Journal of Pediatric Surgery 56 (2021) 923–928

Contents lists available at ScienceDirect

Journal of Pediatric Surgery

journal homepage: www.elsevier.com/locate/jpedsurg.org

Review Article

Pediatric urology amidst SARS-CoV-2 pandemic: Building the future with current knowledge

Alyssa M. Lombardo[d,#,*], Ciro Andolfi[a,e,#], Abhishek P. Deshpande[c], Joshua M. Aizen[a], Pankaj P. Dangle[b], Mohan S. Gundeti[a]

[a] Pediatric Urology, Section of Urology, Department of Surgery, Division of the Biological Sciences and Pritzker School of Medicine, The University of Chicago, 5841 S. Maryland Ave. MC 7122, Chicago, IL 60637, United States
[b] Section of Pediatric Urology, Department of Urology, University of Alabama at Birmingham, Children's of Alabama, 1530 3rd Ave. S, Birmingham, AL 35233, United States
[c] University of Illinois, College of Medicine, 1853W Polk St. MC 785, Chicago, IL 60612, United States
[d] University of Chicago Pritzker, School of Medicine, 924 E 57th St. Ste. 104, Chicago, IL 60637, United States
[e] The MacLean Center for Clinical Medical Ethics, The University of Chicago, 5841 S Maryland Ave. MC 6098, Chicago, IL 60637, United States

ARTICLE INFO

Article history:
Received 19 November 2020
Revised 3 January 2021
Accepted 5 January 2021

Keywords:
Pediatric urology
SARS-CoV-2
COVID-19
Ethics
Social justice
Nonmaleficence

ABSTRACT

Introduction: The COVID-19 pandemic has ripped around the globe, stolen family members and forced healthcare systems to operate under an unprecedented strain. As of December 2020, 74.7 million people have contracted COVID-19 worldwide and although vaccine distribution has commenced, a recent rise in cases suggest that the pandemic is far from over.
Methods: This piece explores how COVID-19 has explicitly impacted the field of pediatric urology and its patients with a focus on vulnerable subpopulations.
Results: Various medical and surgical associations have published guidelines in reaction to the initial onset of the pandemic in early 2020.
Discussion and Conclusion: As the number of patients with COVID-19 increases, long-term recovery and future preparedness are imperative and should be cognizant of patient subpopulations that have been subject to disproportionate morbidity and mortality burden. Development of a dedicated response team would aid in achieving preparedness by drafting and implementing plans for resource allocation during scarcity, including logistic and ethical considerations of vaccine distribution.
Level of evidence: III

1. Introduction

In December 2019, the people of Wuhan, China, were first to face the outbreak of another severe acute respiratory syndrome (SARS) caused by a type of coronavirus (SARS-CoV-2), whose RNA genome is completely new to humans. A novel coronavirus disease (COVID-19) rapidly developed into a global pandemic with over 74 million infections and 1.6 million deaths worldwide [1].

Data from the Chinese Center for Disease, Control and Prevention indicated that as of August 2020, approximately 7.3% of total confirmed cases were between the age of 0–18 years [2,3]. The disease burden is compounded when children have underlying comorbidities. A study by Lu et al. found that three (1.7%) out of 171 children with COVID-19 required intensive care support with invasive mechanical ventilation [4]. All three patients had underlying conditions––hydronephrosis, intussusception and leukemia. Other comorbidities associated with worse clinical outcomes were diabetes, chronic renal failure and neurological disorders. These data pose additional concerns about the health and well-being of children with disabilities, who may experience heightened difficulty as families navigate restrictions on physical distancing when seeking and receiving care.

The opportunity presents itself to reflect on failures and successes of our first response to a pandemic, and to review our major responsibilities as a healthcare providers and as a teaching institution. This article is written in an effort to provide guid-

Abbreviations: AAP, American Academy of Pediatrics; ACIP, Advisory Committee on Immunization Practices; ACS, American College of Surgeons; AHA, American Hospital Association; AUA, American Urological Association; BAPU, British Association of Paediatric Urologists; CKD, chronic kidney disease; COVID-19, Coronavirus Disease; ESAS, Elective Surgery Acuity Scale; ESPU, European Society of Paediatric Urology; EUA, Emergency Use Authorization; EUA, European Urological Association; FDA, Food and Drug Administration; MeNTS, Medically-Necessary, Time-Sensitive procedures; MIS, minimally invasive surgery; pMeNTS, Pediatric Medically-Necessary, Time-Sensitive procedures; SARS, severe acute respiratory syndrome; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2; SRAT, Scarce Resource Allocation Team.

* Corresponding author.
E-mail address: alyssa.lombardo@uchospitals.edu (A.M. Lombardo).
# Equal Contribution

https://doi.org/10.1016/j.jpedsurg.2021.01.017
0022-3468/

ance for long-term recovery and develop preparedness for future resurgence of infections, focusing on scarce resources prioritization, continuity of care for children with special needs, prosperity of our communities and ethical vaccine distribution.

2. Resource prioritization and continuity of care

2.1. Triaging

As we adapt to a constantly evolving set of conditions, it is important to ensure that the needs of our patients are adequately being met. In response to the pandemic, many major governing professional organizations, including the American Urological Association (AUA), European Urological Association (EUA), British Association of Paediatric Urologists (BAPU), American Academy of Pediatrics Section of Urology (AAP), and European Society of Paediatric Urology (ESPU) have released official statements offering guidance. Overarchingly and across departments, these bodies were in agreement that in front of an infection surge the first step is to suspend elective activities, prioritizing clinical needs based on the availability of limited resources and minimizing exposure of patients, families and healthcare personnel [5,6]. Under these circumstances, surgeons are required to triage patients and ascertain their clinical diagnostic or surgical priorities (Tables 1 and 2). Based on this, Table 1 is our suggested ambulatory triage of pediatric urology maladies by organ system and Table 2 outlines triage of pediatric urology surgical cases. To aid in triaging non-emergent cases, the American College of Surgeons (ACS) released the Elective Surgery Acuity Scale (ESAS), a prioritization algorithm for pediatric surgeons. This algorithm, though not specifically designed for pediatric urologists, uses a tiered system to assess acuity, overall patient health and risks associated with delayed or ambulatory surgery. Both ACS and the American Society of Anesthesiologists recommended a daily acuity assessment within the context of resource availability in preparation for fluctuations in viral spread and future challenges [7,8].

Regarding Pediatric Urology, the BAPU has recommended that in-person outpatient clinic encounters be limited to urgent needs only. Routine clinic visits, instead, should be performed via phone or video conferencing. With regard to surgical care, BAPU suggests using a numeric classification system on a scale of 1–5, with 5 representing a threat to life or limb and 1 representing elective surgery that can be delayed for at least two months without clinical repercussions. Prachand et al. proposed the Medically-Necessary, Time-Sensitive (MeNTS) scoring system, which generates a cumulative score based on procedure type, disease process and patient characteristics, with higher scores associated with poorer outcomes [9]. The MeNTS model considers resource scarcity and provider risk to ethically and efficiently determine which procedures should proceed. A similar model called pMeNTS has been developed at the University of Chicago for use in pediatric surgical patients [10].

When it is determined that a case should proceed with surgery, specific precautions should be taken to minimize aerosolization and risk of transmission during minimally invasive surgery (MIS), including conventional laparoscopy and robotic-assisted technique, which is widely used in pediatric urology. For instance, Mottrie et al. suggested reducing insufflation pressures, use of a smoke evacuator to prevent gas leakage, and carbon dioxide deflation should be performed via a closed system at the conclusion of the case [11]. Additionally, surgeons should lower the electrocautery power setting and avoid ultrasonic sealing devices to reduce aerosolization. Intuitive Surgical® has also recommended that all components of the robotic console should be cleaned with agents effective against coronavirus. Because of the risk of airborne spread during anesthesia and for the safety of patients and providers, all patients are tested, and results are reviewed prior to surgery. Test results should be reviewed with caution as it has been discovered that children can shed SARS-CoV-2 in their stool for up to 35–51 days, a longer period of time when compared to adults [12]. Ling et al. reported limited SARS-CoV-2 nucleic acid in urine, though no clear association between urine spillage and viral transmission has been reported [13]. Special screening and considerations should be made when a pediatric urologist is operating outside of the genitourinary tract, including, but not limited to, obtaining a buccal graft or performing augmentation cystoplasty and catheterizable channel.

2.2. Outpatient telemedicine

The current pandemic has altered the usual approach to patient care, presented new challenges and accelerated adaptation for both patients and providers. New technologies have been adopted including HIPAA compliant, EPIC-integrated video calls and phone calls. Although new technology inevitably presents a learning curve, the value of telemedicine in the pediatric urology realm has been well-studied and was instituted at some centers prior to COVID-19 [14-16]. Estrada et al. compared remote patient encounters via a live video system with conventional in-person visits in over 200 patients who did not require physical examination or radiological investigation. No difference was identified in appointment compliance or clinical outcomes; however, patients engaging in virtual visits encountered shorter wait times and decreased absences from school and work [16]. Additionally, for populations who face barriers to care, including transportation and interference with work, telemedicine may lessen those burdens and decrease incidence of late or missed appointments. Preliminary results of an ongoing quality review of patients receiving pediatric surgical specialty care at the University of Chicago Medical Center indicate that parents and caregivers are satisfied with the care they received via telehealth [17].

2.3. Ethical considerations during COVID-19

Undoubtedly, the shift from in-person visits to telehealth and other changes made in response to COVID-19 will have considerable impact on vulnerable sub-populations of children with preexisting co-morbidities and those requiring regular care. For instance, a meta-analysis by Henry et al. found a significant association between children with chronic kidney disease (CKD) and severe COVID-19 infection [OR=3.03 (95% CI 1.09–8.47)] [18]. Similarly, it is likely that parents of children with disabilities may have trouble bridging the gap in health care needs, including access to health care providers and medical supplies (e.g. catheters for neurogenic bladder patients). Without in-person guidance for parents and caretakers, children with neurogenic bladder may be prone to developing urinary tract infections, worsening of urinary incontinence, and other complications as a result of improper bladder management. We would be remiss not to acknowledge the impact of structural health and social injustices pertaining to COVID-19 infection rates and deaths and the disproportionate burden borne by minority groups. Between March 21 and July 25, 2020, Hispanic or Latino and non-Hispanic black children (less than 18 years old) had higher cumulative rates of COVID-19–associated hospitalizations (16.4 and 10.5 per 100,000, respectively) than did non-Hispanic white children (2.1) [19]. These data are striking and should be at the core of discussions to develop plans for better allocation of resources, which have historically given preference to white or affluent patients [20]. Recently, in *The Lancet*, a team from Johns Hopkins discussed considerations for a plan to fairly distribute resources without perpetuating existing inequalities by periodically

Table 1
Suggested ambulatory triage in pediatric urology by organ system.

	Emergent/Life threatening:ER Visit	Semi urgent:Office visit within 2- 4 weeks	Non-urgent new patient and follow up visit: Telehealth visit
Renal	• Renal Trauma • Pyelonephritis • Life threatening hematuria	• Renal Tumors (e.g. Wilms' tumor) • *Hematuria, ongoing • *Bilateral hydronephrosis, pre- or post-natal	• UPJO • Duplex kidney • Nonfunctioning kidney • Multicystic dysplastic kidney • Stones • Postnatal Hydronephrosis • (Provided imaging available for above, if not triaging on phone and plan to see 4–6 weeks with imaging) • Follow up of above condition for established patients if no surgical intervention required
Ureter	• Trauma • Obstruction	• Ureterocele, obstructing • *VUR with recurrent pyelonephritis • *VUJ (Obstruction with UTI)	• VUR/UVJ /Treated VUR Follow up after initial established diagnosis • (Wait until imaging available for 4–6 weeks)
Bladder/ Urethra	• Foreign body • Trauma • Urinary retention of various causes (i.e. posterior urethral valve) • Cloacal Exstrophy • Urogenital sinus with hydrometrocolpos	• *Persistent hematuria • *Neurogenic bladder UTI • *Rhabdomyosarcoma bladder/Prostate • *Exstrophy complex	• Follow up Neurogenic Bladder • Recurrent UTI • Urinary Incontinence • Urachal remnant • Bladder diverticulum • Urethral stricture voiding • Meatal stenosis • Urogenital sinus without complications • (Wait until imaging available for 4–6 weeks)
Penis	• Trauma to Penis • Paraphimosis • Neonatal circumcision injury • Priapism	• Lesions over penis	• Hypospadias • Chordee • Epispadias • Foreskin issues • Other penile disorders • (12–24 weeks)
Scrotum/ Testis	• Testicular torsion • Rupture • Epididiymoorchitis with abscess • Obstructed hernia	• *Tumor • *Intra-abdominal undescended testis	• Varicocele • Palpable undescended testis • Epididymal cyst • Reducible hernia • (4–12 weeks based on symptoms)
Vagina	• Trauma	• * Malignancy (embryonal rhabdomyosarcoma)	• + Urethral prolapse • Disorder of sexual differentiation • (Wait until imaging available for 4–12 weeks based on symptoms)

* Imaging Required for evaluation and further management (Exception, based on induvial patient and complexity).
+ Telehealth visit is appropriate following presentation to the Emergency Department and/or topical treatment.

assessing their survival numbers by income, race and other socioeconomic factors and integrating feedback from community members to address deficiencies [21,22].

2.4. Resource allocation and financial impact

Due to the cessation of elective surgeries and procedures, hospital revenues have been severely impacted, threatening closure of safety-net hospitals, which often operate on razor-thin financial margins [23]. The American Hospital Association (AHA) estimates total projected losses to hospitals and health systems in 2020 of at least $323.1 billion [24]. For instance, in the wake of the 2019 closure of Hahnemann Hospital, a century-old, safety-net hospital in Philadelphia, thousands of patients lost access to their established care teams and were subject to subsequent increased morbidity and mortality [23]. Hospital bankruptcy and subsequent closures, especially of safety-net hospitals, will further exacerbate morbidity and mortality associated with the COVID-19 pandemic, especially among low-income populations who rely on these hospitals for care. Worldwide, the direct and indirect repercussions of hospital closures and patients' loss of health insurance or employment is difficult to assess considering variations in healthcare systems

Table 2
Suggested surgical triage in pediatric urology by organ system.

	Emergent/Life-threatening	Urgent/Semi-Urgent	Elective
Renal	• Grade IV / V renal trauma with hemodynamic instability • Ureteropelvic junction (UPJ) disruption with urinoma	• UPJO in solitary kidney, decreased renal function, or symptomatic • Bilateral high-grade obstruction • Tumors	• =UPJO with normal renal function • =Duplex kidney with nonfunctioning upper pole • =Nonfunctioning kidney with hydronephrosis
Ureter	• Symptomatic stone disease with obstruction, infection, sepsis • Trauma	• + Obstructing Ureterocele • + High grade VUR with multiple breakthrough UTIs or pyelonephritis, reduced renal function • * Symptomatic ureterovesical junction obstruction with decreased renal function	• =VUR, persistent, high grade, with renal scarring • =VUR into duplicated system with preserved upper pole function with UTI
Bladder Urethra	• Foreign body • Trauma • Urinary retention with inability to pass catheter (e.g. posterior urethral valve)	• + Persistent hematuria not responding to conservative management • + Hematuria related to mass lesion, clot retention • + Neurogenic bladder with failure to empty and unable to catheterize • # Rhabdomyosarcoma bladder/Prostate • +Bladder diverticulum with UTI • +Urethral stricture • +Meatoplasty	• ~Bladder augmentation • ~Continence procedures • ~Urachal remnant procedures • ~Urogenital sinus • =Exstrophy complex
Penis	• Trauma	• ^ Non-reducible paraphimosis • ^ Urethral stenosis with urinary retention • ^ Neonatal circumcision injury • ^ Abscess, not responding to antibiotics • ^ Balanitis/balanoposthitis with retention • ^ Trauma	• ~Hypospadias /Chordae repair • ~Epispadias • ~Routine circumcision • ~Other reconstructive procedures
Scrotum/Testis	• Testicular torsion • Abscess with pyrexia • Obstructed hernia	• Testicular rupture • Tumor • = Intra-abdominal undescended testis	• =Varicocele repair with testicular asymmetry • ~Testicular prosthesis • ~Epididymal cyst excision
Vagina	• Injury	• # Malignancy (e.g. embryonal rhabdomyosarcoma) ± urinary retention	• ~Urethral prolapse • ~Disorder of sexual differentiation

* Diversion with Stent.
\+ Endoscopic procedure to reduce the morbidity and length of hospitalization.
\# Alternative to surgery if possible, and equivocal results for patient.
^ Simple procedure (minimal risk and morbidity) to alleviate the current problem.
= Discuss risk of surgery Vs Observation, while waiting for period of 3 months.
~ Elective can wait for more than 3 – 6 months(Exception based on individual patient symptoms and complexity).

and is beyond the scope of this piece but will undoubtedly cause increased suffering, especially among marginalized peoples.

Without intervention, our most vulnerable patients will suffer, and all patients will be impacted by the effects of a healthcare system operating under unprecedented strain. The opportunity has now presented itself to be more prepared for increasing infection rates than we were for the initial onset of cases in early 2020. To be thoroughly prepared, further recommendations specifically tailored to pediatric patients will be required to preserve essential resources and deliver proper treatment to children in need of urological care. Preparation for future pandemics or increasing COVID-19 infections should include allocation of both human and infrastructure resources, case prioritization by medical necessity, wellness programming for healthcare providers and families and budgeting. Penn School of Arts and Sciences political scientist and Leonard Davis Institute (LDI) of Health Economics Senior Fellow, Julia Lynch, PhD, pioneered a guide for establishment of a “Scarce Resource Allocation Team,” or SRAT, which is committee dedicated to such decision-making [25]. Fig. 1 relies on the “Plan-Do-Study-Act” model of Quality Improvement [26] to integrate establishment of a SRAT or other structured emergency response team with the various, often competing interests of an ever-evolving pandemic.

2.5. Vaccine distribution

Omission of commentary regarding the ethical considerations and status of a COVID-19 vaccine, its distribution and the infrastructure required for widespread inoculation would render this

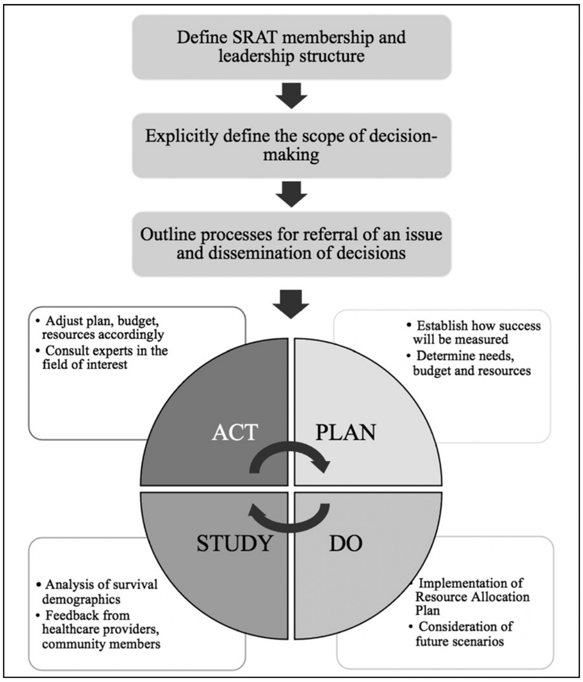

Fig. 1. Development and implementation of a "scarce resource allocation team" (SRAT) using the quality improvement plan-do-study-Act model.

piece incomprehensive. Though details continue to unfold, on December 11, 2020, the U.S Food and Drug Administration (FDA) issued an Emergency Use Authorization (EUA) for the Pfizer-BioNTech COVID-19 vaccine. On December 12, 2020, the Advisory Committee on Immunization Practices (ACIP) issued an interim recommendation for use of the Pfizer-BioNTech COVID-19 vaccine in persons aged 16 years and older for the prevention of COVID-19 [27]. On December 18, 2020 the U.S. FDA issued an EUA for the Moderna COVID-19 Vaccine to be distributed for use in individuals 18 years of age and older [28]. Therefore, at the current time, children under 16 years of age will not be eligible for vaccination due to exclusion of children from vaccine clinical trials. Under such circumstances, the field of pediatric urology may question how to best advocate for the health and safety of their patient population beyond the current precautionary measures and triaging of surgical cases to reduce exposure risk. On the contrary, Scarce Resource Allocation Teams (SRATs), healthcare providers and multidisciplinary teams have the opportunity to prepare for the distribution of vaccines and think critically about how it may impact their pediatric patients, both logistically and ethically.

Though no finalized plans have been made, it is expected that hospitals and large pharmacy chains will be among those distributing the early vaccine, before local pharmacies and clinics [29]. More than ever, hospitals will have tremendous power and social responsibility. For instance, increased attention should be paid to communities of color, where some of the highest rates of vaccine hesitancy in the country are rooted in deep history of exclusion and unconsented experimentation [30]. Recognition of generational trauma and establishment of intentional, reciprocal community partnerships are integral to successful and widespread vaccination. Hospitals that engage with members of their catchment areas may find the exchange of resources to be symbiotic. For instance, community members or business owners can offer influence and marketing, volunteer manpower or provide space accommodating of a "drive thru" vaccination clinic (e.g., school auditorium, place of worship, covered car wash) [29]. This would inform planning and allocation of funding such that a mobile, refrigerated "Vaccination Van" may prove more cost-effective than the renovation or construction of a hospital-associated space for public inoculation. In partnering with communities, hospitals can be a key player in the solution to the problem of vaccine documentation including which vaccine and how many doses were received. Through use of the electronic medical record system, hospitals can reap the benefits of a catchment area with easily accessible documentation to better understand exposure risk for healthcare workers and prevent delays in future procedures for lack of documentation of inoculation. Even so, larger problems remain including logistic and ethical considerations of worldwide vaccine distribution, which will necessitate an enormous humanitarian effort to ensure a safe return to travel, a robust global market and protection of the human race from COVID-19 and future pandemics.

Conclusion

The COVID-19 pandemic has uncovered existing inefficiencies in our current mechanisms of healthcare delivery. Under immense pressure imposed by the pandemic, Emergency Response Teams and think tanks have been forced to innovate and act quickly. Perhaps the quote "react, mitigate & prepare for future, in crisis" illustrates how utilization of both hindsight and foresight can drive adaptation and innovation amidst adversity and uncertainty. For example, point of care devices and telehealth services may help alleviate burdens currently faced by traditional healthcare delivery systems. Pertinent to pediatric urology, the creation of at-home urinalysis kits and portable ultrasound machines with associated smartphone applications have converted cell phones into diagnostic tools to detect renal masses, kidney stones, hydronephrosis, abdominal masses, and other pathology. It is feasible to imagine how these devices may ultimately be used to reduce patient exposure to hospital settings where infectious diseases may be transmitted. In an exciting endeavor, the concept of telerobotic surgery has been trialed in Canada, though its success has been limited by delays in transmission of movement [31]. While development of these systems will face high initial capital costs and training, development and adoption of innovative technologies have the potential to reduce the risk of viral transmission, alleviate healthcare disparities in rural locations through expansion of catchment areas and equip hospitals with the resources to treat critically ill patients inpatient while managing less acute problems from afar. The COVID-19 public health emergency has uncovered many issues and while many families, businesses and hospitals are still actively fighting and recovering from the effects of the pandemic, we have an opportunity and responsibility to address inequities in healthcare and develop strategies for adaptation that will fortify the healthcare system and strengthen our communities.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

References

[1] Coronavirus COVID-19 Global cases by the center for systems science and engineering (CSSE) at Johns Hopkins University. Johns Hopkins Coronavirus Resource Center; 2020. Accessed September 4 https://coronavirus.jhu.edu/map.html .
[2] Lee PI, Hu YL, Chen PY, et al. Are children less susceptible to COVID-19? J Microbiol Immunol Infect 2020:19–20. doi:10.1016/j.jmii.2020.02.011.
[3] Wang D, Hu B, Hu C, et al. Clinical characteristics of 138 Hospitalized Patients with 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China. JAMA - J Am Med Assoc 2020;323:1061–9. doi:10.1001/jama.2020.1585.
[4] Lu X, Zhang L, Du H, et al. SARS-CoV-2 infection in children. N Engl J Med 2020;382:1663–5. doi:10.1056/NEJMc2005073.
[5] Hospitals cancel elective operations amid rising COVID admissions; 2020. Accessed October 19 https://updates-rcseng.co.uk/4D4N-XRUD-AECA32D1C9D933CE117YVOCC6A1E10AAB5433F/cr.aspx .

[6] Europe Landler M. Which thought it had the virus tamed, faces a resurgence. The New York Times; 2020. https://www.nytimes.com/2020/10/14/world/europe/europe-coronavirus.html. Published October 19, 2020. Accessed October 19.
[7] COVID-19: guidance for triage of non-emergent surgical procedures March 17, 2020. American College of Surgeons; 2020. Accessed November 5 https://www.facs.org/covid-19/clinical-guidance/triage .
[8] Joint statement: roadmap for maintaining essential surgery during COVID-19 pandemic; 2020. Accessed November 5 https://www.asahq.org/about-asa/newsroom/news-releases/2020/08/joint-statement-roadmap-for-maintaining-essential-surgery-during-covid-19-pandemic .
[9] Prachand VN, Milner R, Angelos P, et al. Medically necessary, time-sensitive procedures: scoring system to ethically and efficiently manage resource scarcity and provider risk during the COVID-19 pandemic. J Am Coll Surg 2020;231:281–8. doi:10.1016/j.jamcollsurg.2020.04.011.
[10] Slidell MB, Kandel JJ, Prachand V, et al. Pediatric modification of the medically necessary, time-sensitive scoring system for operating room procedure prioritization during the COVID-19 pandemic. J Am Coll Surg 2020;23:205–15. doi:10.1016/j.jamcollsurg.2020.05.015.
[11] Mottrie A. ERUS (EAU robotic urology section) guidelines during COVID-19 emergency. 2020. https://uroweb.org/wp-content/uploads/ERUS-guidelines-for-COVID-def.pdf.
[12] Ma X, Su L, Zhang Y, et al. Do children need a longer time to shed SARS-CoV-2 in stool than adults? J Microbiol Immunol Infect 2020;53:373–6. doi:10.1016/j.jmii.2020.03.010.
[13] Ling Y, Xu S-B, Lin Y-X, et al. Persistence and clearance of viral RNA in 2019 novel coronavirus disease rehabilitation patients. Chin Med J (Engl) 2020;133:1039–43. doi:10.1097/CM9.0000000000000774.
[14] Canon S, Shera A, Patel A, et al. A pilot study of telemedicine for post-operative urological care in children. J Telemed Telecare 2014;20:427–30. doi:10.1177/1357633X14555610.
[15] Finkelstein JB, Cahill D, Kurtz MP, et al. The use of telemedicine for the postoperative urological care of children: results of a pilot program. J Urol 2019;202:159–63. doi:10.1097/JU.0000000000000109.
[16] Finkelstein JB, Cahill D, Young K, et al. Telemedicine for pediatric urological postoperative care is safe, convenient and economical. J Urol 2020;204:144–8. doi:10.1097/JU.0000000000000750.
[17] Mohanty A, Shin YJ, et al. Telehealth - A new paradigm? pediatric surgery telemedicine survey during the COVID-19 pandemic at a tertiary care center, Chicago, Illinois: University of Chicago Quality and Safety Symposium; 2020. Poster Presentation presented at the.
[18] Henry BM, Lippi G. Chronic kidney disease is associated with severe coronavirus disease 2019 (COVID-19) infection. Int Urol Nephrol 2020;52:1193–4. doi:10.1007/s11255-020-02451-9.
[19] Kim L. Hospitalization rates and characteristics of children aged 18 years hospitalized with laboratory-confirmed COVID-19 — COVID-NET, 14 states. March 1–July 25, 2020. MMWR Morb Mortal Wkly Rep 2020;69. doi:10.15585/mmwr.mm6932e3.
[20] Schmidt H. The way we ration ventilators is biased. New York Times; April 15, 2020. Published online https://www.nytimes.com/2020/04/15/opinion/covid-ventilator-rationing-blacks.html .
[21] COVID-19 story tip: pandemic resource allocation needs to address health inequity. Johns Hopkins medicine newsroom; June 30, 2020. PublishedAccessed October 19, 2020 https://www.hopkinsmedicine.org/news/newsroom/news-releases/covid-19-story-tip-pandemic-resource-allocation-needs-to-address-health-inequity .
[22] Galiatsatos P, Kachalia A, Belcher HME, et al. Health equity and distributive justice considerations in critical care resource allocation. Lancet Respir Med 2020;8:758–60. doi:10.1016/S2213-2600(20)30277-0.
[23] Reese PP, Lin E, Harhay MN. Preparing for the next COVID-19 crisis: a strategy to save safety-net hospitals; 2020. Accessed October 19/do/10.1377/hblog20200617.787349/full.
[24] New aha report finds losses deepen for hospitals and health systems due to COVID-19 | aha; 2020. Accessed October 19 https://www.aha.org/issue-brief/2020-06-30-new-aha-report-finds-losses-deepen-hospitals-and-health-systems-due-covid-19 .
[25] Levins H, Lynch Julia. How can hospitals address scarce resources during COVID-19? LDI; 2020. Accessed October 19 https://ldi.upenn.edu/news/how-can-hospitals-address-scarce-resources-during-covid-19 .
[26] Plan-Do-Study-Act (PDSA) directions and examples; 2020. Accessed October 19 http://www.ahrq.gov/health-literacy/improve/precautions/tool2b.html .
[27] Oliver SE, Gargano J, Marin M. The advisory committee on immunization practices' interim recommendation for use of Pfizer-BioNTech COVID-19 vaccine — United States. December 2020. MMWR Morb Mortal Wkly Rep 2020;69. doi:10.15585/mmwr.mm6950e2.
[28] Commissioner of the fda takes additional action in fight against COVID-19 by issuing emergency use authorization for second COVID-19 vaccine. FDA; 2020. Published December 21Accessed December 22, 2020 https://www.fda.gov/news-events/press-announcements/fda-takes-additional-action-fight-against-covid-19-issuing-emergency-use-authorization-second-covid .
[29] Are You Near a Vaccine Desert? 11 Crucial questions answered. NBC News; 2020. Accessed December 17 https://www.nbcnews.com/news/us-news/how-get-covid-vaccine-everything-we-know-cost-effectiveness-n1250624 .
[30] Inside the complexity of COVID vaccine distribution. LDI; 2020. Accessed December 17 https://ldi.upenn.edu/news/inside-complexity-covid-vaccine-distribution .
[31] Anvari M, McKinley C, Stein H. Establishment of the world's first telerobotic remote surgical service. Ann Surg 2005;241:460–4. doi:10.1097/01.sla.0000154456.69815.ee.