Schmtiz CAA, Harzheim E, Molina-Bastos CG, de Oliveira EB, Roman R, Umpierre RN, Gonçalves MR. The role of telehealth in the covid-19 pandemic: A Brazilian experience. *Ciencia e Saude Coletiva*. 2021;26(6):2149–2157. PMID:34231727
  51. Sahni M, Choudhry J, Mittal A, Bhogal G. Remote Musculoskeletal Consultations: A Survey of General Practitioner Registrars' Level of Confidence, Acceptability, and Management. *Cureus*. 2021 May 18; doi: 10.7759/cureus.15084
  52. Leung K, Qureshi S. Managing high frequency users of an electronic consultation system in primary care: A quality improvement project. *BMJ Open Quality*. 2021 Jun 10;10(2). PMID:34112657
  53. Tuijt R, Rait G, Frost R, Wilcock J, Manthorpe J, Walters K. Remote primary care consultations for

- people living with dementia during the COVID-19 pandemic: Experiences of people living with dementia and their carers. *Br J Gen Pract.* 2021 Aug 1;71(709):E574–E582. PMID:33630749
54. Salisbury C, Quigley A, Hex N, Aznar C. Private video consultation services and the future of primary care. *J Med Internet Res.* 2020. PMID:32812887
55. Murphy M, Scott LJ, Salisbury C, Turner A, Scott A, Denholm R, Lewis R, Iyer G, Macleod J, Horwood J. Implementation of remote consulting in UK primary care following the COVID-19 pandemic: A mixed-methods longitudinal study. *Br J Gen Pract.* 2021 Mar 1;71(704):E166–E177. PMID:33558332
56. Saiz Llamosas JR, Pérez García R. Efficacy of primary health care physical therapy treatment using telephonic remote consultation to attend a patient discharged after coronavirus pneumonia. *Fisioterapia.* 2021 Jan 1;43(1):58–62. doi: 10.1016/j.ft.2020.09.003
57. Coronado-Vázquez V, Ramírez-Durán MDV, Gómez-Salgado J, Dorado-Rabaneda MS, Benito-Alonso E, Holgado-Juan M, Bronchalo-González C. Evolution of a cohort of covid-19 infection suspects followed-up from primary health care. *J Pers Med.* 2021;11(6). doi: 10.3390/jpm11060459
58. Morreel S, Philips H, Verhoeven V. Organisation and characteristics of out-of-hours primary care during a COVID-19 outbreak: A real-time observational study. *PLoS ONE.* 2020 Aug 1;15(8 August). PMID:32790804
59. Verhoeven V, Tsakitzidis G, Philips H, van Royen P. Impact of the COVID-19 pandemic on the core functions of primary care: Will the cure be worse than the disease? A qualitative interview study in Flemish GPs. *BMJ Open.* 2020 Jun 17;10(6). PMID:32554730
60. Johnsen TM, Lønnebakke Norberg B, Kristiansen E, Zanaboni P, Austad B, Helgetun Krogh F, Getz L. Suitability of video consultations during the COVID-19 pandemic lockdown: Cross-sectional survey among Norwegian general practitioners. *J Med Internet Res.* 2021. PMID:33465037
61. Lapão LV, Peyroteo M, Maia M, Seixas J, Gregório J, da Silva MM, Heleno B, Correia JC. Implementation of digital monitoring services during the COVID-19 pandemic for patients with chronic diseases: Design science approach. *J Med Internet Res.* 2021 Aug 1;23(8). PMID:34313591
62. Florea M, Lazea C, Gaga R, Sur G, Lotrean L, Puia A, Stanescu AMA, Lupsor-Platon M, Florea H, Sur ML. Lights and shadows of the perception of the use of telemedicine by romanian family doctors during the covid-19 pandemic. *Int J Gen Med.* 2021;14:1575–1587. PMID:33953605
63. Mueller M, Knop M, Niehaves B, Adarkwah CC. Investigating the acceptance of video consultation by patients in rural primary care: Empirical comparison of preusers and actual users. *JMIR Med Inform.* 2020 Oct 1;8(10). doi: 10.2196/20813
64. Kludacz-Alessandri M, Hawrysz L, Korneta P, Gierszewska G, Pomaranik W, Walczak R. The impact of medical teleconsultations on general practitioner-patient communication during COVID-19: A case study from Poland. *PLoS ONE.* 2021 Jul 1;16(7 July). PMID:34270587
65. Zeltzer D, Einav L, Rashba J, Balicer RD. The Impact of Increased Access to Telemedicine [Internet]. 2021. Available from: <http://web.stanford.edu/~leinav/wp/telemed.pdf> [accessed Nov 20, 2021].
66. Hasani S al, Ghafri T al, al Lawati H, Mohammed J, al Mukhainai A, al Ajmi F, Anwar H. The Use of Telephone Consultation in Primary Health Care During COVID-19 Pandemic, Oman: Perceptions from Physicians. *J Prim Care Community Health;* 2020;11. PMID:33307943
67. Alharbi K, Aldosari M, Alhassan A, Alshallal K, Altamimi A, Altulaihi B. Patient satisfaction with virtual clinic during Coronavirus disease (COVID-19) pandemic in primary healthcare, Riyadh, Saudi Arabia. *J Family Community Med.* 2021;28(1):48. doi: 10.4103/jfcm.jfcm\_353\_20
68. Jannati N, Nakhaee N, Yazdi-Feyzabadi V, Tjondronegoro D. A cross-sectional online survey on patients' satisfaction using store-and-forward voice and text messaging teleconsultation service during the COVID-19 pandemic. *Int J Med Inform.* 2021 Jul 1;151. PMID:33965682
69. Isautier MJM, Copp T, Ayre J, Cvejic E, Meyerowitz-Katz G, Batcup C, Bonner C, Dodd R, Nickel B, Pickles K, Cornell S, Dakin T, McCaffery KJ. People's experiences and satisfaction with telehealth during the COVID-19 pandemic in Australia: Cross-sectional survey study. *J Med Int Res.* 2020.

PMID:33156806

70. Javanparast S, Roeger L, Kwok Y, Reed RL. The experience of Australian general practice patients at high risk of poor health outcomes with telehealth during the COVID-19 pandemic: a qualitative study. *BMC Family Pract.* 2021 Dec 1;22(1). PMID:33832422
71. Ervin K, Weller-Newton J, Phillips J. Primary healthcare clinicians' positive perceptions of the implementation of telehealth during the COVID-19 pandemic using normalisation process theory. *Aust J Prim Health.* 2021 Apr 1;27(2):158–162. PMID:33653506
72. Imlach F, McKinlay E, Middleton L, Kennedy J, Pledger M, Russell L, Churchward M, Cumming J, McBride-Henry K. Telehealth consultations in general practice during a pandemic lockdown: survey and interviews on patient experiences and preferences. *BMC Family Pract.* 2020 Dec 1;21(1). PMID:33308161
73. Zandi D. Digital health and COVID-19. *Bulletin of the World Health Organization.* NLM (Medline). 2020 Nov. PMID:33177768
74. Fatehi F, Wootton R. Telemedicine, telehealth or e-health? A bibliometric analysis of the trends in the use of these terms. *J Telemed Telecare.* 2012. p. 460–464. PMID:23209265
75. World Health Organization. WHO Guideline: Recommendations on digital interventions for health system strengthening. Geneva; 2019.
76. Maia MR, Castela E, Pires A, Lapão LV. How to develop a sustainable telemedicine service? A Pediatric Telecardiology Service 20 years on-An exploratory study. *BMC Health Serv Res.* 2019 Sep 23;19(1). PMID:31547824
77. Atherton H, Brant H, Ziebland S, Bikker A, Campbell J, Gibson A, McKinstry B, Porqueddu T, Salisbury C. The potential of alternatives to face-to-face consultation in general practice, and the impact on different patient groups: a mixed-methods case study. *Health Serv Res.* 2018 Jun;6(20):1–200. doi: 10.3310/hsdr06200
78. Thiagarajan A, Grant C, Griffiths F, Atherton H. Exploring patients' and clinicians' experiences of video consultations in primary care: A systematic scoping review. *BJGP Open.* 2020;4(1). PMID:32184212
79. Huibers L, Moth G, Carlsen AH, Christensen MB, Vedsted P. Telephone triage by GPS in out-of-hours primary care in Denmark: A prospective observational study of efficiency and relevance. *Br J Gen Pract.* 2016 Sep 1;66(650):e667–e673. PMID:27432608
80. Uscher-Pines L, Jones M, Sousa JL, Predmore Z, Ober AJ. The Doctor Will Call Me Maybe: The Uncertain Future of Audio-Only Visits and Why We Need Them to Address Disparities [Internet]. The Rand Blog. 2021. Available from: <https://www.rand.org/blog/2021/03/the-doctor-will-call-me-maybe-the-uncertain-future.html> [accessed Nov 1, 2021].
81. Donaghy E, Atherton H, Hammersley V, McNeilly H, Bikker A, Robbins L, Campbell J, McKinstry B. Acceptability, benefits, and challenges of video consulting: A qualitative study in primary care. *Br J Gen Pract.* 2019;69(686):E586–E594. PMID:31160368
82. Randhawa RS, Chandan JS, Thomas T, Singh S. An exploration of the attitudes and views of general practitioners on the use of video consultations in a primary healthcare setting: A qualitative pilot study. *Prim Health Care Res Dev.* 2018 Jun 18;20. PMID:29909798
83. Trethewey SP, Beck KJ, Symonds RF. Video consultations in UK primary care in response to the COVID- 19 pandemic. *Br J Gen Pract.* 2020;70(693):228–229. PMID:32217573
84. Greenhalgh T, Wherton J, Shaw S, Morrison C. Video consultations for covid-19. *BMJ.* 2020 Mar 12;368:m998. doi: 10.1136/bmj.m998
85. Greenhalgh T, Wherton J, Papoutsis C, Lynch J, Hughes G, A'Court C, Hinder S, Fahy N, Procter R, Shaw S. Beyond adoption: A new framework for theorizing and evaluating nonadoption, abandonment, and challenges to the scale-up, spread, and sustainability of health and care technologies. *J Med Internet Res.* 2017 Nov 1;19(11). PMID:29092808
86. Farr M, Banks J, Edwards HB, Northstone K, Bernard E, Salisbury C, Horwood J. Implementing online consultations in primary care: A mixed-method evaluation extending normalisation process

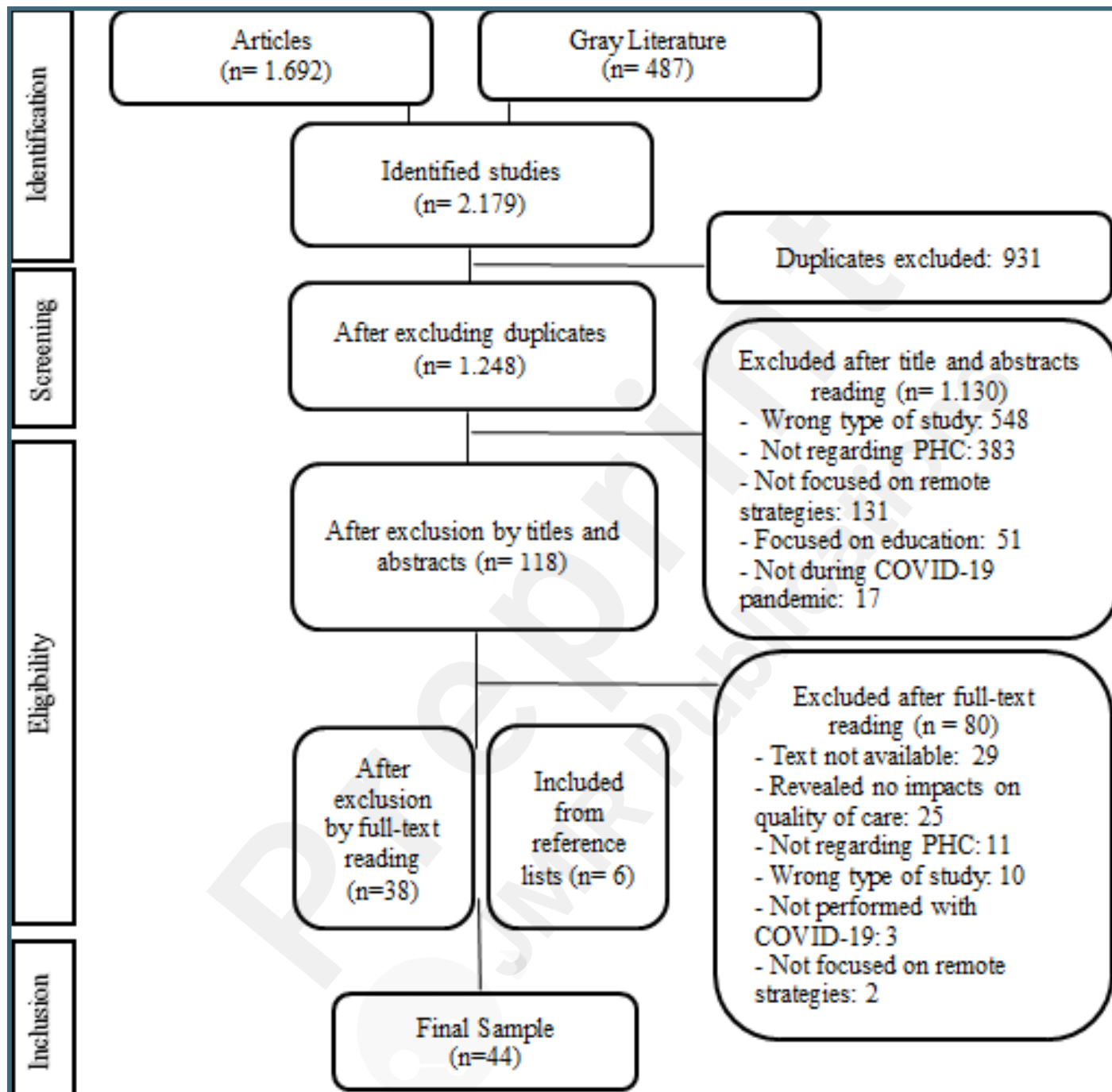
- theory through service co-production. *BMJ Open*. 2018 Mar 1;8(3). PMID:29555817
87. Breton M, Deville-Stoetzel N, Gaboury I, Smithman MA, Kaczorowski J, Lussier MT, et al. Telehealth in Primary Healthcare: A Portrait of its Rapid Implementation during the COVID-19 Pandemic. *Health Policy*. 2021 Aug;17(1):73-90. PMID: 34543178.
88. Gouvernement du Québec. Coronavirus (COVID-19 Guide de soutien pour la mise en œuvre des téléconsultations dans les établissements de santé du Québec dans le contexte de pandémie) [Internet]. 2020. Available from: [https://telesantequebec.ca/wp-content/uploads/2020/12/20\\_210\\_133W\\_Guide\\_mise\\_en\\_oeuvre\\_teleconsultations\\_pandemie\\_MSSS\\_V2\\_VF.pdf](https://telesantequebec.ca/wp-content/uploads/2020/12/20_210_133W_Guide_mise_en_oeuvre_teleconsultations_pandemie_MSSS_V2_VF.pdf). [accessed Nov 20, 2021].
89. Lim J, Broughan J, Crowley D, O’Kelly B, Fawsitt R, Burke MC, McCombe G, Lambert JS, Cullen W. COVID-19’s impact on primary care and related mitigation strategies: A scoping review. *Eur J Gen Pract*. 2021. p. 166–175. PMID:34282695
90. Neves AL, Li E, Gupta PP, Fontana G, Darzi A. Virtual primary care in high-income countries during the COVID-19 pandemic: Policy responses and lessons for the future. *Eur J Gen Pract*. 2021 Dec;27(1):241-7. PMID: 34431426.
91. Bokolo Anthony J. Use of Telemedicine and Virtual Care for Remote Treatment in Response to COVID-19 Pandemic. *J Med Syst*. 2020 Jun 15;44(7):132. PMID: 32542571.
92. Car J, Koh GC, Foong PS, Wang CJ. Video consultations in primary and specialist care during the covid-19 pandemic and beyond. *BMJ*. 2020 Oct 20;371:m3945. PMID: 33082127
93. Anthony Jnr B. Implications of telehealth and digital care solutions during COVID-19 pandemic: a qualitative literature review. *Inform Health Soc Care*. 2021 Mar 2;46(1):68-83. PMID: 33251894.
94. Centers for Disease Control and Prevention. Gouvernement du Québec. Coronavirus (COVID-19 Guide de soutien pour la mise en œuvre des téléconsultations dans les établissements de santé du Québec dans le contexte de pandémie) [Internet]. 2020. Available from: <https://www.cdc.gov/coronavirus/2019-ncov/hcp/telehealth.html> [accessed Dec 30, 2021].
95. Gerke S, Stern AD, Minssen T. Germany's digital health reforms in the COVID-19 era: lessons and opportunities for other countries. *NPJ Dig Med*. 2020;3:94. PMID: 32685700.
96. Seto E, Smith D, Jacques M, Morita PP. Opportunities and challenges of telehealth in remote communities: Case study of the yukon telehealth system. *JMIR Med Inform*. 2019 Oct 1;7(4). doi: 10.2196/11353
97. Egerton T, Nelligan R, Setchell J, Atkins L, Bennell KL. General practitioners’ perspectives on a proposed new model of service delivery for primary care management of knee osteoarthritis: A qualitative study. *BMC Family Pract*. 2017 Sep 7;18(1). PMID:28882108
98. Eccles A, Hopper M, Turk A, Atherton H. Patient use of an online triage platform: A mixed-methods retrospective exploration in UK primary care. *Br J Gen Pract*. 2019. p. E336–E344. PMID:30910874
99. Hammersley V, Donaghy E, Parker R, McNeilly H, Atherton H, Bikker A, Campbell J, McKinstry B. Comparing the content and quality of video, telephone, and face-to-face consultations: A non-randomised, quasi-experimental, exploratory study in UK primary care. *Br J Gen Pract*. 2019;69(686):E595–E604. PMID:31262846
100. Banks J, Farr M, Edwards H, Horwood J, Salisbury C, Northstone K, Bernard E. Use of an electronic consultation system in primary care: A qualitative interview study. *Br J Gen Pract*. 2018 Jan 1;68(666):e1–e8. PMID:29109115
101. Ball SL, Newbould J, Corbett J, Exley J, Pitchforth E, Roland M. Qualitative study of patient views on a “telephone-first” approach in general practice in England: Speaking to the GP by telephone before making face-to-face appointments. *BMJ Open*. 2018 Dec 1;8(12). PMID:30598491
102. Hanna L, Fairhurst K. Using information and communication technologies to consult with patients in Victorian primary care: The views of general practitioners. *Aust J Prim Health*. 2013;19(2):166–170. PMID:22950961
103. Newbould J, Exley J, Ball S, Corbett J, Pitchforth E, Roland M. GPs’ and practice staff’s views of a telephone first approach to demand management: A qualitative study in primary care. *Br J Gen Pract*.

2019. p. E321–E328. PMID:31015225
104. Organização Pan-Americana da Saúde. A COVID-19 e o papel dos sistemas de informação e das tecnologias na atenção primária [Internet]. 2020. Available from: <https://iris.paho.org/handle/10665.2/52023> [accessed Nov 20, 2021].
  105. Organização Pan-Americana da Saúde. Atenção Primária à Saúde [Internet].. Available from: <https://www.paho.org/pt/topicos/atencao-primaria-saude> [accessed Nov 20, 2021].
  106. Loon Chong J, Matchar DB. Programme in Health Services and Systems Research, Duke-NUS Medical School, Singapore Address for Correspondence: Mr Chong Jia Loon [Internet]. Programme in Health Services and Systems Research. 2017. Available from: <http://www.healthknowledge.org.uk/public-health> [accessed Nov 20, 2021].
  107. Chong JL, Lim KK, Matchar DB. Population segmentation based on healthcare needs: A systematic review. *Syst Rev*. 2019 Aug 13;8(1). PMID:31409423
  108. Lillrank P, Groop PJ, Malmstrom TJ. Demand and Supply-Based Operating Modes-A Framework for Analyzing Health Care Service Production. *Milbank Q*. 2010;88(4):595–615.
  109. Salvador PTC de O, Alves KYA, Costa TD da, Lopes RH, Oliveira LV e, Rodrigues CCFM. Contribuições da scoping review na produção da área da saúde: reflexões e perspectivas. *Revista Enfermagem Digital Cuidado e Promoção da Saúde*. 2021;6. doi: 10.5935/2446-5682.20210058

## Supplementary Files

## Figures

Flowchart of study selection for scoping review adapted from the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA).



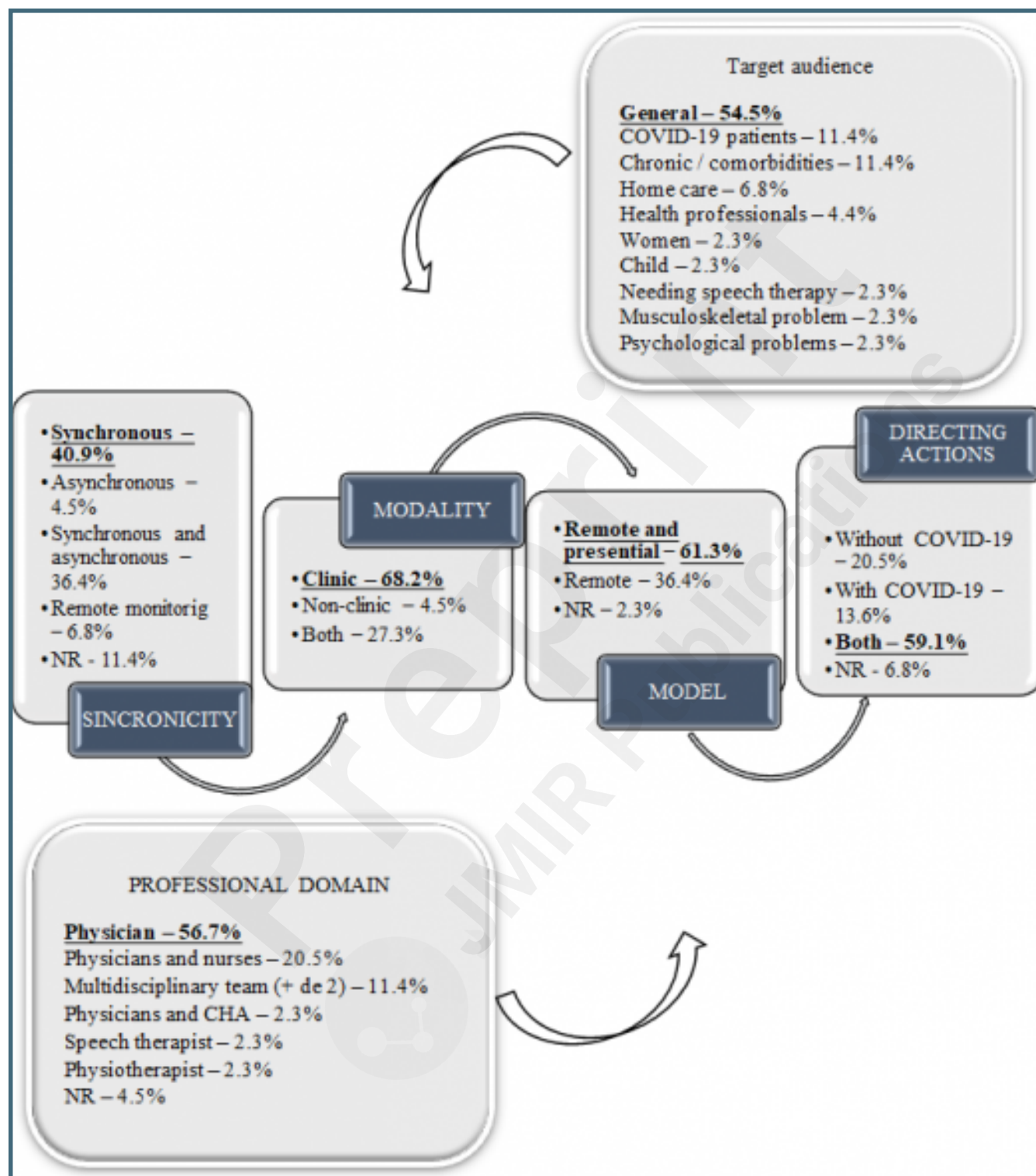
Distribution of countries that used digital strategies in PHC. Numbers represent the amount of studies performed in each country.



Word cloud with nomenclatures used to refer to digital strategies in primary health care.



Characteristics of remote strategies in primary health care. \* NR: Not reported; CHA: Community health agents.



## Multimedia Appendixes

Search.

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Data extraction original language.

URL: <http://asset.jmir.pub/assets/10bbda2a4812c9496d38628644f91997.xlsx>

Stakeholders consultation guide.

URL: <http://asset.jmir.pub/assets/86020a386de1c78ca8dedd2ce4c5fe34.doc>



## CONSORT (or other) checklists

Prisma ScR Checklist.

URL: <http://asset.jmir.pub/assets/366d9fbd033e85b39c30b109ea9e48da.pdf>