2 BACKGROUND AND CONTEXT

2.1 Overview of air pollution and health in Detroit

People living and working in Detroit are exposed to elevated levels of ambient air pollutants. Air pollutants of concern include, but are not limited to, particulate matter (PM), diesel exhaust,[1, 2] volatile organic compounds (VOCs),[1,2,3,4] sulfur dioxide (SO_2), nitrogen oxides (NO_x), ozone (O_3), and several toxics (such as manganese). Exposures to these and other pollutants and the associated health effects have long been a concern among Detroit residents, who disproportionately experience many adverse health effects. Air pollution continues to be identified as one of the top public health priorities by Detroit community members and community-based organizations.[5, 6]

The adverse impacts of air pollutant exposure on health over the life course are well established.[7, 8] Air pollutants have been demonstrated to affect asthma,[9, 10] cardiovascular risk,[11, 12] and birth outcomes.[13] These adverse health effects can occur at concentrations below the current U.S. National Ambient Air Quality Standards (NAAQS). There is strong evidence that environmental pollutants make a large contribution to adverse health outcomes in urban areas such as Detroit, where a large and vulnerable population experiences high exposures.[14] Pollutant exposures have been associated with elevated cardiovascular risk,[11] asthma exacerbation,[9, 10] and adverse birth outcomes[9] among Detroit residents.

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[1] Du L, Batterman SB, Parker E, et al. 2011.Particle concentrations and effectiveness of free-standing air filters in bedrooms of children with asthma in Detroit, Michigan. Build Environ 46(11):2303-2313. PMCID: PMC3161201

[2] Keeler GJ, Dvonch JT, Yip F, et al. 2002. Assessment of personal and community-level exposures to particulate matter among children with asthma in Detroit, Michigan, as part of Community Action Against Asthma (CAAA). Environ Health Perspect. 110(suppl 2):173-181

[3] Batterman S, Chin JY, Jia C, et al. 2012. Sources, concentrations, and risks of naphthalene in indoor and outdoor air. Indoor Air 22(4):266-78.

[4] Jia C, Batterman SB, Godwin C. 2008. VOCs in industrial, urban and suburban neighborhoods: Part 2: Factors affecting indoor and outdoor concentrations. Atmospheric Environment 42(9):2101-2116.

[5] Detroit Works Project. 2012. Strategic Action Plan. Available: http://detroitfuturecity.com/framework/ [accessed 10 May 2016]

[6] Southwest Detroit Environmental Vision. 2013. SW Detroit Environmental Vision Care Project Action Plan. http://www.sdevweb.org/healthybusinesses.htm

[7] Pope CA. 2007. 3rd. Mortality effects of longer term exposures to fine particulate air pollution: Review of recent epidemiological evidence. Inhal Toxicol. 19 Suppl 1:33-38.

[8] U.S. Census Bureau. 2010. 2010 Census, Detroit City Quickfacts. Available: http://quickfacts.census.gov/qfd/states/26/2622000.html [accessed 10 May 2016]

[9] Li S, Batterman S, Wasilevich E, Elasaad H, Wahl R, Mukherjee B. 2011. Asthma exacerbation and proximity of residence to major roads: A population-based matched case-control study among the pediatric Medicaid population in Detroit, Michigan. Environ Health 10:34. PMCID: PMC3224543

[10] Li S, Batterman S, Wasilevich E, et al. 2011. Association of daily asthma emergency department visits and hospital admissions with ambient air pollutants among the pediatric Medicaid population in Detroit: time-series and time-stratified case-crossover analyses with threshold effects. Environ Res 111(8):1137-1147. PMID: 21764049

[11] Milando C, Huang L, Batterman S. 2016. Trends in PM2.5 emissions, concentrations and apportionments in Detroit and Chicago. Atmos Environ 129:197-209.

[12] Peters A, Dockery DW, Muller JE, Mittleman MA. 2012. Increased particulate air pollution and the triggering of myocardial infarction. Circulation 103(3):2810-2815.

[13] Le HQ, Batterman SA, Wirth JJ, et al. 2012. Air pollutant exposure and preterm and term small-for-gestational-age births in Detroit, Michigan: Long-term trends and associations. Environ Int 44:7-17. PMID: 223141

[14] Giles LV, Barn P, Kunzli N, et al. 2011. From good intentions to proven interventions: Effectiveness of actions to reduce the health impacts of air pollution. Environ Health Perspect 2011;119(1):29-36. PMCID: PMC301849

Air pollutants typically occur as mixtures, and these mixtures vary at different points in time and across areas. As a result, it can be challenging to identify and quantify the specific pathways through which pollutants affect respiratory (lung), cardiovascular (heart and circulatory system), neurological, and other health outcomes. Section 4 of this manual describes air quality monitoring and exposures in Detroit and describes, for key pollutants, attainment with the NAAQS, the monitoring network for that pollutant, and concentration trends. Monitoring and exposures of $PM_{2.5}$, O_3 and SO_2 are emphasized, given the importance of these pollutants in the Detroit area.

Because exposures vary across places, it is important to identify where there are vulnerable populations who are being exposed. Important factors linked to vulnerability of individuals and populations include age (young, old), race and ethnicity (African American and Hispanic), income, and pre-existing cardiovascular (heart) or pulmonary (lung) disease. Protecting vulnerable populations from exposure to air pollutants is particularly important because their health is more strongly affected. Issues of vulnerability and susceptibility are detailed in Section 3 of this manual.

In addition to the amount of pollutants emitted, exposure is affected by how close point (stationary) and mobile (cars, trucks) emission sources are to homes, schools, playgrounds and other frequented locations, and the number of people living or going to school or work in an area affects how many people are exposed.[9, 15] However, emissions from many sources, including those with elevated stacks and those that form secondary pollutants, can affect a broad region, and sometimes the area most affected can be several or many miles distant from sources. Section 5 of this manual describes emission sources, including point, mobile and area sources, the spatial patterns or dispersion of pollutants result from major sources factoring in effects of meteorology, and estimates the health impacts from $PM_{2.5}$, O_3, and NO_x exposures.

2.2 Important sources of ambient air pollutants in Detroit

Exposure to ambient air pollutants results from emissions at both stationary and mobile sources. The concentrations that result from these emissions are influenced by weather and climate conditions, including wind patterns that carry and disperse pollutants from sources to neighborhoods, cities and other regions.[16, 17] Source apportionment studies provide estimates of sources contributing to air pollutants. One study that used data from southwest and eastside Detroit indicated that 60% of ambient particulate matter ($PM_{2.5}$) is attributable to secondary sulfate/coal combustion sources (for example, coal fired power plants), and 30% to vehicular sources (e.g., cars, trucks).[18] A more recent study in Detroit found that while Wayne county-wide data suggest emissions from point sources are decreasing, emissions from on-road mobile sources are constant.[11] Thus, while concentrations of $PM_{2.5}$ have declined over the past two decades, the fraction of $PM_{2.5}$ due to emissions from vehicles and some other local emission sources has increased.[11] Section 4 of this manual provides a more recent update, showing that trends of $PM_{2.5}$ are not decreasing. These and other studies in North America, Europe and Asia show that in urban areas, cars, trucks and other vehicles are one of the

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[15] Rioux CL, Tucker KL, Mwamburi M, Gute DM, Cohen SA, Brugge D. Residential traffic exposure, pulse pressure, and C-reactive protein: Consistency and contrast among exposure characterization methods. Environ Health Perspect 118(6):803-811. PMCID: PMC2898857

[16] Health Effects Institute. 2010. Traffic-related air pollution: A Critical review of the literature on emissions, exposure, and health effect. Boston, MA. Available: http://pubs.healtheffects.org/view.php?id=334 [accessed 10 May 2016]

[17] Turner JR. 2008. A Conceptual Model for Ambient Fine Particulate Matter Over Southeast Michigan: High Concentration Days: Southeast Council of Governments.

[18] Hammond DM, Dvonch JT, Keeler GJ, et al. 2008. Sources of ambient fine particulate matter at two community sites in Detroit, Michigan. Atmos Environ 42:720-732.

dominant sources of air pollutants such as PM, diesel exhaust PM, VOCs, carbon monoxide (CO), nitrogen oxides (NO_x), and ozone (O_3) precursors.

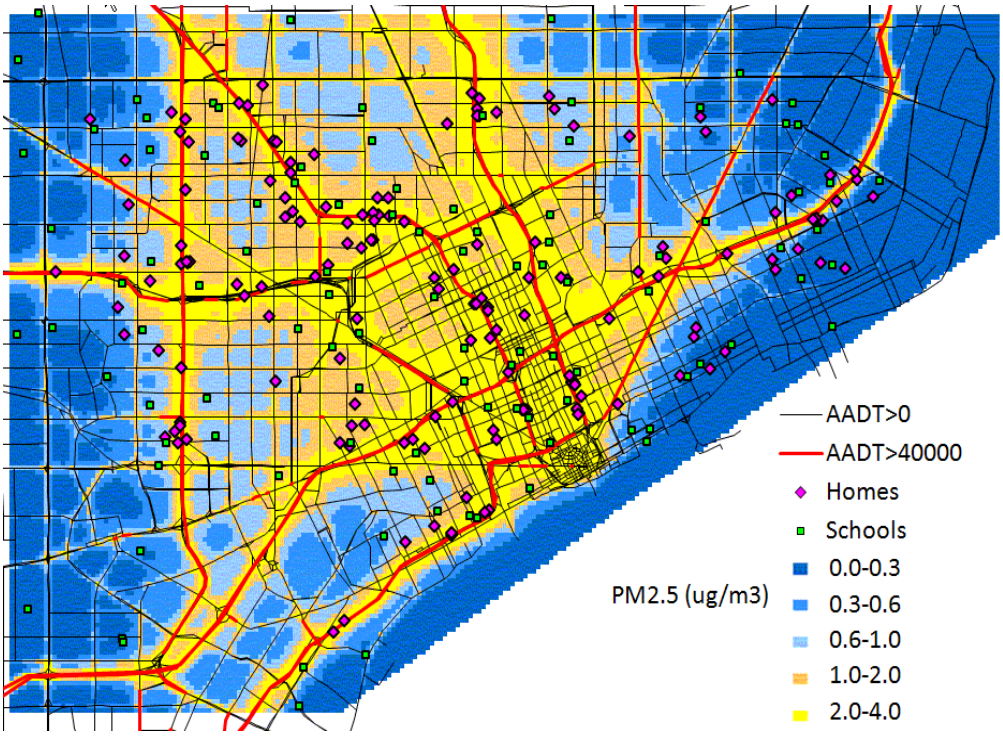

Figure 1-1 is a map showing annual average (2010) $PM_{2.5}$ concentrations attributable to vehicular sources in Detroit, showing sharp spatial gradients characteristic of these emissions, and the locations of study participant homes and schools in one of our CBPR-based epidemiological studies.[19] Section 5 of this resource manual describe emission sources in depth.

Fig 1-1: Annual average $PM_{2.5}$ concentrations from traffic in Detroit/Wayne Co. Based on EPA MOVES/ AERMOD models, 9701 road links, 2010 meteorology. Figure also shows homes and schools in an ongoing CAAA study. Derived from Batterman et al., 2014. [20]

As an older industrial city, Detroit has many homes and schools very close to highways. For example, 80 public schools are within 150 meters (about 500 feet) of large highways, many with high proportions of heavy diesel vehicles.[21] The proximity of many homes and schools to freeways can increase residents' and students' exposure to air pollutants from traffic, including $PM_{2.5}$ and diesel exhaust.[16, 22]

[19] Vette A, Burke J, Norris G, et al. 2012. The near-road exposures and effects of urban air pollutants study (NEXUS): Study design and methods. Sci Total Environ

[20] Batterman S, Ganguly R, Isakoff V, Burke J, Arunachalam S, Snyder M, et al. 2014. Dispersion Modeling of Traffic-Related Air Pollutants: Exposure and Health Effects among Children with Asthma in Detroit, Michigan. Transportation Research Record (TRR), Journal of the Transportation Research Board, No. 2452, 105–113.

[21] Wu YC, Batterman SA. 2006. Proximity of schools in Detroit, Michigan to automobile and truck traffic. J Expo Sci Environ Epidemiol 16(5):457-470.

[22] Cho SH, Tong H, McGee JK, Baldauf RW, Krantz QT, Gilmour MI. 2009. Comparative toxicity of size-fractionated airborne particulate matter collected at different distances from an urban highway. Environ Health Perspect 117(11):1682-1689. PMCID: PMC2801189

Detroit is also notable for its many large industrial sources of air pollutants. These include coal-fired power plants, coke, steel, and cement facilities, petroleum refineries, and incinerators, among others. There are also large neighborhoods adjacent to many of the large industrial facilities. Several of these facilities are large emitters of sulfur dioxide (SO_2) and other pollutants, and portions of the Detroit area are currently classified as a SO_2 NAAQS non-attainment area, that is, an area that does not meet the heath-based federal air pollution standard for this pollutant. Fig 1-2 shows that high SO_2 concentrations span much of the Detroit region, largely due to emissions from coal-fired power plants, steel industry, and other SO_2 emission sources. Ambient monitoring, emissions and health impacts related to SO_2 exposure (and other pollutants) are discussed in Sections 4 and 5 of this manual.

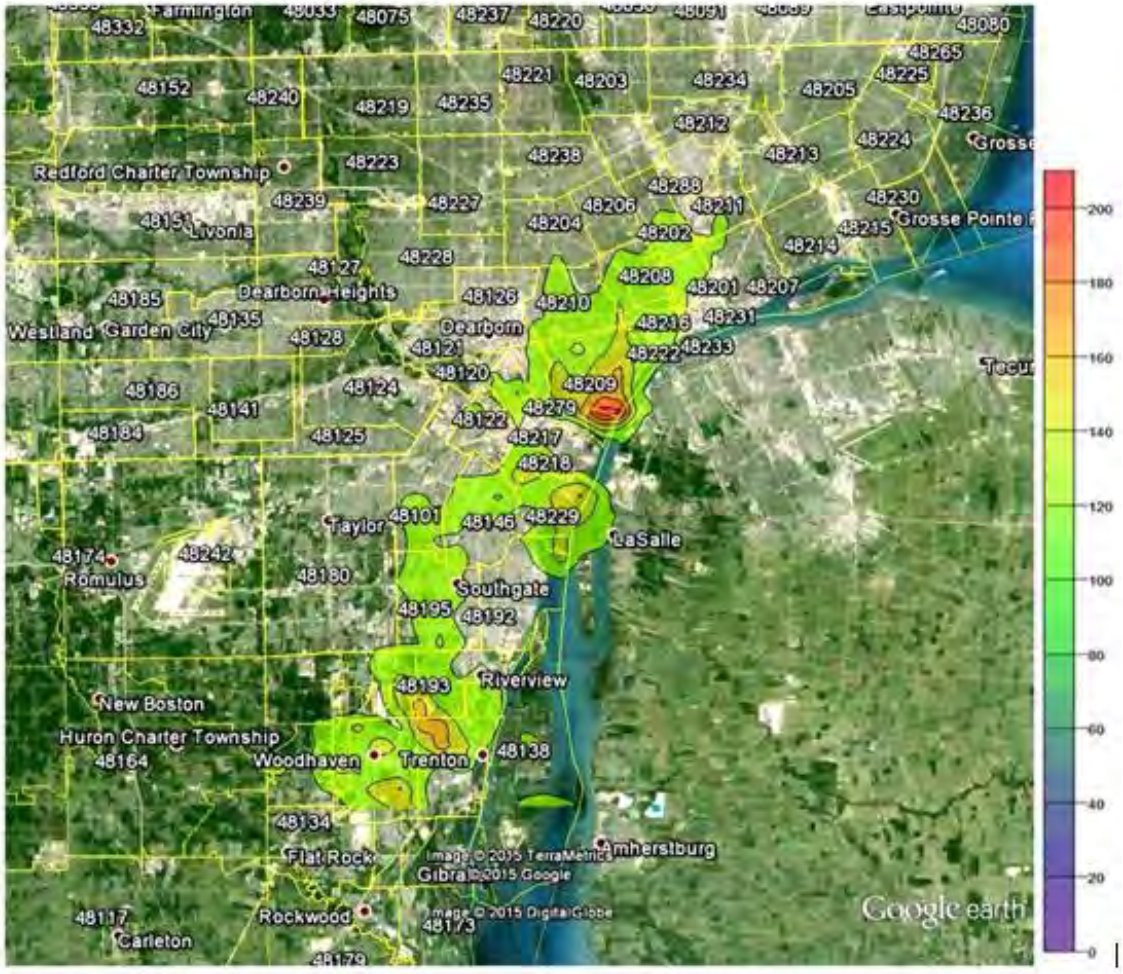

Figure 1-2. Predicted SO_2 concentrations ($\mu g/m^3$) across the Detroit region. Shows 4th highest daily 1-hr concentration predicted from major Detroit area. Based on AERMOD, 2012 meteorology, 1000 m grid, and no background. (157 $\mu g/m^3$ is equal to 75 ppb, the current 1-hr NAAQS concentration. Concentration scale at right.

Considering pollutants other than SO_2 and $PM_{2.5}$, Detroit (like many other urban areas) is very close to exceeding the health-based ozone (O_3) NAAQS that was promulgated by US EPA in late 2015; this might require significant reductions in precursor NO_x and VOC emissions to attain the new and lower O_3 standard. From a regulatory and political perspective, non-attainment status greatly increases both the awareness and attention given to air pollution problems. O_3 and other pollutants are discussed in Sections 4 and 5.

2.3 Mitigating air pollutant exposure

There are many approaches or interventions that can be used to mitigate air pollutant exposure, reduce adverse health effects, and improve public health.[14, 23] Public health actions informed by scientific evidence can make substantial contributions to public health. Potential interventions include, for example, "traditional" end-of-pipe emission controls, air filters installed in homes and schools to reduce particulate matter exposure, and the

[23] U.S. EPA. 2011. School Siting Guidelines. Atlanta, GA: EPA; Report No.: EPA-100-K-11-004. http://www.epa.gov/schools/siting/

use of barriers, buffers and "green spaces" adjacent to roadways and other pollution sources (e.g., industry) that can reduce noise and the concentration of air pollutants that reach people.[24, 25,26]

A wide range of mitigation measures is evaluated in Section 9 of this manual. This includes a considerable amount of new information and research evaluating the effectiveness and applicability of these measures to improving health in the Detroit area.

2.4 CAPHE goals and partnerships

Community Action to Promote Healthy Environment's (CAPHE's) goal is to develop a public health action plan that includes multiple strategies that will improve air quality and health in Detroit.

CAPHE builds on, and substantially extends, over 15 years of community-based participatory research (CBPR) partnerships, involving collaboration between community-based organizations working on environmental health issues in Detroit, academic researchers with expertise in the health effects of air pollutants, land use, climate change, and community health promotion, and public health and environmental health practitioners based in government institutions.

Three long-standing CBPR partnerships serve as the foundation for CAPHE; the Detroit Community-Academic Research Center, Community Action Against Asthma, and the Healthy Environments Partnership.

The **Detroit Community-Academic Research Center (Detroit-URC)** a CBPR partnership established in 1995, involves collaboration among eight community-based organizations (Community Health and Social Services Center, CHASS; Communities In Schools; the Detroit Hispanic Development Corporation (DHDC); Detroiters Working for Environmental Justice (DWEJ); Friends of Parkside (FOP); Latino Family Services (LFS); Neighborhood Service Organization (NSO); Eastside Community Network (ECN), the Institute for Population Health, Detroit Health Department, Henry Ford Health System, and the University of Michigan Schools of Public Health, Nursing and Social Work. These organizations comprise the URC Board, which oversees all URC activities, including adherence to its CBPR principles and the development of new, affiliated partnerships.[27] The URC's mission is to foster and support community-based participatory research efforts to examine and address social and physical environmental determinants of health aimed at eliminating health inequities. Its policy-advocacy goals are to: (1) enhance capacity at the organization, local, state and national levels to impact policy change; and (2) translate research findings to promote policy change. Since 2008, the URC has worked to enhance knowledge and skills of community members to engage in the policy advocacy process.[28]

Community Action Against Asthma (CAAA) began in 1998 as part of an NIEHS/EPA funded Children's Center initiative. CAAA uses a CBPR approach to conduct epidemiological and intervention research investigating the influence of environmental factors on childhood asthma. It engages six CBO partners, including the DHDC, DWEJ,

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[24] Baldauf R, Thoma E, Hays M, et al. 2008. Traffic and meteorological impacts on near-road air quality: Summary of methods and trends from the Raleigh Near-Road Study. J Air Waste Manag Assoc 58(7):865-878. PMID: 18672711

[25] Bowker GE, Baldauf RW, Isakov V, Khlystov A, Petersen W. 2007. Modeling the effects of sound barriers and vegetation on the transport and dispersion of air pollutants from roadways. Atmos Environ 41:8128-8139.

[26] The Marathon Oil Refinery, located on Detroit's Southwest side, recently purchased several hundred homes around it so it could expand; this forms a type of buffer. As a result, hundreds of nearby households moved away. However, buffers have much broader applicability.

[27] Israel BA, Lichtenstein R, Lantz P, et al. 2001. The Detroit Community-Academic Urban Research Center: Development, implementation and evaluation. J Public Health Manag Pract 7(5):1-19.

[28] Israel BA, Coombe CM, Cheezum RR, et al. 2010. Community-based participatory research: A capacity building approach for policy advocacy aimed at eliminating health disparities. Am J Public Health 2010;100(11):2094-2102. PMID: 20864728

Southwest Detroit Environmental Vision, LFS, FOP, WCDC and CHASS. Its Steering Committee oversees all phases of the research process.[29] Since its inception, CAAA has received 4 R01s from NIEHS and an EPA STAR grant. CAAA has conducted an intervention study investigated the efficacy of air filters in reducing PM levels and improving respiratory health among children with asthma, an exposure and health effects study investigating effects of residence and school proximity to major highways and exposure to diesel PM on the health status of children with asthma,[30] and an epidemiologic study evaluating interactions between traffic exposures and viral respiratory infections, and asthma. CAAA has reported, for example: elevated levels of PM and effects of filters on indoor air quality[1, 3, 31, 32], elevated indoor levels of VOCs[3, 33, 34], relationships between PM exposure and children's asthma symptoms and unscheduled medical visits,[35] areas within the city where high concentrations of African American and Hispanic residents experience reduction in lung function with exposure to PM[33], and advanced exposure modeling techniques.[19] For a summary of CAAA's research, see Appendix TBD.

The **Healthy Environments Partnership**, established in 2000 with funding from NIEHS, is a CBPR partnership with a focus on cardiovascular health in Detroit neighborhoods.[36] HEP conducts etiological research linking aspects of the physical, built and social environments to cardiovascular health, and develops, implements and evaluates interventions to address those conditions toward the end of reducing racial/ethnic and socioeconomic inequities in cardiovascular disease (CVD). Since HEP's inception, the partnership has examined environmental

[29] Parker EA, Israel BA, Brakefield-Caldwell W, et al. Community Action Against Asthma: Examining the partnership process of a community-based participatory research project. J Gen Intern Med 18(7):558-567.

[30] Li S, Mukherjee B, Batterman S. 2012. Point source modeling of matched case-control data with multiple disease subtypes. Stat Med 31(28):3617-3637. PMID: 22826092

[31] Du L, Batterman S, Godwin C, et al. 2012. Air change rates and interzonal flows in residences, and the need for multi-zone models for exposure and health analyses. Int J Environ Res Public Health 9(12):4639-61.

[32] Batterman S, Du L, Mentz G, et al. 2012. Particulate matter concentrations in residences: an intervention study evaluating stand-alone filters and air conditioners. Indoor Air 22(3):235-252. PMID: 22145709

[33] Chin JY, Godwin C, Jia C, et al. 2012. Concentrations and risks of p-dichlorobenzene in indoor and outdoor air. Indoor Air 23(1):40-9. PMCID: PMC3501547

[34] Jia C, Batterman SA, Relyea GE. 2012. Variability of indoor and outdoor VOC measurements: an analysis using variance components. Environ Pollut 169:152-159. PMID: 21995872

[35] Lewis TC, Robins TG, Dvonch JT, et al. 2005. Air pollution associated changes in lung function among asthmatic children in Detroit. Environ Health Perspect 113(8):1068-1075.

[36] Schulz AJ, Kannan S, Dvonch JT, et al. 2005. Social and physical environments and disparities in risk for cardiovascular disease: The Healthy Environments Partnership conceptual model. Environ Health Perspect 113(12):1817-1825

conditions and CVD risk factors.[37, 38, 39, 40, 41, 42] Research conducted has demonstrated effects of $PM_{2.5}$ on blood pressure, particularly for residents of neighborhoods proximate to air pollutant sources.[43] These effects are exacerbated for residents who are obese[44] and for those who report high levels of stress.[45] HEP has also conducted an extensive community assessment and participatory action planning process,[46] which included dissemination of findings to policy makers, in order to develop multilevel interventions to reduce inequities in CVD, which are currently being implemented and evaluated. In keeping with HEP's CBPR approach, four CBOs (Friends of Parkside (FOP), Detroit Hispanic Development Corporation (DHDC), Eastside Community Network (ECN) and Chandler Park Conservancy (CPC)), Detroit Health Department, Henry Ford Health System, and the University of Michigan School of Public Health are members of the HEP Steering Committee, which guides all phases of this work. For a summary of HEP's research, see www.hepdetroit.org, and for a summary of HEP's research related to air quality and health, see Appendix TBD.

Representatives from each of the above partnerships are involved with CAPHE, as well as additional groups and organizations whose work is relevant to air pollution and health in Detroit.

2.5 CAPHE Core Team

Members of the CAPHE Core Team include:

The **Detroit Hispanic Development Corporation (DHDC),** a non-profit organization in Southwest Detroit, rooted in the vibrant culture of Detroit's Latino community. DHDC's mission is to make a difference by creating life-changing opportunities. DHDC serves over 5,000 youth and adults annually. Programs include adult education services that reach out to non-traditional students, youth services that are recognized as some of the best in the city of Detroit, and family services that emphasize the importance of healthy family communication and parent leadership. DHDC also leads a "Colectivo" of Latino-led groups in organizing efforts designed to strengthen the Detroit Latino community's voice and increase their participation in democratic processes, while

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[37] Schulz AJ, House JS, Israel BA, et al. 2008. Relational pathways between socioeconomic position and cardiovascular risk in a multiethnic urban sample: Complexities and their implications for improving health in economically disadvantaged populations. J Epidemiol Community Health 62(7):638-646. PMCID: PMC2668209

38 Zenk S, Schulz AJ, Hollis-Neely T, et al. 2005. Fruit and vegetable intake in African Americans: Income and store characteristics. Am J Prev Med 29(1):1-9.

[39] Zenk S, Schulz AJ, House JS, Benjamin A, Kannan S. 2005. Application of CBPR in the design of an observational tool: The Neighborhood Observational Checklist. In: Israel BA, Eng E, Schulz AJ, Parker E, eds. Methods in Community-Based Participatory Research for Health. San Francisco, CA: Jossey-Bass p. 167-187.

[40] Zenk S, Schulz AJ, Israel BA, James SA, Bao S, Wilson ML. 2005. Neighborhood racial composition, neighborhood poverty, and supermarket accessibility in metropolitan Detroit. Am J Public Health 95(4):660-667.

[41] Zenk SN, Schulz AJ, Israel BA, House JS, Benjamin A, Kannan S. 2005. Use of community-based participatory research to assess environmental determinants of health: Challenges, facilitators, and implications for universities. Metropolitan Universities Journal 16(1):107-125.

[42] Schulz AJ, Mentz G, Lachance L, Johnson J, Gaines C, Israel BA. 2012. Associations between socioeconomic status and allostatic load: Effects of neighborhood poverty and tests of mediating pathways. Am J Public Health 102(9):1706-14. PMCID: PMC3416053

[43] Dvonch JT, Kannan S, Schulz AJ, et al. 2009. Acute effects of ambient particulate matter on blood pressure: Differential effects across urban communities. Hypertension 53(5):853-859. PMID:19273743

[44] Kannan S, Dvonch JT, Schulz AJ, et al. 2010. Exposure to fine particulate matter and acute effects on blood pressure: effect modification by measures of obesity and location. J Epidemiol Community Health 64(1):68-74. PMID:19833604

[45] Hicken MT, Dvonch, JT, Schulz AJ, Mentz G, Max P. 2014. Fine particulate matter air pollution and blood pressure: The modifying role of psychosocial stress. Environmental Research. 133:195-203. PMID: 24968081. PMCID: PMC4137402

[46] Schulz AJ, Israel BA, Coombe CM, et al. 2011. A community-based participatory planning process and multilevel intervention design: Toward eliminating cardiovascular health inequities. Health Promot Pract 12(6):900-912. PMCID: PMC3212629

building their capacity as agents of change and self-determination in their own families, schools and communities.

Detroiters Working for Environmental Justice (DWEJ) champions local and national collaboration to advance environmental justice and sustainable redevelopment. They foster clean, healthy and safe communities through innovative policy, education and workforce initiatives. DWEJ envisions Detroit as the global model of a vibrant urban center where all thrive in environmental, economic and social health. DWEJ provides leadership and coordination for the Detroit Environmental Agenda, a far reaching plan to promote environmental justice throughout the city, and encompassing air, water, tree canopy, recycling, sewerage and other environmental issues in the city.

Southwest Detroit Environmental Vision (SDEV), is a 501(c)(3) nonprofit organization whose mission is to improve the environment and strengthen the economy of Southwest Detroit. They work together with residents, community organizations, government agencies, schools, businesses and industry to combat environmental issues, including: indoor and outdoor air quality, blight (illegal dumping, graffiti, abandoned homes), and incompatible land use. SDEV is funded through memberships, individual and corporate donations, and grants. SDEV's work would not be possible without the dedication of our community volunteers.

The **University of Michigan School of Public Health (UM SPH),** whose mission is to create and disseminate knowledge with the aim of preventing disease and promoting the health of populations worldwide. The UM SPH is especially concerned with health equity and thus has a special focus on populations who disproportionately experience excess exposures that are harmful to health, including exposures in the physical environment (e.g., air pollutants) and social and economic environments (e.g., isolation, poverty). Faculty from the Departments of Environmental Health Sciences and Health Behavior and Health Education are actively involved with CAPHE, and bring expertise in air pollution and mitigation strategies, social and economic factors that are associated with health equity, community-based participatory research, and translation of research into action to promote health and health equity.

2.6 CAPHE Steering Committee

Members of the CAPHE Steering Committee include the above mentioned Core Team Members, and additional representatives from:

Detroit Future City (DFC), the home-base of the DFC Strategic Framework, which was formed in 2013 after three years of solid work, drawing on the best local and national talent as well as the insights of tens of thousands of Detroiters. The DFC Strategic Framework is a highly detailed long term guide for decision–making by all of the stakeholders in the City. Through the support of the Kresge Foundation, Detroit Economic Growth Corporation, W. K. Kellogg Foundation, John S. and James L. Knight Foundation and working in collaboration with the City of Detroit, the DFC Strategic Framework is guiding planning in Detroit.

Green Door Initiative (GDI), a non-profit 501(c) 3, environmental organization that works to ensure that every person is environmentally literate capable of practicing and promoting sustainability as a life style. GDI has several programs including environmental education and awareness, land use development, "Youths Speak Green" youth development program, climate change and environmental restoration, and development of a green workforce in Detroit.

Michigan Department of Environmental Quality (DEQ), the state agency that ensures that Michigan's air remains clean by regulating sources of air pollutants to minimize adverse impact on human health and the

environment. Goals are to meet and maintain air quality standards, limit emissions of hazardous and toxic pollutants, and inform the public about current air conditions.

The **Sierra Club's** Detroit-based Environmental Justice Office, which is part of the nation's oldest, largest and most influential grassroots environmental organization. The Sierra Clubs Environmental Justice efforts in Detroit include a strong focus on communities disproportionately affected by environmental exposures, with advocacy to change policies to promote environmental justice.

The Taubman College of Architecture and Urban Planning, a school at the University of Michigan, that strives to improve the environmental quality, economic potential, and social equity of places: neighborhoods, towns, cities, metropolitan areas, and larger regions. The college seeks to shape place-based policy and design for social equity and sustainability, regional solutions to metropolitan problems, just and effective remedies for urban decline, and the creation of human settlements that offer alternatives to environmentally consumptive land-development patterns.

The **University of Michigan's Medical School,** which has more than 160 years of service to the University, State of Michigan, and the world. They have known how to put patients first, when to push the boundaries of science and medicine, how to design successful curricula, and how to reward our faculty, students and staff for their everyday excellence.

Wayne State University Law School – Transnational Environmental Law Clinic: Wayne State University Law has partnered with the University of Windsor Law School to create North America's first Transnational Environmental Law Clinic. The clinic teaches students the skills and strategies needed to affect environmental policy in all three branches of state and federal government. During classroom sessions, students learn about current environmental policy challenges and opportunities and explore these issues from multiple perspectives. In the clinical component, students participate in the lawmaking process by preparing policy papers and formal legislative testimony, commenting on rulemaking and permit decisions, and engaging in judicial review and enforcement litigation.