# Pediatric Telemedicine
## Lessons Learned During the Coronavirus Disease 2019 Pandemic and Opportunities for Growth

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- Telemedicine • Telehealth • Virtual visits • Video visits • Pediatrics

**Key points**

- Educational resources that incorporate the most recent evidence on pediatric telemedicine care are needed to promote consistency across providers, increase provider confidence, and improve quality of care.
- Patient-generated data, including remote patient monitoring, could improve the quality of virtual visits, but issues with measurement quality and parent self-efficacy must be addressed.
- Rigorous studies examining specific practices within telemedicine delivery and use are needed to develop evidence-based guidelines around virtual care for pediatric conditions.
- A focus on equity is essential for ensuring that telemedicine interventions do not widen health disparities.

## INTRODUCTION

The coronavirus disease 2019 (COVID-19) pandemic has resulted in a dramatic and rapid increase in the adoption and implementation of telemedicine services, including in pediatrics [1–4]. Many pediatric providers that previously had not offered telemedicine services quickly adopted telemedicine and have continued to provide services well after the start of the pandemic. This shift presents opportunities to expand our understanding of the impact of telemedicine on access to care, quality of care, and health care costs on a broader scale.

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The pandemic has changed the way that patients and caregivers, providers, and health systems think about telemedicine. A prepandemic review of the pediatric telemedicine landscape identified licensing requirements, provider interest, lack of resources to train providers, and reimbursement issues as the main challenges facing pediatric telemedicine programs [5]. The Public Health Emergency forced the resolution of many of these challenges, making telemedicine a necessary part of patient care as shelter-in-place orders and other infection prevention measures discouraged in-person encounters. Given that telemedicine will remain a mainstay of pediatric care, the field now faces the challenge of improving the delivery of telemedicine for pediatric patients to ensure that all patients have access to high-quality care [3]. Identifying evidence-based practices and understanding how these practices can be implemented and scaled are the next steps toward meeting this challenge.

Since the start of the pandemic in spring 2020, new research has been published, providing insights into promising practices for pediatric telemedicine, adoption by parents and providers, and barriers and facilitators to telemedicine use. These studies bring to the field great diversity in terms of patients, providers, settings, and specialties; they use larger amounts of data than were possible to collect prepandemic and are pragmatic, based in real-world settings. Understanding the lessons learned is important for optimizing telemedicine delivery going forward. With this in mind, the objectives of this review are to (1) summarize recent evidence on the delivery of telemedicine for pediatric patients with an emphasis on lessons learned during the pandemic and (2) highlight opportunities in telemedicine delivery and research.

## MODELS OF CARE WITHIN PEDIATRIC TELEMEDICINE

Telemedicine encompasses several different models of technology-enabled health care services:

- ''Provider-to-provider'' telemedicine services allow communication between 2 providers (with or without the patient) and typically involve consultations in real time over video with pediatric subspecialists to primary care providers practicing in communities where specialists may not be available [6,7]. Before the pandemic, these types of consultations had been used for many pediatric subspecialists including cardiology, ophthalmology, nephrology, dermatology, neurology, endocrinology, and emergency medicine [8].
- Provider-to-patient telemedicine services or virtual visits allow for direct encounters over real-time video from the providers to the patient or family, often in the convenience of their homes. This model of care has seen the greatest increase in use since the beginning of the pandemic [3].
- School-based telemedicine services allow children to receive care through telemedicine at their local school while in the presence of a school nurse or other school personnel. School-based telemedicine services have been used widely for asthma care [9] and mental health care [10] and have recently been tested for pediatric physiatry [11] and treatment of attention-deficit/hyperactivity disorder [12].

- Remote patient monitoring, remote physiologic monitoring, or more simply, telemonitoring involves the monitoring of patient-generated data. These programs have been used in pediatrics primarily for management of type 1 diabetes [13,14] and asthma [15,16] and monitoring of congenital heart disease and cardiovascular implantable devices [13].

For the purposes of this review, the focus is on the most common use of telemedicine in pediatric care, virtual visits, and recently emerging evidence around this model of care.

## LESSONS LEARNED

The accelerated uptake of telemedicine during the pandemic has resulted in valuable experience and evidence on the delivery of telemedicine for pediatric patients. Here the focus is on the lessons learned in 4 main areas: education and training, developing and adapting clinical workflows, patient assessment and treatment, and family-centered care.

### Education and training

Education and training in telemedicine is important for improving pediatric providers' acceptance of and comfort with virtual visits [17]. Telemedicine-specific training may also improve the quality of the visits and increase the experience of the encounters for providers, patients, and families [3]. In addition to training focused on delivering care over video, site-specific training around telemedicine workflows and processes is necessary for ensuring comprehensive and compliant documentation.

Training tools for telemedicine, including toolkits, webinars, and learning modules, can be used to improve adoption and implementation of telemedicine. The development and use of online educational modules was one strategy adopted during the pandemic to rapidly train providers. These modules are mandatory in some clinics and/or health systems and train providers on how to interface with the electronic health record during telemedicine visits, how to optimize sound and lighting, and how to best engage patients, for example, by adjusting the computer to simulate eye contact [18]. Tutorials have also been used for onboarding new providers, including educational materials on navigating the telemedicine software, supporting documentation, and outlining compliance and billing requirements [2]. Such training modules have also been required by medical staff offices for physician privileging purposes. Tip sheets are another useful tool that can help providers maintain professional, consistent, high-quality care [3,19]. These sheets may include strategies for optimizing audio and visual quality, assessing patients over video, documenting the visit, and billing. Training resources for pediatric telehealth continue to be developed, including by the American Academy of Pediatrics [3].

The appointment of official telemedicine "champions" within a clinic is another strategy that has been used to improve both telemedicine adoption and training among providers [2]. It has been well documented that physician champions can help change attitudes among their peers, influencing the success

of implementation and increasing the likelihood of sustainability. Champions can also act as peer educators, improving the skills and confidence of other providers, and have been used for one-on-one trainings to support other providers as practices transitioned to telemedicine during the pandemic [18]. Having a designated peer to answer questions and provide resources as needed can make providers feel supported. The presence of a provider telemedicine champion can also be an effective strategy for introducing new information on evidence-based practices, processes, and policies.

Medical education is an area in which high-quality telemedicine training is especially relevant. Incorporating telemedicine into the formal curriculum will improve the delivery of virtual visits and increase confidence. Despite the fact that trainees in all specialties are frequently seeing patients over telemedicine, fewer than 50% of pediatric training programs report having a formalized telemedicine curriculum and formal curricula that do exist are rated low in overall adequacy [20]. Recently, the American Association of Medical Colleges released a list of telehealth competencies relevant to medical education for physicians upon entry into residency or practice, and for experienced faculty physicians postresidency [21]. These competencies are organized across the following 6 domains:

- Patient safety and appropriate use of telehealth
- Access and equity in telehealth
- Communication via telehealth
- Data collection and assessment via telehealth
- Technology for telehealth
- Ethical practices and legal requirements for telehealth

Although these competencies add to emerging areas to help guide curricular and professional development, performance assessment, and cross-continuum collaborations, there remain opportunities to further develop curricula that incorporate evidence-based practices that add value to patients, providers, and payors. To this end, medical education, training programs, and ongoing continuing professional education should remain current and incorporate new clinical information on best practices as it becomes available.

## Developing and adapting clinical workflows

The accelerated uptake of telemedicine during the pandemic also necessitated rapid adaptations to clinical workflows. Clinics and providers were forced to triage patients to determine whether an in-person visit was necessary or if a virtual visit would be appropriate. Oftentimes, this triage would occur over a virtual visit [18,22]. Some providers and clinic offices created specific, well-defined guidelines for determining whether a patient should receive an in-person or telemedicine visit [18,22]. Often, the determination as to whether the encounter/visit could be done by telemedicine depended on the provider specialty, the patient diagnosis, or the urgency of the referral or medical condition. Others also described approaches that considered personal preferences, such as at the request of the provider or the patient [23,24].

Scheduling telemedicine visits also required workflow changes for many clinics. Scheduling systems were updated to accommodate video visits and schedulers adopted additional roles as telemedicine coordinators or navigators, helping patients to schedule, test electronic access, and participate in virtual visits. For example, navigators were often tasked with obtaining consent for the encounter, explaining to each patient how to connect to the telemedicine platform and assessing their technological capacity to successfully conduct the visit, and describing the benefits and risks of virtual visits to patients [18]. These processes often caused confusion as some parents reported missed telemedicine visits because they forgot to schedule follow-up visits, which were previously scheduled by going to the front desk at the end of an in-person visit [23]. Thus, integrating scheduling and support into the telemedicine workflow can prevent delays in care caused by scheduling and technical issues.

Providing team-based care over telemedicine poses additional challenges and also requires thoughtful changes in operations and clinical workflows. To continue providing team-based care, many provider teams developed systems that would allow all members of the usual in-person team to be present during the video visit [25]. This included virtual ''rooming'' by the medical assistant or nurse, who would take the patient's history, review medications, and begin visit documentation. Despite the operational and technical challenges, telemedicine shows promise for improving care coordination for children, especially those with chronic disease [26]. By allowing more members of the patient's care team to be present, including family members or distant caregivers, virtual visit telemedicine encounters could help to improve the shared decision-making process. Such encounters could include team members who may not typically join a patient's visit with a physician, such as pharmacists, physical or occupational therapists, and providers, such as a primary care provider [27,28]. Practicing virtual visits with all members of the caregiver team may help to improve the quality of these visits [25].

## Assessment and treatment

The inability to conduct a comprehensive physical examination has been frequently cited by both providers and caregivers as another disadvantage of virtual visits. Despite this, during the pandemic, providers found new ways to assess patients over video, many of which have been published [18,29]. For primary care and nonurgent conditions, a review of pediatric musculoskeletal teleassessments found that minimizing background noise and distractions, gathering items the child can use to demonstrate fine motor skills, ensuring the child is dressed in comfortable clothing, and preparing children for what to expect can help to facilitate an effective examination [30]. Other published studies found virtual examinations to be effective for diagnosing and treating common musculoskeletal conditions [29]. Eye examinations have also been conducted virtually during the pandemic for children, relying on parents to position their child's eye in the camera [22]. Training caregivers to conduct physical examinations may improve the quality of examinations; tools such as dolls,

cards, and checklists could help to facilitate effective and efficient virtual visits [25,29,31].

In addition to providing routine, scheduled visits to children with chronic health conditions, virtual visits have been increasingly used during the pandemic for the diagnosis and treatment of acute conditions such as upper and lower respiratory tract infections [8,32]. One large study of 47 primary care practices found high concordance with antibiotic-prescribing guidelines for children with acute respiratory tract infections assessed over telemedicine when encounters occurred within the medical home [32]. However, there is evidence that when third-party clinical services are used outside the medical home, guideline-concordant antibiotic management for respiratory infections is lower compared with in-person visits with children's primary care provider [33]. Other studies also found acceptable concordance with guideline-based care for the assessment and treatment of children with behavior health and externalizing disorders, including attention and disruptive behavior problems [34]. Importantly, telemedicine can also be used to facilitate COVID-19 screening, diagnosis, and monitoring from home [35].

Patient-generated data for the purposes of remote physiologic monitoring can also help to support virtual visits by providing information that is typically collected in person. For example, home spirometry and peak flow meters can help to provide an idea of a patient's lung function between in-office spirometry measurements for patients with asthma [36,37]. Patients with diabetes mellitus commonly use devices such as insulin pumps, smart pens, and continuous glucose monitors, which provide data directly to providers that can be discussed during a virtual visit [38,39]. However, some research has shown that increased home monitoring may not result in improved outcomes and may even increase health care utilization given the closer monitoring and more convenient access to care [40]. In addition, although patient-generated measurements have the potential to increase the provider confidence and support a shift to alternating or supplementing in-person and telemedicine visits, parents may have low self-efficacy with regard to home measurements [23,31]. Thus, appropriate training of caregivers and better evidence are necessary to ensure successful use of home monitoring devices and a positive caregiver experience.

### Family-centered care

It is increasingly recognized that telemedicine can be used to promote family-centered care [41], defined as a partnership approach to decision making between the family and the provider [42]. [43]. For children with complex medical needs, telemedicine has been shown to reduce care days outside of the home, serious illness, and health care costs [44], as well as improve a family's sense of security [45,46]. The use of telemedicine for postsurgical and palliative care is also promising, resulting in lower anxiety for parents and enhanced communication between providers and families [43,47].

During the pandemic, telemedicine was leveraged to provide family-centered care for hospitalized children [41,48]. When restrictions on physical presence

were in place, family-centered rounds using telemedicine in the neonatal intensive care unit (NICU), pediatric intensive care unit (PICU), and inpatient ward allowed families and caregivers to be actively engaged in their child's care [29,49,50]. In the settings of both inpatient and outpatient care, telemedicine allows both parents (and other caregivers and family members) to be present. This can result in improved parent/caregiver experience [23] and may have larger implications for the child's care long term.

The accelerated move to video visits has also given providers an opportunity to see pediatric patients in their home environments, which may lead to a deeper understanding of the social and environmental factors that may be affecting the child. This unique and personal experience can help to provide more personalized care. However, providers should be cognizant of any potential negative impacts. For example, some adolescents may feel uneasy discussing sensitive topics while at home, which could lead to limited or inaccurate responses [4,51,52]. Future research should explore how this aspect of virtual visits can bring value to pediatric care while ensuring confidentiality when needed.

## OPPORTUNITIES

The rapid adoption of telemedicine during the pandemic has highlighted the limitations of current technologies, workflows, and knowledge related to the delivery of telemedicine for pediatric patients. Key opportunities for growth exist in the areas of engaging pediatric patients, improving and measuring access to care, addressing health equity, and expanding the evidence base.

### Improving engagement with pediatric patients

Research has consistently found that adult patients are generally satisfied with physicians' ability to develop rapport and communicate effectively over telemedicine [53,54]. However, engaging with pediatric patients over video may be more challenging, particularly for children who are introverted or who lack communication skills [23]. This challenge may be exacerbated by a virtual encounter with a new provider who has never met the child in person [23]. Strategies and resources that aid providers in developing therapeutic alliance with patients could enhance virtual visits by increasing trust, improving patient and parent experience, and encouraging better communication by pediatric patients.

### Improving and measuring access to care

Telemedicine has long been recognized as a potential strategy to improve access to care, particularly for rural populations; this is especially true for children requiring pediatric subspecialty care because pediatric subspecialists are often scarce and concentrated at urban academic medical centers. Although it is widely accepted that telemedicine can reduce burdens on families related to travel and missed school and work days [26], the magnitude of this impact has not been quantified. In fact, during this pandemic, large-scale analyses on administrative data show that rural populations are less likely to use

telemedicine with their provider [55]. It is likely that there are subgroups of patients for whom the availability of telemedicine could significantly impact health care utilization and ultimately, patient outcomes. Identifying these subgroups could help to target specific patients who could benefit most from telemedicine services.

### Addressing health equity

There is concern that a shift to telemedicine use could lead to widening health disparities by improving access to care for those who already experience relatively lower burdens and better outcomes [56–58]. It is increasingly recognized that unless there is a specific focus on equity, interventions are likely to be implemented in a way that benefits those who already have relative advantages [59]. Identifying specific practices that promote equity within the delivery of telemedicine is important for developing evidence-based recommendations for best practices. Interventions that target patients less likely to access telemedicine could significantly contribute to health equity.

### Expanding the evidence base for pediatric telemedicine

Telemedicine has often been tested as a single component (eg, telemedicine vs in-person care) despite the fact that it is a complex intervention comprising a set of processes. Examining specific practices within the delivery of telemedicine for each condition is necessary for developing a set of best practices. Understanding the essential "core components" of pediatric virtual care for a specific condition can help to create standards of care that could be thoughtfully and intentionally adapted for different local contexts. Dissemination and implementation science approaches are particularly relevant to telemedicine interventions but have been underutilized. Rigorous studies on the implementation of telemedicine, including how programs can be adapted to meet the needs of patients in different local contexts, are necessary for advancing the field.

## SUMMARY

Despite an abundance of recent studies describing increased telemedicine use, there remain important gaps in the field. Opportunities exist to better understand telemedicine's role in education and training; how to best optimize clinical workflows, where telemedicine can improve patient assessment and treatment, and how telemedicine can be best used to support family-centered care. Educational resources that incorporate the most recent evidence on pediatric telemedicine care are needed. The availability of these resources can promote consistency across providers in addition to improving provider confidence and quality of care. Special care should be taken to ensure that these resources can be updated as evidence changes in this rapidly growing field. Patient-generated data, including remote physiologic monitoring, could improve the quality of virtual visits, but issues with measurement quality and parent self-efficacy must be addressed. Rigorous studies examining specific practices within telemedicine delivery and use are needed to develop evidence-based guidelines around virtual care for pediatric conditions. Implementation

science methods and frameworks could be applied to identify and test these practices. Finally, a focus on equity is essential for ensuring that telemedicine interventions do not widen health disparities.

## Disclosure
The authors have nothing to disclose.

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