(PLA) and a second model made from photoreactive acrylic resin (PAR). The drill was operated as a speed of 80,000 rotations per minute with several burrs for 40 minutes each. Sampling was conducted for airborne concentrations of volatile organic compounds (VOC) and total particulate (TP). VOC monitoring was conducted using Assay Technology 521-25 organic vapor badge worn at the surgeon’s neckline. TP monitoring was conducted using a polyvinyl chloride filter housed inside a cassette and coupled with an SKC AirChek 52 personal air-sampling pump. Samples were collected and analyzed in accordance with NIOSH Method 500.

**Results:** Results of the VOC sample were less than detection limits except for isopropyl alcohol at 0.24 parts per million for PAR. TP samples were less than the detection limit of 1.4 mg/m³. The results are below all applicable Occupational Safety and Health Administration Action Levels and permissible exposure limits for all contaminants sampled for.

**Conclusions:** This study supports that the safety of drilling models made from PLA or PAR without the need for additional protective measures.

### Usefulness of Otolaryngology After-Visit Summaries

Matthew G. Crowson, MD (presenter);
Seth Cohen, MD, MPH

**Objectives:** (1) To determine patient-reported satisfaction with after-visit summaries (AVS) from otolaryngology and family medicine outpatient clinics and (2) to compare the usefulness of otolaryngology versus family medicine AVS.

**Methods:** A prospective electronic survey of 522 patients presenting to otolaryngology and family medicine clinics was designed to determine the self-reported usefulness of the AVS. Both Likert scale and forced-choice questions were used. Demographic information was also solicited.

**Results:** Most survey respondents were female (67.4%), white (77.4%), and had a gross household income exceeding $60,000 (56.7%). Overall, patients found the AVS very easy to understand (58.6%) and very helpful (39.9%). The most helpful sections identified were specific patient instructions (38.9%) and clinic information/follow-up details (26.3%). Patients most frequently noted a need for additional specific patient information (23.9%). There was no difference between family medicine and otolaryngology patient Likert scale responses for AVS understandability or helpfulness ($P > .05$). Multiple regression determined Native American race and physician assistant provider type as negative predictors for AVS helpfulness ($P < .05$) and lower health literacy, male gender, and Native American race as negative predictors for understandability ($P < .05$).

**Conclusions:** In our health system, family medicine and otolaryngology clinic patients did not differ in self-reported AVS understandability or helpfulness. However, race, gender, health literacy, and race factors predicted lower usefulness scores. Patient satisfaction surveys can be useful in identifying components of AVS that are helpful or need improvement. Our patients requested more specific patient information and less superfluous information. Considering the AVS is a meaningful use requirement, AVS enhancement is an opportunity for quality improvement.

### Pediatric Otolaryngology

### Adenotonsillectomy in Children Post-transplant

Jessica L. Roberts, MBBS (presenter); Jason Powell, MBBS

**Objectives:** Pediatric solid organ transplantation is an increasingly successful treatment, with most children living well into early adulthood. This improved survival has been paralleled by increased secondary complications of immunosuppression. These include potentially life-threatening complications, such as post-transplant lymphoproliferative disease (PTLD), which frequently presents in Waldeyer lymphatic ring. Adenotonsillar hypertrophy (ATH) is relatively common in children, but in post-transplant children, ATH may indicate PTLD. We review the literature on ATH and the role of adenotonsillectomy in post-transplant children.

**Methods:** A comprehensive literature search was performed on December 9, 2016, using MEDLINE, Embase, and the Cochrane database. Search terms used were obstructive sleep apnoea, adenotonsillar hypertrophy, lymphoid hyperplasia, swelling, head and neck, Waldeyer’s ring, tonsil, adenoid, palatine tonsil, adenotonsillectomy, tonsillectomy, adenoidectomy, post-transplant lymphoproliferative disease/disorder, solid organ transplant, organ transplant, organ transplantation, paediatrics, pediatrics, and children. Search results were limited to English-language publications within the past 20 years. Screening of the bibliographies identified further articles.

**Results:** The literature search yielded 118 unique articles. Screening of abstracts yielded 18 relevant articles. Of these, 10 were retrospective studies and 8 were prospective studies.

**Conclusions:** We present the findings related to ATH and the role of adenotonsillectomy in children after solid organ transplantation. Overall, we found a lack of evidence and prospective studies into this topic, and further high-quality research is needed. This is an area growing in complexity, and the support of colleagues in transplantation and oncology is required.

### Age-Based Comparison of Tonsillectomy Complications

David S. Kim, MD (presenter); Tsungju O-Lee, MD

**Objectives:** To compare postoperative complication rates of tonsillectomy among various pediatric age groups and understand clinical implications.

**Methods:** This was a retrospective study. Current Procedural Terminology codes 42820, 42821, 42825, and 42826 were used to identify eligible patients; 782 pediatric patients (age <18 years) undergoing coblation tonsillectomy by a single surgeon at a tertiary academic center between January 2013 and January 2017 were included. Patients aged <3 years or...
with significant comorbidities were observed overnight. A major complication was defined as any postsurgical event requiring an emergency department visit and/or hospital admission within the first 2 weeks of surgery.

**Results:** The mean age was 6.1 ± 3.8 years. The overall incidence of a major posttonsillectomy complication was 3.6% (n = 28). The types of complication included poor oral intake/dehydration (2.1%; n = 16) and bleeding (1.5%; n = 12). The mean time to presentation was 7.6 ± 2.6 days (range, 2-13 days). As much as 26 of 28 patients (92.9%) did not have any significant comorbidity. Two patients (aged 8 and 11 years, respectively; 0.26%) with oropharyngeal bleeding required operative intervention. Overall, major complication rates were similar between patients aged <3 years and ≥3 years (4.3% vs 3.4%; χ² = 0.284, P = .593). Within the tonsillectomy and adenoidectomy groups, complication rates did not differ significantly between the age <3 years and age ≥3 years groups (4.3% vs 3.5%; χ² = 0.208, P = .648). Among patients <3 years, the incidence rates of major complications in the <1-, 1- to 2-, and 2- to 3-year age groups were 0% (n = 0), 4.3% (n = 2), and 4.5% (n = 5), respectively.

**Conclusions:** Pediatric tonsillectomy has a low overall incidence of major complications. Patients aged <3 years and ≥3 years have comparable complication rates.

**Analysis of Pathogenic Structures on Eardrum in Chronic Otitis Media**
Guillermo L. Monroy, MS (presenter);
Pawjai Khampang; Wenzhou Hong, PhD; Ryan Porter, MD;
Michael Novak, MD; Joseph E. Kerschner, MD;
Stephen A. Boppart, MD, PhD

**Objectives:** To identify pathophysiology of infectious components of middle ear during chronic otitis media (OM) with noninvasive optical coherence tomography (OCT) imaging in vivo and to characterize surgically recovered samples in vitro with polymerase chain reaction and fluorescence in situ hybridization to identify bacterial biofilm activity.

**Methods:** Forty-one pediatric patients were observed under general anesthesia during tympanostomy tube surgery at Carle Foundation Hospital (Urbana, IL, USA) in an institutional review board–approved study (February-June 2016). Prior to and after myringotomy, the tympanic membrane (TM) was assessed for the presence of middle ear biofilms with OCT intraoperatively using a handheld probe and portable system. If identified, surgical tooling was used to sample these structures from the imaging site (mucosal surface of TM). The sampling site was subsequently reimaged with OCT to confirm proper sample collection. Fluorescence in situ hybridization and quantitative polymerase chain reaction techniques provide microbiological characterization of the structures observed with OCT.

**Results:** OCT imaging identified additional pathogenic structures affixed to the TM during chronic OM infection and can observe microstructural alterations from surgery and sampling. Microbiological characterization of samples detected bacterial signatures.

**Conclusions:** Recovered samples demonstrate bacterial activity and provide further evidence that chronic OM is linked with the presence of a middle ear biofilm. OCT can quickly and noninvasively assess for the presence or absence of these pathogenic structures affixed to the TM in a clinical setting. These findings may affect future treatment strategies for OM.

**Barriers to Pediatric Cochlear Implant: A Parental Survey**
Charles Yang, MD (presenter); Brian Reilly, MD;
Diego A. Preciado, MD, PhD

**Objectives:** This study aimed to recognize specific patient-perceived barriers to pediatric cochlear implantation (CI) and determine barriers specific to publicly insured patients, wherein delayed implantation has been reported.

**Methods:** A cross-sectional survey and retrospective chart review were performed in a tertiary care cochlear implant center at an academic pediatric hospital. The validated, 39-item Barriers to Care Questionnaire (BCQ) was administered by phone in October 2016 to the parents of 80 recipients of CI by 2 surgeons between 2013 and 2016. Survey results and diagnosis to implant interval were compared based on public or private insurance status.

**Results:** A total of 110 patients received CI between August 2013 and October 2016; 27 of 80 English-speaking parents completed the survey. Of these, 23 received CI for prelingual sensorineural hearing loss, 15 were privately insured, and 12 were publicly insured. Publicly insured patients had significantly longer median time from diagnosis to implant than privately insured patients (19 vs 8 months, P = .01). The 2 worst scoring barrier categories for privately insured families in order were Pragmatics, Expectations, and Marginalization, whereas for publicly insured families it was Pragmatics, Skills, and Expectations. The lowest scoring individual survey item for privately insured patients was “Having to take time off work.” For the publicly insured, it was “Lack of communication.”

**Conclusions:** Publicly insured patients reported more barriers on the BCQ. Although pragmatics was the lowest-scoring barrier category for both groups, difficulties found on the survey ranked differently for each group. This information can help guide providers address disparities and access barriers for vulnerable patients.

**Characterization of Otitis Media Using an Optical Coherence Tomography Otoscope**
Diego A. Preciado, MD, PhD (presenter); Ryan Nolan, MS;
Radhika Joshi; Gina Krakovsky, MS, RN; Anqi Zhang, PhD;
Stephen A. Boppart, MD, PhD; Nancy M. Bauman, MD

**Objectives:** To clinically image in vivo human tympanic membrane (TM) and middle ear contents using an optical coherence tomography (OCT) handheld probe and to assess OCT-facilitated blinded reader accuracy detecting the presence or absence of middle ear effusion and/or biofilm.
Children with Obstructive Sleep Apnea and Tonsillectomy: Intraoperative Morphine

Yuti Desai (presenter); Scott Chung; Robert T. Swanson; Uma R. Parekh, MBBS; Michele M. Carr, MD, PhD, DDS

Objectives: To evaluate complications after pediatric tonsillectomy for patients with obstructive sleep apnea given morphine intraoperatively and postoperatively compared with those who were not given morphine and to compare length of stay (LOS) in the hospital for these patients.

Methods: A tertiary care children’s hospital electronic medical record database was queried for tonsillectomy in children between 1 and 17 years of age for 2013 to 2016. Intraoperative morphine recipients were compared with children who had not received morphine.

Results: A total of 556 patients were included in this study. As many as 73 patients had morphine intraoperatively, whereas 483 did not; these children were older (8.8 vs 6.5 years, *P* < .001), had a higher body mass index (21 vs 19 kg/m², *P* = .011), and were less likely to have a history of prematurity (5.5% vs 13.9%, *P* = .045) than children who did not receive intraoperative morphine. There were no differences in asthma, whether they had a sleep study, time in the operating room, emergence time, postanesthesia care unit time, airway complications, emergency department visits, readmissions, or postdischarge nurse phone calls. There was a significantly longer LOS (25.9 vs 21.4 hours, *P* = .011) and a higher postoperative bleeding rate within the first 2 weeks (10% vs 4.2%, *P* = .035) for the group receiving intraoperative morphine. Linear regression revealed that, after controlling for age and morphine given in postanesthesia care unit or later, children who received intraoperative morphine had a 6.8-hour longer LOS (*P* = .025). Logistic regression showed that the major contributor to postoperative bleeding was age (*P* < .001).

Conclusions: Children with obstructive sleep apnea who receive intraoperative morphine appear to have prolonged hospitalization after tonsillectomy but no other increase in morbidity.

Craniofacial Morphology of Patients with Velopharyngeal Dysfunction

Firas Kassem, MD (presenter)

Objectives: To identify craniofacial morphology characteristics in patients with congenital velopharyngeal dysfunction (VPD) with and without platybasia and palatal anomalies and to examine the relationship between cephalometric measurements reflecting the nasopharyngeal space and the occurrence of VPD.

Methods: This is a retrospective analysis performed at a tertiary referral medical center. The study included 366 patients with VPD. Patients were grouped into platybasic (n = 105) or nonplatybasic (n = 261). Lateral cephalometrics assessed craniofacial and nasopharyngeal anatomy.

Results: Average craniofacial measurements differed significantly according to cranial base flexure. The cranial base angle (BaSn) ranged from 110° to 149° (mean ± standard deviation, 131.9° ± 6.4°). Platybasic patients had a more obtuse angle (139.5° ± 2.8°), whereas nonplatybasic patients had a more acute angle (128.8° ± 4.6°). The platybasic group had greater ANSptmVe angle, smaller SBa and NBaPP angles, shorter posterior linear dimensions of cranial base structure (SBa, SAa, and Sptm), and smaller SNA and SNB angles (without difference in ANB and GgGnr angles), demonstrating “bimaxillary” retrognathism group, compared with the nonplatybasic group.

Conclusions: Cranial base flexure should be determined when evaluating the genetic, embryonic, and clinical etiologies of palatal anomalies. Platybasia is a phenotypic structural defect feature that aids in diagnosing patients with congenital VPD. The tubercle of atlas should be a reference point for the superiorly based pharyngeal flap height. The pharyngeal flap should be below the tubercle in platybasic patients, because the tubercle is in a high retrosuperior position relative to the maxilla, in contrast to nonplatybasic patients.

Development of a Novel Mandibular Distraction Simulator

Chelsea L. Reighard, MS (presenter); David A. Zopf, MD, MSc

Objectives: To identify the process to create a surgical education device using 3-dimensional (3D) printing technology, and to reflect on the potential of 3D printing in accelerating and amplifying surgical education.
**Methods:** A computer model of a neonatal skull obtained from the National Institutes of Health 3D Print Exchange and a nonidentifiable scan of an infant soft-tissue envelope were utilized for model creation. The files were modified to be micrognathic using Materialise 3-Matic computer-aided design (CAD) software. The skull base and skin mold were 3D printed with polylactic acid and the mandible with Formlabs standard white and clear resins. Medical-grade silicone dye with intrinsic coloring was poured into the mandibular canal to produce a composite mandible model with alveolar nerve. Once cured, the skin and bony components of the mandibular distraction simulation device were assembled to create the final product. Expert surgeons tested these prototypes using KLS Martin external mandibular distraction devices. They rated the simulator based on ease of use, realism, and educational value. The cost of production was estimated based on materials and labor.

**Results:** The use of CAD and 3D printing techniques allowed for a realistic, reproducible surgical simulation of mandibular distraction osteogenesis. Time of production was approximately 10 hours, and cost of production was less than $20.00. Expert surgeon ratings are reported.

**Conclusions:** Our novel mandibular distraction simulator is a feasible training tool with potential for the craniofacial surgeon. Future evaluation of this simulation device aims to assess potential for accelerated attainment of proficiency among residents and improved surgical outcomes.

**Drivers of Prolonged Length of Stay in Inpatient Croup**

Aparna Govindan (presenter); Christine Mathew, MS; Kristen Echanique; Ashley Rodgers, MS; Evelyne Kalyoussef, MD

**Objectives:** To identify patient characteristics associated with outlier length of stay (LOS) in pediatric patients hospitalized for croup.

**Methods:** The Kids’ Inpatient Database was queried for pediatric admissions for croup from 2003 to 2012. Logistic regression analysis was performed to identify demographic, comorbid, and procedural variables leading to increased incidence of outlier LOS, defined as >75th percentile.

**Results:** A total of 60,275 patients met the inclusion criteria. Outlier LOS was found to be >2 days. Bivariate analysis of regional differences in outlier LOS revealed a significantly increased incidence of prolonged LOS in the South. A subset analysis of LOS identified several factors contributing to outlier status in this region. In the South, African American and Hispanic patients were more likely to have an outlier LOS (odds ratio [OR] = 1.538, \( P < .001 \); OR = 1.292, \( P = .008 \)) than Caucasian patients (OR = 0.808, \( P = .023 \)). Comorbidities including stridor (OR = 1.306, \( P < .001 \)), asthma (OR = 1.656, \( P < .001 \)), chronic pulmonary disease (OR = 1.787, \( P < .001 \)), hypertension (OR = 6.411, \( P < .001 \)), fluid and electrolyte disorders (OR = 1.614, \( P < .001 \)), and gastroesophageal reflux disease (OR = 2.668, \( P < .001 \)) showed increased odds of prolonged LOS. Complications including pneumonia (OR = 3.214, \( P < .001 \)) and acute pulmonary edema/respiratory failure (OR = 2.18, \( P < .001 \)) independently predicted outlier LOS. Airway procedures were associated with greater LOS, specifically bronchoscopy (OR = 11.933, \( P < .001 \)), laryngoscopy (OR = 15.072, \( P < .001 \)), and mechanical ventilation (OR = 14.684, \( P < .001 \)).

**Conclusions:** Several demographic factors, comorbidities, and complications contributed to outlier LOS in the Southern United States, perhaps related to access to health care and other regional differences. These variables warrant further investigation. By predicting groups who are at risk for complicated croup, it may allow for more cost-efficient resource allocation and decreased overall LOS.

**Drug Eluting Bioresorbable Tympanostomy Tubes**

Deepa J. Galaiya, MD (presenter); Sarah A. Bradner, PhD; Jeffrey T. Cheng, PhD; Michael J. Whalen, MD; David Kaplan, PhD; Christopher Hartnick, MD, MS

**Objectives:** To understand the design, engineering principles, and physical construction of bioresorbable silk tympanostomy tubes and demonstrate the efficacy of bioresorbable silk tympanostomy tubes in a chinchilla model with regard to hearing outcomes, complications, and ability to deliver topical medications.

**Methods:** Bioresorbable tympanostomy tubes are created from silk fibroin and coated with a thin layer of crystallized ciprofloxacin and dexamethasone. The tubes are constructed in such a way that resorption is expected in 3 months. Adult chinchillas are then anesthetized, and their hearing and cochlear function are analyzed with distortion product otoacoustic emission and auditory brain stem response testing. The tube is then placed in one ear of the chinchilla while the other ear is a control. Serial examinations are performed to examine the placement and degree of resorption of each tube. At 4 months, the animal is anesthetized again for auditory testing to ensure no change from baseline. The animal is then killed, any remnant tube is removed for resorption analysis, and the tympanic membrane is harvested for histology.

**Results:** Ciprofloxacin-dexamethasone–coated silk tympanostomy tubes were designed and constructed. Serial resorption measurements in vitro show resorption at 4 months. Five adult chinchillas had silk tympanostomy tubes placed. One ear tube extruded at 1 week, 1 ear tube occluded with cerumen, and 3 ear tubes remained patent. There was no change in distortion product otoacoustic emissions and auditory brain stem responses before and after. Terminal histologic analysis is ongoing.

**Conclusions:** Drug-eluting bioresorbable silk tympanostomy tubes are feasible to design and can be safely placed in the chinchilla model without change in auditory function. Resorption is demonstrated at 4 months. The tympanic membrane of the chinchilla can heal upon resorption of the tympanostomy tube.
Drug-Induced Sleep Endoscopy in Pediatric OSA
Marco M. Peres, MD (presenter); Ivo M. Moura, MD; Cristina Adónis, MD; Diogo Raposo, MD; Ana Guimarães, MD; Filipe Freire, MD

Objectives: (1) Define the characteristic findings of upper airway obstruction in children with Obstructive Sleep Apnea (OSA), using drug-induced sleep endoscopy (DISE). (2) Understand DISE major indications.

Methods: Children with OSA and indication for DISE were prospectively included in this study. DISE indications were (1) persistent OSA after adenotonsillectomy (AT); (2) OSA associated with co-morbidities such as obesity, Down Syndrome (DS), or Sickle Cell Disease (SCD); (3) OSA in children without a characteristic physical examination. Treatment was individually tailored according to UA findings during DISE and polysomnographic data.

Results: Forty children were submitted to DISE. The adenotonsillar and tongue base levels were the most common sites of obstruction. The majority of children had obstruction at multiple sites. Individualized, multilevel, DISE-directed surgical treatment was performed in all the patients.

Conclusions: DISE is a useful tool to identify the major sites of obstruction in children with persistent OSA after AT, with OSA associated with other diseases, and with OSA without characteristic physical findings, such as adenotonsillar hypertrophy.

Early Otorrhea in Randomized Controlled Trials Comparing Cipro Drops to Saline
Gabriel Gabarain, MD, MS (presenter); Rachael C. Baird; Megan V. Morisada; Samantha Anne, MD, MS; Brandon S. Hopkins, MD

Background/Objectives: Perioperative topical ciprofloxacin (PTC) during tympanostomy tube placement is the most common prophylaxis against early tympanostomy tube otorrhea (ETTO) and tympanostomy tube (TT) occlusion. There are no large randomized controlled trials reporting duration and quality-of-life (QOL) impact of ETTO or TT patency nor comparing PTC to perioperative normal saline (PNS). The goals of this study are to provide a benchmark for reporting incidence, duration, and QOL impact of ETTO and TT patency and to compare PTC and PNS on these measures.

Methods: A total of 200 patients undergoing tympanostomy tube placement between November 19, 2015, and September 12, 2016, were randomized to intraoperative plus 1 week of either PTC or PNS. Patients reported the incidence, duration, and QOL impact of ETTO via 4 weekly surveys. Patient’s ETTO history and TT patency were evaluated during a 4- to 6-week postoperative visit.

Results: A total of 140 patients completed all survey and in-office follow-up. The overall ETTO incidence was 23.9% for PNS (NS_w1) and 16.7% for PTC (P = .32). The weekly ETTO incidence was not statistically different (PNS_w1 16.4%, PTC_w1 11.5%, P = .42; PNSw4 6%, PTCw4 4.9%, P = .1; PNSw3 7.5%, PTCw3 4.9%, P = .72; PNSw2 7.5%, PTCw2 3.3%, P = .44). Duration of ETTO was not statistically different (PNS 4.5%, PTC 2.8%, P = .74). QOL impact was not statistically different (PNS 1.2, PTC 1.5, P = .71). TT patency was not statistically different, with only 1 of 250 ears occluded at follow-up.

Conclusions: We provide a benchmark for reporting incidence, duration, and QOL impact of ETTO as well as TT patency. We show no difference in these measures between PTC and PNS. This supports substitution of PTC with PNS in ears without acute otitis media (AOM), which would reduce both cost and unnecessary antibiotic use.

Effect of Adenoidectomy on Preventing Otitis Media
Ran A. Wang, MD (presenter); Adam B. Johnson, MD, PhD; Gresham T. Richter, MD

Objectives: The role of adenoidectomy in preventing otitis media in pediatric patients remains unclear. We aim to compare the need for future tympanostomy tube insertion (TTI) in a cohort of patients who either received or did not receive an adenoidectomy simultaneous to TTI and examine the role of adenoidectomy in the need for repeat TTI with regard to comorbidities.

Methods: A retrospective review of 880 patient records from children who received their first TTI for chronic or recurrent otitis media within 1 calendar year (January 2012 to December 2012) at a tertiary pediatric hospital was performed. Analysis of subsequent TTIs received, comorbidities, and timing of adenoidectomy was performed.

Results: Of 880 patients, 523 (59.5%) underwent adenoidectomy with their primary TTI while 357 (40.5%) had TTI alone. Of the total number of patients who had TTI with adenoidectomy, 122 (23.3%) needed a repeat TTI. By contrast, among patients who received TTI alone, 166 (46.5%) needed a repeat TTI (χ² [N = 880] = 7.6, P = .006). Adenoidectomy significantly decreased reinsertion rates for those with sleep disturbance and obstruction (37.1% vs 70.0%, P < .05). Patients with aerodigestive disorders and Down syndrome were more likely to need repeat TTIs, even with adenoidectomy; patients had 47.1% and 67.2% reinsertion rates, respectively.

Conclusions: The data suggest that concomitant adenoidectomy with TTI reduces the need for repeat TTI for certain comorbidities (sleep obstruction) but may not have the same effect for other comorbidities (aerodigestive disorders and Down syndrome).

The Effect of CIPRODEX on Subglottic Stenosis
Wesley Mcilwain, MD (presenter); Paul Wistermayer, MD; Nicholas Ieronimakis, PhD; Shannon T. Marko; Derek J. Rogers, MD

Objectives: To demonstrate the efficacy of endoscopic balloon dilation (EBD) on subglottic stenosis (SGS) in a rabbit
Endoscopic versus Microscopic Myringoplasty in Children
Riccardo D’Ereditia, MD (presenter)

Objectives: To assess feasibility and long-term results of the totally endoscopic (TE) versus standard microscopic endocanalicular approach (ME) of tympanic membrane (TM) perforation repair in children using a bioactive material for tissue graft, derived from porcine small intestinal mucosa (SIS). This material promotes early vessel growth, provides scaffolding for the remodeling tissues, and is inexpensive and ready to use. The TE approach is reported to be more effective and precise in TM perforation repair in general otology. We evaluated and compared efficacy, safety, and surgery time of TE and ME myringoplasty with SIS in children.

Methods: This is a prospective, 2-group (TE and ME) randomized, blinded study over 7 years’ follow-up performed at a tertiary care pediatric institution. A total of 43 children with TM repair were randomly assigned to receive TE or EA myringoplasty with SIS graft. Primary outcomes were the healing of the TM and surgical time. Long-term follow-up ranging from 5 to 7 years was obtained in all enrolled children.

Results: Forty-seven TM (22 in the EA and 25 in the TE groups) perforations were treated. There were 20 stable TM closures in the EA arm (90%) and 24 (96%) in the TE arm. TM closure was higher in the TE arm. Results were not statistically significant (odds ratio = 0.4, 95% confidence interval = 0.12-1.41). Use of the SIS graft associated with the TE approach yielded reduced surgical time. No reaction to SIS was encountered.

Conclusions: TE with SIS myringoplasty is a safe and effective method for TM closure in children with reduced surgical time as compared with EA.

Epidemiological Trends in Preterm Infants with Apnea
Elliot Regenbogen, MD (presenter); Shouling Zhang

Objectives: Challenges exist in diagnosing and treating preterm newborns with apnea. The incidence and yearly trends for complications and readmissions have not been well documented. The purpose of this study was to characterize the trends in apnea of prematurity (AOP) and related adverse events for the New York City region.

Methods: From 2003 to 2014, the New York State Statewide Planning and Research Cooperative System and the New York City Department of Health Vital Statistics Department databases were merged. All live, preterm singleton births, as well as readmissions within 30 days were identified. Log-linear Poisson regression model was used to model the linear trend, and multivariable logistic regression model was used to examine risk factor for AOP.

Results: Of all births (N = 1,384,013), 103,471 were preterm, 7392 were identified as AOP, and 1319 as reflux. Preterm birth rates declined over years (relative ratio = 0.987, 95% confidence interval [CI] = 0.982-0.991); apnea among preterm singletons increased significantly (relative ratio = 1.069, 95% CI = 1.049-1.089). Differences in apnea rate were found in race, region, and insurance. Multivariable logistic regression suggested that those with reflux or small gestational age were more likely to have apnea (odds ratio = 3.19, 95% CI = 2.80-3.63 and odds ratio = 0.83 for every 1 week increase in gestational age 95% CI = 0.82-0.84). AOP newborns were twice as likely to be readmitted within the first 30 days, and charges were 5.4 times higher.

Conclusions: The public policy challenges associated with preterm newborns with AOP are substantial, as higher rates for readmissions and increased charges were documented. More research appears warranted to identify ways to optimize the quality of care to this high-risk newborn subpopulation.

Functional Impact of Unilateral Hearing Loss in Youth
Patricia L. Purcell, MD, MPH (presenter); Meghan Wisneski, AuD; Todd C. Edwards, PhD; Henry Ou, MD; Dylan K. Chan, MD, PhD; Kathleen C. Sie, MD

Objectives: To understand the functional impact of unilateral hearing loss (UHL) in youth and develop patient-reported functional assessment instrument for youth with UHL.

Methods: We conducted semistructured interviews of youth with UHL at a pediatric tertiary care facility from January 2014 to November 2015. Two independent coders thematically analyzed interview transcripts to identify excerpts related to functional impact of UHL. These excerpts were then used to generate instrument items. Multi-institutional expert panel reviewed items using predefined item selection criteria. Finally, youth with UHL prioritized items using 3-point scale.

Results: Thirty-two youth participated. Ages ranged from 11 to 18 years; 34% used hearing devices. We identified common themes related to functional impact, including problems with
sound localization (14/15 interviewees), importance of head/physician activation when listening (13/15), and challenges with physician learning (12/15). Excerpts were thematically grouped into domains of physical and social functioning; 100 physical function items and 116 social function items were developed. Hearing health experts and youth with UHL reviewed all items, selecting 41 for prioritization. Youth prioritized the following items as most important: (1) I am able to understand what they say (“very important” for 12/13 youth), (2) people are able to get my attention if they speak toward my deaf ear (“very important” for 10/13), and (3) when people speak toward my deaf ear, I understand what they say (“very important” for 9/13).

Conclusions: Youth describe negative impact of UHL on physical and social function, which supports role for functional assessment in management of UHL.

Ibuprofen: Post-tonsillectomy Bleeds in Older Children

Robert T. Swanson (presenter); Michele M. Carr, MD, PhD, DDS

Objectives: To evaluate pediatric post-tonsillectomy outcomes, including bleeding, emergency room (ER) visits, and nurse phone calls in patients discharged with ibuprofen versus those without.

Methods: Retrospective chart review of children who underwent adenotonsillectomy at a children’s hospital between 2012 and 2016. Main outcome measures were bleed rates, ER visits, and nurse phone calls. Predictors were ibuprofen prescription at discharge, age, gender, and indication for surgery. Analysis included nonparametric tests and logistical regression.

Results: A total of 773 patients were included; 504 had ibuprofen at discharge (ID) and 269 did not (NID). There were significant differences in mean age: 6.69 years in the ID group versus 8.55 in the NID group (P < .001). Indication for surgery was sleep apnea in 70.5% of the ID and 44.0% of the NID (P < .001). About 8.7% of the ID had a post-tonsillectomy bleed, whereas 5.9% of the NID bled (P = .168). There were no significant differences between the 2 groups in phone calls (P = .775), phone call reason (P = .801), or ER visits (P = .092). There was no significant difference in the outcome measures between patients with either sleep apnea or recurrent tonsillitis. There were significant bleeding differences in patients of different age: 12.1% in children aged 9 to 18 years versus 4.8% in children aged 3.1 to 6.0 years (P = .006); 16.7% of children aged 9 to 18 years in the ID group bled versus 7.5% in the NID group (P = .039). Logistical regression revealed that both ibuprofen and age contributed to postoperative bleeding.

Conclusions: Ibuprofen is associated with significantly elevated post-tonsillectomy bleeding in children aged 9 to 18 years, suggesting that ibuprofen use in this group should be avoided.

Impact of Deductibles on Parental Decision Making

Phayvanh P. Sjogren, MD (presenter); Jeremy D. Meier, MD

Objectives: Describe how deductible health plans impact parental decision making for common pediatric otolaryngology operations.

Methods: A cross-sectional survey was conducted. Parents of patients less than 18 years of age were surveyed via email with a multiple-choice survey to assess for factors in decision making related to common surgeries performed by otolaryngologists. Operations included outpatient myringotomy with tubes and adenotonsillectomy at a tertiary pediatric hospital between July 2015 and June 2016. Children in foster care and those who underwent non-elective surgery were excluded.

Results: A total of 108 parents responded to the survey. The average annual deductible was $1922, and the average maximum out-of-pocket expenses were $4288 per child. There were 76 (70%) patients who required a co-pay during the office visit, with an average cost of $98. At the time of surgery, 76 (70%) had not met their deductible and 74 (69%) patients had a deductible cycle that ended in December. The majority, 67 (62%), stated that knowing the surgery cost would be helpful in the decision making process, 23 (21%) were neutral, and 18 (17%) disagreed. More than half, 58 (54%), of parents strongly agreed or agreed that deductibles and/or out-pocket expenses impact the decision for the surgery, while 17 (16%) were neutral and 33 (31%) disagreed.

Conclusions: Deductible health plans and out-of-pocket expenses can influence parental decision making for common otolaryngology operations such as tube placement and adenotonsillectomy. Future studies to determine if deductibles impact access to care in the pediatric population are needed.

Improving Outcomes of Laryngotracheal Reconstruction

Taylor M. Gilliland (presenter); Nicholas Ettinger, MD, PhD; Rahul Baijal, MD; Prasad J. Thottam, DO; Deepak Mehta, MD, FRCS

Background/Objectives: Pediatric laryngotracheal reconstruction (LTR) is the standard of care in patients requiring expansion of a stenotic airway. Single-stage LTR (SSLTR) requires a multidisciplinary team to optimize preoperative decision making and ensure fastidious postoperative care. Evidence-based protocols addressing this has been sparsely described in the literature. Our objective was to evaluate SSLTR perioperative outcomes before and after implementation of a standardized care algorithm.

Methods: A case-control study was performed to examine groups of pediatric patients who underwent SSLTR from 2010 to 2016 at tertiary care academic centers. Patients who underwent standardized care were compared with those who did not receive standardized care. Data regarding perioperative management were collected and compared using Fisher exact test and Wilcoxon rank test. Planned extubation, average intensive care unit stay, and complications were examined.

Results: Nineteen patients completed SSLTR after standardized care protocol was initiated, while 26 prior patients were used as controls. Nine (35%) in the control group as compared...
with only 1 (5%) in the standardized group failed planned extubation ($P = .028$). A successful planned extubation demonstrated its role in fewer perioperative complications ($P < .0001$) and decreased intensive care unit stay ($P = .25$). Control patients who failed planned extubation had a greater severity of complications including acute respiratory distress syndrome and unplanned tracheostomy. Patient factors including demographics, type of graft, graft cartilage, and preoperative methicillin-resistant *Staphylococcus aureus* status were not significantly different between groups.

**Conclusions:** A standardized perioperative algorithm can improve outcomes of pediatric patients undergoing SSLTR. Successful achievement of these outcomes required a standardized care algorithm and multidisciplinary approach involving pediatric surgeons, anesthesiologists, and intensivists.

**Laryngeal Abnormalities in 22q11.2 Patients**

Bridget E. Ebert (presenter); James Sidman, MD; Noelle Morrell, CCC-SLP; Brianne B. Roby, MD

**Objectives:** To analyze voice and vocal fold abnormalities in patients with 22q11.2 deletion.

**Methods:** This is a retrospective chart review. Records of a velocardiofacial syndrome clinic and an otolaryngology clinic at a tertiary pediatric hospital were reviewed. Patients with confirmed 22q11.2 deletion were identified. Medical and surgical histories along with speech and voice characteristics were recorded.

**Results:** A total of 109 patients were identified. Eighteen percent ($n = 20$) displayed a vocal fold abnormality, either congenital in origin or iatrogenic. Congenital abnormalities included laryngeal web ($n = 10$), subglottic stenosis ($n = 7$), laryngeal cleft ($n = 3$), laryngomalacia ($n = 1$), vocal fold nodules ($n = 1$), and atrophic vocal fold ($n = 1$). Iatrogenic abnormalities included posterior vocal fold erosion ($n = 1$), dislocated arytenoid ($n = 1$), and paralyzed left vocal fold ($n = 4$). Perceptual analysis by speech therapy showed 65% ($n = 71$) of patients presented a voice within normal limits, while 17% ($n = 19$) were outside normal limits. Of the 20 patients with a vocal fold abnormality, 15% ($n = 3$) demonstrated a voice within normal limits, while 65% ($n = 13$) were not within normal limits. Perceptual analysis of voice was not possible for 4 patients due to limited verbal communication. Of 19 patients with a voice outside normal limits, 68% ($n = 13$) had a vocal fold abnormality. Sixteen percent ($n = 3$) had an abnormal voice due to other issues.

**Conclusions:** In patients with 22q11.2 deletion, 18% displayed a laryngeal abnormality and 17% had abnormal vocal quality. This suggests that voice and vocal fold abnormalities are important to consider in the treatment of these patients. Distinguishing between speech and voice abnormalities can ensure appropriate intervention.

**Lateral Semicircular Canal Function in Children with Cochlear Implant**

Nader M. Nassif, MD (presenter); Cristiano Balzanelli, MD; Luca O. Redaelli de Zinis, MD

**Objectives:** In children with profound deafness, bilateral cochlear implant (CI) is an effective, established procedure. However, recently, its safety on vestibular function has been debated. The goal of this study is to evaluate the long-term lateral semicircular canal high-frequency vestibulo-oculomotor reflex (LSC HF VOR) in children with CI by video head impulse testing.

**Methods:** A cross-sectional study assessing a cohort of children who received either a unilateral ($n = 12$) or a bilateral ($n = 12$) CI compared with a control group of 12 normal-hearing children.

**Results:** No significant LSC HF VOR gain difference was found between CI users and controls. In the unilaterally implanted group, the LSC HF VOR gain measured in the “CI-ON” condition was significantly higher than in the “CI-OFF” condition, both in the implanted and in the nonimplanted ear. In the bilaterally implanted group, the difference between the 2 conditions was not significant.

**Conclusions:** Our results do not show any impairment of LSC HF VOR function in children with CI compared with normal-hearing children in the long-term period. This suggests that both unilateral and simultaneous/sequential bilateral CI are procedures that do not impair HF LSC long-term function as far as it is analyzed by video head impulse testing.

**Management Trends in Pediatric Post-tonsillectomy Bleeds**

Christine M. Clark, MD (presenter); Jane R. Schubart, PhD, MBA, MS; Michele M. Carr, MD, PhD, DDS

**Objectives:** To describe current perioperative practices and management of secondary post-tonsillectomy hemorrhage in children following tonsillectomy and determine if differences in management exist based on pediatric otolaryngology fellowship completion, regions of training and current practice, practice type, and number of years in practice.

**Methods:** An anonymous online REDCap survey of pediatric and general otolaryngologists was conducted in June and July of 2016. Multiple-choice questions regarding perioperative management and treatment strategies in response to 3 hypothetical case scenarios featuring secondary bleeding were posed. Demographic data were also collected.

**Results:** A total of 400 surveys were distributed with 104 responses. Fellowship-trained respondents were earlier in their practice and more concentrated in academic settings. They were less likely to prescribe antibiotics and more likely to prescribe Tylenol (98.3% vs 80.4%; $P = .002$), ibuprofen (79.3% vs 56.5%; $P = .012$), and narcotics (74.1% vs 50.0%; $P = .011$) postoperatively as compared with general otolaryngologists. When faced with a post-tonsillectomy patient with visible clot but no active bleeding, pediatric otolaryngologists were less likely to remove the clot (31.6% vs 54.3%; $P = .02$) and more likely to proceed to the operating room (75.9% vs 56.5%; $P = .037$) and admit the patient (87.9% vs 68.9%; $P = .017$). Few regional differences were encountered; however, factors influencing the decision to pursue operative intervention varied by region.
Conclusions: Pediatric otolaryngologists are more likely to follow American Academy of Otolaryngology guidelines for perioperative management. They also manage patients with secondary post-tonsillectomy hemorrhage differently than general otolaryngologists. Management trends are similar by region, but the salient factors considered in the decision-making process vary.

Medical Therapy of Acute Mastoiditis: A Systematic Review
Samantha Anne, MD, MS (presenter); Seth R. Schwartz, MD, MPH; Stacey L. Ishman, MD, MPH; Brandon S. Hopkins, MD

Background: Acute mastoiditis is the most common complication of acute otitis media in children, yet there is no established standard of care in management of pediatric acute mastoiditis. Treatment options include intravenous antibiotics with or without myringotomy, tympanostomy tube placement, or mastoidectomy.

Objectives: Systematically review English-language literature to evaluate efficacy of medical treatment of pediatric acute mastoiditis.

Methods: PubMed, Embase, Medline, CINAHL, and Cochrane Library were searched from inception to August 2016. Manual searches of bibliographies were also completed. All studies that described medical treatment as the only treatment or the initial treatment were included in review. The primary outcome measure was cure rate. Secondary outcome measures included rates of serious complications (eg, intracranial extension) and rates of treatment prior to hospitalization. Two independent evaluators reviewed each abstract and article.

Results: We identified 310 articles; 19 met inclusion criteria and were reviewed. All studies were retrospective reviews. Overall, 990 patients were included with a weighted mean age of 3.3 years; 57.4% were male. Antibiotics were given prior to hospitalization in 47% of cases. Serious complications occurred in 7.1%. The average rate of cure with intravenous antibiotics alone was 71.7% (median = 70%, range, 26.3%-100%).

Conclusions: The medical treatment of pediatric acute mastoiditis had a high success rate with nearly 72% of children experiencing resolution. This suggests that intravenous antibiotic treatment is a reasonable first-line therapy for pediatric acute mastoiditis with surgery reserved to treat children who do not improve with antibiotics alone.

Murine Model of Pediatric Obstructive Sleep Apnea and Circadian Dysregulation
Douglas C. von Allmen, MD (presenter); Lauren J. Franckey, MSc; Robert E. Schmidt; John B. Hogenesch, PhD; David F. Smith, MD, PhD

Objectives: Pediatric obstructive sleep apnea (OSA) is a pervasive disease with significant medical and economic burden. Multiple clinical sequelae are seen in children with OSA, including elevated blood pressure, diabetes, and pulmonary hypertension. The mechanisms underlying pathophysiology are not well understood. The circadian and hypoxia response pathways play important roles in lung function but have not been studied in OSA. We developed a murine model of pediatric OSA to examine the relationship between hypoxic injury and circadian dysregulation.

Methods: Per2LUC mice have a Luciferase-fusion transgene to track endogenous PER2 expression in cells. We entrained these mice to a 12-hour light:12-hour dark cycle for 10 days. Mice were then exposed to intermittent hypoxia and recovery (IHR) by cycling them from 21% to 10% O2 throughout sleep. A 12-hour acute exposure to IHR was compared with chronic exposure for 12 days. Control mice were kept in 21% oxygen during sleep. Following exposure, mice were killed and lungs harvested. Kinetic luciferase activity was measured continuously for 7 days from the lung explants.

Results: Acute IHR exposure or exposure to ambient air did not result in changes to PER2 expression. Surprisingly, however, chronic exposure to IHR increased baseline and amplitude of PER2 expression, demonstrating general changes to clock function.

Conclusions: IHR in Per2LUC mice is a viable model to study cross-talk between the circadian and hypoxia pathways. Chronic exposure to IHR changes circadian clock function in lung. Future work will characterize hypoxia-induced circadian dysregulation to identify signaling pathways contributing to end-organ damage in pediatric OSA.

The Natural History of Unrepaired Complete Tracheal Rings
Lyndy J. Wilcox, MD (presenter); Catherine Hart, MD; Michael J. Rutter, MD, FRACS; Claudia Schweiger, MD, PhD; Nithin S. Peddireddy; Alessandro De Alarcon, MD, MPH

Objectives: Determine the natural history of growth in unrepaired complete tracheal rings.

Methods: This was a retrospective case series at a tertiary pediatric academic center. Medical records of patients with confirmed tracheal rings on bronchoscopy from 1993 to 2016 were reviewed. Patients who had operative notes documenting tracheal sizing over time and either did not require surgical intervention, required repair at >8 years-old, or were followed for at least one year prior to requiring repair at age >3 years-old were included. Exclusion criteria included tracheal stenosis not caused by complete tracheal rings and surgical repair prior to presentation at our institution. Comorbidities and airway characteristics were compared between children who did not require repair and those who underwent late repair.

Results: Twenty-two patients were included. The growth of the complete tracheal rings over time, as determined by endoscopic sizing, was chronicled. The growth curves will be presented, and growth trends will be discussed. Comorbidities and factors that may contribute to the need for late repair will also be presented.

Conclusions: A select group of children with complete tracheal rings can be managed expectantly without surgical intervention. Airway growth does occur in this population and can
be monitored over time. However, tracheal growth may be non-linear in nature. Having a standardized method for sizing complete tracheal rings allows for more effective communication between providers and allows assurance of continued growth of the airway while following patients with complete tracheal rings.

**Objective Symptoms of Chronic Rhinosinusitis in Pediatric Patients**

Phillip R. Purnell, MD, PhD (presenter); Hassan Ramadan, MD, MS

**Objectives:** The symptoms of chronic rhinosinusitis (CRS) in children can be nonspecific, making the diagnosis difficult. We report a series of pediatric patients who presented with symptoms of CRS and had a sinus computed tomography (CT) scan completed to determine any objective symptoms, which could improve the diagnosis of CRS in pediatric patients.

**Methods:** Retrospective chart review of 141 pediatric patients from a major academic medical center. Patients aged 2 to 12 years (average age, 7.24) presenting with CRS symptoms and with a subsequent CT scan of the sinuses were included in the study. Chart reviews were completed for the objective symptoms of sinusitis (obstruction, rhinorrhea, and cough) recorded and compared with Lund–Mackay scoring for CT results. Objective symptoms for patients with Lund scores >5 (33 patients, 23%) were compared with those patients with Lund scores ≤5 (108 patients, 77%).

**Results:** The average duration of symptoms was 31.8 months. There was no significant difference in the total number of objective nasal symptoms between the groups and no single symptom differentiated the 2 groups. There was a statistically significant correlation between the combination of obstruction and cough and CRS, as determined by CT Lund scoring ≥5 (P = .036). No other combination of objective findings differentiated CRS.

**Conclusion:** No single objective symptom (obstruction, rhinorrhea, or cough) can differentiate CRS as assessed by sinus CT. However, the combination of obstruction and cough on examination is significantly associated with CT scan Lund score ≥5. This study indicates that those pediatric patients with both obstruction and cough on examination have a higher likelihood of CRS.

**Pathogenesis of Obstructive Sleep Apnea in Children [PRESENTATION WITHDRAWN]**

Tulia Mateus, MSc (presenter); Lea-Ann Kirkham, PhD, MSc; Harvey Coates, MD, PhD, MSc; Shyan Vijayasekaran, MD, MS, FRACS; Peter Richmond, MD, PhD, MSc; Ruth Thornton, PhD

**Objectives:** To compare the density of respiratory pathogens in nasopharyngeal swab (NPS) and throat swab (TSs) of children with obstructive sleep apnea (OSA), recurrent tonsillitis (RT), and healthy controls and to determine antibody titers to bacterial antigens for children with OSA and RT and for healthy controls.

**Methods:** Quantitative polymerase chain reaction was used to determine the density of common bacterial pathogens in NPS and TS from children with OSA (n = 54), RT (n = 21), and healthy controls (n = 55). Serum immunoglobulin G (IgG) and IgA titers to bacterial antigens were measured using bead-based immunoassays.

**Results:** The density of *Moraxella catarrhalis* was higher in the NPS and TS of children with OSA compared with those with RT and healthy controls (P ≤ .016). Nontypeable *Haemophilus influenzae* (NTHi) density was highest in TS of children with OSA and RT compared with controls (P ≤ .004). Children with OSA had significantly higher IgG and IgA titers against antigens from NTHi (P ≤ .007), *Streptococcus pneumoniae* (P ≤ .009), and group A streptococcus (GAS; P ≤ .01) compared with healthy controls and those with RT. Anti-P4 and P6 IgG titers increased with NTHi density in NPS and TS from children with OSA (P ≤ .016). Anti-ScpA IgG increased with GAS density in NPS from children with OSA and TS from healthy children (P ≤ .048). Increased *S pneumoniae* density in TS from children with OSA was correlated with increased anti-PspA1 and CbpA IgG titers (P ≤ .026).

**Conclusions:** NTHi and *M catarrhalis* were present at the highest densities in the nasopharynx of OSA children. Antibody titers to antigens increased with bacterial densities in children with OSA, suggesting a response to exposure. Future work will focus on preventative therapies and/or novel treatments against pathogens.

**Patterns of Facial Trauma in Child Abuse**

Carlyn M. Atwood (presenter); David R. White, MD; Ronald J. Teufel, MD; Sharon H. Gnagi, MD

**Objectives:** To describe common facial injury patterns seen in child abuse and apply knowledge of abusive injury patterns to help identify children suffering from abuse.

**Methods:** This study examined all admissions in the 1997-2012 editions of the Kids’ Inpatient Database with a diagnosis in child maltreatment syndrome (International Classification of Diseases, Ninth Revision [ICD-9], diagnosis code 995.5) listed in the first 15 diagnoses. Using the ICD-9 diagnosis codes, soft-tissue injuries including open wounds (872-873), contusions (920), abrasions (910.0-910.1), and burns (941.0), as well as fracture of facial bones (802, 804), were tracked across years. Admissions of patients >18 years of age were excluded from the analysis.

**Results:** A total of 31,219 admissions were analyzed. The median age at time of admission was 1 year. There were more male admissions (53.2%) than female admissions (46.8%). Physical abuse was the most common child maltreatment syndrome code (n = 14,447). Of the 5158 facial soft-tissue injuries, contusion of the face, scalp, or neck was the most common (n = 3461). The <1-year age group accounted for 46.7% of these contusions (n = 1615). Facial fractures (n = 185) occurred less frequently than soft-tissue injuries but were predominately seen in ages ≤5 years (n = 137, 74.1%).
Mandibular fracture was the most frequently occurring facial fracture (n = 51).

Conclusions: Knowledge of common injury patterns in children suffering from maltreatment is important for practicing otolaryngologists. Early recognition and prompt treatment of abusive injuries may aid in early recognition of at-risk children.

PCV13 Impact on Otologic Surgeries: Resident Experience
Sarah Dermody (presenter); Jaeil Ahn, PhD; Sonya Malekzadeh, MD; Earl H. Harley, MD

Objectives: To identify trends in resident training experience with chronic otitis media–related surgeries since the introduction of pneumococcal conjugate vaccine (PCV13) in 2010 and to quantify the number of myringotomy and tympanostomy, tympanoplasty, and mastoidectomy cases logged in the American Council for Graduate Medical Education (ACGME) Case Log System from 2006 to 2016.

Methods: Retrospective review of ACGME national and program case log data. We calculated for each year the mean number of myringotomy and tympanostomy, tympanoplasty, and mastoidectomy cases logged in the ACGME Case Log System (2006-2016). Mean numbers against years were plotted to identify monotonic trends. Data were divided into the pre-PCV13 era (2006-2010) and the post-PCV13 era (2011-2016). Mann–Whitney U test was used to test the null hypothesis that the numbers of otologic surgeries are equivalent before and after the introduction of PCV13.

Results: There has not been a significant change in myringotomy and tympanostomy tube placement nationally since the introduction of PCV13 (P = .055). Mean number of both tympanoplasties (P = .028) and mastoidectomies (P = .0062) increased. Analysis of program-level data supports national findings.

Conclusions: While the number of myringotomy and tympanostomy procedures has not changed significantly since the introduction of PCV13, a decreasing trend exists. Data should be reassessed in 5 years to examine the impact of PCV13 on resident training. Resident experience of tympanoplasties and mastoidectomies has significantly increased in the past decade. Introduction of key indicator cases may contribute to this increase. The impact of PCV7 was unable to be assessed because of the lack of electronic case log records prior to 2005.

Pediatric Airway Foreign Body Safety Outcomes in the American College of Surgeons National Surgical Quality Improvement Program Pediatric
Grace X. Tan, MD (presenter); Emily Boss, MD, MPH; Daniel Rhee, MD, MPH

Objectives: To describe safety outcomes of bronchoscopy with foreign-body removal in children using a large, standardized, multi-institutional data platform and identify factors associated with 30-day adverse events for this procedure.

Methods: Children under 18 years who underwent bronchoscopy with removal of foreign body (Current Procedural Terminology 31635) were identified in the 2012-2015 American College of Surgeons National Surgical Quality Improvement Program Pediatric public data set, a platform consisting of standardly abstracted data on 94 individual measures from 73 pediatric care institutions nationally. Patient demographics, comorbidities, and 30-day postoperative adverse events, including complication and readmission, were analyzed. Multivariate logistic regression was used to identify predictive factors for postoperative complications.

Results: Of 267,289 total cases, 275 (0.1%) children underwent bronchoscopic foreign-body removal—165 (60%) male, 75 (27%) African American and/or Hispanic, with mean age of 3.5 years (range, 0.63-17.9, median 2.0). Adverse events occurred in 11 children (4%). Seven had pulmonary-related complications, and 1 patient died. Three patients were readmitted; there were no reoperations. On multivariate analysis, preoperative pulmonary disease (eg, asthma, cystic fibrosis) or need for pulmonary support ( supplemental oxygen or ventilation; odds ratio = 21.0; P = .007) and preoperative cardiopulmonary instability (odds ratio = 10.7; P = .08) predicted postoperative complications. Race, age, gender, and other comorbidities were not associated with increased adverse events.

Conclusions: Bronchoscopy for retrieval of foreign body in children has overall low incidence of 30-day adverse events. Children with preoperative pulmonary compromise have significantly higher risk of postoperative complications. These findings may be applied to optimize perioperative care and counsel parents and families.

Pediatric Mandible Fractures: Age, Location, and Management
Sharon H. Gnagi, MD (presenter); Carlyn M. Atwood; Krishna Patel, MD, PhD; Shaun A. Nguyen, MD; David R. White, MD

Objectives: Describe a comprehensive analysis of pediatric mandible fractures using a national database including demographics, anatomic location, and management.

Methods: All admissions in the 1997-2012 Kids’ Inpatient Database were evaluated for a diagnosis of mandibular fracture (International Classification of Diseases, Ninth Revision, Clinical Modification [ICD-9 CM] 802.2-802.3) in the first 15 diagnoses. Patients >18 years old, and those with multiple or unspecified (802.20 and 802.30) fracture location were excluded. The management of mandibular fractures was analyzed over time and compared across age groups by tracking the incidence of open reduction (OR) of mandibular fracture (ICD-9 CM procedure code 76.76). Statistical analyses included χ2 test of homogeneity with pairwise comparison and χ2 for trend.
Results: A total of 14,727 admissions were analyzed, with most among the 16- to 18-year group (N = 8021, 54.5%). The proportion of admissions that received OR increased significantly with increasing age. Less than 8% of admissions in the youngest age group (<1 year) received OR, whereas 50.7% of the oldest age group (16-18 years) received OR (P < .001). The distribution of fracture location varied significantly by age group. Condylar fractures accounted for 47.4% (n = 36) of fractures in the <1-year group but accounted for only 7.9% (n = 631) in the 16- to 18-year group (P < .05). By contrast, fractures of the angle of mandible occurred significantly more in the 16- to 18-year group (n = 2271, 28.3%) compared with all other age groups (P < .05).

Conclusions: Fractures of the mandible are an uncommon occurrence in children, and specific fracture site varies with age group. The incidence of mandibular fractures and OR of these injuries increase with increasing age.

Pediatric Nasal Septal Perforation
Jesse Greenberg, MD (presenter); Amber D. Shaffer, PhD; Amanda L. Stapleton, MD

Objectives: To describe demographic and clinical characteristics of pediatric nasal septal perforations and to analyze efficacy of treatment modalities in symptom management and resolution of pediatric nasal septal perforations.

Methods: This is a retrospective chart review of patients aged 0 to 18 years seen in a tertiary care pediatric otolaryngology practice from 2008 to 2016 whose diagnoses included nasal septal perforation. Demographic and clinical characteristics including gender, age, race, presenting symptoms, and location, size, and etiology of perforation were collected. Outcomes including persistence of perforation and symptoms at 1 year and at most recent visit were recorded. A total of 20 patients were included. Statistical analysis was performed using Fisher t test for categorical variables and Wilcoxon rank-sum for continuous variables.

Results: Median age was 167.5 months (range, 1.5-221.0). The most common etiology was iatrogenic (40.0%), followed by button battery (20.0%). As much as 35.0% of patients underwent surgical repair; 83.3% of patients with 1 year of follow-up had a persistent perforation. Although not statistically significant, there was a trend toward successful closure of perforations in those who presented with pain (P = .187), nasal packing (P = .187), and infection (P = .187) as etiologies and allograft placement as treatment (P = .136).

Conclusions: Pediatric nasal septal perforation is an infrequent but challenging pathology with extremely limited literature to date; 40% of septal perforations were iatrogenic and 20% were due to button batteries. Future larger studies may further elucidate characteristics and treatment modalities associated with successful closure.

Pediatric Salivary Malignancy: A Population-Based Review
Andrew Walls, MD (presenter); David Kasle, MD; Nicole Aaronson, MD; Erik Waldman, MD

Objectives: To elucidate incidence, metastatic sites, demographics, and 15-year disease-specific survival of pediatric patients diagnosed with salivary gland malignancy.

Methods: This is a cross-sectional review using data from the Surveillance, Epidemiology, and End Results (SEER) database. Our group retrospectively queried the SEER database for pediatric patients diagnosed with mucoepidermoid, acinic cell, and adenoid cystic carcinomas. Kaplan–Meier curves were produced to determine 15-year disease-specific survival in patients with primary salivary malignancy and primary salivary malignancy with local cervical metastases. In addition, our group evaluated disease-specific survival for patients who underwent surgery versus surgery and radiation for local regional control if positive cervical lymph nodes were identified.

Results: A total of 349 pediatric patients were identified between 1973 and 2015. Mucoepidermoid carcinoma was the most frequent histologic diagnosis while adenoid cystic carcinoma was the most infrequent. Based on age cohorts, older patients diagnosed with adenoid cystic carcinoma demonstrated significantly poorer disease-specific survival when compared with their younger age cohort with the same diagnosis (P = .03). Adjuvant radiation provided no significant survival benefit for mucoepidermoid or acinic cell carcinoma with cervical metastases regardless of age (P = .76 and .54). Level 3 lymph nodes were the most frequent local metastatic site.

Conclusions: Kaplan–Meier calculations demonstrate beneficial outcomes regardless of the histologic subtype and metastases were usually isolated to the deep cervical lymph node chains. It may be possible to reserve radiation in patients demonstrating local regional metastases.

Pediatric Septoplasty and Rhinoplasty: A Quality-of-Life Outcome Study
Alexander Manteghi, DO (presenter); Hena Din, MPH; Shelby Leuin, MD

Objectives: To evaluate preoperative and postoperative quality-of-life outcomes for septoplasty and functional septorhinoplasty (FSR) patients using the Nasal Obstruction Symptom Evaluation (NOSE) scale. We also evaluated whether gender, age, nasal trauma, prior nasal surgery, allergic rhinitis, or additional surgeries (at the time of procedure) contributed to postoperative NOSE scores.

Methods: Prospective case series evaluating preoperative and postoperative NOSE scores in 133 pediatric patients undergoing septoplasty or FSR at a tertiary children’s hospital. Multiregression analysis evaluated whether gender, age, nasal trauma, prior nasal surgery, or allergic rhinitis influenced postoperative NOSE scores.

Results: A total of 133 patients with a mean age of 15.7 ± 2.5 years were included in the study with a mean follow-up of 3.4 ± 5.3 months (range, 0.5-31 months). A total of 55 patients underwent septoplasty (41.4%), while 78 underwent FSR (58.6%). There was a statistically significant decrease in
NOSE scores preoperatively (septoplasty: median = 70; FSR: median = 75) and postoperatively (septoplasty and FSR: median = 15) in the septoplasty (z = -6.11, P < .001) and FSR (z = -5.69, P < .001) groups. Gender, age, nasal trauma, prior nasal surgery, and allergic rhinitis did not have a statistically significant effect on postoperative NOSE scores for septoplasty or FSR patients. Additional surgery at the time of procedure was not a confounding variable in the relationship between surgery type and change in NOSE score.

**Conclusions:** There is significant improvement in disease-specific quality of life in patients undergoing septoplasty and FSR. Gender, nasal trauma, prior nasal surgery, and allergic rhinitis did not significantly affect postoperative NOSE scores in either group.

**Permeatal Totally Endoscopic Ear Surgery for Congenital Cholesteatoma in Children**

Riccardo D’Eredita, MD (presenter)

**Objectives:** Totally endoscopic ear surgery (TEES) can provide excellent visual access during resection of middle ear disease than the operating microscope in an exclusive surgical permeatal access (PA). The purpose of this study was to determine the safety and efficacy of PA-TEES when used for the management of congenital cholesteatoma (CC) in children.

**Methods:** Prospective case study at a tertiary referral center over the past 7 years. Twelve children with CC confined to the middle ear underwent PA-TEES. Seven children were Potsic stage I, 4 were stage II, and 1 was stage III. Age range was 1.5 to 6 years (mean, 3.5 years); follow-up was 5 years (mean, 4.1 years). All children were treated with the PA-TEES approach. Outcome measures were incidence of surgical complications, cholesteatoma recurrence, hearing loss.

**Results:** Twelve children underwent PA-TEES. No surgical complications occurred. Postoperative audiograms were available for all patients who had pure-tone averages ranging from 3.3 to 35.9 dB hearing level (HL; mean, 12.7 dB HL). One patient with a stage III CC was found to have conductive pure-tone average of 35.9 dB HL during the follow-up period. All patients underwent 1-stage procedure, and none developed cholesteatoma recurrence during the follow-up time frame.

**Conclusions:** Although the follow-up period and number of patients were limited, early-stage CC can be safely removed using PA-TEES. Further studies with larger series are warranted.

**Pharyngeal Flap versus Sphincter Pharyngoplasty for Velopharyngeal Insufficiency**

Joshua D. Horton, MD (presenter); Sharon H. Gnagi, MD; Carlyn M. Atwood; Darrell Wright, MD; Shaun A. Nguyen, MD; David R. White, MD

**Objectives:** To compare admission trends, operative data, and complications in patients undergoing pharyngeal flap (PF) or sphincter pharyngoplasty (SP) for velopharyngeal insufficiency (VPI).

**Methods:** A retrospective analysis of the 2014 and 2015 American College of Surgeons National Surgical Quality Improvement Project–Pediatrics was performed. Current Procedural Terminology (CPT) codes were used to identify children undergoing PF (42225, 42226) and SP (42950) for VPI (International Classification of Diseases, Ninth Revision, 478.29, 528.9, or 750.29). The data were reviewed for patient demographics, admission trends, operative details, and complications. SPSS statistical software was used to analyze the results for significance.

**Results:** A total of 446 patients were treated for VPI with either PF (n = 250) or SP (n = 196). The groups were demographically similar in age, gender, race, and preoperative comorbidity. PF was associated with longer operating room times compared with SP: anesthesia duration (median 128.0 [interquartile range = 74] vs 117.5 [interquartile range = 65] minutes, P = .004), operation duration (74.0 [57] vs 70.5 [61] minutes, P = .031), and total operating room time (119.0 [71] vs 109.5 [69] minutes, P = .004). PF was performed less often as an outpatient procedure than SP: anesthesia duration (median 96/250 [38.4%] vs 130/196 [66.3%], P < .0001), and patients receiving PF had a longer total length of hospital stay (1.76 ± 1.29 vs 0.98 ± 0.91 days, P < .0001). No difference in total complications (10/250 [4.0%] vs 3/196 [1.5%, P = .124] was identified. However, cumulative readmissions and reoperations were higher for PF (12/250 [0.05%] vs 2/196 [0.01%], P = .02).

**Conclusions:** Patients undergoing SP for VPI had shorter operative times and hospital stays as well as decreased readmission/reoperation rates compared with those receiving PF. No difference in complications was identified between the 2 procedures.

**Pulmonary Function Testing in Laryngotracheal Stenosis**

Amy M. Manning, MD (presenter); Catherine Hart, MD; Meredith Tabangin, MPH; Charles Myer, MD; Crisalli Joseph, MD; Alessandro De Alarcon, MD, MPH

**Objectives:** To describe the relationship between pulmonary function testing (PFT) and endoscopy findings in patients with laryngotracheal stenosis and to examine the effect of laryngotracheal reconstruction (LTR) on PFT findings.

**Methods:** This is a case series conducted in a tertiary pediatric medical center. Medical records from all patients undergoing LTR at a single institution between 2005 and 2014 were cross-referenced with patients with PFT data. Data examined included demographic data, surgical procedures, endoscopy findings, and PFT results. Preoperative and postoperative forced expiratory volume in 1 second (FEV₁) and FEV₁/forced vital capacity (FVC) were compared and correlated to airway endoscopy findings.

**Results:** Fourteen patients had both preoperative and postoperative PFT data for 18 procedures. Age of patients ranged from 7 to 24 years. Preoperatively, 7 patients (41.2%) had supraglottic obstruction, 7 (41.2%) had glottic stenosis, 11 (64.7%) had subglottic stenosis, and 12 (70.6) had tracheal...
stenosis. Ten patients (71.4%) had multilevel obstruction. The median preoperative FEV₁/FVC was 67.5 (interquartile range = 63-79), whereas the median postoperative FEV₁/FVC was 70 (interquartile range = 66-78). The median change in FEV₁/FVC was 0.5. Preoperatively, 10 patients had Myer–Cotton grade 1 stenosis, 4 grade 2, and 3 grade 3. Postoperatively, 5 patients had no stenosis, 10 grade 1, and 2 grade 3. No patients had grade 4 stenosis.

Conclusions: Despite an overall decrease in the grade of airway stenosis, there was not a significant change seen in FEV₁/FVC between preoperative and postoperative PFTs, suggesting that FEV₁/FVC may not be an adequate outcome measure following LTR. Further research is needed to define the role of PFTs in the management of patients with airway stenosis.

Quantitative Optical Ranging Pneumatic Otoscopy
Jungeun Won (presenter); Guillermo L. Monroy, MS; Pin-Chieh Huang, MS; Ryan L. Shelton, PhD; Malcolm C. Hill, MD; Stephen A. Boppart, MD, PhD

Objectives: Assessing the displacement, mobility, and dynamics of the tympanic membrane (TM) in otitis media (OM) is often intrinsically difficult because of the limited perception and subjective assessment of small on-axis motion. The purpose of this study is to develop quantitative metrics for TM dynamics using a pneumatic LCI otoscope integrated with an optical ranging technique called low-coherence interferometry (LCI) and correlate the quantitative metrics with standard tympanometry.

Methods: A total of 17 patients visiting an outpatient pediatric clinic were recruited at Carle Foundation Hospital in Urbana, Illinois. Tympanometry was performed to determine peak admittance and middle ear pressure (MEP). A pneumatic LCI otoscope (spatial and temporal resolution of 8 µm and 1 ms, respectively) was subsequently used to measure TM displacement dynamics under pressure transients (average of 12 mm Hg). Using physician diagnosis along with the depth-resolved dynamics provided by LCI, patients were categorized as normal, strong negative MEP, or effusion.

Results: The compliance ratio (ratio of TM displacement to pressure) of the effusion group was significantly less than that of the normal (P < .001, α = 5%). Linear relationships were observed between the compliance ratio and the peak admittance and between the amplitude ratio (ratio of TM displacements in 2 opposite directions) and MEP. Furthermore, the pneumatic LCI otoscope estimated the MEP and the turbidity of the effusion.

Conclusions: Pneumatic LCI otoscopy can be used to evaluate the presence and turbidity of an effusion, MEP, and TM dynamics, providing potentially new data to better characterize the middle ear in OM.

Reduced Emergency Department Visits after Tonsillectomy
Caitlin W. Pacheco, (presenter); Mark Finkelstein; Rocco Ferrandino; Michael A. Palese, MD; Fred Lin, MD

Objectives: To identify a population of pediatric patients who underwent tonsillectomy and/or adenoidectomy for obstructive sleep apnea (OSA) and to assess whether there is a change in emergency department (ED) usage after surgery for these patients.

Methods: The Statewide Planning and Research Cooperative System was searched for patients aged 2 to 12 years who both had OSA and underwent tonsillectomy and/or adenoidectomy. These patients were separated into cohorts with and without comorbid asthma. The number of overall ED visits and visits for respiratory complaints for 1 year preoperatively and postoperatively were recorded.

Results: A total of 26,269 patients were identified, 4080 of whom had asthma. ED visits for both overall and respiratory complaints were more frequent in patients with comorbid asthma (P = .0221), and black children had a higher frequency of comorbid asthma than white children (P < .01). All included patients experienced a 15% decrease in the number of ED visits in the year after surgery, 69% of which was due to a decrease in respiratory complaints. Patients with comorbid asthma experienced a 21% decrease in ED visits, 57% of which was due to a decrease in respiratory complaints. For nonasthmatic patients, these numbers were 13% and 75%, respectively.

Conclusions: The interaction between upper respiratory diseases common in children is still imperfectly understood, and treatments for one may affect another. These data show a significant benefit for children undergoing tonsillectomy and/or adenoidectomy for OSA in the form of reduced ED usage, especially for respiratory complaints. This effect is even more dramatic in patients without comorbid asthma.

Reducing Pediatric Post-tonsillectomy Pain
Edward Chisholm, MD, MBBS, FRCS; Sophie Mella, MBBS; Fenella Shelton, MBBS; Hiro Ishii, MBBS (presenter); Dylan Chew, MBBS; Jemma Winterbottom, MBBS

Objectives: To reduce readmission for pain control postpediatric tonsillectomy.

Methods: A prospective audit from September 2014 to August 2015 was completed. Discharge analgesic regimens and readmission rates post-tonsillectomy for recurrent tonsillitis in nonsyndromic 2- to 16-year-old children were studied in a large general hospital in the United Kingdom. An analgesic protocol devised and instigated paracetamol (15 mg/kg 4 times a day) and ibuprofen (7.5 mg/kg 4 times a day) for 2 weeks, and oral morphine sulfate for breakthrough pain. Second cycle of audit ran from December 2015 to November 2016.

Results: In cycle 1, 151 children (mean age, 7.9 years) underwent tonsillectomy for tonsillitis, 25 (16.6%) of whom were readmitted; 12 experienced postoperative hemorrhage, 13 required pain control, and 1 had infection. The analgesic regimen suggested by the discharging team varied widely and often included purchase of over-the-counter ibuprofen and paracetamol (antipyretic dose). In cycle 2, 119 children (mean age, 8.8 years) underwent tonsillectomy for tonsillitis, 17 (14.4%) children had
readmissions, 12 had postoperative hemorrhage, 0 needed pain control, 3 had infection, and 2 had other problems. Readmission for pain control showed a significant reduction ($\chi^2 P = .0027$) from 7.3% to 0% in the study. Overall, there was no significant change in readmission rate (from 16.6% to 14.4%) or postoperative hemorrhage rate (8.9% overall).

**Conclusions:** A readily available standardized postoperative analgesic protocol can significantly reduce readmission rates for pain control following tonsillectomy in a pediatric population.

### Sequelae of Tympanostomy Tube Placement

**Reema K. Padia, MD (presenter); Prem Narayanan, MS; Wendy Gort, MS; Jeremy D. Meier, MD**

**Objectives:** To determine the rate of various sequelae following tympanostomy tube placement in the pediatric population.

**Methods:** A case series of children aged 0 to 3 years who underwent tympanostomy tube placement between 2004 and 2010 within a multihospital network was reviewed. The patients were followed for 5 years to determine the number of repeat tube placements, need for surgical removal of tube/s for retention, and presence of perforation requiring myringoplasty.

**Results:** The study cohort included 46,029 children who underwent tympanostomy tube placement. A total of 6966 (15.1%) patients required a second set of tubes within the 5 years of follow-up studied; 1647 (3.6%) patients required a myringoplasty either by paper patch, fascia, or fat; 1076 (2.3%) patients required removal of a tube under general anesthesia.

**Conclusions:** This study identifies rates of subsequent procedures after tympanostomy tube placement in young children using a large multihospital cohort. Appropriate counseling should occur with families before the first set of tubes is placed, and more research needs to be done on how to better individualize care to minimize the need for these subsequent procedures.

### Severe Ulceration in Infantile Hemangioma

**Dan H. Gordon, MD (presenter)**

**Objectives:** Infantile hemangioma (IH) is the most common benign tumor of infancy. Ulceration of the hemangioma is a well-documented phenomenon. While most cases of ulceration resolve with current treatment, there remains a subset of patients who experience refractory ulceration with significant pain, feeding issues, or marked cosmetic deformity. This study analyzes the prevalence of severe ulceration of IH in the head and neck region. It describes trends in presentation and management of these refractory cases.

**Methods:** A case series was selected from the hospital database of IH patients seen at the vascular anomalies clinic affecting the head and neck region over 14 years from 2003 to 2016. After extracting cases with ulceration, each case was reviewed. Cases that showed marked ulceration with severe pain, restricted feeding, or destructive ulceration were included for analysis. The demographics, type of IH, location, and treatment practices were recorded. A review of recent treatment options for refractory ulceration in IH is also presented.

**Results:** This series presents 12 cases of severe ulceration representing a prevalence of 1.3%. The gender, focal and segmental distribution, and airway involvement are described. A pattern of propranolol and postpropranolol institution is noted. Despite the use of propranolol, severe refractory ulceration still occurs. The use of adjuvant treatment is reported.

**Conclusions:** Severe and refractory ulceration is a devastating complication in a small subset of patients with IH. Various adjuvant treatment options exist with limited data supporting their use. Ongoing research to predict and treat these refractory cases is required.

### Sleep Study Indices and Post-tonsillectomy Outcomes

**Yuti Desai (presenter); Schubart Jane, PhD, MBA; Robert T. Swanson; Scott Chung; Uma R. Parekh, MBBS; Michele M. Carr, MD, PhD, DDS**

**Objectives:** Correlate sleep study findings for children with obstructive sleep apnea (OSA) prior to pediatric tonsillectomy to anesthesia emergence time (ET), recovery room (RR) time, and length of stay (LOS).

**Methods:** Children with OSA between 1 and 17 years of age who had sleep studies prior to tonsillectomy in a tertiary children’s hospital from 2013 to 2016 were included. Sleep study Apnea–Hypopnea Index (AHI), Central Apnea Index, O$_2$ nadir, and end-tidal CO$_2$ were compared with the anesthesia ET post-tonsillectomy, RR time, and LOS.

**Results:** A total of 262 patients with average age of 7.0 years were included. Average AHI was 8.6 (standard deviation [SD] = 13.3), average Central Apnea Index was 0.7605 (SD = 2.7), average O$_2$ nadir was 84.3% (SD = 10.9), and average end-tidal CO$_2$ was 50.02 (SD = 6.7). Average ET was 16 minutes (SD = 8.9), RR time was 66 minutes (SD = 49.1), and LOS was 23.03 hours (SD = 16.2). When controlled for age, gender, and body mass index, children with a higher AHI had a significantly longer ET ($P < .001$) and LOS ($P = .01$). Children with a lower O$_2$ nadir had a significantly longer ET ($P = .032$). End-tidal CO$_2$ did not have a significant relationship with any of the outcomes evaluated. AHI, O$_2$ nadir, Central Apnea Index, and end-tidal CO$_2$ were not associated with RR time.

**Conclusions:** Sleep study indices (AHI and O$_2$ nadir) have value in predicting prolonged ET and LOS among children with OSA.

### Socioeconomic Status and Pediatric Hearing Loss Outcomes

**Blake R. Smith, MD (presenter); Jessica J. Zhang; Nikhila Raol, MD, MPH; Julina Ongkasuwan, MD; Samantha Anne, MD, MS**

**Objectives:** Evaluate effects of socioeconomic status (SES) on accessibility to hearing rehabilitation and speech language outcomes in children with hearing loss.
Methods: Charts were reviewed of children diagnosed with hearing loss from 2010 to 2012. They were separated into 2 groups based on SES using insurance coverage as proxy for financial status (private insurance versus Medicaid).

Results: A total of 87 patients were identified. Of these, 61 (70.1%) had private insurance and 25 (28.7%) had Medicaid. One international patient was excluded. Medicaid and privately insured groups were equivalent in age (11.45 ± 3.7 years, \( P = .44 \)), there was no statistical difference between the groups in completion of a hearing aid evaluation (\( P = .3 \)), hearing aid compliance (\( P = .43 \)), receipt of speech therapy (\( P = .69 \)), or speech language outcomes (\( P = .9 \)). There was no disparity with regard to participation in an individualized education program (\( P > .99 \)), or use of a frequency modulation (FM) system (\( P = .19 \)). However, significantly more Medicaid patients were lost to follow-up (\( P = .008 \)).

Conclusions: Previous studies have shown disparities in speech and language development in children from higher and lower SES families. In our study of children with hearing loss, there was no inequality with regard to hearing aid access, school support services (FM systems, individualized education programs), or speech language outcomes. However, SES negatively affected follow-up. Acknowledging hearing loss as a disability and aggressive therapy may help equalize the disparity in speech language outcomes otherwise seen between higher and lower SES children.

**Staphylococcus aureus in Advanced Orbital Complications of Sinusitis**

Sarah Gitomer, MD (presenter); Doug Marx, MD; Preeti Thyparampil, MD; Richard Jenkins, MD; Karina Canadas, MD

Objectives: To describe the clinical characteristics of pediatric postseptal orbital complications of sinusitis and to analyze the impact of *Staphylococcus aureus* on disease severity.

Methods: Retrospective review was conducted from May 2012 to April 2015 of children with orbital cellulitis presenting to a tertiary care pediatric hospital. Outcomes for patients with *S. aureus* cultured were compared with patients without *S. aureus* cultured.

Results: Fifty children were identified: 35 boys (70%) and 15 girls (30%). Mean age was 9.4 ± 5.2 years. Thirty-four children (68%) were febrile at presentation. On initial imaging, 8 patients (16%) had orbital cellulitis (Chandler group II), 20 (40%) had subperiosteal abscess (Chandler group III), and 22 (44%) had orbital abscess (Chandler group IV). No patient had cavernous sinus thrombosis. Thirty-four patients (68%) had surgery. Eighteen patients (36%) had cultures with *Streptococcus* species, 12 (24%) had *S. aureus*—5 (10%) methicillin resistant and 7 (14%) methicillin susceptible. *S. aureus* was more common in Chandler class IV patients (\( P = .006 \)). Patients with *S. aureus*—positive cultures had higher white blood cell count at presentation (\( S. aureus 19.4 ± 5.9, non-S. aureus 12.9 ± 4.5, P < .001 \)) and were more likely to require surgery (100% in the *S. aureus* group vs 66% in the non-*S. aureus* group, \( P = .018 \)).

Conclusions: Pediatric postseptal complications of sinusitis are most common in adolescent boys. In children, complications are more frequently severe based on Chandler classification. *S. aureus* is increasingly prevalent in this disease and is associated with more serious orbital complications of sinusitis in children.

**Systematic Review: Surgery in Pediatric Acute Mastoiditis**

Brandon S. Hopkins, MD (presenter); Seth R. Schwartz, MD, MPH; Stacey L. Ishman, MD, MPH; Samantha Anne, MD, MS

Background: There is no established standard of care for treatment of pediatric acute mastoiditis (PAM). Surgical options include myringotomy with or without tube placement (M/MTP), subperiosteal abscess drainage, and mastoidectomy.

Objectives: Systematically review English-language literature to evaluate efficacy of surgical treatments for PAM.

Methods: PubMed, Embase, Medline, CINAHL, and Cochrane Library were searched from inception to August 2016, along with manual bibliography searches. Studies describing surgical therapy were included. The primary outcome was cure rate. The secondary outcome was rate of significant complications. Two independent evaluators reviewed each abstract and article. The estimated success probability and 95% confidence intervals were calculated using a random effects model.

Results: A total of 310 articles were identified; 36 met inclusion criteria. We included 2930 patients with mean age of 2.8 years (range, 0.5-6.2 years); 58.7% were male. As much as 16.6% of cases involved a serious complication (eg, intracranial extension). Overall, 1495 patients had M/MTP; 92 failed therapy and needed additional surgery. Subperiosteal abscess drainage occurred in 223 children, with or without M/MTP; 44 failed and needed additional surgery. Mastoidectomy was performed in 1060 children (with or without M/MTP); 11 worsened. The estimated success probability and 95% confidence intervals are as follows: M/MTP 92.4% (86.9-95.7), mastoidectomy with or without tube 95.3% (93.3-96.8), and subperiosteal abscess drainage 76.0% (65.1-84.3).

Conclusions: M/MTP and mastoidectomy have high success rates in curing PAM, while subperiosteal abscess drainage had a high failure rate. This suggests that subperiosteal abscess drainage should be avoided as primary therapy for PAM.

**Tonsil and Adenoid Size Not Linked to Tobacco Exposure**

Christine M. Clark, MD (presenter); Sarah Benich; Michele M. Carr, MD, PhD, DDS

Objectives: To determine if pediatric tonsil or adenoid size is correlated with environmental tobacco smoke (ETS) exposure using salivary cotinine as an objective marker.

Methods: Saliva samples were collected from children meeting tonsillectomy ± adenoidectomy criteria in 2016, and salivary cotinine levels were measured. Salivary cotinine concentrations above 1.0 ng/mL constituted ETS exposure.
Intraoperative tonsil and adenoid sizes were recorded by a single surgeon and retrieved from the operative report. Demographic data and smoke exposure history were also determined. Comparisons were made with nonparametric statistics.

**Results:** Tonsil and adenoid data were available from 97 and 92 children, respectively. Average age was 6.7 years (range, 1.5-15.0 years); 55.7% were male and 44.3% were female. Indication for tonsillectomy was obstructive sleep apnea in 70.1%; the remainder had recurrent tonsillitis. As much as 28.9% had a history of secondhand smoke exposure, but 49.5% had a positive salivary cotinine level; 9.3% had 1+ tonsils, 43.3% had 2+, 35.1% had 3+, 12.3% had 4+. As much as 54.3% of children with tonsils 3+ or larger had positive salivary cotinine levels, compared with 30.0% for children with 1+ tonsils and 47.6% for children with 2+ tonsils. About 26.1% had 1+ adenoid, 43.5% had 2+, 22.8% were 3+, and 7.6 were 4+. Regardless of adenoid size, half had positive salivary cotinine levels. Salivary cotinine concentration was not significantly different based on tonsil size ($P = .449$) or adenoid size ($P = .784$).

**Conclusions:** Our results indicate that tonsil and adenoid size is not correlated with ETS exposure as measured by salivary cotinine.

**Trends in Pediatric Otolaryngology Disparities Research**

Jad R. Jabbour, MD, MPH (presenter); Thomas C. Robey, MD; Michael J. Cunningham, MD

**Objectives:** Attention given to health care disparities in the otolaryngology literature is increasing. Mounting evidence also highlights how disparities affect quality improvement and health care reform. This study aims to (1) describe trends in disparities research within pediatric otolaryngology, as evidenced by major meeting presentations, and (2) compare observed trends to those in quality improvement and patient safety.

**Methods:** Meeting programs from the American Society of Pediatric Otolaryngology, Triological Society, and American Academy of Otolaryngology—Head and Neck Surgery Foundation from 2003 to 2016 were searched for pediatric-related oral and poster presentations addressing disparities and socioeconomic determinants of health, as well as patient safety and quality improvement. Presentation frequency was compared between categories and within each category over time.

**Results:** Of 9389 total presentations, 2245 were related to the pediatric population; 1199 (53.4%) of those were oral presentations. Disparities-related presentations increased from 0 in 2003 to 13 in 2016. From 2003 to 2009, 3/429 (0.7%) presentations involved disparities, compared with 52/1816 (2.9%) from 2010 to 2016 ($P = .008$). The proportion of presentations regarding patient safety and quality improvement also significantly increased (25/429 [5.8%] in 2003-2009 vs 164/816 [9.0%] in 2010-2016, $P = .03$). Patient safety and quality improvement presentations remain more common than disparities presentations (9.0% vs 2.9%, $P < .001$).

**Conclusions:** Health care disparities are increasingly addressed in pediatric otolaryngology meeting presentations. Compared with the well-established realm of patient safety and quality improvement, disparities research remains nascent, but is similarly gaining increasing attention. Health care reform and quality improvement efforts should recognize the role of socioeconomic factors and include strategies for addressing disparities.

**Using Laryngeal Electromyography for Pediatric Vocal Fold Immobility**

Sarah N. Bowe, MD (presenter); Christopher Hartnick, MD, MS

**Objectives:** Vocal fold immobility (VFI) is a common cause of both dysphonia and dysphagia in children. Management of VFI is based on the severity of patient symptoms, cause of injury, and likelihood of recovery. Laryngeal electromyography (EMG) is a useful tool in predicting the return of laryngeal function. Herein, we will (1) describe our modified approach to laryngeal EMG using bipolar double hook-wire electrodes and (2) provide case examples wherein EMG data influence patient management.

**Methods:** Previously, a simplified technique for intraoperative laryngeal EMG in children was developed using standard nerve integrity monitoring electrodes. Currently, bipolar double hook-wire electrodes are placed into the bilateral thyroarytenoid and posterior cricoarytenoid muscles. These electrodes record the potential between 2 hooks, eliminating the need for a negative wire to be placed externally, providing crisper signal clarity. In addition, channel outputs can be recorded simultaneously and in isolation using audiovisual digital recording equipment for expert review by neurologists with EMG training.

**Results:** The technique will be illustrated in a 5-year-old girl with a history of neurofibromatosis type 2 with bilateral jugular foramen tumors with left VFI, aspiration, and dysphonia. A series of cases of unilateral and bilateral VFI with management options will then be discussed.

**Conclusions:** Laryngeal EMG is a safe procedure that has the possibility of being a useful adjunct in the management of children with VFI. Continued work will be necessary to refine techniques and analysis and determine its long-term utility.

**Validation of a Pediatric Dysphagia Quality-of-Life Instrument**

Derek J. Lam, MD, MPH (presenter); Zipei Feng, PhD; Eleni O’Neill, MPH; Carol MacArthur, MD

**Objectives:** Validate a Swallowing Quality of Life (SWAL-QOL) dysphagia-specific QOL instrument in children using videofluoroscopic swallow studies (VFSSs) and validated generic QOL instruments.

**Methods:** Cross-sectional study of patients seen from 3/1/2013 to 8/1/2016 in the Doernbecher Aerodigestive Clinic.
Dysphagia was assessed using VFSS (recommendation quantified as 0, normal; 1, nectar thick; 2, nectar plus; 3, honey thick; 4, pureed; and 5, nil per os) and a modified SWAL-QOL instrument consisting of 7 domains whose scores were averaged to yield an overall score ranging from 0 (worst) to 100 (best). Patients were also administered a generic QOL instrument: the Infant/Toddler QOL (ITQOL) questionnaire (age <6 years) or Child Health Questionnaire (age 6-18 years). Linear regression and Pearson correlation analyses were used to quantify the relationships between measures.

**Results:** A total of 167 patients (61% male, mean age 3.3 ± 3.5 years, 83% age <6 years) completed the VFSS and QOL questionnaires. The overall SWAL-QOL score was significantly associated with VFSS-recommended thickness (β = -3.4, P = .03), multiple ITQOL scales (Physical Abilities \( r = .63, P < .001 \), Behavior \( r = .60, P < .001 \), Parental Impact-Time \( r = .68, P < .001 \)) and multiple Child Health Questionnaire scales (Global Health \( r = .56, P < .01 \), Behavioral Difficulties \( r = .52, P = .02 \), and Family Activity \( r = .63, P = .002 \)).

**Conclusions:** The modified SWAL-QOL is a valid measure of dysphagia-specific QOL in children. It demonstrates a significant association with VFSS and moderate-to-strong correlations with multiple domains of generic QOL measures.

**WatchPAT in the Diagnosis of Pediatric Obstructive Sleep Apnea**

Archwin Tanphaichitr, MD (presenter); Arathaya Thianboonsong, MD; Wish Banhiran, MD; Kitirat Ungkanont, MD; Vannipa Vathanophas, MD

**Objectives:** Assess the accuracy and clinical reliability of WatchPAT compared with polysomnography (PSG) for the diagnosis of pediatric obstructive sleep apnea (OSA).

**Methods:** A diagnostic, cross-sectional study was performed from January to October 2016. Pediatric patients aged 8 to 15 years with clinically suspected OSA underwent level 1 full-night PSG and simultaneously wore WatchPAT 200 in sleep laboratory. PSG and WatchPAT parameters were analyzed and compared.

**Results:** Thirty-six patients were included in this study. Mean age was 10.2 ± 1.8 years. From the sleep parameters of PSG and WatchPAT, median Apnea–Hypopnea Index (AHI) values were 8.0 (5.5, 12) and 2.9 (0.5, 7.5) events per hour, median Oxygen Desaturation Index (ODI) values were 2.5 (1.4, 8.3) and 1.3 (0.2, 3.8) events per hour, mean total sleep time values were 398.4 ± 38.3 minutes and 401.9 ± 36.1 minutes, mean minimum \( \text{O}_2 \) saturation (MinO2sat) values were 87.1% ± 8.1% and 89.4% ± 7.1%, respectively. The agreement was excellent in AHI (intra-class correlation coefficient = 0.89, \( P < .001 \)) and ODI (intra-class correlation coefficient = 0.87, \( P < .001 \)). There was very good to excellent correlation in ODI (\( r = .83, P < .001 \)) and moderate to good correlation in AHI (\( r = .64, P < .001 \)). According to the receiver-operating characteristic curve, the AHI obtained from WatchPAT cut point at 3.5 yielded the highest accuracy with sensitivity of 76.9% and specificity of 78.3%, whereas the cut point at 10 gave the highest specificity as 91.3% to differentiate severe OSA cases.

**Conclusions:** WatchPAT is well correlated with PSG and provides a reliable method for detecting uncomplicated pediatric OSA. Thus, it might be used as an alternative test when PSG is not available.