

Implementation and Usefulness of Telemedicine During the COVID-19 Pandemic: A Scoping Review

Journal of Primary Care & Community Health

Volume 11: 1–7

© The Author(s) 2020

Article reuse guidelines:

sagepub.com/journals-permissions

DOI: 10.1177/2150132720980612

journals.sagepub.com/home/jpc



María Alejandra Hincapié¹, Juan Carlos Gallego^{1,2},
Andrés Gempeler² , Jorge Arturo Piñeros^{1,2}, Daniela Nasner²,
and María Fernanda Escobar² 

Abstract

Objectives: Identify and summarize the available literature on the acceleration in the use of telemedicine in the midst of the COVID-19 pandemic, with an aim to provide justification and guidance for its implementation to overcome the limitations associated with the pandemic worldwide. **Methods:** We conducted a scoping review through different search strategies in MEDLINE and Google Scholar to identify the available literature reporting data on implementation and usefulness of various modalities of telemedicine during the current pandemic. We summarized the included studies according to field and mode of implementation in a narrative way. **Results:** We included 45 studies that fulfilled selection criteria. About 38% of the studies were conducted in the United States of America (USA), followed by 15.5% in India and 15.5% in China. Most studies (73%) were cross-sectional studies based on historical records. All publications were written in English with the exception of 1 studied published in Spanish. The majority of reports focused on use of telemedicine for outpatient care, followed by in-hospital care. **Conclusion:** The COVID-19 pandemic has promoted the use of telemedicine, a tool that has transformed the provision of medical services. Several modes of implementation are useful to overcome difficulties for patient care during the pandemic. Its benefits are specific to different fields of medical practice. Such benefits, along with the guidance and reported experiences should invite health systems to work for an effective and comprehensive implementation of telemedicine in various fields.

Keywords

telemedicine, telehealth, COVID-19, SARS-CoV-2, pandemic

Dates received 29 September 2020; revised 19 November 2020; accepted 19 November 2020

Introduction

On March 11, 2020, the emergency committee of the World Health Organization (WHO) declared COVID-19 (coronavirus infectious disease, 2019) caused by SARS CoV-2 virus infection, as a global pandemic that would sooner or later affect all countries of the world.¹ The lack of specific treatments and vaccines has forced management to focus on preventive strategies that reduce viral transmission. In trying to control the spread of the virus worldwide, various public health policies have been implemented, including the use of face masks, correct and frequent hand wash and social distancing, with isolation and quarantine strategies imposed by different governments.¹ This has represented an unprecedented challenge for health services, which have been forced to modify the usual modality of service

provision,² and to transform and focus this opportunity towards progress.³⁻⁵ Through this driving force, medical care has migrated from hospitals to the homes of patients by the strengthening of home care and the implementation of telemedicine,⁶ a first-line tool to confront this pandemic.⁷

Telemedicine has been considered an ideal tool to face this emergency. Globally, for approximately a decade, telemedicine

¹Universidad Icesi, Cali, Colombia

²Fundación Valle del Lili, Cali, Valle del Cauca, Colombia

Corresponding Author:

María Fernanda Escobar, Department of Obstetrics and Gynecology—
High Complexity Obstetric Unit, Fundación Valle del Lili, Carrera 98
No. 18-49, Cali, Valle del Cauca 760032, Colombia.

Email: maria.escobar.vi@fvl.org.co



Creative Commons Non Commercial CC BY-NC: This article is distributed under the terms of the Creative Commons

Attribution-NonCommercial 4.0 License (<https://creativecommons.org/licenses/by-nc/4.0/>) which permits non-commercial use, reproduction and distribution of the work without further permission provided the original work is attributed as specified on the SAGE and Open Access pages (<https://us.sagepub.com/en-us/nam/open-access-at-sage>).

had been gradually implemented. However, restrictive administrative regulations and missing solid legal frameworks had been the compelling reasons behind the slow growth of this type of care. Other limitations can be added to explain the short expansion of telemedicine. Limited economic investment in technological resources for hospitals, and the reluctance to adopt telemedicine by medical providers and by patients themselves, have also played a pivotal role.^{6,8}

The COVID-19 pandemic has promoted and accelerated the implementation of telemedicine.⁹ The objective of this scoping review was to conduct a comprehensive assessment of the utility of telemedicine during this global emergency and to summarize its achievements, with focus on physicians and patients experience with this tool.

Methodology

A scoping review was conducted to identify and summarize the current evidence about the implementation and utility of telemedicine during the COVID-19 pandemic. We selected the methodology of a scoping review because it allows a general and comprehensive approach to the subject.

The search strategy employed is provided in supplemental data Appendix 1. MEDLINE and Google Scholar were the databases used to identify the selected publications. The MESH terms and keywords used to optimize and maximize the search were *COVID-19*, *Telemedicine*, *SARS-CoV-2*, *Coronavirus*. The final date of the search was May 31, 2020.

Inclusion Criteria and Selection Process

The inclusion criteria were applied by 2 obstetrics and gynecology physicians involved in telemedicine research, independently (MH and JG). Disagreements upon the fulfillment of the inclusion criteria were resolved by in-depth discussion until a consensus was reached. The included studies had to directly use, implement or evaluate telemedicine in its different modalities; had to be used as a strategy during the COVID-19 pandemic; and had to report quantitative data on the process of implementation, usefulness and/or evaluation of telemedicine. We limited our search to publications written in English or Spanish, without restriction according to study type or design. We considered published literature and *preprint* literature given the emerging nature of this topic. The titles and abstracts of all search results were reviewed, and finally, the full texts of the selected studies were obtained to determine inclusion. Study protocols were excluded.

Data Extraction

All studies were independently reviewed by the 2 reviewers. After ruling out duplicates, the included studies were reviewed in full text and data was obtained regarding the

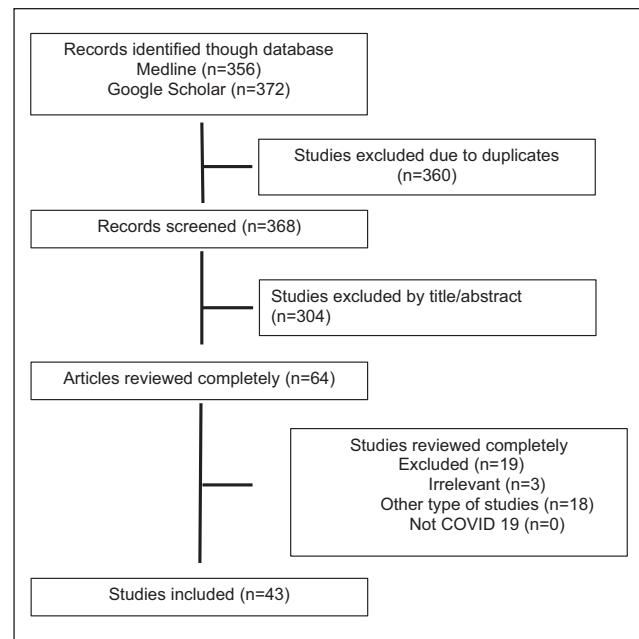


Figure 1. PRISMA flowchart illustrating the selection of studies.

type of publication, type of study, patient characteristics, and telemedicine modality implemented and/or evaluated. Quantitative results aiming at measuring the usefulness of telemedicine after implementation during the COVID-19 pandemic were extracted. The data was summarized in tables and verified by the reviewers. As part of the analysis, we sought to describe and highlight the rationale for different telemedicine modalities implemented and the different fields of application. Subsequently, we analyzed the benefits, difficulties and limitations described across the studies.

Results

The initial search yielded 728 results (MEDLINE, 356; Google Scholar, 372). After eliminating duplicates and applying the selection criteria, 43 articles were included in the review. This process is shown in Figure 1.

Table 1 summarizes the characteristics of the selected articles. A total of 72% of the studies were cross-sectional studies with collection and retrospective analysis. About 99% of the publications were written in English, with a single publication in Spanish. All publications were written in the first semester of 2020, during the months of March, April, and May, and only 1 study was a preprint.

Fields of Implementation

The majority of published studies focused only on 1 field of telemedicine implementation, as shown in Table 2. Few

Table 1. Summary of the Characteristics of the Articles Included in the Review (n=43).

Characteristics	Studies = n (%)
Country	
USA	16 (37.2%)
China	7 (16.2%)
Italia	5 (11.6%)
United Kingdom	4 (9.3%)
Spain	3 (7%)
India	2 (4.6%)
Canada	1 (2.3%)
Ireland	1 (2.3%)
Mexico	1 (2.3%)
Poland	1 (2.3%)
Switzerland	1 (2.3%)
Iran	1 (2.3%)
Study design	
Cross-sectional study	31 (72%)
Survey	7 (16.2%)
Cohort study	5 (11.8%)
Languages	
English	42 (98%)
Spanish	1 (2%)
Month of publication/development	
May, 2020	24 (55.8%)
April, 2020	17 (39.6%)
March, 2020	2 (4.6%)

researchers explored its use in more than 1 area. The most common application of telemedicine identified was for outpatient care (54%), followed by in-hospital care (24%), where it has been applied in emergency and hospitalization scenarios. Some studies focused on the perceptions of physicians and patients after telemedicine implementation (18%). Finally, studies on the usefulness of telemedicine, focused on education during the COVID-19 pandemic (4%).

Supplemental Table 2.1 displays the 27 studies that focused on the implementation of telemedicine in outpatient clinics.^{10,11,12,13-36} In the majority of these studies, 2 technologies were implemented: video calls and telephone calls for consultations. All of the study results positively evaluated the experience and usefulness of telemedicine. Supplemental Table 2.2 shows the 12 publications that focused on in-patient care, evaluating the use of telemedicine in areas such as emergency triage service (7),^{10,22,23,37-40} inpatient care (4)⁴¹⁻⁴⁴ and interhospital consultations (1).¹² Supplemental Table 2.3 summarizes the studies that addressed the perception of physicians and patients after the implementation of telemedicine in different services.^{20,25,29,34,45-49} Supplemental Table 2.4 includes the four studies addressed the topic of telemedicine used for education during the pandemic.^{24,50-52}

Discussion

Our review identified 43 studies that reported on telemedicine implementation and experience in different fields during the current COVID-19 pandemic, reporting quantitative results that provide objectivity to the analysis. The significant number of articles published in such a short period of the year 2020 and the diversity of the countries that have reported their experiences highlight the massive growth that this tool has had. In this way, telemedicine has become a front-line strategy in the fight against SARS-CoV-2 and the pandemic caused by its massive spread.

Implementation of Telemedicine in Outpatient Consultation

One of the fields of greatest implementation of telemedicine, even before the pandemic, is outpatient consultation or virtual ambulatory control. In the search for continuity of medical care, without exposing patients or doctors and avoiding transportation to hospitals and unnecessary contact in waiting rooms via consultations, virtual consultations were adopted. This is clearly reflected in the migration that occurred from face-to-face outpatient management to virtual management developed through video calls or phone calls, otherwise known as teleconsultation.

Our review identified 27 publications that evaluated the usefulness of telemedicine in the outpatient setting. Various hospitals in the United States during the months of March and April experienced a massive migration to virtual care, associated with a decrease of more than 80% of in-person visits.¹⁰ In a report from New York City, the epicenter of the pandemic during those months, the growth of teleconsultations was exorbitant, increasing from less than 50/day to more than 1000/day, representing more than 70% of the ambulatory volume they were previously managed in 4 hospitals.¹⁰

Ambulatory practices of various specialties, in countries such as Italy, the United States and India reported virtual migration percentages between 60% and 95% of their usual practice.¹³⁻¹⁵ Additionally, they reported a satisfactory control of different chronic pathologies, ensuing continuity of care and a quick transition to virtual care through the use of electronic medical.

Implementation of Telemedicine in In-Patient Care

The benefits of the implementation of telemedicine can be transferred in the same way to in-hospital care, as reported in 12 of the selected publications. In emergency services, so-called “forward triage” is a concept that has been specifically designed for crisis scenarios such as viral epidemics and catastrophes. It is defined as the process of determining

Table 2. Articles Included by Field of Implementation.

Field of implementation	Number of studies	Countries reporting	Type of telemedicine implemented
Out-patient consultation	27	USA, China, Poland, Spain, Italy, Canada, UK, India	Video call and phone call
Inpatient care: emergency triage, hospitalization, and interhospital consultation	12	USA, China, Italy, UK, Iran	Multimodal: video call, phone call, and mobile application
Patient and physician satisfaction	9	USA, Mexico, UK, Ireland, India	Video call and phone call
Education	4	USA, Switzerland, China	Video call, video conference

a patient's condition before the patient arrives at the emergency department.⁸ Through a 24/7 service in which, via video calls- preferably between doctors and patients-, symptoms and epidemiological links are evaluated and, according to a medical evaluation, further care is provided. In New York, during the months of March and April in the NYU Langone Health (NYULH) system, emergency forward triage was the first telemedicine service that showed exponential growth. Over the course of 15 days, there was an increase from 82 virtual consultations to 1336, of which 55% involved symptoms suggestive of COVID-19; at 6 weeks, they had more than 16000 emergency consults related to COVID-19.¹⁰ Through video calls, they determined which patients were at high risk of deterioration and required emergency referral, and which patients could continue remote home management, avoiding unnecessary visits, which reduced the number of individuals in the emergency department and makes resource allocation more efficient.

Another application of telemedicine for in-patient care is as a tool for daily follow-up of hospitalized patients, allowing medical rounds via video calls. To avoid direct contact and nosocomial contagion, patients are isolated with an electronic device.⁴ Additionally, the use of personal protective equipment (PPE) was minimized by avoiding direct contact.⁴¹

Likewise, telemedicine allows virtual consultations between hospitals, an especially useful modality when facing a new and unknown entity such as COVID-19, because it allows constant communication between institutions and opens the possibility of contacting experts to guide and counsel medical and/or administrative decisions. This represents an important gain for rural areas, even more so in times of transportation restrictions.⁵³

Acceptance of Telemedicine Implementation

The various applications have allowed the implementation of telemedicine in a comprehensive manner in different health services, which translates into multiple benefits for the general community. This has been reflected in the interest of the general population in this form of health care. In the United

States, through quantification of the volume of searches on Google, researchers found that as COVID-19 cases increased, the number of searches and interest in telemedicine increased, with a high correlation ($r=0.948$, $P < .001$).⁴⁵

Within the institutions that have implemented telemedicine, this tool has been widely accepted by users and patients, as shown in different evaluations and satisfaction surveys. This shows that the use of telemedicine translates to a high degree of satisfaction by users, even more so when it facilitates consultations for many patients who must travel long distances to receive a medical evaluation by a specialist.³⁴

Regarding acceptance, the perception of health personnel should be also be measured, for in the case of a low approval rate efficiency could decrease, as would implementation of telemedicine over time. In Ireland, ninety-two percent of the psychiatrists surveyed reported a reduction in diagnostic confidence by not being able to evaluate the patient's nonverbal language. These important aspects must be taken into account to achieve success in the implementation of telemedicine because the physician plays fundamental role. Transitioning from telephone consultations to video consultations would improve the acceptance of this modality by psychiatrists.⁴⁹

Limitations and Strengths

Our search was limited to articles published until May 31, 2020, and due to the rapid advancement of information on this topic, new useful information may arise for the implementation of telemedicine services in the short term. Furthermore, despite the rigorous search strategy, there may be other unidentified studies. Our search was exhaustive and included gray literature, trying to cover a wide range of evidence worldwide.

Among the strengths of our review is that quantitative results were identified to support telemedicine implementation. By focusing on the 43 studies that reported quantitative data, we guaranteed objectivity in our analyses. Similarly, we classified and analyzed the publications according to the field in which telemedicine was used or evaluated, which allowed us to generate a comprehensive and complete

review of the subject useful for many actors and stakeholders in the healthcare provision sector worldwide.

Conclusion

The COVID-19 pandemic has had a significant global impact on the provision of healthcare. The need for implementation of digital technologies such as telemedicine has never been more relevant.⁵⁴ The various applications and benefits presented make telemedicine probably, as discussed in Hollander and Carr⁵⁵, a highly useful, if not essential, strategy to face this pandemic. However, accessing these benefits requires comprehensive logistics to ensure successful implementation. In Latin America, the hospital infrastructure is not as robust and homogeneous at all levels, as is in North America or Europe. Hospitals in low and medium income countries continue to be concentrated in large cities, and few have the comprehensive level of expertise, technology and resources needed, which can hinder telemedicine implementation, mainly in rural areas.⁵⁶

Similarly, to ensure maximum impact and proper functioning of telemedicine, it must be fully integrated into health systems. For this, changes must be generated through regulations and policies that include this new modality of service provision so that it is authorized by insurers. Global Health Intelligence (GHI), in a Webinar conducted on April 23, 2020, reviewed the penetration of telemedicine in Latin America. Among the main obstacles identified, is the lack of political support and the lack of an understanding of the applications and usefulness of telemedicine.⁵⁷ This scoping review is also intended as a call to create awareness of the potential solutions that telemedicine provides for many difficult situations in health care provision and community well being during the COVID-19 pandemic.

The COVID-19 pandemic will probably be a landmark for telemedicine history. Our review shows that this pandemic has transformed the provision of medical services, with applications for telemedicine in various fields of medical practice. Health systems are faced with an unprecedented opportunity to learn from the current situation and draw lessons for the future. To enable low and medium-income countries to widely rely on this tool, more information is needed regarding costs and necessary resources to ensure effective implementation.


Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

ORCID iDs

Andrés Gempeler  <https://orcid.org/0000-0001-9217-9500>

María Fernanda Escobar  <https://orcid.org/0000-0002-1441-0890>

Supplemental Material

Supplemental material for this article is available online.

References

1. World Health Organization. Coronavirus disease (COVID-19) pandemic. Accessed May 25, 2020. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019>.
2. Smith AC, Thomas E, Snoswell CL, et al. Telehealth for global emergencies: Implications for coronavirus disease 2019 (COVID-19). *J Telemed Telecare*. March 2020;26:309-313.
3. Bashshur R, Doarn CR, Frenk JM, Kvedar JC, Woolliscroft JO. Telemedicine and the COVID-19 pandemic, lessons for the future. *Telemed e-Health*. 2020;26:571-573.
4. Schwamm LH, Erskine A, Licurse A. A digital embrace to blunt the curve of COVID19 pandemic. *npj Digit Med*. 2020;3:64.
5. Ohannessian R, Duong TA, Odone A. Global telemedicine implementation and integration within health systems to fight the COVID-19 pandemic: a call to action. *JMIR Public Heal Surveill*. 2020;6:e18810.
6. Dorsey ER, Topol EJ. Telemedicine 2020 and the next decade. *Lancet*. 2020;395:859.
7. Vidal-Alaball J, Acosta-Roja R, Pastor Hernández N, et al. Telemedicine in the face of the COVID-19 pandemic. *Atención Primaria*. 2020;52:418-422.
8. Moazzami B, Razavi-Khorasani N, Dooghaie Moghadam A, Farokhi E, Rezaei N. COVID-19 and telemedicine: immediate action required for maintaining healthcare providers well-being. *J Clin Virol*. 2020;126:104345.
9. Webster P. Virtual health care in the era of COVID-19. *Lancet*. 2020;395:1180-1181.
10. Mann DM, Chen J, Chunara R, Testa PA, Nov O. COVID-19 transforms health care through telemedicine: evidence from the field. *J Am Med Inform Assoc*. 2020; 27:1132-1135.
11. Hernando-Requejo V, Huertas-González N, Lapeña-Motilva J, Ogando-Durán G. The epilepsy unit during the COVID-19 epidemic: The role of telemedicine and the effects of confinement on patients with epilepsy. *Neurologia*. 2020;35:274-276.
12. Hong Z, Li N, Li D, et al. Telemedicine During the COVID-19 Pandemic: Experiences From Western China. *J Med Internet Res*. 2020;22:e19577.
13. Nair AG, Gandhi RA, Natarajan S. Effect of COVID-19 related lockdown on ophthalmic practice and patient care in India: results of a survey. *Indian J Ophthalmol*. 2020;68:725-730.
14. Blue R, Yang AI, Zhou C, et al. Telemedicine in the era of COVID-19: a neurosurgical perspective. *World Neurosurg*. 2020;139:549-557.
15. Hemingway JF, Singh N, Starnes BW. Emerging practice patterns in vascular surgery during the COVID-19 pandemic. *J Vasc Surg*. 2020;72:396-402.

16. Fatyga E, Dziegielewska-Gęsiak S, Wierzgoń A, Stołtny D, Muc-Wierzgoń M. The coronavirus disease 2019 pandemic: telemedicine in elderly patients with type 2 diabetes. *Polish Arch Intern Med.* 2020;130:452-454.
17. Luciani LG, Mattevi D, Cai T, Giusti G, Proietti S, Malossini G. Teleurology in the time of covid-19 pandemic: here to stay? *Urology.* 2020;140:4-6.
18. Borchert A, Baumgarten L, Dalela D, et al. Managing urology consultations during covid-19 pandemic: application of a structured care pathway. *Urology.* 2020; 141:7-11.
19. Compton M, Soper M, Reilly B, et al. A Feasibility study of urgent implementation of cystic fibrosis multidisciplinary telemedicine clinic in the face of covid-19 pandemic: single-center experience. *Telemed J e-health.* 2020;26:978-984.
20. Tenforde AS, Iaccarino MA, Borgstrom H, et al. Feasibility and high quality measured in the rapid expansion of telemedicine during COVID-19 for sports and musculoskeletal medicine Practice. *PM R.* 2020;12:. doi:10.1002/pmrj.12422
21. Punia V, Nasr G, Zagorski V, et al. Evidence of a rapid shift in outpatient practice during the COVID-19 pandemic using telemedicine. *Telemed J e-health.* 2020; 26:1301-1303.
22. Schirinzì T, Cerroni R, Di Lazzaro G, et al. Self-reported needs of patients with Parkinson's disease during COVID-19 emergency in Italy. *Neurol Sci.* 2020;41:1373-1375.
23. 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.* 2020;17.
24. Buckstein M, Skubish S, Smith K, Braccia I, Green S, Rosenzweig K. Experiencing the surge: report from a large new york radiation oncology department during the COVID-19 pandemic. *Adv Radiat Oncol.* 2020;5:610-616.
25. Lees CW, Regueiro M, Mahadevan U. Innovation in IBD Care during the COVID-19 Pandemic: results of a global telemedicine survey by the international organization for the study of inflammatory bowel disease. *Gastroenterology.* 2020; 159: 805-808.
26. Lam PW, Sehgal P, Andany N, et al. A virtual care program for outpatients diagnosed with COVID-19: a feasibility study. *C Open.* 2020;8:E407-E413.
27. Pérez Sust P, Solans O, Fajardo JC, et al. Turning the crisis into an opportunity: digital health strategies deployed during the COVID-19 outbreak. *JMIR Public Heal Surveill.* 2020;6:e19106.
28. Indini A, Aschele C, Cavanna L, et al. Reorganisation of medical oncology departments during the novel coronavirus disease-19 pandemic: a nationwide Italian survey. *Eur J Cancer.* 2020;132:17-23.
29. 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.* 2020;9.
30. Salzano A, D'Assante R, Stagnaro FM, et al. Heart failure management during COVID-19 outbreak in Italy. Telemedicine experience from a heart failure university tertiary referral centre. *Eur J Heart Fail.* May 2020;22:1048-1050.
31. Zhao Y, Wei L, Liu B, Du D. Management of transplant patients outside hospital during covid-19 epidemic: a chinese experience. *Transpl Infect Dis.* 2020:e13327.
32. Roy B, Nowak RJ, Roda R, et al. Teleneurology during the COVID-19 pandemic: a step forward in modernizing medical care. *J Neurol Sci.* 2020;414:116930.
33. Luengo-Alonso G, Pérez-Tabernero FG-S, Tovar-Bazaga M, Arguello-Cuenca JM, Calvo E. Critical adjustments in a department of orthopaedics through the COVID-19 pandemic. *Int Orthop.* 2020:1-8.
34. Shenoy P, Ahmed S, Paul A, Skaria TG, Joby J, Alias B. Switching to teleconsultation for rheumatology in the wake of the COVID-19 pandemic: feasibility and patient response in India. *Clin Rheumatol.* 2020:1-6.
35. Yellowlees P, Nakagawa K, Pakyurek M, Hanson A, Elder J, Kales HC. Rapid conversion of an outpatient psychiatric clinic to a 100% virtual telepsychiatry clinic in response to COVID-19. *Psychiatr Serv.* 2020:appips202000230.
36. Wosik J, Fudim M, Cameron B, et al. Telehealth transformation: COVID-19 and the rise of virtual care. *J Am Med Inform Assoc.* 2020;27:957-962.
37. Khairat S, Meng C, Xu Y, Edson B, Gianforcaro R. Interpreting COVID-19 and virtual care trends: cohort study. *JMIR public Heal Surveill.* 2020;6:e18811.
38. Gong K, Xu Z, Cai Z, Chen Y, Wang Z. Internet hospitals help prevent and control the epidemic of COVID-19 in China: multicenter user profiling study. *J Med Internet Res.* 2020;22:e18908.
39. Yang Y, Zhou Y, Liu X, Tan J. Health services provision of 48 public tertiary dental hospitals during the COVID-19 epidemic in China. *Clin Oral Investig.* 2020;24:1861-1864.
40. 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.* 2020;42:1674-1680.
41. Jones MS, Goley AL, Alexander BE, Keller SB, Caldwell MM, Buse JB. Inpatient transition to virtual care during COVID-19 pandemic. *Diabetes Technol Ther.* 2020;22:444-448.
42. Ren X, Zhai Y, Song X, Wang Z, Dou D, Li Y. The application of mobile telehealth system to facilitate patient information presentation and case discussion. *Telemed J e-health.* 2020;26:725-733.
43. Davarpanah AH, Mahdavi A, Sabri A, et al. Novel screening and triage strategy in Iran during deadly coronavirus disease 2019 (COVID-19) epidemic: value of humanitarian Teleconsultation service. *J Am Coll Radiol.* 2020;17:734-738.
44. Zhai Y, Wang Y, Zhang M, et al. From isolation to coordination: how can telemedicine help combat the COVID-19 outbreak? *medRxiv.* January 2020:2020.02.20.20025957. doi:10.1101/2020.02.20.20025957
45. Hong Y-R, Lawrence J, Williams DJ, Mainous A III. Population-level interest and telehealth capacity of us hospitals in response to covid-19: cross-sectional analysis of google search and national hospital survey data. *JMIR Public Heal Surveill.* 2020;6:e18961.

46. Rogers BG, Coats CS, Adams E, et al. Development of telemedicine infrastructure at an lgbtq+ clinic to support hiv prevention and care in response to COVID-19, Providence, RI. *AIDS Behav.* 2020;1-5.
47. Perez-Alba E, Nuzzolo-Shihadeh L, Espinosa-Mora JE, Camacho-Ortiz A. Use of self-administered surveys through QR code and same center telemedicine in a walk-in clinic in the era of COVID-19. *J Am Med Inform Assoc.* 2020;27:985-986.
48. Layfield E, Triantafillou V, Prasad A, et al. Telemedicine for head and neck ambulatory visits during COVID-19: evaluating usability and patient satisfaction. *Head Neck.* 2020;42:1681-1689.
49. Olwill C, Mc Nally D, Douglas L. Psychiatrist experience of remote consultations by telephone in an outpatient psychiatric department during the COVID-19 pandemic. *Ir J Psychol Med.* 2020;1-8.
50. Zamberg I, Manzano S, Posfay-Barbe K, Windisch O, Agoritsas T, Schiffer E. A mobile health platform to disseminate validated institutional measurements during the COVID-19 outbreak: utilization-focused evaluation Study. *JMIR Public Heal Surveill.* 2020;6:e18668.
51. Rasouli JJ, Shin JH, Than KD, Gibbs WN, Baum GR, Baaj AA. Virtual spine: a novel, international teleconferencing program developed to increase the accessibility of spine education during the COVID-19 pandemic. *World Neurosurg.* 2020;140:e367-e372.
52. Zhou T, Huang S, Cheng J, Xiao Y. The distance teaching practice of combined mode of massive open online course micro-video for interns in emergency department during the covid-19 epidemic period. *Telemed J e-health.* 2020;26:584-588.
53. Nagata JM. Rapid Scale-up of telehealth during the COVID-19 pandemic and implications for subspecialty care in rural areas. *J Rural Heal.* Published online April 3, 2020. doi:10.1111/jrh.12433
54. Javaid M, Haleem A, Vaishya R, Bahl S, Suman R. Industry 4.0 technologies and their applications in fighting COVID-19 pandemic. *Diabetes Metab Syndr Clin Res Rev.* 2020;14:2-5.
55. Hollander JE, Carr BG. Virtually perfect? Telemedicine for Covid-19. *N Engl J Med.* 2020;382:1679-1681.
56. Grange ES, Neil EJ, Stoffel M, et al. Responding to COVID-19: The UW medicine information technology services experience. *Appl Clin Inf.* 2020;11:265-275.
57. Intelligence GH. Telemedicine in Latin America: gauging its potential during the COVID-19 crisis and beyond. *Webinar.*