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Telemedicine Application and Assessment During the COVID-19 Pandemic

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Abstract

Telemedicine had a significant increase during the novel coronavirus (COVID-19) pandemic, which is still on course. In different parts of the world, healthcare units had to adapt their practice, and several assistance services were remotely delivered. The present study is a systematic review of studies that had applied telemedicine during the COVID-19 pandemic and had assessed its effects on the delivered care. We have covered a 1-year period in order to assess the initiatives developed during the pandemic time and that had already evaluated the effects of the telemedicine program that had been implemented. All the analyzed studies evidenced a positive effect of telemedicine in the treatment of different conditions, including chronic diseases, mental disorders and oncologic diseases. The real impact of the COVID-19 pandemic in the healthcare sector is still to be fully understood, and telemedicine implementation in different areas is one of its positive legacies.

Keywords:

Telemedicine; COVID-19; Pandemics.

Introduction

Telehealth is defined by the World Health Organization as the "delivery of health care services, where patients and providers are separated by distance" [1]. Telemedicine was initially created to provide healthcare to people living in remote areas, with lack of health services or even with few resources to reach a medical center [2], but it has spread and offered diverse services aiming to facilitate people's life in different ways. A systematic review of more than 2000 studies regarding patients' satisfaction with telehealth evidenced as the main reasons for its effectiveness were improvement of outcomes, preferred modality and ease of use [3].

During the COVID-19 pandemic there was a substantial increase in telemedicine [2]. In virtually all parts of the world measures of social distancing were adopted, along with other actions, in order to prevent infection and decrease the epidemic curves [4]. Hence, health services were adapted to deliver remote care, others have expanded already existing telehealth facilities, and telemedicine have expanded as never before.

The aim of this study is to analyze the applications of telemedicine during the COVID-19 pandemic, through a systematic review of studies that had already evaluated the results of their implemented programs.

Methods

A systematic review of the literature was conducted in the PubMed/Medline search database, using the terms "telemedicine" and "COVID-19", according to PRISMA [5]. The main inclusion criteria were: to have scientific relevance and to be according to the search query - "How was telemedicine application and its feasibility during the COVID-19 pandemic?". Besides, the studies prioritized were those that had at least one answer to the proposed question. We had included in the final analysis the papers that had implemented the telemedicine and had already assessed its effects on patients' outcomes, perceptions or other aspects that had been analyzed.

We selected original articles published between April, 2020 and April, 2021, as the subject of the study is related to the COVID-19 pandemic. In the end, 8 articles were selected for the qualitative analysis. The detailed selection process is represented in Figure 1.

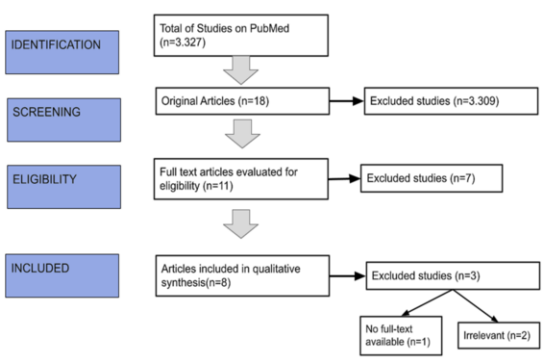

Figure 1– PRISMA flow diagram of studies' screening and selection

Results

The application of telemedicine on psychiatric diseases, on a randomized controlled trial, was shown to have high feasibility, apart from 91% reported satisfaction after a support by text messages [6]. In another study, also on patients with mental diseases, the therapists believe that the psychomotor therapy proved to be easier than expected, besides the activities that have shown to be well received by the patients [7].

When discussing chronic disorders, studies about fibromyalgia showed that although having their treatment interrupted due to COVID-19, a total of 89.9% joined the telerehabilitation program and showed some significantly positive outcomes.[8] In the study by Tarolli et al. [9], patients in addition to the chronic disease, an average of 64 years old, the results were similar, with more than 90% indicating satisfaction about the entire online experience and 76% indicating that inclusion of remote visits would increase the participation in future trials [9].

The study by Philip et al. [10] recruited 18 participants, which were individuals with COPD. These have been separated into 2 groups: 9 treated with usual care and the other 9 treated with Singing for Lung Health (SLH). The participants started attending face-to-face sessions before changing to the online format. The trial lasted 12 weeks, and, for the SLH arm, there has been a mean attendance to the sessions of 69% (90% of face-to-face sessions, 53% of online sessions). Comparing the online with the face-to-face-sessions, there were some limitations for the virtual model, such as the privacy physical space, the internet connection and the technological skills required. However, the online sessions have been enjoyed by the majority of participants, in spite of their preference for the face-to-face treatment. Many participants related that the online delivery overcame some obstacles seen in attending physical sessions, like the geographic location and the risk of infections [10].

Ben-Arye et al. [11] implemented an online Integrative Oncology (IO) treatment program during the pandemic. The six-week period of tests involved 56 Integrative Oncology (IO) patients, from which 23 attended online sessions and, therefore, underwent a total of 169 online interventions. The online group had higher rates of breast cancer ($p = 0.022$) and lower rates of metastatic disease ($p = 0.01$), and adherent patients were found to be more likely to choose the online treatment (100%) than the non-adherent (65%). Besides, patients with metastatic disease were less likely to choose the online model (odds ratio 0.194; 95% CI 0.058–0.657) [11].

On the matter of remote clinical trials, a study from Hill et al. [12] showed that based on delivery of supplies for the research, continuous support and diverse ways of data return, the trial managed to adapt to COVID-19 limitations in a short span of time and achieve a return rate for usability assessment instruments in approximately 50% of the initial population.

Discussion

Telemedicine implementation had positive evaluation in all the analyzed studies, both by patients and healthcare professionals. The COVID-19 pandemic has changed several aspects of our world, and the healthcare sector was massively impacted, forcing to adapt to the new reality. Remote healthcare delivery, which characterizes telehealth/telemedicine, was one of the adaptations most observed during this pandemic. In the present systematic review, we had initially found more than 3,000 papers published linking telemedicine and COVID-19, and after our study criteria, aiming to analyze the implementation and assessment of telemedicine services during the pandemic, we had included 8 studies. It is important to clarify that we had chosen to make a selection of studies that had reached clear conclusion regarding the analysis of the implemented telemedicine service, so it resulted in this small number of studies in the final analysis of this review.

Regarding mental disorders, COVID-19 pandemic had significantly increased its incidence and worsening of existing disorders, making it necessary to provide psychological/psychiatric care [13, 14]. It is even expected an additional increase in mental disorders in the post-COVID-19 pandemic [13]. In the studies analyzed here, the online implemented interventions were effective in achieving positive results for patients' improvement, even with text message [6, 7].

Chronic diseases, besides representing the main risk factors for severe COVID-19 and its complications, requires maintenance of care, and telemedicine is a good way of doing it [15, 16]. The present review evidence that different conditions can be treated by remote care, including rehabilitation programs, with positive results and good patients' satisfaction level [8].

Oncology is another area highly impacted by the COVID-19 pandemic, with high number of patients having delayed diagnosis and others having problems with treatment maintenance [17, 18]. In the analyzed studies, there were good examples of how to provide remote care for patients, preparing them for future surgery or helping them cope with the disease, and this kind of support was evidenced to be very important to them [11, 19].

These above-mentioned areas are not the only branches of medicine that were affected by this pandemic, and the effects are still on the way. There are currently studies on the so-called "post-COVID" syndrome [20, 21], which will require multi-disciplinary attention, and telehealth is certainly a tool that can be applied in different clinical settings.

Conclusions

Telemedicine is increasingly being implemented all over the world, and the COVID-19 pandemic has accelerated its adoption by several healthcare services. This systematic review evidenced benefic effect of telemedicine application during the pandemic in different areas of medicine, including chronic diseases, mental disorders, oncology, and also as a way of remotely conducting clinical trials. Innovation and adaptation may be the key for success in healthcare, as for survival it is already known since Charles Darwin's work.

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Table 1– Studies on Telemedicine in a COVID-19 pandemic context, April 2020 to April 2021

Main Author, Year	Study Model	Main Method	Study Objective	Primary Conclusion
Ben-Zeev, 2020 [6]	Randomized Controlled Trial	Text Messages	Implement and evaluate a "mobile intervention" seeking the recovery of psychiatric patients, an alternative in times of COVID-19	The intervention via text message proved to be viable, safe and acceptable, in addition to being clinically promising. Therefore, the study proved that a online support is crucial in supporting continuity of treatment
van Dijk, 2020 [7]	Clinical Trial	Over-the-phone instructions	Evaluate an online therapy program for geriatric patients due to social isolation	Positive results have been observed in cases where face-to-face treatment is not available and digital is sufficient for online therapy
Hernando-Garijo, 2021 [8]	Randomized Controlled Trial	Use of video with aerobic exercises and borg scale	To analyze the effects of the Telerehabilitation Program on physical and mental symptoms in women with fibromyalgia	The use of the Telerehabilitation Program has proven to be very effective in reducing pain in patients with fibromyalgia, allowing them to feel less pain and have a sense of satisfaction, due to the modification of neurotransmitter production caused by aerobic exercise.
Tarolli, 2020 [9]	Clinical Trial	Remote Video-Based Visits	Analyse the possibility and application of making remote visits of individuals with Parkinson disease in times of pandemic	Remote visits are reliable for individuals with early and untreated Parkinson disease
Philip, 2020 [10]	Randomized Controlled Trial	Interviews and analysis	Evaluate if Singing for Lung Health (SLH) can be delivered online for people with chronic obstructive pulmonary disease (COPD)	Online singing sessions may produce clinically significant outcomes and provide health and well-being for people with COPD
Ben-Arye, 2021 [11]	Controlled Clinical Trial	Online Integrative Oncology (IO) sessions	Examine the feasibility of an online treatment program developed by an Integrative Oncology (IO) service in northern Israel during the COVID-19 lockdown	Online IO treatments are feasible and can be provided to oncology patients, despite the many challenges to overcome in this type of treatment.
Hill, 2021 [12]	Clinical Trial	Delivery of "care packages" that contained everything necessary for the trial	Deliver and conduct remotely testing for an mHealth technology intervention for older adult participants that were already enrolled in a clinical trial of the technology in-person prior to the COVID-19 pandemic	The study successfully demonstrated the feasibility of remotely delivering and assessing technology interventions in older adults participants during pandemic and future circumstances as an alternative to face-to face interactions
Sell, 2020 [19]	Clinical Trial	Virtual health-optimizing interventions	Report a home-based virtual prehabilitation program for patients who are undergoing neoadjuvant therapy	A structured virtual prehabilitation program for cancer patients during COVID-19 pandemic can prepare them well for future surgery

References

[1] World Health Organization. Global Health Observatory (GHO) data. Telehealth. Analysis of third global survey on eHealth based on the reported data by countries, 2016. Available at https://www.who.int/gho/goe/telehealth/en/. Accessed on 20th April 2021.

[2] S. Romanick-Schmiedl, and G. Raghu. Telemedicine – maintaining quality during times of transition. *Nat. Rev. Dis. Primers.* **6** (2020) 45. doi: 10.1038/s41572-020-0185-x

[3] C.S. Kruse, N. Krowski, B. Rodriguez, L. Tran, J. Vela, and M. Brooks. Telehealth and patient satisfaction: a systematic review and narrative analysis. *BMJ Open.* **7** (2017) e016242. doi: 10.1136/bmjopen-2017-016242.

[4] D.K. Chu, E.A. Akl, S. Duda, K. Solo, S. Yaacoub, H.J. Schünermann, and COVID-19 Systematic Urgent Review Group Effort (SURGE) study authors. Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: a systematic review and meta-analysis. *Lancet.* **395** (2020) 1973-1987. doi: 10.1016/S0140-6736(20)31142-9.

[5] D. Moher, A. Liberati, J. Tetzlaff, D.G. Altman, and PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med.* **6** (2009) e1000097. doi: 10.1371/journal.pmed.1000097.

[6] D. Ben-Zeev, B. Buck, S. Meller, W.J. Hudenko, and K.A. Hallgren. Augmenting Evidence-Based Care With a Texting Mobile Interventionist: A Pilot Randomized Controlled Trial. *Psychiatr. Serv.* **71** (2020) 1218-1224. doi: 10.1176/appi.ps.202000239.

[7] S.D.M. van Dijk, R. Bouman, E.H. Folmer, R.C. den Held, J.E. Warringa, R.M. Marijnissen, and R.C.O. Voshaar. (Vi)-rushed Into Online Group Schema Therapy Based Day-Treatment for Older Adults by the COVID-19 Outbreak in the Netherlands. *Am. J. Geriatr. Psychiatr.* **28** (2020) 983-988. doi: 10.1016/j.jagp.2020.05.028.

[8] I. Hernando-Garijo, L. Ceballos-Laita, M.T. Mingo-Gómez, R. Medrano-de-la-Fuente, E. Estébanez-de-Miguel, M.N. Martínez-Pérez, and S. Jiménez-Del-Barrio. Immediate Effects of a Telerehabilitation Program Based on Aerobic Exercise in Women with Fibromyalgia. *Int. J. Environ. Res. Public Health.* **18** (2021) 2075. doi: 10.3390/ijerph18042075.

[9] C.G. Tarolli, K. Andrzejewski, G.A. Zimmerman, M. Bull, S. Goldenthal, P. Auinger, M. O'Brien, E.R. Dorsey, K. Biglan, and T. Simuni. Feasibility, Reliability, and Value of Remote Video-Based Trial Visits in Parkinson's Disease. *J. Parkinsons. Dis.* **10** (2020) 1779-1786. doi: 10.3233/JPD-202163.

[10] K.E. Philip, A. Lewis, E. Jeffery, S. Buttery, P. Cave, D. Cristiano, A. Lound, K. Taylor, W.D. Man, D. Fancourt, M.I. Polkey, and N.S. Hopkinson. Moving singing for lung health online in response to COVID-19: experience from a randomised controlled trial. *BMJ Open. Respir. Res.* **7** (2020) e000737. doi: 10.1136/bmjresp-2020-000737.

[11] E. Ben-Arye, O. Gressel, E. Ben-Arye, and N. Samuels. Feasibility of an Online Integrative Oncology Treatment Program During COVID-19. *J. Pain. Symptom. Manage.* **61** (2021) e1-e3. doi: 10.1016/j.jpainsymman.2020.11.009.

[12] J.R. Hill, A.B. Harrington, P. Adeoye, N.L. Campbell, and R.J. Holden. Going Remote-Demonstration and Evaluation of Remote Technology Delivery and Usability Assessment With Older Adults: Survey Study. *JMIR. Mhealth. Uhealth.* **9** (2021) e26702. doi: 10.2196/26702.

[13] J.J. Mari, and M.A. Oquendo. Mental health consequences of COVID-19: the next global pandemic. *Trends. Psychiatry. Psychother.* **42** (2020) 219-220. doi: 10.1590/2237-6089-2020-0081.

[14] M. Taquet, S. Luciano, J.R. Geddes, and P.J. Harrison. Bidirectional associations between COVID-19 and psychiatric disorder: retrospective cohort studies of 62 354 COVID-19 cases in the USA. *Lancet. Psychiatry.* **8** (2021) 130-140. doi: 10.1016/S2215-0366(20)30462-4.

[15] N. Martini, C. Piccinni, A. Pedrini, and A. Maggioni. CoViD-19 e malattie croniche: conoscenze attuali, passi futuri e il proggeto MaCroScopio. *Recenti. Prog. Med.* **111** (2020) 198-201. doi: 10.1701/3347.33180.

[16] K. Danhieux, V. Buffel, A. Pairon, A. Benkheil, R. Remmen, E. Wouters, and J. van Olmen. The impact of COVID-19 on chronic care according to providers: a qualitative study among primary care practices in Belgium. *BMC Fam. Pract.* **21** (2020) 255. doi: 10.1186/s12875-020-01326-3.

[17] C.C. Sternberg, T.L. Andrade, A.P.G.A.V. Nova, B.V. Fiscina, A.P.L. Fernandes, C.D. Alves, A.B. Alves, L.O. Hizumi, S.S.N. Dias, P. Nobre, A. Calabrich, A. Coutinho, and A.P. Silva. Oncology practice during COVID-19 pandemic: a fast response is the best response. *Rev. Assoc. Med. Bras.* **66** (2020) 338-344. doi: 10.1590/1806-9282.66.3.338.

[18] M.L. Disis. Oncology and COVID-19. *JAMA.* **324** (2020) 1141-1142. doi: 10.1001/jama.2020.16945.

[19] N.M. Sell, J.K. Silver, S. Rando, A.C. Draviam, D.S. Mina, and M. Qadan. Prehabilitation Telemedicine in Neoadjuvant Surgical Oncology Patients During the Novel COVID-19 Coronavirus Pandemic. *Ann. Surg.* **272** (2020) e81-e83. doi: 10.1097/SLA.0000000000004002.

[20] M. Kamal, M.A. Omirah, A. Hussein, and H. Saeed. Assessment and characterisation of post-COVID-19 manifestations. *Int. J. Clin. Pract.* (2020) Sep 29 e13746. doi: 10.1111/ijcp.13746. Online ahead of print.

[21] P. Garg, U. Arora, A. Kumar, and N. Wig. The "post-COVID" syndrome: How deep is the damage? *J. Med. Virol.* **93** (2021) 673-674. doi: 10.1002/jmv.26465

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