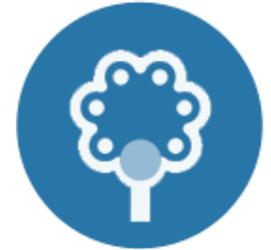


Healthy Environments, Healthy People

A Funder Guide on Improving Environmental Conditions for Health



Scientists have confirmed what many people know from life experience: everyday environmental conditions affect health. Substantial research has found that pollutants worsen health outcomes, both individually and in combination with genetic and socioeconomic factors.¹ This information creates a new opportunity for philanthropy concerned with health: many health problems may be reduced or prevented by improving environmental conditions.

Environmental health – the study of and work on environmental conditions impacting health – is a dynamic area of philanthropy.² Grantmakers concerned about health, conservation, community development, and environmental justice are investing in environmental health because they recognize that:

- People are affected by the environment, and people affect the environment.
- Understanding how the environment affects health creates significant opportunities to prevent disease and proactively protect people.
- Building awareness of health stakes in environmental conditions helps build support for environmental protection.
- Everyone deserves to live in environmental conditions that make a healthy life possible.

Philanthropy is helping to expand knowledge about the connections between health and the environment. It also is helping put that knowledge into action to improve environmental conditions where people live, learn, work, and play.

■ Sources of Knowledge:

Linking the Environment and Health

Information about how the environment is impacting health can come from a wide range of sources. Very often, people living in a community make the first connections between environmental conditions and their health. It might be residents experiencing headaches from air pollution, a grandmother concerned about contaminated water and cancers in her neighborhood, or a school nurse treating an unusually high number of asthmatic children.

The public health and medical communities also regularly contribute to the knowledge base about health and the environment. From a 19th century doctor named Dr. John Snow who first connected London's cholera outbreak to contaminated drinking water, to the President's Cancer Panel reporting in 2009 on environmental cancer risk, public health and medical professionals often help track disease patterns and potential causes.^{3,4}

In the U.S., for example, the Centers for Disease Control and Prevention direct a national environmental health tracking network.⁵ The public health community is active internationally as well; a 2006 World Health Organization (WHO) report cited environmental risk factors as responsible for nearly a quarter of all disease and as contributors to 80 percent of the diseases WHO tracks.⁶

Environmental biologists, toxicologists, and other researchers also are critical sources of information. For decades, a wide array of researchers have been studying and deepening basic understanding about how the environment affects health. The knowledge base continues to expand, including through work of scientists in universities, industry, and government entities like the National Institute of Environmental Health Sciences.⁷

■ Knowledge into Impact: Philanthropy Helps Expand Awareness and Action

Philanthropy is helping to expand environmental health knowledge by actively supporting many efforts in communities, public health, and environmental health science. Grantmakers also are actively drawing on environmental health knowledge to better inform their grantmaking to support activities that promote healthier lives, environments, and communities.

Identifying and Reducing Hazardous Exposures

A basic starting point in environmental health is to identify substances in the environment that may cause health problems. Many common substances, some naturally-occurring and others human-made, have been found to have the potential for harm, such as:

- Heavy metals like lead, arsenic, and mercury, or gases like radon;
- Air pollution, including from tobacco smoke, transportation, wood burning, and power plants; and
- Toxic chemicals in drinking water, food, or consumer products.⁸

People and wildlife may be exposed to hazardous substances in varied ways: through air, water, soil, or food, or through dermal (skin) or *in utero* (in the womb) contacts.

How harmful an exposure is depends on a substance's intrinsically hazardous properties and on factors such as route of exposure. Lead, for example, is a known neurotoxin, meaning it can damage brain and other nerve tissues. Lead is not absorbed well through the skin, but ingesting it in paint chips or inhaling it in dust pose serious risks.

The amount, or "dose," duration, and timing of an exposure also matters.⁹ Using a potent household cleaner occasionally could produce a short-term eye irritation, whereas working everyday with toxic chemicals means a longer-term exposure. Contrary to popular assumptions that "the dose makes the poison," many studies have demonstrated that a high or low-level exposure may be

more harmful, depending upon the substance and developmental stage of those exposed.¹⁰

There is a lot of information now on many individual environmental hazards. Research focused on specific substances helps identify potential risks, determine how exposures happen, and understand the health impacts. This information helps point the way to many opportunities to reduce hazards and prevent disease.

Although governmental funding is the bigger source of support for research, philanthropy also is supporting specific research projects and translation of research findings. Many funders also are using information about harmful exposures to focus grants on reducing exposures to those health threats.

Grantmakers are putting knowledge about hazards into action, for example by focusing on:

Housing: Improving living conditions for vulnerable families. Philanthropy is helping remove hazards like lead and mold in low-income housing, including through funding of local home cleanups, advocacy for more health-protective housing policies, and research on returns on investment in healthier housing.¹¹

Healthcare: Making hospitals safer places to heal and work. With foundation support, experts are helping hospital administrators learn how to replace hazardous materials used in health care facilities with safer alternatives.

Consumer Products: Creating consumer demand for safer products. Funders are investing in campaigns that educate the public about unsafe ingredients in everyday products and that press companies to act, like by removing reproductive toxins from cosmetics and baby products.

Communities: Monitoring and addressing local hazards. Community groups are using grants to organize online systems for local residents to report health hazards, paired with community task forces to address reported hazards.¹²

Decisions: Taking health into account in policies and planning. Grants for "health impact assessments" (HIAs)¹³ could, for instance, identify risks to children's health from building a school on a former industrial site, and flag risk reduction options like soil testing and cleanup.

Protecting the Most Vulnerable: Focus on Early Exposures

The youngest are often the most vulnerable. That's one critical lesson from environmental health science, and one very relevant to foundations focused on children.

Even before birth, exposures *in utero* can profoundly alter human development and shape health outcomes decades or even generations later. Fetal development represents a particularly vulnerable period of exposure as cells, tissues, and systems are forming.¹⁴

Children also are particularly vulnerable to environmental exposures. They eat, drink, and breathe proportionally more than adults do. Children spend more time on the ground and often put things in their mouths, receiving proportionally larger doses of toxicants. In addition, they are at heightened risk from environmental exposures as their bodies, tissues, and organs are still developing.¹⁵

Grantmakers are increasing protection of children's health, for example by focusing on:

Education: Foundations are helping to deepen environmental health expertise of pediatricians, school nurses, and other professionals who work with children and their parents. Examples include investments in development of environmental health curricula for pediatric residency programs, and in scholarships enabling mid-career professionals to attend trainings in children's environmental health.

Safer Places: Improving conditions where children live, play, and learn. Grant-funded projects are working to identify and reduce toxic hazards in maternity wards, childcare centers, school buildings, and homes. Grantees are, for instance, screening daycare centers with checklists to reduce harmful exposures from things like toxic pesticides, cleaners, lead paint, art supplies, or mercury thermometers.

Policies: Philanthropy is helping make laws and regulations more child-protective. Grants for policy analysis are flagging gaps where current environmental standards are failing to prevent dangerous childhood exposures. Grants for advocacy are promoting policy reforms, such as bans of toxins in toys or revised chemical safety standards to improve safeguards for pregnant women and children.¹⁶

A study at Columbia University, supported by several foundations, has been tracking cohorts of pregnant women and their children to assess impacts of the mothers' daily conditions on their children's health and healthy development.

The Mothers and Newborns Study has documented significant impacts on children's health from factors like the mothers' exposure to traffic pollution or poverty-related stress. Encouragingly, the study also has demonstrated that reducing hazards can improve health outcomes. For instance, the study found measureable improvements in infant health following a ban of an indoor pesticide commonly used in low-income housing.¹⁷

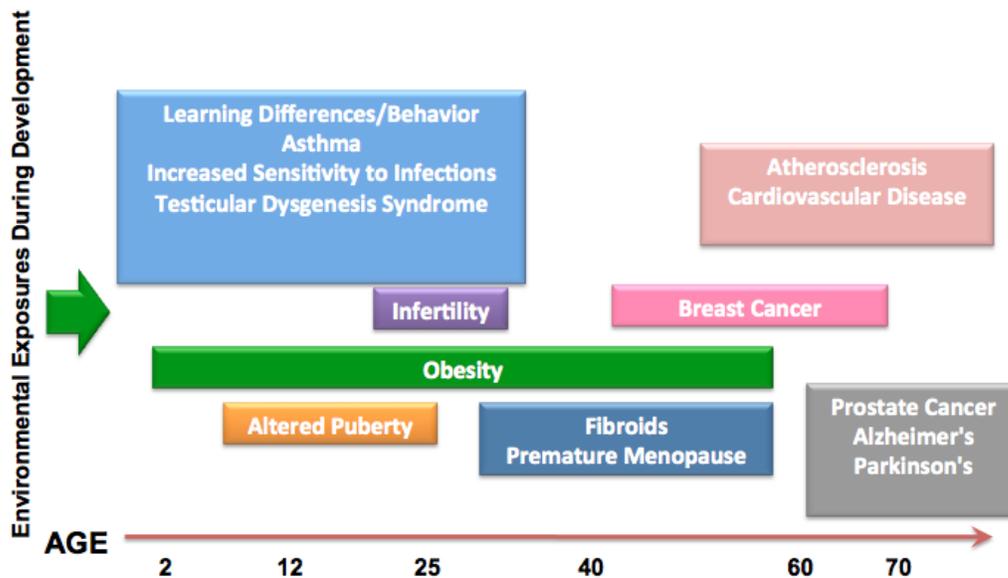
Alongside the very young, other populations are quite vulnerable to environmental hazards, including seniors and people with immune-compromised systems. Increasingly researchers are finding that exposures across a whole lifetime – including beginning in the womb or in childhood – are connected to health concerns often associated with older age. For instance, lifetime influences of environmental factors play a role in some chronic degenerative diseases like Alzheimer's and Parkinson's.¹⁸

Research finding that vulnerability to environmental exposures varies at different stages of life has heightened focus on "endocrine disrupting chemicals" (EDCs). These are substances that affect the endocrine system. EDCs may mimic or interfere with normal hormones, send false signals for development, and produce developmental, reproductive, neurological, and immune problems that may show up over a lifetime.¹⁹

The Endocrine Society, a global scientific and medical association, has concluded that it cannot be assumed there is any safe level of exposure to EDCs.²⁰ This raises urgent health concerns, as EDCs such as Bisphenol A (BPA) and phthalates are being widely used in consumer products, including toys, cosmetics, computers, and food packaging.

Research finding that vulnerability to environmental hazards is heightened during certain periods in life also has challenged assumptions about what "safe" levels of exposure might be, and for whom. Historically, regulations and standards have been based on studies of how dangerous a substance might be for adult males, such as workers regularly exposed to hazards on the job.

Examples of Developmental Origins of Health and Disease



Source: National Institute of Environmental Health Sciences/World Health Organization

Newer science points to a different picture of how environmental exposures impact children.²¹ While protecting workers remains important, the evidence base now underscores that more stringent standards that better protect pregnant women and children are needed in order to protect health and healthy development for all.

Focusing on Diseases

Understanding that even low-level environmental exposures can have a major health impact during certain periods of development or vulnerability has given new insight about specific diseases. Much more information now is available, including from lab research and from public health tracking of disease rates, about environmental connections to specific diseases and disorders.

Breast cancer studies, for instance, are looking at susceptibility during different life stages including *in utero*, pre-pubescence, and menopause.²² The President's Cancer Panel in 2008-2009 concluded that "the true

Philanthropy is helping tackle environmentally-linked diseases, for example by focusing on:

Research: Expanding knowledge about specific health problems linked to environmental exposures. Some funders support academic projects investigating environmental origins of disease; others support advocacy to increase public funding for environmental health research and disease tracking.

Translation of Science: Making research on environmental origins of diseases more understandable and useful. Foundation grants are enabling experts to summarize peer-reviewed science for audiences like health affected groups, media, and policymakers.

Disease Groups: Engaging those most affected by environmentally linked health problems. Philanthropy is helping affected groups gain environmental health expertise, speak up for health-protective policies, and build public pressure for safer products.

burden of environmentally induced cancer is grossly underestimated,” challenging old estimates that about six percent of cancers are linked to environmental and occupational exposures.^{23, 24}

Families and health professionals dealing with diseases that have a known or suspected link to environmental conditions are gaining critical insights from this knowledge base – as well as motivation to reduce preventable harm. In philanthropy as well, this issue can be both personal and professional; numerous funders and donors have been drawn to environmental health grantmaking because of the health issues faced by trustees or staff.

Addressing Disparities, Promoting Environmental Justice

Considerable social science research has affirmed what many people recognize from daily experience: the poor and people of color are disproportionately exposed to hazardous conditions and tend to have poorer health outcomes.²⁵

Industrial sites, waste facilities, refineries, highways, and other pollution sources tend to be located in areas with less economic clout or political voice; unsurprisingly minority and low-income neighborhoods have worse air quality.²⁶ Residents in many local communities have linked their health concerns to disparities in environmental conditions, gotten organized, and sparked the rise of a movement for environmental justice.²⁷

Documenting relationships between worse-than-average environmental conditions and health outcomes has drawn varied funders into environmental health grantmaking, including health funders concerned about health disparities and vulnerable populations, as well as funders bringing a justice, rights, or equity lens to their grantmaking.²⁸

Comprehensively Addressing Factors Affecting Health

Research has found that many health outcomes result from combinations of factors, like stress, nutrition, or pollution.²⁹ People are exposed every day to multiple hazards, whether at home, at work or school, or out in the community. Such combined exposures can produce additional or synergistic health problems; this is similar to

Philanthropy is addressing environmental injustice and reducing disparities, for example by focusing on:

Community Data-Gathering: Equipping communities to document their realities. Local groups are using grants to map hazards and problems, such as by doing a health survey in Native American households near uranium mining sites, or by training residents of urban neighborhoods in low-cost ways to monitor air pollution from nearby industrial facilities.

Research and Analysis: Expanding evidence and informing solutions. Foundations are helping underwrite academic work, such as to study air pollution levels and impacts at school sites where minority children are concentrated and to identify helpful measures like indoor air filtration, bus idling rules, or school siting distances from pollution sources.

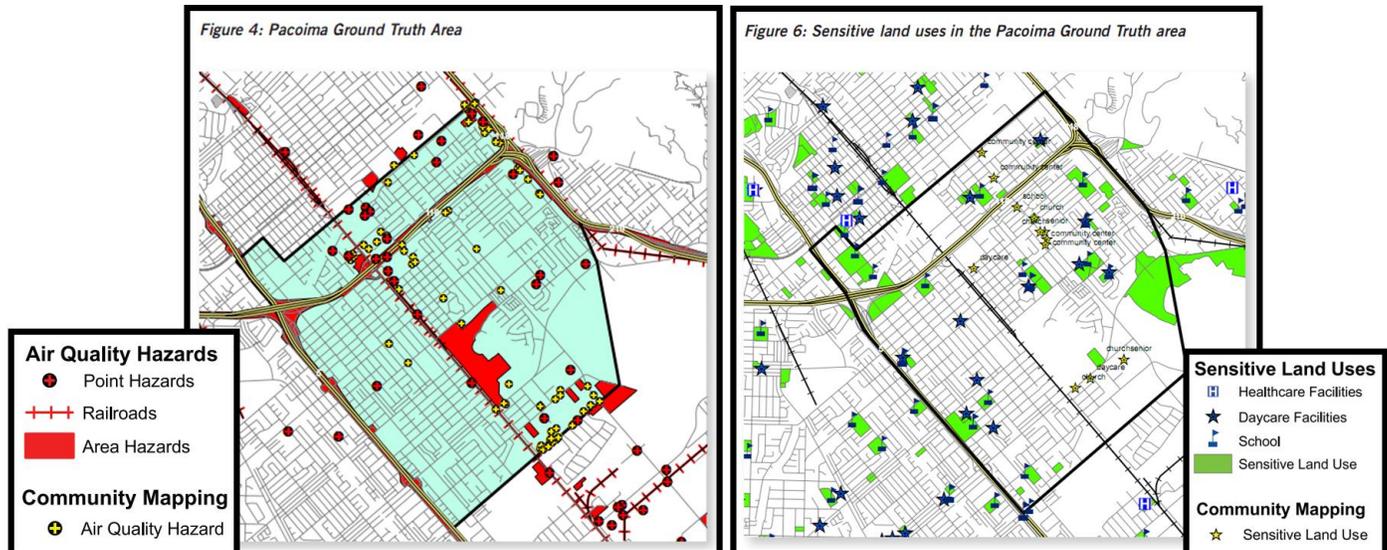
Organizing and Leadership: Building power to make change. Philanthropy is helping strengthen communities’ capacity through support of work like grassroots organizing, youth leadership development, and civic engagement to boost local voices in decisions affecting their environments and their health.

the well-recognized potential of pharmaceutical drugs to interact if taken in combination.³⁰

Studies demonstrate that environmental exposures can interact with genes and other determinants (factors that affect health like diet or stress) causing or amplifying health effects.³¹ A combination, for example, of certain genetic variations and pesticide exposures has been found to increase some risks for Parkinson’s disease.³² Likewise, stresses of living in poverty may make children more biologically susceptible to indoor and outdoor pollutants.³³

This area of research helps explain some variations in disease rates. It also is spurring a more comprehensive focus on communities’ cumulative exposures, stressors, and health problems.

Looking at existing conditions and the various factors that can affect health outcomes can create a much fuller picture of the problems. It also provides much better information and more vantage points from which to intervene to protect health.



Source: Liberty Hill Foundation

Grantmaking is encouraging more holistic environmental health approaches, for example by focusing on:

Community-based participatory research: Bringing fuller information into assessments of community conditions. Foundations are helping researchers and community groups jointly map local hazards, vulnerable populations, and other conditions into a more comprehensive picture of factors cumulatively impacting a neighborhood’s health.³⁴

Analytical tools: Making environmental health information actionable. Grants are advancing development and use of methodologies for integrating environmental, demographic and health data into tools for decision-making, like by identifying “hot spots” of particularly unhealthy conditions for priority action.

Regional approaches: Focusing cities and counties on environmental health. Foundations are encouraging diverse stakeholders to work together on regional needs and strategies, such as through regular convenings, development of indicators, or initiatives to improve air and water quality.³⁵

Building a Movement

In recent years, the solid evidence base about environmental impacts on health has attracted and informed a broad movement to ensure everyone has the chance to live in healthy conditions. Environmental health philanthropy in the past decade has invested hundreds of millions of dollars in building public awareness, engagement, and more effective action for healthier places and people.

Philanthropic investment is supporting a movement on environmental health in and across many places, from communities living near ports and transportation corridors, urban neighborhoods dealing with land use and transportation issues, or in rural communities living near industrial agriculture or fossil fuel extraction.

There are hubs of environmental health activity in many professions and sectors of society, as well as groups helping connect information and activities across hubs of work. Interest also is growing in strengthening effective communications about environmental health issues to various audiences and in translating environmental health knowledge into tools for decision-making.³⁶

Philanthropy is broadening awareness and action on environmental health, for example by focusing on:

Public Education: Ensuring citizens understand their health stake in a clean environment. Grantmakers are funding local and online efforts to disseminate information and create learning opportunities, such as through grassroots outreach, town hall meetings, conferences, or social media.

Media Coverage: Buttressing news in the public interest. Foundations are supporting journalism centers, special investigative series, and archives of environmental health science and news coverage.

Education & Training: Equipping health professionals and scientists as effective messengers. Grants are helping build key professionals' capacity, for instance, through projects providing environmental health literacy, policy, or media training to doctors, nurses, hospital administrators, and scientists.

Corporate Shifts: Making change in the marketplace. Philanthropy is expanding actions by investors and shareholders (including some foundations) seeking to have health and environmental values reflected in investments and corporate decisions. Grant-funded projects also are helping businesses integrate environmental health objectives in their products, operations, and workplaces.

Organizing and Advocacy: Building voices for change. Philanthropy is supporting a wide array of non-profits, networks, coalitions, and campaigns to work on environmental health issues, at the neighborhood, state, federal, or global levels.

Responding to Disasters

A special category of environmental health work arises in the context of disasters. Foundations concerned about health and the environment often are among the first institutions to be asked for help from communities experiencing a disaster, whether related to a weather event, industrial accident, or terrorist attack. Pre-existing environmental hazards often are worsened and compounded by new hazards created in the wake of disasters. While official and charitable assistance often goes to local governments or large organizations, foundations may be particularly well placed to help

respond to the needs of affected communities, whether by assisting them in gaining information about environmental conditions posing health threats or helping community groups have a voice in post-disaster decisions.

Grantmaking has helped communities cope with disasters, for example by focusing on:

Immediate needs: Addressing urgent environmental health problems. Foundations use discretionary funds to quickly cover purchase and distribution of emergency protective gear and environmental health safety guides, or to help dispatch mobile health clinics to reach emergency responders and residents.

Monitoring: Providing quick, trustworthy information. Philanthropy can do rapid-response funding of independent monitoring for pollutants in air, floodwaters and drinking water, and soil, giving affected communities more information about immediate hazards and baselines for later monitoring.

Community Voice: Ensuring communities affected by disasters are represented. Grant support such as funds for travel may enable local residents and leaders to participate in decision-making processes about relief, restoration, and community renewal.

Flexibility: Addressing new realities of grantees. Foundations may give grantees in an affected area more leeway on uses of grant funds, reporting requirements, or other measures to enable more flexible focus on new priorities.

Addressing Emerging Threats

We are constantly learning about environmental health issues, and new concerns arise with changes in the world around us. Foundations valuing health, the environment, and communities often expand or shift their grantmaking to respond to emerging threats and opportunities.

Climate change is rapidly rising on the agenda as an area of concern and grantmaking activity. Some philanthropy already is focused on health and community impacts of fossil fuel extraction, combustion and transportation, all of which contribute to climate change. Grantmaking is also beginning to address impacts of climate change, such as

heat waves or hurricanes, as well as to invest in building communities' resilience, or ability to adapt in a changing climate and capacity to protect vulnerable populations.

Emerging technologies likewise are of growing interest. Developments in areas like nanotechnology, genetic engineering, and synthetic biology often outpace understanding of their risks or impact to health and the environment. Philanthropy may play important roles in supporting research on new technologies to expand understanding of adverse impacts or potential safeguards, as well as in supporting voices for the public interest in policy and market decisions.

As these and other new environmental health concerns emerge, philanthropy will continue to have roles to play. Foundations can help build and spread knowledge about key issues. They can support affected groups, communities, non-profits, and stakeholders in getting better informed and more effectively engaged. Philanthropy can help underscore environmental health and justice values, by lifting up their champions and by supporting their integration into public education, discourse, and decisions.

About HEFN and This Issue Brief

HEFN is a network of funders investing at the intersections of health and the environment.

HEFN's mission is to maximize philanthropy's impact on environmental health and environmental justice.

Healthy Environments, Healthy People was co-authored by HEFN Director Karla Fortunato, HEFN Director Kathryn Sessions, and consultant Michael Passoff. HEFN Communications Associate Lauren Linville provided editorial support.

For more information, please visit www.HEFN.org.

Endnotes

- ¹ Morello-Frosch, R., M. Zuk, M. Jerrett, et al, "Understanding the Cumulative Impacts of Inequalities in Environmental Health: Implications for Policy," *Health Affairs* 30(5): 879-887, 2011, <http://www.ncbi.nlm.nih.gov/pubmed/21555471>.
- ² Fortunato, Karla, and Kathryn Sessions, "Philanthropy At The Intersection Of Health And The Environment," *Health Affairs* 30(5): 989-993, 2011, <http://www.ncbi.nlm.nih.gov/pubmed/21555484>.
- ³ Markel, H. "Happy Birthday, Dr Snow," *The Journal of the American Medical Association* 309(10): 995-996, March 13, 2013, <http://jama.jamanetwork.com/article.aspx?articleID=1667095>
- ⁴ Reuben, Suzanne H. "Reducing Environmental Cancer Risk: What We Can Do Now," The President's Cancel Panel, U.S. Department of Health and Human Services, National Institutes of Health, National Cancer Institute, April 2010, http://deainfo.nci.nih.gov/advisory/pcp/annualReports/pcp08-09rpt/PCP_Report_08-09_508.pdf.
- ⁵ "National Environmental Public Health Tracking Program," Centers for Disease Control and Prevention, January 2014, <http://www.cdc.gov/nceh/tracking/>.
- ⁶ Prüss-Üstün, A. and C. Corvalán, "Preventing Disease Through Healthy Environments: Towards an Estimate of the Environmental Burden of Disease," Geneva, World Health Organization, 2006, http://cdrwww.who.int/quantifying_ehimpacts/publications/preventingdiseasebegin.pdf.
- ⁷ "National Institute of Environmental Health," National Institutes of Health, 2014, <http://www.niehs.nih.gov/>.
- ⁸ Prüss-Ustün, A., et al, "Knowns and Unknowns on Burden of Disease Due to Chemicals: A Systematic Review," *Environmental Health* 2011; 10:9, <http://www.ehjournal.net/content/pdf/1476-069X-10-9.pdf>.
- ⁹ "About Exposure," New York State Department of Health, July 2012, <http://www.health.ny.gov/environmental/about/exposure.htm>.
- ¹⁰ Fagin, D. "Toxicology: The Learning Curve," *Nature*, October 24, 2012, <http://www.nature.com/news/toxicology-the-learning-curve-1.11644>.
- ¹¹ "Improving Health through Housing: The Kresge Foundation Works to Eliminate Dangerous and Unhealthy Housing," Health and Environmental Funders Network, 2013, http://hefn.org/connect/story/improving_health_through_housing.
- ¹² "Environmental Monitoring and Health: A California Wellness Foundation-Funded Model Spreads Across California," Health and Environmental Funders Network, 2013, http://hefn.org/connect/story/environmental_monitoring_health.
- ¹³ "Health Impact Project" Robert Wood Johnson Foundation and the Pew Charitable Trusts, 2011, <http://www.healthimpactproject.org/>.
- ¹⁴ "Linking Early Environmental Exposures to Adult Diseases," National Institute of Environmental Health Sciences, October 2008,

http://www.niehs.nih.gov/health/assets/docs_f_o/linking_early_environmental_exposures_to_adult_diseases.pdf.

¹⁵ “Early Childhood Exposures,” University of Louisville, 2008,

<http://louisville.edu/research/eoh/early-childhood-exposure>.

¹⁶ “Tackling Toxics: Funders Collaborate to Catalyze a Movement,” Health and Environmental Funders Network, 2013,

http://hefn.org/connect/story/tackling_toxics.

¹⁷ “Featured NYC Research Findings,” Columbia Center for Children’s Environmental Health, Mailman School of Public Health, Columbia University, 2014, <http://ccceh.org/our-research/featured-nyc-research-findings>.

¹⁸ Stein, Jill, et al, “Environmental Threats to Healthy Aging: With a Closer Look at Alzheimer’s & Parkinson’s Diseases,” Greater Boston Physicians for Social Responsibility and Science and Environmental Health Network, 2008,

http://www.agehealthy.org/pdf/GBPSRSEHN_HealthyAging1017.pdf

¹⁹ “Endocrine Disruptors,” National Institute of Environmental Health Sciences, June 5, 2013,

<http://www.niehs.nih.gov/health/topics/agents/endocrine/>.

²⁰ Young, W., “Letter to President Barroso, European Commission,” The Endocrine Society, June 3, 2013,

<https://www.endocrine.org/~media/endsociety/Files/Advocacy%20and%20Outreach/Society%20Letters/Endocrine%20Society%20Letter%20to%20EU%20Commission.pdf>.

²¹ Why Are Children More Susceptible To Environmental Exposures?” University of Louisville, 2008,

<http://louisville.edu/research/eoh/early-childhood-exposure>.

²² “Breast Cancer Risk and Environmental Factors,” National Institute of Environmental Health Sciences, October 2012,

http://www.niehs.nih.gov/health/assets/docs_a_e/environmental_factors_and_breast_cancer_risk_508.pdf.

²³ Reuben, Suzanne H. “Reducing Environmental Cancer Risk: What We Can Do Now,” The Presidents Cancer Panel, U.S. Department of Health and Human Services, National Institutes of Health, National Cancer Institute, April 2010.

²⁴ Israel, Brett and Environmental Health News. “How Many Cancers are Caused by the Environment?” Scientific American, May 21, 2010, <http://www.scientificamerican.com/article/how-many-cancers-are-caused-by-the-environment/>.

²⁵ Morello-Frosch, R., M. Zuk, M. Jerrett, et al., “Understanding the Cumulative Impacts of Inequalities in Environmental Health: Implications for Policy,” *Health Affairs* 30(5): 879-886, 2011.

²⁶ Katz, Cheryl, “Unequal Exposures: People in Poor, Non-White Neighborhoods Breathe More Hazardous Particles,” *Environmental Health News*, November 1, 2012,

<http://www.environmentalhealthnews.org/ehs/news/2012/unequal-exposures>.

²⁷ Bullard, Robert D., Glenn S. Johnson, Angel O. Torres, “Environmental Health and Racial Equity in the United States: Building Environmentally Just, Sustainable, and Livable Communities,” APHA Press, April 2011.

²⁸ Mitchell, Faith and Kathryn Sessions, “Philanthropy and Disparities: Progress, Challenges, and Unfinished Business,” *Health Affairs*, 30(10): 2017-2022, October 2011.

²⁹ Morello-Frosch, R., M. Zuk, M. Jerrett, et al. “Understanding the Cumulative Impacts of Inequalities in Environmental Health: Implications for Policy,” *Health Affairs* 30(5):879-886, 2011.

³⁰ Carpenter, D. et al., Understanding the human health effects of chemical mixtures. *Environmental Health Perspectives*, February 2002, 110 (Suppl 1): 25–42.

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1241145/>

³¹ Bookman EB, McAllister K, Gillanders E, Wanke K, Balshaw D, Rutter J, et al. “Gene-Environment Interplay in Common Complex Diseases: Forging an Integrative Model-Recommendations from an NIH Workshop,” *Genet Epidemiology* 35(4): 217–225,

<http://www.ncbi.nlm.nih.gov/pubmed/21308768>

³² “Harley, Kim and Wendy Hessler, “Pesticides plus genetics increase risk of Parkinson’s Disease,” *Environmental Health News*, May 14, 2009,

<http://www.environmentalhealthnews.org/ehs/news/science/pesticides-plus-genes-up-risk-of-parkinsons/>.

³³ Konkel, Lindsey, “Stress + Pollution = Health Risks for Low-Income Kids,” *Environmental Health News*, June 6, 2012,

<http://www.environmentalhealthnews.org/ehs/news/2012/pollution-poverty-and-people-of-color-stress-day-3>.

³⁴ “Revealing and Remediating Hidden Hazards: The Liberty Hill Foundation Funds Clean Up and Green Up Campaign,” Health and Environmental Funders Network, 2013,

http://hefn.org/connect/story/revealing_remediating_hidden_hazards.

³⁵ “Taking the Lead on Air Pollution: Heinz Endowments Initiative Raises Awareness & Support for Cleaner Air,” Health and Environmental Funders Network, 2013,

http://hefn.org/connect/story/taking_lead_air_pollution.

³⁶ Simon, Adam F., Nathaniel Kendall-Taylor and Eric Lindland.

“Using Values to Build Public Understanding and Support for Environmental Health Work,” Frameworks Institute, May 2013, http://www.frameworksinstitute.org/assets/files/Environmental%20Health/EnvironmentalHealth_values_final.pdf.