Review

# Hybrid Care Modifications in the Delivery of Nonpandemic Care During the COVID-19 Pandemic: Scoping Review

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## Abstract

**Background:** The COVID-19 pandemic had an unprecedented impact on the delivery of health care, with digital interventions accelerating more than ever before. However, evidence of how hybrid care models, combining digital health interventions with in-person care, were implemented during the pandemic remains scattered. Understanding hybrid care models is imperative to build resilient health systems that can ensure access to care during crisis situations.

**Objective:** The study aimed to examine the implementation of hybrid care modifications to support the delivery of nonpandemic health care services in Europe during the COVID-19 pandemic.

**Methods:** A scoping review was conducted following PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews) guidelines. Systematic searches were conducted in PubMed or MEDLINE, Embase, CINAHL, Web of Science, and PsycINFO on May 22, 2024, and updated on January 14, 2026. Studies were eligible if they included primary data on the use of digital care modifications implemented or scaled up during the COVID-19 pandemic for the delivery of nonpandemic health care services in Europe. Non–peer-reviewed publications and studies with a primary focus on mental health or pediatric care were excluded. Quality appraisal was conducted using the Mixed Methods Appraisal Tool. Descriptions of digital care modifications were inductively analyzed and used to create digital flows, combining telehealth systems, digital interventions, and care functions. Digital care modifications were categorized according to their hybrid care implementation (digital-only or hybrid). Study evaluations were extracted using the Kirkpatrick model.

**Results:** A total of 189 studies were included for analysis. Studies covered evidence from 2020 to 2024, a total of 23 countries, and 37 health care disciplines. Hybrid care implementation was reported in over 60% (115/189) of the studies, describing various forms of digital and in-person care. Care modifications incorporating in-person and digital care components were more commonly described in specialty care contexts. A total of 68 distinct digital flows were identified, with a limited number of telehealth systems allowing substantial variety in both interventions and care functions. Prominent digital flows included the use of online platforms to support video and messaging for follow-up care. Over half of the studies did not describe any kind of evaluation.

**Conclusions:** This review has shown how few telehealth systems were able to support a variety of care functions in the delivery of nonpandemic care throughout the COVID-19 pandemic, underscoring their practical versatility. Integrating digital health as part of hybrid care models is essential in designing care pathways that can adapt to different contexts, including future health crises. Although a comprehensive search was conducted, the heterogeneous reporting of care modifications may have influenced the interpretation of the findings. In the future, research may expand the application of hybrid care models to innovative strategies for effective crisis management.

*J Med Internet Res 2026;28:e84756;* doi: 10.2196/84756

**Keywords:** hybrid care; digital health; telemedicine; COVID-19 pandemic; health care delivery

# Introduction

The COVID-19 pandemic had an unprecedented impact on the delivery of health care, leading to modifications that sought to compensate for service disruptions. By 2022, the World Health Organization reported that over 90% of countries worldwide were still facing disruptions in health service delivery [1]. As health systems continue to recover post pandemic, it is critical to understand the modifications implemented to support the delivery of nonpandemic health care (ie, health care provided for conditions other than COVID-19 disease). Among the various modifications implemented, the rapid surge in the use of digital health played a critical role in responding to the challenges posed by the pandemic, which restricted resources and impeded the safe delivery of in-person care [2]. Understanding modifications to care, particularly those involving digital health, is crucial for building resilient health systems that can ensure access to care, including during emergency situations.

Digital health refers to the use of technologies, including those for communication and information exchange, to support health systems [3]. Previous literature has covered the adoption and use of digital health during the COVID-19 pandemic, showing its potential benefits for operational and clinical applications such as data services, population-level responses, decision-support systems, and direct patient care [4,5]. For instance, the value of digital health interventions during the pandemic has been described for patients with conditions such as cancer and heart failure [6,7]. Although it has been recognized that digital health should be examined beyond the implementation of individual tools, research to date has tended to focus on standalone digital health interventions. Rather than studying these interventions as silos, they can be better examined as part of broader care pathways [5], highlighting the critical need for integration into existing health care systems [8].

Alongside digital health interventions, hybrid approaches have emerged as integrated alternatives to ensure the continuity of essential health services. Hybrid care can be defined as the delivery of health care services involving in-person (face-to-face) care and digital health components. Hybrid care provision has been studied previously in various contexts [9-12], including explorations of its potential in contrast to standard models of care for patients with chronic conditions [13,14]. In the context of the COVID-19 pandemic, previous research has shown a positive impact of the use of hybrid care models in specific clinical contexts [15]. Additionally, research on the effectiveness of telehealth compared to in-person care has highlighted the importance of further researching the integration between these types of care [16].

Given the increased uptake, hybrid care is anticipated to become the new norm for health care delivery in the coming years, offering novel avenues for unlocking access to care during regular and crisis situations. However, little is still known about how, and for which purposes, these models of care have been implemented and evaluated in previous crisis contexts. A scoping review was chosen to systematically map available evidence regarding the different types of modifications to care. This scoping review aimed to examine the implementation of hybrid care modifications to support the delivery of nonpandemic health care services in Europe during the COVID-19 pandemic. Specifically, it aimed to characterize modifications of care involving digital health, including the telehealth systems used and their functionalities, and how they were integrated into hybrid models of care. Additionally, it aimed to provide an overview of the maturity and extent of evaluations conducted on the implemented care modifications.

# Methods

## Study Design

A scoping review was conducted to examine reports on health delivery modifications incorporating digital health components, which were introduced due to the COVID-19 pandemic to deliver nonpandemic health care services. The review was conducted as part of the Horizon Europe RAPIDE (Regular and Unplanned Care Adaptive Dashboard for Cross-Border Emergencies) project and followed the PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews) guidelines [17] (Checklist 1). The research protocol was registered on the Open Science Framework Registries [18].

## Eligibility Criteria

The main outcome of interest for included studies was modifications to health delivery involving a digital health intervention, implemented for the provision of nonpandemic care in the context of the COVID-19 pandemic in Europe. Evidence sources included peer-reviewed primary research studies. Aligned with this outcome and context, the following specific inclusion criteria were applied: (1) studies reporting primary data on the use of digital care modifications (ie, health care delivery modifications with digital health components), alongside descriptions of their implementation, intervention characteristics (eg, specific setting, patient groups, and clinical contexts), telehealth systems used, and their care functions; (2) studies describing digital care modifications introduced or scaled up in the context of the COVID-19 pandemic and aimed for nonpandemic care services; (3) studies focused on care for adult populations; and (4) studies reporting data from countries within the European Union, the European Economic Area, the Schengen area, or the United Kingdom.

In addition, the following exclusion criteria were considered: (1) non–peer-reviewed publications; (2) studies that did not separately report outcomes for eligible countries;

(3) publications in a language other than English, Dutch, French, or Spanish; and (4) studies with a primary focus on mental health or pediatric health care. Studies with a focus on mental and pediatric care were excluded due to the distinct organization and service delivery models used in these types of care, as these studies would have introduced additional variability beyond the scope of this review.

## Information Sources

A comprehensive search was initially conducted on May 22, 2024, and later updated on January 14, 2026. The following electronic databases were searched, without applying multidatabase searching: PubMed or MEDLINE (Ovid), Embase (Ovid), CINAHL (EBSCOhost), Web of Science (Clarivate), and PsycINFO (Ovid). No other registries or online resources were consulted, and no additional data were sought through contacts. No additional information sources or search methods were used.

## Search

The search aimed to cover a broad range of literature, for which the concepts "delivery of health care," "nonpandemic care," and "COVID-19" were used to build the search strategy across all databases, including a combination of keywords and indexed vocabulary. No further limits, restrictions, or search filters were applied. No existing search strategies from other reviews were adapted or reused. The search was developed and reviewed by all authors in consultation with an information specialist, and no other external experts peer-reviewed the search. The original search strategy was reproduced for updating the search, which was consistent with the original search in all databases. The reproducible searches for all databases are available in Multimedia Appendix 1. Duplicates were removed by the researchers using EndNote (Clarivate) and Rayyan.ai (Qatar Computing Research Institute) deduplication features. All information related to the search used is reported in accordance to the PRISMA-S (Preferred Reporting Items for Systematic Reviews and Meta-Analyses Literature Search Extension) [19] (Checklist 2).

## Selection of Sources of Evidence

A broad search was conducted with the aim of capturing the diversity of service delivery modifications. First, all studies describing service delivery modifications (both digital and nondigital) and meeting all other eligibility criteria were preliminarily included. Next, studies were categorized according to the types of service delivery modifications, and those applying digital care modifications were selected for inclusion. This approach ensured the selection of studies that addressed digital health as part of broader service modification, even if it was not the primary focus.

As part of the screening, a pilot was first conducted for title and abstract screening to ensure clarity among researchers regarding eligibility criteria. Title and abstract screening was conducted by 3 researchers (NSV, TVL, and LN), and 10.4% (798/7652) of the total records were screened by at least two researchers independently. Full-text screening was conducted by 2 researchers (NSV and LN), with 5% (32/641) of the records screened by both researchers independently. The remaining records were screened separately due to strong agreement in the pilot screening. Citation searching was conducted for review studies that met the initial inclusion criteria through a manual search of reference lists; cited studies were then individually screened for inclusion. All discrepancies were resolved by consensus. The web application Rayyan.ai was used to support the screening process.

## Data Charting Process

A standardized data extraction form was developed and piloted among 3 researchers (NSV, TVL, and Dilek Yildirim), until agreement and consistency were reached. Studies were then split among the researchers who conducted the data extraction (NSV, TVL, and Dilek Yildirim). The online platform Airtable (Formagrid Inc) was used for data extraction, and Microsoft Excel was used to support additional data collation for reporting.

## Data Items

Data extracted included the year of publication, study design, country, health care discipline, level of care, pandemic period of study data, presence and type of evaluation, and characteristics of the digital care modifications (including telehealth systems, digital interventions, care functions, and in-person care components). Definitions for the uses of digital technology for health, including systems and interventions, were based on World Health Organization [3] and were used to inform both the terminology and categorization of digital components during data extraction and synthesis.

## Critical Appraisal of Individual Sources of Evidence

The methodological quality of the studies was appraised by 2 researchers (NSV and TVL) using the Mixed Methods Appraisal Tool (MMAT) [20]. The researchers independently rated a subset of 5 studies and aligned on the interpretation of criteria. The remaining studies were divided and separately appraised by the 2 researchers using a standardized form. Percentages of quality criteria met were calculated per study, and no studies were excluded based on methodological quality.

## Synthesis of Results

Descriptions of digital care modifications were inductively analyzed and used to create distinct *digital flows*, defined as the combination of 1 telehealth system, 1 digital intervention, and 1 care function (Table 1). Digital flows were constructed by the researchers based on descriptions of digital health modifications in each study. For studies describing several systems, interventions, or care functions, multiple digital flows were recorded. Digital care modifications were further categorized according to their hybrid care implementation, registering whether digital health was implemented as an individual approach (digital-only) or in combination with the provision of in-person care components (hybrid). Study evaluations of reported modifications were recorded following the Kirkpatrick model of evaluation, allowing multiple levels of evaluation, if applicable [21]. The

Kirkpatrick model covers 4 distinct levels of evaluation and has been widely applied across health disciplines, allowing its pragmatic application across diverse outcomes as well as its straightforward interpretation [21].

**Table 1.** Definitions used to construct digital flows for mapping hybrid care modifications in the delivery of nonpandemic care.

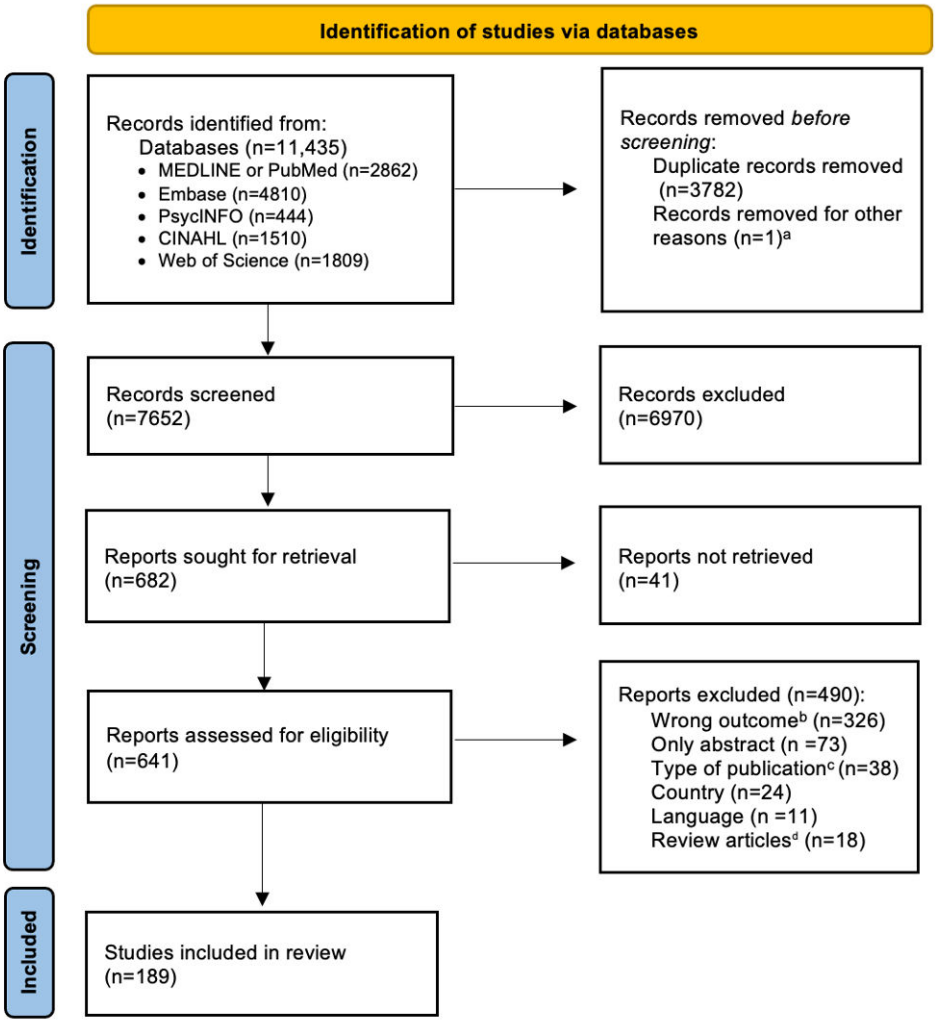
| Concept | Definition |
|---|---|
| Telehealth systems | Information and telecommunication technologies used to provide clinical care [3] |
| Digital health interventions | Technology capabilities designed to address a specific health objective [3] |
| Care function | Function or purpose of the digital health intervention: includes triage (prioritization of patients' needs based on the urgency of their condition), first consultation (initial contact between a patient and a health care provider to evaluate a novel health concern), follow-up (subsequent care contacts to evaluate previously diagnosed conditions), among others |

# Results

## Selection of Sources of Evidence

In total, 7652 distinct studies were identified, of which 641 full texts were screened for eligibility. Studies included within identified reviews (n=18) were further screened for eligibility, resulting in 38 additional included studies. Finally, 189 studies met eligibility criteria and were included in the analysis (Figure 1).

**Figure 1.** PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram depicting the study selection process. [a]Article retracted. [b]Outcome defined as digital health modifications meeting inclusion criteria. [c]Includes opinion pieces, editorials, letters to the editor, correspondence, commentaries, position papers, and other non–peer-reviewed publications. [d]Review articles snowballed for additional records meeting inclusion criteria, with 38 additional records identified for inclusion.




## Characteristics of Sources of Evidence

Included studies were published between 2020 and 2025. Most studies were written in English (183/189, 96.9%), and several had full text available in Spanish (n=4) [22-25] and French (n=2) [26,27]. Over 80% (n=157) of the studies were either observational (n=79) or descriptive (n=78). The studies covered 23 distinct countries and 37 distinct

health care disciplines across different settings, with a strong dominance of secondary and tertiary care (n=139) and nonsurgical disciplines (26/37, 70.3%). Data derived from the year 2020 were most frequently reported, and 114 studies exclusively covered data from February to June 2020. The studies' characteristics are found in Table 2 (additional details provided in Multimedia Appendix 2).

**Table 2.** Characteristics of included studies in the scoping review.

| Characteristics | Studies |
|---|---|
| Year of publication, n (%) | |
| 2020 | 65 (34.4) |
| 2021 | 57 (30.2) |
| 2022 | 27 (14.3) |
| 2023 | 17 (9) |
| 2024 | 15 (7.9) |
| 2025 | 8 (4.2) |
| Countries[a], n | |
| United Kingdom | 52 |
| Italy | 45 |
| Spain | 18 |
| France | 12 |
| The Netherlands | 8 |
| Ireland | 7 |
| Portugal | 6 |
| Germany | 5 |
| Poland | 5 |
| Sweden | 4 |
| Austria | 3 |
| Belgium | 3 |
| Denmark | 3 |
| Norway | 3 |
| Romania | 3 |
| Switzerland | 3 |
| Bulgaria | 1 |
| Croatia | 1 |
| Czech Republic | 1 |
| Finland | 1 |
| Hungary | 1 |
| Malta | 1 |
| Slovenia | 1 |
| Studies focusing on 5 or more countries | 6 |
| Study design, n (%) | |
| Observational | 79 (41.8) |
| Descriptive | 78 (41.3) |
| Qualitative | 14 (7.4) |
| Mixed methods | 13 (6.9) |
| Experimental | 5 (2.6) |
| Levels of care[b], n | |
| Secondary or tertiary care | 139 |
| Primary care | 57 |
| Community care | 5 |
| Home care or residential care | 1 |
| Alternative medicine | 1 |
| Not specified | 1 |

| Characteristics | Studies |
|---|---|
| Health care disciplines[c], n | |
| General practice or family medicine | 46 |
| Oncology | 32 |
| Cardiology | 14 |
| Neurology | 14 |
| Orthopedics and trauma | 14 |
| Endocrinology | 8 |
| Gastrointestinal medicine | 8 |
| Gynecology or obstetrics, including reproductive health | 7 |
| Dentistry or oral surgery | 6 |
| Dermatology | 4 |
| Midwifery | 4 |
| Ophthalmology | 4 |
| Plastic surgery and burn unit | 4 |
| Rheumatology | 4 |
| Urology | 4 |
| Immunology | 3 |
| Physiotherapy | 3 |
| Pharmacy services | 3 |
| Other[d] | 26 |
| Multiple (>5) | 5 |
| Not specified[e] | 3 |
| Pandemic period of reported data[f], n | |
| February-June 2020 | 170 |
| July-December 2020 | 59 |
| January-June 2021 | 39 |
| July-December 2021 | 26 |
| January-December 2022 | 8 |
| 2023-2024 | 8 |
| Not specified | 6 |

[a]For studies reporting more than 1 country (but <5), all countries were counted separately.
[b]14 studies reported more than 1 level of care.
[c]For studies reporting more than 1 health care discipline (but <5), all disciplines were counted separately.
[d]Other health care disciplines, less frequently reported. Details provided in Multimedia Appendix 2.
[e]Specific areas of care not indicated.
[f]Refers to the period corresponding to the data reported in studies (not the date of publication). Studies may report data from several periods. The number of studies in each period is reported and therefore studies may be represented in different time periods.

## Critical Appraisal Within Sources of Evidence

Quality appraisal was conducted for 84.1% (159/189) of the studies, while 15.9% (30/189) comprised narrative accounts of care modifications and did not meet the MMAT screening criteria to be appraised. Nearly 60% (94/159) of the appraised studies met 80% or more of the quality criteria, and only a small number of studies (9/159) met 40% or less of the MMAT criteria.

## Synthesis of Results

### Digital and Hybrid Care Modifications

Hybrid care modifications (incorporating both in-person and digital care components) were reported by 60.8% (115/189) of the studies, while digital-only care modifications (without in-person care components) were reported by 36% (68/189) of the studies. In 3.2% (6/189) of the studies, the extent of hybrid care use was not reported, and broad descriptions of digital care use did not allow classification into a specific category; although these studies could not be classified, they were still incorporated in the descriptive analysis of digital care modifications.

Care modifications incorporating hybrid modalities integrated digital and in-person components in a variety of ways. Hybrid care was used either for a determined subset of patients, for example, offering both in-person and digital care for the same patient but for different care purposes, or for different patient populations, for example, selecting either digital care or in-person care. Service delivery modifications also ranged from being predominantly focused on digital care while allowing in-person care in certain contexts [28-

59] to approaches that incorporated a digital care component while predominantly maintaining in-person care [60-63]. For instance, several studies described the dominance of remote services, with in-person visits used only for specific clinical indications [28,36,48] or care purposes such as therapy administration [34] or clinical examination [41]. Most modifications, however, described the incorporation of substantial elements of both in-person and digital care.

Care modifications incorporating in-person and digital care components were commonly described in specialty care contexts. Organized care pathways, involving structured models for hybrid care provision, were found in areas, including orthopedic surgery [64,65], oncology [66,67], plastic surgery [68], and endocrinology [69]. Set clinical criteria, definition of patient groups, and applications of triage were common considerations reported to define the extent of application of hybrid care, both in primary and specialty care contexts.

Among modifications incorporating substantial in-person and digital care components, in-person care was commonly offered to patients requiring nondeferrable care [24,65,68,70-80], often decided after remote assessments [65,71,73,77]. Several studies reported in-person care only in clinically necessary cases [81-84]. Specific clinical criteria were often used to select in-person care contacts, including cases of severe disease or suspicion of malignancy [66,78,85-88]. Several studies focusing on cancer patients prioritized in-person consultations for new diagnoses or initial assessments [26,72,74,76,82]. Other patient factors were considered to select in-person versus remote care, including patient preference [82,87,89], patient age [69,90], and ease of access to health care facilities [91]. Conversely, remote consultations were more commonly reported for known patients [81,92] and scheduled follow-up consultations [83,93-99].

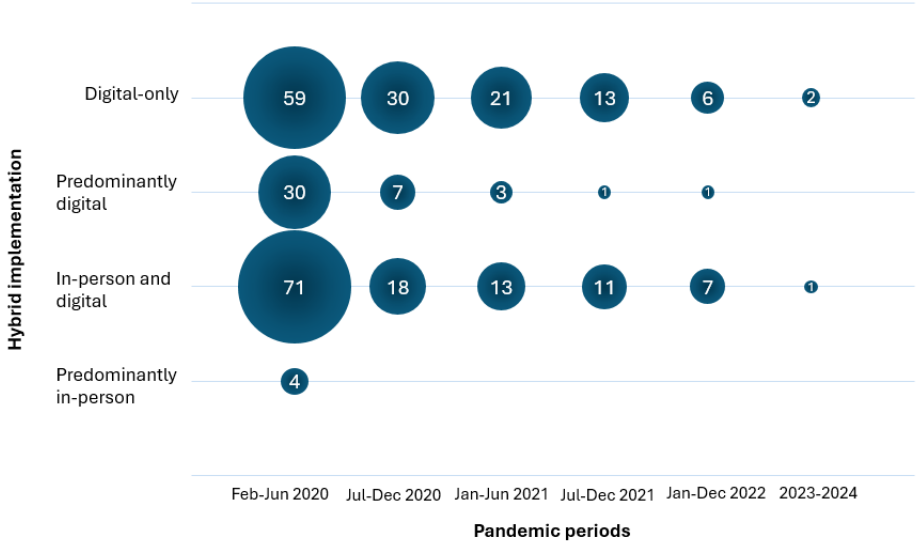
Studies commonly reported multiple in-person care components taking place within hybrid care provision, for either the same group of patients or for different patients within a health service. In general, in-person consultations and surgical interventions were the most frequently reported in-person care components involved in hybrid care use. In several cases, interventions such as physical examinations and functional tests were explicitly reported separately from overall consultations (Table 3).

**Table 3.** In-person care components reported in modifications involving hybrid care use for the delivery of nonpandemic care throughout the COVID-19 pandemic in Europe.

| In-person care interventions | Studies, n |
|---|---|
| Consultation | 85 |
| Surgical intervention | 23 |
| Therapy administration | 18 |
| Minor procedures or interventions | 17 |
| Imaging | 16 |
| Laboratory tests | 15 |
| Physical examination | 13 |
| Inpatient interventions | 7 |
| Functional tests | 5 |
| Endoscopic procedures | 3 |
| Vital signs measurement | 3 |
| Not specified | 6 |

In addition, hybrid and digital care modifications were implemented to varying degrees throughout the pandemic. Hybrid care (including in-person and digital, predominantly digital, and predominantly in-person modifications) was more frequently reported than digital-only care during the early stages of the pandemic (February to June 2020), while digital-only care was reported more often between July 2020 and June 2021. In 2022, hybrid care variations remained more common than digital-only modifications, although overall reporting decreased. Studies reporting care modifications in the postpandemic period (2023 and 2024) were scarce (Figure 2).

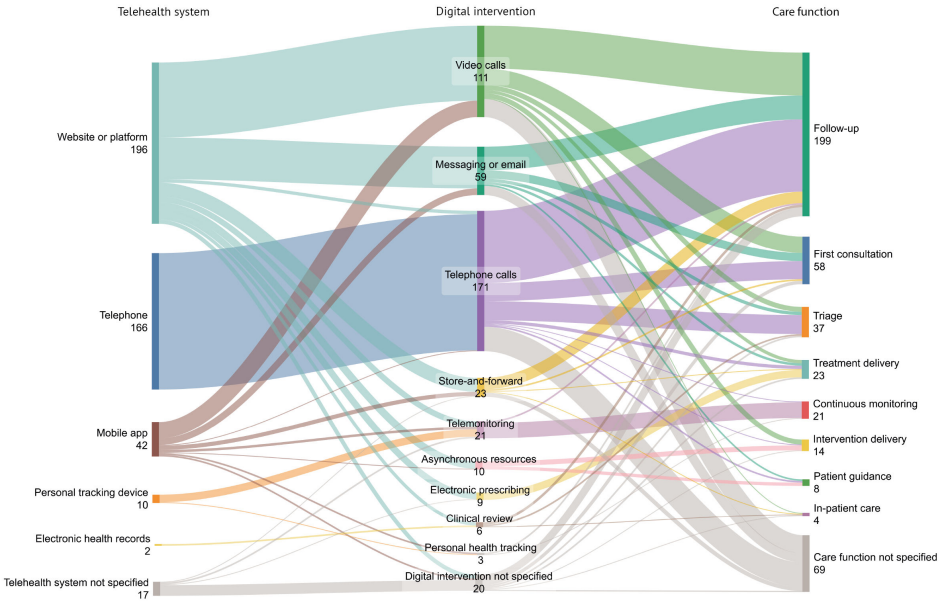
**Figure 2.** Variations in the report of hybrid care modifications for the delivery of nonpandemic care across different periods of the COVID-19 pandemic in Europe. Bubbles depict number of studies reporting different types of hybrid care modifications. Unspecified values are excluded.




## Digital Flows

Digital care modifications identified are illustrated through the creation of digital flows, composed of 3 levels that indicate telehealth systems, digital interventions, and care functions (Figure 3). A total of 433 individual digital care elements, comprising the 3 levels of telehealth systems, digital interventions, and care functions, were extracted, creating 68 distinct digital flows. Substantial variety was found in both interventions and care functions, while the diversity of telehealth systems was more limited. Distinct combinations of systems, interventions, and care functions formed several prominent flows.

**Figure 3.** Digital flows illustrating digital care modifications implemented during the COVID-19 pandemic for the delivery of nonpandemic care in Europe. Digital flows are composed of 3 levels that indicate telehealth systems, digital interventions, and care functions. All telephone calls were assumed to have occurred via telephone service, if not indicated otherwise. Telehealth system for video calls was not indicated in 25 cases, for which the use of "website or platform" was assumed. Digital interventions were classified following the World Health Organization classification of digital interventions, services, and applications in health [3] whenever possible, with multiple interventions recorded when applicable.




One of the most prominent digital flows was the use of websites or platforms to conduct video calls, for the provision of follow-up care. This flow was commonly described in outpatient specialty care contexts, including neurology [22,23,29,100-102] and orthopedics [43,55,103,104]. Follow-up consultations in these cases often involved

chronic patient care and postsurgical assessments, respectively. While specialty care was more common, video calls for follow-up purposes were also found at the primary and community care levels [51,95,105-111]. Additionally, the use of mobile technologies to support video calls was frequently linked to the follow-up care of patients in specialty contexts [35,43,49,82,94,100,103,112-114].

In addition to video calls, the role of messaging and email stood out. The application of these interventions was more evenly divided among primary and secondary or tertiary levels of care. At the primary care level, text-based interventions involved triage, first consultations, follow-up, and patient guidance as care functions. At the secondary or tertiary care level, interventions entailed follow-up of patients, including in cardiology [46,49,62,114-116] and oncology [32,34,117,118] services. Additionally, a number of text-based interventions highlighted mobile apps as the telehealth systems used [49,109,111,114,118-120].

Another key digital flow involved the use of telephone calls, commonly with the functions of follow-up, first consultations, and triage. The use of telephone calls was extensively reported at the secondary or tertiary care level across specialties including oncology [32,34,45,50,54,59,63,76,78,79,121-124], orthopedics [30,37,38,55,64,65,75,104,125-127], and neurology [22,29,53,100,101,128-132]. At the primary care level, telephone use often involved follow-up care, but first consultations and triage also took a substantial role.

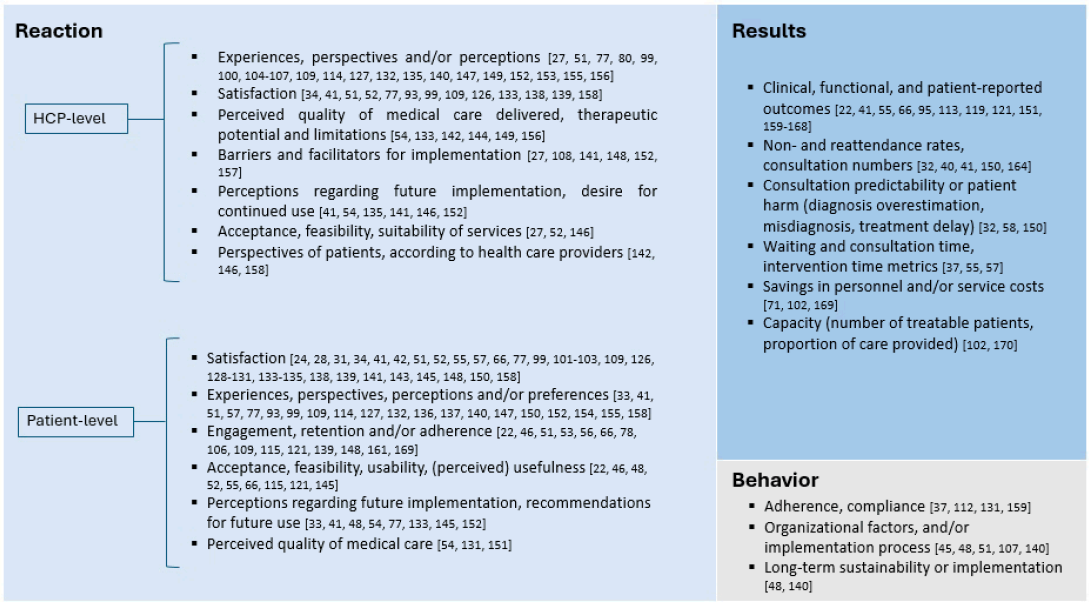
Moreover, telemonitoring as a digital intervention was supported by personal tracking devices, websites or online platforms, and mobile apps and was most commonly used for continuous patient monitoring. Telemonitoring included live monitoring of patients' clinical status [133], periodical monitoring to assess treatment adherence and adjust management plans [49], and a combination with other interventions such as telephone follow-up consultations [56,120]. In one instance, it also included the use of artificial intelligence (AI) for instant patient feedback [120].

## Evaluation of Modifications

Over half of the studies (96/189, 50.8%) did not describe any kind of evaluation. Studies without evaluation were most commonly descriptive (n=55) and often exclusively considered data from February to June 2020 (n=64). Studies that evaluated modifications (93/189, 49.2%) were mostly limited to the year 2020 (n=66). Studies involving the use of certain telehealth systems more commonly reported evaluations, including 73.8% (31/42) of studies reporting the use of mobile apps and 61.4% (105/171) of studies reporting the use of websites or platforms.

Among all studies with evaluations, evaluations at a reaction level (n=73) were the most common, followed by evaluations at the results level (n=29) and the behavior level (n=9; Figure 4). No studies included evaluations at a learning level. At the reaction level, methodologies for evaluation ranged from the use of surveys and questionnaires [23,25,28,29,32,34,35,42,43,47,49,52,53,55,56,58,67,78,94,100-104,110,127-154] to qualitative participant accounts, often collected through interviews and focus group discussions [49,52,67,81,100,105-110,119,122,133,142,149,153,155-159].

**Figure 4.** Levels of evaluation (Kirkpatrick model) and associated evaluated elements found in studies describing hybrid care modifications for the delivery of nonpandemic care during the COVID-19 pandemic in Europe. Each level size is represented according to the number of studies with evaluations at each level. A total of 18 studies reported multiple levels of evaluation. HCP: health care provider [23,25,28,31-34,37,40-42,45,46,48,51-58,66,67,71,77-80,93,95,99-109,112-115,119,121,126-171].




Studies evaluated at the reaction level commonly assessed satisfaction and experiences and perceptions of health care providers and patients. These studies generally reported high levels of satisfaction, as well as overall positive experiences.

Concerning health care providers' perspectives, some studies also reported disadvantages such as increased time investment and workload [42,81,156], increased cognitive demand [52], and concerns regarding contact and communication with patients [28,115,133]. From patients' perspectives, studies highlighted benefits, including economic and time travel–related costs [78,115,130]. Additionally, some studies reported concerns related to limited uptake, impeded access, or lower satisfaction among specific patient groups, including the older population [25,35,43,131,134,136,159].

Multiple studies evaluated patients' and providers' perspectives on future implementation of digital health, in some cases proposing new hybrid models of care to be incorporated into new care standards [138]. Other studies used evaluations to build guidance for overcoming barriers for long-term implementation [49] and to join wider initiatives for adapting care services beyond the pandemic period [46]. Additionally, several studies explored the experiences of other stakeholders, including staff involved in the organization of care (eg, receptionists, practice managers, program managers, IT staff, medical advisors, health insurance representatives) [105,106,119,149,153,158] and caregivers [129,130].

In relation to evaluations at the results level, studies mainly focused on the measurement of clinical outcomes (including adverse events and laboratory measurements) [42,56,96,114,120,151,152,160-166], functional outcomes (including physical function measures) [23,67,122,167,168], and patient-reported outcomes (including quality of life and general health status) [42,56,67,122,169].

# Discussion

## Summary of Evidence

This scoping review has provided a comprehensive examination of modifications involving hybrid care implemented during the COVID-19 pandemic to support nonpandemic care services. To our knowledge, this is the first review focusing on hybrid care modifications implemented throughout the entire pandemic period. During the COVID-19 pandemic, digital health was considerably scaled up to support the provision of nonpandemic care, which could be observed through frequent reports of digital health as a novel or upscaled application. By mapping digital flows, we were able to examine the diverse ways digital care modifications were implemented in practice, highlighting the importance of analyzing the different components involved in digital health implementation. Linked to digital flows, the limited number of telehealth systems supporting a variety of care functions underscores their practical versatility. This review not only examines the variety of telehealth systems, interventions, and care functions used in different health care settings but also expands the understanding of their implementation as part of hybrid care pathways.

Our findings show that digital health was commonly described as part of hybrid care provision, rather than standalone digital approaches. Central factors for implementation included the selection of patient groups, prioritization based on clinical condition and urgency, and availability of telehealth systems, which often defined the distribution and use cases of in-person and digital interventions. The diverse ways in which in-person and digital care were combined reflect the constant need for adaptation of care models throughout the pandemic and across health care settings. Previous experiences with specific health care settings and patient groups may point to necessary context-specific adaptations [170-172]. Also linked to the constant need for adaptation, the number of publications describing hybrid care modifications decreased throughout the years. This decrease may be partly reflective of the return to prepandemic care delivery but may also be related to a decrease in the reporting of novel care delivery modifications.

The creation of digital flows revealed the various ways digital health technologies were implemented during the pandemic. Notably, a few telehealth systems facilitated the application of numerous interventions and care functions. Online websites and platforms were more commonly reported than mobile technologies, which may have been linked to unclear reporting of which specific systems were used and whether overlaps with other systems were present. Similarly, reports of mobile technology application may have been limited to specific demographic groups, such as the younger population. The concomitant use of multiple telehealth systems may reflect efforts to target distinct care functions and different types of users. Evidence on disparities of technology adoption for different users, including older people and ethnic minorities [173,174], underscores the need for flexibility, adaptation, and consideration of access requirements in the implementation of models of care during emergency situations.

Emerging technologies using AI, such as virtual health assistants, were nearly absent in our findings. Previous studies indicate the use of these technologies during the pandemic was concentrated in areas other than direct nonpandemic care, such as diagnosis and detection of COVID-19 [175], which may also be related to their early stage of development, as well as regulatory barriers hindering wider adoption. As technology advances, it is expected that these types of interventions might take on a more prominent role in the future.

In contrast to telehealth systems, a wider variety of digital interventions was identified. The frequent use of telephones is in line with findings from previous studies [176,177] and may be associated with their familiarity, low cost, and ease of access for providers and patients. The common report of the use of video calls during the pandemic has also been previously reported in multiple health care contexts [177-179]. While text-based interventions have been examined in previous studies [176], more research may be needed to better understand their scope, especially in relation to other interventions such as those involving store-and-forward technologies.

Interventions were most commonly linked to follow-up care, aligning with studies from the first months of the pandemic [176,177,180]. Previous research has pointed out that remote care may yield more positive outcomes when patients have a pre-existing relationship with providers [181]. Distinguishing between new patients and follow-up or known patients may also be of value for assessing satisfaction with remote consultations [55,131]. The broad application of different interventions for follow-up care indicates great potential for enabling continuity of care for patients with chronic conditions, both during normal and crisis situations.

Additionally, our findings show that evaluations of modifications in the delivery of nonpandemic care were limited in scope. Over half of the included studies did not report any form of evaluation, and most of those that did focus on short-term user experiences rather than behavioral, clinical, or long-term implementation outcomes. Many of these care modifications were introduced rapidly as emergency responses to an evolving crisis, often without the time or infrastructure to plan for formal evaluation. Time pressure and resource scarcity during the pandemic, alongside the frequent ad hoc nature of modifications, may have contributed to the low number of evaluations.

Evaluations of patients' and providers' experiences and satisfaction align with previous studies, which have similarly centered on user acceptability and adoption [182] and have found high levels of satisfaction with digital health during the pandemic [183,184]. Behavioral and organizational outcomes also align with evaluations conducted before the pandemic, which have evaluated aspects such as behavior change, cost-effectiveness, and clinical and patient-centered outcomes [185]. Regarding clinical outcomes, previous evidence has shown clinical efficacy in the use of digital health interventions for a variety of patient groups [186,187], highlighting its relevance for remote care provision. Although less frequently found, evaluations conducted with the aim of exploring long-term implementation underscore the critical need for addressing sustainability in digital health implementation [188].

## Limitations

This review has applied a comprehensive and systematic methodological approach. However, some limitations are worth noting. Although the inclusion of solely peer-reviewed publications helped ensure rigor in the synthesized data, evidence reported through other means has not been included. Additionally, a publication bias may exist toward positive experiences with digital health, and less successful practices may be underrepresented. The variation in study designs, alongside the diversity of health care contexts and patient groups, may have influenced the interpretation of the findings. Future research may provide additional insights into which specific patient groups may benefit more from the implementation of hybrid care.

This review limited its scope to modifications directly related to service provision; however, other types of interventions, such as those for interprofessional collaboration or patient education, may also be valuable for improving timely access to high-quality care. Strategies to improve remote communication between primary and secondary care providers, as well as the implementation of remote multidisciplinary meetings, have shown potential to improve the organization of care and may be a focus for future research [34,42,75,80,99,121].

Moreover, differences in the use of terminology for digital health greatly contribute to diverse reporting of systems, interventions, and functions and may have influenced the reporting of results. Future research can benefit from using common terminology frameworks, increasing consistency in reporting and helping improve future understanding of the implementation and evaluation of digital and hybrid care. Such common frameworks may also be essential for the development of legal and regulatory procedures [180].

## Conclusions

This review synthesizes findings essential for understanding the scope of hybrid care modifications used in the delivery of nonpandemic care and implemented throughout the COVID-19 pandemic. It provides a unique view as it analyzes digital health interventions as part of broader care pathways, which combine different types of care delivery implemented to sustain access to care. Integrating digital health as part of hybrid care models is essential in designing care pathways that can adapt to different contexts, including future health emergency situations.

The use of digital health and emerging technologies such as AI will continue to shape the future of health care delivery. As evidence regarding its applications advances, research should identify which combinations of digital interventions and care functions offer the greatest accessibility and cost-effectiveness. In the future, research may expand the application of hybrid care models to innovative strategies for the effective management of any crisis involving disrupted infrastructure. Policymakers, researchers, and implementers should also prioritize strategies to reduce inequities in access to digital and in-person care, particularly for underserved populations. Finally, evaluations should move beyond short-term user experiences and assess long-term implementation, clinical outcomes, and sustainability of hybrid care models.

### Acknowledgments

The authors wish to thank Dilek Yildirim for her assistance with data extraction and Alice Tillema for her assistance with the development of the search strategy. Preliminary findings from this study were previously presented as abstracts at the 14th European Congress on Tropical Medicine and International Health 2025 and at the 18th European Public Health Conference 2025 [189,190]. These abstracts included preliminary results and analyses concerning a subset of the reviewed articles, which

differ from the final results and analyses described in this study. No generative AI was used in the preparation of this manuscript.

## Data Availability

Data generated during this study are included in this published article and its supplementary information files. Additional datasets used for analysis during this study are available from the corresponding author on reasonable request.

## Authors' Contributions

AT, CPR, MAC, MLS, TVL conceptualized the review. NSV developed the search strategy, searched and screened studies, extracted and analyzed data, and wrote the first draft of the manuscript. TVL screened studies, extracted data, and analyzed data. LN assisted in developing the search strategy and screened studies. AT, MLS, TVL, and CPR supervised the review process and assisted in preparation of the draft for submission. All authors contributed to the interpretation of results and revisions of the manuscript. All authors read and approved the final manuscript.

## Conflicts of Interest

None declared.

## Multimedia Appendix 1

Search strategy.
[DOC File (Microsoft Word File), 87 KB-Multimedia Appendix 1]

## Multimedia Appendix 2

Extracted data of included studies.
[DOCX File (Microsoft Word File), 99 KB-Multimedia Appendix 2]

## Checklist 1

PRISMA-ScR checklist.
[DOC File (Microsoft Word File), 66 KB-Checklist 1]

## Checklist 2

PRISMA-S checklist.
[DOCX File (Microsoft Word File), 17 KB-Checklist 2]

## References

1. Third round of the global pulse survey on continuity of essential health services during the COVID-19 pandemic. World Health Organization; 2022. URL: https://iris.who.int/server/api/core/bitstreams/057fc218-13ce-4f50-8103-eab552b8e02c/content [Accessed 2026-04-01]
2. The COVID-19 pandemic and the future of telemedicine. OECD Publishing; 2023. URL: https://www.oecd.org/content/dam/oecd/en/publications/reports/2023/01/the-covid-19-pandemic-and-the-future-of-telemedicine_1c878192/ac8b0a27-en.pdf [Accessed 2026-04-01]
3. Classification of digital interventions, services and applications in health: a shared language to describe the uses of digital technology for health. World Health Organization; 2023. URL: https://iris.who.int/server/api/core/bitstreams/bb20354e-ebee-44aa-8a58-7b1da85c6f95/content [Accessed 2026-04-01]
4. Golinelli D, Boetto E, Carullo G, Nuzzolese AG, Landini MP, Fantini MP. Adoption of digital technologies in health care during the COVID-19 pandemic: systematic review of early scientific literature. J Med Internet Res. Nov 6, 2020;22(11):e22280. [doi: 10.2196/22280] [Medline: 33079693]
5. Gunasekeran DV, Tseng RMWW, Tham YC, Wong TY. Applications of digital health for public health responses to COVID-19: a systematic scoping review of artificial intelligence, telehealth and related technologies. NPJ Digit Med. Feb 26, 2021;4(1):40. [doi: 10.1038/s41746-021-00412-9] [Medline: 33637833]
6. Garavand A, Khodaveisi T, Aslani N, Hosseiniravandi M, Shams R, Behmanesh A. Telemedicine in cancer care during COVID-19 pandemic: a systematic mapping study. Health Technol. Jul 2023;13(4):665-678. [doi: 10.1007/s12553-023-00762-2]
7. Severino P, Prosperi S, D'Amato A, et al. Telemedicine: an effective and low-cost lesson from the COVID-19 pandemic for the management of heart failure patients. Curr Heart Fail Rep. Oct 2023;20(5):382-389. [doi: 10.1007/s11897-023-00624-y] [Medline: 37665424]
8. Tossaint-Schoenmakers R, Versluis A, Chavannes N, Talboom-Kamp E, Kasteleyn M. The challenge of integrating ehealth into health care: systematic literature review of the Donabedian model of structure, process, and outcome. J Med Internet Res. May 10, 2021;23(5):e27180. [doi: 10.2196/27180] [Medline: 33970123]

9. Pilosof NP, Barrett M, Oborn E, Barkai G, Zimlichman E, Segal G. Designing for flexibility in hybrid care services: lessons learned from a pilot in an internal medicine unit. Front Med Technol. 2023;5:1223002. [doi: 10.3389/fmedt.2023.1223002] [Medline: 38053662]
10. van Steenkiste J, Verberk-Jonkers I, de Koning S, Voss-de Haan J, de Jong-Verhagen B, Dohmen D. Patient engagement in a hybrid care pathway for hypertension: not one size fits all. J Patient Exp. 2024;11:23743735241297626. [doi: 10.1177/23743735241297626] [Medline: 39654654]
11. Tossaint-Schoenmakers R, Kasteleyn MJ, Rauwerdink A, Chavannes N, Willems S, Talboom-Kamp EPWA. Development of a quality management model and self-assessment questionnaire for hybrid health care: concept mapping study. JMIR Form Res. Jul 7, 2022;6(7):e38683. [doi: 10.2196/38683] [Medline: 35797097]
12. Walter KH, Glassman LH, Levine JA, et al. Telebehavioral health, in-person, and hybrid modalities of treatment delivery among US service members: longitudinal observational study. JMIR Ment Health. Jan 5, 2026;13:e83809. [doi: 10.2196/83809] [Medline: 41490370]
13. Bola H, Rai A, Penumaka R, Ulucay E, Levin E, Maron D. Cardiac rehabilitation for coronary artery disease: gaps, digital models, and the future of personalized prevention. Am J Cardiol. Mar 1, 2026;262:16-27. [doi: 10.1016/j.amjcard.2025.12.013] [Medline: 41468986]
14. Zakaria H, Paul G, Debs J, et al. Impact of virtual patient engagement on glycemic control in type 2 diabetes: a retrospective observational study from GluCare hybrid care model. Front Endocrinol. 2025;16. [doi: 10.3389/fendo.2025.1695381]
15. Fan S, Imsirovic H, Cooper C. Telemedicine and hybrid engagement models facilitate hepatitis C cascade of care during periods of healthcare disruption. Ann Hepatol. Dec 24, 2025;31(1):102178. [doi: 10.1016/j.aohep.2025.102178] [Medline: 41453643]
16. Hatef E, Wilson RF, Zhang A, et al. Effectiveness of telehealth versus in-person care during the COVID-19 pandemic: a systematic review. NPJ Digit Med. Jun 15, 2024;7(1):157. [doi: 10.1038/s41746-024-01152-2] [Medline: 38879682]
17. Tricco AC, Lillie E, Zarin W, et al. PRISMA extension for Scoping Reviews (PRISMA-ScR): checklist and explanation. Ann Intern Med. Oct 2, 2018;169(7):467-473. [doi: 10.7326/M18-0850] [Medline: 30178033]
18. Sanchez Villalobos N, van Loenen T, Ngongalah L, et al. Hybrid care modifications in the delivery of non-pandemic care during the COVID-19 pandemic: a scoping review protocol. OSF. URL: https://doi.org/10.17605/OSF.IO/MDRAS [Accessed 2026-04-24]
19. Rethlefsen ML, Kirtley S, Waffenschmidt S, et al. PRISMA-S: an extension to the PRISMA Statement for reporting literature searches in systematic reviews. Syst Rev. Jan 26, 2021;10(1):39. [doi: 10.1186/s13643-020-01542-z] [Medline: 33499930]
20. Hong QN, Pluye P, Fàbregues S, et al. Mixed Methods Appraisal Tool (MMAT). PBWorks. 2018. URL: http://mixedmethodsappraisaltoolpublic.pbworks.com/ [Accessed 2026-04-09]
21. Kirkpatrick D, Kirkpatrick J. Evaluating Training Programs: The Four Levels. 3rd ed. Berrett-Koehler Publishers, Inc; 2006. URL: https://books.google.co.in/books/about/Evaluating_Training_Programs.html?id=BJ4QCmvP5rcC&redir_esc=y [Accessed 2026-04-01] ISBN: 9781576757963
22. Fuentes B, Alonso de Leciñana M, Calleja-Castaño P, et al. Impact of the COVID-19 pandemic on the organisation of stroke care. Madrid Stroke Care Plan. Neurologia (Engl Ed). 2020;35(6):363-371. [doi: 10.1016/j.nrl.2020.05.007] [Medline: 32563566]
23. Noé E, Navarro MD, Amorós D, et al. Effectiveness, adherence and usability of a teleneurorehabilitation programme to ensure continuity of care for patients with acquired brain injury during the COVID-19 pandemic [Article in Spanish]. Rev Neurol. Nov 16, 2021;73(10):345-350. [doi: 10.33588/rn.7310.2021275] [Medline: 34755887]
24. Soler MJ, Macia Heras M, Ortiz A, del Pino y Pino MD, Salgueira Lazo M. Impacto de la pandemia COVID-19 en los servicios de Nefrología españoles [Article in Spanish]. Nefrología. Nov 2020;40(6):579-584. [doi: 10.1016/j.nefro.2020.08.002]
25. Gomes-de Almeida S, Marabujo T, do Carmo-Gonçalves M. Telemedicine satisfaction of primary care patients during COVID-19 pandemics [Article in Spanish]. Semergen. 2021;47(4):248-255. [doi: 10.1016/j.semerg.2021.01.005] [Medline: 33781673]
26. Ohnleiter T, Piot L, Rogenmuser A, Noirclerc M, Hamlaoui R, Grandgirard A. Management of a radiotherapy center during the COVID-19 outbreak: the experience of the Mulhouse Hospital Centre (France) [Article in French]. Cancer Radiother. Jun 2020;24(3):188-193. [doi: 10.1016/j.canrad.2020.04.002] [Medline: 32334905]
27. Viegas L, Dupie I, Rigal L, et al. Triage of patients and remote consultations in primary care facilities during the COVID-19 pandemic in France (PRICOV-19 study) [Article in French]. Sante Publique. Dec 11, 2023;35(4):393-403. [doi: 10.3917/spub.234.0393] [Medline: 38078634]

28. Bos WH, van Tubergen A, Vonkeman HE. Telemedicine for patients with rheumatic and musculoskeletal diseases during the COVID-19 pandemic; a positive experience in the Netherlands. Rheumatol Int. Mar 2021;41(3):565-573. [doi: 10.1007/s00296-020-04771-6] [Medline: 33449162]
29. De Marchi F, Sarnelli MF, Serioli M, et al. Telehealth approach for amyotrophic lateral sclerosis patients: the experience during COVID-19 pandemic. Acta Neurol Scand. May 2021;143(5):489-496. [doi: 10.1111/ane.13373] [Medline: 33185886]
30. Faria G, Onubogu IK, Tadros BJ, Relwani J. Change in practice due to COVID-19 - early experiences of a United Kingdom district general hospital in trauma & orthopaedics. J Orthop. 2020;22:288-290. [doi: 10.1016/j.jor.2020.06.004] [Medline: 32565644]
31. Kilduff CL, Thomas AA, Dugdill J, et al. Creating the Moorfields' virtual eye casualty: video consultations to provide emergency teleophthalmology care during and beyond the COVID-19 pandemic. BMJ Health Care Inform. Aug 2020;27(3):e100179. [doi: 10.1136/bmjhci-2020-100179] [Medline: 32796085]
32. Ambrosini F, Di Stasio A, Mantica G, Cavallone B, Serao A. COVID-19 pandemic and uro-oncology follow-up: a "virtual" multidisciplinary team strategy and patients' satisfaction assessment. Arch Ital Urol Androl. Jun 23, 2020;92(2). [doi: 10.4081/aiua.2020.2.78] [Medline: 32597103]
33. Bourdon H, Jaillant R, Ballino A, et al. Teleconsultation in primary ophthalmic emergencies during the COVID-19 lockdown in Paris: experience with 500 patients in March and April 2020. J Fr Ophtalmol. Sep 2020;43(7):577-585. [doi: 10.1016/j.jfo.2020.05.005] [Medline: 32564983]
34. Rodler S, Apfelbeck M, Schulz GB, et al. Telehealth in uro-oncology beyond the pandemic: toll or lifesaver? Eur Urol Focus. Sep 15, 2020;6(5):1097-1103. [doi: 10.1016/j.euf.2020.05.010] [Medline: 32534969]
35. Barsom EZ, Meijer HAW, Blom J, Schuuring MJ, Bemelman WA, Schijven MP. Emergency upscaling of video consultation during the COVID-19 pandemic: contrasting user experience with data insights from the electronic health record in a large academic hospital. Int J Med Inform. Jun 2021;150(104463):104463. [doi: 10.1016/j.ijmedinf.2021.104463] [Medline: 33872824]
36. Brunasso AMG, Massone C. Teledermatologic monitoring for chronic cutaneous autoimmune diseases with smartworking during COVID-19 emergency in a tertiary center in Italy. Dermatol Ther. Jul 2020;33(4):e13495. [doi: 10.1111/dth.13695] [Medline: 32458588]
37. Gabriel C, Mathiot A, Boumediane M, et al. Organization of outpatient consultations at a hand surgery department in a French university hospital during the COVID-19 lockdown. Hand Surg Rehabil. Feb 2021;40(1):17-24. [doi: 10.1016/j.hansur.2020.10.006] [Medline: 33130022]
38. Geerdink TH, Salentijn DA, de Vries KA, et al. Optimizing orthopedic trauma care delivery during the COVID-19 pandemic. a closed-loop audit of implementing a virtual fracture clinic and fast-track pathway in a Dutch level 2 trauma center. Trauma Surg Acute Care Open. 2021;6(1):e000691. [doi: 10.1136/tsaco-2021-000691] [Medline: 34632079]
39. Jácome C, Pereira AM, Amaral R, et al. The use of remote care during the coronavirus disease 2019 pandemic: a perspective of Portuguese and Spanish physicians. Eur Ann Allergy Clin Immunol. Jan 2022;54(1):25-29. [doi: 10.23822/EurAnnACI.1764-1489.184] [Medline: 33354962]
40. Legrottaglie EF, Balia L, Camesasca FI, et al. Management of an ophthalmology department during COVID-19 pandemic in Milan, Italy. Eur J Ophthalmol. Sep 2021;31(5):2259-2267. [doi: 10.1177/1120672120960334] [Medline: 32962415]
41. Mugnai G, Volpiana A, Cavedon S, Paolini C, Perrone C, Bilato C. Boosting telemedicine through remote monitoring of cardiac electronic devices during the Italian COVID-19 outbreak. Cardiol J. 2021;28(2):336-338. [doi: 10.5603/CJ.a2021.0011] [Medline: 33634839]
42. O'Donovan M, Buckley C, Benson J, et al. Telehealth for delivery of haemophilia comprehensive care during the COVID-19 pandemic. Haemophilia. Nov 2020;26(6):984-990. [doi: 10.1111/hae.14156] [Medline: 32997849]
43. Perrin A, Mainard N, Limousin M, et al. Satisfaction and feasibility of videoconsultation (VC) in orthopaedic and trauma surgery in the context of the COVID-19 pandemic: prospective study of 783 patients. Orthop Traumatol Surg Res. Feb 2023;109(1):103345. [doi: 10.1016/j.otsr.2022.103345] [Medline: 35671985]
44. Ramaswami U, D'Amore S, Finnegan N, Hughes D, Kazemi M, Lysosomal Disorders Team, Royal Free London NHS Foundation Trust. Impact of SARS-CoV-2 (COVID-19) pandemic on patients with lysosomal storage disorders and restoration of services: experience from a specialist centre. Intern Med J. Oct 2021;51(10):1580-1593. [doi: 10.1111/imj.15473] [Medline: 34487419]
45. Rossi B, Zoccali C, Baldi J, et al. Reorganization tips from a sarcoma unit at time of the COVID-19 pandemic in Italy: early experience from a Regional Referral Oncologic Center. J Clin Med. Jun 15, 2020;9(6):1868. [doi: 10.3390/jcm9061868] [Medline: 32549298]

46. Sacchi C, Andersson K, Roczniewska M, et al. Mind the gap: analysis of two pilot projects of a home telehealth service for persons with complex conditions in a Swedish hospital. BMC Health Serv Res. May 9, 2023;23(1):463. [doi: 10.1186/s12913-023-09409-4] [Medline: 37161458]
47. Schnoor K, Versluis A, Chavannes NH, Talboom-Kamp EPWA. The usability of Homelab, a digital self-service at a Dutch general practice, for diagnostic tests: pilot study with a questionnaire. JMIR Form Res. Jan 26, 2023;7:e42151. [doi: 10.2196/42151] [Medline: 36701183]
48. Świerad M, Dyrbuś K, Szkodziński J, Zembala MO, Kalarus Z, Gąsior M. Telehealth visits in a tertiary cardiovascular center as a response of the healthcare system to the Severe Acute Respiratory Syndrome Coronavirus 2 pandemic in Poland. Pol Arch Intern Med. Aug 27, 2020;130(7-8):700-703. [doi: 10.20452/pamw.15370] [Medline: 32426953]
49. Testa S, Mayora-Ibarra O, Piras EM, et al. Implementation of tele visit healthcare services triggered by the COVID-19 emergency: the Trentino Province experience. Z Gesundh Wiss. 2022;30(1):77-92. [doi: 10.1007/s10389-021-01609-8] [Medline: 34150467]
50. van de Haar J, Hoes LR, Coles CE, et al. Caring for patients with cancer in the COVID-19 era. Nat Med. May 2020;26(5):665-671. [doi: 10.1038/s41591-020-0874-8] [Medline: 32405058]
51. Wanat M, Hoste M, Gobat N, et al. Transformation of primary care during the COVID-19 pandemic: experiences of healthcare professionals in eight European countries. Br J Gen Pract. Aug 2021;71(709):e634-e642. [doi: 10.3399/BJGP.2020.1112] [Medline: 33979303]
52. Wherton J, Greenhalgh T, Shaw SE. Expanding video consultation services at pace and scale in Scotland during the COVID-19 pandemic: national mixed methods case study. J Med Internet Res. Oct 7, 2021;23(10):e31374. [doi: 10.2196/31374] [Medline: 34516389]
53. Willems LM, Balcik Y, Noda AH, et al. SARS-CoV-2-related rapid reorganization of an epilepsy outpatient clinic from personal appointments to telemedicine services: a German single-center experience. Epilepsy Behav. Nov 2020;112:107483. [doi: 10.1016/j.yebeh.2020.107483] [Medline: 33181898]
54. Klain M, Nappi C, Maurea S, et al. Management of differentiated thyroid cancer through nuclear medicine facilities during COVID-19 emergency: the telemedicine challenge. Eur J Nucl Med Mol Imaging. Mar 2021;48(3):831-836. [doi: 10.1007/s00259-020-05041-0] [Medline: 32965559]
55. Luengo-Alonso G, Pérez-Tabernero FGS, Tovar-Bazaga M, Arguello-Cuenca JM, Calvo E. Critical adjustments in a department of orthopaedics through the COVID-19 pandemic. Int Orthop. Aug 2020;44(8):1557-1564. [doi: 10.1007/s00264-020-04647-1] [Medline: 32474718]
56. Piro A, Magnocavallo M, Della Rocca DG, et al. Management of cardiac implantable electronic device follow-up in COVID-19 pandemic: lessons learned during Italian lockdown. J Cardiovasc Electrophysiol. Nov 2020;31(11):2814-2823. [doi: 10.1111/jce.14755] [Medline: 32954600]
57. Omboni S, Ballatore T, Rizzi F, Tomassini F, Panzeri E, Campolo L. Telehealth at scale can improve chronic disease management in the community during a pandemic: an experience at the time of COVID-19. PLoS ONE. 2021;16(9):e0258015. [doi: 10.1371/journal.pone.0258015] [Medline: 34587198]
58. Muthiah S, Craig FE, Sinclair S, et al. Rapid expansion of a teledermatology web application for digital dermatology assessment necessitated by the COVID-19 pandemic: retrospective evaluation. JMIR Dermatol. Jul 26, 2023;6:e36307. [doi: 10.2196/36307] [Medline: 37632929]
59. Hardman JC, Tikka T, Paleri V, ENT UK, BAHNO and INTEGRATE (The UK ENT Trainee Research Network). Remote triage incorporating symptom-based risk stratification for suspected head and neck cancer referrals: a prospective population-based study. Cancer. Nov 15, 2021;127(22):4177-4189. [doi: 10.1002/cncr.33800] [Medline: 34411287]
60. Chana M, Muse S, Ball S, Bennett R, McCarthy R. Critical limb ischaemia in the time of COVID-19: establishing ambulatory service provision. Ann R Coll Surg Engl. Nov 2022;104(9):673-677. [doi: 10.1308/rcsann.2021.0294] [Medline: 34941433]
61. Bonalumi G, Giambuzzi I, Barbone A, et al. A call to action becomes practice: cardiac and vascular surgery during the COVID-19 pandemic based on the Lombardy emergency guidelines. Eur J Cardiothorac Surg. Aug 1, 2020;58(2):319-327. [doi: 10.1093/ejcts/ezaa204] [Medline: 32584978]
62. Mazzone P, Peretto G, Radinovic A, et al. The COVID-19 challenge to cardiac electrophysiologists: optimizing resources at a referral center. J Interv Card Electrophysiol. 2020;59(2):321-327. [doi: 10.1007/s10840-020-00761-7] [Medline: 32425656]
63. Montesi G, Di Biase S, Chierchini S, et al. Radiotherapy during COVID-19 pandemic. How to create a no fly zone: a Northern Italy experience. Radiol Med. Jun 2020;125(6):600-603. [doi: 10.1007/s11547-020-01217-8] [Medline: 32415473]

64. Mathai NJ, Venkatesan AS, Key T, Wilson C, Mohanty K. COVID-19 and orthopaedic surgery: evolving strategies and early experience. Bone Jt Open. May 2020;1(5):160-166. [doi: 10.1302/2633-1462.15.BJO-2020-0021.R1] [Medline: 33241227]
65. Morgan C, Ahluwalia AK, Aframian A, Li L, Sun SNM. The impact of the novel coronavirus on trauma and orthopaedics in the UK. Br J Hosp Med. Apr 2, 2020;81(4):1-6. [doi: 10.12968/hmed.2020.0137]
66. Butler D, Davies-Husband C, Dhanda J, et al. Head and neck oncological ablation and reconstruction in the COVID-19 era - our experience to date. Br J Oral Maxillofac Surg. Oct 2020;58(8):1008-1013. [doi: 10.1016/j.bjoms.2020.06.011] [Medline: 32576467]
67. Denti M, Pecorari A, Accogli MA, et al. Facing the COVID-19 pandemic: an Italian feasibility study of a mixed in-person/telerehabilitation intervention for cancer patients. Cancer Med. Aug 2024;13(15):e70022. [doi: 10.1002/cam4.70022] [Medline: 39095954]
68. Pignatti M, Pinto V, Miralles MEL, Giorgini FA, Cannamela G, Cipriani R. How the COVID-19 pandemic changed the plastic surgery activity in a regional referral center in Northern Italy. J Plast Reconstr Aesthet Surg. Jul 2020;73(7):1348-1356. [doi: 10.1016/j.bjps.2020.05.002] [Medline: 32499187]
69. Ceccato F, Voltan G, Sabbadin C, et al. Tele-medicine versus face-to-face consultation in endocrine outpatients clinic during COVID-19 outbreak: a single-center experience during the lockdown period. J Endocrinol Invest. Aug 2021;44(8):1689-1698. [doi: 10.1007/s40618-020-01476-2] [Medline: 33355915]
70. Caravatta L, Rosa C, Di Sciascio MB, et al. COVID-19 and radiation oncology: the experience of a two-phase plan within a single institution in central Italy. Radiat Oncol. Sep 29, 2020;15(1):226. [doi: 10.1186/s13014-020-01670-9] [Medline: 32993690]
71. Carter E, Currie CC, Asuni A, et al. The first six weeks - setting up a UK urgent dental care centre during the COVID-19 pandemic. Br Dent J. Jun 2020;228(11):842-848. [doi: 10.1038/s41415-020-1708-2] [Medline: 32541745]
72. Collins PM, Madden A, O'Connell C, et al. Urological service provision during the COVID-19 period: the experience from an Irish tertiary centre. Ir J Med Sci. May 2021;190(2):455-460. [doi: 10.1007/s11845-020-02352-x] [Medline: 32856269]
73. Crusz SM, Hall PE, Earwicker K, et al. Providing an acute oncology service during the COVID-19 pandemic. Clin Med (Lond). Sep 2021;21(5):e548-e551. [doi: 10.7861/clinmed.2020-0693] [Medline: 34385297]
74. Kenis I, Theys S, Hermie E, Foulon V, Van Hecke A. Impact of COVID-19 on the organization of cancer care in Belgium: lessons learned for the (post-)pandemic future. Int J Environ Res Public Health. Sep 30, 2022;19(19):12456. [doi: 10.3390/ijerph191912456] [Medline: 36231756]
75. Nuñez JH, Porcel JA, Pijoan J, et al. Rethinking trauma hospital services in one of Spain's largest university hospitals during the COVID-19 pandemic. How can we organize and help? Our experience. Injury. Dec 2020;51(12):2827-2833. [doi: 10.1016/j.injury.2020.09.055] [Medline: 33004206]
76. Rajasekaran RB, Whitwell D, Cosker TDA, Gibbons CLMH. Service delivery during the COVID-19 pandemic: experience from the Oxford Bone Tumour and Soft Tissue Sarcoma service. J Clin Orthop Trauma. Jul 2020;11(Suppl 4):S419-S422. [doi: 10.1016/j.jcot.2020.05.035] [Medline: 32774004]
77. Shah A, Bryant C, Patel J, Tagar H, Akintola D, Obisesan O. COVID-19: establishing an oral surgery-led urgent dental care hub. Br Dent J. Jun 2020;228(12):957-963. [doi: 10.1038/s41415-020-1713-5] [Medline: 32591712]
78. Smrke A, Younger E, Wilson R, et al. Telemedicine during the COVID-19 pandemic: impact on care for rare cancers. JCO Glob Oncol. Jul 2020;6(6):1046-1051. [doi: 10.1200/GO.20.00220] [Medline: 32639877]
79. Paleri V, Hardman J, Tikka T, Bradley P, Pracy P, Kerawala C. Rapid implementation of an evidence-based remote triaging system for assessment of suspected referrals and patients with head and neck cancer on follow-up after treatment during the COVID-19 pandemic: model for international collaboration. Head Neck. Jul 2020;42(7):1674-1680. [doi: 10.1002/hed.26219] [Medline: 32374942]
80. Scaldaferri F, Pugliese D, Privitera G, et al. Impact of COVID-19 pandemic on the daily management of biotechnological therapy in inflammatory bowel disease patients: reorganisational response in a high-volume Italian inflammatory bowel disease centre. United European Gastroenterol J. Aug 2020;8(7):775-781. [doi: 10.1177/2050640620929133] [Medline: 32438878]
81. Anderson H, Scantlebury A, Galdas P, Adamson J. Remote and technology-mediated working during the COVID-19 pandemic: a qualitative exploration of the experiences of nurses working in general practice (the GenCo Study). J Adv Nurs. Apr 2024;80(4):1592-1606. [doi: 10.1111/jan.15921] [Medline: 37909600]
82. Miceli L, Dal Mas F, Biancuzzi H, et al. Doctor@Home: through a telemedicine co-production and co-learning journey. J Cancer Educ. Aug 2022;37(4):1236-1238. [doi: 10.1007/s13187-020-01945-5] [Medline: 33442862]
83. Rayo MN, Fernández-Buhigas I, Ferrer E, Arrébola M, Gil MM, Santacruz B. Application of a new protocol for providing obstetric care in an outpatient service during the COVID-19 pandemic in a public hospital in Madrid, Spain. Front Med (Lausanne). 2022;9(902640):902640. [doi: 10.3389/fmed.2022.902640] [Medline: 35991653]

84. Vassallo C, Scerri Harney A, Abela S. An audit on the provision of telemedicine in primary care in Malta during the COVID-19 pandemic. Malta Med J. 2024;36(1):34-44. URL: https://www.um.edu.mt/library/oar/handle/123456789/120749 [Accessed 2026-04-01]
85. Del Hoyo J, Millán M, Garrido-Marín A, et al. Changes in the management of IBD patients since the onset of COVID-19 pandemic. A path toward the implementation of telemedicine in Spain? [Article in English, Spanish] Gastroenterol Hepatol. Nov 2022;45(9):697-705. [doi: 10.1016/j.gastrohep.2021.08.006] [Medline: 34508808]
86. Joy M, McGagh D, Jones N, et al. Reorganisation of primary care for older adults during COVID-19: a cross-sectional database study in the UK. Br J Gen Pract. Aug 2020;70(697):e540-e547. [doi: 10.3399/bjgp20X710933] [Medline: 32661009]
87. Pascual J, Mazuecos A, Sánchez-Antolín G, et al. Best practices during COVID-19 pandemic in solid organ transplant programs in Spain. Transplant Rev (Orlando). Jan 2023;37(1):100749. [doi: 10.1016/j.trre.2023.100749] [Medline: 36889117]
88. Luciani LG, Mattevi D, Cai T, Giusti G, Proietti S, Malossini G. Teleurology in the time of COVID-19 pandemic: here to stay? Urology. Jun 2020;140:4-6. [doi: 10.1016/j.urology.2020.04.004] [Medline: 32298686]
89. Stansfield J, Dobbs S, Harrison R, et al. Management of ENT emergencies during the coronavirus disease 2019 pandemic. J Laryngol Otol. Feb 2021;135(2):117-124. [doi: 10.1017/S0022215121000530] [Medline: 33612142]
90. Nebsbjerg MA, Vestergaard CH, Bomholt KB, Christensen MB, Huibers L. Use of video in telephone triage in out-of-hours primary care: register-based study. JMIR Med Inform. Apr 4, 2024;12:e47039. [doi: 10.2196/47039] [Medline: 38596835]
91. Minniti A, Maglione W, Pignataro F, Cappadona C, Caporali R, Del Papa N. Taking care of systemic sclerosis patients during COVID-19 pandemic: rethink the clinical activity. Clin Rheumatol. Jul 2020;39(7):2063-2065. [doi: 10.1007/s10067-020-05191-4] [Medline: 32462423]
92. Chappell P, Dias A, Bakhai M, Ledger J, Clarke GM. How is primary care access changing? A retrospective, repeated cross-sectional study of patient-initiated demand at general practices in England using a modern access model, 2019-2022. BMJ Open. Aug 17, 2023;13(8):e072944. [doi: 10.1136/bmjopen-2023-072944] [Medline: 37591638]
93. Saibeni S, Scucchi L, Dragoni G, et al. Activities related to inflammatory bowel disease management during and after the coronavirus disease 2019 lockdown in Italy: how to maintain standards of care. United European Gastroenterol J. Dec 2020;8(10):1228-1235. [doi: 10.1177/2050640620964132] [Medline: 33070758]
94. Fieux M, Duret S, Bawazeer N, Denoix L, Zaouche S, Tringali S. Telemedicine for ENT: effect on quality of care during COVID-19 pandemic. Eur Ann Otorhinolaryngol Head Neck Dis. Sep 2020;137(4):257-261. [doi: 10.1016/j.anorl.2020.06.014] [Medline: 32624390]
95. Crowley D, Delargy I. A national model of remote care for assessing and providing opioid agonist treatment during the COVID-19 pandemic: a report. Harm Reduct J. Jul 17, 2020;17(1):49. [doi: 10.1186/s12954-020-00394-z] [Medline: 32680520]
96. El Moazen G, Pfeifer B, Loid A, Kastner P, Ciardi C. The effectiveness of telemedical monitoring program DiabCare Tirol for patients with gestational diabetes mellitus. Stud Health Technol Inform. Oct 27, 2021;285(205-10):205-210. [doi: 10.3233/SHTI210599] [Medline: 34734875]
97. Casella D, Fusario D, Cassetti D, et al. The patient's pathway for breast cancer in the COVID-19 era: an Italian single-center experience. Breast J. Aug 2020;26(8):1589-1592. [doi: 10.1111/tbj.13958] [Medline: 32596965]
98. Sheil O, McAuliffe FM. Reorganisation of obstetric services during the COVID pandemic – experience from National Maternity Hospital Dublin Ireland. Best Pract Res Clin Obstet Gynaecol. Jun 2021;73:104-112. [doi: 10.1016/j.bpobgyn.2021.03.013]
99. Murris F, Huchon C, Zilberman S, et al. Impact of the first lockdown for coronavirus 19 on breast cancer management in France: a multicentre survey. J Gynecol Obstet Hum Reprod. Nov 2021;50(9):102166. [doi: 10.1016/j.jogoh.2021.102166] [Medline: 34033966]
100. Altmann P, Leutmezer F, Ponleitner M, et al. Remote visits for people with multiple sclerosis during the COVID-19 pandemic in Austria: the TELE MS randomized controlled trial. Digit Health. 2022;8:20552076221112154. [doi: 10.1177/20552076221112154] [Medline: 35847524]
101. Benaque A, Gurruchaga MJ, Abdelnour C, et al. Dementia care in times of COVID-19: experience at Fundació ACE in Barcelona, Spain. J Alzheimers Dis. 2020;76(1):33-40. [doi: 10.3233/JAD-200547] [Medline: 32538856]
102. Pareyson D, Pantaleoni C, Eleopra R, et al. Neuro-telehealth for fragile patients in a tertiary referral neurological institute during the COVID-19 pandemic in Milan, Lombardy. Neurol Sci. Jul 2021;42(7):2637-2644. [doi: 10.1007/s10072-021-05252-9] [Medline: 33929645]
103. Muschol J, Heinrich M, Heiss C, et al. Digitization of follow-up care in orthopedic and trauma surgery with video consultations: health economic evaluation study from a health provider's perspective. J Med Internet Res. Dec 25, 2023;25:e46714. [doi: 10.2196/46714] [Medline: 38145481]

104. Dunkerley S, Thelwall C, Omiawele J, Smith A, Deo S, Lowdon I. Patient care modifications and hospital regulations during the COVID-19 crisis created inequality and functional hazard for patients with orthopaedic trauma. Int Orthop. Dec 2020;44(12):2481-2485. [doi: 10.1007/s00264-020-04764-x] [Medline: 32767088]
105. Papoutsi C, Shaw S, Greenhalgh T. Implementing video group consultations in general practice during COVID-19: a qualitative study. Br J Gen Pract. Jul 2022;72(720):e483-e491. [doi: 10.3399/BJGP.2021.0673] [Medline: 35636969]
106. Silsand L, Severinsen GH, Berntsen G. Preservation of person-centered care through videoconferencing for patient follow-up during the COVID-19 pandemic: case study of a multidisciplinary care team. JMIR Form Res. Mar 5, 2021;5(3):e25220. [doi: 10.2196/25220] [Medline: 33646965]
107. Lapão LV, Peyroteo M, Maia M, et al. Implementation of digital monitoring services during the COVID-19 pandemic for patients with chronic diseases: design science approach. J Med Internet Res. Aug 26, 2021;23(8):e24181. [doi: 10.2196/24181] [Medline: 34313591]
108. Stewart J, McCorry N, Reid H, Hart N, Kee F. Implementation of remote asthma consulting in general practice in response to the COVID-19 pandemic: an evaluation using extended Normalisation Process Theory. BJGP Open. Mar 2022;6(1):BJGPO.2021.0189. [doi: 10.3399/BJGPO.2021.0189] [Medline: 34862167]
109. Murphy M, Scott LJ, Salisbury C, et al. Implementation of remote consulting in UK primary care following the COVID-19 pandemic: a mixed-methods longitudinal study. Br J Gen Pract. 2021;71(704):e166-e177. [doi: 10.3399/BJGP.2020.0948] [Medline: 33558332]
110. Békási S, Girasek E, Győrffy Z. Telemedicine in community shelters: possibilities to improve chronic care among people experiencing homelessness in Hungary. Int J Equity Health. Dec 17, 2022;21(1):181. [doi: 10.1186/s12939-022-01803-4] [Medline: 36528777]
111. Asomugha AU, Pakai A. Trends and shifts in Swedish telemedicine consultations during the pre-COVID-19, COVID-19, and post-COVID-19 periods: retrospective observational study. JMIR Form Res. May 16, 2025;9:e60294. [doi: 10.2196/60294] [Medline: 40378415]
112. Corea F, Ciotti S, Cometa A, et al. Telemedicine during the coronavirus disease (COVID-19) pandemic: a multiple sclerosis (MS) outpatients service perspective. Neurol Int. Jan 18, 2021;13(1):25-31. [doi: 10.3390/neurolint13010003] [Medline: 33477432]
113. Giudice A, Barone S, Muraca D, et al. Can teledentistry improve the monitoring of patients during the COVID-19 dissemination? A descriptive pilot study. Int J Environ Res Public Health. May 13, 2020;17(10):3399. [doi: 10.3390/ijerph17103399] [Medline: 32414126]
114. Salzano A, D'Assante R, Stagnaro FM, et al. Heart failure management during the COVID-19 outbreak in Italy: a telemedicine experience from a heart failure university tertiary referral centre. Eur J Heart Fail. Jun 2020;22(6):1048-1050. [doi: 10.1002/ejhf.1911] [Medline: 32463534]
115. Peretto G, De Luca G, Campochiaro C, et al. Telemedicine in myocarditis: evolution of a mutidisciplinary "disease unit" at the time of COVID-19 pandemic. Am Heart J. Nov 2020;229:121-126. [doi: 10.1016/j.ahj.2020.07.015] [Medline: 32957030]
116. Russo V, Cassini R, Caso V, et al. Nursing teleconsultation for the outpatient management of patients with cardiovascular disease during COVID-19 pandemic. Int J Environ Res Public Health. Feb 21, 2021;18(4):2087. [doi: 10.3390/ijerph18042087] [Medline: 33669951]
117. Perrone AM, Dondi G, Giunchi S, et al. COVID-19 free oncologic surgical hub: the experience of reallocation of a gynecologic oncology unit during pandemic outbreak. Gynecol Oncol. Apr 2021;161(1):89-96. [doi: 10.1016/j.ygyno.2020.09.030] [Medline: 33223219]
118. Gebbia V, Piazza D, Valerio MR, Borsellino N, Firenze A. Patients with cancer and COVID-19: a WhatsApp Messenger-based survey of patients' queries, needs, fears, and actions taken. JCO Glob Oncol. May 2020;6:722-729. [doi: 10.1200/GO.20.00118] [Medline: 32412811]
119. Solberg Carlsson K, Øvretveit J, Ohrling M. Rapid implementation of remote digital primary care in Stockholm and implications for further system-wide implementation: practitioner's and manager's experience of the Always Open mobile application. Scand J Prim Health Care. Sep 2023;41(3):232-246. [doi: 10.1080/02813432.2023.2229387] [Medline: 37470469]
120. Albert L, Capel I, García-Sáez G, Martín-Redondo P, Hernando ME, Rigla M. Managing gestational diabetes mellitus using a smartphone application with artificial intelligence (SineDie) during the COVID-19 pandemic: much more than just telemedicine. Diabetes Res Clin Pract. Nov 2020;169:108396. [doi: 10.1016/j.diabres.2020.108396] [Medline: 32890548]
121. Brandes AA, Ardizzoni A, Artioli F, et al. Fighting cancer in coronavirus disease era: organization of work in medical oncology departments in Emilia Romagna region of Italy. Future Oncol. Jul 2020;16(20):1433-1439. [doi: 10.2217/fon-2020-0358] [Medline: 32437242]
122. Wu F, Rotimi O, Laza-Cagigas R, Rampal T. The feasibility and effects of a telehealth-delivered home-based prehabilitation program for cancer patients during the pandemic. Curr Oncol. Jun 17, 2021;28(3):2248-2259. [doi: 10.3390/curroncol28030207]

123. Forrester M, Breitenfeld L, Castelo-Branco M, Aperta J. The effects of the COVID-19 pandemic in oncology patient management. Int J Environ Res Public Health. Jul 25, 2022;19(15):9041. [doi: 10.3390/ijerph19159041] [Medline: 35897414]
124. Kaddour H, Jama GM, Stagnell S, Kaddour S, Guner K, Kumar G. Remote triaging of urgent suspected head and neck cancer referrals: our experience during the first wave of the COVID-19 pandemic. Eur Arch Otorhinolaryngol. Feb 2022;279(2):1111-1115. [doi: 10.1007/s00405-021-07135-3] [Medline: 34661717]
125. Miguela Álvarez SM, Bartra Ylla A, Salvador Carreño J, Castillón P, García Cardona C, Anglès Crespo F. Telephone consultation service in orthopedics during COVID-19 pandemic [Article in Spanish]. Revista Española de Cirugía Ortopédica y Traumatología (English Edition). May 2021;65(3):167-171. [doi: 10.1016/j.recote.2020.07.007]
126. Chesser TJS, Handley R, Kloos J, et al. International trauma care: initial European approaches during the COVID 19 pandemic. OTA Int. Mar 2021;4(1 Suppl):e112. [doi: 10.1097/OI9.0000000000000112] [Medline: 38630066]
127. Gilbert AW, Billany JCT, Adam R, et al. Rapid implementation of virtual clinics due to COVID-19: report and early evaluation of a quality improvement initiative. BMJ Open Qual. May 2020;9(2):e000985. [doi: 10.1136/bmjoq-2020-000985] [Medline: 32439740]
128. Banks J, Corrigan D, Grogan R, et al. LoVE in a time of COVID: clinician and patient experience using telemedicine for chronic epilepsy management. Epilepsy Behav. Feb 2021;115:107675. [doi: 10.1016/j.yebeh.2020.107675] [Medline: 33342712]
129. Vasta R, Moglia C, D'Ovidio F, et al. Telemedicine for patients with amyotrophic lateral sclerosis during COVID-19 pandemic: an Italian ALS referral center experience. Amyotroph Lateral Scler Frontotemporal Degener. May 2021;22(3-4):308-311. [doi: 10.1080/21678421.2020.1820043] [Medline: 32924624]
130. Capozzo R, Zoccolella S, Musio M, Barone R, Accogli M, Logroscino G. Telemedicine is a useful tool to deliver care to patients with amyotrophic lateral sclerosis during COVID-19 pandemic: results from Southern Italy. Amyotroph Lateral Scler Frontotemporal Degener. Nov 2020;21(7-8):542-548. [doi: 10.1080/21678421.2020.1773502] [Medline: 32530314]
131. McKenna MC, Al-Hinai M, Bradley D, et al. Patients' experiences of remote neurology consultations during the COVID-19 pandemic. Eur Neurol. 2020;83(6):622-625. [doi: 10.1159/000511900] [Medline: 33147591]
132. Motolese F, Magliozzi A, Puttini F, et al. Parkinson's disease remote patient monitoring during the COVID-19 lockdown. Front Neurol. 2020;11:567413. [doi: 10.3389/fneur.2020.567413] [Medline: 33117262]
133. van de Vijver S, Hummel D, van Dijk AH, et al. Evaluation of a digital self-management platform for patients with chronic illness in primary care: qualitative study of stakeholders' perspectives. JMIR Form Res. Aug 3, 2022;6(8):e38424. [doi: 10.2196/38424] [Medline: 35921145]
134. Hartl L, Semmler G, Hofer BS, et al. COVID-19-related downscaling of in-hospital liver care decreased patient satisfaction and increased liver-related mortality. Hepatol Commun. Oct 2021;5(10):1660-1675. [doi: 10.1002/hep4.1758] [Medline: 34222742]
135. Barth J, Canella C, Oehler M, Witt CM. Digital consultations during COVID-19: a multiperspective mixed-methods study in an integrative medicine setting in Switzerland. J Altern Complement Med. Jul 2021;27(7):569-578. [doi: 10.1089/acm.2020.0539] [Medline: 33960805]
136. Doica IP, Florescu DN, Oancea CN, et al. Telemedicine chronic viral hepatitis C treatment during the lockdown period in Romania: a pilot study. Int J Environ Res Public Health. Apr 1, 2021;18(7):3694. [doi: 10.3390/ijerph18073694] [Medline: 33916226]
137. Quinn LM, Olajide O, Green M, Sayed H, Ansar H. Patient and professional experiences with virtual antenatal clinics during the COVID-19 pandemic in a UK tertiary obstetric hospital: questionnaire study. J Med Internet Res. Aug 31, 2021;23(8):e25549. [doi: 10.2196/25549] [Medline: 34254940]
138. Thomas I, Siew LQC, Rutkowski K. Synchronous telemedicine in allergy: lessons learned and transformation of care during the COVID-19 pandemic. J ALLERGY Clin Immunol Pract. Jan 2021;9(1):170-176. [doi: 10.1016/j.jaip.2020.10.013] [Medline: 33091636]
139. Tyler JMB, Pratt AC, Wooster J, Vasilakis C, Wood RM. The impact of increased outpatient telehealth during COVID-19: retrospective analysis of patient survey and routine activity data from a major healthcare system in England. Int J Health Plan Manag. Jul 2021;36(4):1338-1345. [doi: 10.1002/hpm.3185]
140. Byrne E, Watkinson S. Patient and clinician satisfaction with video consultations during the COVID-19 pandemic: an opportunity for a new way of working. J Orthod. Mar 2021;48(1):64-73. [doi: 10.1177/1465312520973677] [Medline: 33251951]
141. Pinar U, Anract J, Perrot O, et al. Preliminary assessment of patient and physician satisfaction with the use of teleconsultation in urology during the COVID-19 pandemic. World J Urol. Jun 2021;39(6):1991-1996. [doi: 10.1007/s00345-020-03432-4] [Medline: 32909174]
142. Shaw SE, Hughes G, Wherton J, et al. Achieving spread, scale up and sustainability of video consulting services during the COVID-19 pandemic? Findings from a comparative case study of policy implementation in England, Wales, Scotland and Northern Ireland. Front Digit Health. 2021;3:754319. [doi: 10.3389/fdgth.2021.754319] [Medline: 34988546]

143. Eger K, Paroczai D, Bacon A, et al. The effect of the COVID-19 pandemic on severe asthma care in Europe: will care change for good? ERJ Open Res. Apr 2022;8(2):00065-2022. [doi: 10.1183/23120541.00065-2022] [Medline: 35582679]
144. Florea M, Lazea C, Gaga R, et al. 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. [doi: 10.2147/IJGM.S309519] [Medline: 33953605]
145. Gesuete FP, Molle M, Gubitosi A, et al. Telemonitoring wound recovery with smartphone: an Italian experience during pandemic period. Plast Reconstr Surg Glob Open. May 2023;11(5):e5076. [doi: 10.1097/GOX.0000000000005076] [Medline: 37250826]
146. Gleeson LL, Ludlow A, Wallace E, et al. Changes to primary care delivery during the COVID-19 pandemic and perceived impact on medication safety: a survey study. Explor Res Clin Soc Pharm. Jun 2022;6:100143. [doi: 10.1016/j.rcsop.2022.100143] [Medline: 35702683]
147. Johnsen TM, Norberg BL, Kristiansen E, et al. Suitability of video consultations during the COVID-19 pandemic lockdown: cross-sectional survey among Norwegian general practitioners. J Med Internet Res. Feb 8, 2021;23(2):e26433. [doi: 10.2196/26433] [Medline: 33465037]
148. Stepaniuk A, Pawlukianiec C, Krawiel M, Lewoc M, Baran A, Flisiak I. Great hopes or disappointment - a survey-based study on patients' and doctors' perception of telemedicine during the COVID-19 pandemic in Poland. Postepy Dermatol Alergol. Apr 2022;39(2):384-391. [doi: 10.5114/ada.2022.113827] [Medline: 35645687]
149. Rzewuska Díaz M, Locock L, Keen A, Melvin M, Myhill A, Ramsay C. Implementation of a web-based outpatient asynchronous consultation service: mixed methods study. J Med Internet Res. Jun 4, 2024;26:e48092. [doi: 10.2196/48092] [Medline: 38833695]
150. Tensen E, Kuziemsky C, Jaspers MW, Peute LW. General practitioners' perspectives about remote dermatology care during the COVID-19 pandemic in the Netherlands: questionnaire-based study. JMIR Dermatol. Jun 13, 2023;6:e46682. [doi: 10.2196/46682] [Medline: 37632975]
151. Li JPO, Thomas AAP, Kilduff CLS, et al. Safety of video-based telemedicine compared to in-person triage in emergency ophthalmology during COVID-19. EClinicalMedicine. Apr 2021;34:100818. [doi: 10.1016/j.eclinm.2021.100818] [Medline: 33842860]
152. Wilk M, Surowiec P, Matejko B, et al. Diabetes management delivery and pregnancy outcomes in women with gestational diabetes mellitus during the first wave of the 2020 COVID-19 pandemic: a single-reference center report. J Diabetes Res. 2021;2021:5515902. [doi: 10.1155/2021/5515902] [Medline: 34307689]
153. Angelovská O, Dobiášová K, Těšinová JK. Pandemic COVID-19 as a challenge for telemedicine in the Czech Republic. Int J Health Plann Manage. Jan 2025;40(1):271-286. [doi: 10.1002/hpm.3863] [Medline: 39497023]
154. Sanders MW, Field J, Newell D, Osborne N. Use of remote consultations by chiropractors in the United Kingdom during the COVID-19 pandemic: a cross-sectional survey. J Chiropr Med. 2025;24(1-4):106-118. [doi: 10.1016/j.jcm.2025.07.003]
155. Boydell N, Reynolds-Wright JJ, Cameron ST, Harden J. Women's experiences of a telemedicine abortion service (up to 12 weeks) implemented during the coronavirus (COVID-19) pandemic: a qualitative evaluation. BJOG. Oct 2021;128(11):1752-1761. [doi: 10.1111/1471-0528.16813] [Medline: 34138505]
156. Deml MJ, Minnema J, Dubois J, et al. The impact of the COVID-19 pandemic on the continuity of care for at-risk patients in Swiss primary care settings: a mixed-methods study. Soc Sci Med. Apr 2022;298:114858. [doi: 10.1016/j.socscimed.2022.114858] [Medline: 35247784]
157. Ochieng L, Salehi M, Ochieng R, et al. Augmented video consultations in care homes during the COVID-19 pandemic: a qualitative study. BJGP Open. Dec 2022;6(4):BJGPO.2022.0073. [doi: 10.3399/BJGPO.2022.0073] [Medline: 35764408]
158. Riboli-Sasco E, El-Osta A, El Asmar ML, et al. Investigating barriers & facilitators for the successful implementation of the BP@home initiative in London: primary care perspectives. PLoS ONE. 2024;19(2):e0298898. [doi: 10.1371/journal.pone.0298898] [Medline: 38422101]
159. Kollmann J, Sana S, Magnée T, et al. Patients' and professionals' experiences with remote care during COVID-19: a qualitative study in general practices in low-income neighborhoods. Prim Health Care Res Dev. Jun 3, 2024;25:e32. [doi: 10.1017/S1463423624000240] [Medline: 38826073]
160. Cervantes-Torres L, Romero-Blanco C. Longitudinal study of the flash glucose monitoring system in type 1 diabetics: an mHealth ally in times of COVID-19. J Clin Nurs. Jul 2023;32(13-14):3840-3851. [doi: 10.1111/jocn.16523] [Medline: 36071646]
161. Severino P, D'Amato A, Prosperi S, et al. Clinical support through telemedicine in heart failure outpatients during the COVID-19 pandemic period: results of a 12-months follow up. J Clin Med. May 16, 2022;11(10):2790. [doi: 10.3390/jcm11102790] [Medline: 35628916]
162. Abedin N, Kilbinger C, Queck A, et al. Telemedicine hybrid care models in gastroenterology outpatient care: results from a German tertiary center. J Clin Med. Apr 4, 2025;14(7):2471. [doi: 10.3390/jcm14072471] [Medline: 40217919]

163. Cuevas Fernández FJ, Quintana AE, López OTG, Galeote JCG, de León AC, Aguirre-Jaime A. The role of telemedicine in the monitoring and control of patients with hypertension during the COVID–19 pandemic: a multicenter study in primary care. Fam Med Prim Care Rev. 2024;26(4):438-443. [doi: 10.5114/fmpcr.2024.144911]
164. Zondag AGM, Haitjema S, de Groot MCH, et al. Comparison of outpatient attendance, cardiovascular risk management and cardiovascular health across preCOVID-19, during and postCOVID-19 periods: a prospective cohort study. BMJ Open. Jul 16, 2025;15(7):e092374. [doi: 10.1136/bmjopen-2024-092374] [Medline: 40669897]
165. Beauquis J, Petit AE, Michaux V, Sagué V, Henrard S, Leprince JG. Dental emergencies management in COVID-19 pandemic peak: a cohort study. J Dent Res. Apr 2021;100(4):352-360. [doi: 10.1177/0022034521990314] [Medline: 33541180]
166. Munda A, Indihar BŠ, Okanovič G, Zorko K, Steblovnik L, Barlovič DP. Maternal and perinatal outcomes during the COVID-19 epidemic in pregnancies complicated by gestational diabetes. Zdr Varst. Mar 2023;62(1):22-29. [doi: 10.2478/sjph-2023-0004] [Medline: 36694793]
167. Bauwens PH, Fayard JM, Tatar M, et al. Evaluation of a smartphone application for self-rehabilitation after anterior cruciate ligament reconstruction during a COVID-19 lockdown. Orthop.Traumatol Surg Res. Feb 2023;109(1):103342. [doi: 10.1016/j.otsr.2022.103342]
168. Grobe-Einsler M, Taheri Amin A, Faber J, et al. Development of SARA$^{home}$, a new video-based tool for the assessment of ataxia at home. Mov Disord. May 2021;36(5):1242-1246. [doi: 10.1002/mds.28478] [Medline: 33433030]
169. Pulvirenti F, Cinetto F, Milito C, et al. Health-related quality of life in common variable immunodeficiency Italian patients switched to remote assistance during the COVID-19 pandemic. J Allergy Clin Immunol Pract. Jun 2020;8(6):1894-1899. [doi: 10.1016/j.jaip.2020.04.003] [Medline: 32278865]
170. Bhadola S, Tang C, Marks A, et al. Disparate healthcare access and telehealth-based hybrid consultations during the COVID-19 pandemic. WORK. 2022;73(2):377-382. [doi: 10.3233/WOR-211463]
171. Banbury A, Smith AC, Taylor ML, et al. Cancer care and management during COVID-19: a comparison of in-person, video and telephone consultations. J Telemed Telecare. Dec 2022;28(10):733-739. [doi: 10.1177/1357633X221123409] [Medline: 36346931]
172. Ashley C, Williams A, Dennis S, et al. Telehealth's future in Australian primary health care: a qualitative study exploring lessons learnt from the COVID-19 pandemic. BJGP Open. Jun 2023;7(2):BJGPO.2022.0117. [doi: 10.3399/BJGPO.2022.0117] [Medline: 36750374]
173. Sachs JW, Graven P, Gold JA, Kassakian SZ. Disparities in telephone and video telehealth engagement during the COVID-19 pandemic. JAMIA Open. Jul 2021;4(3):ooab056. [doi: 10.1093/jamiaopen/ooab056] [Medline: 34632322]
174. Weber E, Miller SJ, Shroff N, Beyrouty M, Calman N. Recent telehealth utilization at a large federally qualified health center system: evidence of disparities even within telehealth modalities. Telemed J E Health. Nov 2023;29(11):1601-1612. [doi: 10.1089/tmj.2022.0511] [Medline: 36961396]
175. Singh K, Kaur N, Prabhu A. Combating COVID-19 crisis using artificial intelligence (AI) based approach: systematic review. Curr Top Med Chem. 2024;24(8):737-753. [doi: 10.2174/0115680266282179240124072121] [Medline: 38318824]
176. Abd-Alrazaq A, Hassan A, Abuelezz I, et al. Overview of technologies implemented during the first wave of the COVID-19 pandemic: scoping review. J Med Internet Res. Sep 14, 2021;23(9):e29136. [doi: 10.2196/29136] [Medline: 34406962]
177. Ganjali R, Jajroudi M, Kheirdoust A, Darroudi A, Alnattah A. Telemedicine solutions for clinical care delivery during COVID-19 pandemic: a scoping review. Front Public Health. 2022;10:937207. [doi: 10.3389/fpubh.2022.937207] [Medline: 35937265]
178. Li HL, Chan YC, Huang JX, Cheng SW. Pilot study using telemedicine video consultation for vascular patients' care during the COVID-19 period. Ann Vasc Surg. Oct 2020;68:76-82. [doi: 10.1016/j.avsg.2020.06.023] [Medline: 32562832]
179. Manski-Nankervis JA, Davidson S, Hiscock H, et al. Primary care consumers' experiences and opinions of a telehealth consultation delivered via video during the COVID-19 pandemic. Aust J Prim Health. Jun 2022;28(3):224-231. [doi: 10.1071/PY21193] [Medline: 35287793]
180. Doraiswamy S, Abraham A, Mamtani R, Cheema S. Use of telehealth during the COVID-19 pandemic: scoping review. J Med Internet Res. Dec 1, 2020;22(12):e24087. [doi: 10.2196/24087] [Medline: 33147166]
181. Ramachandran M, Brinton C, Wiljer D, Upshur R, Gray CS. The impact of eHealth on relationships and trust in primary care: a review of reviews. BMC Prim Care. Nov 3, 2023;24(1):228. [doi: 10.1186/s12875-023-02176-5] [Medline: 37919688]
182. Pong C, Tseng RMWW, Tham YC, Lum E. Current implementation of digital health in chronic disease management: scoping review. J Med Internet Res. Dec 12, 2024;26(26):e53576. [doi: 10.2196/53576] [Medline: 39666972]
183. Andrews E, Berghofer K, Long J, Prescott A, Caboral-Stevens M. Satisfaction with the use of telehealth during COVID-19: an integrative review. Int J Nurs Stud Adv. Nov 2020;2:100008. [doi: 10.1016/j.ijnsa.2020.100008] [Medline: 33083791]

184. Pogorzelska K, Chlabicz S. Patient satisfaction with telemedicine during the COVID-19 pandemic-a systematic review. Int J Environ Res Public Health. May 17, 2022;19(10):6113. [doi: 10.3390/ijerph19106113] [Medline: 35627650]
185. Bashi N, Fatehi F, Mosadeghi-Nik M, Askari MS, Karunanithi M. Digital health interventions for chronic diseases: a scoping review of evaluation frameworks. BMJ Health Care Inform. Mar 2020;27(1):e100066. [doi: 10.1136/bmjhci-2019-100066] [Medline: 32156751]
186. Snoswell CL, Chelberg G, De Guzman KR, et al. The clinical effectiveness of telehealth: a systematic review of meta-analyses from 2010 to 2019. J Telemed Telecare. Oct 2023;29(9):669-684. [doi: 10.1177/1357633X211022907] [Medline: 34184580]
187. Kuan PX, Chan WK, Fern Ying DK, et al. Efficacy of telemedicine for the management of cardiovascular disease: a systematic review and meta-analysis. Lancet Digit Health. Sep 2022;4(9):e676-e691. [doi: 10.1016/S2589-7500(22)00124-8] [Medline: 36028290]
188. Valdes D, Shanker A, Hijazi G, et al. Global evidence on the sustainability of telemedicine in outpatient and primary care during the first 2 years of the COVID-19 pandemic: scoping review using the Nonadoption, Abandonment, Scale-Up, Spread, and Sustainability (NASSS) framework. Interact J Med Res. Feb 28, 2025;14:e45367. [doi: 10.2196/45367] [Medline: 40053716]
189. Bernhard-Nocht-Institut for Tropical Medicine (BNITM) Federation of European Societies for Tropical Medicine and International Health (FESTMIH) German Society for Tropical Medicine TMaGHD. Strengthening pandemic preparedness – enabling access through hybrid care models – project RAPIDE. In: 14th European Congress on Tropical Medicine and International Health (ECTMIH 2025); 2025. Frontiers; 2025. URL: https://www.frontiersin.org/books/14th_European_Congress_on_Tropical_Medicine_and_International_Health_ECTMIH_2025/14193 [Accessed 2026-03-03]
190. Sanchez Villalobos N, vanLoenen T, Ngongalah L, Connolly M, Timen A. Pathways for hybrid care: modifications in non-pandemic care delivery during the COVID-19 pandemic. Eur J Public Health. Oct 1, 2025;35(Supplement_4). [doi: 10.1093/eurpub/ckaf161.101]

## Abbreviations

**AI:** artificial intelligence
**MMAT:** Mixed Methods Appraisal Tool
**PRISMA-S:** Preferred Reporting Items for Systematic Reviews and Meta-Analyses Literature Search Extension
**PRISMA-ScR:** Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews
**RAPIDE:** Regular and Unplanned Care Adaptive Dashboard for Cross-Border Emergencies

*Edited by Stefano Brini; peer-reviewed by Andre Luiz Bigal, Najmeh Namazee; submitted 24.Sep.2025; final revised version received 12.Mar.2026; accepted 12.Mar.2026; published 30.Apr.2026*

*Please cite as:*
*Sanchez Villalobos N, van Loenen T, Ngongalah L, Connolly MA, Stein ML, Rovers CP, Timen A*
*Hybrid Care Modifications in the Delivery of Nonpandemic Care During the COVID-19 Pandemic: Scoping Review*
*J Med Internet Res 2026;28:e84756*
*URL: https://www.jmir.org/2026/1/e84756*
*doi: 10.2196/84756*