

The impact of telemedicine on the quality and satisfaction with the health care provided during the COVID-19 pandemic in the field of pediatrics with special reference to the surgical professions

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ABSTRACT: The COVID-19 pandemic has forced healthcare systems around the world to adopt telemedicine at an unprecedented rate. Visits to telemedicine have increased to provide access and maintain continuity of care. Internet access has almost become a necessity, and new technologies allow for the easy flow of data from patient to doctor and vice versa. Doctors of all specialties were forced to adapt to the pandemic and emerging conditions. The provision of surgical services and the learning ability of surgeons are particularly disrupted, and the pediatric surgical community is not exempt. During the pandemic, telemedicine proved to be a viable and safe technique for providing health services. In an environment of a health system that is constantly facing a shortage of resources, effective telemedicine placement can come with a high benefit-cost ratio and quality of care, while ensuring patient satisfaction.

KEYWORDS: children, surgery, telehealth, telemedicine

ABBREVIATIONS

CHD – congenital heart disease

IBS – irritable bowel syndrome

IF – intestinal failure

MeSH – Medical Subject Headings

SARS-CoV-2 – severe acute respiratory syndrome coronavirus 2

INTRODUCTION

The current COVID-19 pandemic has compelled healthcare systems across the world to adopt telemedicine at an unprecedented speed to continue providing care to all patient populations from pediatrics to geriatrics and from primary care to specialty care. As in all activities, and in healthcare, during the COVID-19 pandemic, people approached online tools. Telemedicine visits have increased to allow access and maintain continuity of care, while reducing disease transmission and the complications that can result from them [1–3]. The Google Trends tool, at the start of the pandemic, recorded a huge increase in searches for the term telemedicine, making it clear to the community in which direction the trends will move. We live in a world where internet access has become a necessity, and the advancement of new devices that are constantly connected allows for an easy flow of data from patient to doctor. Medical personnel of all specialties were forced to adapt to the pandemic and emerging conditions, which was especially evident in surgical activities [4–6]. Given the direct contact with patients, the pandemic also directly affected the mental health of surgeons [7]. Both the provision of surgical services and the learning opportunity for surgeons are particularly disrupted, and the pediatric surgical community is not an exception. Concerns about staff training and advancement have become increasingly prominent as the pandemic has not abated. New ways of working through telemedicine have also opened up a number of ethical issues such as concerns about data confidentiality and the

quality of health care itself [8–10]. The aim of this paper is to see how in the course of the pandemic telemedicine has fitted into the currents of pediatrics, with special reference to the surgical profession and related branches.

MATERIALS AND METHODS

A systematic literature search and review was conducted according to PRISMA guidelines using the PubMed online database on August 19, 2021. The search was performed in all fields, based on the MeSH (Medical Subject Headings) terms; telemedicine, COVID, child*, surg* with the use of Boolean operator AND. Regarding the type of articles, their availability (abstract, full paper), date of publication and gender, no limiter was used. Only articles in English for the age group 0 to 18 were searched. After detailed reading of abstracts and complete articles, papers were selected that dealt in the narrowest sense with the following topics:

- the impact of the pandemic on the increase in health services through telemedicine,
- availability of telemedicine and limiting factors,
- quality of health care provided through telemedicine,
- types of telemedicine used,
- potentials of telemedicine in the future,
- postoperative monitoring via telemedicine,
- satisfaction of users and providers of health care,
- influence of telemedicine on the psychological aspect of patients.

RESULTS

Based on the previous search strategy, a total of 154 studies were obtained from the database. By careful reading of abstracts and complete papers, with defined topics of interest for discussion, 31 papers were selected (Fig. 1., Tab. I.).

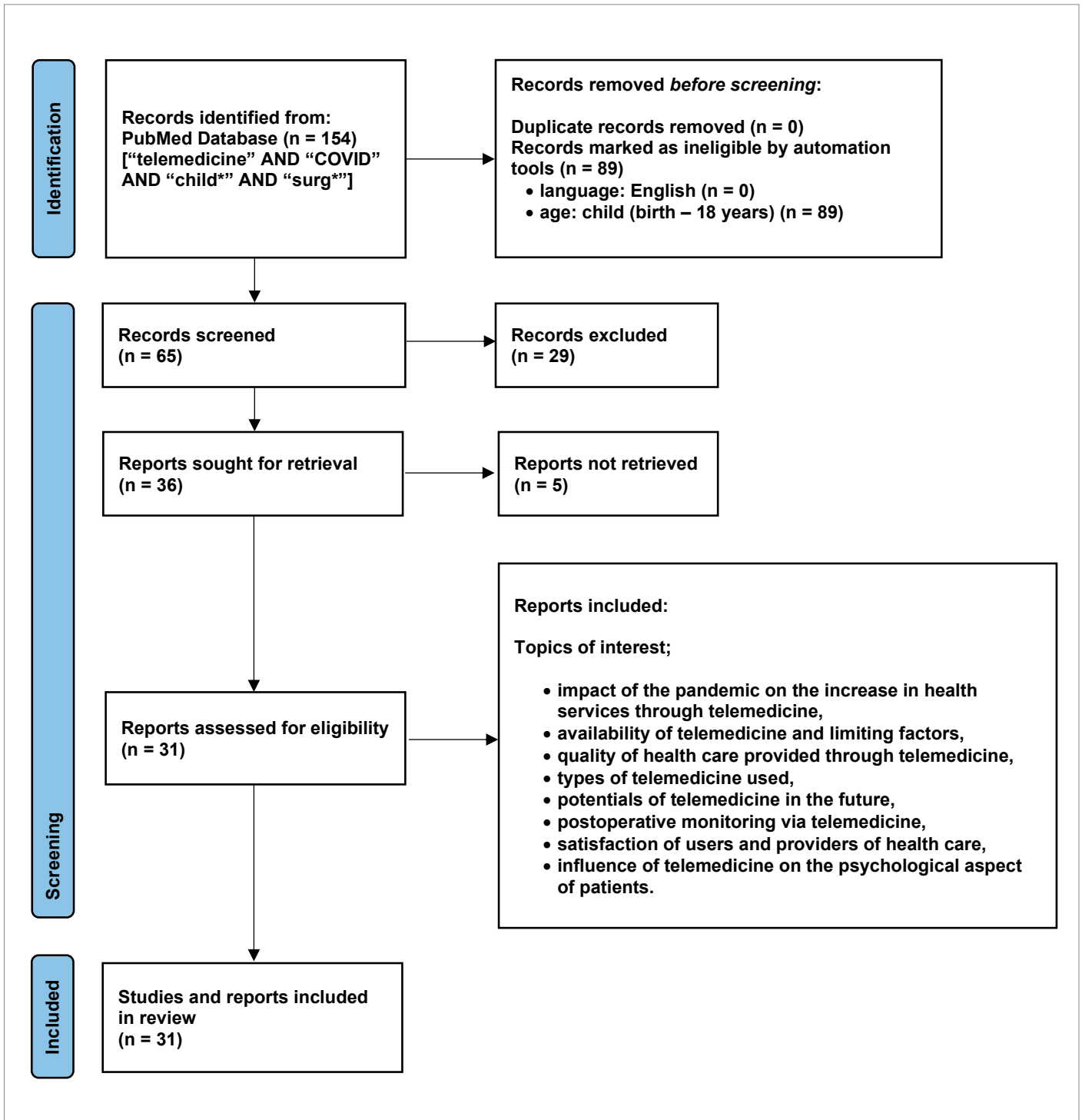


Fig. 1. PRISMA Flow Diagram.

DISCUSSION

Telemedicine challenges are often especially complex for pediatric and adolescent patients who require biometric authentication, parentage documentation, and adolescent consent for enrolment [11]. Xu et al. within the period of the pandemic noticed significant reductions in the number of inpatients, emergency department cases and outpatients. In contrast, there was a four-fold increase in telemedicine visits. Analyses suggested that the rise in telehealth visits offset the reduction in outpatient visits [12]. An assessment of demographic and socioeconomic factors associated with patient participation in telehealth concluded that age, sex, median household income,

insurance status, and legal status are related to patient participation in telehealth. These findings identify vulnerable patient populations who would not be using telemedicine, yet still require medical aid at the time of the pandemic [13]. Pediatric surgeons across North America have adopted a consensus on the following: reducing in-hospital staffing, limiting clinical fellow exposure, implementing telemedicine for conducting outpatient clinical visits, and using universal precautions for trauma [14]. Metzger et al. assessed the prospects and potential value of telemedicine by surveying patients or caregivers of patients examined by a personal general pediatric surgeon before COVID-19 and during COVID-19. During the COVID-19 period, 76% reported the care received as excellent, 86% were very satisfied

with their care, 87% reported the appointment was less stressful for their child than an in-person appointment, and 57% would choose telemedicine in the future. They concluded that telemedicine should be viewed as a viable option for pediatric surgery patients, and future research should focus on optimizing the experience for patients and service providers [15]. According to a research from Germany, the pandemic increased the number of telemedicine services in Pediatric Surgery by 50%, 21% of the Pediatric Surgery departments in Germany provided telemedicine, of which 57% started due to the pandemic. The strongest advantages of telemedicine were found to be saving time and resources. The lack of physical examination and face-to-face contact seem to be the major limitations to surgeons and parents. According to 48% of the parents telemedicine is equal to or better than traditional appointments, while 33% thought that telemedicine is worse. Videoconferencing had proven to be more appropriate for consulting with new patients as well as when indicating surgery compared to telephone consultations, while the majority of those surveyed said that they would not consult new patients or indicate surgery over the telephone but would indicate surgery in a video consultation. The groups of most common diagnoses for teleconsultations were congenital malformations, urology, micturition/defecation disorders, haemangioma, post-traumatic follow-ups. The study shows that families and doctors alike have had positive experiences with telemedicine and most of them will continue to use this format after the pandemic [16]. A positive example of telemedicine in the field of pediatric urology comes to us from the United Kingdom. Guidance on undertaking remote clinics during the pandemic was issued by the European Association for Urology Guidelines Panel for Paediatric Urology in March 2020, advising reduced attendances to outpatient clinics. Remote clinics can be used to sooner detect indications for acute action which otherwise might have been postponed to the next face-to-face appointment, e.g. retractile testis in follow-up that now causes intermittent pain due to potential intermittent torsion. In the United Kingdom centre 60% of consultations are now performed remotely and early results from a departmental service evaluation suggest parents prefer remote clinics with 95% satisfaction rates, due to shorter waiting times, reduced travel and less exposure to others [17]. At the time of the pandemic virtual fracture clinics can provide a means to treat patients remotely, using agreed-upon protocols. They have a crucial role in the current COVID-19 pandemic, due to the possibility to provide ongoing care in an otherwise challenging setting. Efficiency was reflected in the number of patients examined and discharged using the model, savings in clinic slots, reduced waiting times, or reduced consumption of resources [18]. According to a study by Smith et al., in a regional Australian environment, there was no increase in complications following emergent implementation of telehealth for orthopaedic fracture clinic follow-up in their institution [19]. Managing infantile haemangiomas at the time of the pandemic was also a challenge. Infantile haemangiomas may require urgent evaluation and risk stratification to determine which infants need treatment and which can be managed with continued observation. Clinical guidelines have been adopted about when telehealth is an appropriate alternative to in-office visits, including medication initiation, dosage changes, and ongoing evaluation [20]. In the Israeli example, when it comes to pediatric burns, we can see the successful implementation of telemedicine in lower-grade burns. They concluded that the quality of treatment was not affected by the use of telemedicine and that the standards and quality of treatment were maintained [21]. Zhang et al., for the purpose of preoperative monitoring and health care of infants with congenital heart disease (CHD), used the WeChat application. They concluded that

the application was useful in identifying the state of an infant's condition as well as in identifying and relieving care pressure, anxiety and depression in their parents [22]. Telemedicine has also been shown to be useful in monitoring infants of mothers infected with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [23]. In the area of pediatric cardiac surgery during the pandemic, there was also a significant decrease in total surgical volume and a change in case mix in terms of an increase in the proportion of emergency operations. There was a significantly higher proportion of patients who had follow-up through the Internet or phone in the COVID-19 group (26.4% vs 9.6%, $P < 0.0001$). There was no statistical difference in death or rehospitalization rate among the groups ($P = 0.49$). There was higher parents' anxiety score ($P < 0.0001$) and more frequent use of telemedicine ($P = 0.004$) in the COVID-19 group. They concluded that online medical service appears to be an effective alternative to the conventional method [24]. And when it comes to pediatric transplantation, we must emphasize that in one study, as many as 7 out of 18 centers started or increased the use of telemedicine. Twelve of 18 centers decided to follow COVID-19 cases with mild symptoms at home through telemedicine and to hospitalize only suspected cases with moderate-severe symptoms [25]. According to one study from the US, all 29 centers have participated in telemedicine visits with their IF (intestinal failure) patients, but only 6 centers (21%) deemed this alternative healthcare model capable of providing the same level of care for patients with IF as compared to prior to the pandemic. Most centers reported that a physician (28 centers), nurse (16 centers), and dietitian (23 centers) regularly participated in their telemedicine visits [26]. The implementation of telemedicine has started in most of the centres enlarging the possibilities of follow-up for children with IBS (irritable bowel syndrome) in remission of disease [27]. In the field of pediatric otorhinolaryngology Kolb et al. report on the possibilities of telemedicine for children suffering from recurrent acute otitis media or sleep-disordered breathing. Groups were compared for completeness of physical exam, management, follow-up recommendations, and correlation of physical exam findings with intraoperative findings. Recommendations for surgery, additional studies, or routine follow-up were similar between telehealth and office-based groups. Physical exam feasibility was significantly different for the nasal cavity, oropharynx, and middle ear. Patients who underwent office-based consultation were much more likely to have findings of middle ear fluid at the time of tympanostomy tube placement. There was no significant difference between preoperative and intraoperative tonsil size discrepancies. They concluded that telemedicine can be used successfully for the evaluation of pediatric patients with sleep-disordered breathing. However, reliance on history alone may result in unnecessary tympanostomy tube placement in patients with recurrent acute otitis media [28]. A study from the United States, which examined satisfaction with telemedicine for the purpose of providing otolaryngology services, found that despite low initial expectations of telemedicine, most of their service providers after a month of use felt that telemedicine would remain a valuable platform after the pandemic. Telemedicine with video comprised 68% and telephone only 32%. The survey demonstrated a significant difference ($P < 0.00002$) in provider's anticipated telehealth experience (mean 3.94, 95%CI [3.0632; 4.8118]) compared to their actual experience after the study period (mean 7.5, 95%CI [7.113; 7.887]) [29]. Another study showed that the most commonly reported cause of missed telehealth appointments was technical difficulties [30]. The third study showed that the reasons why patients did not schedule telemedicine appointments included preference for in person appointments, and lack of adequate device at home to complete telemedicine visit [31].

Tab. I. A brief overview of selected manuscripts.

Branches of medicine	Manuscripts	Main conclusions
General medicine	Patel et al. (2020)	Experience with the rapid conversion of a patient enrolment process can provide guidance for telehealth surge management in the future.
	Xu et al. (2021)	In-person health care utilization decreased drastically during the early period of the pandemic, but there was a corresponding increase in telehealth visits during the same period.
Pediatric surgery	Ingram et al. (2020)	Interhospital consensus is high for reducing in-hospital staffing, limiting clinical fellow exposure, implementing telehealth for conducting outpatient clinical visits, and using universal precautions for trauma.
	Metzger et al. (2021)	For families seeking an alternative to the in-person encounter, telemedicine can provide added value over the traditional in-person encounter by reducing the burden of travel without compromising the quality of care. Telemedicine should be viewed as a viable option for pediatric surgery patients.
	Lakshin et al. (2021)	Both families and doctors place a great deal of trust in telemedicine. Despite its known limitations, many medical situations can be solved remotely. Despite all of the advantages and disadvantages of telemedicine, both families and doctors would continue using it after the COVID-19 pandemic. Telemedical services are a valuable addition to conventional outpatient visits.
	Pandey et al. (2020)	Communication on the phone can be an effective option for consultation during follow-up. In wake of any event affecting the movement of patients, active efforts and call from the treating doctors can make a lot of difference with minimal effort and energy.
Pediatric urology	Charnell et al. (2021)	In the UK centre 60% of consultations are now performed remotely and early results from a departmental service evaluation suggest parents prefer remote clinics with 95% satisfaction rates, due to shorter waiting times, reduced travel and less exposure to others.
Orthopedic surgery	Murphy et al. (2020)	At the time of the pandemic virtual clinics can provide a means to treat patients remotely, using agreed-upon protocols.
	Smith et al. (2020)	Rapid implementation of telemedicine can be achieved without increasing complication rates.
Pediatric dermatology / surgery	Frieden et al. (2021)	Telemedicine is particularly well-suited for typically brief follow-up visits. Clinical guidelines have been adopted about when telehealth is an appropriate alternative to in-office visits, including medication initiation, dosage changes, and ongoing evaluation.
	Yaacobi et al. (2021)	Successful implementation of telemedicine in lower-grade burns. Treatment was not affected by the use of telemedicine and that the standards and quality were maintained.
Pediatric cardiac surgery	Zhang et al. (2021)	During the COVID-19 pandemic, follow-up management and health services for infants with CHD prior to surgery through the WeChat platform were useful in identifying the state of an infant's condition as well as in identifying and relieving care pressure, anxiety and depression in the parents.
	Shi et al. (2021)	There was a significantly higher proportion of patients who had follow-up through the Internet or phone. There was no statistical difference in death or rehospitalization rates. Follow-up through the online medical service appears to be an effective alternative to the conventional method.
Neonatology	Salvatore et al. (2020)	Telemedicine has been shown to be useful in monitoring infants of mothers infected with severe acute respiratory syndrome coronavirus 2.
Pediatric transplantation	Doná et al. (2020)	Twelve of 18 centers decided to follow COVID-19 cases with mild symptoms at home through telemedicine and to hospitalize only suspected cases with moderate-severe symptoms.
Pediatric gastroenterology / surgery	Galloway et al. (2021)	Despite the availability of telemedicine, intestinal failure centers should remain attentive to the global needs of the pediatric intestinal failure patient, as well as their families.
	Arrigo et al. (2021)	The implementation of telemedicine has started in most of the centres enlarging the possibilities of follow-up for children with IBD in remission of disease.
Pediatric otorhinolaryngology	Darrat et al. (2021)	Findings identify and highlight that age, sex, median household income, insurance status, and marital status were associated with patient's participation in telehealth.
	Kolb et al. (2021)	Office and telehealth visits have differences in physical exam completeness. Telehealth appears effective in assessing children with sleep-disordered breathing. Telehealth may result in unneeded surgery in patients with recurrent ear infections.
	Belcher et al. (2021)	Despite low initial expectations of telemedicine, most of their service providers after a month of use felt that telemedicine would remain a valuable platform after the pandemic.
	Kolb et al. (2021)	Clear, concise education materials on the technical aspects of telehealth, platform optimization, and robust technical and administrative support may be necessary to reduced missed telehealth appointments and support large-scale telehealth operations.
	Govil et al. (2020)	Reasons that patients did not schedule telemedicine appointments included preference for in person appointments, and lack of adequate device at home to complete telemedicine visit.
	Darr et al. (2020)	The satisfaction when assessing the doctor-patient relationship, privacy & trust, as well as consultation domains was high, with an overwhelming majority of parents being content with the future integration and participation.
Pediatric ophthalmology	Gupta et al. (2021)	Telemedicine helps determine the severity and urgency of surgery in children. It is useful for scheduling examinations for new patients as well as for returnees. Telemedicine has also been shown to be useful for monitoring patients after cataract surgery to reduce the number of subsequent visits.
Neurosurgery	Patel et al. (2020)	Telehealth was increasingly used for assessments. The long-term effects of the reduced neurosurgical volume and increased telehealth usage on patient outcomes should be explored.

Tab. I. cd. A brief overview of selected manuscripts.

Branches of medicine	Manuscripts	Main conclusions
Pediatrics	Mercuri et al. (2021)	Contactless model implementation in the future may reduce the duration of hospital admissions, costs and parental absence from work.
	Brambilla et al. (2021)	Families are in favour of remote contact in pandemics, especially those travelling long distances to reach expert centres. Telemedicine protocols should be established in preparation for future similar situations, emergency consultations or in case the patient lives far from the reference hospital.
	Deolmi et al. (2020)	Anxiety and stress-related disorders can improve if resources such as information about mental health education, video-counselling, telemedicine and telepsychiatry services, are available online.
	Tse et al. (2021)	Telehealth, including telephone services, is an acceptable and even preferred way of providing services to clients with mental illness.
Pediatric infectology	Patel et al. (2021)	The potential of telemedicine must be harnessed to not only sustain the work of global health missions but also aid rapid dissemination of knowledge related to the care of COVID-19 pediatric patients to low- and medium-income countries. Telemedicine conferences can help low- and medium-income countries sustain the work of pediatric teaching mission trips unable to currently provide direct patient care and on-site teaching.
	Esposito et al. (2020)	The influence of telemedicine on the connection of primary care physicians with hospital specialists was excellent, where primary care physicians consulted a hospital specialist for infectious diseases through telemedicine.

In India, at the time of the pandemic, the number of children with cataracts drastically decreased, which was an alarm, given the consequences of untimely treatment. Telemedicine helped them to determine the severity and emergency of surgery in children. They used it to schedule an appointment to new as well as returning patients who complained of having children showing unilateral or bilateral white reflex (leukocoria/absence of red reflex) in their one or both eyes. Appointments were considered urgent when vision was at risk, especially due to amblyopia in a young child. All patients under 8 years of age who had visually significant cataract or visual axis obscuration due to membranes or pigments over the intraocular lens were given an appointment to be examined on the slit lamp. Telemedicine was also used to follow up patients who underwent cataract surgery to decrease the number of follow-up visits [32]. In the field of neurosurgery weekly telehealth encounters increased from a median of 0 (IQR, 0-0) before to a median of 151 (IQR, 126–156) during COVID-19 ($P < 0.001$) [33]. Postoperative follow-up through telemedicine is a particular challenge. According to a study from India, where telephone calls were used for postoperative consultations, seven children (26.9%) fared well in the post-operative period and were advised stitch removal from local health center. Nine (34.6% of contactable patients) parents had the following complaints: ostomy diarrhea with dehydration in three neonates (responded well to intravenous fluid administration with the help of local medical practitioner); two children with urethral stent in situ (stent was removed by telephonic coordination with local practitioner following which the patients did well); one neonate with perigastrostomy tube leakage and dehydration (managed successfully with telephonic advice for gastrostomy tube removal at nearby Primary Health Centre); one patient having in situ double-J (DJ) stent for seven weeks with symptoms of pyelonephritis was managed by DJ stent removal; one patient with adhesive obstruction was successfully managed conservatively and one patient with slipped feeding jejunostomy was re-operated. However, three patients were advised to come to the hospital [34]. Mercuri et al. developed a modular framework to display an incremental set of services, establishing each step, from the identification of patients to the delivery of the most accurate and complex level of care, aimed to cover diagnostic procedures and monitor disease progression in chronic pediatric patients. They prioritized patients enrolled in long-term follow-up, at risk of complications, requiring regular multidisciplinary assessments as suggested

by available care recommendations. Other criteria to define priority were lack of adequate alternative territorial assistance and the distance from their centre, as transport could constitute a significant burden on the family in terms of time, cost and safety. The implementation of such projects in the future could contribute to reducing the duration of hospitalization, money and parental leave [35]. The influence of telemedicine on the connection of primary care physicians with hospital specialists was excellent in case of Italy, where primary care physicians consulted a hospital specialist for infectious diseases through telemedicine. Telemedicine participants could connect for real-time interaction usually during the 4-hour/day period of primary care paediatrician activity in the ambulatory. As many as 90.2% of paediatric problems that without telemedicine support could have led the patient to hospital emergency room were solved in the community [36]. According to Darr et al. the satisfaction with the doctor-patient relationship, privacy & trust, as well as consultation domains was high, with an overwhelming majority of parents being content with the future integration and participation in virtual outpatient clinics. A follow-up face-to-face meeting was required in only 10% of participants [37]. Brambilla et al. also concluded that telemedicine would help them because it would reduce travel times and their consequent physical and financial costs for patients, ultimately improving the quality of life of both patients and parents. Many families felt that remote psychosocial support was insufficient – only 21 out of 219 families received such a support. Telemedicine protocols should be established in preparation for future similar situations, emergency consultations or in case the patient lives far from the reference hospital [38]. Anxiety and stress-related disorders can improve if resources such as information about mental health education, video-counselling, telemedicine and telepsychiatry services, are available online [39]. In a study by Tse et al. examining the acceptability and feasibility of telehealth services in the field of mental health, >80% of respondents stated that their ability to connect with staff, receive support, and schedule appointments was at least the same as before the pandemic. Among 80% of respondents who showed an interest in continuing distance services after the end of the pandemic, 83% preferred a mix of distance services and face-to-face services. The findings of this study suggest that telehealth, including telephone services, is an acceptable and even preferred way of providing services for clients with mental illness [40]. The potential of telemedicine must be

harnessed to not only sustain the work of global health missions but also aid rapid dissemination of knowledge related to the care of COVID-19 pediatric patients to low- and medium-income countries. Telemedicine conferences can help low- and medium-income countries sustain the work of pediatric teaching mission trips unable to currently provide direct patient care and on-site teaching [41]. Adopting secure methods of photo transfer, developing tools or platforms to train families on proper use, and protocols for determining which patients are the best candidates for telemedicine will increase the ability to treat patients in these challenging times.

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CONCLUSION

Telemedicine is anticipated to be an important modality of patient treatment in the future. It is critical to assess and identify potential discrepancies in telemedicine access, as well as to undertake proactive adjustments to overcome obstacles. During the pandemic, telemedicine has proven to be a feasible and safe technique of delivering health services. In the setting of a health system that is continually challenged by shortages of resources, an effective telemedicine setup can come with high benefit-cost ratios and quality of care, along with the assurance of patient satisfaction.

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