



Protecting Opportunity and Overcoming Disinvestment: The Call to Action on Healthy Homes



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Across America, many low-income families live in homes so severely deteriorated they cannot be weatherized. Across Pennsylvania, weatherization providers turn away thousands of households in need every year, simply because of repair issues. Typically, these WAP-rejected homes have active roof leaks, plumbing and sewer problems, substandard electrical wiring and related issues. However, all it takes is a problem WAP dollars cannot be used for, such as mold. These homes often have high relative humidity, mold, mildew, pest infestations and a host of other asthma triggers and allergens, as well as conditions that can cause or exacerbate other health problems.¹ The economic cost of indoor dampness and mold is high: \$16.8 billion from asthma alone.² In Pennsylvania, roughly 260,000 kids and 891,600 adults are missing school and work because of this condition.³

It doesn't have to be this way- asthma sensitization and triggering occurs when genetic factors meet environmental ones, and eliminating environmental triggers can dramatically reduce symptoms for current sufferers of asthma. Strong evidence has linked home exposure to allergens to sensitization, asthma episodes, and morbidity.^{4, 5} These sensitizing allergens derive from dust mites, cockroaches,⁶ rodents,⁷ molds, and pet dander.^{8, 9} A range of pulmonary and cardiac conditions currently aggravated by in-home exposures can also be addressed.

The problem is only getting worse as our climate shifts: the "Northeast has experienced a greater recent increase in extreme precipitation than any other region in the United States; between 1958 and 2010, the Northeast saw more than a 70% increase in the amount of precipitation falling in very heavy events (defined as the heaviest 1% of all daily events)."¹⁰

¹ Rauh VA, Chew GL, Garfinkel RS. Deteriorated housing contributes to high cockroach allergen levels in inner-city households. *Environ Health Perspect.* 2002;110:323–327.

² Mudarri DH. [Valuing the Economic Costs of Allergic Rhinitis, Acute Bronchitis, and Asthma from Exposure to Indoor Dampness and Mold in the US.](#) *J Environ Public Health.* 2016;2016:2386596. doi: 10.1155/2016/2386596. Epub 2016 May 29. Review. PubMed PMID: 27313630; PubMed Central PMCID: PMC4903120.

³ Natural Resources Defense Council. *Climate Change Health Threats in Pennsylvania.*

⁴ Dales R, Liu L, Wheeler AJ, Gilbert NL. Quality of indoor residential air and health. *Can Med Assoc J.* 2008;179:147–152.

⁵ Kanchongkittiphon W, Gaffin JM, Phipatanakul W. [The indoor environment and inner-city childhood asthma.](#) *Asian Pac J Allergy Immunol.* 2014 Jun;32(2):103-10. Review. PubMed PMID: 25003723; PubMed Central PMCID: PMC4110514.

⁶ Rosenstreich DL, Eggleston P, Kattan M, et al. The role of cockroach allergy and exposure to cockroach allergen in causing morbidity among inner-city children with asthma. *N Engl J Med.* 1997;336:1356–1363.

⁷ Salo PM, Jaramillo R, Cohn RD, London SJ, Zeldin DC. Exposure to mouse allergen in U.S. homes associated with asthma symptoms. *Environ Health Perspect.* 2009;117:387–391.

⁸ Institute of Medicine. *Damp indoor spaces and health.* Washington, DC: National Academy Press; 2004.

⁹ Zock JP, Jarvis D, Luczynska C, Sunyer J, Burney P. European Community Respiratory Health Survey. Housing characteristics, reported mold exposure, and asthma in the European Community Respiratory Health Survey. *J Allergy Clin Immunol.* 2002;110:285–292.

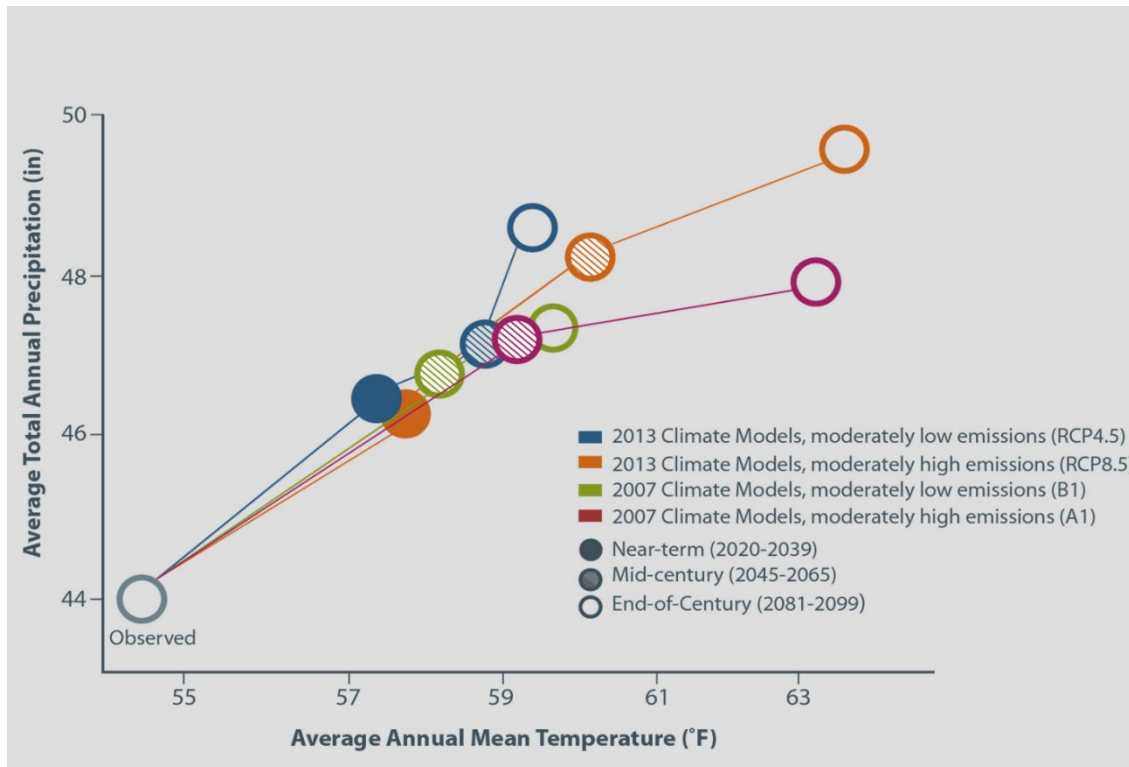
¹⁰ Horton, R., G. Yohe, W. Easterling, R. Kates, M. Ruth, E. Sussman, A. Whelchel, D. Wolfe, and F. Lipschultz, 2014: Ch. 16: Northeast. *Climate Change Impacts in the United States: The Third National Climate Assessment*, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 16-1-nn.

Higher levels of precipitation in extreme events stress stormwater management systems at the city level, but also drive mold-feeding water infiltration for individual homes. Meanwhile, warmer winters are allowing mildews and pest populations to survive later into the fall and begin growth earlier within the spring.

The Warmer, Wetter US Northeast

In both low and high emissions scenarios, between 2020 and 2039, the annual mean temperature in the Greater Philadelphia area will rise by over 3 degrees Fahrenheit, and annual precipitation will increase by over two inches.¹¹ These mean increases will not be evenly spread; the expectation is instead for more severe and more frequent storms and extreme heat events. Extreme heat triggers loose volatile organic compounds (VOCs), ground-level ozone, and other air factors to create poorer air quality, creating a dangerous mix of airborne triggers while the extreme heat poses a threat on its own. While this generally does not threaten healthy adults, this can “pose a major health risk to vulnerable groups: young children, the elderly, and those with pre-existing health conditions including asthma.”¹²

Climate models align with observed history, but represent an acceleration:



¹¹ Mayor’s Office of Sustainability, ICF International. Growing Stronger: Toward a Climate Ready Philadelphia. 2015 Nov.

¹² Horton et. al. 2014.

Figure 1: Globe-level climate predictions isolated for our region. Credit to the Philadelphia Mayor's Office of Sustainability

Only the steadfast pursuit of climate goals that creates a low-emissions scenario keeps warming within four degrees of warming, and additional rainfall around four inches. If business as usual continues, the region could see over an eight degree rise in average annual temperature, along with close to six inches of additional rainfall.

While the last degree and a half of warming for our area occurred over 60+ years, the next degree and a half comes within the next twenty years. Already, discrepancies in surface materials, roofing and green space mean that impact are concentrated in certain block areas: where there are the fewest plants, the most asphalt and the most tar roofs, surface temperatures can be up to eight degrees higher are observed (data was collected midday, measuring street-level temperature.)

The fact that these discrepancies align with existing social vulnerabilities shows the situation clearly: climate change threatens the health of those who have the least resources to adapt to it.

AVERAGE SURFACE TEMPERATURES BY CENSUS BLOCK, 2013-15

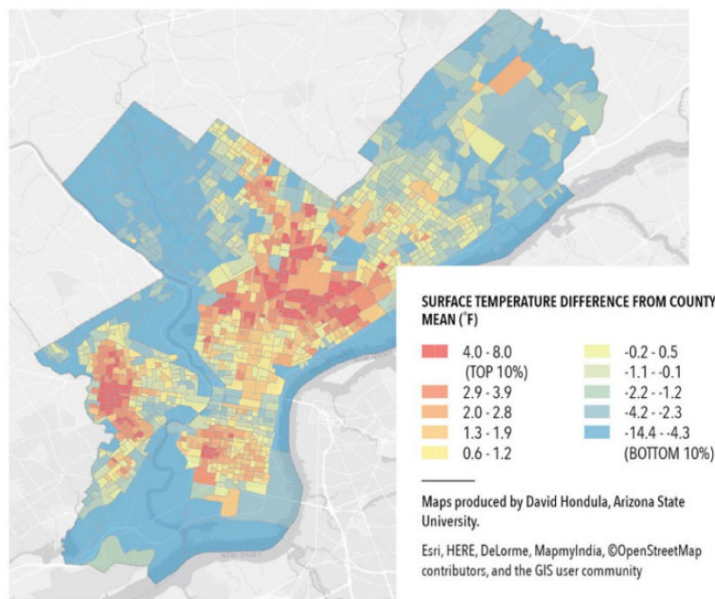


Figure 3: David Hondula, Arizona State University

Philadelphia Social Vulnerability Index

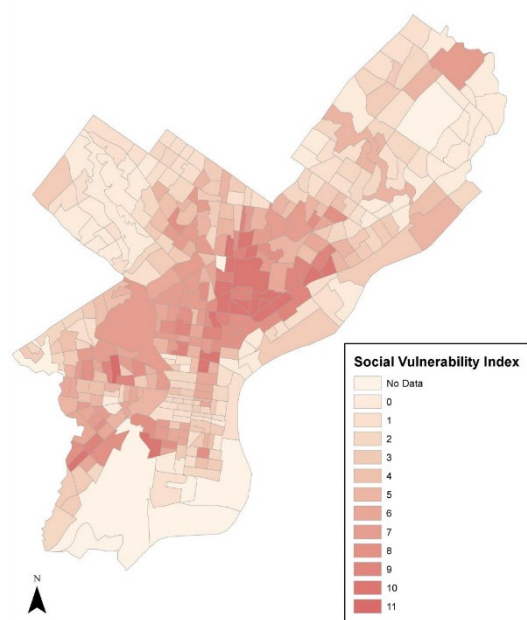


Figure 2: Philadelphia Department of Public Health

Housing and Mental Health

It should come as no surprise that living in homes that do not adequately control temperature, harbor pests, and hold other issues is not conducive to mental well-being. When homes are comfortable places in which residents feel secure and at ease, other stresses are

mitigated. Turn that around and make home itself a stressful, uncomfortable place, and a resident may spend only a fraction of their time in a place they feel they can relax. Home as a place of safety, comfort, relaxation, and self-identification is a physical and psychosocial necessity.¹³ Housing has an immediate impact of mental health, independent of overall neighborhood changes.¹⁴

The Solutions are Evident

An overwhelming preponderance of evidence supports combined weatherization and health interventions in residential homes for a broad spectrum of public policy objectives. Single-component housing interventions lack the health impact of multi-component approaches, and the retrofitting of insulation itself (a core activity in weatherization) has discrete and positive health impacts.¹⁵ A single-touch approach to create energy efficient and healthy homes can deliver major public benefits through reducing health and energy burdens with better cost-effectiveness than scattered, many-touch, limited intervention mixes.¹⁶ Especially for asthma, “evidence for multi-trigger, multi-component home visits is strong, the costs reasonable, and the feasibility of implementation clear.”¹⁷ For children suffering asthma, a specially convened Task Force found upon exhaustive review that “the combination of minor to moderate environmental remediation with an educational component provides good value for the money invested, based on improvement in symptom-free days and savings from averted costs of asthma care.”¹⁸ In the State of Washington, a study titled “Exploring Potential Impacts of Weatherization and Healthy Homes Interventions on Asthma-related Medicaid Claims and Costs in a Small Cohort in Washington State” found that weatherization and light-touch

¹³ Bashir SA. Home Is Where the Harm Is: Inadequate Housing as a Public Health Crisis. *American Journal of Public Health*. 2002;92(5):733-738.

¹⁴ Burdette AM, Hill TD, Hale L. Household Disrepair and the Mental Health of Low-Income Urban Women. *Journal of Urban Health : Bulletin of the New York Academy of Medicine*. 2011;88(1):142-153. doi:10.1007/s11524-010-9529-2.

¹⁵ Pega F, Wilson N. A Systematic Review of Health Economic Analyses of Housing Improvement Interventions and Insecticide-Treated Bednets in the Home. Fernandez-Reyes D, ed. *PLoS ONE*. 2016;11(6):e0151812. doi:10.1371/journal.pone.0151812..

¹⁶ Kuholski K, Tohn E, Morley R. Healthy energy-efficient housing: using a one-touch approach to maximize public health, energy, and housing programs and policies. *J Public Health Manag Pract*. 2010 Sep-Oct;16(5 Suppl):S68-74. doi: 10.1097/PHH.0b013e3181ef4aca. PubMed PMID: 20689378.

¹⁷ Krieger J. Home is Where the Triggers Are: Increasing Asthma Control by Improving the Home Environment. *Pediatr Allergy Immunol Pulmonol*. 2010 Jun;23(2):139-145. PubMed PMID: 22375276; PubMed Central PMCID: PMC3281289.

¹⁸ Task Force on Community Preventive Services. Recommendations from the Task Force on Community Preventive Services to decrease asthma morbidity through home-based, multi-trigger, multicomponent interventions [Internet]. *Am J Prev Med*. 2011 [cited 2013 Jan 19];41(2S1):S1-S4. Available from: <http://www.thecommunityguide.org/asthma/supportingmaterials/asthma%20task%20force%20recs.pdf>

education and supply delivery typical to healthy homes programming are separately effective in delivering positive health outcomes and most effective combined.¹⁹

Research into ‘home-based, multi-trigger multi-component interventions with an environmental focus’ have found a positive return on investment (ROI) in medical cost reduction alone.²⁰ However, when considering the economic impact of reducing parents’ missed workdays and children’s days absent from school, these same interventions have shown cost-benefit ratios from 5.3 to 14.0.²¹ Eliminating residential risk factors “would result in a 39% decline in doctor-diagnosed asthma among US children <6 years old.”²² These figures do not include the energy savings realized through weatherization which may follow remediation of home health hazards and issues of disrepair, nor the eventual costs to local governments when affordable low-income housing deteriorates to the point of being uninhabitable, eventually needing to be demolished. There are a broad variety of interests which benefit from the integration of these solutions. Pennsylvania has yet to identify all funding streams which can tackle the issue of housing deterioration and social determinants of health that accompany dense poverty.

The repair of mold-damaged housing decreases environmentally driven respiratory symptoms, including asthma, in adults and children.²³ Meta-analysis of studied housing interventions suggests health benefits begin within months of housing interventions, and makes it clear that adequately affordable and warm housing is a key determinant of health and health impacts, especially respiratory.²⁴ Based on level of disrepair, community factors, targeting, scope of the intervention, and depth of partnership between building science and medical practitioners, along with other factors, levels of success in mitigating asthma with healthy homes treatments varies. However, extraordinary results are achievable: a Michigan “Healthy Homes University” program that combining home repair with CHW home visits and education produced decreases of “48% for unscheduled visits to a health-care provider, 53% for

¹⁹ Erin Rose, Beth Hawkins, Bruce Tonn, Debbie Paton and Lorena Shah Exploring Potential Impacts of Weatherization and Healthy Homes Interventions on Asthma-related Medicaid Claims and Costs in a Small Cohort in Washington State. Oakridge National Laboratory Report. September, 2015

²⁰ Woods ER, Baumik U, Sommer SJ, Ziniel, S. et al. Community asthma initiative: evaluation of a quality improvement program for comprehensive asthma care. *Pediatrics* Vol. 129, No. 3. March 2012.

²¹ Nurmagambetov, T, Barnett, S, Verughese, J, Chattopadhyay, S, et al. Economic value of home-base, multi-trigger, multicomponent interventions with an environmental focus for reducing asthma morbidity. *American Journal of Preventive Medicine*. Vol. 41, Issue 2, Supplement 1: S33-S47. August 2011.

²² Lanphear BP, Aligne CA, Auinger P, Weitzman M, Byrd RS. Residential exposures associated with asthma in US children. *Pediatrics*. 2001 Mar;107(3):505-11. PubMed PMID: 11230590

²³ Sauni R, Verbeek JH, Uitti J, Jauhiainen M, Kreiss K, Sigsgaard T. Remediating buildings damaged by dampness and mould for preventing or reducing respiratory tract symptoms, infections and asthma. *Cochrane Database of Systematic Reviews* 2015, Issue 2. Art. No.: CD007897. DOI: 10.1002/14651858.CD007897.pub3.

²⁴ Thomson H, Thomas S, Sellstrom E, Petticrew M. Housing improvements for health and associated socio-economic outcomes. *Cochrane Database of Systematic Reviews* 2013, Issue2. Art. No.: CD008657. DOI: 10.1002/14651858.CD008657.pub2

emergency department visits, and 68% for hospitalizations. All three reductions were statistically significant ($p < 0.0001$).²⁵ Energy Efficiency treatments, properly performed, offer further improvements in health outcomes over home repair alone. By reducing indoor exposures to particulate matter, energy efficiency treatments drive “substantial benefits for mortality and morbidity from asthma, coronary heart disease and lung cancer.”²⁶

Following demonstration of medical cost-effectiveness alongside energy savings and other benefits, evidence and momentum should drive policy shifts to advance coordination and indeed alignment of multiple long-term funding streams for holistic interventions. In this manner, pilot programs exhibiting best practices under short-term foundation funding or local funding can be scaled at state, regional, and national levels.

ECA Can Deliver

Since the 1993 heat wave killed 118 Philadelphians, the Energy Coordinating Agency (ECA) has been looking for methods to make homes safer for their residents. Over two decades of investigation have led to a robust solution which preserves the life of the roof and absorbs significantly less solar energy. Installing a new, modified bitumen roof with an reflective elastomeric coating can lower upper-floor temperatures during heat waves by precious degrees, saving lives. The energy impact is debatable, as this represents a loss of thermal gain valued during winter months, but the health impact is sure.

ECA implemented ‘Cool Homes’ programming from 2002-2004, and the 2000’s included a significant learning period as we grappled with a notion of using closed cell rooftop spray-foam over existing roofs. While this achieved the temperature reduction, it was cost-prohibitive. From 2004-2006, ECA was implementing the WRAP (Weatherization, Repair, and Asset Preservation) program of the Ford Foundation. Many homes in the Point Breeze neighborhood of Philadelphia were stabilized in repair level and energy costs, allowing low income homeowners to hold on to their assets in the face of gentrification. In 2012, ECA partnered with Dow to deliver the ‘RetroFIT Philly Coolest Block Contest,’ and turned the roofs of 1200 Wolf Street from tar and asphalt to cool roofs.

In 2013-2014, with a grant for \$1 million from the Oak Foundation and funding from the City Housing Trust Fund, ECA launched EnergyFIT Philly, our signature program that leverages all available resources for impact, targeting at the whole-block level for cost-efficiency and community solidarity. We began this work in the Mantua neighborhood of West Philadelphia, where the most serious issues we encountered were in the basement rather than on the roof.

²⁵ Largo TW, Borgianni M, Wisinski CL, Wahl RL, Priem WF. [Healthy Homes University: a home-based environmental intervention and education program for families with pediatric asthma in Michigan](#). Public Health Rep. 2011 May-Jun;126 Suppl 1:14-26. PubMed PMID: 21563708; PubMed Central PMCID: PMC3072899.

²⁶ Milner J, Chalabi Z, Vardoulakis S, Wilkinson P. [Housing interventions and health: Quantifying the impact of indoor particles on mortality and morbidity with disease recovery](#). Environ Int. 2015 Aug;81:73-9. doi: 10.1016/j.envint.2015.04.011. Epub 2015 May 25. PubMed PMID: 25958127.

In Mantua, we found homes with shockingly high relative humidity, 70% or more in three cases. For perspective, the EPA recommends relative humidity levels between 25% and 55%. High relative humidity drives mold growth, causes permanent damage to the home over time, provides an environment suitable to other pests and infectious organisms, and directly reduces the body's ability to manage heat. During a heat wave, indoor humidity can make a critical difference. ECA experimented with a variety of remedies, but in the end, the only effective measure was removal of all damp items and re-sealing of the basement. Today, those homes are drier, cooler in the summer, and more energy efficient all year round.

In 2015 and 2016, after a full year and half in Mantua, ECA was able to address needs on two blocks. On Seltzer and Helen St, the complete program of home repair, energy efficiency, and cool roofing was applied. In 2017 and 2018, we worked in Wishart Street, North Marshall Street, and West French street.

Entire neighborhoods can be stabilized as health threats are eliminated and homes are made more energy efficient. ECA performs repairs that enable homeowners to qualify for federal programs, leveraging the investment and achieving deep energy savings. This work is combined with community education and counseling to engage residents in energy conservation and to ensure long-term success. This is a one-touch solution applied at community scale, which addresses a broad spectrum of problems for a cost well under \$40,000 per home. This program stabilizes low-income populations in their current residences while improving the area and property values. It addresses a root cause of homelessness: housing deterioration past the point of livability, which also prevents the homes themselves from ending up as vacant properties which bring down the neighborhoods around them until taxpayers fund L&I demolition- at costs greatly exceeding the repairs delivered through EnergyFIT Philly. It financially empowers all residents by improving the value of their greatest asset and significantly reducing monthly energy bills. The elderly are better able to comfortably age in place, and working parents miss less work due to children being sick.

Scaling the Effort

ECA has worked and is working to secure stable and scaled support for coordinated home repair, home health improvement, and weatherization. After a year-long process of engagement with the statewide Policy Advisory Committee, the PA DCED began conducting pilots in expanding allowable funding uses for LIHEAP WAP (Low Income Home Energy Assistance Program – Weatherization Assistance Program transfer,) also raising the allowable per-home spend. ECA has also joined the Built to Last coalition and is committed to working alongside the Philadelphia Energy Authority and other area partners to scale integrated repair-weatherization solutions.