Environmental Factors Shape Child Population Health: How Researchers Can Help Develop New Interventions and Policies

Population Health Sciences

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The places where children grow up profoundly shape their health. At PolicyLab, we take a population health approach to understanding these key drivers of health—considering how varying levels of environmental exposures and their overlap may impact distinct groups of children differently—and lead to varying impacts on child health and well-being.

This is a developing area of PolicyLab research and collaboration situated within PolicyLab's Population Health Sciences portfolio, which I help to lead. Our interdisciplinary researchers come from a range of personal backgrounds and clinical disciplines, which enriches their research and helps open up new lines of inquiry. They examine how distinct and overlapping environmental factors help foster or hinder children's health outcomes with an eye toward intervention. By developing or evaluating individual- and system-level strategies to intervene on modifiable factors, they are each making significant contributions to PolicyLab's portfolio and the future of their fields.

In my own work related to environmental health, I have partnered with environmental epidemiologists to understand how air quality, outdoor aeroallergens, and environmental conditions such as extreme heat and heavy precipitation, impact childhood asthma outcomes in the Philadelphia region. This work has detailed important ways in which environmental conditions influence respiratory health for children with asthma, both replicating findings from other work and highlighting novel associations with local cohorts in the Philadelphia region. Replicating prior findings and generating local descriptive data is an important step to help better

understand problems. Mechanistic and interventional research must follow; I am increasingly interested in systems-level interventions that leverage partnerships between health care systems, non-profits and local government.

In this post, PolicyLab researchers working in environmental health share why they're pursuing specific areas of inquiry and how they hope their work can help improve child health. I am excited to see where their research leads—and to partner with them in putting PolicyLab's evidence-to-action model into practice as we work together for policy change.

Improving air quality



Jessica Rice, DO, MHS

How does your research get at challenges that may seem intractable and what about your research in this area inspires you to keep going?

As a pediatric pulmonologist, I am specifically interested in outcomes for infants born prematurely with bronchopulmonary dysplasia (BPD), the most common and serious complication of preterm birth. These infants are at increased risk for re-hospitalization in the first one to two years of life, as well as chronic respiratory morbidity and lower lung function, compared with full term infants.

What inspires me to keep doing research in this area is caring for these infants in the hospital and following them longitudinally. For these preterm infants, the first few years of life are a period of rapid lung development and catch-up growth, but environmental exposures can impede optimal lung function. This can lead to acute and chronic respiratory diseases throughout life. Since proven treatments for BPD are lacking, providers focus on avoiding further lung injury and supporting growth. Therefore, it is important to identify and address modifiable risk factors for respiratory morbidity in this population, especially during their early critical years of lung growth and development to decrease risk of adult chronic lung disease.

What knowledge or research gaps do you hope to help close in the next 5-10 years?

A major gap is understanding not only which aspects of the home environment affect respiratory health, but also whether changing or reducing those exposures improves health. I have previously shown a positive association between exposure to fine particulate matter ($PM_{2.5}$) in the home and respiratory morbidity in children born preterm. That said, we don't yet know which interventions are most effective, which populations will benefit the most, if the interventions are feasible in a real-world setting and how these interventions can be implemented broadly. These are the frontiers of my future work.



Tim Nelin, MD, MSHP

As you look to the future of this research, what opportunities excite you most?

What excites me most is the combination of increasingly powerful data and the opportunity to use what we learn in ways that might contribute to lasting change. We are entering an era in which large clinical datasets, longitudinal residential histories, satellite-derived exposures and increasingly sophisticated analytic methods will allow us to ask questions about child health that simply were not possible before. I think that is both scientifically fascinating and genuinely fun.

What knowledge or research gaps do you hope to help close in the next 5-10 years?

There is already an abundance of literature showing that different aspects of the environment can be harmful to child health. While there is certainly more to learn about how environmental exposures influence outcomes among children born preterm, I think one of the larger gaps is that we know much less about what to do with that information.

I hope to contribute not only to understanding which exposures matter, when children are most susceptible, and who is most vulnerable, but also to identifying the best ways to ameliorate those risks. That means moving beyond asking why facets of the neighborhood environment may be associated with worse outcomes and toward asking which policies, interventions or changes to the built environment can actually improve health. My goal is that the next phase of this work is increasingly solutions-oriented, so that we are not simply describing disparities or environmental harms, but helping to identify practical ways to reduce them.

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Housing policy and child health



Daria Murosko, MD, MPH, MSHP

How does your research get at challenges that may seem intractable and what about your research in this area inspires you to keep going?

I always like to think of my research as one drop in a large bucket: something that someone else will build upon, expand, and make slow, steady progress. At the same time, I try to be pragmatic in how I design my research questions. For example, I'm working on a project focused on the Low-Income Housing Tax Credit, which is the largest federal policy creating affordable housing units in this country. This huge program has created over 3 million affordable units in the last 40 years, but it's not perfect. Homes are often constructed in high-poverty, low-opportunity neighborhoods. I am looking at the longitudinal trend of where these homes are built: are they being developed in communities that offer more access to the resources and opportunities that promote child health? If we can identify policies that are effective in guiding development into high opportunity communities, we can outline more specific guidelines to help families access affordable homes in those communities.

What knowledge or research gaps do you hope to help close in the next 5-10 years?

I'm interested in digging into the tension between housing affordability and location—specifically thinking about this through the lens of infant health. In this current affordability crisis, more and more families are grappling with this trade-off. I believe that NICU patients may be a "canary in the coal mine" to show us the long-term impacts on child health. I hope to explore and eventually amplify creative program and policy solutions to help families strike this balance.



Doug Strane, MPH

How does your research get at challenges that may seem intractable and what about your research in this area inspires you to keep going?

My evaluation of the CAPP+ Home Repairs Program has really made me think differently about the scope of what health systems can do when it comes to environmental determinants. Ten years ago, it would have been unthinkable to have a health system doing home repairs to address asthma. But after 250 homes and some very promising findings on the impact on asthma, it suddenly doesn't seem so outrageous that CHOP facilitates a home repair program. Credit goes to Dr. Tyra Bryant-Stephens, who has remained committed to this vision of home repairs to address asthma triggers, even when it was a moonshot.

How might your line of inquiry advance child and family health policy?

The dream would be to make some of our environmental interventions that support child health reimbursable and sustainable. I don't think it's crazy to think that we could one day make a solid case that Medicaid or private-public partnerships pay for home repairs.

As you look to the future of this research, what opportunities excite you most?

While our research to date has focused on the children with asthma who most directly stand to benefit from home repairs, the effects of CAPP+ are experienced by everyone in the household and even those in the neighborhood. There's so much more we can learn about what home repairs can mean for a family's stress, housing stability and economic stability.

Understanding how neighborhoods shape child health



Stephanie Mayne, PhD, MHS

How does your research get at challenges that may seem intractable and what about your research in this area inspires you to keep going?

Even with problems that feel intractable, there may be opportunities to adapt and improve health. For example, our research on extreme temperatures and missed pediatric preventive visits may help inform how primary care practices and health systems adapt to increasingly volatile temperatures. The impacts of climate change can be felt clearly already, so it feels important to work in this space even if the problem sometimes feels overwhelming.

What current knowledge or research gaps do you hope to help close in the next 5-10 years?

Most research on the role of the neighborhood environment in child health focuses on where children live. A child's neighborhood is an incredibly important context, but particularly in big cities like Philadelphia, many children and especially adolescents attend school and spend time in different parts of the city from where they

live. If we ignore these other contexts, we may be missing other environments which shape health in important ways. This is why my research is increasingly focused on adolescents' activity space—all locations in which they spend time—and how stressors and supports in that activity space influence sleep and other outcomes.



Keven Cabrera, MD, MSHP

How might your line of inquiry advance child and family population health and health policy?

The ways our communities are designed and structured have lasting impacts on child and family health. They are often expensive and difficult to change once implemented. By conducting research to better understand both how these factors impact our health and how a community's vision and priorities can help shape those factors, we can more effectively and efficiently strengthen communities and the built environments that shape child health—while supporting community members as stewards of their neighborhoods.

As you look to the future of this research, what opportunities excite you most?

I am excited to create paths and methodologies that allow community members to partner and lead research investigating the forces that help shape their lives, not just advise it. I believe that pride in and ownership of our community spaces generates positive health outcomes just as much as any other variable researchers study. The only way to foster that is by giving community members a leading voice in how their environment is shaped.

Chén Kenyon
Chén Kenyon
MD, MSHP
Faculty Member