Trends and Shifts in Swedish Telemedicine Consultations during pre-COVID, COVID, and post-COVID seasons: A Retrospective Observational Study

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Abstract

Background: Background
The telemedicine landscape has evolved profoundly in recent time, bridging the gap between healthcare providers and patients, particularly in the face of modern challenges such as the COVID-19 pandemic.

Objective: Objective
This study seeks to explore the Swedish telemedicine landscape in terms of primary patient symptoms for teleconsultation, the pattern of telemedicine use in the periods before COVID-19, during COVID-19, and post- COVID-19; including the primary care utilization dynamics with respect to the teleconsultations done.

Methods: Methods
Secondary data was used in the observational retrospective study, and the study population consisted of Swedish residents, who had online meeting consultations. Telemedicine consultations were divided by text and video consultations; the period of analysis ranged from November 2018 to June 2023. The statistical methods used for the data analysis included descriptive analysis, two-way cross tabulations, and the generalized linear model.

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During the pandemic, the number of teleconsultations concerning general, unspecified symptoms increased in comparison to the rest of the analysed symptoms, signaling the change in care-seeking behaviour under epidemiological pressure. General health-related issues were the most pronounced symptom across all periods: 186.9/1000 consultations during (pre-COVID-19), 1264.6/1000 consultations (during COVID), and 319.2/1000 consultations (post-COVID-19). There was no significant main effect of COVID period on the number of telemedicine consultation meetings ($F(2) = 1.653$, $p = .377$). The interaction effect between meeting style and period was statistically significant ($F(2) = 14.723$, $p = .000$).

Conclusions: Conclusions
The findings support the idea that the COVID-19 pandemic had a significant impact on the use of telemedicine, increasing its role in general health consultations and acute conditions. This trend indicates a preference for personal engagements and an interactive mode of communication in patient care. Video consultations were more prominent because of the importance of bi-directional communication. The study suggests the transformation of patterns of demand for healthcare and the necessity for healthcare systems to respond to these changes. Clinical Trial: Not applicable

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ABSTRACT

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Trial registration: Not applicable.

Keywords: Telemedicine, COVID-19, Healthcare Consultation, Sweden, Digital Health, Patient Behavior, Video Consultation, Telehealth Trends.

Introduction

Despite its seeming modernity, the concept of telemedicine dates back to the early twentieth century [1,2]. Initially, telemedicine was established as a way to give medical care to patients in remote places utilizing technologies like as radio. However, as technology advanced, telemedicine

had evolved into optimizing sophisticated platforms that featured cutting-edge computing systems and communication technologies [3,4]. Telemedicine is crucial in today's world since it bridges the gap between patients and healthcare providers and offers a realistic alternative to traditional medical consultations [5]. Several studies have proved its efficacy in offering timely interventions and cost-effective solutions; for example, telemedicine has been shown to improve health outcomes and decrease hospitalization rates in patients with chronic illnesses [6-8].

Recent global events have highlighted an increasing trend in the usage of telemedicine. The World Health Organization [9] estimated that more than 60% of its member countries have integrated telemedicine into their health-care systems, demonstrating the technology's growing acceptance and utilization. Likewise, The Precedence Research Market Report [10] reported that the telemedicine industry is anticipated to grow by 17.16% per year between 2022 and 2030, reaching a valuation of USD 225 billion. Telemedicine adoption differs by area; North America has led the way, thanks in part to technological infrastructure and legislative frameworks, but emerging countries are experiencing an increase in telemedicine programs. Notably, telemedicine has played an important role in combating endemic diseases and delivering key healthcare interventions in countries such as Africa and parts of Asia [11].

The development of telemedicine in Sweden has been shaped by a combination of forward-thinking legislation, cutting-edge technology, and a steadfast dedication to patient-centered treatment. With a praiseworthy focus on fair access and high-quality care, Sweden's healthcare system is frequently praised as one of the most extensive and inclusive in the world [12]. With 20% of Sweden's population expected to be over 65 by 2050, the potential burden on healthcare resources is evident [13]; hence, Sweden urgently needs to deploy telemedicine solutions due to its aging population. Telemedicine's capacity to offer remote monitoring and chronic illness treatment lends credence to its potential to be a major player in addressing this demographic shift.

Health systems worldwide, including those in Sweden, faced unprecedented obstacles with the

arrival of the COVID-19 pandemic. Before the pandemic, telemedicine was sufficiently flexible to address a wide range of symptoms and care requirements [14]. The subsequent pandemic period unquestionably indicates that these tendencies not only offer a solid basis but also highlight the ability of telemedicine to adapt and scale in the face of global issues [15]. Telemedicine consultations increased dramatically in the first half of the pandemic, with some healthcare providers reporting an increase of more than 300 percent compared with the same period the year before [16]. While the post-pandemic world grapples with a few challenges, it also stands on the cusp of transformative changes in healthcare delivery. Telemedicine, once in the future, is now very much the present, shaping the trajectory of patient care in ways previously unimagined [17]. As we navigate this new epoch, the confluence of technology, medical expertise, and patient centricity offers a beacon of hope and progress.

The aims of this research are to elaborate on the patients' symptoms that prompted their telemedicine consultation (with respect) and explore the differences, if any during the pre-COVID, COVID, and post-COVID pandemic season. Secondly, to access differences in pattern of consultations of telemedicine during the pre-COVID-19, COVID-19, and post-COVID-19 pandemic season, respectively; and thirdly, to analyze the changes in the primary care utilization of telemedicine and the pattern of changes in the utilization for the pre-COVID, COVID, and post-COVID pandemic seasons, respectively. The unique nature of the COVID-19 pandemic necessitated new patterns of seeking medical attention and the widespread implementation of telemedicine, hence, this study offers useful information and insights regarding the trends and shifts in Swedish telemedicine consultations over time.

Methods

Study Design

An observational retrospective design was used for this study. In a context where controlled

experimentation is not feasible, researchers can observe trends and correlations without interfering with the process [18]. This involved telemedicine consultations formats and the symptoms noted from the consultations during the pre-COVID-19 period of November 2018 to November 2019; the COVID period of December 2019 to July 2022; and the post-COVID-19 period of August 2022 to June 2023.

Data and Population

The population for this study is all residents of Sweden in the periods under study. Data was collected from Kry International AB; a leading health start-up and telemedicine provider who offers insightful data for research purposes and promotes accessible healthcare across several countries, including Sweden, the United Kingdom, France, Germany, Norway, and Spain. Collecting data from Kry involves several stages to ensure reliability and relevance. The primary methodology employed by researchers typically entails obtaining aggregated and anonymized data from Kry's extensive pool of telemedicine consultations. This process involves adhering to strict ethical guidelines and privacy regulations to ensure patient information remains protected.

Kry's datasets offer ample opportunities for analyzing various aspects of telemedicine, such as patient demographics, clinical outcomes, and usage patterns. Kry operates through a mobile application, enabling patients to consult doctors, psychologists, and other healthcare specialists virtually, removing the need for physical appointments.

The data from Kry comprised of the records of text meeting consultations and video meetings consultations; As well as the symptoms diagnosed by the health carers after consultations. For symptoms, Skin rash, poisonous animal bite and acne were categorized as Skin disorders; Sore throat, cold and flu, cough, fever, diarrhea, sinusitis, eye infection were categorized COVID like symptoms; pollen/allergy were categorized as allergy symptoms; Chlamydia, Urinary tract infection and Contraceptives were categorized as Reproductive health related issues; General health, Revisit and Prescription Renewal as General Health related issues; Sleep-disorders; and Thread worms.

Statistical Plan

Descriptive analysis of text and video consultations, pre-, during-, and post-COVID seasons were prepared using bar-charts for a clear graphical overview. Two-way cross tabulations were used to summarize the symptoms across the pre-, during-, and post-COVID seasons. These were used to provide efficient summary and visualization of the trends across diverse time periods and consultations types.

A two-way between-subjects generalized linear model was used to establish significant interaction effects and main effects between the periods and meeting consultation styles. The generalized linear model offers necessary flexibility to this study given the complex nature of healthcare care which involves non-normal distributions; and Tukey's HSD test was used as the post-hoc test to determine the levels of each factor that are significantly different from each other including controlling for Type 1error across multiple comparisons. IBM SPSS 25 was used for the data analysis.

RESULTS

Patients' symptoms that prompted telemedicine consultation

Table 1 shows that the most pronounced symptom across all periods was general health-related issues:186.9/1000 consultations (pre-COVID-19), 1264.6/1000 consultations (during COVID), and 319.2/1000 consultations (post-COVID-19); more general health-related issues were reported during COVID than post-COVID and pre-COVID periods. Other symptoms that prompted telemedicine consultations included skin disorders, COVID-like symptoms, allergies, reproductive health-related issues, sleep disorders, and threadworms. There were more COVID-like symptoms such as sore throat, cold and flu, cough, fever, diarrhea, sinusitis, and eye infection during COVID-19 (314.1/1000 consultations), 110.4/1000 consultations post-COVID, and fewer occurrences pre-COVID (141.4/1000 consultations).

Table 1

Symptoms/per 1000 consultations

	Pre-COVID-19	During COVID-19	Post-COVID-19
Skin disorders	129.4	409.0	95.7
COVID-like symptoms	141.4	378.9	161.0
Allergy	21.6	0.6	14.9
Reproductive health-related issues	41.9	314.1	110.4
General health related issues	186.9	1264.6	319.2
Sleep disorder	9.7	-	-
Threadworms	15.4	4.5	-

Difference in pattern of consultations of telemedicine

The data collected showed that there were two patterns of telemedicine consultations in Sweden: Text meetings and video meetings. There were more video meetings (M = 66415.38, SD = 23737.20) than text meetings (M = 7247.73, SD = 4747.52) across the three periods (pre-COVID, during COVID, and Post-COVID). The results showed that there were significantly more text meetings during the course (M = 8428.31, SD = 5564.29) than post-COVID period (7965.27, SD = 4747.52) and pre-COVID (M = 3734.54, SD = 2053.39). Likewise, more video meetings were recorded during the COVID period (M = 76977.19, SD = 21475.66) than post-COVID (M = 71459.73, SD = 5162.53) and pre-COVID (38364.15, SD = 15832.76), as presented in Table 2.

Table 2
Descriptive Statistics of Pattern of Consultation

Meeting Form	Period	Mean	Std. Deviation
Text Meeting	Pre-COVID	3734.54	2053.387
	During COVID	8428.31	5564.290
	Post-COVID	7965.27	1361.069
	Mean of Totals	7247.73	4747.516
Video Meeting	Pre-COVID	38364.15	15832.756
	During COVID	76077.19	21475.659
	Post-COVID	71459.73	5162.527
	Mean of Totals	66415.38	23767.203
Total	Pre-COVID	21049.35	20836.101
	During COVID	42252.75	37475.717
	Post-COVID	39712.50	32702.515
	Mean of Totals	36831.55	34265.881

Table 3
ANOVA Table of Treatment Means

Source	Df	Mean Square	F	P
Intercept	1	1.066E+11	26.867	.035
Meeting form	1	6.902E+10	28.682	.032
Period	2	4.269E+10	1.653	.377
Meeting form * Period	2	2.583E+10	14.724	.000

A two-way between-subject generalized linear model was used to assess the main and interaction effects of the period (pre-COVID, during COVID, and post-COVID) and meeting styles. As presented in Table 3, there was no statistically significant main effect of period on the number of telemedicine consultation meetings ($F(2) = 1.653$, $P = .38$), in essence, the number of the meetings at either of the periods were not statistically different. The main effect of the meeting (text or video) style on the number of consultations was statistically significant ($F(1) = 28.682$, $P = .03$) with a large effect size, eta = .934 at 95% confidence interval, indicating that video meetings were significantly more frequently used for telemedicine consultations than text meetings. The interaction effect between meeting style and period was statistically significant ($F(2) = 14.723$, $P < .001$) with a small effect size, eta = .22); for pre-COVID period, there were more video meetings than text meetings; likewise, during the course, there were more video consultation meetings than text meetings, as well as in the post-COVID period.

Pairwise comparisons of the interaction effect further proved that there was a significant increase in video meeting consultations during the COVID period over the pre-COVID period. Similarly, there was a significant increase in video meetings during the post-COVID period compared to the pre-COVID period, while there was no difference in consultations between the COVID and post-COVID periods. Meanwhile, the period did not have any significant effect on text-meeting consultations.

Changes in the primary care utilization of telemedicine

Primary Care utilization in the pre-COVID, during COVID and post-COVID periods involved either

text consultation meetings or video consultation meetings. During either of the three periods, the number of video meetings was significantly higher than the text meetings. The mean difference was the lowest in the pre-COVID period (M= 34629.62, P < .001), but the highest during the COVID period (M = 67648.88, P < .001) and reduced in the post-COVID period (M = 63494.46, P < .001), as shown in Table 4.

Table 4

Mean Difference in Count of Primary Care Utilization of Telemedicine

	Video Meeting	**Text Meeting**	**Std. Error**	**P**
	Mean difference			
Pre - COVID	34629.615*		5195.856	.000
During COVID	67648.875*		3311.721	.000
Post COVID	63494.455*		5648.491	.000

* - significant at 95% level of confidence

Discussion

This study aimed to elaborate on Swedish patients' symptoms that prompted their telemedicine consultation (with respect) and explore the differences, if any during the pre-COVID, COVID, and post-COVID pandemic season. The study further assessed the differences in the pattern of telemedicine consultations during the pre-COVID, COVID, and post-COVID pandemic seasons, and analyzed the changes in the primary care utilization of telemedicine and the pattern of changes in the utilization for the pre-COVID, COVID, and post-COVID pandemic seasons.

Our findings highlight a pronounced increase in telemedicine consultations for general health-related issues during the COVID-19 pandemic compared to the pre-COVID and post-COVID periods. This

marked elevation in teleconsultations for general health-related issues over other recorded symptoms during COVID can be correlated with the public health circumstances at the time when accessing healthcare was fraught with exposure risks, and telemedicine emerged as a crucial alternative. The substantial reduction during the post-COVID period reflects the adaptation and stabilization of healthcare services, and possibly the public's growing confidence in in-person consultations. This does not align with the finding of [19] that the implementation of lockdown measures and fear of visiting healthcare facilities led to a shift in healthcare-seeking behavior, with telemedicine serving as a viable alternative. Considering the exposure risks associated with accessing healthcare in person during the COVID-19 pandemic, it is reasonable to posit that individuals sought virtual consultations for general health-related issues to minimize their potential exposure to the virus.

The incidence of consultations for symptoms related to COVID-19, such as sore throat, cold, flu, and fever, understandably saw a surge during the pandemic compared to before the COVID period, given the global concern and heightened awareness of the virus. However, these consultations maintained a consistent presence post-COVID on the enduring role of telemedicine in addressing acute, potentially infectious conditions. This finding resonates with the existing literature underscoring the surge in telemedicine utilization during the pandemic due to an overlap of symptoms of COVID-19 with those of other respiratory illnesses, such as the common cold or flu [20]. Individuals were more inclined to consult healthcare professionals for appropriate diagnosis and guidance through digital platforms that facilitated uninterrupted healthcare access amidst physical constraints, as it is challenging to distinguish COVID-19 from other respiratory infections without medical evaluation. However, the persistence of telemedicine reliance on general health and acute conditions post-pandemic is a novel observation that suggests a potentially irreversible shift in healthcare-seeking behaviors.

Our results further showed a clear preference for video meetings over text meetings across all study

periods. This predominant inclination towards video meetings can be interpreted as an inclination for more personal, interactive, and visually enriched communication between healthcare providers and seekers, thus enhancing the accuracy and quality of healthcare delivery. Our findings are consistent with previous research suggesting that face-to-face communication is more effective in building rapport, establishing trust, and conveying non-verbal cues, which are crucial in the healthcare setting [21,22]. Furthermore, the findings align with [23], who noted that factors leading to the increased use of video meetings in the healthcare industry include technology advancements, improved internet connection, and the growing acceptance of telemedicine as a competitive option to in-person consultations. As healthcare providers and searchers seek to cross physical distances, the choice for video sessions reflects the need for human connection to be maintained even in a virtual setting.

Furthermore, there was an increase in text and video consultations during the COVID-19 pandemic; this is consistent with the global requirement for remote healthcare solutions in the face of pandemic-related limits [24]. The number of text consultation meetings increased dramatically throughout the COVID period, as compared to the pre-COVID period, and further increased into the post-COVID period. This trend was mirrored in video meetings, which peaked during COVID and underscored the essential role that visually engaging platforms play in maintaining healthcare continuity in these similar unprecedented circumstances like the COVID-19 pandemic. This significant increase in text consultation sessions during the COVID-19 pandemic, as compared to the pre-COVID and post-COVID periods, demonstrates the efficacy and growing popularity of text-based communication in the healthcare sector. The efficacy and convenience of text-based consultations, particularly for follow-up therapy and non-emergency medical circumstances, are consistent with the findings of [25] and [26]; Text consultations allow patients to speak with healthcare practitioners asynchronously, reducing the need for in-person appointments and allowing for scheduling flexibility. The ongoing usage of text and video meetings following COVID highlights the pandemic's long-term consequences on healthcare-seeking behaviors and service delivery techniques,

thereby highlighting the need for further research and contextualization.

This study found that there was no statistically significant difference in the number of telemedicine consultations. This result differs from what we expected because previous study has showed how effective telemedicine may be in times of medical emergency [27-29]. The lack of significant differences in the number of telemedicine consultations may be related to the digital divide, which refers to various demographic groups' limited access to technology and internet services. This could have made it more difficult for them to participate in telemedicine consultations, leading to a skewed representation of our sampled data. Furthermore, patient preferences and comfort levels with telemedicine may have contributed to the consistent number of consultations throughout the different periods. Certain individuals may have indicated a predilection for in-person visits due to their appreciation of direct communication with healthcare providers or practitioners, and their increased confidence in the supposed precision of diagnoses obtained from physical examinations. This mismatch between patient preferences and the possible advantages of telemedicine emphasizes how crucial it is to take patients' viewpoints into account when introducing new medical technology. There doesn't seem to have been much of a shift in the quantity of consultations between different times periods around the COVID-19 unprecedented global health crisis.

Healthcare is another area in which people have become accustomed to using technology in today's digital age. Healthcare is made more accessible to people with mobility difficulties or who live in remote places through the use of video meetings because of the elimination of geographical obstacles and flexibility in scheduling sessions [30]. Several patients preferred video meetings over other consultation methods across all time periods, suggesting a possible innate bias towards more interactive and visually enriched consultation modes that emphasize the importance of human connection in healthcare interactions. Several factors may have contributed to the popularity of online preferences. The first possible cause of the innate propensity towards more interactive

consultation modalities is the desire to improve healthcare providers' and patients' ability to communicate and interact with one another. A robust and efficient healthcare service delivery is possible owing to the use of video meetings, which allow for real-time engagement, facial expressions, and body language clues [31]. The ease and availability of video conferences may also play a role in their increasing popularity.

Limitations

The results of this study should be interpreted with caution because of the presence of a few limitations. First, the data used for analysis were only from telemedicine consultations in Sweden; thus, it may not be applicable everywhere due potential confounding factors such as differences in healthcare systems and patient preferences outside of Sweden. As a result, the findings should not be generalized without proper qualification. Second, the data used in the study were collected retrospectively from telemedicine consultations, which could have introduced errors or omissions into the results. The results may be affected by variability in the accuracy and completeness of the symptoms and diagnosis recording that occurs during consultations. Furthermore, this study was limited in its ability to explain the causes of the observed variances and similarities in telemedicine consultations across time. Subsequent research should look into the socioeconomic factors that may have influenced patients' use of telemedicine during the COVID-19 outbreak. Finally, some text meetings were converted to video meetings as a function of necessity of the case; but the dataset did not specify which meetings were converted from text to video consultations, hence, there is a likelihood that this could possibly affect the results.

Conclusions

This study examined Swedish telemedicine consultation symptoms and trends before, during, and after the COVID-19 pandemic. During COVID-19, general health-related teleconsultations increased, perhaps because to public health concerns and the desire to minimize exposure. The pandemic also saw a surge in COVID-19-type consultations, demonstrating that telemedicine help

mitigate illnesses like sore throats and fever. The sample's preference for video meetings over text meetings underscored the importance of visual and interactive communication in healthcare delivery. In light of these findings, socioeconomic considerations may influence patient involvement with telemedicine during the COVID-19 pandemic. Patient preferences and comfort with telemedicine might reveal telehealth adoption and use. More research on public perception and attitudes toward in-person preferences in telemedicine may help explain post-COVID-19 healthcare-seeking habits. Finally, examining telemedicine adoption barriers including the digital divide and access to technology and internet services can guide efforts to expand telehealth services to all demographic groups.

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AA wrote the analyzed the introduction and analyzed the dataset. AP was instrumental in writing the rest of the manuscript. All authors read and approved the final manuscript. This research is self-funded.

Conflicts of Interest

The authors declare that they have no conflict of interests.

Abbreviations

JMIR: Journal of Medical Internet Research
RCT: randomized controlled trial

References

1. Dyb, K., & Halford, S. (2009). Placing globalizing technologies: Telemedicine and the making of difference. *Sociology*, *43*(2), 232-249. https://doi.org/10.1177/0038038508101163
2. El-Miedany, Y. (2017). Telehealth and telemedicine: how the digital era is changing standard health care. *Smart Homecare Technology and TeleHealth*, *4*, 43-51. https://doi.org/10.2147/shtt.s116009
3. Carlo, F. D., Sociali, A., Picutti, E., Pettorruso, M., Vellante, F., Verrastro, V., Martinotti, G., & Giannantonio, M. D. (2020). Telepsychiatry and other cutting edge technologies in COVID-19 pandemic: Bridging the distance in mental health assistance. https://doi.org/10.22541/au.159007666.69069059
4. Manju, R., Harinee, P., Gangolli, S. S., & Bhuvana, N. (2023). Evolution of computational intelligence in modern medicine for health care informatics. *Translating Healthcare Through Intelligent Computational Methods*, 395-411. https://doi.org/10.1007/978-3-031-27700-9_24
5. Orozco-Beltran, D., Sánchez-Molla, M., Sanchez, J. J., & Mira, J. J. (2017). Telemedicine in primary care for patients with chronic conditions: The ValCrònic quasi-experimental study. *Journal of Medical Internet Research*, *19*(12),

e400. https://doi.org/10.2196/jmir.7677
6. Şahin, E., Yavuz Veizi, B. G., & Naharci, M. I. (2021). Telemedicine interventions for older adults: A systematic review. *Journal of Telemedicine and Telecare*, 1357633X2110583. https://doi.org/10.1177/1357633x211058340
7. Kvedar, J., Coye, M. J., & Everett, W. (2014). Connected health: A review of technologies and strategies to improve patient care with telemedicine and Telehealth. *Health Affairs*, *33*(2), 194-199. https://doi.org/10.1377/hlthaff.2013.0992
8. Bohingamu Mudiyanselage, S., Stevens, J., Watts, J. J., Toscano, J., Kotowicz, M. A., Steinfort, C. L., ... & Hayles, R. (2019). Personalised telehealth intervention for chronic disease management: a pilot randomised controlled trial. *Journal of telemedicine and telecare*, *25*(6), 343-352.
9. World Health Organization (WHO). *The world health report 2010*. (Accessed June 16, 2022). https://www.who.int/publications/i/item/9789241564021
10. Precedence Research - Market Research Reports & Consulting Firm. *Telemedicine market size to reach USD 225 billion by 2030*. (Accessed May 10, 2023). https://www.precedenceresearch.com/telemedicine-market
11. Alhassan, G. N., Öztürk, İ., Adedoyin, F. F., & Bekun, F. V. (2021). Telehealth as a panacea amidst global pandemic (COVID-19) in Africa. *Duzce Medical Journal*, *23*(Special Issue), 43-47.
12. Heshmati, A., Tsionas, M., & Rashidghalam, M. (2022). An assessment of the Swedish health system's efficiency during the COVID-19 pandemic. *International Journal of Healthcare Management*, *16*(3), 336-352. https://doi.org/10.1080/20479700.2022.2102184
13. ISPI (2023). *Sweden, almost a country for old men*. (Accessed March 20, 2023). https://www.ispionline.it/en/publication/sweden-almost-a-country-for-old-men-106929
14. Omboni, S., Padwal, R. S., Alessa, T., Benczúr, B., Green, B. B., Hubbard, I., Kario, K., Khan, N. A., Konradi, A., Logan, A. G., Lu, Y., Mars, M., McManus, R. J., Melville, S., Neumann, C. L., Parati, G., Renna, N. F., Ryvlin, P., Saner, H., … Wang, J. (2022). The worldwide impact of telemedicine during COVID-19: Current evidence and recommendations for the future. *Connected Health*. https://doi.org/10.20517/ch.2021.03
15. Patrício Silva, A. L., Prata, J. C., Walker, T. R., Duarte, A. C., Ouyang, W., Barcelò, D., & Rocha-Santos, T. (2021). Increased plastic pollution due to COVID-19 pandemic: Challenges and recommendations. *Chemical Engineering Journal*, *405*, 126683. https://doi.org/10.1016/j.cej.2020.126683
16. Sclafani, A. P., Shomorony, A., Stewart, M. G., Grunstein, E., & Overdevest, J. B. (2021). Telemedicine lessons learned during the COVID-19 pandemic: The augmented outpatient otolaryngology teleconsultation. *American Journal of Otolaryngology*, *42*(4), 102960. https://doi.org/10.1016/j.amjoto.2021.102960
17. Lindeman, D. A., Kim, K. K., Gladstone, C., & Apesoa-Varano, E. C. (2020). Technology and caregiving: Emerging interventions and directions for research. *The Gerontologist*, *60*(Supplement_1), S41-S49. https://doi.org/10.1093/geront/gnz178
18. Thyer, B. A. (2012). Quasi-experimental group designs. *Quasi-Experimental Research Designs*, 77-106. https://doi.org/10.1093/acprof:oso/9780195387384.003.0003
19. Kambris, M. E. K., AlBlooshi, S., Elamin, A., & Ajja, R. (2023). Healthcare services utilization and seeking behaviour during COVID-19 pandemic in the UAE–A cross-sectional study.

20. Agricola, E., Beneduce, A., Esposito, A., Ingallina, G., Palumbo, D., Palmisano, A., Ancona, F., Baldetti, L., Pagnesi, M., Melisurgo, G., Zangrillo, A., & De Cobelli, F. (2020). Heart and lung multimodality imaging in COVID-19. *JACC: Cardiovascular Imaging*, *13*(8), 1792-1808. https://doi.org/10.1016/j.jcmg.2020.05.017
21. Sethuraman, K. (2001). Doctor-patient communication: An overview. *Communication Skills in Clinical Practice (Doctor-Patient Communication)*, 1-1. https://doi.org/10.5005/jp/books/11607_2
22. Pinedo-Torres, I., Garcia-Villasante, E. J., Gutierrez-Ortiz, C. C., Quispe-Sarria, C., Morales-Pocco, K., Cedillo-Balcázar, J., Moran-Mariños, C., & Baca-Carrasco, V. (2023). The doctor-patient relationship and barriers in non-verbal communication during teleconsultation in the era of COVID-19: A scoping review. *F1000Research*, *12*, 676. https://doi.org/10.12688/f1000research.129970.1
23. Haleem, A., Javaid, M., Singh, R. P., & Suman, R. (2021). Telemedicine for healthcare: Capabilities, features, barriers, and applications. *Sensors International*, *2*, 100117. https://doi.org/10.1016/j.sintl.2021.100117
24. Wasserman, D., & Carli, V. (2021). Evidence-based suicide prevention strategies during and after the COVID-19 pandemic. *Oxford Textbook of Suicidology and Suicide Prevention*, 795-800. https://doi.org/10.1093/med/9780198834441.003.0096
25. Hylock, R. H., & Zeng, X. (2019). A blockchain framework for patient-centered health records and exchange (HealthChain): Evaluation and proof-of-Concept study (Preprint). https://doi.org/10.2196/preprints.13592
26. Woodward, M., De Pennington, N., Grandidge, C., McCulloch, P., & Morgan, L. (2020). Development and evaluation of an electronic hospital referral system: A human factors approach. *Ergonomics*, *63*(6), 710-723. https://doi.org/10.1080/00140139.2020.1748232
27. Ward, M. M., Jaana, M., & Natafgi, N. (2015). Systematic review of telemedicine applications in emergency rooms. *International Journal of Medical Informatics*, *84*(9), 601-616. https://doi.org/10.1016/j.ijmedinf.2015.05.009
28. Napi, N. M., Zaidan, A. A., Zaidan, B. B., Albahri, O. S., Alsalem, M. A., & Albahri, A. S. (2019). Medical emergency triage and patient prioritisation in a telemedicine environment: A systematic review. *Health and Technology*, *9*(5), 679-700. https://doi.org/10.1007/s12553-019-00357-w
29. Zhu, X., Merchant, K. A., Mohr, N. M., Wittrock, A. J., Bell, A. L., & Ward, M. M. (2021). Real-time learning through telemedicine enhances professional training in rural emergency departments. *Telemedicine and e-Health*, *27*(4), 441-447. https://doi.org/10.1089/tmj.2020.0042
30. Kiianytsia, V. V. (2020). The role of telemedicine during the COVID-19 pandemic. *NEW TRENDS AND UNRESOLVED ISSUES OF PREVENTIVE AND CLINICAL MEDICINE*. https://doi.org/10.30525/978-9934-588-81-5-2.46
31. Almathami, H. K., Win, K. T., & Vlahu-Gjorgievska, E. (2020). Barriers and facilitators that influence telemedicine-based, real-time, online consultation at patients' homes: Systematic literature review. *Journal of Medical Internet Research*, *22*(2), e16407. https://doi.org/10.2196/16407