



A pediatrician's guide to climate change-informed primary care

Rebecca Pass Philipsborn, MD, MPA,^a Julia Cowenhoven, MD,^b Aparna Bole, MD,^c Sophie J Balk, MD,^d and Aaron Bernstein, MD, MPH^{e,*}

Despite the urgency of the climate crisis and mounting evidence linking climate change to child health harms, pediatricians do not routinely engage with climate change in the office. Each primary care visit offers opportunities to screen for and support children burdened with risks to health that are increasingly intense due to climate change. Routine promotion of healthy behaviors also aligns with some needed—and powerful—solutions to the climate crisis. For some patients, including those engaged in athletics, those with asthma and allergies, or those with complex healthcare needs, preparedness for environmental risks and disasters worsened by climate change is a critical component of disease prevention

and management. For all patients, anticipatory guidance topics that are already mainstays of pediatric best practices are related closely to needed guidance to keep children safe and promote health in the setting of compounding risks due to climate change. By considering climate change in routine care, pediatricians will be updating practice to align with evidence-based literature and better serving patients. This article provides a framework for pediatricians to provide climate-informed primary care during the structure of pediatric well child and other visits.

Curr Probl Pediatr Adolesc Health Care 2021; 51:101027

In the course of daily practice, pediatricians are well-poised to reduce harms to our patients and to promote health equity in responding to the climate crisis. The climate crisis poses risks to the health and well-being of every child.^{1,2} Those children already burdened by structural racism and poverty are at greater risk of worse health outcomes.^{3,4} Climate

In the course of daily practice, pediatricians are well-poised to reduce harms to our patients and to promote health equity in responding to the climate crisis.

action—reducing greenhouse gas emissions and preparing for climate change—supports optimal child health, growth, and development, now and in the future, and is closely linked with racial justice.⁵ However, conversations about climate change and child health are nei-

ther part of standard pediatric practice nor occurring with the frequency demanded by the climate crisis. Though trusted health educators and advocates for children, pediatricians may feel a disconnect between daily practice and the climate crisis.⁶ This article provides a practical approach for connecting climate change with health in primary care pediatrics, including recommendations from the American Academy of Pediatrics (AAP) policy statement on climate change and children's health.¹

There is little debate among scientists and health professionals that climate change is the result of unsustainable human activity and that the implications for human health are profound.⁷ In 2017, global temperatures reached 1°C warming above pre-industrial levels.⁸ Scientists advise that greenhouse gas emissions must be reduced by 45% below 2010 levels by 2030, and that we must have a “net zero” planet by 2050, to avoid consequences that are potentially catastrophic and irreversible.⁸ This change

From the ^aDivision of General Pediatrics and Gangarosa Department of Environmental Health, Emory University, and Children's Healthcare of Atlanta, Atlanta, GA, United States; ^bDepartment of Medicine, Boston Children's Hospital, Department of Pediatrics, Harvard Medical School, and Department of Pediatrics, Boston University, 401 Park Drive, 4th Floor West, Boston, MA 02215, United States; ^cDivision of General Academic Pediatrics, UH Rainbow Babies & Children's Hospital, Department of Pediatrics, Case Western Reserve University School of Medicine, Cleveland, OH, United States; ^dDivision of Academic General Pediatrics, Children's Hospital at Montefiore, Albert Einstein College of Medicine, Bronx, NY, United States; and ^eDivision of General Pediatrics, Boston Children's Hospital, Center for Climate, Health and the Global Environment, Harvard T.H. Chan School of Public Health, Boston, MA and Harvard Global Health Institute, Cambridge, MA, United States.

*Corresponding author.

E-mail: aaron_bernstein@hms.harvard.edu

Curr Probl Pediatr Adolesc Health Care 2021;51:101027

1538-5442/\$ - see front matter

© 2021 Elsevier Inc. All rights reserved.

<https://doi.org/10.1016/j.cppeds.2021.101027>

necessitates urgently reducing greenhouse gas emissions and adapting our routines and our infrastructure, including healthcare infrastructure, to the current climate reality.⁹ Both are essential to child health and equity.

Climate change-driven health harms affect every organ system.^{8,10} Many health promotion behaviors emphasized at well child visits, such as healthy diets, are part of the solution to climate change.¹¹ Nevertheless, health professionals' perceived barriers to discussing climate change include time constraints, a lack of personal knowledge or training, perception that climate change is controversial, and that discussing it with patients would not make a difference.¹² Integrating climate change into the basic components of a well-child check and other visits addresses many of these barriers. This feasible and adaptable model gives pediatricians a tool to support child health and wellness in the climate crisis.

Climate action and patient care

By incorporating climate change into the flow of the well child visit, primary care pediatricians can identify children at risk of harmful exposures, enhance wellness promotion, and prepare children and their families to protect their health in the climate crisis (Fig.). These connections fit within the Bright Futures health promotion themes that pediatricians already integrate into

practice, including healthy nutrition, physical activity, mental health, and attention to special healthcare needs.¹³ Climate change-informed screening questions can be included alongside existing patient-facing questionnaires or pre-visit forms. Age-specific anticipatory guidance topics offer many touchpoints for safeguarding child health from climate risks. Clinicians can directly use or adapt available resources (e.g., handouts available online or referrals to clinicians with specific expertise) that address common concerns (e.g., food insecurity, water quality, energy insecurity and disaster preparedness) that may increase with climate change. The Table outlines components of pediatric primary care visits, climate and health relevance, and discussion points or written resources.

Triage and screening: environmental determinants of health

Global climate change is a major determinant of child health, especially for vulnerable children.¹⁴ Pediatricians can screen for climate risks, just as we screen for social determinants of health.¹⁵ This section guides pediatricians in including climate-sensitive environmental determinants of health — such as energy security and displacement — alongside basic assessments of food security and housing in well child checks.

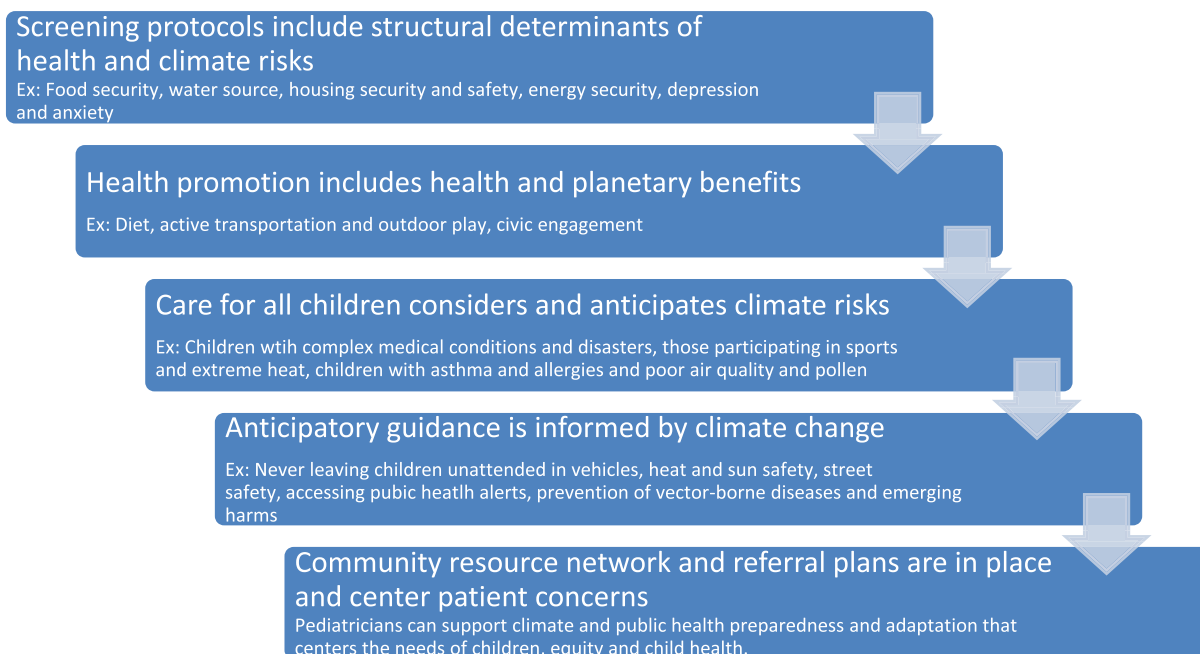


Fig. Aspects of climate-informed primary care pediatrics.

Food security and water source

The COVID-19 pandemic resulted in a rapid rise in food insecurity for American children, especially children in low-income households.¹⁶ Climate change also contributes to food insecurity through disruption of food supply chains, crop destruction and increased food costs.⁹ Food security screening (identification of families who experience food insecurity), and connecting families with local school-based or social support programs—as recommended by the AAP—remain paramount due to the climate crisis.¹⁷

Beyond food security, climate threatens water security. Climate change stresses water supplies and infrastructure and can cause water shortages. Extreme weather disrupts water systems and mobilizes contaminants into water supplies. Flooding can also overwhelm combined sewage systems (with a common pipe for sewage and rainwater) which serve more than 700 communities and 40 million Americans. When rainfall exceeds the system capacity, risks of waterborne diseases increase.¹⁸ Drought and warmer temperatures also deteriorate water quality.^{9,19} Families who use well water are particularly at risk.²⁰ Pediatric screening often includes questions on water fluoridation and, in some communities, water source (i.e., well water). These questions inform counseling on fluoride, water-borne disease risks, and lead exposure. They also facilitate discussion on how to assure safe drinking water (e.g. when advisories to boil water are issued) in the climate crisis.

Though families need to stay informed on local water quality alerts, filtered tap water is usually safe for consumption. In most communities with piped water systems, tap water is of equal or superior quality to bottled water.²¹ Although Americans spend billions of dollars on bottled water each year, bottled water is not without risks, as demonstrated by a recent hepatitis A outbreak among users of a brand of bottled alkaline water.²² Using tap water instead of bottled water helps prevent caries, reduces greenhouse gas emissions, reduces plastic pollution, and can save money for other essential household expenditures, such as food.²³ Pediatricians' water safety and consumption guidance can be informed by climate change effects on water security.

Housing security

The health of unhoused and unstably housed children is at greater risk from climate-driven extreme weather events.⁹ When screening for housing insecurity, questions related to leaks or standing water in basements, air conditioning (availability and

affordability), and heating systems can be included. For renters with concerns about molds, pediatricians may refer to legal aid resources to support remediation.²⁴ Homeowners are eligible for the U.S. Department of Energy's (DOE) Weatherization Assistance Program (WAP) if they are at or below 200% of the poverty income guidelines, or if they receive Supplemental Security Income or Aid to Families with Dependent Children.²⁵ Pediatricians may refer qualified owners to these programs that essentially seal the home's envelope, reducing mold.

Energy security

Home weatherization also addresses energy insecurity by reducing energy consumption, saving money on utility bills, and, as a result, increasing disposable income for necessities such as food and medicine.²⁶ Low-income households spend 16.3% of annual income on energy compared to 3.5% for other households.²⁷ Black and Hispanic families are more likely to experience energy insecurity,²⁸ and the Southeast U.S. has the greatest proportion of families struggling to pay for energy on a month-to-month basis.²⁹ Energy insecurity can be life-threatening when families lose access to heating or air conditioning in harsh conditions. By screening for energy insecurity, pediatricians can support health by connecting families with local resources or by providing documentation of medical conditions that place individuals in the household at-risk. Pediatricians can refer qualified at-risk families to local Low Income Home Energy Assistance Programs (LIHEAP) programs. Many states also provide protections against utility shut-offs for individuals with health conditions and for families with infants, and pediatricians can provide medical certification to avert these shut-offs and resulting health harms.³⁰

Mental health screening

Climate change erodes mental health in various ways, from climate anxiety to acute trauma to distant sequelae of displacement.³¹ Disasters increase caregiver stress and the risk of non-accidental trauma in infants.³² In older children, mental health concerns associated with extreme weather events include depression, anxiety, sleep disturbance, post-traumatic stress disorder (PTSD), acute stress reactions, panic disorder, phobias, and adjustment disorder.³³ Symptoms of PTSD overlap with other childhood conditions such as attention-deficit/hyperactivity disorder (ADHD), oppositional defiant disorder, conduct disorder, or depression, and may be misdiagnosed if not intentionally considered in the wake of a disaster.³⁴ Although

hurricanes, floods and wildfires may trigger a pediatrician to screen for mental health sequelae, other effects of climate change, especially heat waves, may not. Substantial evidence supports an association between heat and adverse mental health outcomes, including suicide.³⁵ Adolescents in particular may be at risk for what has been termed “ecoanxiety,” a term that refers to persistent worry about the future of the Earth.³⁶

The AAP recommends universal depression screening at well visits for adolescents and postpartum depression screening for mothers of infants up to 6 months of age.^{37,38} Physicians may make these screenings climate-informed by having an awareness of the role of climate change and extreme weather in mental health symptoms and diagnoses.

Language preference

Upon registration at a visit, families indicate language preference. Of the 18 million U.S. children who live in families with caregivers who are immigrants, 21% live in households considered “linguistically isolated,” a term used by the U.S. Census Bureau when adults in the home have limited English proficiency.³⁹ Children and families who experience linguistic isolation may be at risk for increased harm from disasters, including those wrought by climate change.⁴⁰ In addition, climate change is increasing global displacement and the migration of children and families, as discussed by Uddin et al. in this issue.⁴¹ Pediatricians can support these families by accessing translation services during visits, and by providing information about how to access local public health messages and emergency alerts as well as resources for advancing English proficiency for adults in the home.

Health promotion

Healthy habits emphasized at a well-child visit can also address climate change. Active transportation and time outside for play, diets with less meat and rich in plant-based nutrients, and breast milk instead of formula all promote the health of children and support greenhouse gas reduction. Some of these healthy choices may result in financial savings for families. In illustrating for patients that daily healthy choices also are climate solutions, pediatricians promote powerful individual practices to mitigate climate change.⁴² For pediatricians working in a busy practice, the synergy of these climate-related points with health promotion topics helps lessen the tension between the limited

minutes allotted for each patient encounter and the limited years to mitigate emissions and safeguard health.

Nutrition

Eating more plant-based diets reduces risk for a wide variety of diseases and reduces greenhouse gas emissions.^{43,44} Red meat consumption has been associated with increased all-cause mortality as well as increased risks of ischemic heart disease, stroke, type 2 diabetes, overweight and obesity, and breast and colorectal cancers.^{43,45} The World Health Organization has classified beef as a carcinogen, and substituting one red meat meal per week with fish, poultry, nuts, beans or whole grains has been shown to reduce mortality in adults by 7–19%.⁴⁶ One study projects that a predominantly plant-based diet, in comparison to a typical regional reference diet, may result in a 6–10% global mortality reduction and 29–70% global greenhouse gas emission reduction by the year 2050.⁴⁷ When discussing diets, pediatricians can emphasize the health and planetary benefits of plant-rich diets and lifelong healthy eating habits. If locally available, “double up” programs that give double value for food stamps spent at local farmers’ markets can support patients’ access to produce.⁴⁸ Pediatricians can promote these resources where they exist and advocate their adoption in more states.

The AAP recommends exclusive breastfeeding for the first six months of life with few exceptions and with good reason.⁴⁹ Breastmilk remains best for the health of mothers, babies, and for sustainability. Benefits include lower rates of type 2 diabetes, cardiovascular disease, breast and ovarian cancer, and post-partum depression in mothers; and reduced risk of obesity, diabetes, respiratory tract infections, sudden infant death syndrome, allergic disease, celiac disease, and improved neurodevelopmental outcomes in infants.⁴⁹ Exclusively breastfeeding an infant for six months also saves an estimated 95–153 kg in CO₂ emissions per baby compared with formula feeding—and saves money. Barriers that impede breastfeeding in the U. S.⁵⁰ include lack of adequate maternity leave and protections for pumping at work. Pediatricians can support breastfeeding—in the office and through advocacy—and consider it part of climate action.

Physical activity and exercise

AAP recommends that young children aged 3–5 years engage in more than 3 h of active play per day and that children 6–17 years old engage in

60 min per day of physical activity.⁵¹ These recommendations are cornerstones of promoting child health and combatting climate change. Active transportation, especially when incorporated into daily routines, can be a major source of physical activity and contribute to improved neighborhood air quality. Car trips of under one mile add up to 10 billion miles and 2 million metric tons of CO₂ emissions annually.⁵² Walking, biking, or taking the bus to school, when safe and available, promotes physical activity and community cohesion, and reduces pollution. Public transportation promotes physical activity, saves on costs of transportation, and decreases pollution-associated respiratory illness.¹¹ Discussions about physical activity can be combined with guidance on street safety as well as assessment of access to nature.

Children need access to parks, green space, and safe routes for active transportation to school and activities. Many communities, especially communities facing challenges due to poverty or structural racism, lack safe active transportation infrastructure.⁵³ Access to green space likewise is inequitably distributed.⁵⁴ This reality makes it harder for children of color or in families with low-incomes to bike or walk to school or activities and increases the temperature of their communities from the “urban heat island effect.”⁵⁵ Green space in cities can lower temperatures and, if properly designed, improve air quality. Being outside in nature may also confer health benefits independent of exercise.^{56,33} Time spent outside and in nature also improves cognitive functioning and overall development, fosters positive peer relationships, and cultivates environmental stewardship.⁵⁷ The COVID-19 pandemic has exposed challenges and inequities in public transportation as well as access to green space and, in doing so, brought greater attention to designing communities more equitably. Pediatricians can promote safe play and active transport for patients with access to these community resources. At the same time, pediatricians can advocate for equitable improvements to the built environment in local neighborhoods.

Activities and civic engagement

Bright Futures recommends that pediatricians speak to adolescents about active community engagement and civic service.¹³ For adolescents concerned about planetary health, worried about their future and that of their families in the climate crisis, or already affected by climate-driven disasters, engagement with nature-based or youth-powered organizations may provide

meaningful community involvement to support mental health while making positive change.^{58,59}

Considerations for specific pediatric populations

Climate-informed care provision applies to many common childhood conditions. Pediatricians can better care for the children they serve when they understand how climate change influences the presentation, severity, and management of these conditions.

Asthma and allergies

One in 14 American children have asthma.⁶⁰ Pediatricians are trained extensively in diagnosis and management of asthma, but sometimes are less focused on its prevention. Air pollution—breathing polluted air—has been associated with development of asthma in one in five children with asthma as well as millions of emergency department visits.⁶¹ Extreme heat, longer and more severe pollen seasons, wildfire smoke, and mold exposures, all associated with climate change, also increase asthma symptoms in children.^{62–66}

Pediatricians typically provide asthma action plans designed to treat symptoms after they start. Neither air pollution, nor pollen levels, nor heat risks are routinely included on asthma action plans. Pediatricians can augment anticipatory guidance regarding asthma management with considerations related to local air quality, including listing these as patient-specific triggers on asthma action plans. Pediatricians can advise families to monitor the Air Quality Index (AQI), pollen forecasts, and the temperature forecast and to avoid prolonged time outdoors if indicated. Children age 6 years and over can wear an N-95 mask to protect against particulate pollution when the AQI is in the moderate to — unhealthy range for sensitive groups — or severe — unhealthy range for everyone.⁶⁷ When possible, children should avoid exercising near high traffic areas and exercise earlier in the day when air quality is typically better. In areas affected by wildfire smoke, families can install household HEPA filters.⁶⁴

Children with complex medical conditions

Children with complex or multiple medical conditions, especially those dependent on technology-based care (e.g., ventilators and pumps) are especially vulnerable to disruptive events driven by climate change. The leading cause of power outages in the U.S. is extreme weather. Having a disaster-preparedness plan is critical for children

with existing conditions for whom missing a dose of medication, inability to access emergency care, or loss of electrical power would cause serious risk of illness exacerbation or death.⁶⁸ At well checks or with changes in regimens or medications, pediatricians can ensure that these families have contingency plans for cold-chain dependent medications and electricity-dependent devices. Contingency plans may include up-to-date emergency information forms with essential healthcare information (e.g., medications, feeding plans, technology settings, special supplies, etc.) and plans for contacting providers or accessing care in emergencies when the power is out (and cell phones, the sole phone type for many families, cannot be charged) or roads are impassible.

The sports physical

Youth athletes and children who participate in sports are particularly vulnerable to extreme heat events that are increasing in frequency and duration and occurring earlier and later in the year because of climate change.^{9,69} Studies demonstrate increased morbidity and mortality during extreme heat events, particularly in older individuals, infants, young children, and minority and formerly redlined communities.^{70,71} Children often do not drink enough to replenish hydration losses during exercise.⁷² Importantly, older adolescents may be at higher risk than younger children, and the ability of younger athletes to endure heat may result in complacency for heat risks as children age.⁶⁹

At the sports physical, pediatricians can advise parents of the risks of extreme heat and ways to reduce these risks. Pediatricians can document recommendations on sports physical paperwork, including: acclimatize prior to vigorous exercise outdoors, monitor the heat index and limit the intensity or length of exercise on extreme heat index days, restrict physical activity to the coolest part of the day, enforce hydration during exercise (5–8 ounces every 20 min), and wear light-colored, lightweight clothing.^{73,74} Pediatricians can teach older children and parents about the signs of heat exhaustion and heat stroke and when to seek immediate care: warm, dry skin, temperature above 40 °C, or altered mental status.⁷⁵ Some pediatricians and parents may wish to work with coaches and gym teachers directly to educate about exercising safely in the context of climate change and extreme heat events.

Children who require prescription medications

Heat alters the efficacy and safety of commonly prescribed medications.⁷⁶ As part of medication

reconciliation done at every check-up, physicians can include guidance on appropriate medication storage and use during the summer months, especially for medications that alter heat or water homeostasis (e.g., anticholinergics, antihistamines, tricyclic antidepressants, antidopaminergics, selective serotonin uptake inhibitors (SSRIs), antipsychotics, sympathomimetics, and diuretics) or increase risk of side effects with dehydration (e.g., non-steroidal anti-inflammatory drugs [NSAIDs]).⁷⁵ Children with complex medical conditions may not express classic symptoms of heat illness. Pediatricians, in consultation with specialists as indicated, may consider lowering medication doses in summer months or around heat waves and educate caregivers (and older children) about recognizing heat-associated illness.

Anticipatory guidance

The climate crisis lends new vigor to anticipatory guidance topics that are already mainstays of pediatrics. Bright Futures recommends counseling on age-appropriate safety at each visit, with topics including heat illness and sun protection, outdoor safety, drowning prevention, and disaster safety. Because the effects of the climate crisis vary by region and personal and neighborhood-level factors, pediatricians are positioned to listen to patient and family concerns and tailor guidance to the local context and individual patient. Many of these topics can be incorporated into handouts and lightly tailored takeaway materials. Some guidance on avoiding seasonal exposures could be provided via patient-directed electronic medical record (EMR) reminders or outreach throughout the year.

Heat and sun protection

Bright Futures recommends reminding parents at the newborn visit never to leave children unattended in a vehicle. In this era of the climate crisis, prevention of heat illness—not just in cars—on hot days takes on more importance. Increased ambient temperatures also are associated with increased risk of sudden infant death syndrome (SIDS).⁷⁷ Pediatricians should continue to counsel on prevention of heat illness, appropriate clothing, sunscreen, and other sun protection measures,⁷⁸ the importance of safe sleep and temperature control for infants, and may draw the link for parents of the risk of more dangerous heat due to climate change.

Disaster preparedness

In 2020, the U.S. experienced 22 “billion dollar” weather and climate disasters — a record number that

TABLE Practical recommendations for integrating climate change into the flow of pediatric primary care visits.

	Climate-health rationale	Practical screening questions, suggested climate conversation starters, recommendations and resources
Triage and Screening		
Food security	Climate change puts crop yields at risk, disrupts global food supply chains, and may increase the number of patients facing food insecurity.	<p><i>In the last 12 months, have you worried you would run out of food before you had money to buy more?</i></p> <ul style="list-style-type: none"> ○ Refer for services <ul style="list-style-type: none"> • United Way 211 for local, essential community services • USDA National Hunger Hotline – 1-863-3-HUNGRY • Feeding America online search tool: https://www.feedingamerica.org/find-your-local-foodbank
Water source and safety	Climate change makes severe floods and droughts more likely and promotes water borne disease risk. Bottled water contributes to pollution and the climate crisis, is not generally safer, and lacks fluoride.	<p><i>What is your primary drinking water source?</i></p> <ul style="list-style-type: none"> ○ Discuss tips for healthy drinking water (e.g. filters) https://www.cdc.gov/healthywater/drinking/index.html ○ Show patients how to sign up for local boil water advisories ○ Share the EWG Tap Water Database: https://www.ewg.org/tapwater/
Housing security and housing problems	Those without shelter face exceptional risks from extreme weather. Dampness and mold exposures in homes, made more likely with warm damp conditions, can cause mycotoxin mediated and allergic symptoms.	<p><i>What is your housing situation?</i></p> <p><i>Do you have problems with leaks, flooding, dampness or mold in your home?</i></p> <p><i>Let's think about dampness and molds and indoor air quality in your asthma action plan.</i></p> <ul style="list-style-type: none"> ○ Refer for housing, weatherization resources, and provide information for medico-legal aid support (see also below) ○ Review air quality concerns as a component of asthma management
Energy security	More extreme weather contributes to power outages, increases costs of energy delivery and promotes energy insecurity. Lack of electricity, heating and cooling can contribute to heat and cold related illnesses.	<p><i>In the past 12 months, have you had trouble paying your utility bills, or has a utility company turned off or threatened to turn off your services?</i></p> <ul style="list-style-type: none"> ○ Refer for energy assistance, provide accommodation letters, letters to utilities, and information for medico-legal aid support • Weatherization https://www.energy.gov/eere/wap/how-apply-weatherization-assistance • LIHEAP https://www.acf.hhs.gov/ocs/map/liheap-map-state-and-territory-contact-listing HEATLINE at 1-800-632-8175 • State laws on utility shut-offs and sample medical certification letter: https://www.nclc.org/images/pdf/energy_utility_telecom/consumer_protection_and_regulatory_issues/Serious_Illness_Ap_F.pdf
Depression screening	Climate change, disasters, and displacement can compromise mental health and result in stress for children and caregivers.	<p><i>I am so sorry to hear that you experienced a flood in your home. How are you and your family doing?</i></p> <ul style="list-style-type: none"> ○ Use validated screens like PHQ-9 or PHQ-2.⁹⁶ ○ Maintain high index of suspicion about potential relationship between climate, disasters, and positive screens ○ Refer for local mental and behavioral health resources ○ Suggest opportunities to engage with youth and community support groups where appropriate
History and Health Promotion		
Nutrition	Plant-forward diets can reduce greenhouse gas emissions and reduce lifetime risk of chronic diseases. Consuming more vegetarian diets and reducing food waste reduce greenhouse gas emissions that drive climate change. Breastfeeding is best and more sustainable.	<p><i>Getting more nutrients from plant sources is good for you and good for the planet.</i></p> <p><i>Eating more plant protein and avoiding wasting extra food are some of the most powerful things individuals can do to help reduce climate change and protect our health.</i></p> <p><i>Special programs, like "Double up," can help you access fresh, local food.</i></p> <ul style="list-style-type: none"> ○ Counsel on health benefits of reduced meat intake and the risks of too much meat and cow's milk intake. ○ Reference healthychildren.org for families interested in vegetarian diets: https://www.healthychildren.org/English/healthy-living/nutrition/Pages/Plant-Based-Diets.aspx ○ Refer families to "double up" programs that provide twice the value for local produce in areas where they exist: https://doubleupamerica.org/
Physical activity	Active commuting reduces an individual's carbon footprint, improves physical fitness, and can improve well-being and local air quality.	<p><i>Walking and biking to school and for close errands helps keeps you fit, helps improve the air in your community, and helps address climate change.</i></p> <p><i>Playing outdoors, in nature and parks, has lots of benefits for children beyond just exercise.</i></p> <ul style="list-style-type: none"> ○ Encourage outside time and time in nature for active play and physical activity in accordance with AAP guidelines. Example of local handouts: https://naturenet.org/connecting-children/nature-health/ ○ Counsel on individual and public health benefits of active transportation and alternative commutes. https://medsocietiesforclimatehealth.org/educate/patients/ ○ Advocate structural changes to the built environment that promote equitable access to green space.
Extracurricular activities	Engagement with organizations on the climate crisis promotes community and purpose, and may buffer negative mental states associated with climate change (e.g. eco-anxiety and eco-depression).	<p><i>What are some things you could do to help keep yourself, your community, and the environment healthy?</i></p> <p><i>How can you work with your community to address climate change?</i></p> <ul style="list-style-type: none"> ○ Talk to children about climate change and the importance of individual choices Many resources exist. One example: https://www.nytimes.com/interactive/2021/04/18/climate/climate-change-future-kids.html ○ Discuss climate action with interested teens and engage with local chapters of nature-based solutions and advocacy groups. Some examples: https://www.sunrisemovement.org/

(continued on next page)

TABLE (Continued)

Climate-health rationale		Practical screening questions, suggested climate conversation starters, recommendations and resources
Disease Management Plans and Special Considerations		http://thisiszerohour.org/ https://www.youth4nature.org/ https://earthuprising.org/
Asthma and allergies	Climate change and pollution share common drivers—both are sequelae of fossil fuel combustion. Heat contributes to ground-level ozone air pollution. Climate change increases risks of droughts and wildfires. Some allergenic plants produce more pollen when exposed to higher CO ₂ concentrations in the air, and the pollen season is longer. Heat, pollution, pollen and wildfire smoke worsen air quality and respiratory illnesses.	<p><i>Climate change makes pollen season longer and stronger. (It's not just your imagination that your allergies are getting worse).</i> <i>Climate change is causing hotter weather, and heat makes pollution and air quality worse. Children's lungs are sensitive to bad air quality, and it can trigger and worsen asthma. Let's think about temperature and air quality in your asthma action plan.</i> <i>What are your plans to stay safe from wildfire smoke?</i></p> <ul style="list-style-type: none"> ○ Include pollution and seasonal pollen counts in asthma management plans. ● Recommend that patients exercise and play outdoors when the local air quality index is good and avoid outside time during "Code Orange" or higher air quality alerts. ● Consider a mask when age-appropriate and when in areas affected by wildfire smoke or a local air quality index of moderate or severe.⁹⁷ ○ Show patients how to access the air quality index and pollen counts (where available): https://www.airnow.gov/ https://pollen.aaaai.org/ ○ In areas affected by wildfire smoke, advise families to use a household HEPA filter. ○ Refer families to the fire.airnow.gov fire and smoke map that includes data from low-cost sensors to enhance resolution of fire smoke information: https://fire.airnow.gov/
Sports physical	Climate change is resulting in more extreme heat. Children and youth involved in athletic activities are at risk for heat related illnesses.	<p><i>Climate change is causing more extreme heat and more heat earlier in the spring and later in the fall. It is important to exercise safely and pay attention to hydration.</i></p> <ul style="list-style-type: none"> ○ Discuss prevention of heat illness when completing sports physicals. ● Encourage hydration during strenuous outdoor activity. ● Acclimatize at the beginning of the season. ● Avoid the hottest time of the day. ● Recognize the signs and symptoms of heat illness. ○ Provide families with resources to take home and share with coaches and teams. ● National Athletic Trainers Association: https://www.nata.org/sites/default/files/hydration_heat_illness_handout.pdf ● https://www.nata.org/sites/default/files/heat-illness-parent-coach-guide.pdf ● Korey Stringer Institute - https://ksi.uconn.edu/wp-content/uploads/sites/1222/2019/05/Reducing-Heat-Illness-in-College-and-High-School-Sports.pdf
Children with complex medical conditions	Climate change is worsening weather disasters. Planning for disaster is critical for children with complex needs whose well-being depends on close management of health conditions.	<p><i>Climate change is causing more serious and disruptive disasters. Some children are at greater risk because of their health conditions.</i> <i>Do you have a plan to stay safe in disasters?</i></p> <ul style="list-style-type: none"> ○ Discuss steps for disaster preparedness with families: be informed, make a plan, build a kit, and get involved. Refer families to AAP's page for resources for each step: https://www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/Children-and-Disasters/Pages/CYWSN.aspx ○ Ensure patients have an up-to-date emergency information card: https://cshcn.org/pdf/in-case-of-emergency-english.pdf ○ Review medication refills and supplies, and assist families with phone numbers and information to access their care team in emergencies.
Medication reconciliation	Elevated ambient temperatures alter the efficacy of some medications. Some medications affect heat and water homeostasis and place children more at risk of heat-related illness or dehydration in the changing climate.	<p><i>Climate change makes it even more important to store some of your medications in a temperature-controlled place.</i></p> <ul style="list-style-type: none"> ○ Counsel patients on temperature-controlled storage of medications- never in cars and use caution with mail-order services in hot months. Example handout: https://www.thechildren.com/health-info/conditions-and-illnesses/heat-and-medication-humidity-and-soaring-temperatures-can-alter ○ Counsel patients on the risks of medications that alter heat and water homeostasis.
Anticipatory Guidance and Injury Prevention		
Heat and sun safety	Climate change is resulting in more extreme heat. Heat exposure has been associated with heat-related illness, heat stroke, and infant mortality.	<ul style="list-style-type: none"> ○ Ensure families are prepared to protect children from heat illness: https://apha.org/-/media/files/pdf/topics/climate/childrens_health.ashx https://www.cdc.gov/cpr/infographics/beattheheat.htm ○ Continue to recommend sun safety measures
Disaster preparedness	Climate change is increasing the numbers of children exposed to weather-related disasters.	<ul style="list-style-type: none"> ○ Discuss disaster preparedness with families and share preparedness resources. ● AAP family readiness kit: https://www.aap.org/en-us/Documents/disasters_family_readiness_kit.pdf ● CDC Ready Wrigley - https://www.cdc.gov/cpr/readywrigley/index.htm ○ Ensure children have an emergency contact card and know parental information. ○ Tailor information on local outbreaks and emerging diseases with families. ● CDC National Outbreak Reporting System: https://wwwn.cdc.gov/norsdashboard/ ● CDC Lyme Toolkit: https://www.cdc.gov/lyme/toolkit/index.html ● AAP guide for parents on choosing insect repellents: https://www.healthychildren.org/English/safety-prevention/at-play/Pages/Insect-Repellents.aspx ● Local <i>Vibrio</i> safety flyer, Virginia: https://www.vdh.virginia.gov/content/uploads/sites/12/2016/01/Vibrio-Safety.pdf ● Algal blooms infographic: https://www.epa.gov/sites/production/files/2019-05/documents/habs-infographic-detailed-2019.pdf
Emerging conditions	Changing patterns of infections and exposures create health risks in new geographies.	

ranged from fires, tornadoes, hurricanes, and hail storms to drought and heat.⁷⁹ Climate hazards differ across regions, and guidance to patients needs to reflect these regional differences.⁹ Although children's needs evolve throughout youth, all children are at risk during disasters. Bright Futures guidelines recommend first discussing emergency plans at the one month well visit with new parents.¹³ Newborns require special care and consideration for their transport, sleeping, eating, and temperature control at all times, and especially during disasters. At the one month check-up and subsequent visits, pediatricians may provide families with tips for protecting children before, during, and after climate-driven extreme events. The AAP Policy Statement, Ensuring the Health of Children in Disasters, outlines points and resources for physicians to share with parents.⁸⁰ Topics include wildfire safety and protection against smoke inhalation, hurricane evacuations and safe return after the storm, avoiding flooded areas and drowning prevention, tornado safety and generator safety in power outages, and access to care and mental health assessments after extreme events. Parents should keep a recent picture of their child with them or on their mobile devices. As safety measures in case of family separation, even young children should be taught their parents' first and last names, how to call 911, and their address and phone number.⁸⁰ Pediatricians can direct families to existing guidance on disaster preparedness and encourage families to create a disaster kit and a disaster plan for their household.

Emerging threats and infectious diseases

Changing temperature and precipitation patterns during the climate crisis affect the "where and when" of infectious diseases, including West Nile, dengue, chikungunya, and Chagas disease.^{81,82} Insect vector ranges are expanding, leading to diseases such as Lyme disease, ehrlichiosis and anaplasmosis at higher latitudes.⁸² Pediatricians can integrate climate discussions with guidance on prevention of vector-borne diseases. For example, if a tick is found on a child, pediatricians can adapt advice based on the local risk of disease – including Lyme disease, Rocky Mountain spotted fever, southern tick-associated rash illness (STARI), anaplasmosis, and ehrlichiosis, among others – in the particular area.

The suitability of U.S. coastal waters for *Vibrio cholera* also has increased—by up to 99% in the Northeast—and outbreaks in shellfish have become more common along the gulf and Atlantic coasts.⁸³

Consuming undercooked, contaminated shellfish, and swimming in brackish waters in the warm months with a scrape in the skin can place children at risk for vibriosis. Warming temperatures have also been associated with more northward incidence of non-cholera *Vibrio* species that cause toxin mediated diarrheal disease.⁸⁴

Algal blooms in recreational waters are increasing and occurring at higher latitudes with contaminated runoff and climate change.⁸⁵ Heavier downpours flush nutrients that feed algae from land, and warmer temperatures spur algal growth. Harmful algal blooms are toxic to aquatic organisms and people who may ingest their toxins.⁸⁶ Toxins also can aerosolize and cause eye irritation, headaches and asthma exacerbations.²⁰

Pediatricians must be prepared to recognize illnesses from these exposures and others and to update their practice with the latest evidence-based recommendations. Pediatricians can monitor public service messages about emerging risks in their area and serve as ambassadors by encouraging families to access these alerts. At well child visits, updated information about local risks can be included with verbal or written anticipatory guidance on outdoor safety.

Climate action in practice management

By striving for more sustainable practice operations, pediatricians can mitigate climate change and improve health today and for future generations. The U.S. health-care sector contributes roughly 10% of U.S. greenhouse gas emissions.⁸⁷ Outpatient clinics use more energy per square foot than most commercial buildings.⁸⁸ Global emissions reduction targets and timelines require rapid transformation to cleaner healthcare delivery.⁸⁹ Practice management strategies that mitigate climate change can also benefit a practice's bottom line. Changing to LED bulbs, installing smart thermostats, and unplugging electronic devices that are not in use are practical first steps. Some practices may be situated in areas where installation of solar panels is feasible or with options to purchase alternative energy, supporting transition of the energy grid. Pediatric practice managers can consider energy commissioning and prioritizing energy efficiency in building renovation and construction.⁹⁰ Pediatricians who work in facilities that serve food can petition for sustainable food sourcing, more vegetarian and plant-based options, and attention to reducing food waste.⁹¹ Alternative commuter programs for staff can be linked to wellness and

burnout prevention while reducing the office's carbon footprint.⁸⁹ Resources from the American College of Physicians and My Green Doctor provide the business case and practical steps for physicians to "green" the office setting.^{92,93}

Telemedicine visits, when clinically appropriate, improve care access for families who have transportation difficulties or live far from clinics while reducing energy use and air pollution. Clinicians newly entering the workforce or changing employers may seek ways to align their personal values with their practice and consider sustainability as part of their job search. Practice-based sustainability initiatives may aid in recruitment and retention while contributing to global efforts to reduce emissions. As an example, over-prescription of medication and non-adherence to prescribed regimens contribute to global carbon emissions and healthcare waste.⁹⁴ Practices may choose quality improvement projects on sustainability topics such as investigating prescribing practices and avoiding unnecessary refills. Finally, practices operating as small businesses should consider disaster insurance to guard against protracted disruptions in operations due to extreme weather events.

The leading role of pediatricians in climate action

The AAP was the first medical organization to put forward a policy statement on climate change.⁹⁵ Pediatricians have been among the first healthcare professionals to express concern about the health effects of climate change and the need to take actions against it. Climate change disproportionately harms children, our patients. We understand the vital importance of prevention and the benefits of establishing good health practices early in life towards ensuring that children achieve their full potential.

The alignment of pediatricians' clinical responsibilities with climate action is clear and compelling. Although the scope of the problem may seem daunting and the actions of any individual practice may appear small, pediatricians have outsized influence on how children, families and communities understand climate change and the urgent need to combat it. Opportunities for engaging patients and families exist during routine

By updating daily practice with the evidence base on child health and climate change, pediatricians can support the health of their patients now and improve the health of the planet and future generations.

well visits and other visits. Thousands of these visits—and opportunities—occur on any given weekday across the US. By updating daily practice with the evidence base on child health and climate change, pediatricians can support the health of their patients now and improve the health of the planet and future generations.

Declaration of Competing Interest

The authors have no conflicts of interest relevant to this article to disclose.

Funding source

No funding was secured for this article.

References

1. American Academy of Pediatrics Council on Environmental Health. Global climate change and children's health. *Pediatrics* 2015;136(5):992–7.
2. Watts N, Amann M, Arnell N. The 2019 report of The Lancet Countdown on health and climate change: ensuring that the health of a child born today is not defined by a changing climate. *Lancet* 2019;394(10211):1836–78.
3. Sheffield PE, Landrigan PJ. Global climate change and children's health: threats and strategies for prevention. *Environ Health Perspect* 2011;119(3):291–8.
4. Levy BS, Patz JA. Climate change, human rights, and social justice. *Ann Glob Health* 2015;81(3):310–22.
5. Gutschow B, Gray B, Ragavan MI, Sheffield PE, Philipsborn RP, 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.
6. Maibach E, Frumkin H, Ahdoot S. Health professionals and the climate crisis: trusted voices, essential roles. *World Med Health Policy* 2021;13(1):137–45.
7. Anderegg WR, Prall JW, Harold J, Schneider SH. Expert credibility in climate change. *Proc Natl Acad Sci U S A* 2010;107(27):12107–9.
8. Intergovernmental Panel on Climate Change, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors,

- J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)). World Meteorological Organization, Geneva, Switzerland, 32 pp.
9. Ebi KL, Balbus JM, Lubet G, Human health. In: Reidmiller DR, Avery CW, Easterling D, et al., eds. Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II. Washington, DC, USA: U.S. Global Change Research Program; 2018:539-571.
10. Salas RN, Solomon CG. The climate crisis — health and care delivery. *N Engl J Med* 2019;381(8):e13.
11. Patz JA, Stull VJ, Limaye VS. A low-carbon future could improve global health and achieve economic benefits. *JAMA* 2020;323(13):1247–8.
12. Kotcher J, Maibach E, Miller J. Views of Health Professionals on Climate Change and Health: A Multinational Survey Study. *The Lancet Planetary health*; 2021.
13. Hagan JG, Shaw JS, Duncan PM. Bright Futures: Guidelines for Health Supervision of Infants, Children, And Adolescents. 4th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2017.
14. Ragavan MI, Marcil LE, Garg A. Climate change as a social determinant of health. *Pediatrics* 2020;145(5):e20193169.
15. Sokol R, Austin A, Chandler C. Screening children for social determinants of health. *Syst Rev* 2019;144(4):e20191622.
16. Hake M, Dewey A, Engelhard E, Strayer M, Dawes S, Summerfelt T, Gundersen C. Feeding America. The impact of coronavirus on food insecurity in 2020 and 2021. 2021. Available at: https://www.feedingamerica.org/sites/default/files/2021-03/National%20Projections%20Brief_3.9.2021_0.pdf. Date accessed: May 5, 2021.
17. Promoting Food Security for All Children. *Pediatrics*. 2015; peds.2015-3301.
18. Olds HT, Corsi SR, Dila DK, Halmo KM, Bootsma MJ, McLellan SL. High levels of sewage contamination released from urban areas after storm events: a quantitative survey with sewage specific bacterial indicators. *PLoS Med* 2018;15(7):e1002614;e1002614.
19. Mosley LM. Drought impacts on the water quality of freshwater systems: review and integration. *Earth-Sci Rev* 2015;140:203–14.
20. Trtanj J, Jantarasami L, Brunkard J, Ch. 6: climate impacts on water-related illness. In: The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment. Washington, DC: U.S. Global Change Research Program; 2016:157–188.
21. Postman A. The truth about tap. NRDC. January 5, 2016. <https://www.nrdc.org/stories/truth-about-tap>. Accessed June 3, 2021.
22. Food and Drug Administration. Investigation of acute non-viral hepatitis illnesses — “Real Water” brand alkaline water (March 2021). March 16, 2021. Updated June 1, 2021. <https://www.fda.gov/food/outbreaks-foodborne-illness/investigation-acute-non-viral-hepatitis-illnesses-real-water-brand-alkaline-water-march-2021>. Accessed May 5, 2021.
23. Centers for Disease Control and Prevention. Drinking Water. Updated November 23, 2020. <https://www.cdc.gov/healthy-water/drinking/index.html>. Accessed May 5, 2021.
24. Hernández D. “Extra Oomph:” addressing housing disparities through medical legal partnership interventions. *Hous Stud* 2016;31(7):871–90.
25. Office of Energy Efficiency and Renewable Energy. About the Weatherization Assistance Program. <https://www.energy.gov/eere/wap/about-weatherization-assistance-program>. Accessed June 5, 2020.
26. Tonn B, Rose E, Hawkins B. Evaluation of the U.S. department of energy’s weatherization assistance program: impact results. *Energy Policy* 2018;118:279–90.
27. Brown MA, Soni A, Lapsa MV, Southworth K, Cox M. High energy burden and low-income energy affordability: conclusions from a literature review. 2020.
28. Hernández D, Aratani Y, Jiang Y. Energy Insecurity Among Families with Children. New York: National Center for Children in Poverty. Columbia University Mailman School of Public Health; 2014.
29. Bryan W, Kelley M. Energy insecurity fundamentals for the Southeast. Atlanta: SEEA; 2021. Available at: <https://www.seealliance.org/initiatives/energy-insecurity/>. Accessed March 3, 2021.
30. Wein O, Charlie H. Protecting seriously ill consumers from utility disconnections: what sates can do to save lives now. *Boston: NCLC* 2021;February 24Available at: <https://www.nclc.org/issues/energy-utilities-a-communications/protecting-seriously-ill-consumers-from-utility-disconnections.html>. Accessed May 7, 2021.
31. Barkin JL, Buoli M, Curry CL. Effects of extreme weather events on child mood and behavior. *Developmental medicine and child neurology*. 2021.
32. Seddighi H, Salmani I, Javadi MH, Seddighi S. Child abuse in natural disasters and conflicts: a systematic review. *Trauma Violence Abuse* 2021;22(1):176–85.
33. Cianconi P, Betrò S, Janiri L. The impact of climate change on mental health: a systematic descriptive review. *Front Psychiatry* 2020;11:74.
34. Kar N. Psychological impact of disasters on children: review of assessment and interventions. *World J Pediatr WJP* 2009;5(1):5–11.
35. Thompson R, Hornigold R, Page L, Waite T. Associations between high ambient temperatures and heat waves with mental health outcomes: a systematic review. *Public Health* 2018;161:171–91.
36. Wu J, Snell G, Samji H. Climate anxiety in young people: a call to action. *Lancet Planet Health* 2020;4(10):e435–6.
37. Earls MF, Yogman MW, Mattson G, Rafferty J. Committee on psychosocial aspects of child and family health. incorporating recognition and management of perinatal depression into pediatric practice. *Pediatrics* 2019;143(1):e20183259.
38. Zuckerbrot RA, Cheung A, Jensen PS, Stein REK, Laraque D. Guidelines for adolescent depression in primary care (GLAD-PC): Part I. *Pract Prep Identif Assess Initial Manag* 2018;141(3):e20174081.
39. Kids Count Data Center. Linguistic isolation still a challenge for some kids in immigrant families. Baltimore: Annie E Casey Foundation; 2017. Available at: <https://datacenter.kids-count.org/updates/show/150-linguistic-isolation-still-a-challenge>. Accessed May 5, 2021.
40. Nepal V, Banerjee D, Perry M, Scott D. Disaster preparedness of linguistically isolated populations: practical issues for planners. *Health Promot Pract* 2012;13(2):265–71.

41. Uddin R, Philipsborn RP, Smith D, Mutic A, Thompson L. A Global Perspective for Local Pediatric Providers: Extreme Weather, Migration, and Child Mental Health. *Current Problems in Pediatric and Adolescent Health Care*; 2021.
42. Hawken P, Wilkinson K, Frischmann C, Drawdown: the most comprehensive plan ever proposed to reverse global warming. 2017. Solutions available online at: <https://drawdown.org/solutions/table-of-solutions>.
43. Willett W, Rockstrom J, Loken B. Food in the Anthropocene: the EAT-Lancet Commission on healthy diets from sustainable food systems. *Lancet* 2019;393(10170):447–92.
44. Clark M, Macdiarmid J, Jones AD, Ranganathan J, Herrero M, Fanzo J. The role of healthy diets in environmentally sustainable food systems. *Food Nutr Bull* 2020;41:31s–58s: (2_suppl).
45. Bouvard V, Loomis D, Guyton KZ. Carcinogenicity of consumption of red and processed meat. *Lancet Oncol* 2015;16(16):1599–600.
46. Zheng Y, Li Y, Satija A. Association of changes in red meat consumption with total and cause specific mortality among US women and men: two prospective cohort studies. *BMJ* 2019;365:12110.
47. Springmann M, Godfray HC, Rayner M, Scarborough P. Analysis and valuation of the health and climate change cobenefits of dietary change. *Proc Natl Acad Sci U S A*. 2016;113(15):4146–51.
48. Rockler BE, Grutzmacher S, Smit E, Notarianni M. Participant perceptions of the double up food bucks program at Oregon farmers' markets. *J Nutr Educ Behav* 2020;52(11):1043–51.
49. American Academy of Pediatrics Section on Breastfeeding. Breastfeeding and the use of human milk. *Pediatrics* 2012;129(3):e827–41.
50. Karlsson JO, Garnett T, Rollins NC, Rööös E. The carbon footprint of breast milk substitutes in comparison with breastfeeding. *J Clean Prod* 2019;222:436–45.
51. Lobelo F, Muth ND, Hanson S, Nemeth BA. American academy of pediatrics council on sports medicine and fitness; section on obesity. Physical activity assessment and counseling in pediatric clinical settings. *Pediatrics* 2020;145(3):e20193992.
52. U.S. Environmental Protection gency. What if we kept our cars parked for trips less than one mile? 2015. <https://www.epa.gov/greenvehicles/what-if-we-kept-our-cars-parked-trips-less-one-mile>. Accessed: June 4, 2020.
53. Young DR, Cradock AL, Eyler AA. 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):e167–83.
54. McDonald RI, Biswas T, Sachar C. The tree cover and temperature disparity in US urbanized areas: quantifying the association with income across 5,723 communities. *PLoS ONE* 2021;16(4):e0249715.
55. U.S. Environmental Protection Agency. Heat island effect. <https://www.epa.gov/heatislands>. Updated May 26, 2021. Accessed May 28, 2021.
56. Strife S, Downey L. Childhood development and access to nature: a new direction for environmental inequality research. *Org Environ* 2009;22(1):99–122.
57. Hahn ER. The developmental roots of environmental stewardship: childhood and the climate change crisis. *Curr Opin Psychol* 2021;42:19–24.
58. Stanley SK, Hogg TL, Leviston Z, Walker I. From anger to action: differential impacts of eco-anxiety, eco-depression, and eco-anger on climate action and wellbeing. *J Clim Change Health* 2021;1:100003.
59. Sanson AV, Van Hoorn J, Burke SEL. Responding to the Impacts of the climate crisis on children and youth. *Child Dev Perspect* 2019;13(4):201–207.
60. Centers for Disease Control and Prevention. Most recent national asthma data. 2019 National Health Interview Survey (NHIS). Updated March 31, 2021. https://www.cdc.gov/asthma/most_recent_national_asthma_data.htm. Accessed June 4, 2021.
61. Anenberg SC, Henze DK, Tinney V. Estimates of the Global Burden of Ambient PM_{2.5}, Ozone, and NO₂ on Asthma Incidence and Emergency Room Visits. *Environ Health Perspect* 2018;126(10):107004.
62. Soneja S, Jiang C, Fisher J, Upperman CR, Mitchell C, Sapkota A. Exposure to extreme heat and precipitation events associated with increased risk of hospitalization for asthma in Maryland, U.S.A. *Environ Health* 2016;15(1):57.
63. Gilmour MI, Jaakkola MS, London SJ, Nel AE, Rogers CA. How exposure to environmental tobacco smoke, outdoor air pollutants, and increased pollen burdens influences the incidence of asthma. *Environ Health Perspect* 2006;114(4):627–633.
64. Holm SM, Miller MD, Balmes JR. Health effects of wildfire smoke in children and public health tools: a narrative review. *J Exposure Sci Environ Epidemiol* 2021;31(1):1–20.
65. Ziska LH. An overview of rising CO₂ and climatic change on aeroallergens and allergic diseases. *Allergy Asthma Immunol Res* 2020;12(5):771–82.
66. Karvonen AM, Hyvärinen A, Korppi M. Moisture damage and asthma: a birth cohort study. *Pediatrics* 2015;135(3):e598–606.
67. Li L, Lin GZ, Liu HZ, Guo Y, Ou CQ, Chen PY. Can the air pollution index be used to communicate the health risks of air pollution? *Environ Pollut* 2015;205:153–60:Barking, Essex: 1987.
68. Hipper TJ, Davis R, Massey PM. The disaster information needs of families of children with special healthcare needs: a scoping review. *Health Secur* 2018;16(3):178–92.
69. Bergeron MF. Training and competing in the heat in youth sports: no sweat? *Br J Sports Med* 2015;49(13):837–9.
70. Basu R, Ostro BD. A multicounty analysis identifying the populations vulnerable to mortality associated with high ambient temperature in California. *Am J Epidemiol* 2008;168(6):632–7.
71. 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.
72. Bar-Or O, Dotan R, Inbar O, Rotshtein A, Zonder H. Voluntary hypohydration in 10- to 12-year-old boys. *J Appl Physiol* 1980;48(1):104–8.
73. Smith CJ. Pediatric thermoregulation: considerations in the face of global climate change. *Nutrients* 2019;11(9):2010.
74. American Academy of Pediatrics Committee on School Health, Bergeron MF, Devore C, Rice SG. Policy statement—

- climatic heat stress and exercising children and adolescents. *Pediatrics* 2011;128(3):e741–7.
75. Groot E, Abelsohn A, Moore K. Practical strategies for prevention and treatment of heat-induced illness. *Can Fam Phys* 2014;60(8):729.–e394.
 76. Westaway K, Frank O, Husband A. Medicines can affect thermoregulation and accentuate the risk of dehydration and heat-related illness during hot weather. *J Clin Pharm Ther* 2015;40(4):363–367.
 77. Jhun I, Mata DA, Nordio F, Lee M, Schwartz J, Zanolotti A. Ambient temperature and sudden infant death syndrome in the United States. *Epidemiology* 2017;28(5):728–34.(Cambridge, Mass).
 78. American Academy of Pediatrics Council on Environmental Health, Section on Dermatology, Balk SJ. Ultraviolet radiation: a hazard to children and adolescents. *Pediatrics* 2011;127(3):588.
 79. NOAA National Centers for Environmental Information (NCEI). U.S. 2020 Billion-dollar weather and climate disasters (2021). <https://www.ncdc.noaa.gov/billions/>. Accessed May 7, 2021.
 80. American Academy of Pediatrics Disaster Preparedness Advisory Council. Committee on pediatric emergency medicine. Ensuring the health of children in disasters. *Pediatrics*. 2015;136(5):e1407–17.
 81. Garza M, Feria Arroyo TP, Casillas EA, Sanchez-Cordero V, Rivaldi CL, Sarkar S. Projected future distributions of vectors of *Trypanosoma cruzi* in North America under climate change scenarios. *PLoS Negl Trop Dis* 2014;8(5):e2818.
 82. Beard CB, Eisen RJ, Barker CM. Ch. 5: Vectorborne Diseases. In: *The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment*. Washington, DC: U.S.: Global Change Research Program; 2016. p. 129–56.
 83. Lancet Countdown LCoHaCCPBftUSoASR, Lester PK, Hess JJ. Lancet Countdown U.S. Policy Brief, Lancet Countdown LCoHaCCPBftUSoASR, London, United Kingdom.
 84. Baker-Austin C, Trinanes J, Gonzalez-Escalona N, Martinez-Urtaza J. Non-cholera vibrios: The microbial barometer of climate change. *Trends Microbiol* 2017;25(1):76–84.
 85. Gobler CJ, Doherty OM, Hattenrath-Lehmann TK, Griffith AW, Kang Y, Litaker RW. Ocean warming since 1982 has expanded the niche of toxic algal blooms in the North Atlantic and North Pacific oceans. *PNAS* 2017;114(19):4975–80.
 86. Weirich CA, Miller TR. Freshwater harmful algal blooms: toxins and children's health. *Curr Probl Pediatr Adolesc Health Care* 2014;44(1):2–24.
 87. Eckelman MJ, Sherman J. Environmental impacts of the U.S. health care system and effects on public health. *PLoS ONE* 2016;11(6):e0157014.
 88. U.S. Energy Information Administration. 2012 Commercial buildings energy consumption survey: energy usage summary. March 18, 2016. Available at: <https://www.eia.gov/consumption/commercial/reports/2012/energyusage/index.php>. Accessed May 28, 2021.
 89. Karliner JRS, Boyd R, Ashby B, Steele K. Global road map for health care decarbonization. Healthcare Without Harm. April 2021. Available at: <https://healthcareclimateaction.org/roadmap>. Accessed May 7, 2021.
 90. EnergyStar. Energy star building upgrade manual chapter 5: retro commissioning. 2007. Available at: <https://www.energystar.gov/buildings/tools-and-resources/energy-star-building-upgrade-manual-chapter-5-retrocommissioning>. Accessed May 31, 2021.
 91. American Academy of Pediatrics Council on Environmental Health. Green offices and practice sustainability. In: *Pediatric Environmental Health*, 4th Edition. Itasca, IL: American Academy of Pediatrics, 2019, pages 1053–1066.
 92. My Green Doctor. <https://mygreendoctor.org/>. Accessed June 5, 2020.
 93. American College of Physicians. Climate change toolkit. <https://www.acponline.org/advocacy/advocacy-in-action/climate-change-toolkit>. Accessed May 26, 2021.
 94. Richie C. Environmental sustainability and the carbon emissions of pharmaceuticals. *J Med Ethics* 2021. <https://doi.org/10.1136/medethics-2020-106842>.
 95. American Academy of Pediatrics Committee on Environmental Health. Global climate change and children's health. *Pediatrics* 2007;120(5):1149–52.
 96. Maurer DM, Raymond TJ, Davis BN. Depression: screening and diagnosis. *Am Fam Phys* 2018;98(8):508–15.
 97. Carlsten C, Salvi S, Wong GWK, Chung KF. Personal strategies to minimize effects of air pollution on respiratory health: advice for providers, patients and the public. *Eur Resp J* 2020;55(6):1902056.