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Benefits and barriers to pediatric teleurology during the COVID-19 pandemic

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Abbreviations

VV, Video visit; UVA, University of Virginia; DCI, Distressed Communities Index; SES, socioeconomic status

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Summary

Introduction

Telemedicine video visits are an under-utilized form of delivering health care. However due to the COVID-19 pandemic, practices are rapidly adapting telemedicine for patient care. We describe our experience in rapidly introducing video visits in a tertiary academic pediatric urology practice, serving primarily rural patients during the COVID-19 pandemic.

Objective

The primary aim of this study was to assess visit success rate and identify barriers to completing video visits. The secondary aim identified types of pathologies feasible for video visits and travel time saved. We hypothesize socioeconomic status is a predictor of a successful visit.

Materials and methods

Data was prospectively collected and analyzed on video visits focusing on visit success, **defined by satisfactory completion of the visit as assessed by the provider**. Other variables collected included duration, video platform and technical problems. Retrospective data was collected via chart review and analyzed including demographics, insurance, and distance to care. Socioeconomic status was

estimated using the Distressed Communities Index generated for patient zip code.

Results/discussion

Out of 116 attempted visits, 81% were successful. The top two reasons for failure were “no-show” (64%) and inability to connect (14%). Success versus failure of visit was similar for patient age ($p = 0.23$), sex ($p = 0.42$), type of visit (initial vs. established) ($p = 0.51$), and socioeconomic status ($p = 0.39$). After adjusting for race, socioeconomic status, and type of provider, having public insurance remained a significant predictor of failure ($p = 0.017$). Successful visits were conducted on multiple common pediatric urologic problems (excluding visits requiring palpation on exam), and video was sufficient for physical exams in most cases (Summary Table). A median of 2.25 h of travel time was saved.

Conclusions

While socioeconomic status, estimated using the Distressed Communities Index, did not predict success of video visits, patients with public insurance were more likely to have a failed video visit. There is compelling evidence that effective video visits for certain pathologies can be rapidly achieved in a pediatric urology practice with minimal preparation time.

Summary Table Primary diagnoses addressed.

| Visit Diagnosis | N (%) |
|---|----------|
| Bladder and Bowel Dysfunction (dysuria, urgency, nocturnal enuresis, urinary incontinence, voiding dysfunction, or frequency with constipation) | 35 (37%) |
| Post-Operative Care | 17 (18%) |
| Penile Conditions (adhesions, hidden penis, phimosis, meatal stenosis, or hypospadias) | 15 (16%) |
| Prenatal Hydronephrosis (Postnatal visit) | 11 (12%) |
| Vesicoureteral Reflux | 5 (5%) |
| Nephrolithiasis | 3 (3%) |
| Prenatal Hydronephrosis (Fetal visit) | 3 (3%) |
| Scrotal Conditions (pain or swelling) | 2 (2%) |
| Vaginal Conditions (discharge or labial adhesions) | 2 (2%) |
| Ureteropelvic Junction Obstruction | 1 (1%) |

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Introduction

The COVID-19 pandemic has had an enormous impact on pediatric urologic practices throughout the world, necessitating postponement of elective surgical procedures and non-urgent patient appointments [1,2]. Emergency surgeries continue to be performed, but questions remain as to what non-urgent surgeries can safely be postponed [2,3]. Similar questions arise for postponement of office visits. Delay of pediatric urologic care in certain cases (e.g. obstructive uropathy) could lead to worse outcomes or allow for progression of irreversible conditions, without being immediately life-threatening. To prevent morbidity associated with the postponement of care during the COVID-19 pandemic, methods that safely allow for high quality care have been implemented.

The COVID-19 pandemic has drastically accelerated the adaptation of telemedicine within pediatric urology [4]. Telemedicine allows for the delivery of care while maintaining safe social-distancing measures. Remote video visits (VVs) have been used successfully for years in pediatric urology for the delivery of postoperative care [5,6] and prenatal urologic consultation [7]. Yet overall, there is a paucity of existing research on the use of telemedicine for general pediatric urologic conditions.

The University of Virginia (UVA) is an academic tertiary care center catering to a mainly rural population across the state of Virginia. Beginning in March 2020 in response to COVID-19, the pediatric urology department at UVA began offering VVs to patients for the first time. This study seeks to present our experience of rapidly integrating the use of VVs into a previously in-person only practice. The primary aim was to assess the rate of successful VVs and identify barriers to a successful remote VV. The secondary aim was to delineate what types of visits were more feasible for VVs and how much travel time was saved by VVs.

Material and methods

Institutional Review Board approval was obtained (IRB #22340). In March 2020, the Pediatric Urology Division began rescheduling non-urgent patient appointments to telephone visits, VVs, or postponed in-person visits. Four providers (2 pediatric urologists and 2 nurse practitioners) selected the visits that were deemed appropriate for VV and conducted all of the VVs. Visits excluded from VV included conditions that required palpation on physical exam (e.g. undescended testis) and visits that required imaging (e.g. ultrasound, fluoroscopic imaging, etc.) that was unable to be obtained due to COVID-19. **VV platforms (doxy.me and Facetime) were selected based on institutional approval and patient preference; during the initial pandemic-related clinic closures, Facetime was given institutional approval for telemedicine use. Patients did not receive pre-clinic check-ins or phone calls to obtain initial intake.** Data was prospectively collected on patients scheduled for a VV from March 27, 2020 to May 15, 2020. Providers collected data on visit outcome (success vs. failure), duration, VV platform, and any technical problems encountered. VV success was defined as satisfactory completion of the clinical visit using VV technology as

assessed by the provider. Conversion of a VV to telephone appointment due to technical difficulties or a “no-show” was considered a failure. **Patients were present with their parent/guardian at all VVs.**

Following the VV, retrospective data were collected by chart review. Patient data collected included age, race, zip code, and type of insurance (public, private, or no insurance). VV data included primary diagnosis as well as the clinical outcome of the visit (e.g. medication change, imaging studies, surgery). The patient’s originally scheduled appointment location, cancelled due to COVID-19, was noted (main campus or satellite clinic). **Roughly 15% of patients are typically seen at one of the 4 satellite clinics located between 30 and 118 miles away from the main campus.** The distance from their home zip code to the original appointment location was then entered into Google Maps™ to estimate the travel distance and time they saved, using traffic conditions for 1:00 PM on a Wednesday. When a patient had no original visit, it was assumed they would have been scheduled for an appointment at the main campus location. The average distance of the shortest route and time to the clinic were recorded. Roundtrip time was estimated by doubling these values.

Socioeconomic status (SES) was estimated using the Distressed Communities Index (DCI) generated for each patient’s zip code. Created by the Economic Innovations Group, the DCI was generated using the U.S. Census Bureau’s American Community Survey’s 5-Year Estimates and Business Pattern data from 2007 to 2011 and 2012–2016 [8]. The DCI generates a normalized, comparative distress score ranging from 0 (“prosperous”) to 100 (“distressed”) for each zip code. The distress score is a composite of seven variables: rate of graduation, housing vacancy rate, unemployed adults, poverty rate, median income, change in employment, and change in the number of business establishments. DCI scores were licensed for use in this publication.

Statistical analysis

Descriptive variables are presented as median (interquartile range IQR) and count (percentage) as appropriate. Independent *t*-tests and Chi-square tests were used as appropriate to compare successful versus failed VV based on characteristics described above. Univariate and multivariable logic regression modeling was used to analyze the effect of study variables on VV success. The final model included patient and clinical variables with $p < 0.20$ on univariate analysis. Study data were collected and managed using REDCap electronic data capture tools [9]. SAS version 9.4 (SAS Institute Inc. Cary, NC) was used to perform statistical analysis with a statistical significance threshold set at 0.05.

Results

Primary outcome

During the seven-week study period, 116 patients scheduled for a VV were included in our cohort. Three additional patients were asked to participate in a VV but declined due

to lack of internet availability. Of the 116 VV attempts, 94 were successful and 22 failed for an overall VV success rate of 81%. Of these patients, 5 initially had a failed visit due to “no-show” but later had a successful visit. Otherwise, no patients in our sample had multiple VVs. Median length of successful VV was 22 min (IQR 15–30). Clinical outcomes of these 94 visits resulted in further testing with imaging or labs (37.2%), prescription changes (21.2%), surgery/procedure scheduling (10.6%), and follow-up visit only (46.8%). Reasons for VV failure included “no-show” (63.6%) and inability to connect (13.6%). For all patients who were unable to connect, the VV was converted to a telephone visit. The remaining 22.7% failed for several reasons: one patient’s parent required an interpreter, one patient’s parent was not sent the web browser link for the appointment, one patient’s parent requested to reschedule the visit, one patient’s parent decided to proceed with a telephone visit instead without video, and in one case, another child in the household was using the computer for school during the appointment (Table 1).

Doxy.me was the most commonly used video platform attempted (84%). Patients who successfully completed a VV were similar to those who failed in age ($p = 0.23$), sex ($p = 0.42$), type of visit (initial vs. established) ($p = 0.51$), and socioeconomic status as estimated by median DCI score ($p = 0.29$) (Table 2). A larger proportion of patients with VV success had commercial insurance than those with VV failure [61% vs. 32% respectively; $p = 0.029$]. Race differed between the two groups with more Caucasian patients in the successful VV group compared to the failed VV group [91% vs. 73%; $p = 0.034$]. There was no significant difference in provider type (physician vs. advanced practice provider) between the successful and failed VV groups [$p = 0.059$].

After adjusting for race, socioeconomic status, and type of provider, having public insurance (vs. commercial insurance or no insurance) remained a significant predictor of VV failure [OR, 3.85; 95% CI 1.28–11.60; $p = 0.017$] (Table 3).

Secondary outcome

The most common primary diagnoses addressed for a VV included bladder and bowel dysfunction (37%), post-

operative care (18%), and penile conditions (16%) (Table 4). Most visits were for established patients (62%) and less for new patients (38%). 33% of patients had imaging done prior that was discussed during their VV. All imaging was reviewed by the provider without the use of outside reports. The majority of VVs that required a physical exam was completed successfully. Out of 37 initial visits, 14 required a physical exam to determine the plan of care. Eight exams were successfully performed via video for diagnoses including penile adhesions, hypospadias, labial adhesions and circumcision/circumcision revision. Six exams were considered difficult. For 3 patients, difficulties were due to patient movement and grainy picture quality to evaluate the conditions including penile skin bridging, hypospadias/chordee, and meatal stenosis. Three additional patients required in-person testicular exams for palpation purposes to evaluate scrotal pain or undescended testis. Of note, the undescended testis was not the primary reason for the visit but was incidentally discussed by the parent. For the patients with inadequate video exams, in-person clinic follow-up was requested. Out of 57 follow-up and post-operative VVs, 19 required physical exams to evaluate post-operative healing or determine future plan of care. All of these exams were adequate via the video platform. Post-operative VVs were performed for hypospadias repair, orchidopexy/orchiectomy, inguinal hernia repair, circumcision, and chordee repair.

Patients who successfully completed a VV would have travelled a median 101.4 miles (IQR 51.4–155.9) round-trip with a median travel time of 135 min (IQR 72.9–200) to get to the in-person appointment.

Discussion

Prior to the COVID-19 pandemic, telemedicine was an under-utilized form of delivering health care in the field of pediatric urology [10]. Prior studies have demonstrated successful telemedicine encounters for post-operative visits as well as for prenatal consultations on urologic conditions, most commonly including urinary tract dilation [5–7]. Out of necessity, the pandemic has changed the way practitioners have traditionally provided services in order to maintain quality care for pediatric urologic patients. Due to this unforeseen adaptation of telemedicine into a solely in-person practice, this study aimed to understand factors that may lead to a successful VV and also understand barriers to the process. VVs commenced within one week of hospital wide changes in response to COVID-19. Despite the minimal preparation time, our VVs were largely successful at an 81% rate. In scheduled visits excluding no-shows, our technical success rate was 92%. A previous pediatric urology telemedicine investigation by Finkelstein et al. found a similar rate of 96% [6]. No patients in the study had previous telemedicine visits with our practice, so the technical success rate did not benefit from patient experience with previous pediatric urology telemedicine visits. We still had a modest no-show rate, totaling 12%; this rate was fairly surprising given the state had a stay-at-home order at the time. This rate was certainly higher than the rate reported by Finkelstein et al., at 6% [6]. There are many possible reasons for this discrepancy including demographics, nature

Table 1 Outcomes from successful visits and reasons for failed visits.

| Successful video visits (n = 94) | |
|---|-----------|
| Clinical outcome of video visits ^a – no. (%) | |
| Further testing (labs, imaging, etc.) | 35 (37.2) |
| Prescription (new, change, refill) | 20 (21.2) |
| Scheduled surgery/procedure | 10 (10.6) |
| Further follow-up only (none of the above) | 44 (46.8) |
| Failed video visits (n = 22) | |
| Reason for failure – no. (%) | |
| No show | 14 (63.6) |
| Patient unable to connect | 3 (13.6) |
| Other | 5 (22.7) |

^a More than one outcome per visit possible.

Table 2 Baseline demographics and clinical characteristics of scheduled remote video visits (VVs) in pediatric urology clinic from 3/27-5/15.

| Characteristic | All attempted video visits (n = 116) | Successful video visits (n = 94) | Failed video visits (n = 22) | p-value |
|--|---|-------------------------------------|---------------------------------|---------|
| Age | | | | 0.06 |
| Median age – yrs (IQR) | 5.0 (1.6–11.0) | 5.0 (1.0–10.0) | 7.0 (3.0–12.0) | |
| Sex – no. (%) | | | | 0.42 |
| Male | 72 (62.1) | 60 (63.8) | 12 (54.6) | |
| Female | 44 (37.9) | 34 (36.2) | 10 (45.5) | |
| Race – no. (%) | | | | 0.034 |
| White/Caucasian | 97 (87.4) | 81 (91.1) | 16 (72.7) | |
| Black/African-American | 9 (8.1) | 6 (6.7) | 3 (13.6) | |
| Hispanic/Latino | 5 (4.5) | 2 (2.3) | 3 (13.6) | |
| Asian | 0 (0) | 0 (0) | 0 (0) | |
| American Indian/Alaska Native | 0 (0) | 0 (0) | 0 (0) | |
| Missing race (n = 5) | | | | |
| Health Insurance – no. (%) | | | | 0.029 |
| Public | 50 (43.0) | 35 (37.3) | 15 (69.2) | |
| Commercial | 64 (55.2) | 57 (60.6) | 7 (31.8) | |
| Self-pay | 2 (1.7) | 2 (2.1) | 0 (0) | |
| Distressed Communities Index (DCI) | | | | |
| Median DCI – DCI (IQR) | 48.0 (29.5–66.2) | 50.0 (29.6–68.7) | 37.4 (27.2–56.5) | 0.29 |
| DCI Quartiles – no. (%) | | | | 0.29 |
| Q I: DCI 0–24.9 | 23 (20.0) | 19 (20.4) | 4 (18.2) | |
| Highest SES | | | | |
| Q II: DCI 25–49.9 | 38 (33.0) | 27 (29.0) | 11 (50.0) | |
| Q III: DCI 50–74.9 | 40 (34.8) | 35 (37.6) | 5 (22.7) | |
| Q IV: DCI 75–100 | 14 (12.2) | 12 (12.9) | 2 (9.1) | |
| Lowest SES | | | | |
| Missing DCI (n = 1) | | | | |
| Type of visit – no. (%) | | | | 0.51 |
| New patient | 44 (37.9) | 37 (39.4) | 7 (31.8) | |
| Established patient | 77 (62.1) | 57 (60.6) | 15 (68.2) | |
| Provider type – no. (%) | | | | 0.059 |
| Physician | 47 (40.5) | 42 (44.7) | 5 (22.7) | |
| Advanced practice provider (APP) | 69 (59.5) | 52 (55.3) | 17 (77.3) | |
| Video platform | | | | 0.80 |
| attempted for VV– no (%) | | | | |
| Doxy.me | 97 (83.6) | 79 (84.0) | 18 (81.8) | |
| FaceTime | 19 (16.4) | 15 (15.9) | 4 (18.2) | |

of the visits, and potential differences in scheduling and reminders. While post-operative visits comprised 18% of our cohort, Finkelstein's study included only post-operative visits [6]. Postoperative visits have previously been found to be better attended than other follow-up appointments in an otolaryngology study [11] that may be explained by patients investing more in an appointment after a surgery. Only some of the patients received pre-appointment reminders, and these reminders are a proven method to reduce no-show rates for in-person visits [12]. Additionally, our success rate could have been higher if we included telephone conversion as a successful visit given many

providers may feel telephone is sufficient. However, we did not consider these converted visits as a success given the element of video or visualization of the patient can be an important component of an office visit.

In the course of this study, we sought to understand what factors predict a failed VV. We presumed patient age and sex would not be predicting factors given the parent or guardian was the participant in the VV and not the child. We unfortunately did not have data on parents' demographics. We had anticipated higher SES would be positively correlated with visit success, as bandwidth and SES have been found to be barriers to the use of telemedicine in

Table 3 Modeling video visit failure.

| Multivariate analysis | OR | p-value |
|---|----------------------|---------|
| Minority (vs. White) | 1.24 (0.35–4.43) | 0.74 |
| Public insurance | 3.85 (1.28–11.60) | 0.017 |
| DCI Quartile (vs. Quartile I– Highest SES) | | 0.43 |
| Quartile II: DCI 25–49.9 | 6.17 (0.68–56.30) | |
| Quartile III: DCI 50–74.9 | 0.59 (0.38–6.05) | |
| Quartile IV: DCI 75–100 – Lowest SES | 0.54 (0.07–4.03) | |
| MD provider (vs. APP) | 0.35 (0.11–1.10) | 0.071 |

the past [13]. Alternatively, we found that DCI, a proxy for SES, did not predict visit failure. **The DCI has been used in several medical studies including recent publications examining the relationship between SES and surgical risk [14,15].** We, however, recognize the flaws in using DCI as a surrogate for SES given this score generalizes a community to their zip code and does not account for individuals who deviate within the mean. Additionally, given the popularity and wide-spread use of smart phones and computer technology in 2020, failure of VVs may not be representative of low SES as it may have been in the past. Interestingly, public insurance, that may be considered another alternate for low SES, significantly predicted a failed VV in a multivariate analysis.

Beyond the feasibility of VVs, there are many advantages of telemedicine for patients and families including a reduction in pre-appointment wait time [9,14], greatly-reduced travel time and rate of missing school or work for the appointment with equivalent clinical outcomes as compared to in-person visits [16]. Obviating the need to travel is an important benefit to emphasize, as our patients

Table 4 Primary diagnoses addressed.

| Visit Diagnosis | N (%) |
|--|----------|
| Bladder and Bowel Dysfunction (dysuria, urgency, nocturnal enuresis, urinary incontinence, voiding dysfunction, or frequency with constipation) | 35 (37%) |
| Post-Operative Care | 17 (18%) |
| Penile Conditions (adhesions, hidden penis, phimosis, meatal stenosis, or hypospadias) | 15 (16%) |
| Prenatal Hydronephrosis (Postnatal visit) | 11 (12%) |
| Vesicoureteral Reflux | 5 (5%) |
| Nephrolithiasis | 3 (3%) |
| Prenatal Hydronephrosis (Fetal visit) | 3 (3%) |
| Scrotal Conditions (pain or swelling) | 2 (2%) |
| Vaginal Conditions (discharge or labial adhesions) | 2 (2%) |
| Ureteropelvic Junction Obstruction | 1 (1%) |

live throughout the state of Virginia and often need to travel great distances to attend an appointment. The patients in our cohort would have saved a **median 2.25 h** in travel time. Although we serve a mainly rural population, the experience of our patients' families is not unique, as it has been found that 29% of the under-18 population in the United States lives at least 40 miles from the nearest pediatric urology practice [17].

This time and travel savings has to be balanced with providing good quality care remotely. Within our cohort, the VVs were productive in that they lead to a change in plan of action in 69% percent of cases (i.e. prescription change, surgery or imaging scheduling, etc). **To our knowledge, this is the first study to demonstrate the utility of telemedicine in pediatric urology beyond prenatal consultation and postoperative visits. In our study, telemedicine was used for decision-making that led to changes in care including surgery and medication changes.** In scheduling the patients for VV, we recognized that a large number of patients required imaging results to have a meaningful visit. If patients were unable to get these studies, their visits were required to be delayed and did not merit a VV. Another barrier with telemedicine is the lack of ability to perform a thorough physical exam, especially one that requires palpation. Therefore, patients with undescended testes were strategically deferred for an in-person visit. **Other conditions such as identifying a urethrocutaneous fistula or meatal stenosis after hypospadias repair may be quite challenging.** From our secondary outcome, we found that post-operative visits were quite amenable to VV as previously demonstrated by others [6], with no difficulties in examination; however 43% of exams were considered inadequate on initial visits that were reliant on the physical exam. While the number of difficult exams was small, it highlights that certain conditions are better suited for telemedicine compared to others. Future research should focus on success rates and outcomes of VV appointments broken down by diagnosis.

Several limitations should be noted. Our sample is a largely self-selected group of patients that had access to the equipment necessary for VVs, therefore may hold selection bias. It would be prudent to examine the rates of patients turning down the opportunity for VVs to gain a better understanding of what barriers in the community prevent patients from even attempting a VV. We also did not have demographic data on the parents to help identify factors that could influence the success or failure of VVs. Additionally, although providers deemed visits successful, it would be beneficial to examine patients' perception on whether they feel their goals were accomplished. Equally so, a comparison between VVs and in-person visits may be informative. Finally, as mentioned above, although we used DCI as a surrogate for SES, this score is certainly flawed due to its generalization based on zip code.

Conclusions

Our results provide compelling evidence that effective remote VVs can be rapidly achieved in a pediatric urology practice with minimal preparation time. Private insurance status was the most predictive factor for a successful VV.

Certain pathologies are more amenable for a quality visit via telemedicine, mostly those visits less reliant on physical exam findings. Future use of telemedicine would allow for greater access to patients in need of pediatric urological services.

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Declaration of competing interest

None.

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