



# PYIR

Pediatric Year in Review

 **ATS** 2022

# Pediatric Year in Review Bibliography

## MODERATORS

Terri A. Laguna, MD, MSci  
Ann & Robert H. Lurie Children's Hospital of Chicago  
Pediatrics/Pediatric Pulmonary  
Chicago, IL

Benjamin T. Kopp, MD, MPH, ATSF  
Nationwide Children's Hospital  
Pediatrics/Pulmonary Medicine  
Columbus, OH

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*This session and the International Conference are supported by an independent medical educational grant from **Merck & Co.***

## Sleep Disordered Breathing

Olufunke Afolabi-Brown, MBBS

Children's Hospital of Philadelphia

Department of Pediatrics

Philadelphia, PA

### BURDEN OF SLEEP DISORDERED BREATHING IN CHILDREN WITH SICKLE CELL DISEASE

Liguoro I, Arigliani M, Tan HL, Gupta A. **The burden of sleep disordered breathing in children with sickle cell disease.** *Pediatr Pulmonol.* 2021 Dec;56(12):3607-3633

#### Summary

Children with sickle cell disease (SCD) are at a higher risk of sleep disordered breathing (SDB) than the general population. There are, however, several gaps in the literature regarding the risk factors and clinical implications of SDB. This review is a concise narrative and systematic synthesis of the available evidence of the epidemiology, clinical presentation, complications and management of SDB in children with SCD. The authors looked at published studies between January 2000 and December 2020, focusing on SDB in children with SCD. At the end of a rigorous selection process, 62 studies out of 190 papers were included for analysis. SDB was associated with worse neurologic, neurocognitive and cardiovascular outcomes. Based on the current available evidence, the association of SDB with frequency or severity of vaso-occlusive pain events and acute chest syndrome could not be clarified. While therapeutic interventions like adenotonsillectomy or oxygen supplementation may result in significant increase in mean nocturnal oxygen saturation, long-term effective clinical implications remain unclear.

#### Comments

1. Children with SCD and sleep disordered breathing are at a risk for negative neurological, neurocognitive and cardiovascular outcomes, based on this systematic review.
2. There are no studies to date looking at the long-term impact of various SDB interventions on quality of life and various clinical outcomes.

3. Most of the studies on the management of SDB in SCD were retrospectively designed with heterogenous interventions, hence while there was improvement in the severity of SDB, the clinical implications remain unclear.
4. Given the potentially devastating clinical consequences of untreated sleep disordered breathing and specifically chronic hypoxemia in this population, it is important to provide regular screening for SDB in this patient population.

### NON-INVASIVE VENTILATION ADHERENCE IN CHILDREN

Thomas A, Langley R, Pabary R. **Feasibility and efficacy of active remote monitoring of home ventilation in pediatrics.** *Pediatr Pulmonol.* 2021 Dec;56(12):3975-3982

#### Summary

Non-invasive positive airway pressure (PAP) therapy is used to treat children with sleep-disordered breathing. Effective management requires good adherence. In response to the problem of reduced adherence over time, this group conducted a pilot study using ventilators equipped with technology to remotely monitor home adherence.

Data on children requiring home PAP therapy was collected, including usage, apnea-hypopnea index (AHI) and mask leak on days 14, 42 and 90. Additionally, parental understanding of adherence was assessed. Over the 90 day period, the median nightly PAP use was 6.58 h (interquartile range: 2.47–8.62); 60% of patients met criteria for good adherence (>4 h for >70% of nights). There was a decrease in median nightly usage in Week 1 (6.92 h) versus Week 12 (6.15 h),  $p = 0.04$ . Mask leak was higher in Week 1 (17.7 L/min) versus Week 12 (14.7 L/min),  $p = 0.053$ . There was no significant difference in AHI between Week 1 (2.7/h) versus Week 12 (2.3/h),  $p = 0.75$ . 45% of questionnaire respondents felt

active remote monitoring positively influenced PAP usage, and 84% reported overall satisfaction with PAP therapy.

The authors concluded that remote monitoring technology is a feasible and acceptable means to assess and improve home PAP adherence in children.

### Comments

1. Following initiation of remote monitoring in this cohort, median nightly usage was higher than the minimum recommended four hours and significantly higher than that reported in previous pediatric studies.
2. Positive airway pressure therapy adherence in children with developmental delays did not significantly differ, when compared to those with no underlying conditions.
3. AHI calculated nightly by PAP devices can be used as a proxy measure of therapy effectiveness despite limitations to the sensitivity of algorithms used. The ability to alter settings via the online platform and order equipment from manufacturers to be delivered directly to patients can potentially help facilitate interventions without the need for a hospital visit.

### DRUG INDUCED SLEEP ENDOSCOPY

Baldassari CM, Lam DJ, Ishman SL, Chernobilsky B, Friedman NR, Giordano T, Lawlor C, Mitchell RB, Nardone H, Ruda J, Zalzal H, Deneal A, Dhepyasuwan N, Rosenfeld RM. **Expert Consensus Statement: Pediatric Drug-Induced Sleep Endoscopy.** *Otolaryngol Head Neck Surg.* 2021 Oct;165(4):578-591

### Summary

Drug induced sleep endoscopy (DISE) is a transnasal flexible fiber-optic evaluation of the upper airway, performed under sleep-like sedation. DISE has been widely adopted and is frequently utilized to evaluate adults with OSA who are being considered for surgical therapy. The interest in DISE as part of the treatment for pediatric OSA occurred more recently, over the past 5 years. DISE has been utilized to identify sites of obstruction in children prior to or concurrent with adenotonsillectomy (“surgically naïve”) and also in

those who have persistent post-adenotonsillectomy OSA. However, evidence demonstrating its utility and effectiveness is sparse. This review was an expert consensus on pediatric DISE that clarifies controversies and offers opportunities for quality improvement. The author’s primary aim was to develop statements that would address areas of controversy, with the goal of reducing practice variation and improving the quality of care for pediatric patients with OSA. After an extensive literature search by the expert consensus statement (ECS) development group members, 59 consensus statements were developed for assessment with focus on 1) indications and utility of DISE, (2) protocol, (3) optimal sedation, (4) grading and interpretation, (5) complications and safety, and (6) outcomes for DISE-directed surgery.

### Comments

1. Polysomnogram (PSG) should be performed prior to performing DISE in children to assess severity of OSA as DISE has limited utility in children with apnea-hypopnea index (AHI) less than 2 events per hour.
2. Photo and video documentation of pediatric DISE in a standardized approach are useful to facilitate education, collaboration, and research.
3. While the ideal anesthetic for pediatric DISE maintains spontaneous ventilation and mimics normal asleep airway tone without exacerbating underlying medical conditions, there is opportunity for quality improvement regarding sedation due to a significant amount of practice variation in this area.
4. The anatomic sites that should be documented during pediatric DISE are the nasal cavity and nasopharynx, the velum, the pharynx (including lateral walls and tongue base), and the supraglottic larynx.
5. Pre-DISE PSG provides valuable information regarding a child’s oxygenation that can be used to guide the degree of desaturation allowed during the procedure.

## HEALTH CARE UTILIZATION IN SLEEP DISORDERED BREATHING: ROLE OF BIG DATA

Ehsan Z, Glynn EF, Hoffman MA, Ingram DG, Al-Shawwa B. **Small sleepers, big data: leveraging big data to explore sleep-disordered breathing in infants and young children.** *Sleep.* 2021 Feb 12;44(2)

### Summary

Infants represent an understudied minority in sleep-disordered breathing (SDB) research and yet the disease can have a significant impact on health over the formative years of neurocognitive development that follow. Due to the paucity of centers performing infant polysomnograms, there is a limited understanding of the evolution of SDB in infancy. As a result, the available literature in this age group is based on information from select centers. Additionally, management of infant OSA is based on extrapolation of available literature from older children, potentially increasing the risk of providing inappropriate therapy to this understudied and underserved population with SDB. Ehsan et al determined the association between SDB in infants and young children and comorbid medical disorders, characterized the patterns of health care utilization, and explored economic outcomes in this population to better understand these relationships and determine priorities for future research focusing on precision medicine in infant SDB. In a cohort of 68.7 million unique patients over a 9-year period, there were 9,773 infants and young children with a diagnosis of SDB who met inclusion criteria, across 62 U.S. health systems, 172 facilities, and 3 patient encounter types (inpatient, clinic, and outpatient). Thirty-nine percent were female. Thirty-nine percent were  $\leq 1$  year of age, 50% were 1–2 years of age, and 11% were 2 years of age. The most common comorbid diagnoses were micrognathia, congenital airway abnormalities, gastroesophageal reflux, chronic tonsillitis/adenoiditis, and anomalies of the respiratory system. Payor mix was dominated by government-funded entities.

### Comments

1. The etiology of sleep-disordered breathing (SDB) in infants is multifactorial and the pathophysiology is different from older children and adults.

2. Infants and young children with chronic lung conditions may be predisposed to OSA and should be screened appropriately.
3. One major limitation is the paucity of polysomnogram data in their cohort. The electronic health record systems only started including procedures as of 2013.
4. Further research focusing on infants at highest risk for SDB can help target resources and facilitate personalized management.

## PREDICTORS OF OBSTRUCTIVE SLEEP APNEA

Gutierrez MJ, Nino G, Landeo-Gutierrez JS, Weiss MR, Preciado DA, Hong X, Wang X. **Lower respiratory tract infections in early life are associated with obstructive sleep apnea diagnosis during childhood in a large birth cohort.** *Sleep.* 2021 Dec 10;44(12):zsab198. doi: 10.1093/sleep/zsab198. PMID: 34522958; PMCID: PMC8664572.

### Summary

Several birth cohorts have established a role between early lower respiratory tract infections (LRTIs) within the first 2 to 3 years of life and risks of pediatric respiratory conditions, such as wheezing illnesses and asthma beyond 6 years of age. The association between early LRTI and future development of obstructive sleep apnea has however not been established. In this study, the authors investigated whether early LRTIs increase the risk of pediatric OSA, by analyzing data in children followed during the first 5 years in the Boston birth cohort (an ongoing prospective, longitudinal birth cohort of newborns recruited at the Boston Medical Center). The study showed that early life LRTI increased the risk of pediatric OSA independently of other pertinent covariates and risk factors (hazard ratio, 1.53; 95% CI, 1.15 to 2.05). This association was limited to LRTIs within the first 2 years of life. They also noted that children with severe respiratory syncytial virus bronchiolitis during infancy had two times higher odds of OSA at 5 years when compare with children without this exposure (odds ratio, 2.09; 95% CI, 1.12 to 3.88). These findings serve as a building block for further research investigating potential pathophysiologic mechanisms and therapeutic interventions for OSA in younger pediatric populations.



## Comments

1. LRTIs occurring in early childhood (0-2 years of age) significantly increase the risk of pediatric OSA by the age of 5 years of age.
2. Children with preschool-age LRTI (2-5 years) had no significantly different risk of incident OSA, compared with those without LRTI.
3. There was a significant increase in the odds of OSA among children with a history of hospitalization due to RSV bronchiolitis.
4. The association between early life LRTI and OSA was independent of major risk factors for OSA and other pediatric respiratory diseases (e.g., prematurity or obesity).
5. Despite the above findings, conclusions regarding causality cannot be drawn as it is possible that infants who have RSV bronchiolitis and later present with OSA were born with an intrinsic airway predisposition to develop both respiratory conditions.

## Other Articles of Interest

### Treatment of OSA

Baumert M. **Cyclic alternating pattern in children with obstructive sleep apnea and its relationship with adenotonsillectomy, behavior, cognition, and quality of life.** *Sleep.* 2021 Jan 21;44

Kheirandish-Gozal L, Katz SL. **Predicting Behavioral Problems from Sleep-disordered Breathing Trajectories. Not an Easy Game.** *Am J Respir Crit Care Med.* 2021

Clements AC, Dai X, Walsh JM, Sterni LM, Prichett L, Boss EF, Seal SM, Ryan MA. **Outcomes of Adenotonsillectomy for Obstructive Sleep Apnea in Prader-Willi Syndrome: Systematic Review and Meta-analysis.** *Laryngoscope.* 2021

Kang KT, Chiu SN, Lee CH, Lin MT, Hsu WC. **Effect of adenotonsillectomy on blood pressure in children with obstructive sleep apnea: a meta-analysis.** *Sleep Med.* 2021 Aug;84:334-342

Sawunyavisuth B, Ngamjarus C, Sawanyawisuth K. **Any Effective Intervention to Improve CPAP Adherence in Children with Obstructive Sleep Apnea: A Systematic Review.** *Glob Pediatr Health.* 2021 May 28;8:2333794X211019884

### Sleep Disordered Breathing and Comorbid Conditions

Sunkonkit K, Chiang J, Moraes TJ, To W, Schneiderman JE, Cifra B, Amin R. **Congenital central hypoventilation syndrome and ventilatory responses during cardiopulmonary exercise testing.** *Pediatr Pulmonol.* 2021 Jun;56(6):1694-1703

Stowe RC, Miranda-Schaeubinger M, Andronikou S, Tapia IE. **Polysomnographic predictors of abnormal brainstem imaging in children.** *J Clin Sleep Med.* 2021 Jul 1;17(7):1411-1421

Tsou PY, Cielo C, Xanthopoulos MS, Wang YH, Kuo PL, Tapia IE. **Impact of obstructive sleep apnea on assisted ventilation in children with asthma exacerbation.** *Pediatr Pulmonol.* 2021 May;56(5):1103-1113

Gurbani N, Pascoe JE, Katz S, Sawnani H. **Sleep disordered breathing: Assessment and therapy in the age of emerging neuromuscular therapies.** *Pediatr Pulmonol.* 2021 Apr;56(4):700-709

Naime S, Weiss M, Lew J, Aziz J, Pan Q, Allen M, Xuchen X, Weinstock J, Nino G. **Central breathing abnormalities in children with trisomy 21: Effect of age, sex, and concomitant OSA.** *Pediatr Pulmonol.* 2021 Feb;56(2):472-478

Haim A, Daniel S, Hershkovitz E, Goldbart AD, Tarasiuk A. **Obstructive sleep apnea and metabolic disorders in morbidly obese adolescents.** *Pediatr Pulmonol.* 2021 Dec;56(12):3983-3990

# State of the Pediatric Pulmonology Workforce in the U.S.

Jennifer A. Rama, MD, MEd

Baylor College of Medicine, Texas Children's Hospital  
Department of Pediatric Pulmonology  
Houston, TX

## OVERVIEW OF U.S. WORKFORCE CONCERNS IN PEDIATRIC PULMONOLOGY

Oermann CM, Lahiri T, Peterson-Carmichael SL, Weiss P. **The history of workforce concerns in pediatric pulmonary Medicine.** *Pediatr Pulmonol.* 2020; 1-7. doi:10.1002/ppul.25094

### Summary

This review is the first of a four-part series introducing the joint efforts of the Pediatric Pulmonary Division Directors Association (PPDDA) and the Pediatric Pulmonary Training Directors Association (PEPTDA) to address pediatric pulmonary workforce issues. PPDDA and PEPTDA have shared serious workforce concerns for the past two decades. The rationale over these concerns is substantiated by data including static trends over time of first year fellows in pediatric pulmonology compared to other pediatric subspecialties, low National Residency Match Program (NRMP) fill rates in pediatric pulmonology, and unequal U.S. geographic distributions of pediatric pulmonologists. The authors describe reasons for low match rates pertaining to inadequate exposure in residency, financial disincentives, and inadequate infrastructure to develop physician scientists and physician educators. Additional workforce concerns are summarized; the potential influence of advance practice providers and hospitalists, the vulnerability of training programs due to financial insecurity and the need to ensure diversity and equity within the field. Acknowledging the numerous facets of workforce issues, the authors set the stage for part 2, recruitment into pediatric pulmonary fellowship; part 3 effectiveness and outcomes of fellowship programs; and part 4, future pediatric pulmonary landscape.

### Comments

1. The rationale over workforce concerns stems largely from long-standing low NRMP fill rates and an aging pediatric pulmonology workforce.
2. The reasons for low NRMP fill rate are complex and include a multitude of contributing factors such as inadequate exposure in residency, financial

disincentives, inadequate infrastructure for career support, and fellow attrition.

3. A pertinent introduction of complex issues related to pediatric pulmonology workforce is provided while more in-depth data and discussion on pipeline, current training, and future needs are provided over the rest of the series.

## FACTORS INFLUENCING THE SELECTION OF PEDIATRIC PULMONOLOGY AS A CAREER CHOICE

Nelson BA, Boyer D, Lahiri T, Oermann CM, Rama JA. **A statement on the current status and future needs of the pediatric pulmonology workforce: Pipeline Workgroup.** *Pediatr Pulmonol.* 2020;1-7. doi: 10.1002/ppul.25139

### Summary

This statement paper is part 2 of the four-part series reflecting the work of a subgroup tasked with 1.) identifying factors impacting recruitment into pediatric pulmonary training programs, 2.) summarizing current initiatives to enhance recruitment and 3.) proposing a plan to increase interest in pediatric pulmonary. Based on qualitative data from focus group interviews with residents at the 2019 ATS conference, the authors identified how and why residents choose to enter pediatric pulmonary fellowship using the social cognitive career theory as a framework. Focusing on actionable items, the authors elucidated 1.) specific types of learning experiences that attract residents 2.) the importance of enhancing residents' self-efficacy and expectations, as well as providing mentorship and early exposure 3.) the effect of specific support and barriers during active decision-making. To address workforce concerns, the authors describe existing educational programs with the aim of fostering interest in pediatric pulmonary, most sponsored by national organizations. A proposed plan to increase interest in the field includes 1.) earlier exposure starting in medical school or earlier 2.) diverse learning experiences with community involvement 3.) connections with faculty mentors and role-models who exemplify healthy work-life balance 4.) ongoing

investigation to study optimal duration of training and mitigate financial barriers.

### Comments

1. Factors that influence trainees to apply for pediatric pulmonary fellowship include 1.) learning experiences in bronchoscopy, respiratory physiology, diverse patient populations, opportunities for networking and scholarly work 2.) a learning environment that provides early exposure to the field with role-models and mentors 3.) situational supports and overcoming barriers at the time of active decision making.
2. Faculty can influence career choice by promoting residents' belief in their ability to succeed (enhance self-efficacy) and aligning residents' expectations favorably and realistically.
3. Loan repayment programs and ongoing research to investigate the optimal duration of fellowship training can address the barriers of educational debt burden and disincentives associated with additional three years of training.

### PEDIATRIC PULMONOLOGY FELLOWSHIP ISSUES: DEMOGRAPHICS, DURATION OF TRAINING AND FUNDING LIMITATIONS

Esther CR, Oermann CM, Ross KR, Weiss P. **An assessment of fellowship training issues affecting the pediatric pulmonary medicine workforce.** *Pediatr Pulmonol.* Published online 2021. doi:10.1002/ppul.25256

#### Summary

This paper focuses on issues related to pediatric pulmonology training programs. The authors show the American Board of Pediatrics (ABP) data of pediatric pulmonary fellowship program fill rates, a more complete count than the National Residency Match Program (NRMP) which is an underestimate. The ABP tracks all fellows in training and reports board eligibility and certification, while the NRMP includes only match statistics. Approximately 1/3 of positions are filled outside the match which explains the discrepancy. From 2010-2018 the ABP fill rate was 89.2% and the NRMP fill rate was 60.9% over the same time frame. Shortening the duration of fellowship to 2 years is highly controversial with some in favor to help recruitment and ease financial burdens on programs and individuals, while others express concern on the impact of clinical and research competence. Duration of training should be based on educational outcomes, which is currently being measured by milestones and entrustable professional activities. More work is needed

to determine the minimum level of milestones and EPAs needed for clinical and scholarly activity competencies. Financial insecurities are evident which impact the quality of training, recruitment and future workforce needs.

### Comments

1. While the NRMP fill rate in pediatric pulmonary is 60.9% during 2010-2018, the actual fill rate according to the ABP is 89.2% during the same time frame because approximately one third of slots are filled outside of the match.
2. Data exists to indicate that scholarly activity during fellowship may influence individuals to pursue a research career who may otherwise not have considered it.
3. Shortening duration of fellowship continues to remain highly controversial with a lack of critical data on the potential effects on recruitment, financial burdens, clinical competency, and burgeoning areas within the field.
4. Pediatric pulmonology fellowship programs experience financial insecurity due to unstable funding streams which can adversely affect the quality of training and future workforce needs.

### PERSPECTIVES OF DIVISION DIRECTORS AND SHIFTING SCOPE OF PRACTICE AND RESEARCH OF PEDIATRIC PULMONOLOGISTS

Noah TL, Tolleson-Rinehart S, Esther CR, Peterson-Carmichael SL, Davis SD, Moore PE. **The future of pediatric pulmonology: a survey of division directors, assessment of current research funding, and discussion of workforce trends.** *Pediatric Pulmonology.* 2020;1-9. <https://doi.org/10.1002/ppul.25228>

#### Summary

This paper describes a complex and shifting scope of pediatric pulmonology practice and research, a model of current and future workforce and a compilation of current and future clinical and research priorities. The authors present the results of a 2019 survey of members of the pediatric pulmonary division directors association (PPDDA) regarding the current needs and perceived clinical and research priorities over the next 5-10 years. Asthma, cystic fibrosis, and bronchopulmonary dysplasia were the top 3 diagnoses for both clinical and research priorities. The changing nature of CF care and opportunities to shift toward other facets including technology-dependence, chronic disease management and biologics are discussed. Regarding NIH research funding for children's



respiratory disorders, 51 of 371 grants (14%) related to pediatric respiratory disorders had a pediatric pulmonologist listed as principal investigator and most of the funding was for asthma, CF, respiratory microbiome and BPD with relatively little for other disorders considered part of the discipline. The authors generated a retirement curve and an active workforce model which showed steady increases and a modest growth rate over the next two decades. Whether this growth is sufficient to meet the need is unknown.

### Comments

1. Workforce modeling shows that current and projected workforce is sufficient to maintain and grow the total number of pulmonologists, but it is unknown whether it is sufficient to meet the need and demand.
2. Due to the impact of CFTR modulators, physician extenders and growing hospitalist services, the future clinical scope will need to shift to opportunities in other areas such as technology-dependence, neonatal intensive care, new and emerging infections and multidisciplinary care teams.
3. NIH funding particularly for asthma, infection and microbiome studies is relatively robust and can be an area of focus for physician-scientists in our discipline.
4. Better inclusion of underrepresented groups in medicine among providers of pediatric pulmonary medicine is needed to optimally provide care for children with chronic respiratory disorders, many of which disproportionately affect underserved minority populations.

### PROPOSED SOLUTIONS TO ADAPT TO THE CHANGING LANDSCAPE OF PEDIATRIC PULMONOLOGY

Gaston B, Laguna TA, Noah TL, et al. **A proposal for the addressing the needs of the pediatric pulmonary workforce.** *Pediatr Pulmonol.* 2020;55(8):1859-1867. <https://doi.org/10.1002/ppul.24856>

### Summary

This paper summarizes current and anticipated challenges in the future of pediatric pulmonary medicine and proposes specific, long-term solutions to address the emerging problems in the field. The authors present a collection of ideas of faculty from various institutions who met in 2019. The authors identify 7 workforce needs: physician shortage, upkeep with rapid acceleration of scientific discovery, retention of academicians, formal training in sub-specialties of pulmonary, support for physician scientists, team

science, and workforce diversity. A table of 9 opportunities in pediatric pulmonary academic medicine is compiled. Lastly, a detailed proposal of solutions are presented and consist of 1.) optimization of practices by regional collaboration and partnership with governmental agencies and business leaders who work for division heads 2.) development of a financial base for training raised through philanthropy, research foundation, industry, advocacy groups and the NIH. 3.) optimization of pre-fellowship outreach by increasing the visibility of pediatric pulmonary specialists with undergraduates, medical student, and residents 4.) improvement and restructuring of training in clinical, didactic, pulmonary science; curricular content by year of training and the role of PhDs and physician extenders are also outlined.

### Comments

1. The authors have generated a comprehensive, detailed and thoughtful proposal to keep up with the evolving developments and challenges in our field.
2. Acknowledging the financial, logistical and practical efforts that are needed in this type of undertaking, the authors also propose concrete steps that might lead to a path of success.

### UNDERREPRESENTED IN MEDICINE (URiM) AMONG PEDIATRIC RESIDENTS AND FELLOWS, THE FUTURE WORKFORCE

Montez K, Omoruyi EA, Mack WJ. **Trends in Race / Ethnicity of Pediatric Residents and Fellows : 2007 – 2019.** *Pediatrics.* 2021;148(1):1-10. e2020026666

### Summary

This paper describes the importance of a diverse pediatric workforce to help mitigate health inequities. To that end, numerous initiatives, calls for action, and requirements by national organizations have been implemented. The authors conducted a cross-sectional study of longitudinal trends from 2007 to 2019 in racial/ethnic representation of U.S. pediatric trainees and compared it to the U.S. population using the AAMC Graduate Medical Education Census and the U.S. Census Bureau. By using the Cochran-Armitage test, the authors found that trends in underrepresented in medicine (URiM) proportions were unchanged in pediatric residents (16% in 2007 to 16.5 % in 2019; p=0.98) and overall decreased for pediatric fellows (14.2% in 2007 to 13.5% in 2019; p=0.002). Pulmonology was only one of two pediatric subspecialties in which trends of URiM representation significantly increased over time (12.4 %

in 2007 and 18.6% in 2019;  $p=0.009$ ). The percentage of URiM pediatric representation was considerably lower compared to the U.S. population. The authors conclude by stating underrepresentation of URiM pediatric trainees may perpetuate health inequities and there is a critical need to recruit and retain pediatric URiM residents and fellows.

### Comments

1. Significantly increased trends in URiM representation existed in pulmonology fellows from 2007-2019.
2. In 2019, URiM representation among overall pediatric trainees did not reflect the racial and ethnic diversity of the U.S. population.
3. Reasons for lack of URiM representation in pediatrics are multifactorial and appear to originate before medical school application and continue through to higher education and clinical training.
4. The importance of several interventions at the individual, departmental, and national levels are discussed to actively improve URiM representation in the pipeline of pediatric workforce.

### OTHER ARTICLES OF INTEREST

American Board of Pediatrics Data and Workforce; Subspecialty Fellowship Statistics.  
<https://www.abp.org/content/subspecialty-fellowship-statistics>

*Results and Data Specialties Matching Service® 2022 Appointment Year.* <https://www.nrmp.org/wp-content/uploads/2022/03/2022-SMS-Results-Data-FINAL.pdf>

Celedón JC. **Building a Diverse Workforce in Pulmonary, Critical Care, and Sleep Medicine.** *ATS Scholar.* 2021;2(2):145-148.

Nelson BA, Rama JA, Weiss P, Hinkle LJ. **How and Why Trainees Choose a Career in Pediatric Pulmonology. A Qualitative Study.** *ATS Sch.* 2020;1(4):372-383.

Weiss P, Mauer E, Gerber LM, Boyer D, Abramson EL. **Funding sources and effects of limited funding in pediatric pulmonology fellowship programs.** *Pediatr Pulmonol.* 2020;55:221-225.

Harris C, Katkin J, Cataletto M, Dorkin H, Laskosz L, Ruch-Ross H. **US pediatric pulmonology workforce.** *Pediatr Pulmonol.* 2019;54(4):444-450.

Collaco JM, Abman SH. **Evolving Challenges in Pediatric Pulmonary Medicine. New Opportunities to Reinvigorate the Field.** *Am J Respir Crit Care Med.* 2018 Sep 15;198(6):724-729.

Macy ML, Leslie LK, Turner A, Freed GL. **Growth and changes in the pediatric medical subspecialty workforce pipeline.** *Pediatr Res.* 2021;89(5):1297-1303.

Catenaccio E, Rochlin JM, Simon HK. **Differences in lifetime earning potential for pediatric subspecialists.** *Pediatrics.* 2021;147(4). doi:10.1542/peds.2020-027771.

## Pediatric COVID-19

Lael M. Yonker, MD

Massachusetts General Hospital

Department of Pediatrics

Boston, MA

### ACUTE PEDIATRIC COVID-19

Loske J, Rohmel J, Lukassen S, Stricker S, Magalhaes VG, Liebig J, Chua RL, Thurmann L, Messingschlager M, Seegebarth A, Timmermann B, Klages S, Ralser M, Sawitzki B, Sander LE, Corman VM, Conrad C, Laudi S, Binder M, Trump S, Eils R, Mall MA, Lehmann I. **Pre-activated antiviral innate immunity in the upper airways controls early SARS-CoV-2 infection in children.** *Nat Biotechnol.* 2021. Epub 2021/08/20. doi: 10.1038/s41587-021-01037-9. PubMed PMID: 34408314.

#### Summary

Nasal swabs were collected from children and adults with and without COVID-19. Cells on the swab were analyzed by single cell sequencing.

#### Comments

1. Children express higher levels of viral pattern recognition receptors.
2. This results in stronger innate antiviral response.
3. Pediatric airways are primed for antiviral response, which may allow them to clear virus more quickly from upper airways.
4. This article uses single cell sequencing, a technique that was used by many during COVID-19 to define immune landscape.

Yonker LM, Boucau J, Regan J, Choudhary MC, Burns MD, Young N, Farkas EJ, Davis JP, Moschovis PP, Kinane TB, Fasano A, Neilan AM, Li JZ, Barczak AK. **Virologic features of SARS-CoV-2 infection in children.** *J Infect Dis.* 2021. Epub 2021/10/15. doi: 10.1093/infdis/jiab509. PubMed PMID: 34647601.

#### Summary

Nasal swabs from children infected with SARS-CoV-2 were characterized for PCR load, viral culture and sequence. Live culture was most likely to be detected within first 5 days of symptoms and viral load did not correspond with symptoms, disease severity, or age.

#### Comments

1. Live virus is detected in nasal secretions of infection in children, therefore children can be infectious.
2. Viral load was not different across ages; no one age was more infectious than another.
3. Live virus likely to clear within 5 days; corresponds with CDC quarantine guidance.
4. Viral load does not correspond with severity-immune responses drive disease severity.
5. Cohort included high representation of racial and ethnic minorities most significantly impacted early in the pandemic.

### MULTISYSTEM INFLAMMATORY SYNDROME IN CHILDREN

Feldstein LR, Tenforde MW, Friedman KG, Newhams M, Rose EB, Dapul H, Soma VL, Maddux AB, Mourani PM, Bowens C, Maamari M, Hall MW, Riggs BJ, Giuliano JS, Jr., Singh AR, Li S, Kong M, Schuster JE, McLaughlin GE, Schwartz SP, Walker TC, Loftis LL, Hobbs CV, Halasa NB, Doymaz S, Babbitt CJ, Hume JR, Gertz SJ, Irby K, Clouser KN, Cvijanovich NZ, Bradford TT, Smith LS, Heidemann SM, Zackai SP, Wellnitz K, Nofziger RA, Horwitz SM, Carroll RW, Rowan CM, Tarquinio KM, Mack EH, Fitzgerald JC, Coates BM, Jackson AM, Young CC, Son MBF, Patel MM, Newburger JW, Randolph AG, Overcoming C-I.

**Characteristics and Outcomes of US Children and Adolescents With Multisystem Inflammatory Syndrome in Children (MIS-C) Compared With Severe Acute COVID-19.** *JAMA.* 2021;325(11):1074-87. Epub 2021/02/25. doi: 10.1001/jama.2021.2091. PubMed PMID: 33625505; PMCID: PMC7905703.

#### Summary

539 patients with MIS-C were compared with 577 patients with severe COVID-19. Risk factors, presenting features, lab values, and clinical trajectory were compared to identify distinguishing features. This case series suggest that MIS-C was more common in 6-12 year-olds, non-Hispanic black children, and mucocutaneous and cardiovascular involvement was

more common in MIS-C, and lab markers displayed a higher degree of inflammation in MIS-C.

### Comments

1. Largest clinical cohort describing COVID-19 and MIS-C.
2. Discusses which features are more common in MIS-C, which are more common in COVID.
3. Highlights lab values, which ones more abnormal in MIS-C.
4. Discussed outcomes, resolution of cardiac involvement in MIS-C.

Yonker LM, Gilboa T, Ogata AF, Senussi Y, Lazarovits R, Boribong BP, Bartsch YC, Loiselle M, Rivas MN, Porritt RA, Lima R, Davis JP, Farkas EJ, Burns MD, Young N, Mahajan VS, Hajizadeh S, Lopez XIH, Kreuzer J, Morris R, Martinez EE, Han I, Griswold K, Jr., Barry NC, Thompson DB, Church G, Edlow AG, Haas W, Pillai S, Arditi M, Alter G, Walt DR, Fasano A. **Multisystem inflammatory syndrome in children is driven by zonulin-dependent loss of gut mucosal barrier.** *J Clin Invest.* 2021;131(14). Epub 2021/05/26. doi: 10.1172/JCI149633. PubMed PMID: 34032635; PMCID: PMC8279585

### Summary

Using biospecimens from children with MIS-C, COVID-19 and controls, children with MIS-C were found to have SARS-CoV-2 in stool, increased zonulin, a marker of breakdown of mucosal barrier integrity, in their blood, and SARS-CoV-2 antigens in their blood. As a proof of concept, a child with MIS-C was treated with a zonulin inhibitor and symptoms and antigenemia improved, informing pathogenesis of MIS-C and novel therapeutic pathways.

### Comments

1. In MIS-C, SARS-CoV-2 is detected in the gut.
2. Role of virus in the gut needs to be better understood.
3. Breakdown in mucosal integrity leads to antigen leak into the bloodstream.
4. Therapies targeting mucosal permeability are being investigated (disclosure: I am PI on Phase 2 study).
5. Provides insight into pathogenesis of MIS-C.

### mRNA VACCINATION IN CHILDREN

Fowlkes AL, Yoon SK, Lutrick K, et al. **Effectiveness of 2-Dose BNT162b2 (Pfizer BioNTech) mRNA Vaccine in Preventing SARS-CoV-2 Infection Among Children Aged 5–11 Years and Adolescents Aged 12–15 Years — PROTECT Cohort, July 2021–February 2022.**

*MMWR Morb Mortal Wkly Rep.* ePub: 11 March 2022. DOI: <http://dx.doi.org/10.15585/mmwr.mm7111e1>

### Summary

1,364 children and adolescents ages 5–15 years were tested weekly for SARS-CoV-2, regardless of symptoms, from July 2021–Feb 2022. Vaccination status was noted and vaccine effectiveness (VE) was assessed. For children 5–11, VE was 31% against Omicron, compared to 59% for adolescents. Vaccinated children across all ages had one half day less sick in bed.

### Comments

1. Shows real world effectiveness of vaccination in kids.
2. Highlights vaccine effectiveness may vary across ages and pediatric responses need to be better understood.
3. mRNA vaccines are a novel technology.
4. Vaccines are recommended for all children.

### IMPACT OF COVID-19 PANDEMIC ON FAMILIES

Unwin HJT, Hillis S, Cluver L, Flaxman S, Goldman PS, Butchart A, Bachman G, Rawlings L, Donnelly CA, Ratmann O, Green P, Nelson CA, Blenkinsop A, Bhatt S, Desmond C, Villaveces A, Sherr L. **Global, regional, and national minimum estimates of children affected by COVID-19-associated orphanhood and caregiver death, by age and family circumstance up to Oct 31, 2021: an updated modelling study.** *Lancet Child Adolesc Health.* 2022. Epub 2022/02/28. doi: 10.1016/S2352-4642(22)00005-0. PubMed PMID: 35219404; PMCID: PMC8872796

### Summary

Using established modeling, the authors estimated the number of children who lost parents or caregivers as a result of COVID-19 from March 2020–October 2021 across 21 countries, including the U.S. COVID-19 deaths meant 5.2 million children lost a parent or caregiver. Three quarters of these losses were paternal, one quarter were maternal. Two thirds of these children experiencing orphanhood were adolescents.

### Comments

1. Important aspect of pediatric health when considering the global pandemic.
2. Underscores need for global vaccination strategy.
3. Understanding ages of loss predicts vulnerabilities in behaviors and health issues secondary to grief.

## OTHER ARTICLES OF INTEREST

## Pediatric COVID-19

Cotugno N, Ruggiero A, Bonfante F, Petrara MR, Zicari S, Pascucci GR, Zangari P, De Ioris MA, Santilli V, Manno EC, Amodio D, Bortolami A, Pagliari M, Concato C, Linardos G, Campana A, Dona D, Giaquinto C, Team CS, Brodin P, Rossi P, De Rossi A, Palma P. **Virological and immunological features of SARS-CoV-2-infected children who develop neutralizing antibodies.** *Cell Rep.* 2021;34(11):108852. Epub 2021/03/18. doi: 10.1016/j.celrep.2021.108852. PubMed PMID: 33730580; PMID: PMC7962998

## MIS-C:

Sacco K, Castagnoli R, Vakkilainen S, Liu C, Delmonte OM, Oguz C, Kaplan IM, Alehashemi S, Burbelo PD, Bhuyan F, de Jesus AA, Dobbs K, Rosen LB, Cheng A, Shaw E, Vakkilainen MS, Pala F, Lack J, Zhang Y, Fink DL, Oikonomou V, Snow AL, Dalgard CL, Chen J, Sellers BA, Montealegre Sanchez GA, Barron K, Rey-Jurado E, Vial C, Poli MC, Licari A, Montagna D, Marseglia GL, Licciardi F, Ramenghi U, Discepolo V, Lo Vecchio A, Guarino A, Eisenstein EM, Imberti L, Sottini A, Biondi A, Mato S, Gerstbacher D, Truong M, Stack MA, Magliocco M, Bosticardo M, Kawai T, Danielson JJ, Hulett T, Askenazi M, Hu S, Group NIRTc, Chile MISCG, Pavia Pediatric C-G, Cohen JI, Su HC, Kuhns DB, Lionakis MS, Snyder TM, Holland SM, Goldbach-Mansky R, Tsang JS, Notarangelo LD. **Immunopathological signatures in multisystem inflammatory syndrome in children and pediatric COVID-19.** *Nat Med.* 2022. Epub 2022/02/19. doi: 10.1038/s41591-022-01724-3. PubMed PMID: 3517786

## Vaccinations

Walter EB, Talaat KR, Sabharwal C, Gurtman A, Lockhart S, Paulsen GC, Barnett ED, Munoz FM, Maldonado Y,

Pahud BA, Domachowske JB, Simoes EAF, Sarwar UN, Kitchin N, Cunliffe L, Rojo P, Kuchar E, Ramet M, Munjal I, Perez JL, Frenck RW, Jr., Lagkadinou E, Swanson KA, Ma H, Xu X, Koury K, Mather S, Belanger TJ, Cooper D, Tureci O, Dormitzer PR, Sahin U, Jansen KU, Gruber WC, Group CCT. **Evaluation of the BNT162b2 Covid-19 Vaccine in Children 5 to 11 Years of Age.** *N Engl J Med.* 2022;386(1):35-46. Epub 2021/11/10. doi: 10.1056/NEJMoa2116298. PubMed PMID: 34752019; PMID: PMC8609605

Ali K, Berman G, Zhou H, Deng W, Faughnan V, Coronado-Voges M, Ding B, Dooley J, Girard B, Hillebrand W, Pajon R, Miller JM, Leav B, McPhee R. **Evaluation of mRNA-1273 SARS-CoV-2 Vaccine in Adolescents.** *N Engl J Med.* 2021;385(24):2241-51. Epub 2021/08/12. doi: 10.1056/NEJMoa2109522. PubMed PMID: 34379915; PMID: PMC8385554

Levy M, Recher M, Hubert H, Javouhey E, Flechelles O, Leteurtre S, Angoulvant F. **Multisystem Inflammatory Syndrome in Children by COVID-19 Vaccination Status of Adolescents in France.** *JAMA.* 2022;327(3):281-3. Epub 2021/12/21. doi: 10.1001/jama.2021.23262. PubMed PMID: 34928295; PMID: PMC8689418

## Impact of COVID-19 on Pediatric Pulmonary

Nayir Buyuksahin H, Emiralioglu N, Ademhan Tural D, Ozsezen B, Sunman B, Guzelkas I, Yalcin E, Dogru D, Ozcelik U, Kiper N.. **Impact of COVID-19 on pediatric pulmonology healthcare practice** *Pediatr Pulmonol.* 2021;56(9):2811-7. Epub 2021/07/16. doi: 10.1002/ppul.25557. PubMed PMID: 34265185; PMID: PMC8441731

Masarweh K, Gur M, Bar-Yoseph R, Bentur L, Dabaja-Younis H. **Characterization of respiratory illness surge (April-June 2021) post-COVID-19 lockdown.** *Pediatr Pulmonol.* 2022;57(3):667-73. Epub 2021/12/17. doi: 10.1002/ppul.25792. PubMed PMID: 34914208



# Health Disparities in Pediatric Respiratory Medicine: Moving Towards Equity

Beverley J. Sheares, MD, MS

Yale University School of Medicine

Department of Pediatrics, Section of Pediatric Respiratory, Allergy/Immunology, & Sleep Medicine  
New Haven, CT

## DISPARITIES IN CORONAVIRUS-19 AND VACCINE HESITANCY

White A, Liburd LC, Coronado F. **Addressing Racial and Ethnic Disparities in COVID-19 Among School-Aged Children: Are We Doing Enough?** *Prev Chronic Dis.* 2021;18:E55.

### Summary

Disparities in morbidity and mortality associated with COVID-19 among Latinx, non-Latinx Black, and American Indian/Alaska Native children and teenagers have been well documented. These data clearly reveal that the impact of COVID-19 in pediatric populations mirrors racial disparities in the adult population. Reducing these disparities along with overcoming unintended negative consequences of the pandemic, such as the disruption of in-person schooling, calls for broad community-based collaborations and nuanced approaches. Many of the factors driving these disparities are the result of chronic inequities in the structural and social determinants of health such as access to secure income, housing, education, and health care. There is cause for serious concern that the disproportionate impact of this pandemic on communities of color will only widen these gaps. Based on national survey data, some of these children who experienced more severe outcomes also had a higher prevalence of obesity, asthma, type 2 diabetes, and hypertension. This article provides a summary of potential community-based health promotion strategies to address racial and ethnic disparities in COVID-19 outcomes and educational inequities among children and teens, specifically in the implementation of strategic partnerships, including initial collective work, outcomes-based activities, and communication. These collaborations can facilitate policy, systems, and environmental changes in school systems that support emergency preparedness, recovery, and resilience when faced with public health crises.

### Comments

1. The health impact of COVID-19 has exposed long-standing inequities that have systematically undermined the physical, social, material, and emotional health of racial and ethnic communities of color.
2. Factors associated with severe childhood COVID-19 outcomes include preexisting medical comorbidities and higher levels of disadvantage.
3. Structural and social determinants of health, discrimination, and distrust of health care system are all contributors to COVID-19 inequities experienced by the pediatric population.
4. There are exposure risks associated with returning to in-person classrooms that may be mitigated by community resources that could provide educational and social support. Increasing testing and vaccination rates in communities of color would also reduce disparities in pediatric COVID-19.
5. Since the causes of health disparities are complex and multifactorial, eliminating health disparities cannot be accomplished by a single intervention, partners from the public and private sectors are needed to improve population health.

## COMMUNICATION: DISPARITIES IN THE USE OF TELEHEALTH

Albon D, Van Citters AD, Ong T, Dieni O, Dowd C, Willis A, Sadoska KA, Scalia P, Reno K, Oates GR, Schechter MS. **Telehealth use in cystic fibrosis during COVID-19: Association with race, ethnicity, and socioeconomic factors.** *J Cyst Fibros.* 2021;20 Suppl 3:49-54.

### Summary

There was rapid implementation of telehealth during the COVID-19 pandemic, including in cystic fibrosis (CF) care. This study aimed to understand telehealth use and perceptions and to identify the facilitators and barriers to telehealth use among a diverse population of people with CF and their families. The authors

analyzed data from the 2020 Cystic Fibrosis State of Care surveys. A total of 424 people with CF and 286 programs responded to the surveys. Among the patient respondents, only 6% self-identified as Latinx and 2% as Black. Even though the representation by people of color with CF was small, the authors found that they were less likely to have had a telehealth visit ( $p=.015$ ). This difference was pronounced among the Latinx population ( $p<.01$ ). Telehealth use did not differ by health insurance and was similarly offered independent of financial status. Those who reported economic constraints and were more financially disadvantaged also reported that telehealth was more difficult to use ( $p=.018$ ) and were less likely to think that their concerns ( $p=.010$ ) or issues that mattered most to them ( $p=.020$ ) were addressed during a telehealth visit. Survey results from CF programs reflected some incongruence with patient reported barriers to telehealth. Programs perceived lack of technology, language barriers, and home conditions as barriers to telehealth in vulnerable populations.

### Comments

1. Communities of color and people of lower socioeconomic status experience decreased access to telehealth for care and were more likely to report telehealth was more difficult to use, their concerns and issues that mattered most to them were not addressed, and they were not included in shared decision-making during a telehealth visit.
2. Although the video component of the telehealth visit is important in assessment of patient wellbeing and participation in the visit, respondents who identified as Black were significantly less likely to have video access during the visit.
3. Limited use of video during telehealth visits by Black respondents was attributed to decreased access to devices, broadband access, and reliable cellphone data plans, however limited video use during telehealth visits by this group of respondents needs further exploration.
4. Telehealth has the potential to address some health inequities by eliminating travel time and cost associated with in-person visits and when implemented in a patient-centered way, may improve patient satisfaction.
5. Telehealth may become part of an equitable CF care model, however recruitment of people of color with CF needs attention to have adequate representation to better understand barriers and facilitators of telehealth use.

### CLIMATE CHANGE AND RESPIRATORY HEALTH DISPARITIES

Arpin E, Gauffin K, Kerr M, Hjern A, Mashford-Pringle A, Barros A, Rajmil L, Choonara I, Spencer N. **Climate Change and Child Health Inequality: A Review of Reviews.** *Int J Environ Res Public Health* 2021;18(20):10896.

### Summary

There is increasing evidence of the consequences of climate change on the health of children however there have been fewer studies of the consequences of climate change on inequities in child health. The authors report on a scoping review of twenty-three reviews published between 2007-2021 with the aim of assessing the strength of evidence for the extent and mechanisms by which climate change and its consequences differentially impact children in social groups within countries and in low- and middle-income countries compared with high income countries. The authors report within country, between country, geographic, and intergenerational inequities. The authors note that there are strong descriptive data supporting that climate change exacerbates child health inequalities, more quantitative data are needed. The outcomes of these reviews suggest compared with more advantaged groups, children in poor, low income, low educated, socially marginalized households and those in indigenous societies, were identified as more likely to suffer consequences of climate change. Understanding the mechanisms by which climate change may exacerbate child health inequalities is key to interventions to minimize its effects. Several mechanisms were proposed including weak economies, poor infrastructure (e.g., air quality control, pollution control), low levels of maternal education, and poor water sanitation.

### Comments

1. Children, particularly poor children, those living in low- and middle-income countries and those who live in disadvantaged households regardless of country are most vulnerable to the adverse effects of climate change.
2. Respiratory diseases, preterm birth and low birth weight, and increased susceptibility to infections are among the adverse health conditions that affect children as a result of climate change.
3. Children's vulnerability to the health effects of climate change is in part due to their inability to mitigate their environments, their reliance on

parents and/or caregivers to do so and their incomplete physiologic and cognitive development.

4. Although child health effects of climate change are recognized, quantitative evidence of the differential effect of low compared to high income households is needed.
5. There is an urgent need for research to provide evidence for effective interventions to mitigate the effects of climate change on children's health.

### PROMOTING HEALTH EQUITY

Rao DR, Kopp B, Kamerman-Kretzmer RJ, Afolabi F, Liptzin DR, Balasubramaniam V, Sadreameli SC.

**Advocacy Considerations for the Pediatric Pulmonologist in the Era of the COVID-19 Pandemic.** *Ann Am Thorac Soc.* 2021;18(6):942-945.

#### Summary

The authors highlight a number of advocacy opportunities for pediatric pulmonologists and clinicians providing care for children with chronic respiratory conditions. They advocate for a number of policies to improve air quality and environmental health, provide innovations in telemedicine, increase funding for research, address bias and racism by providing anti-racism and bias training in medical education and continuing medical education, and increase workforce diversity. Their emphasis is primarily on changes in policies, the structural determinants of health, to improve the respiratory health of all children and to move towards equity by reducing health disparities. The authors call upon members of our subspecialty to advocate for the policies that will improve outcomes for our patients. Advocacy can occur locally at individual hospitals, health systems, or medical schools. Pediatric pulmonologists in their roles as scientists can promote and champion funding opportunities for rare diseases and research that occurs at the community and population levels. Those in leadership can encourage and implement antibias training for trainees and colleagues.

#### Comments

1. Improving outdoor air quality can reduce the disproportionate burden that air pollution plays in ongoing racial disparities in respiratory health of children. Pediatric pulmonologists and allied health professionals can advocate for improved air quality by engaging with the American Thoracic Society and policy makers to affect change.
2. Telemedicine has the potential to close disparities in access and improve health care providers

understanding of patients' living conditions however policies are needed to improve internet connectivity and affordability in rural and low-income neighborhoods (and in low- and middle-income countries) to reduce disparities in telehealth accessibility.

3. Pulmonary research in rare diseases and research at the community and population levels are underfunded which may disproportionately affect the research careers of scientists of color and stall innovative interventions for families in underserved communities.
4. Understanding the role that physician bias plays in disparate outcomes for Black, Latinx, Indigenous People, Asian, Pacific Islanders, more anti-bias training and continuing medical education is needed to mitigate bias towards patients and colleagues of color.
5. Innovations in recruitment of the pediatric pulmonary workforce is essential for the subspecialty to grow. Policies easing the J-1 visa requirements for international medical graduates, expanding student loan forgiveness programs, reducing the length of training, and providing accommodations in the workplace that promote tenure and success of women, junior faculty, and people of color should be among the highest priorities.

### OTHER ARTICLES OF INTEREST

#### DISPARITIES IN CORONAVIRUS-19 AND VACCINE HESITANCY

Saatci D, Ranger TA, Garriga C, et al. **Association Between Race and COVID-19 Outcomes Among 2.6 Million Children in England.** *JAMA Pediatr.* 2021;175(9):928-938.

Yilmaz O, Gochicoa-Rangel L, Blau H, Epaud R, Lands LC, Lombardi E, Moore PE, Stein RT, Wong GWK, Zar HJ. **Brief report: International perspectives on the pediatric COVID-19 experience.** *Pediatr Pulmonol.* 2020;55(7):1598-1600.

Alfaro T, Batiste A, Duque A, et al. **The Effect of Vaccine Hesitancy on Racial and Ethnic Minority Children During the COVID-19 Pandemic.** *Pediatric Annals* 2022;51(3):e107-e11.

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Kampmann B, Okomo U. **COVID-19 vaccines for children in LMICs: another equity issue.** *Lancet* 2021;398(10302):731-32.

McKinnon B, Quach C, Dubé È, Tuong Nguyen C, Zinszer K. **Social inequalities in COVID-19 vaccine acceptance and uptake for children and adolescents in Montreal, Canada.** *Vaccine* 2021;39(49):7140-45.

Myles DE. **Why advocating for children and vaccine equity is not zero-sum.** *J Natl Med Assoc* 2022;114(1):16-17.

Fisher CB, Gray A, Sheck I. **COVID-19 Pediatric Vaccine Hesitancy among Racially Diverse Parents in the United States.** *Vaccines*. 2021;27;10(1):31.

#### COMMUNICATION: DISPARITIES IN THE USE OF TELEHEALTH

Schenker RB, Laguna MC, Odisho AY, Okumura MJ, Burnett H. **Are We Reaching Everyone? A Cross-Sectional Study of Telehealth Inequity in the COVID-19 Pandemic in an Urban Academic Pediatric Primary Care Clinic.** *Clin Pediatr*. 2022;61(1):26-33.

Ray KN, Mehrotra A, Yabes JG, Kahn JM. **Telemedicine and Outpatient Subspecialty Visits Among Pediatric Medicaid Beneficiaries.** *Acad Pediatr*. 2020;20(5):642-651.

Ogbogu PU, Noroski LM, Arcoletto K, Reese BD Jr, Apter AJ. **Methods for Cross-Cultural Communication in Clinic Encounters.** *J Allergy Clin Immunol Pract*. 2022;25:S2213-2198(22)00026-5.

Begay M, Kakol M, Sood A, Upson D. **Strengthening Digital Health Technology Capacity in Navajo Communities to Help Counter the COVID-19 Pandemic.** *Ann Am Thorac Soc*. 2021;18(7):1109-1114.

#### CLIMATE CHANGE AND RESPIRATORY HEALTH DISPARITIES

Adepoju OE, Han D, Chae M, Smith KL, Gilbert L, Choudhury S, Woodard L. **Health Disparities and Climate Change: The Intersection of Three Disaster Events on Vulnerable Communities in Houston, Texas.** *International Journal of Environmental Research and Public Health* 2022; 19(1): 35.

Gutschow B, Gray B, Ragavan MI, Sheffield PE, Philipsborn RP, and Jee SH. **The intersection of pediatrics, climate change, and structural racism: Ensuring health equity through climate justice.** *Current Problems in Pediatric and Adolescent Health Care* 2021; 51: 101028.

Salas RN. **Environmental Racism and Climate Change - Missed Diagnoses.** *N Engl J Med* 2021;385(11): 967-969.

Mathiarasan S, Hüls A. **Impact of Environmental Injustice on Children's Health-Interaction between Air Pollution and Socioeconomic Status.** *Int J Environ Res Public Health* 2021;18(2):795.

Ragavan MI, Marcil LE, and Garg A. **Climate Change as a Social Determinant of Health.** *Pediatrics* 2020; 145(5):e20193169.

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Tzavella F, Vgenopoulou I, Fradelos EC. **Climate change as a social determinant of the quality of public health.** *Archives of Hellenic Medicine* 2021;38(3): 401-409.

Leibel S, Nguyen M, Brick W, Parker S Ilango R, Aguilera R, Gershunov A, Benmarhnia T. **Increase in pediatric respiratory visits associated with Santa Ana wind-driven wildfire smoke and PM2.5 levels in San Diego County.** *Annals of the American Thoracic Society* 2020;17(3): 313-320.

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Lauletta M, Moisé E, La Grutta S, Cilluffo G, Piacentini G, Ferrante G, Peroni DG, Di Cicco M. **Climate advocacy among Italian pediatric pulmonologists: A national survey on the effects of climate change on respiratory allergies.** *Pediatr Pulmonol*. 2022;57(4):862-870.

Goldman RH, Zajac L, Geller RJ, Miller MD. **Developing and implementing core competencies in children's environmental health for students, trainees and healthcare providers: a narrative review.** *BMC Med Educ*. 2021;24;21(1):503.

#### PROMOTING HEALTH EQUITY

Seligman HK, Hamad R. **Moving Upstream: The Importance of Examining Policies to Address Health Disparities.** *JAMA Pediatr*. 2021;175(6):563-564.

Thakur N, Lovinsky-Desir S, Bime C, Wisnivesky JP, Celedón JC. **The Structural and Social Determinants of the Racial/Ethnic Disparities in the U.S. COVID-19 Pandemic. What's Our Role?** *Am J Respir Crit Care Med.* 2020;202(7):943-949.

Baugh A. **The Role of the Chief Resident in Promoting Health Equity.** *ATS Sch.* 2021 Sep 13;2(3):353-359.

Malawa Z, Gaarde J, Spellens S. **Racism as a Root Cause Approach: A New Framework.** *Pediatrics.* 2021;147(1):e2020015602.

Valley TS, Armstrong-Hough M, Adegunsoye A. **Risk, Race, and Structural Racism.** *Ann Am Thorac Soc.* 2021;18(8):1289-1290.

Brown AF, Ma GX, Miranda J, Eng E, Castille D, Brockie T, Jones P, Airhihenbuwa CO, Farhat T, Zhu L, Trinh-Shevrin C. **Structural Interventions to Reduce and Eliminate Health Disparities.** *Am J Public Health.* 2019;109(S1):S72-S78.