



Measuring the Impact of a Delay in Care on Pediatric Otolaryngologic Surgery Completion

Ear, Nose & Throat Journal
2022, Vol. 0(0) 1–7
© The Author(s) 2022
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/01455613221134428
journals.sagepub.com/home/ear


Geethanjeli N. Mahendran, BS¹ , Ching Siong Tey, BS^{2,3}, Mary Frances Musso, DO^{4,5}, Grace Shebha Anand, MPH^{4,5}, Jeffrey Larson, BS⁶, Mitesh Mehta, BS⁷, Lara Reichert, MD, MPH^{8,9}, Kara Prickett, MD^{7,10}, and Nikhila Pinnapureddy Raol, MD, MPH^{7,10}

Abstract

Objective: To determine if postponement of elective pediatric otorhinolaryngology surgeries results in a change in overall healthcare utilization and if there is any commensurate impact on disease progression. **Methods:** We identified patients ≤18 years of age whose surgeries were postponed at the onset of the COVID-19 pandemic-related shutdown. We then tracked patients' rate of and patterns of rescheduling surgery. Surveys were also sent to caregivers to better characterize his/her decision regarding moving forward with his/her child's surgery during COVID-19. **Results:** A total of 1915 pediatric patients had elective surgeries canceled, of which 992 (51.8%) were rescheduled within 4 months. No difference in rates of rescheduling was identified based on race or ethnicity. Patients who were scheduled for tonsillectomies and/or adenoidectomies were 1.22 times more likely to reschedule compared to those patients with other planned procedures (CI: 1.02–1.46). A total of 95 caregivers at two hospitals completed surveys: 44 (47.4%) rescheduled their child's surgery. Most caregivers who rescheduled were concerned their child's disease could impact their future (n = 14, 32%). **Conclusions:** Just over half of patients who had pediatric otolaryngologic surgery canceled during a period of social distancing went on to have surgery within a 4-month timeframe. This reflects the dependence of pediatric otolaryngologic surgery on environmental exposures and may represent a potential target for prevention and management of some pediatric otolaryngologic diseases.

Keywords

COVID-19 shutdown, healthcare utilization, pediatric otolaryngology

¹Emory University School of Medicine, Atlanta, GA, USA

²Department of Pediatrics, Emory University School of Medicine, Atlanta, GA, USA

³Department of Psychology, University of Georgia, Athen, GA, USA

⁴Otolaryngology and Head and Neck Surgery, Baylor College of Medicine, Houston, TX, USA

⁵Pediatric Otolaryngology and Head and Neck Surgery, Texas Children's Hospital, Houston, TX, USA

⁶Northwestern University Feinberg School of Medicine, Chicago IL, USA

⁷Department of Otolaryngology-Head and Neck Surgery, Emory University School of Medicine, Atlanta, GA, USA

⁸Department of Otolaryngology-Head and Neck Surgery, Ann and Robert H Lurie Children's Hospital, Chicago, IL, USA

⁹Department of Otolaryngology-Head and Neck Surgery, Albany Medical Center, Albany, NY, USA

¹⁰Children's Healthcare of Atlanta, Atlanta, GA, USA

Received: May 20, 2022; revised: September 25, 2022; accepted: October 4, 2022

Corresponding Author:

Nikhila Pinnapureddy Raol, MD, MPH, Department of Pediatric Otolaryngology, Children's Healthcare of Atlanta, 1400 Tullie Rd NE 1st Floor, Atlanta, GA 30329, USA.

Email: nikhila.p.raol@emory.edu



Creative Commons Non Commercial CC BY-NC: This article is distributed under the terms of the Creative Commons

Attribution-NonCommercial 4.0 License (<https://creativecommons.org/licenses/by-nc/4.0/>) which permits non-commercial use, reproduction and distribution of the work without further permission provided the original work is attributed as specified on the SAGE and

Open Access pages (<https://us.sagepub.com/en-us/nam/open-access-at-sage>).

Introduction

The natural progression of common pediatric otolaryngologic diseases can be difficult to assess. Children present and progress through the disease process as they grow—making it difficult to ascertain when to intervene. Additionally, the presence of communicable diseases can exacerbate or mask underlying illnesses.¹ The decision to intervene precludes an understanding of disease progression. Finally, the unethical nature of withholding pediatric treatment prevents a thorough understanding of the natural progress of childhood diseases.

The mandated COVID-19 shutdown created an opportunity to study the natural progression of several pediatric otolaryngologic diseases.² The prohibition of elective surgeries forced caregivers and healthcare providers to engage in watchful waiting and reassess the need for intervention. Further, mandated public health behaviors such as wearing masks and remote learning reduced the incidence of communicable diseases among children.³⁻⁵

Our study aims to determine if postponement of elective pediatric otorhinolaryngology surgeries results in a change in overall healthcare utilization and if there is any commensurate impact on disease progression. Through a prospective analysis of disease succession during the pandemic, we can highlight opportunities to revisit common treatment algorithms.

Patients & Methods

The study was approved by the Institutional Review Board of all three involved medical systems. Medical records were reviewed to identify patients whose previously scheduled pediatric otolaryngology surgeries between March 17, 2020 and April 14, 2020 were postponed or canceled due to the COVID-19 crisis at Children's Healthcare of Atlanta (CHOA), Ann and Robert H. Lurie Children's Hospital of Chicago (Lurie), and Texas Children's Hospital (TCH). Demographic data collected includes age at COVID-19 shutdown (March 17, 2020), sex, ethnicity, race, preferred language, insurance, comorbidities, indication for elective surgery, number of ED visits, and any medication changes. Data at all three institutions was collected by August 2020. Of note, only medication changes for CHOA and Lurie were collected. Preferred language was categorized as English, Spanish, and other or unknown. Insurance was categorized as public, private, TriCare, unknown, and self-pay. Indications for surgery were grouped into ten categories: minor ear, major ear, airway, tonsil and/or adenoid (T&A), nasal cases, benign head and neck, cancer, urgent (lacerations and foreign body removal), and other.

Among CHOA and TCH's patient cohort, caregivers were asked to complete a survey to assess decision-making on surgery rescheduling and additional services sought during the delay period. Parents who did not have adequate resources to complete the survey, had no email address on file, were unable to read and understand English and those who did not provide

e-consent were excluded. Surveys reported information regarding caregiver decision-making, their child's disease status, COVID-19 exposure, number of emergency room visits and if their child had any medication changes during the delay period.

Patients were grouped into those who rescheduled surgery (RS) and those who did not reschedule (NR). Any procedure not rescheduled by August 2020 after reopening was considered NR. Statistical analysis was completed using SPSS (Version 27.0, © IBM Corporation, Armonk, NY). Two sample t-tests were used to compare continuous data, such as age at COVID-shut down. Chi-squared analysis was performed to compare demographic and clinical characteristics between RS and NR patients. Fisher's Exact Test was performed when more than 20% of expected cells had values <5. Multivariable logistic regression was performed to determine the effects of patient demographics on scheduling outcomes. Variables were considered for the regression models if they were associated with the outcome in the unadjusted univariable analysis with P -value of $\leq .15$. The conservative P -value allowed for reporting of possible trends and potential confounders that were marginally significant. All variables with P -value < .05 were considered statistically significant. Confidence Intervals (CI) were reported at 95% level.

Results

Demographic Data

After reopening of elective surgeries, 30 days after the COVID-19 lockdown, a total of 992 (51.8%) patients had their surgeries rescheduled. 42.1% (229) of patients at CHOA rescheduled compared to 59.4% (360) at Lurie and 52.7% (403) at TCH (Table 1). RS patients were older than NR patients (average age 5.41(SD: 4.1); RS average age 5.52 (4.2) vs NR average age 5.30 (4.0)); $P = .237$). Although ethnicity was found to be significantly associated with scheduling outcomes ($P < .001$) this was only significant for patients with an "Unknown" ethnicity in post-hoc analysis (OR: .34; CI: .19-.63). Gender, race, and language were not significantly associated with likelihood to reschedule ($P = .853$, $P = .192$, $P = .406$). Insurance was significantly associated with scheduling outcomes ($P = .004$). Notably, patients with TriCare insurance were less likely to be rescheduled compared to patients with public insurance (OR: .25; CI: .08-.75). On multivariable logistic regression, patient demographic characteristics were not found to be significant.

Surgery Indication

There was a total of 1265 and 1132 surgical indications for RS and NR patients, respectively (Table 2). In both RS and NR groups, minor ear surgeries ($n = 469$ and $n = 461$, respectively) and T&A ($n = 483$ and $n = 404$, respectively) were the most common surgical indications. Patients who

Table 1. Patient Demographics.

	Total No. (%)	Re-scheduled patients No. (%)	Not rescheduled No. (%)	P-value
	1915	992	923	
CHOA	544 (28.4)	229 (23.1)	315 (34.1)	
Lurie	606 (31.6)	360 (36.3)	246 (26.7)	< .001
TCH	765 (39.9)	403 (40.6)	362 (39.2)	
Age, years (SD)	5.41 (4.1)	5.52 (4.2)	5.30 (4.0)	.237
Male sex	1083 (56.6)	559 (56.4)	534 (56.8)	.853
Ethnicity				
Not Hispanic/Latino	1268 (66.2)	651 (65.6)	617 (66.8)	
Hispanic/Latino	594 (31.0)	327 (33.0)	267 (28.9)	< .001
Unknown	53 (2.8)	14 (1.4)	39 (4.2)	
Race, No. (%)				
White	1147 (59.9)	615 (62.0)	532 (57.6)	
Black	452 (23.6)	229 (23.1)	223 (24.2)	
Asian	60 (3.1)	27 (2.7)	33 (3.6)	
Native American	6 (.3)	2 (.2)	4 (.4)	
Native Hawaiian/Pacific Islander	5 (.3)	3 (.3)	2 (.2)	.192
Other	127 (6.6)	68 (6.9)	59 (6.4)	
Multiracial	18 (.9)	8 (.8)	10 (1.1)	
Unknown	100 (5.2)	40 (4.0)	60 (6.5)	
Language, No. (%)				
English	1661 (86.7)	867 (87.4)	794 (86.0)	
Spanish	222 (11.6)	112 (11.3)	110 (11.9)	
Other	24 (1.3)	11 (1.1)	13 (1.4)	.406
Unspecified	8 (.4)	2 (.2)	6 (.7)	
Insurance, No. (%)				
Public	1030 (53.8)	536 (54.0)	494 (53.5)	
Private	826 (43.1)	440 (44.4)	386 (41.8)	
TriCare	19 (1.0)	4 (.4)	15 (1.6)	.004
Unknown	15 (.8)	4 (.4)	11 (1.2)	
Self-Pay/None	25 (1.3)	8 (.8)	17 (1.8)	
Comorbidity Yes, No. (%)	553 (28.9)	292 (29.4)	261 (28.3)	.576

CHOA = Children's Healthcare of Atlanta, Lurie = Lurie's Children Hospital of Chicago, TCH = Texas Children's Hospital. Age = Age at COVID-19 shutdown (March 17, 2020). P-values in bold are significant.

were scheduled for T&A were more likely to have re-scheduled a surgery compared to those patients who were not scheduled for a T&A (OR: 1.22; CI: 1.02–1.46). All other surgical indications were not significantly associated with scheduling outcomes.

Comorbidities

Five Hundred Fifty-three patients had at least one comorbidity (Table 1). Among RS patients, 292 (29.4%) had at least one comorbidity compared to 261 (28.3%) NR patients (Table 3). Patients with a pulmonary comorbidity were significantly more likely to reschedule surgery compared to those without a pulmonary comorbidity ($P = .020$). In contrast, those with an endocrinology comorbidity were less likely to reschedule surgery ($P = .005$).

Survey Data

A survey on the decision of rescheduling was conducted between 2 and 4 months after COVID-19 lockdown. A total of 95 CHOA and TCH patients had caregivers who completed surveys on their behalf. Fifty one of these respondents had not rescheduled surgery and 44 of patients did reschedule their child's operation (Table 4). Among those who had not rescheduled their child's surgery, 14% (7) made their decision due to concern their child would be exposed to COVID-19 in the medical facility, 10% (5) noted natural resolution of their child's illness, and 14% (7) had difficulty with scheduling. 57% (29) of respondents indicated Other. Only three of these caregivers provided responses: one indicated that their child had larger surgery scheduled elsewhere, one stated their doctor had decided to wait until the patient had another ear infection,

Table 2. Surgery Indication by Institution.

		CHOA	Lurie	TCH	All
Minor ear	RS	45.3% (116)	57.1% (144)	49.5% (209)	51.8% (469)
	NR	54.7% (140)	42.9% (108)	50.5% (213)	48.2% (461)
Major ear	RS	27.3% (6)	42.4% (14)	77.3% (17)	48.1% (37)
	NR	72.7% (16)	57.6% (19)	22.7% (5)	51.9% (40)
Airway	RS	42.2% (54)	70.9% (61)	54.6% (171)	54.3% (286)
	NR	57.8% (74)	29.1% (25)	45.4% (142)	45.7% (241)
T&A	RS	48.6% (119)	60.6% (175)	53.5% (189)	54.5% (483)
	NR	51.4% (126)	39.4% (114)	46.5% (164)	45.5% (404)
Nasal	RS	54.3% (26)	57.1% (8)	69.0% (20)	59.3% (54)
	NR	45.8% (22)	42.9% (6)	31.0% (9)	40.7% (37)
Benign Head & Neck	RS	30.0% (6)	62.5% (10)	66.7% (16)	53.3% (32)
	NR	70.0% (14)	37.5% (6)	33.3% (8)	46.7% (28)
Cancer	RS	0 (0)	66.7% (2)	100% (1)	75.0% (3)
	NR	0 (0)	33.3% (1)	0 (0)	25.0% (1)
Urgent	RS	44.4% (4)	0 (0)	0 (0)	36.4% (4)
	NR	55.6% (5)	0 (0)	100% (2)	63.6% (7)
Other	RS	37.5% (6)	50.0% (1)	83.3% (5)	50.0% (12)
	NR	62.5% (10)	50.0% (1)	26.7% (1)	50.0% (12)

*Fisher's Exact Test.

RS, Rescheduled; NR, Not Rescheduled; TCH, Texas Children's Hospital. Minor Ear: Tubes, Tube Removal, Myringoplasty/Tympanoplasty, Cerumen removal; Major Ear: Mastoidectomy, Cochlear Implant, BAHA; Airway: DLB, DISE, Frenulectomy, Supraglottoplasty, LTR, Cricoid Split, Tracheostomy; Nasal Cases: FESS, Turbinate Reduction, Nasal Endoscopy, Septoplasty, Rhinoplasty; Benign Head & Neck: Neck Masses & Congenital Lesions, Pre-Auricular cyst, Branchial Remnants, Thyroglossal Duct cysts, Excisions, Biopsies; Cancer: Thyroidectomy, Basal Cell Carcinoma; Urgent: Foreign Body Removal, Laceration Repair; Other: Cleft Palate Repair, Botox Injections, Split Graft Repair/Wound Tissue Transfer, Removal of face hardware. *P*-values in bold are significant.

Table 3. Comorbidities.

Comorbidity	Total	Rescheduled	Not rescheduled	<i>P</i> -value
Cardiac	145	73	72	.715
Neurology	145	80	65	.398
Gastrointestinal	172	94	78	.433
Pulmonology	216	128	88	.020
Endocrinology	30	8	22	.005
Rheumatology	1	0	1	.482*
Oncology	8	5	3	.727*
Immunology/Allergy	49	19	30	.065
Genetic	113	64	49	.289
Psychiatric	68	34	34	.762
Hematology	29	14	15	.702
Other	49	29	20	.295

*Fisher's Exact Test; Other = Renal and/or Musculoskeletal. *P*-values in bold are significant.

and one was concerned that the child's husband had been exposed to COVID-19.

Among the patients who rescheduled ($n = 44$), 32% (14) patients indicated that they worried their child's condition could affect their child's future, 25% (11) indicated their child did not get better, and 36% (16) indicated "other." Among those who chose, other, only 3 respondents provided additional details which included "due to the COVID-19 outbreak," "due to surgery center not doing elective surgery," and "protections are now very high for protection from Covid-19. I

felt it was better to complete the surgery now than to wait when vigilance might become relaxed."

ED Visits and Medication Alterations

Of 1915 patients from CHOA, Lurie and TCH, a total of 73 patients (3.8%) had at least one encounter at the emergency department and 14 patients (1.2%) of patients from Lurie and CHOA had at least one medication changed (Table 5). Among RS patients, 10 and 44 patients had a medication change or

Table 4. Reasons for Not Rescheduling Surgery vs Rescheduling Surgery*.

Reasons for Not rescheduling surgery n (%)	n = 51
Difficulty with scheduling	7 (14)
I worry my child could catch COVID-19 in the hospital	7 (14)
My child got better	5 (10)
Doctor/Hospital Out of Network	1 (2)
Cannot take time off for care for my child during or after surgery	1 (2)
Undecided	0 (0)
Loss of Insurance	1 (2)
Family income has decreased due to COVID-19	0 (0)
My child had surgery somewhere else with a shorter wait	0 (0)
Other ^a	29 (57)
<hr/>	
Reasons for Rescheduling surgery	n = 44
I worry this problem could affect my child in the future	14 (32)
My Child did not get better	11 (25)
I don't want my child to keep having to see the doctor or take medicine for this problem	2 (5)
My child's insurance coverage will change or expire soon	1 (2)
Our family income may decrease in the next few months	0 (0)
We met our deductible	0 (0)
Other ^b	16 (36)

*Responses based off of Children's Healthcare of Atlanta and Texas Children's Hospital Surveys.

^aPatient has another surgery scheduled, Physician decided to wait until patient had another ear infection, Patient's father was concerned he had COVID-19, Respondent did not provide further information.

^bDue to COVID-19 outbreak, due to surgery not doing elective surgery, Respondent did not provide further information.

Table 5. Medication Changes and ED Visits*.

	Total	Rescheduled	Not rescheduled	P-value
Medication Change	14	10	4	.132
Emergency Room Visit	73	44	29	.140

*Medication Change only reported for CHOA and Lurie.

Medication Change = Patient had at least one medication change, Emergency Room Visit = Patient had at least one Emergency Room Visit.

emergency room visit, respectively. However, this was insignificant when compared to NR patients ($P = .132$, $P = .140$).

Discussion

The COVID-19 shutdown created a rare opportunity to study the natural progression of common pediatric otolaryngologic diseases without surgical intervention. Among our patient population, 48.2% (923) of caregivers did NR their child's surgery (Table 1). Neither patient demographics nor surgical indication, excluding T&A, predicted scheduling outcomes (Tables 1 and 2). Further, the rate of emergency room visits and medication changes did not vary based on scheduling outcomes (Table 5). This suggests that conservative management for common pediatric otolaryngologic diseases may be effective for many conditions.

The reduction in human and environmental exposures during the shutdown may have played a significant role in the natural progression of common otolaryngologic diseases. In response to the pandemic, school attendance significantly

decreased, with approximately 86% of pre-school aged children staying out of daycare.^{6,7} Upon reopening of childcare centers, COVID-19 safety precautions were implemented including child wellness checks, mask wearing, and an emphasis on hand hygiene.^{8,9} Consequently, there was a decrease in the spread of common communicable diseases, a trend that was even observed globally.^{10,11} Concurrently, there was a significant decrease in air pollution, a known trigger for pediatric asthma.¹² Given that nearly half of our patient cohort did NR, it is likely that the reduction in these exposures played a role. Thus, the development of treatment arms focused on mitigating pediatric triggers could be beneficial for the pediatric otolaryngologic patient population.

Our study also provides insight into how watchful waiting impacts pediatric otolaryngologic care. Tonsil and/or adenoid was associated with a higher likelihood of rescheduling (Table 2). This may be due to clinical research trials that have shown the benefit of early T&A compared to watchful waiting.¹³ Minor ear surgeries were not associated with scheduling outcomes—a likely product of the heterogeneity in

management of acute otitis media compared to chronic otitis media with effusion and recurrent acute otitis media^{14,15} as well as decreased exposure to viral causes of AOM during the pandemic.¹⁶ Therefore, watchful waiting in conjunction with reducing viral exposure can be a management opportunity for AOM. Overall, the trends in surgery rescheduling serve as a powerful reminder that watchful waiting can be a safe alternative for our pediatric population and should not be overlooked.

In response to the pandemic, several surgical specialties revisited their treatment algorithms.¹⁷ While the response was mixed, surgical subspecialties made substantial changes to their workflow to mitigate the growing backlog of cases. Some providers emphasized watchful waiting,¹⁸ while others developed new surgical techniques.¹⁹ Overall, the focus turned to reallocating resources and creating a safe environment for patients during the COVID-19 pandemic. Less attention has been given to revisiting management, including emphasis on preventive care. Our data suggest addressing external factors may help avoid the need for surgical intervention in many cases.

Limitations

Though our study included multiple institutions and has a large sample size, it is not without its limitations. Race and Ethnicity were self-reported and limited the analysis of these demographic variables. 50 (2.7%) and 92 (4.9%) caregivers did not identify their child's race and ethnicity, respectively, among the total cohort. This study did not look at the completion rate of surgeries, which may be different than the number of cases rescheduled. The survey was not conducted at Lurie which study precludes further insight into caregiver decision making. Finally, we did not collect data on COVID-19 behaviors among the participants. Thus, it precludes us from directly measuring the impact of environmental triggers on disease progression.

Future Directions

As we continue to improve management of pediatric diseases it is to revisit current management algorithms. Further studies that elucidate preventable triggers and treatment modifications may help caregivers and practitioners to better manage common diseases. This simulated watch-and-wait situation for many pediatric otolaryngologic disease processes has also shed light on the multifactorial nature of surgical shared decision-making, which should be further explored in future studies.

Conclusions

The COVID-19 pandemic has resulted in cancellation of nearly 50% of pediatric otolaryngologic surgical cases. This

study highlights the potential to revisit treatment algorithms for common pediatric otolaryngologic disease processes.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

ORCID iD

Geethanjeli N. Mahendran  <https://orcid.org/0000-0003-4515-7063>

References

- Glynn JR, Moss PAH. Systematic analysis of infectious disease outcomes by age shows lowest severity in school-age children. *Sci Data*. 2020;7(1):329.
- Surgeons ACo. *COVID-19: Guidance for Triage of Non-emergent Surgical Procedures: Elective Surgery Acuity Scale (ESAS)*. American College of Surgeons; 2021. <https://www.facs.org/covid-19/clinical-guidance/triage>. Published 2020. Accessed December 24, 2021.
- Kaur R, Schulz S, Fuji N, Pichichero M. COVID-19 pandemic impact on respiratory infectious diseases in primary care practice in children. *Front Pediatr*. 2021;9(909):722483.
- Yang DD, Ouldali N, Gajdos V, et al. Common pediatric respiratory infectious diseases may serve as an early predictor for SARS-CoV-2 new wave of infections. *Clin Infect Dis* 2021; 73(2):358–359.
- Angoulvant F, Ouldali N, Yang DD, et al. Coronavirus disease 2019 pandemic: impact caused by school closure and national lockdown on pediatric visits and admissions for viral and nonviral infections—a time series analysis. *Clin Infect Dis*. 2021; 72(2):319–322.
- Barnett S, Jung K, Nores M. *Young Children's Home Learning and Preschool Participation Experiences during the Pandemic. NIEER 2020 Preschool Learning Activities Survey: Technical Report and Selected Findings*. Updated: National Institute for Early Education Research; 2020.
- Lee EK, Parolin Z. The care burden during COVID-19: a national database of child care closures in the United States. *Socius*. 2021;7:23780231211032028.
- Hashikawa AN, Sells JM, DeJonge PM, Alkon A, Martin ET, Shope TR. Child care in the time of coronavirus disease-19: a period of challenge and opportunity. *J Pediatr*. 2020;225: 239–245.
- Czumbel I, Quinten C, Lopalco P, Semenza JC, Eepw group. Management and control of communicable diseases in schools and other child care settings: systematic review on the incubation period and period of infectiousness. *BMC Infect Dis*. 2018;18(1):199–199.

10. Galvin CJ, Li Y-CJ, Malwade S, Syed-Abdul S. COVID-19 preventive measures showing an unintended decline in infectious diseases in Taiwan. *Int J Infect Dis.* 2020;98:18–20.
11. Rana MS, Usman M, Alam MM, et al. Impact of COVID-19 preventive measures on other infectious and non-infectious respiratory diseases in Pakistan. *J Infect.* 2021;82(5):e31–e32.
12. Venter ZS, Aunan K, Chowdhury S, Lelieveld J. COVID-19 lockdowns cause global air pollution declines. *Proc Natl Acad Sci USA.* 2020;117(32):18984–18990.
13. Marcus CL, Moore RH, Rosen CL, et al. A randomized trial of adenotonsillectomy for childhood sleep apnea. *N Engl J Med.* 2013;368(25):2366–2376.
14. Steele DW, Adam GP, Di M, Halladay CH, Balk EM, Trikalinos TA. Effectiveness of tympanostomy tubes for otitis media: a meta-analysis. *Pediatrics.* 2017;139(6):e20170667.
15. Brinker DL, MacGeorge EL, Hackman N. Diagnostic accuracy, prescription behavior, and watchful waiting efficacy for pediatric acute otitis media. *Clin Pediatr.* 2019;58(1):60–65.
16. Diercks GR, Cohen MS. The effect of the COVID-19 pandemic on pediatric tympanostomy tube placement. *Otolaryngology-Head Neck Surg (Tokyo).* 2022;166(1):167–170.
17. Whaley CM, Pera MF, Cantor J, et al. Changes in health services use among commercially insured US populations during the COVID-19 pandemic. *JAMA Netw Open.* 2020;3(11):e2024984–e2024984.
18. Tefik T, Guven S, Villa L, et al. Urolithiasis practice patterns following the COVID-19 pandemic: overview from the EULIS collaborative research working group. *Eur Urol.* 2020;78(1):e21–e24.
19. Santambrogio R, Farina G, D’Alessandro V, Iacob G, Gemma M, Zappa MA. Guidelines adaptation to the COVID-19 outbreak for the management of hepatocellular carcinoma. *J Laparoendosc Adv Surg Tech.* 2021;31(3):266–272.