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Informing Policy on Built Environments to Safeguard Children in Environmental Justice Communities: Case Study of Five AAP Climate Advocates

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Introduction

Climate change is happening. According to the Intergovernmental Panel on Climate Change in 2018, anthropogenic greenhouse gas emissions are causing changes in the global climate system.[1] There are causal links between environmental degradation, pollution, and climate change.[2] Air pollutants that result from human activity, such as carbon dioxide, ground-level ozone, and nitrogen and sulfur oxides, are driving changes in the climate. Human health is interconnected to these issues. For example, inhaled ozone decreases lung function and increases asthma incidence and severity.[3] Particulate air pollution causes oxidative stress and inflammation that decrease lung function, even in individuals without asthma, and is linked to increased risk of cardiovascular disease and premature death.[2,4] Climate change is causing temperature-related morbidity and mortality. For example, increased deaths due to dehydration and heatstroke have been observed in rural populations, especially those with occupational exposure to extreme heat and poor access to care.[5] Extreme heat events and exposure to air pollution are also associated with adverse pregnancy outcomes such as preterm birth and low birth weight.[6,7]

Climate change is a public health crisis, and more importantly to pediatricians – it is a pediatric public health crisis. Over 88% of the diseases caused by climate change affect children under five years of age.[2] Children are uniquely vulnerable when it comes to the health risks imposed upon humans by the changing climate.[2] Children are still developing, including their vital organs, and have a greater surface-to-body ratio of their skin and lung epithelium to total body surface area. These two factors make them uniquely at risk to air pollution and heat.

There are three categories of health effects caused by climate change: primary effects-those experienced directly, secondary effects-those experienced indirectly, and tertiary effects-those which are on a

broader scale and socially driven. Extreme weather events can cause primary effects in children such as serious injury or even death. This is particularly concerning, considering a threefold increase in extreme weather events that occurred between 2000 and 2009 compared to 1980 and 1989.[2] These events also can increase the prevalence of mental health issues, risks of infectious diseases and loss and separation from caretakers.

Secondary effects include shifts in the ecosystem, which result in reduced air quality, increased pollen, and increased smoke from wildfires.[2] These have respiratory impacts that manifest through worsened allergy symptoms, deteriorating lung conditions, and other cardiorespiratory effects.

Tertiary effects are disruptions at the social level including infrastructure damage, disruptions to government systems and school systems. They also adversely affect children's physical and mental health.[8] These disruptions are much more likely to affect communities of lower socioeconomic status, exacerbating already present disparities in health.[8] Also known as environmental justice (EJ) communities, they are subject to a disproportionate burden of environmental pollution and contamination. According to the U.S. Environmental Protection Agency, the guiding principle of environmental justice is that everyone, regardless of race, color, national origin, or income, is entitled to equal protection from environmental harms and risks.[9]

The American Academy of Pediatrics (AAP) policy statement on global climate change and children's health declared that "failure to take prompt, substantive action [on climate change] would be an act of injustice to all children."[2] The statement called for pediatricians as a profession to "advocate for local, national, and international policies that reduce greenhouse gas emissions" and for the U.S. to employ adaptation strategies that improve preparedness for anticipated climate-associated effects.[2] Pediatricians should educate elected officials on the risk that climate change poses to child health, provide expert testimony at public hearings, and "help build a broader coalition across disciplines to address climate change at the local and national levels."[2] Pediatricians are uniquely positioned to advocate for accessible non-polluting public transportation, plant-based food availability, and green spaces that

ultimately affect child and family health.[2,8] The intersection between public health, policy, and medicine will become increasingly important as we approach the point of no return on climate change. Pediatricians are applied research practitioners who live in the world between academic research and clinical practice. They are natural advocates to ensure that the future world is rebuilt with children's health, especially children of EJ communities, at the center.

In 2020, Drs. Lori Byron and Aparna Bole from the AAP were able to quickly assemble a national coalition of climate advocates from each AAP chapter.[10] They formed a network of pediatricians working on climate change and health policy initiatives. Within Facebook groups and among professional networks of former residency friends and in clinic hallways and inpatient wards, the word spread that as a specialty, pediatricians needed to coordinate and to act on climate change. The AAP climate advocate group is composed of academic pediatricians, researchers, community pediatricians, pediatric specialists – indeed, any permutation of what a pediatrician can become is represented. This awakening of clinicians to their role in climate change and health is not unique to the AAP; many groups of like-minded clinicians formed across the country to bring physician voices to what is the largest group project that will happen in many lifetimes. Indeed, the Medical Consortium on Climate and Health was an early example, now representing 32 primary care and medical specialty societies brought together 5 years ago to inform the public and policymakers about the health harms of climate change and the health benefits of equitable climate solutions.

The authors are part of this national group of AAP climate advocates, representing diverse regions from California, Colorado, North Carolina, and Puerto Rico. The wide geographic range poses not only shared environmental challenges such as air and water quality but also unique regional challenges from wildfires to hurricanes. The virtual "planetary code call" went out that the health of children and the planet were at risk and the authors were among the thousands of pediatricians who showed up.

This article reviews the literature on the dangers that children face in the air they breathe, the lack of natural green spaces, and the increasingly hostile built environments. Changes to the built environment

can mitigate some of the effects of climate change.[8] Despite AAP policy statements that are among an outpouring of policy statements from medical groups,[11] the current response in the U.S. is neither coordinated nor child-centric. Unequal city planning leaves EJ neighborhoods with rising temperatures due to high levels of pollution, fewer trees for shade, and older buildings that are more difficult to cool. Even with improving national leadership in infrastructure change, there is more work to be done. Time is of the essence for global climate emissions and for addressing climate change as a pediatric public health crisis.

What can be done by individual pediatricians from diverse regions, but with a shared training experience and shared identity as child advocates? This paper will review opportunities in select local areas to change the built environment in order to work toward reducing carbon emissions and increase overall pediatric health. The paper presents examples of how present knowledge on active transport, green canopies, and air pollution can be applied to improve health and address climate effects. Pediatricians need to be advocates and be at the table when these decisions are made. Below are four case examples of how pediatrcians, as part of community-based physician climate advocacy groups, are taking action.

CALIFORNIA AND POLITICS: Industrial Waterfront, Active Transport, and Health Advocates

San Diego, California sits at the southwest corner of the continental United States. Named America's Finest City, San Diegans are proud of their coastline that includes marine protected areas with thousands of endangered shorebirds that live along a vibrant surfing community. San Diego also is a tourist destination, and actively promotes its natural landscape, downtown Petco Park baseball stadium, waterfront convention center, and a vibrant local craft brewery scene.

Yet for the communities of South San Diego, which are the economic engines of San Diego's industry and defense sector, America's Finest City does not have the finest air. San Diego has the sixth worst air quality for ozone in the nation, and the South San Diego neighborhoods of

Barrio Logan, Sherman Heights, and National City, and the busy border crossing area of Otay Mesa have the worst in the region. Children who live in these neighborhoods suffer a higher burden of asthma and toxic air pollution, and rates of hospitalization for asthma exacerbations are on average four-fold higher for the south county than in other areas of San Diego with much cleaner air.[12]

Active transport refers to how people get from point A to point B using mostly their own energy.[13] Active transport refers to walking, cycling, skateboarding, and foot traffic from light-rail stations. Communities designed for active living have benefits for the overall health of inhabitants in terms of decreased chronic illnesses, especially lower incidence of metabolic diseases and improved mental health. James Sallis, one of the leading researchers in active transport, wrote, "Physical activity has been engineered out of people's lives through urban planning and transportation investments . . . Built environments are worthy of special attention because they can affect virtually all residents of a community for many decades."[14] The benefits of active transport and built environments include prevention of adult cardiovascular disease,[15] less pediatric metabolic diseases, and better child mental health.

Active transport also is associated with less carbon emissions because humans are using their own energy stores instead of combusting fossil fuels. Areas where more children walk, bike, and hike typically have less PM2.5 (atmospheric fine particulate matter that has a diameter of less than 2.5 micrometers). Children who actively transport themselves to school are exposed to less PM2.5 than children who are passively transported by a car to school.[16] Preserving the existing natural environments and altering the built environment by building sidewalks that connect, parks to play in, and trails to hike, will improve children's physical and mental health, and lower carbon emissions. The American Heart Association in a policy statement has addressed this most clearly: "Health professionals and organizations are encouraged to become involved in advocating for active transportation policies at all levels of government."

Yet pediatricians rarely are invited to participate in these decisions on urban planning and built environments and are usually not thought of as stakeholders in these discussions. San Diego Pediatricians for Clean Air (SDPCA) and the AAP San Diego Climate Change and Health

Committee are overlapping organizations comprising a majority of pediatricians who practice in South San Diego neighborhoods.[17] With the highest risk pediatric asthma rates and hospitalizations in the county, South County San Diego pediatricians organized to act against air pollution and also to advocate for children of EJ communities to increase active transport opportunities.

SDPCA formed working connections with established and respected organizations such as the Environmental Health Coalition, Climate Actions Campaign and Mothers Out Front.[17] They made themselves available to partner and advocate on shared projects. When asked by other environmental justice groups, SDPCA supported a petition for hiring environmental justice staff at the Air Pollution Control District Board. SDPCA was then invited to nominate a candidate for the public health member of the Air Pollution Control District Board and recruited a well-respected pediatrician, a Latina woman with enduring ties to National City, to sit on the board.[18] Her application had broad support from the local physician community, and she was voted in by the elected board members.[12] AAP and SDPCA members are meeting with the San Diego County Department of Environmental Health to discuss shared goals. They have reached out to the City of San Diego to have a pediatrician included on the Environmental Advisory Board. Recently SDPCA became involved in Rewild Mission Bay,[19] a local wetland restoration effort. If successful, restoring this natural wetland would sequester carbon, provide a natural buffer for sea level rise and storm surges, and provide active recreational transport opportunities for families. Through multiple avenues, pediatricians in San Diego are identifying where these decisions are made and claiming seats at the table to advocate for children's respiratory health. Rather than just reimagining what might make neighborhoods healthier and cooler for children in EJ communities, they are advocating for positions of influence as child-advocates to voice their opinions and vote for policies aligned with their values.

COLORADO AND AIR: Air Toxicants and Wildfire

In Colorado, refineries and factories often are located in neighborhoods with residents who are immigrants or people of color. The Denver neighborhoods of Globeville and Elyria-Swansea are the location of a large refinery. These residents experience higher rates of heart and lung disease compared with other parts of the city.[20] With already higher rates of preexisting health conditions, the people of Globeville and Elyria-Swansea also are at greater risk from the pollution these corporations release into the environment. Chemicals released include hydrogen chloride, hydrogen cyanide, benzene, and hydrogen sulfide, which are linked to negative health outcomes such as cancer, respiratory arrest, asthma, chronic lung disease exacerbations, pulmonary edema, burns, and seizures. When the preexisting health risks of these populations are combined with living in a polluted area, it is not surprising that there have been higher rates of COVID-19 associated deaths.[21] Historical exposure to particulate matter has been associated with increased mortality from SARS-CoV-2.[21]

The United Nations has described the association between air pollution and climate change as "two sides of the same coin."[22] Climate change affects the location and levels of air pollutants and increases aeroallegens and particulate matter that result in decreased outdoor and eventually indoor air quality.[23] Climate change also has been associated with increased concentrations of other indoor air pollutants such as volatile organic compounds and mold spores. All these pollutants adversely impact human health.[3] Legislation was proposed to hold these refineries accountable for the pollution they generate by requiring them to measure and report on air quality not only at the smoke-stack level but at the industrial "fenceline," where residential neighborhoods border industrial land. This legislation also required corporations to pay higher fines for violations when air quality of the surrounding community was compromised.

A group of pediatricians as part of the Colorado Chapter of the AAP, testified on behalf of the residents of Globeville and Elyria-Swansea explaining the negative health outcomes caused by the emissions. They spoke about the need for "fenceline" and community monitoring so that Globeville and Elyria-Swansea residents can know in real time when neighborhood air quality is poor. The legislation recently passed, in part

because of the recognition that EJ community health was being negatively impacted. These pediatricians have been working with Healthy Air and Water Colorado (HAWC), a nonpartisan, nonprofit organization that advocates for public policy that protects the health of Coloradoans from the negative effects of climate change. HAWC works with health professionals to use their voices to advocate for climate action through the lens of recognizing that climate issues are truly public health issues. Since physicians, particularly pediatricians, are trusted members of the community, their perspectives are respected and can transcend party lines.

In addition to pollution from refineries, air quality in Colorado is adversely affected by wildfires. In 2020, over 625,000 acres burned in the state, including the Cameron Peak Fire, which burned over 200,000 acres, making it the largest wildfire in Colorado history. This surpassed the Pine Gulch Fire that 7 weeks earlier, had claimed that title.[24] At the peak, the Cameron Peak Fire forced the evacuation of over 20,000 residents. The fire burned for 112 days, likely due to the combination of extreme temperature, low humidity, and high winds. During this time, electrical power was turned off in many affected areas to prevent fire destruction of power lines and electrical boxes.

Wildfire smoke is partially made up of PM2.5. PM2.5 from wildfire smoke is more toxic than the same amount of particulate matter in other forms of air pollution.[25] Children are especially vulnerable when exposed to PM2.5 because they still have developing lungs. At a population level, wildfire smoke has been shown to negatively affect lung function in older pediatric patients.[25] In addition, poorer asthma control with wildfire smoke exposure has been observed among African-American children.[26]

Pediatricians in Colorado also are working with HAWC in support of legislation around wildfire mitigation efforts. Wildfire mitigation includes a variety of precautions that can be taken to protect communities from the negative effects of wildfires including mental health, respiratory function, lung disease, and asthma. Various bills are aimed at providing funding to help these efforts.

NORTH CAROLINA AND TREES: Tree Canopy/Green District in Charlotte

North Carolina has historically been thought of as a woodland state, and indeed it boasts almost 60% timberland cover and is among the top forested states in the country. There are approximately 655 species of trees in the state, including an abundance of 491 native thriving species.[27] But even in such settings, rapid growth has potential consequences. The built environment significantly impacts ecological milieu, including temperature, green space, and consequently health. Mapping studies document that urban microclimates vary significantly across individual cities, with temperature differences reaching 10°C or more, primarily dependent on underlying landscape features.[28] Notably, forested or otherwise vegetated areas and lower-density areas are cooler than their counterparts - urbanized, impervious, high-density areas. Lower resourced urban communities are often situated in areas of lower vegetation and higher population density, settings that may be characterized as urban heat hazards.[28] Specifically, Hoffman and Allen mapped the overlap between urban heat islands and historically redlined districts, and noted their continued associations with under-resourced communities and attendant adverse health outcomes.[29]

The impact of heat on health and well-being is broad and far-reaching, including multiple organ systems such as respiratory, renal, and cardiovascular, as well as illness types from heat stroke, dehydration and electrolyte imbalance, to infectious diseases and mental health.[28,30,31] For children, these concerns may even begin prenatally and perinatally. For example, higher incidence of pre-term birth and low birth weight[7,6] can have effects later including developmental and behavioral concerns, and school and learning issues.[30] Importantly, children may be impacted both directly and indirectly by heat; their adult caregivers may experience the same physical and mental health sequelae. These adverse effects on adults may lead to issues such as limited capacity for caregiving, financial strain, and violence, which in turn impact the health and well-being of children.

Greening initiatives, such as increasing tree canopy cover and improving local, accessible green spaces, offer mitigating strategies to

address these concerns.[32,33] Such interventions positively impact health concerns, with a lower prevalence of asthma among children living in areas with higher tree counts,[34] improved mental health with community green space restoration and access,[31,35] and projected improved mortality with vegetation and albedo strategies.[36] These endeavors may have the positive impact of community engagement,[37] as recounted here.

The Historic West End is an over century-old historically African American neighborhood in the northwest corridor of Charlotte, North Carolina. Due to a history of segregation and racially targeted housing discrimination, industrial zoning, and transportation construction, the community has been disproportionately and unjustly impacted by the negative effects of Charlotte's rapid growth.[38] Subsequently, the families who live in the area experience a higher burden of the harmful health effects of environmental exposures. They are close to highways and industrial facilities that contribute to air pollution. The negative effects from redlined neighborhoods persist as these communities generally have less tree canopy, greater paved areas and higher summer temperatures.[39] Furthermore, people of color already suffer from chronic health conditions at higher rates.

Citizens of the Historic West End community with support from Clean Air Carolinas, a nonprofit in North Carolina, have been collecting localized and real-time air quality monitoring using mobile $PM_{2.5}$ sensors through a program called "AirKeepers".[38] They also have worked with schools in the area to educate students about air quality. In response to the initiative, the Board of County Commissioners approved an official air monitoring station in the Historic West End. Furthermore, the city of Charlotte has designated the neighborhood a public health priority area. The plan is to create a Historic West End Green District. Goals include reducing emissions from idling vehicles, using clean construction equipment in the community, improving the tree canopy, and collaborating with local businesses, churches, nonprofits, and government agencies to mitigate air pollution.

The tree canopy density is lower in the Historic West End compared to other neighborhoods in Charlotte.[40] The community is working with Clean Air Carolinas and another nonprofit, Trees Charlotte, to prioritize areas for strategic tree planting to help filter pollution created

by industrial and transportation sources. Increasing tree canopy may improve air and water quality, reduces energy costs, and provides shade for recreational activities. By mitigating risks of heat-related illness and poor air quality that may exacerbate asthma, this helps create a safer environment for children to play. Pediatricians can play an important role in collaborating with EJ communities, supporting nonprofits, educating fellow clinicians and patients about the issue, and advocating for the right for all children to live in a safe environment.

PUERTO RICO AND OCEANS: Storms and Resilience

Puerto Rico is an archipelago located in the Caribbean Sea. Puerto Ricans, U.S. citizens since 1917, have suffered from profound social, health, and economic inequities and environmental injustice.[41] In 2017, barely 2 weeks after the passing of Hurricane Irma, Hurricane Maria devastated Puerto Rico with sustained winds of 155 miles per hour. These hurricanes led to the loss of over 4500 lives. They caused homelessness and the emigration of hundreds of thousands; destroyed the infrastructure and agriculture and altered the ecosystems; resulted in food and water insecurity; interrupted medical care, increased physical and mental morbidity; and resulted in tremendous economic loss.[42] For some children, this also translated into separation from their family; living in a shelter for a prolonged period of time; lack of access to medical care, including vaccines and services for children with special needs; interruption in the monitoring of their growth and development; and interruption in educational services.

Recovery and rebuilding have been slow and poorly coordinated and will take many years. The 2017 hurricanes brought to light the vulnerability of Puerto Rico to the effects of climate change. It is estimated that 90% of the heat trapped in the atmosphere by anthropogenic greenhouse gasses accumulates in the oceans.[1] These warmer waters have the potential for fueling stronger storms with more water vapor to sustain their strength longer, to increase the potential for flooding, and to develop and intensify faster, leaving communities little time to fully prepare.[15] Furthermore, the increase in global mean sea level

as a consequence of global warming is translating to stronger storm surges, making coastal cities even more vulnerable.[43,44]

Some communities and groups, particularly infants and children, are disproportionately affected by these climate change extreme weather events. Climate change exacerbates social and health inequities. Disadvantaged groups suffer the most from the consequences of climate change and get trapped in a vicious cycle that results in even greater inequity. EJ communities contribute less to climate change but bear a greater burden and have fewer resources for adaptation and mitigation. For example, when Hurricane Maria hit, Puerto Rico had one of the highest densities of Superfund and Environmental Protection Agency National Priority List sites per square mile in the U.S. and territories.[45,46] Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), these are defined as sites where hazardous waste is being improperly managed endangering public health and the environment. Storms can cause structural damage and flooding at these hazardous waste and Superfund sites with the potential release of toxic substances. In addition, since 2006 Puerto Rico has experienced a profound economic crisis resulting in under-resourced infrastructure, education (with the closure of hundreds of public schools), and health. Children in Puerto Rico have gone through extreme events of profound losses within the last 5 years: the 2016 Zika pandemic, the 2017 hurricanes, the 2019 earthquake sequence, and the 2020 COVID-19 pandemic. All bring their unique, yet synergizing, adverse childhood experiences.

Pediatricians in Puerto Rico embarked on a mission to empower families and communities to increase preparedness and climate resilience and promote environmental health to better protect children's health and wellbeing. They reaffirmed their roles as clinicians, child advocates, science translators, public health professionals, and health educators. They united efforts among pediatricians and reached out to other medical specialties and subspecialties. Together, health professionals wrote guidelines, increased the medical force capacity to prepare and respond, and coordinated on providing diverse services to the communities.

The work of pediatricians in Puerto Rico extended beyond the clinics and hospitals. They helped promote water safety, distribute first necessity items to remote communities, and led mindfulness activities for Head Start teachers to promote emotional and mental health. They distributi children's books to empower caretakers to talk to their children about hurricanes, earthquakes, and COVID-19. This was not easy for those who were victim themselves, but a united and supportive medical force fueled resilience.

Pediatricians embraced this momentum to increase awareness among clinicians and communities about environmental health and climate change through the Puerto Rico Chapter of the American Academy of Pediatrics and a newly founded chapter of Clinicians for Climate Action affiliated with the Medical Society Consortium on Climate and Health. They have introduced a series of courses for medical students on global health, on climate change and health, and an elective course on pediatric environmental health. Using social media and smartphone technologies, they conducted multiple educational activities and developed educational tools for clinicians, parents and caretakers on readiness and the prevention of environmental exposures. Furthermore, they united with multiple organizations to promote a climate declaration in Puerto Rico. An effort led by the Sierra Club of Puerto Rico, this document declared a climate crisis in Puerto Rico and described 10 main public policy actions that the government must support and promote to attend this emergency in the context of environmental and climate justice. It was signed and promoted by hundreds of citizens and organizations. Puerto Rico Clinicians for Climate Action was key in highlighting the impact of climate change and pollution on human health, especially for those more vulnerable, including infants, children, and adolescents. From traumatic and painful experiences, pediatricians learned to speak up for children, strengthen collaboration and communication, and turn hope into action.

Conclusion

Climate change is an overwhelming reality for children. In September 2019, world-wide 4 million youth marched demanding climate

action.[47] Many of those youth leaders were from EJ communities and continue to persevere and lead.[49] From the pre-industrial era to the present, the average global temperature has increased 1°C. If collective action does not slow this trend and succeed in limiting this increase to less than 1.5°C by 2050, the consequences are estimated to be devastating to planetary ecosystems, human health and global security.[1] The health effects of climate change are most strongly felt in environmental justice communities, which are predominantly people of color.[49] This results in a disproportionate burden of climate change health effects on EJ communities, especially without legislation and policies to mitigate the worsening climate crisis.[50] Climate change is a public health crisis, and more importantly to pediatricians, it is a pediatric public health crisis. At a time when the world is continually distracted, the health-care community will need to stay focused. Pediatricians accept the overwhelming reality of climate change and acknowledge the virtual planetary code call, but just as emergency response begins with airway, breathing, and circulation, there are evidence-based concrete actions to take.

As trusted professionals, pediatricians have a special role and responsibility in increasing climate awareness, advocating for climate action policy, and protecting the health of patients and communities. Pediatricians can work to ensure environmental justice. As individual AAP climate advocates in diverse regions but through their shared experiences, and collaborative membership in the AAP climate advocate group, the authors realized that they could inform policy by doing what pediatricians do best.

They worked together. In all four regions, they worked together with the AAP climate advocate program to share ideas and strategies and collaborated with anyone who would link arms. This included health care colleagues locally who wanted to act on climate, other environmental justice groups, medical schools, and local governments. They found for the most part that everyone welcomed them as health care voices with special knowledge on climate change and children's health. They found that their colleagues with more experience nationally, were open to share ideas and resources.

They emphasized their identity as child-advocates and climate-advocates. When they ventured into board meetings and hearings outside

of their usual clinical spaces, they identified themselves as climate advocates from the AAP, members from organizations that advocate for clean air and clean water, and members of organizations such as Clinicians for Climate Action. These names and identities were chosen purposefully, allowing them to speak plainly about the health effects of climate change on children.

They worked locally. All of them found successes locally and had climate victories in a short time with concerted action. Locally, they realized they had further power as constituents, neighbors, and pediatricians anchored in their respective communities. They were successful within their home communities by testifying at public hearings, running for public health positions, partnering with community groups to strengthen their collective impact, and joining with others to augment the advocacy fold.

How do pediatricians inform policy on built environments to safeguard children in EJ communities? They do so by realizing the interconnectedness of the climate crisis and communities, and working to inform policy on air pollution, water quality, carbon emissions, and child resilience. The authors concentrated on local actions but collaborated nationally. They worked by actively recruiting to grow the number of pediatricians and community members who advocate for climate health and pediatric health. Most importantly they showed up and acted, realizing that a single climate victory can have cascading effects. This can serve as a positive example for the thousands of pediatricians already working or ready to be activated in the global task of protecting planetary and pediatric health.

References

1. Intergovernmental Panel on Climate Change. *Global Warming of 1.5 $^{o}C.$* https://www.ipcc.ch/sr15/. Published 2018. Accessed July 1, 2021.
2. American Academy of Pediatrics Council on Environmental Health. Global climate change and children's health. *Pediatrics*. 2015;136(5):992-997. doi:10.1542/peds.2015-3232.
3. Keet CA, Keller JP, Peng RD. Long-term coarse particulate matter exposure is associated with asthma among children in Medicaid. *Am J Respir Crit Care Med*. 2018;197(6):737-746. doi:10.1164/rccm.201706-1267OC
4. O'Neill MS, Jerrett M, Kawachi I, et al. Health, wealth, and air pollution: advancing theory and methods. *Environ Health Perspect*. 2003;111(16):1861-1870. doi:10.1289/ehp.6334
5. Center for Diseases Control and Prevention. *Preparing for the Regional Health Impacts of Climate Change in the United States*. https://www.cdc.gov/climateandhealth/docs/Health_Impacts_Climate_Change-508_final.pdf. Published July 2020. Accessed July 1, 2021.
6. Miranda ML, Edwards SE, Chang HH, Auten RL. Proximity to roadways and pregnancy outcomes. *J Expo Sci Environ Epidemiol*. 2013;23(1):32-38. doi:10.1038/jes.2012.78
7. Bekkar B, Pacheco S, Basu R, Basu R, DeNicola N. Association of Air Pollution and Heat Exposure with Preterm Birth, Low Birth Weight, and Stillbirth in the US: A Systematic Review. *JAMA Netw Open*. 2020;3(6): 208243. doi:10.1001/jamanetworkopen.2020.8243
8. Sheffield PE, Uijttewaal SAM, Stewart J, Galvez MP. Climate change and schools: environmental hazards and resiliency. *Int J Environ Res Public Health*. 2017;14(11). doi:10.3390/ijerph14111397
9. Environmental Protection Agency. Factsheet on the EPA's Office of Environmental Justice. https://www.epa.gov/environmentaljustice/factsheet-epas-office-environmental-justice. Published 2017. Accessed July 1, 2021.
10. Wyckoff AS. Pediatricians' voices grow louder on climate's impact on child health, equity | American Academy of Pediatrics. AAP News. https://www.aappublications.org/news/2021/04/22/climate-change-health-equity-042221. Published April 22, 2021. Accessed July 1, 2021.

11. Young DR, Cradock AL, Eyler AA, et al. Creating built environments that expand active transportation and active living across the United States: A policy statement from the American Heart Association. *Circulation*. 2020;142(11):e167-e183. doi:10.1161/CIR.0000000000000878
12. Estrada A. Environmental Health Coalition - Three Public Members Join Newly Reformed San Diego Air Pollution Control District Board Ushering in a New Era of Clean Air. *Environmental Health Coalition Press Release*. https://www.environmentalhealth.org/index.php/en/media-center/press-releases/1411-new-sdapcd-board-members. Released April 2, 2021. Accessed July 1, 2021.
13. Crist K, Bolling K, Schipperijn J, et al. Collaboration between physical activity researchers and transport planners: a qualitative study of attitudes to data driven approaches. *J Transport Health*. 2018;8:157-168. doi:10.1016/j.jth.2017.11.142
14. Sallis JF, Spoon C, Cavill N, et al. Co-benefits of designing communities for active living: an exploration of literature. *Int J Behav Nutr Phys Act*. 2015;12(1). doi:10.1186/s12966-015-0188-2
15. McGrath LJ, Hopkins WG, Hinckson EA. Associations of Objectively Measured Built-Environment Attributes with Youth Moderate–Vigorous Physical Activity: A Systematic Review and Meta-Analysis. *Sport Med*. 2015;45(6):841-865. doi:10.1007/s40279-015-0301-3
16. Buttazzoni AN, Coen SE, Gilliland JA. Supporting active school travel: a qualitative analysis of implementing a regional safe routes to school program. *Soc Sci Med*. 2018;212:181-190. doi:10.1016/j.socscimed.2018.07.032
17. Nguyen V. The Founding of SDPCA | San Diego Pediatricians for Clean Air. The Founding of San Diego Pediatricians for Clean Air. Published 2021. Accessed July 1, 2021. https://sdpediatriciansforcleanair.com/the-founding-of-sdpca
18. Nguyen VT. Dr. Birkbeck-Garcia, SDPCA Pediatrician Appointed to the APCD Board | San Diego Pediatricians for Clean Air. Dr. Birbeck-Garcia, SDPCA Pediatrician Appointed to APCD Board. https://sdpediatriciansforcleanair.com/dr-birkbeck-garcia-sdpca-pediatrician-appointed-to-the-apcd-board Published April 7, 2021. Accessed July 1, 2021.
19. Méndez A. San Diego Must Protect and Restore Vital Mission Bay Wetlands – ReWild Mission Bay. *Rewild Mission Bay Blog*. https://rewildmissionbay.org/2020/10/15/san-diego-must-protect-and-restore-vital-mission-bay-wetlands/. Published October 15,

2020. Accessed July 1, 2021.
20. Beaty K. Denver's got the most polluted zip code in the country? Not so fast. - Denverite, the Denver site! *Denverite*. https://denverite.com/2018/02/26/denver-polluted-zip-code/. Published February 26, 2018. Accessed July 1, 2021.
21. Wu X, Nethery RC, Sabath MB, Braun D, Dominici F. Air pollution and COVID-19 mortality in the United States:Strengths and limitations of an ecological regression analysis. *Sci Adv.* 2020;6(45):eabd4049. doi:10.1126/sciadv.abd4049.
22. Solomon CG, LaRocque RC. Climate Change - A Health Emergency. *N Engl J Med*. 2019;380(3):209-210. doi:10.1056/nejmp1811542
23. Centers for Disease Control and Prevention. *Climate Effects on Health*. https://www.cdc.gov/climateandhealth/effects/default.htm. Last reviewed March 2, 2021. Accessed July 1, 2021.
24. Lytle K. Cameron Peak Fire becomes largest wildfire in Colorado history, growing more than 20,000 acres in a day. *Fort Collins Coloradoan*. https://www.msn.com/en-us/weather/topstories/cameron-peak-fire-becomes-largest-wildfire-in-colorado-history-growing-more-than-20000-acres-in-a-day/ar-BB1a2jNT. Published October 15, 2020. Accessed July 1, 2021.
25. Aguilera R, Corringham T, Gershunov A, Benmarhnia T. Wildfire smoke impacts respiratory health more than fine particles from other sources: observational evidence from Southern California. *Nat Commun*. 2021;12(1493). doi:10.1038/s41467-021-21708-0
26. Lipner EM, O'Dell K, Brey SJ, et al. The associations between clinical respiratory outcomes and ambient wildfire smoke exposure among pediatric asthma patients at National Jewish Health, 2012–2015. *GeoHealth*. 2019;3(6):146-159. doi:10.1029/2018gh000142
27. US Department of Agriculture. *U.S. Forest Resource Facts and Historical Trends*. FS-1035. https://www.fia.fs.fed.us/library/brochures/docs/2012/ForestFacts_1952-2012_English.pdf Published August 2014. Accessed July 1, 2021.
28. Shandas V, Voelkel J, Williams J, Hoffman J. Integrating satellite and ground measurements for predicting locations of extreme urban heat. *Climate*. 2019;7(1):1-13. doi:10.3390/cli7010005
29. Hoffman J, Allen M, Labosier CF. Detecting Change: Observations of Temperature and Precipitation Across Virginia's Climate Divisions. *Va J Sci*. 2019;70(1):1-15. doi:10.25778/eq3r-pv57
30. Helldén D, Andersson C, Nilsson M, Ebi KL, Friberg P, Alfvén T.

Climate change and child health : a scoping review and an expanded conceptual framework. *Lancet Planet Health*. 2021;5:e164-e175. doi:10.1016/S2542-5196(20)30274-6
31. Sefcik JS, Kondo MC, Klusaritz H, et al. Perceptions of Nature and Access to Green Space in Four Urban Neighborhoods. *Int J Environ Res Public Health*. 2019;16(13):2313. doi:10.3390/ijerph16132313
32. Kondo MC, Mueller N, Locke DH, et al. Health impact assessment of Philadelphia's 2025 tree canopy cover goals. *Lancet Planet Health*. 2020;4(4):e149-e157. doi:10.1016/S2542-5196(20)30058-9
33. Mabon L, Kondo K, Kanekiyo H, Hayabuchi Y, Yamaguchi A. Fukuoka: adapting to climate change through urban green space and the built environment? *Cities*. 2019;93:273-285. doi:10.1016/j.cities.2019.05.007
34. Lovasi GS, Quinn JW, Neckerman KM, Perzanowski MS, Rundle A. Children living in areas with more street trees have lower prevalence of asthma. *J Epidemiol Community Health*. 2008;62(7):647-649. doi:10.1136/jech.2007.071894
35. South EC, Hohl BC, Kondo MC, MacDonald JM, Branas CC. Effect of Greening Vacant Land on Mental Health of Community-Dwelling Adults: A Cluster Randomized Trial. *JAMA Netw open*. 2018;1(3):e180298. doi:10.1001/jamanetworkopen.2018.0298
36. Stone B Jr, Vargo J, Liu P, et al. Avoided Heat-Related Mortality through Climate Adaptation Strategies in Three US Cities. *PLoS One*. 2014;9(6):e100852. doi:10.1371/journal.pone.0100852
37. Hoffman JS, Shandas V, Pendleton N. The effects of historical housing policies on resident exposure to intra-urban heat: a study of 108 US urban areas. *Climate*. 2020;8(1):12.
38. Ross R. Clearing the air in the Historic West End. https://storymaps.arcgis.com/stories/5071792639ef47729fad54da835d37d3. Published April 22, 2021. Accessed July 1, 2021.
39. Hoffman JS. Learn, Prepare, Act: "Throwing Shade" on Climate Change. *J Museum Educ*. 2020;45(1):28-41. doi:10.1080/10598650.2020.1711496
40. Falero M. Charlotte's declining tree canopy hides years of loss in historically black neighborhoods | WFAE 90.7. https://www.wfae.org/energy-environment/2020-08-28/charlottes-declining-tree-canopy-hides-years-of-loss-in-historically-black-neighborhoods. Published August 28, 2020. Accessed July 1, 2021.
41. Brown P, Vega CMV, Murphy CB, et al. Hurricanes and the environmental justice island: Irma and Maria in Puerto Rico. *Environ Justice*. 2018;11(4):148-153. doi:10.1089/env.2018.0003

42. Kishore N, Marqués D, Mahmud A, et al. Mortality in Puerto Rico after Hurricane Maria. *N Engl J Med*. 2018;379(2):162-170. doi:10.1056/nejmsa1803972
43. Li L, Chakraborty P. Slower decay of landfalling hurricanes in a warming world. *Nature*. 2020;587(7833):230-234. doi:10.1038/s41586-020-2867-7
44. Cheng L, Abraham J, Hausfather Z, Trenberth KE. How fast are the oceans warming? *Science (80-)*. 2019;363(6423):128-129. doi:10.1126/science.aav7619
45. Cordero JF, Meeker JD, Sheahan T, et al. Case Study–Puerto Rico Test Site for Exploring Contamination Threats. In: American Society of Civil Engineers (ASCE); 2012:3553-3562. doi:10.1061/9780784412121.364
46. Welton, Vélez Vega, Murphy, et al. Rosario, Hector Torres, Elle Russell, Phil Brown, Gredia Huerta-Montanez, Deborah Watkins, John D. Meeker, Akram Alshawabkeh JFC. Impact of Hurricanes Irma and Maria on Puerto Rico Maternal and Child Health Research Programs. *J Matern Child Heal*. 2020;24(1):22-29. doi:10.1007/s10995-019-02824-2.Impact
47. Sengupta S. Protesting climate change, young people take to streets in a global strike. *New York Times*. https://www.nytimes.com/2019/09/20/climate/global-climate-strike.html. Published September 20, 2019. Updated September 21, 2019. Accessed July 1, 2021.
48. Wikler M. 3 youth living and organizing on the frontlines of the climate crisis. *Teen Vogue*. https://www.msn.com/en-us/weather/topstories/3-youth-climate-activists-of-color-on-living-through-the-climate-crisis/ar-BB1fYgVc. Published April 23, 2021. Accessed July 1, 2021.
49. Shonkoff SB, Morello-Frosch R, Pastor M, Sadd J. The climate gap: Environmental health and equity implications of climate change and mitigation policies in California-a review of the literature. *Climatic Change*. 2011;109:485-503. doi:10.1007/s10584-011-0310-7