CASE WESTERN RESERVE UNIVERSITY
Schubert Center for Child Studies

Climate Change, Environmental Justice and Maternal and Child Health in Greater Cleveland

Introduction

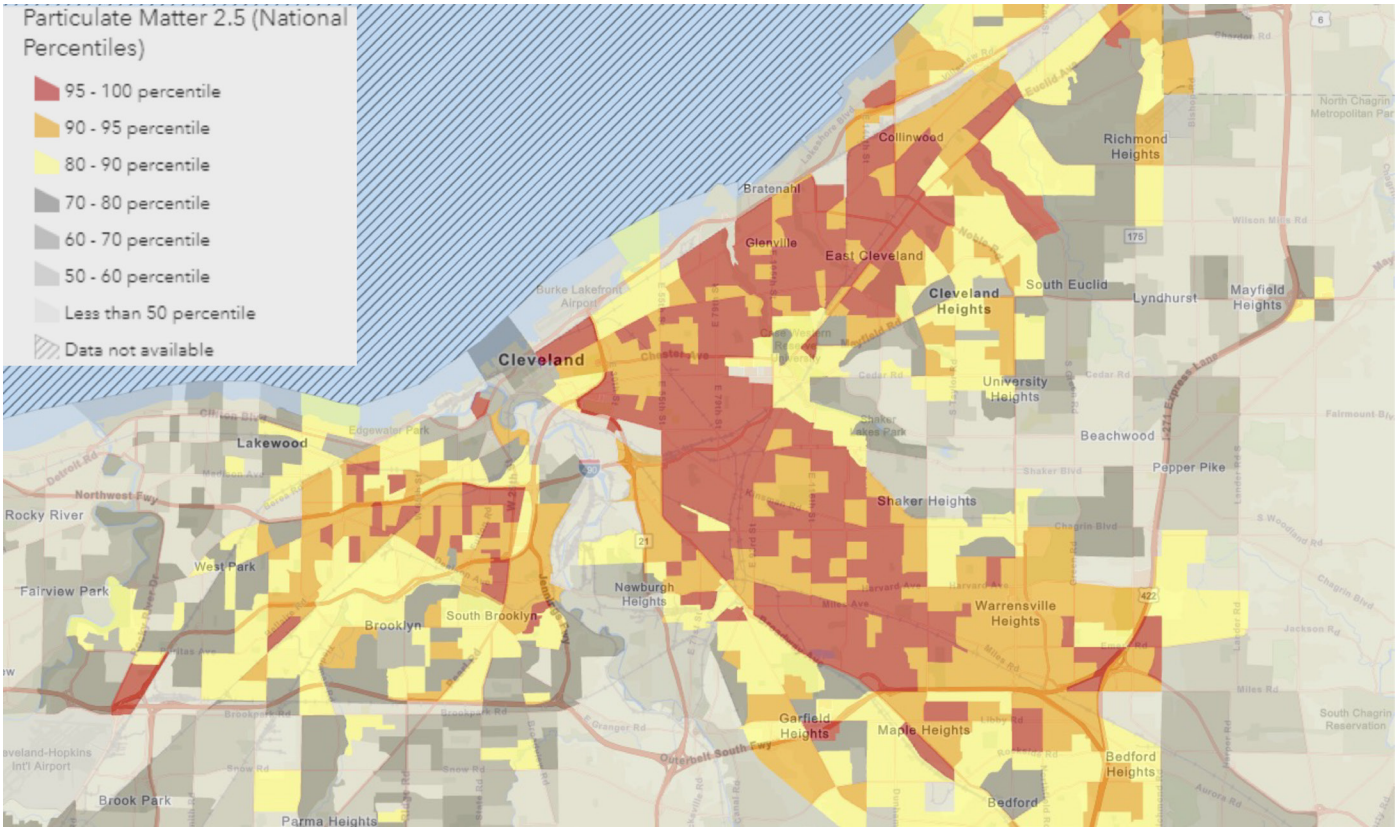
Health threats due to climate change interact with and exacerbate social and environmental drivers of health, contributing to health disparities. These health harms endanger us all, but pregnant women and young children are among the most vulnerable. Over 80% of the global burden of disease related to climate change is borne by children under 5 years old.[1] Historical discrimination and other injustices have led to health disparities[a], and Black and brown women and children disproportionately live in communities with toxic exposures and environmental threats and fewer opportunities for well-being. As an older rust-belt city with aging infrastructure and a legacy of disinvestment in red-lined neighborhoods, Cleveland's built environment[b] and its changing natural environment contributes to increased health disparities among women and children. Improving Cleveland's built environment to combat worsening climate conditions can contribute to lessening these disparities. This brief highlights how pregnant women and young children are uniquely vulnerable to environmental threats, the nature of these threats in the natural and built environments locally and the value of a cross-sector environmental justice[c] policy agenda to better ensure maternal and early child health and wellness. It will take collective action – engaging healthcare workers, policymakers, city planners, public health, social workers, neighborhood and housing partners, and community leaders – to make a meaningful and lasting change now and for future generations.

I. Pregnant Women and Young Children are Uniquely Vulnerable to Climate Change & Environmental Threats[2]

Pregnancy and early childhood include critical periods of growth and development, causing exceptional sensitivity to environmental exposures.[3] Exposure to environmental hazards during these periods can lead to physical and mental health effects. Environmental chemical exposures, whether through inhalation, ingestion, or absorption, during the prenatal period, are associated with neurodevelopmental consequences, future fertility problems, and later incidence of cancer in the child.[4] Exposure to excessive heat during pregnancy is associated with pre-term birth and low birth weight and exposure to air pollution during this time has also been linked to preterm birth, asthma, and neurodevelopmental changes.[5] Some studies also link exposure to pollution during pregnancy to post-partum depression.[6] The prenatal period is also a period of vulnerability to pathogens. For example, maternal infection with Zika virus during pregnancy has been associated with brain and eye defects in the developing fetus[7] and some foodborne illnesses during pregnancy can cause miscarriage, premature delivery, stillbirth, or death of the mother.[8]

a. The USHHS defines health disparities as "a particular type of health difference that is closely linked with social, economic, and/or environmental disadvantage. Health disparities adversely affect groups of people who have systematically experienced greater obstacles to health based on their racial or ethnic group; religion; socioeconomic status; gender; age; mental health; cognitive, sensory, or physical disability; sexual orientation or gender identity; geographic location; or other characteristics historically linked to discrimination or exclusion."
b. The USEPA define the built environment as touching "all aspects of our lives, encompassing the buildings we live in, the distribution systems that provide us with water and electricity, and the roads, bridges, and transportation systems we use to get from place to place. It can generally be described as the man-made or modified structures that provide people with living, working, and recreational spaces."
c. The USEPA define Environmental Justice as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. This goal will be achieved when everyone enjoys: 1) The same degree of protection from environmental and health hazards, and 2) Equal access to the decision-making process to have a healthy environment in which to live, learn, and work."

NATIONAL CENSUS BLOCK RANKINGS FOR PM 2.5 POLLUTION IN GREATER CLEVELAND



Screenshot from the EPA's EJScreen tool showing PM 2.5 pollution exposure by census block in the Cleveland area. The bright red areas are among the top 5% of census blocks nationally for PM2.5 exposure. https://ejscreen.epa.gov/mapper/

Even after birth, young children are also especially vulnerable to environmental threats due to immature immune systems and increased toxic exposures.[2,3] Children breathe more air relative to their body weight and breathe faster than adults. This means that they breathe in more pollutants and allergens from their surroundings than adults do, and this has consequences for their future health through damage to lung function and negative impact on neurodevelopment.[2,9] Children also have increased exposures from spending time on or near the ground and putting their hands in their mouths.[2,9]

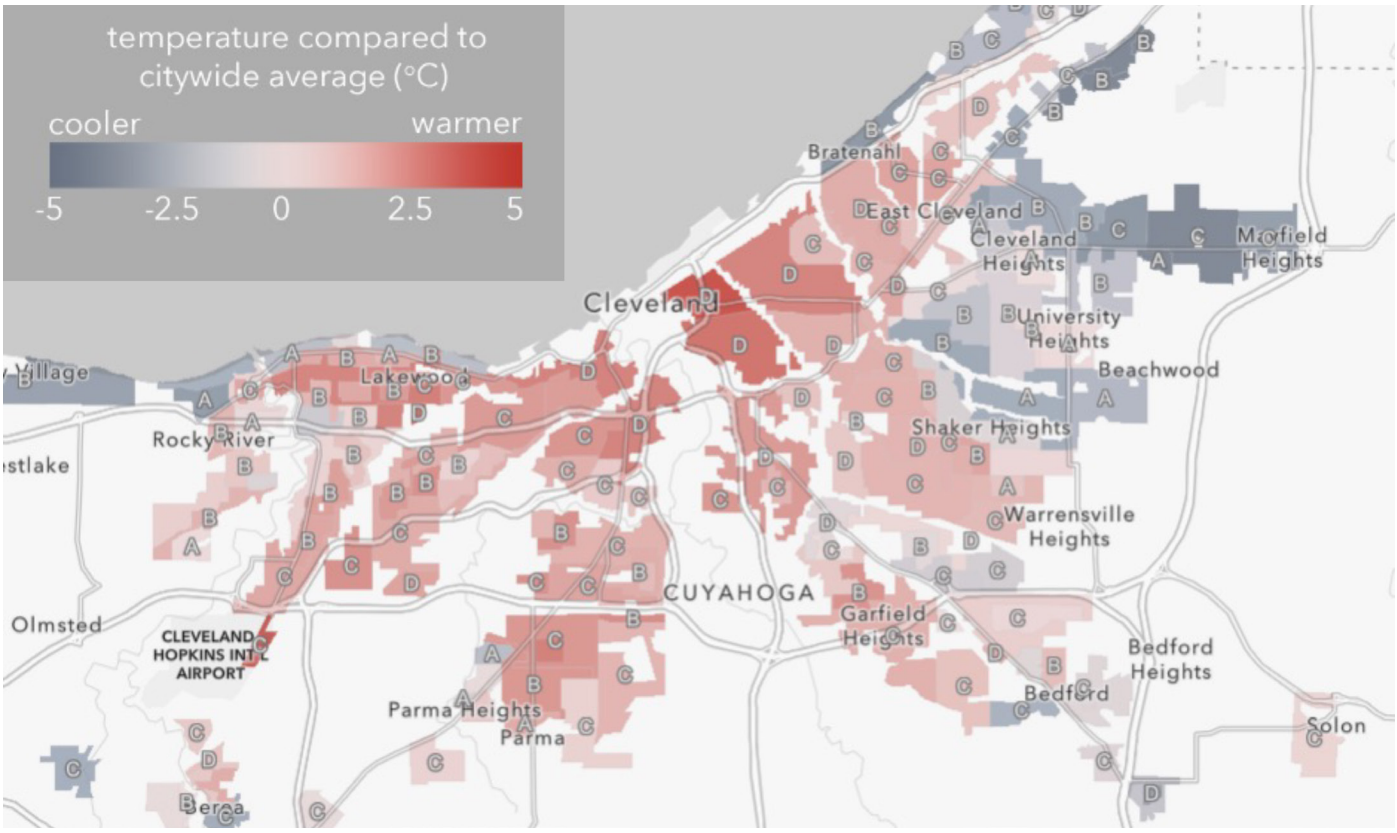
Young children thermoregulate differently than older children and adults and may be unable to alter their surroundings to cool off or access liquids to hydrate in extreme heat. As such, frequent and intense heat waves caused by climate change can be especially dangerous. Infants under 1 year old die from heat-related illnesses at four times the rate of people aged 1-44.[2] While the youngest children have the greatest risk, older children are also vulnerable to heat stroke and other heat-related illnesses when engaging in strenuous activities in high temperature conditions. Rising temperatures also increase the risk of food and water-borne illnesses because the higher temperatures provide ideal conditions for bacteria and fungi to multiply.[10,11] In young children, these illnesses are especially dangerous due to the risks of dehydration associated with vomiting and diarrhea.[12] High temperatures as well as higher moisture levels also increase the risks of vector borne diseases such as West Nile virus, Lyme disease, and dengue fever by lengthening the life cycle and increasing insect reproduction.[2]

II. Environmental Threats in Greater Cleveland Contribute to Significant Childhood Health Disparities

Climate-related environmental hazards that present unique risks to children include: poor air quality, extreme heat, increased flooding and climate-related infectious diseases.[13] A child's risk of exposure to these hazards is impacted by where they live and play; those neighborhoods with the most exposure often have the fewest resources. These disparities in exposure lead to health disparities, some of which are set in motion before children are even born.

According to a 2021 analysis of US metropolitan areas with at least 200,000 people, Cleveland is the 8th most racially segregated metropolitan area in the United States.[14] Much of this segregation can be traced back to historical discriminatory policies such as the redlining practices of the Home Owner's Loan Corporation (HOLC)'s neighborhood rating system nearly 100 years ago, which rated neighborhoods with high percentages of Black residents as "hazardous" for investment, and to the subsequent refusal of banks to lend money to Black home buyers. Systemic disinvestment and neglect in these redlined neighborhoods continues to this day, with disparate health outcomes as a result.[15,16]

CLEVELAND AREA HOMEOWNER'S LOAN CORPORATION (1935-1940) NEIGHBORHOOD GRADES AND RECENT TEMPERATURE TRENDS



Map of 1935-1940 Homeowner's Loan Corporation (HOLC) neighborhood "grades" (A-D) and recent temperature trends (in °C) in greater Cleveland. Areas in red are, on average, warmer than the citywide average. Areas in gray are cooler. The HOLC was a New Deal Era government organization tasked with creating "Residential Security Maps" that indicated the risk of real estate investment at the neighborhood level. Neighborhoods graded C were considered "declining," and those graded D were considered "hazardous" for real estate investment, largely based on the racial makeup of the neighborhood's residents. For more information, explore this interactive map from the University of Richmond Mapping Inequality Project (dsl.richmond.edu/panorama/redlining).

Screenshot From: https://www.arcgis.com/apps/dashboards/73e329457b6644e7aeff13ecce43c8d8

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. doi:10.3390/cli8010012

Built environment impacts in urban areas, such as "heat islands", lack of tree canopy and increased air pollutants due to traffic, energy production and industrial waste, are exacerbated by climate. Industrial facilities, power plants, and highways were often built in predominantly Black neighborhoods that, due to outright discrimination as well as disinvestment from political and business leaders, lacked the resources to oppose their development.[17–19] These facilities emit fine particulate matter (PM2.5) and ground level Ozone (the two pollutants of most concern to human health) which both cause asthma and trigger asthma attacks in those who already have the condition.[20] In Cleveland, disproportionately high childhood asthma prevalence and exposure to pollution occur in these neighborhoods.[21,22]

Asthma is one of the most common chronic diseases in children and Cleveland is a particularly difficult place to live with asthma. According to the Asthma and Allergy Foundation of America, out of the 100 largest cities in the U.S., Cleveland is the fourth worst for people with asthma.[23] For children especially, September is the worst month for asthma accounting for 25% of annual asthma-related hospitalizations in children. This timing coincides with ragweed season, changes in weather that cause increasing mold counts, as well as returning to school from summer break which exposes children to respiratory illnesses.

Cleveland's average summer temperature has increased 3.4 degrees Fahrenheit since 1970 and nighttime temperatures have increased more than 4.5 degrees Fahrenheit.[24] Although temperatures are rising everywhere, Cleveland's inner city is frequently about seven degrees warmer[25] than the surrounding areas due to a phenomenon called "heat islands."[26] Heat islands are areas of the inner city that are consistently warmer than areas further away from the city center due to factors such as buildings, roads and infrastructure which reabsorb and re-emit heat, as well as smaller space between buildings that traps heat. In addition, industrial facilities, vehicles, and buildings emit heat of their own contributing to the increase in temperature. Tree canopies can provide a protective effect by deflecting solar radiation and shielding buildings, but they are often lacking in these areas.[27,28]

Adding to the harmful effects of increasing temperatures, the percentage of households without air conditioning in Cleveland is three times higher than in Cincinnati despite having a similar climate.[29] Black households are even less likely than average to have air conditioning. Many schools in the area also lack air conditioning leading to missed learning days for school-aged children when the temperatures are high.[30,31]

Increasing temperatures also influence Cleveland's water quality by creating ideal conditions for microorganisms to multiply. Lake Erie, which provides our drinking water as well as an opportunity for summer recreation, experiences large blue-green algal (cyanobacteria) blooms each year, due to agricultural runoff.[32] These blooms produce toxins that impact the liver, the nervous system if ingested, and cause skin irritation. Children are especially vulnerable to illness caused by these toxins because they are more likely to swallow water while swimming.[33]

III. Cleveland at a Climate Crossroads for Children: An Opportunity for Cross-Sector Action

As a report from the Harvard Center on the Developing Child (HCDC) recently noted, "Understanding the powerful effects that natural and built environments have on the early foundations of health and development calls for increased attention to important influences that fall well beyond the traditional boundaries of the early childhood field."[3]

The City of Cleveland and Cuyahoga County both have Climate Action Plans and the Northeast Ohio Areawide Coordinating Agency is working on a plan. In addition, the Aspen Institute and Capita have co-convened the Early Years Climate Action Task Force to develop the U.S. Early Years Climate Action Plan. The local plans orient us to the complexity of climate change and its effect on health and well-being, but they do not address the unique vulnerabilities of young children and pregnant women, especially those most affected by health and income disparities. Strategic planning should include those across disciplines that can help address multiple aspects, health, policy, city planning and education, for healthy pregnancy, optimal fetal outcomes, and early childhood growth and development. The detrimental effects of climate change and maternal and child health are not unique to Cleveland; building and city planning strategies and models have been proposed and tested elsewhere in the U.S. Models that prioritize the environmental health threats that are most relevant to this vulnerable population, such as heat, pollution, and exposure to toxic chemicals should be explored. Importantly, these strategies offer both immediate and long-term effects on individual and community-level health and wellness.

Many environmental health strategies focus on increasing parks and reducing paved surface areas given the multiple benefits. These efforts can reduce exposure to toxins and stress during critical fetal developmental stages and give children and mothers a place to engage in social and physical activity which have been shown to be good for both mental and physical health.[34] Added trees and other vegetation also help mitigate some of the effects of climate change.[35,36] Increasing the tree canopy provides shade and can help break up a heat island while also offering protection from harmful noise pollution.[37,38] Trees also pull carbon dioxide out of the air and help prevent runoff, flooding, and erosion during heavy rain events.[39] Parks can also be a great place to provide splash pads and pools to help people cool off on excessively hot days.[40]

Land policy and zoning laws are another focus for environmental justice interventions. Exclusionary zoning practices have concentrated both poverty and pollution while allowing suburbs to extend further and further away from cities creating an over-reliance on personal automobiles.[41,42] This urban sprawl prioritizes vehicular traffic from the suburbs over the health and safety of urban residents who are increasingly exposed to pollutants due to living near roads and highways. Exclusionary zoning practices that prohibit building multi-family housing also reduce energy and land use efficiency. Allowing the construction of multi-family and mixed-use housing has the potential to reduce reliance on cars as well as capitalize on structural energy efficiency.[43] Beyond inclusionary zoning reform, other land use policy interventions that have been proposed include land value capture,[44,45] and limiting highway expansion.[46]

Healthy housing initiatives also aim to reduce exposures to harmful chemicals and pollutants which affects health over both the long term and the short term.[47] Most effective asthma interventions work at the individual level and involve home visits and remediation of asthma triggers within the home.[48] Climate resilient housing that withstands and protects occupants from climate hazards is also important for keeping people healthy.[49] Green infrastructure[50] improvements like green roofs, which provide benefits for indoor temperatures as well as carbon filtering benefits, are another example that can be used as part of healthy housing.[51,52]

Shifting focus of existing structures to more sustainable alternatives is also important for reducing overall emissions and corresponding health effects. Renewable energy and sustainable food systems are two examples of these alternatives. Shifting from fossil fuels to clean energy sources like solar, wind, geothermal, and biomass can reduce emissions and exposures for those who live near power plants.[53,54] Creating sustainable food systems that prioritize local production and healthy, plant-forward diets have the potential to reduce emissions, improve land use, and reduce the incidence of heart disease, stroke, obesity, high cholesterol and other cardiovascular conditions all at the same time while also helping to ensure access to healthy food for all.[55,56]

Many of these interventions that are aimed at long-term environmental effects can be undertaken now with immediate benefits to child health and well-being. They also require creating and examining policies at all levels for their impact on maternal and child health, as well as overall environmental health. The urgency and opportunity for deep impact calls for an interdisciplinary, cross-sector collaborative approach to advance environmental justice for our most vulnerable and most harmed populations.

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