

## Original Article

# Telemedicine in Paediatric Subspecialty : A Low Cost Model for Developing Countries during the COVID-19 Pandemic

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**Background :** Telemedicine is the delivery of Health Care Services using information and communication technologies. Most models of Telemedicine in developed countries involve high-cost infrastructure. The COVID-19 pandemic imposed lockdowns and travel restrictions have highlighted the importance and the necessity of an economically viable model of telemedicine for resource-poor countries like India.

**Methods :** We conducted a prospective study to assess the feasibility, acceptability and effectiveness of low-cost model of Telemedicine services for regular follow-up as well as for triaging. A combination of WhatsApp/email using smartphones and Electronic Medical Records (EMR) system was used to provide Telemedicine services. At the end of the e-consult, the patient/ parents were asked to rate their experience on a scale of 0 to 10.

**Results :** A total of 155 children and 865 consults were included. The mean age of the children was 8.5 years. Forty-four consultations were given to 12 (7.7%) International patients. Thirty-eight (24.5%) patients were seen for the first time via Teleconsultation and the remaining 117 (75.5%) were follow-up patients. The most common diagnosis was Nephrotic Syndrome (51.6%) followed by Chronic Kidney Disease (21.9%), Urinary Tract Infection (10.3%), Kidney-transplant follow-up (6.4%), Acute Glomerulonephritis (3.8%), and Acute Kidney Injury (2.6%). Twenty-three patients were advised admission after the Teleconsultation and the remaining 122 children were advised follow-up e-consults. The mean satisfaction score reported for e-consults was 9.4.

**Conclusion :** Our low-cost Telemedicine model offered a viable modality for delivery of Paediatric Nephrology Services during lockdown period and can be replicated by pediatricians practicing other subspecialties as well.

[J Indian Med Assoc 2022; 120(7): 11-5]

**Key words :** Telemedicine, Paediatric Nephrology, Teleconsultation, COVID-19 pandemic.

Access to paediatric subspecialty care has always been a challenge even for the developed world and the COVID-19 pandemic has made the traditional face-to-face outpatient consultation even more difficult<sup>1</sup>. Telemedicine has emerged as an effective alternative means to deliver Health Care Services using information and communication technologies<sup>2</sup>. Most of the studies evaluating the role of Telemedicine in paediatric Nephrology Care have been conducted in developed countries which had high infrastructure costs<sup>3,4</sup>. There is limited experience of Telemedicine for Paediatric care in India<sup>5,6</sup>. Moreover, studies evaluating the utility of Telemedicine for Paediatric Nephrology subspecialty in India is very rare<sup>7</sup>. In the wake of COVID-19 pandemic, the decision granting legal sanction to Telemedicine by the Governing Body of Medical Council of India (MCI) created a unique opportunity to evaluate the scope of Telemedicine in children<sup>8</sup>. However, there

### Editor's Comment :

- Access to paediatric subspecialty care has always been a challenge even for the developed world and the COVID-19 pandemic made the traditional face-to-face outpatient consultation even more difficult, Telemedicine offered a viable modality for delivery of Paediatric Nephrology Services during pandemic period when access to healthcare was restricted.
- Another advantage is the minimal cost and infrastructure required making it user friendly and widely acceptable.
- Although this experience is with children with kidney diseases it is equally applicable to other pediatric subspecialties where there is limited access.
- Our study can help improve simplify and standardise the practice of telemedicine.

remains a lot of hesitation amongst pediatricians about the safety and applicability of Telemedicine in our country. This single centre prospective observational study was carried out to assess the feasibility, methodology, acceptability and effectiveness of Telemedicine services for regular follow-up as well as for triaging children with kidney diseases for admission, in setting of a countrywide lockdown.

### MATERIALS AND METHODS

The study period was during the period of COVID-19 pandemic in our country from 1st June, 2020 to

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Received on : 07/10/2021

Accepted on : 14/06/2022

31st May, 2021. The parents were informed about the availability of Telemedicine services for Paediatric Nephrology through text messages sent from our patient data base as well through Social Media platforms like Facebook and WhatsApp. The patient data was stored in Electronic Medical Records (EMR) using the Healthplix platform. A combination of WhatsApp/email and EMR database was used to provide Telemedicine services during the study period. On receiving the request, a formatted message was sent to either of the parents' mobile number requesting for following information: current problems, weight, vital signs including temperature, blood pressure (whenever possible) as well as current and previous investigations. The records of follow-up patients was used to check whether patient was normotensive or hypertensive. Whenever required the parents family was asked to get BP recorded at their local pediatrician or nearest physician as in case of Acute Glomerulonephritis and Chronic Kidney Disease (CKD). All our kidney transplant children had been trained to measure and record BP at home. The diagnosis in case of new patients was confirmed by laboratory tests such as Kidney function tests and Urine protein/Creatinine ratio from a local laboratory. UTI is one of the commonest causes of fever and the diagnosis was made based on combination of clinical symptoms, urine examination and culture. The samples for Tacrolimus trough (T0) estimation of kidney transplant recipients were drawn at their nearby laboratory and couriered to the standard labs where testing is routinely done. The data was entered in EMR and electronic prescription was generated. This was sent over email or WhatsApp as per the family's preference. At the end of the e-consult the patient was asked to rate his experience on a scale of 0 to 10. The Study was approved by the Institutional Ethics Committee.

### RESULTS

The study group included patients from whom a request for Teleconsultation was received. During the 1-year study period a total of 865 e-consults were given. Eight-hundred-twenty-one (95.0%) e-consults were for domestic patients and 44 (5.0%) were for international patients. The domestic patients were from the states of Delhi, Uttar Pradesh, Bihar, Chhattisgarh, Madhya Pradesh, Punjab, Rajasthan, Uttarakhand, Gujarat, Assam and Karnataka. The domestic patients were predominantly (56.8 %) from Urban and metropolitan background, 27.1 % from semi-urban and 16.1% from Rural background. The study group

comprised of 155 patients and there were 119 (76.8%) boys and 36 (23.2%) girls. Out of the 155 patients, twelve (7.7%) were International patients and 143 (92.3%) were domestic patients. All these children were provided Teleconsultation using a combination of WhatsApp text and WhatsApp / Google duo video call on smartphone and the e-prescription was sent via email or WhatsApp.

The distribution of the diagnoses was as follows Idiopathic Nephrotic Syndrome (80 patients, 51.6%), Chronic Kidney Disease (34 patients, 21.9%), Kidney Transplant follow-up (10 patients, 6.4%), Urinary Tract Infection (16 patients, 10.3%), Acute Glomerulonephritis (6 patients, 3.8%), Acute Kidney Injury (4 patients, 2.6%) and others (5 patients, 3.2%). The mean age of the patients in was 8.5 years (range 0.17-18 years). All the e-consults that were advised, opted in for Teleconsultation. Of the 155 children in the study, there were 38 (24.5%) new patients that were evaluated for the first time via teleconsultation. The remaining 117 (75.5%) were follow-up patients, previously being followed up in our OPD clinics. Of the 155 children that were given e-consults, 122 (78.7%) were advised follow-up e-consults and 23 (14.8%) were advised admission. Children with Acute Kidney Injury (6) and Acute Glomerulonephritis (4) were managed in co-ordination with the treating pediatrician. In one of these, where a biopsy was indicated, the parents were requested to come to our center and the biopsy revealed Mesangiocapillary Glomerulonephritis.

After a detailed history on a video/audio call and review of the clinical status as well as investigations, a digitalised signed prescription was sent to the child's family. Of the 865 e-consults, 817 (94.5%) e-consults were delivered directly to the patient's parents through a combination of text and WhatsApp, or a combination of audio call and email. In 48 (5.5%) e-consults, where a smart phone was not available, the assistance of a paramedical worker was sought and a video consultation done via a WhatsApp video call. The digital prescription was sent via WhatsApp to the paramedic who in turn printed and handed it over to the patient. Majority of the patients opted for WhatsApp as a medium of e-prescription (727, 84.0%) while 138 (16.0%) e-consults were emailed through an inbuilt software. The mean satisfaction score reported by parents for e-consults was 9.4.

### DISCUSSION

Telemedicine, as defined by the World Health Organization, is: "the delivery of Health Care Services, where distance is a critical factor, by all Healthcare

Professionals. It involves using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation. It also encompasses, continuing education of Health Care Providers, all in the interests of advancing the health of individuals and their communities<sup>2</sup>. Telemedicine has been used as Healthcare Education tool in medicine for last many years. It can also be used for patient care delivery. It has been used extensively in radiology as well as pathology and to some extent in dermatology and paediatrics<sup>3,4,9-11</sup>. According to the interaction between the individuals involved, it is of the following types: (1) Health professional to health professional (giving easier access to specialty care, referral and consultation services) (2) Health professional to patient (providing Healthcare to the unreached population by giving them direct access to a medical professional)<sup>2</sup>.

One of the early Indian experience in Telemedicine in India has been from SGPGIMS, Lucknow, India<sup>12</sup>. Regular Tele-healthcare and Tele-educational services were conducted by them for the Postgraduate students of Medical Colleges of Orissa. In paediatrics, most of the studies have been from US in the pre COVID era<sup>4,9,14,15</sup>. They have demonstrated the usefulness in paediatric subspecialty care in rheumatology, weight management and emergency medicine. There is only 1 previous published study from Australia regarding the delivery of Telemedicine in Paediatric nephrology which evaluated 168 patients over a 10-year period. This was retrospective in nature and also involved dedicated videoconference studios and experienced Telehealth coordinators who manage referrals, provide technical support and assist with the delivery of Telehealth services which makes it expensive and not suitable for developing countries<sup>4</sup>. In contrast, our study is prospective in nature, over a 1-year period and involved a much larger number of e-consults.

There is no previous published experience from developing countries like India which have unique technological and communication challenges. The growth of Telemedicine in India was limited by the cost of infrastructure as well as regulatory issues including some legal judgments delivered by courts against it<sup>16</sup>. The initial challenge for the commencement of the programme posed by the lack of a primary centre for practicing Telemedicine services in many remote areas was resolved with the kick-off of mobile Telemedicine units with satellite communication. Over the past several decades, as the use of wireless broadband technology has become more advanced and

smartphone and internet use has become nearly ubiquitous. The recent pandemic highlighted the need of Telemedicine to bridge the gap of delivery of healthcare.

The Board of Governors responded promptly to the scenario and gave legal sanction to Telemedicine. Most Health insurance companies have also made Teleconsultation reimbursable. The MCI is also planning a certificate course to train medical personnel in the nuances of Telemedicine<sup>8</sup>. The Indian Academy of Pediatrics has also tried to promote Telemedicine by launching an app. The recent review article by Mahajan et al provides an excellent overview of the complexities of this practice<sup>17</sup>. The widespread smartphone penetration in our country makes it possible to deliver consultation through cell phone based applications. These applications include email and WhatsApp as well as Teleconsultation software. However, so far in our country we have followed a traditional Healthcare model which involves face-to-face patient physician contact with a history and good physical examination. However, the scenario is changing fast. Recent study from health-tech platform Practo showed that 50 million Indians have accessed online healthcare between March and May 2020 and there was 500% increase in e-consults and in-person doctor visits are down by 67%<sup>18</sup>. Interestingly, 80% of all Telemedicine users were experiencing it for the first time.

This is a single centre prospective pilot study, the first of its kind during this pandemic and the largest so far involving children with kidney diseases. It was conducted to evaluate the feasibility and applicability of Telemedicine services in management of children with kidney diseases. The low cost technology involved use of smartphones. Over the 1-year period, consults were given to parents of children with kidney diseases. There was a high acceptance of Telemedicine as evident from the fact that all the parents of these 155 children who were offered Telemedicine, consented to go ahead. It was effective across age groups in children ranging from 2-month old infant to an 18-year-old adolescent. It was also useful across a wide spectrum of kidney diseases ranging from simple renal problems like Urinary Tract Infections, Glomerular Diseases, Acute Kidney Injury, Chronic Kidney Disease and Kidney Transplant. We found this to be an effective modality in triaging patients for follow-up and admission. Based on Teleconsultation, 14.8% of the children were successfully triaged into admission. This obviated the need for outpatient-clinic visits in the rest 85.2% who were managed by

Telemedicine follow-up, thus sparing them from the logistical nightmare of travel to the hospital for paediatric nephrology consultation. As far as the modality of Telemedicine was concerned, we used a combination of Electronic Medical Record (EMR) system along with WhatsApp and or email. We found WhatsApp to be particularly suitable in the Indian setting in view of its widespread reach in Urban as well as Rural areas of the country. In the absence of a physical examination, the EMR data was of valuable assistance in tracking the trend of vital signs and laboratory values as well as the previous medications used. It also enabled the delivery of a signed digital prescription which is medicolegally appropriate as well as storage of the same for future reference as per Medical Council of India (MCI) Guidelines. A disclaimer was also added at the end of each consultation documenting the request of the same by the parents for medicolegal purposes. We found Telemedicine to be suitable both for new patients as well as for follow-up consultations.

Out of the 155 children, 76.8% were boys. It is possible that there was a selection bias as the gender distribution depended on the willingness of the parents to request for a Teleconsultation. Majority (94.5%) of the e-consults were delivered directly to the patients via either combination of text message and WhatsApp or audio call and email. Only 5.5% patients did not have a smart phone, where the assistance of a paramedical worker was sought for video consultation using WhatsApp video call. Since the parents or family members of majority of the children could access WhatsApp/ email, most of the children possibly came from educated background. However, the data regarding the educational background was not collected in our study. In the 5.5% of e-consults where a smart phone was not available, it is likely that the educational and Socio-economic status of them were low. The digital prescription was sent via WhatsApp to the paramedic who in turn printed it and handed it over to the patient. Majority (84.3%) of the patients opted for WhatsApp as a medium of e-prescription while rest were emailed through an inbuilt software. In our study, Telemedicine was found to have high acceptance and satisfaction by the parents as evidenced by a mean feedback score of 9.4 for e-consults.

Telemedicine services offer a win-win situation for both doctors as well as patients. The advantages for patients include better access (as during lockdown). This is also important for underserved areas and the services are convenient and available from the setting of patients own home without having to travel long

distances. Another advantage is the reduced cost in terms of time as well as money spent on travel and stay by the parents, which sometimes exceeds the cost of treatment (consultation fee as well as medicines). It also has health benefits for the patient in view of the early diagnosis, detection of complications as well as better patient compliance with treatment. It can also be used for patient education, reminders for vaccination as well as investigations. There are benefits for doctors too in terms of getting access to new patients from distant areas, cross physician referrals as well as second opinions. It improves clinical outcomes because of improved patient compliance as well as easy and better follow-up. It expands the horizon as in our experience we were able to offer e-consults to 12 International patients, of which 4 were new patients. All this comes with enhanced patient satisfaction because of stronger doctor patient relationship and improved tracking of health.

Telemedicine can be used by pediatricians for new patients, follow-up patients and second opinions as well as cross referrals.

There are a variety of modes of Telemedicine delivery platforms (1) audio calls (telephone, WhatsApp or similar platforms) (2) Telemedicine platforms (3) Hybrid using a combination of audio chat/ call in combination with an electronic medical record.

The simplest and quickest form of Telemedicine is an audio call using a telephone or a WhatsApp. It has the advantages of being quick and easy to use, convenient both for the physician as well as the patient and at no, extra cost. The disadvantages include difficulty in identification as well as consent, difficulty in record storage as well as retrieval, also there is no formal prescription, the quality of the consent being poor as well there being an absence of payment gateway. There also a variety of Telemedicine platforms available. These have immense advantages in terms of making patient identification possible, having a recorded consent (for medicolegal purposes), secure record storage and retrieval, having a legal and digital prescription. The quality of Teleconsultation experience is also good as the availability of video consultation simulates live face to face experience. There is payment gateway present making the experience for the Nephrologist a financially viable. Over a long period, it also enables brand customisation. There a few disadvantages as well as it requires the patient to be a bit tech-savvy in terms of ability to download the application on his smartphone or laptop which could limit its use in developing countries like India. Another

disadvantage is the additional cost to the users which may impede its wider usage. A third alternative is using a hybrid of telephone/WhatsApp along with an Electronic Medical Record. This enables record storage and retrieval, a legal and digitalised prescription that can be emailed or sent via WhatsApp at the same time being simple and user friendly. Electronic payment can be requested by bank transfer or digital wallet payments. The biggest advantage is the widespread penetration because of using WhatsApp based prescription delivery and that too at no additional cost. In the current study we utilised the third option with excellent results. There was a wide patient acceptance as well as satisfaction as evidenced by a high feedback score.

So based on this prospective observational study, we conclude that Telemedicine offered a viable modality for delivery of paediatric nephrology services during pandemic period when access to Healthcare was restricted. Another advantage is the minimal cost and infrastructure required making it user friendly and widely acceptable. The decline in in person doctor visits shows the increasing acceptability of Telemedicine in most specialties. Although this experience is with children with kidney diseases it is equally applicable to other Paediatric subspecialties where there is limited access. Our study can help improve simplify and standardise the practice of Telemedicine. This experience can not only be used during the current as well future pandemics, but also during non-pandemic situations. It also opens up new vistas for the paediatric subspecialists to deliver consultations and follow-up patients in remote areas where currently paediatric subspecialty services are unavailable.

#### REFERENCES

- 1 Ray KN, Ashcraft LE, Mehrotra A, Miller E, Kahn JM — Family Perspectives on Telemedicine for Pediatric Subspecialty Care. *Telemed J E Health* 2017; **23(10)**: 852-62. doi:10.1089/tmj.2016.0236.
- 2 WHO Global Observatory for eHealth (2010) Telemedicine: opportunities and developments in Member States: report on the second global survey on eHealth. World Health Organization. <https://apps.who.int/iris/handle/10665/44497>
- 3 Tse Y, Darlington ASE, Tyerman K, Wallace D — COVID-19: experiences of lockdown and support needs in children and young adults with kidney conditions. *Pediatr Nephrol* 2021. <https://doi.org/10.1007/s00467-021-05041-8>.
- 4 Trnka P, White MM, Renton WD, McTaggart SJ, Burke JR, Smith AC — A retrospective review of telehealth services for children referred to a paediatric nephrologist. *BMC Nephrol* 2015; **16**: 1-7.
- 5 Singh M, Das RR — Four years of experience of telemedicine for paediatric care in three Punjab hospitals, North India: achievements and lessons. *Postgrad Med J* 2010; **86(1022)**: 688-91. doi:10.1136/pgmj.2009.082735.
- 6 Kumari J, Jat KR, Kabra SK — Role of Telemedicine in Follow-up Care of Children with Respiratory Illnesses at a Tertiary Care Hospital — An Ambispective Observational Study. *Indian J Pediatr* 2021; <https://doi.org/10.1007/s12098-020-03590-8>.
- 7 Gulati S, Sengar A — Experience with telemedicine in paediatric nephrology during the COVID pandemic. *Pediatr Nephrol* 2021; **36**: 2499-500. <https://doi.org/10.1007/s00467-021-05085-w>.
- 8 Telemedicine Practice Guidelines. Board of Governors in supersession of the Medical Council of India. 2020. Available at: <https://www.mohfw.gov.in/pdf/Telemedicine.pdf>. Accessed 23 June 2020.
- 9 Ray KN, Ashcraft LE, Mehrotra A, Miller E, Kahn JM — Family Perspectives on Telemedicine for Pediatric Subspecialty Care. *Telemed J E Health* 2017; **23(10)**: 852-62. doi:10.1089/tmj.2016.0236.
- 10 Hare N, Bansal P, Bajowala SS — COVID-19: Unmasking Telemedicine [published online ahead of print, 2020 Jun 27]. *J Allergy Clin Immunol Pract* 2020; S2213-2198(20)30673-5. doi:10.1016/j.jaip.2020.06.038.
- 11 Reed ME, Parikh R, Huang J, Ballard DW, Barr I, Wargon C — Real-Time Patient-Provider Video Telemedicine Integrated with Clinical Care. *N Engl J Med* 2018; **379(15)**: 1478-9. doi:10.1056/NEJMc1805746
- 12 Mishra SK, Kapoor L, Singh IP — Telemedicine in India: current scenario and the future. *Telemed J E Health* 2009; **15(6)**: 568-75. doi:10.1089/tmj.2009.0059.
- 13 Kapoor L, Mishra SK, Singh K — Telemedicine: experience at SGPGIMS, Lucknow. *J Postgrad Med* 2005; **51(4)**: 312-5.
- 14 Ray KN, Mehrotra A, Yabes JG, Kahn JM — Telemedicine and Outpatient Subspecialty Visits Among Pediatric Medicaid Beneficiaries. *Acad Pediatr* 2020; **20(5)**: 642-51. doi:10.1016/j.acap.2020.03.014.
- 15 Reed ME, Parikh R, Huang J, Ballard DW, Barr I, Wargon C — Real-Time Patient-Provider Video Telemedicine Integrated with Clinical Care. *N Engl J Med* 2018; **379(15)**: 1478-9. doi:10.1056/NEJMc1805746.
- 16 Aggarwal KK — Prescription sans diagnosis: A case of culpable neglect. India Legal. Available from: <https://www.indialegalive.com-ConstitutionalNews-Courts>. Accessed April 8, 2020.
- 17 Mahajan V, Singh T, Azad C — Using Telemedicine During the COVID-19 Pandemic. *Indian Pediatr* 2020; **57(7)**: 658-61. doi:10.1007/s13312-020-1895-6.
- 18 [https://www.practo.com/company/insights/practo\\_insights\\_report.pdf](https://www.practo.com/company/insights/practo_insights_report.pdf). Accessed September 3, 2021.