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Curriculum Development Participant Statement

Climate Change and Global Child Health in the Pediatric Global Health Track Resident Curriculum

August 2018

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Unsustainable use of resources propelling global climate change will have profound impacts on future generations. Climate change is already affecting global child health. For some children, climate-driven environmental exposures will have life-long negative consequences on their physiology and development, health and well-being. Pediatricians are wired to care for children with most of us wishing for and working long hours towards the best possible health outcomes and future life for every child we see. Yet few of us discuss the implications of climate change on the health of our patients – even though the data are increasingly clear and we are increasingly seeing and feeling its impacts. At stake is the very future that our generation will leave our patients.

I applied to the Piedmont Project with the hope of creating a curriculum around Disaster Preparedness for my global health track pediatric residents. I co-direct the pediatric residency global health track and teach 10-12 residents over 3 years on essential topics of global child health in quarterly half-day sessions. Given the increasing frequency and intensity of natural disasters due to climate change and the relative lack of disaster preparedness education in medical school and residency, as well as the lack of inclusion of residents – those doctors staffing hospitals at all hours – in preparedness plans, I wanted residents to be prepared. I wanted them to know what to do if they should be confronted with the need to care for children in the wake of a disaster and to serve as advocates for inclusion of child-specific needs in disasters preparedness activities. I struggled with how to teach residents about sustainability—how to get them to value sustainability--when they are living and working in a recognizably unsustainable time of their lives as medical trainees. I thought that disaster preparedness might be the most direct connection between climate change as the greatest global health threat of our time and their three year apprenticeship in the practice of clinical medicine.

As I researched and worked on the syllabus, though, more obvious links between our global health track residents’ required knowledge-base and climate change emerged. I could not find many example curricula or programs on teaching medical residents concepts of climate change, but I did find a piece by Bell et al on the concept of teaching “adaptive expertise” that resonated.1 “Sustainability” as a theme became not just an antithesis to residents’ practice of medicine at this time in their lives, but about our shared pediatric patients, intergenerational justice, and adapting the practice of medicine to future climate scenarios. The result is four modules rather than one, with each as a starting point of what I hope will continue to evolve: Climate Change and Global Child Health in the Pediatric Global Health Track Resident Curriculum.

1 Bell, E., G. Horton, G. Blashki and B. Seidel. “Climate change: could it help develop ‘adaptive expertise’? *Adv Health Sci Educ.* 2012; 17:211-224.

**Climate Change and Global Child Health in the Pediatric Global Health Track Resident Curriculum**

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Through these modules integrated into quarterly half-day sessions over the three years of residency, pediatric residents will study the impacts of climate change on global child health in 4 key domains and will demonstrate ability to adapt their medical practice to our changing environment. Domains: Changing patterns of infectious diseases, increasing natural disasters and disaster preparedness, air pollution and respiratory illness, and scarcity of natural resources such as food and water.

Figure 1: Domains of Environmental Change and their Impact of Global Child Health discussed in this curriculum for Global Health of Pediatrics at Emory (GHOPE) residents.

At the conclusion of these modules, pediatric residents will be able to:

* Describe the impact of climate change on global child health
* Elicit environmental determinants of health routinely in patient encounters and integrate knowledge of environmental risk factors in guidance to patients
* Represent the health interests of children in social justice and intergenerational justice issues at stake in climate change discussions
* Identify and be prepared to collaborate with stakeholders in global child health from academia, public and private sectors, non-governmental organizations, foundations and the community
* Advocate from institutional to global levels to incorporate sustainable practices in the provision of healthcare and to reduce carbon emissions in order to mitigate the effects of climate change

**Introduction**

Warm-up: Based on the warm-up exercise during the Piedmont Project Faculty Workshop, participants will answer the question, “Where are you from?” and explore the different meanings of place as coordinates, history, geography; its relationship to people as environment, exposure and sustenance.

Introductory lecture on climate change and the multifaceted impact of climate change on child health.

Resources and Readings: Philipsborn, R. and K. Chan. “Climate Change and Global Child Health.” *Pediatrics*. 2018;141(6):e20173774.

**Changing patterns of infectious and vector-borne diseases**

Theme: Climate change will change patterns of infectious illnesses, disease emergence, and ranges of vector-borne diseases. In their clinical practice, pediatricians must be able to adapt a place-based approach—incorporating local environmental and social context--to changing patterns of infection.

GHOPE Curriculum Synergies: Emerging infections, Parasitic diseases, Diarrheal diseases

Session Goals and Objectives:

* In assessing patient signs and symptoms:
  + (1) adapt differential diagnosis and treatment plan to different geographies
  + (2) contextualize patient encounters and barriers to care locally
* Identify and analyze up-to-date available resources to adapt reasoning and clinical practice under future possible scenarios of climate change

Description of Activities:

1. Small group exercise: Students will divide into 4 groups. Each group will be assigned a location – Southeast United States, Tanzania, Ethiopia, and Brazil (with the overseas locations representing our global health track’s primary rotation sites). Each group will be given a case of an ill child with the same non-specific presenting symptoms and asked to develop a differential diagnosis and first step in management of this child based on just these symptoms and geographic location.

*Case: A 2 year old presents to your health facility with fever for 2 days, fast breathing, vomiting, abdominal pain, not wanting to eat or drink, and not as active as usual.*

1. Large group discussion and applications to practice: Afterwards, the group will come together to discuss each group’s different possible etiologies based on place. We will review the projected impacts of climate change on some of the included climate-sensitive infections and how place-specific differential diagnoses will change over time even within the same geography because of climate change. We will discuss impact of place – where patients are from – on patient health and on our encounters overseas and locally.
2. Case study of *Aedes albopictus*: The group will review the diseases attributable to vector *Aedes albopictus* as well as map the range changes of this vector anticipated due to climate change. This exercise will anchor our discussion on the importance of adaptive clinical reasoning skills and tailored patient counseling in the face of future environmental conditions.

Resources and Readings:

Smith, K.R., A.Woodward, D. Campbell-Lendrum, D.D. Chadee, Y. Honda, Q. Liu, J.M. Olwoch, B. Revich, and R. Sauerborn, 2014: Human health: impacts, adaptation, and co-benefits. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel,A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L.White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 709-754. <http://www.ipcc.ch/ipccreports/tar/wg2/index.php?idp=347>

Wudel, B. and E. Shadabi. A short review of the literature on the effects of climate change on mosquito-borne illnesses in Canada. *NCCID.* September 2016.

<https://nccid.ca/wp-content/uploads/sites/2/2016/07/RapidReviewClimateMosquito-EN.pdf>

CDC Current Outbreak List: <https://www.cdc.gov/outbreaks/index.html>

**Increasing natural disasters**

Theme: Natural disasters are increasing in frequency and intensity due to climate change. Pediatricians must understand risks to children from natural disasters, be prepared to participate in disaster response efforts, and advocate for inclusion of the needs of children in disaster preparedness plans.

GHOPE Curriculum Synergies: Humanitarian response, Care of refugee and immigrant patients

Session Goals and Objectives

* Illustrate the special needs of children throughout the disaster preparedness cycle
* Advocate for inclusion of children’s needs in disaster preparedness plans
* Triage children in a disaster scenario in the field and in evacuation of a hospital scenarios
* Identify components of and work within the basic structure of public health response to disasters

Description of Activities

Chalk talk: Brainstorm the different factors that place children at-risk in the setting of a disaster. (Exposure risk and social factors). Overview of the disaster preparedness cycle: Preparedness, Response, Recovery, Mitigation. What happens at each stage?

Scenario-based learning:

1. Field triage after an earthquake. Residents will learn the JumpSTART algorithm for triaging child victims of a natural disaster and practice this triage method in a role-play exercise. Mock scenario: Westown, USA has just been struck by an earthquake measuring 8 on the Richter scale. You are part of an on-scene response crew triaging child victims of the earthquake. Apply the JumpSTART method of triaging mock victims. (Residents will triage each other based on cards representing different pediatric patients).
2. Evacuation of the hospital. Watch a [brief video](https://www.youtube.com/watch?v=Ruawci7YoFA) of the evacuation of the NICU at NYU during Hurricane Sandy. Mock scenario: Atlanta has been confronted with high winds and torrential rains from Hurricane Mirma. Generators at your hospital have failed overnight and the condition is deemed no longer safe for patients. Plan for the safe evacuation of your unit. (Residents will be given a sign-out list of patients to consider in their evacuation plans and will work in groups of 2).
3. Integration of Pediatrics and Public Health Disaster Response to pandemic cholera. Loosely based on 2007 Zimbabwe Cholera Outbreak that resulted 98,592 cases. Scenario: Your health center (on the outskirts of a large city in a country in Sub-Saharan Africa) has seen a spike in cases of cholera in the wake of heavy flooding, government turmoil and failing water, sanitation and hygiene infrastructure. How and when will you report this outbreak? What organizations will be involved in this disaster response? What are the special needs of children? How do social and government structures modulate impacts of infection? What are the implications for projected changing patterns of infection and emerging infections as discussed in Module 1?

Resources and Readings:

ABC News. “Hurricane Sandy: Power Outage Forces NYU Hospital Evacuation.” Video clip. *YouTube.* 30 Oct 2012. <https://www.youtube.com/watch?v=Ruawci7YoFA>

“Ensuring the Health of Children in Disasters.” Disaster Preparedness Advisory Council and the Committee on Pediatric Emergency Medicine. Pediatrics. 2015; 136(5):e1407-e1417.

AAP/Children and Disasters: <https://www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/Children-and-Disasters/Pages/default.aspx>

JumpSTART Pediatric Triage Algorithm: <https://chemm.nlm.nih.gov/startpediatric.htm>

Esperita, M., U. Patil, H. Cruz, et al. “Evacuation of a Neonatal Intensive Care Unit in a Disaster: Lessons Learned from Hurricane Sandy.” *Pediatrics.* 2014;134(6):1-9.

Zimbabwe Case study: WHO Regional Office for Africa. From a crisis response to institutional capacity building: Experiences from Zimbabwe on cholera outbreak. 2013. <https://www.afro.who.int/sites/default/files/2018-02/Zimbabwe%20case%20study.pdf>

WHO Emergency Response Framework Reference: <http://www.who.int/hac/about/erf_.pdf>

**Air quality and respiratory health**

Theme: Increased emissions and air pollution that are causing global climate change and elevated ambient temperatures have life-long negative consequences on pulmonary health in children, including decreasing expected total lung volumes and increasing frequency of asthma exacerbations. Pediatricians must be aware of environmental science to guide asthma education and advocate for healthier built environments as well as climate change mitigation activities.

Curriculum Synergies: Respiratory infections in global health, Pediatric Resident Community Rotation

Session Goals and Objectives

* Summarize the interactions between air pollutants, temperature, and the short and long-term respiratory health of children
* Map particulate matter concentrations globally and discuss concepts of intergenerational and social justice
* Apply evidence-based medicine principles in critical review of the article by O’Lennick et al.
* Adapt an asthma action plan and associated guidance based on Environmental Protection Agency (EPA) air index/air quality alerts
* Adjunct community rotation activity: Integrate principles of urban design to re-envision the built environment of patients’ neighborhood, addressing concepts of green space, heat islands, and waste management

Description of Activities

Overview presentation: Review greenhouse gases, the greenhouse effect, and a review of the evidence on the impact of air pollution and temperature on child asthma exacerbations as well as the long term respiratory health of children.

Evidence-based medicine journal club: Resident-led discussion of the methods of research and findings of the O’Lennick article to better understand the impact between ozone, temperature, respiratory illness and socioeconomic status.

Application exercise: Apply knowledge on impact of poor air quality on child pulmonary health to adapt a standard asthma action plan and your own routine asthma guidance to incorporate evidence on air quality and daily air quality alerts.

Ethics jigsaw discussion – Three groups will review maps of (1) emissions by country (2) projected impacts of climate change by country (Patz 2007), and (3) Global air pollution (WHO 2017) and then present findings to the group. As a larger group, discuss social justice and intergenerational justice implications of these data. What is the role of pediatricians in addressing climate-associated health disparities? How can pediatricians bring attention to these issues? How can pediatricians advocate for change?

Adjunct activity on Community Rotation: Watch [Howard Frumkin Ted Talk](https://www.youtube.com/watch?v=UfmR0LPfBX8) on healthy human habitats. As part of the community rotation exercise, visit a patient’s neighborhood taking stock of the streetscape, surrounding greenspace, available stores, parking lots, landfills, etc. Re-imagine (draw or write-up a description of) an intersection or section of street. Describe specific improvements that you would make to the built environment and ways that these changes would impact the health of community members.

Resources and Readings:

Frumkin, Howard. “Healthy Human Habitats.” TEDxRanier. Dec. 2012. Lecture. <https://www.youtube.com/watch?v=UfmR0LPfBX8>

O’Lennick, C.R., H. Chang, M. Kramer, et al. “Ozone and childhood respiratory disease in three US cities: evaluation of effect measure modification by neighborhood socioeconomic status using a Bayesian hierarchical approach.” *Environmental Health.* 2017;(16)36:1-15. <https://ehjournal.biomedcentral.com/track/pdf/10.1186/s12940-017-0244-2>

Patz JA, Gibbs HK, Foley JA, Rogers JV, Smith KR. Climate change and global health: quantifying a growing ethical crisis. EcoHealth. 2007;4:397–405.

WHO. 10 Years in Public Health, 2007-2017. Global air pollution and air quality map: <http://www.who.int/publications/10-year-review/health-guardian/en/index1.html>

From the Ashes film: <https://www.fromtheashesfilm.com/>

**Scarcity of basic natural resources, food and water insecurity**

Theme: Climate change is increasing the intensity of droughts and floods, stressing water supply and agricultural systems, contributing to food and water insecurity and associated childhood illnesses and mortality. Pediatricians must understand the risks of illness and death from scarcity of basic resources in a changing climate in order to advocate for global child health.

Curriculum Synergies: Malnutrition, Global Child Health and Mortality, Care of Refugee and Immigrant Patients

Session Goals and Objectives

* Review the contribution of malnutrition to global child mortality in the context of expected impacts due to climate change
* Connect environmental pressures including scarcity of basic natural resources, conflict, and migration with implications for global child health

Description of Activities

Warm-up: Apply principles of “Ox-fam banquet” to lunch – food distributed to class to reflect global diet and socioeconomic status. Add concept of inadequate access to clean water (about 1/3), water scarcity (about 2/5) and discuss access to sanitation and hygiene infrastructure by appropriate percentages.

Refresh: Review pie chart of global child mortality and contribution of malnutrition to under 5 causes of death (Liu, et al). Review the expect impacts of climate change on malnutrition, food insecurity, and water availability. Which causes of global child death will these impact? Where will these impacts be felt most profoundly?

Scenario-based learning: Pastoralist and farmers in West Africa face a changing climate. Break into 2 groups. One group will represent pastoralists in the Sahel region of West Africa and the other group will represent agriculturalists. Group members will research the projected impacts of climate change to their own life and livelihood and present back to the class. What are the impacts of climate change on each group’s way of life? On the place that each group inhabits and interactions? Are there potential similar examples of impacts of environmental change on life, livelihoods, and migration in other areas of the world? How do you design interventions to reach children in these settings?

Resources and Readings:

Oxfam Banquet: <https://www.oxfamamerica.org/take-action/events/oxfam-hunger-banquet/>

Liu, L. et al. “Global, regional, and national causes of under-5 mortality in 2000–15: an updated systematic analysis with implications for the Sustainable Development Goals.” *The Lancet.* 2016;(388)10063:P3027-P3035.

WFP Climate Change Impact of Food Security: <https://www.wfp.org/climate-change/climate-impacts>

United Nations Global Issues, Water: <http://www.un.org/en/sections/issues-depth/water/>

FAO Climate Change and Food Security Modules: <http://www.fao.org/elearning/course/FCC/EN/pdf/learnernotes0854.pdf>

**Areas for future development**

Study the contribution of the healthcare sector to global emissions contributing to climate change and strategies for the sustainable practice of medicine, including resource consumption and waste management at the hospital level. What are strategies to incorporate sustainable practices in day-to-day activities in the hospital or clinic setting?

Healthcare and the media: How does public perception of child health impacts due to environmental change match up with scientific evidence? What are factors contributing to similarities and differences? How can providers effectively communicate within this framework?

Community rotation: Further explore local services and consumption of basic natural resources: food, water, waste-water, waste, and energy. What is sustainable and what is not sustainable about these practices, and how do these effect the health of our pediatric patients? Review the contributions of the food sector, food waste and the cold chain to global climate change and emissions. Work with local food and farm-to-school movement opportunities for improved child nutrition, health, well-being and education as well as sustainable food sourcing.

Adapt the hospital evacuation exercise to our local hospital’s disaster preparedness plan.