2017 DC Public Health Case Challenge

Lead and Adverse Childhood Experiences: Neurological and Behavioral Consequences for Youth in the District of Columbia

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Acknowledgments

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Disclaimer

All characters, organizations, and illustrative vignettes described in the case are fictional and do not reflect the views of actual organizations or specific individuals. The case scenario is complex and does not necessarily have a single correct or perfect solution, thus encouraging teams to develop a judicious balance of creative, interdisciplinary, and evidence-based approaches. The authors of this case study have provided facts and figures within the case as well as appendices with resources and references to help teams create their solutions. The data provided are derived from independent sources, may have been adapted for use in this case, and are clearly cited such that teams can verify or contest the findings within their recommendations whenever pertinent. Teams are responsible for justifying the accuracy and validity of all data and calculations that are used in their presentations, as well as defending their assertions in front of a panel of subject matter experts who will serve as judges representing different stakeholders.

Instructions

Task: Develop a feasible and creative proposal of an intervention or interventions that will address the neurological and behavioral effects of lead and Adverse Childhood Experiences (ACEs) on the development of youth in Washington, DC. Present your proposed solution(s) to address the challenge at the Case Challenge competition to be held on October 13, 2017.

Scope: The proposal is limited to a budget of $2.5 million USD to be used during a five-year span. Your proposal and presentation should specify which sector(s), groups of people, and/or organizations your intervention(s) will engage and provide a justification for these selections. Staff salaries for the intervention should be covered within the allowed budget.

Case information: The case includes some initial background statistics and information relevant to the case topic. However, in your presentation, you do not need to address all the information presented in the case. Rather you can use the provided materials as a reference to help guide your response.

Outside resources: Teams should also consider outside resources for a deeper understanding of the problem and a stronger proposal. However, registered team members must generate the case solution independently. Faculty advisors and other individuals who are used as a resource should not generate ideas for the case solutions but can provide relevant information, guide students to resources, provide feedback on ideas and proposals for case solutions and recommendations generated by the students, and provide feedback on draft slides/practice presentations.

Judging: Refer to the judging rubric (see Appendix E) to see the criteria on which you will be assessed. Judges will represent organizations working with DC residents, along with philanthropy, clinical medicine, environmental economics, and behavioral health.

If you have questions about the case, please email Wyatt Bensken at wbensken@gmail.com prior to 9:00am on Thursday, October 12. He will forward your question and his answer to all of the participating teams.

On the day of the presentation, please remember the following:

- Arrive at the National Academy of Sciences building (2101 Constitution Avenue, NW, Washington, DC) **between 8:00 a.m. and 8:30 a.m.** on October 13, 2017. The security guard can direct you to Room 120 to check in.
- Bring a copy of your presentation in PowerPoint format on a flash drive and give it to the Case Challenge organizers **by 8:30 a.m**.
- Your presentation should be no longer than 15 minutes and will be followed by 10 minutes of Q&A from the judges.
- Dress professionally, as you are representing your school in front of an audience. However, please do not wear anything that would identify your school.

For more information on the Case Challenge guidelines and logistics, refer to the guide in Appendix G for student teams and faculty advisors. If you have questions about the event, please email Sophie Yang (syang@nas.edu).

We are really looking forward to hearing your ideas for contributing to a thriving DC community. Thanks for participating, and have fun!

Case: Lead and Adverse Childhood Experiences: Neurological and Behavioral Effects and Consequences on the Developing Brain of Youth in the District of Columbia

Problem Statement

In addition to a recent national focus on the issue of lead poisoning, such as the Flint, Michigan, Water Crisis, the District of Columbia has had a significant history of lead exposure. This issue has a well-documented disparity of falling along socioeconomic and racial lines, and being a complex one to tackle because of the nature of lead exposure through multiple sources. Additionally, some of the most significant effects can go undetected until significant damage has been done much later in the life course. Although both adults and children are vulnerable to lead, lead poisoning is known to have the largest impact on the developing brain, resulting in the greatest risk being seen in children. It has been documented that many of the same youth who are at risk of lead exposure are also at an increased risk for experiencing Adverse Childhood Experiences (ACEs), which have similar consequences. The neurological consequences of both lead exposure and ACEs contribute not only to medical disability but also to behavioral challenges, affecting youths' interaction with the education system, employment opportunities, and other parts of their community during their development. The challenge of environmental lead exposure compounded with ACEs, and their subsequent impact on children's cognitive function, is a complex public health problem with many potential points of intervention.

Key Relevant Statistics in the District of Columbia

Lead (16,405 children tested in 2014)

- 236 had BLLs between 5 and 9 micrograms per deciliter
- 286 had BLLs greater than or equal to 5 micrograms per deciliter
- 50 had BLLs greater than 10 micrograms per deciliter

ACEs

- 49% of District residents will experience an ACE
- 37% of District residents will experience 1 or 2 ACEs
- 11% of District residents will experience 3+
- In the District, the most common ACEs are: extreme economic hardship, family dysfunction leading to divorce or separation, and being a victim or witness of neighborhood violence.

Funding Announcement

The Foundation for Addressing Major Neurological Risks in Washington, DC, is pleased to announce a grant-funding opportunity for nonprofit organizations working to improve the health and well-being of youth in the District of Columbia. This grant is intended to address the development of youth in our most at-risk communities, specifically those who are at risk for exposure and those who have been recently exposed to lead and Adverse Childhood Experiences (ACEs).

The foundation is committed to funding innovative solutions to complex problems that are faced by at-risk children and youth in the District of Columbia. Presently, most programs are focused on specific individual factors that influence a child's neurologic and behavioral development. However, this grant is intended to address the complex interplay of multiple factors. Evidence demonstrates an overlap in child risk for experiencing Adverse Childhood Experiences (ACEs) and risk for being exposed to elevated lead levels and potentially lead poisoning. This grant was inspired by the recognition that both issues can have significant neurological and resulting behavioral effects on youth, further contributing to a cycle of poverty and oppression. Moreover, historic and systematic injustice and racism have established significant barriers to truly addressing the complexity of these issues. The Foundation for Addressing Major Neurological Risks believes that by not looking at these issues in isolation, but rather as

compounding factors in the neurological development of youth, an innovative solution can be developed to begin mitigating the damage and improving the lives of youth in the District of Columbia.

This grant will last five years and has a total budget of $2.5 million. The award will go to the nonprofit organization that develops a multifaceted, interdisciplinary, innovative, and evidence-based solution targeted at improving the health and development of District children at risk of neurological consequences caused by lead poisoning and ACEs. A successful application will provide a feasible intervention that the applicant organization can readily implement and that also has the potential for impact after the funding from this grant ceases. Proposed plans should prioritize the issues to be addressed, justify the choice of intervention(s), specify the implementation and evaluation strategy, and provide budget estimates for the use of funds within the time frame specified. Specific attention should be paid to external and historical factors that influence these issues, and how the framework for reducing inequality can be used.

An example of a previously funded grant through the foundation focused on reducing rates of diabetes and obesity in youth. Obesity has been linked to numerous neurological and psychological problems and is a significant health burden for youth in the District of Columbia. The successful grant application gave three primary intervention points. First, from birth through 3 months, the children's mothers were targeted for promotion and support for breastfeeding as a strategy for setting a good foundation for healthy weight. At around 6 months the program then shifted to reinforce healthful options as infants transitioned to solid foods. Finally, when the children were age 3, the program screened for building blocks of healthful eating and physical activity and intervened as needed.

This grant solicits submissions through an open, competitive process to eligible nonprofit organizations working on issues relevant to the health and development of youth in the District of Columbia. Teams will present their proposals to the foundation's board of advisors on Friday, October 13, 2017. For more detailed judging criteria, please see Appendix E.

The Challenge

You work for a nonprofit organization headquartered in the District of Columbia that focuses on child health and development. The director of your organization has tasked your team to apply for this grant that calls for a multifaceted solution—consisting of primary and secondary preventive interventions—targeting multiple and interrelated causes of neurologic harm in children from the prenatal period through age 6, with consequences for children's cognition, emotional well-being, and behavior. Therefore, your goal as a team is to develop and propose an interdisciplinary, innovative, equitable, justifiable, and financially sound plan that would be supported by the DC government, local policy makers, potential partner organizations, your target population, and the broader population of DC-area residents. When writing your proposal, note that your director has given approval for your team to hire more skilled personnel as needed to help you implement your proposed solution(s) and meet this challenge. The salaries of any additional personnel must be within the total funding allotted above and must be accounted for in your budget estimates. Good luck!

Case Scenarios

Although the grant focuses on the prenatal period through 72 months of age, the scenarios are provided to illustrate in life-course perspective the breadth of consequences of childhood lead exposure and ACEs

on young people and adults living in the District of Columbia. The scenarios do not need to be included in the proposal.

Mark Smith is a 19-year-old, African American, lifelong resident of the District's Ward 7. Born to a single mother who worked seasonal and temporary jobs, Mr. Smith grew up in low-income, subsidized housing with two older brothers. When Mr. Smith was an infant, he was cared for in an informal child care setting in the basement of a nearby building. Mr. Smith's mother was uninsured, and thus he did not receive regular primary care. Mr. Smith's caretaker noted that he seemed more irritable than the other children and seemed to experience weight loss. When Mr. Smith was five, it was discovered that both his home and the basement where he was being cared for during the first few years of his life had lead paint and water lead levels above the acceptable threshold. Despite this finding, Mr. Smith's blood lead levels were not checked until he started kindergarten, by which time irreversible damage had occurred. Mr. Smith experienced behavioral problems in school, and as time went on, he began to struggle more and more academically. In middle school Mr. Smith became more frequently truant and was first arrested for theft when he was 13 years old. Mr. Smith began committing more violent crimes, and at the age of 17 was convicted of assault.

Ebony Barnes is a 22-year-old African American resident of the District's Ward 8. She grew up in a low-income neighborhood with a mother struggling to provide for her and her four brothers. She often relied on school lunches and convenience store purchases to sustain her through the day. Her father was often absent, and was verbally and physically abusive to her mother when present, creating a tense and disruptive environment. Because of her home environment and additional Adverse Childhood Experiences, Ebony had a hard time focusing in school, and eventually dropped out at the age of 16. After repeated drug-related arrests, Ebony was incarcerated for her actions. She was released at the age of 20 once she had completed her two-year sentence and become sober. However, the transition back to society was difficult for her, and she has since struggled to maintain a job as well as take care of her health. She struggles with obesity, depression, and anxiety because of the trauma she experienced as a child.

Anna Davis is a 14-year-old living in Northeast DC. Her neighborhood has seen a recent spike in gun violence. While walking home with her friends and younger sister after school one afternoon, Ms. Davis was shot by a stray bullet and sustained potentially life-threatening injuries. In response to this shooting, both Ms. Davis's family and families of other children in the neighborhood have limited their children's time outside and ability to move freely through their neighborhood, thus limiting their exercise and play time. Additionally, because of the high cost and limited availability of appropriately trained counselors, Ms. Davis's sister, friends, and school community have had trouble fully processing and handling this shooting and other violent incidents their community has experienced.

Loretta Powell is a 25-year-old who recently found out she is pregnant. She has scheduled regular prenatal checkups with her primary care provider, and began taking standard prenatal supplements. At the beginning of her second trimester, one of the tests ordered by her doctor showed that she had high levels of lead in her bones, which is the primary source of lead exposure in newborn children. Ms. Powell also has iron deficiency anemia because of her exposure to lead. Ms. Powell grew up as an only child with her single mother in government-subsidized housing that was riddled with many problems, including lead paint and asbestos.

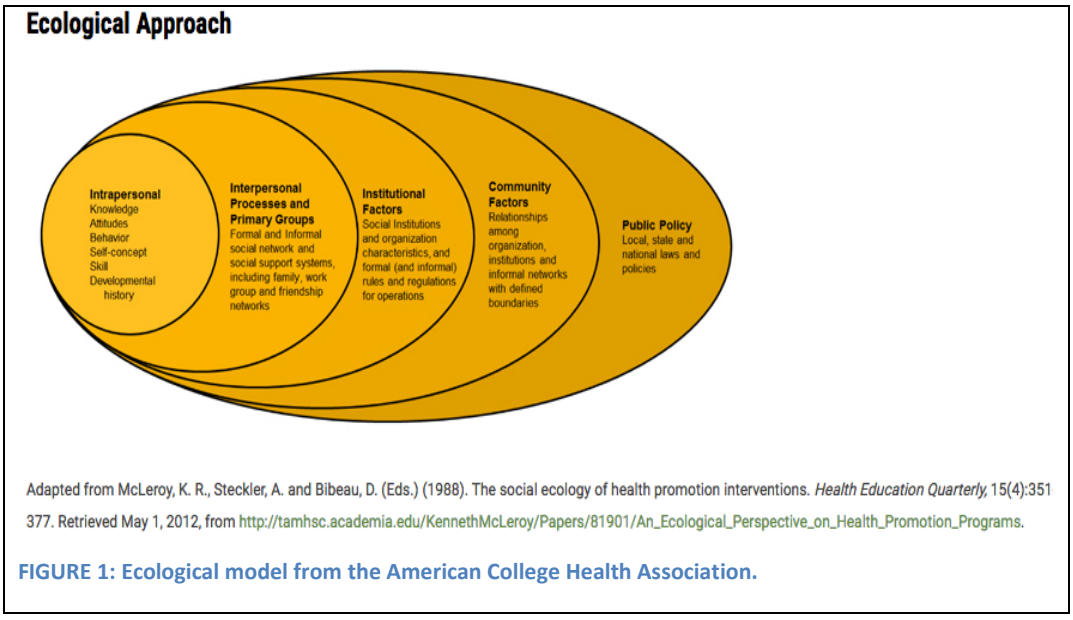
Background

Ecological Framework and Approach

Health is defined by the World Health Organization as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (WHO, n.d.). There are two main methods of conceptualizing health promotion: the medical model approach and the ecological framework approach. Of the two methods, the medical model focuses largely on diseases, injuries, and their outcomes and is more focused on reducing the incidence and adverse effects of these ailments (Fielding et al., 2010). Additionally, the medical model focuses more on individuals in the delivery of clinical services (Fielding et al., 2010).

In contrast, the ecological framework approach (also known as the population health model) considers the relationship between "individuals and their interactions with their peer groups, families, communities, schools and workplaces, as well as the broad economic, cultural, social, and physical environmental conditions at the local, national, and global levels" (Fielding et al., 2010, p. 176). The ecological framework approach to health places a significant focus on the interrelationships that exist among the various levels of health determinants to establish effective methods of intervention (Healthy People 2020, n.d.).

In the ecological approach the factors affecting health fall into the following categories: individual factors; interpersonal factors; institutional and community environments; and social, economic, and political influences (Ruderman, 2013). Additionally, the American College Health Association (ACHA) further illustrates the factors in the ecological model (Figure 1) to include public policy, community, institutional factors, interpersonal processes, and intrapersonal factors (ACHA, n.d.). When addressing public health problems, taking a multilevel approach is needed to understand the complex interplay between each of these factors and how each level impacts others. Interventions aimed at just one level—the individual, for example—might address only one small part of the larger problem, whereas if the intervention focuses on the interplay of policy and community to improve individual health outcomes, it is more likely to be successful and the change sustainable.



Adapted from McLeroy, K. R., Steckler, A. and Bibeau, D. (Eds.) (1988). The social ecology of health promotion interventions. *Health Education Quarterly,* 15(4):351 377. Retrieved May 1, 2012, from http://tamhsc.academia.edu/KennethMcLeroy/Papers/81901/An_Ecological_Perspective_on_Health_Promotion_Programs.

FIGURE 1: Ecological model from the American College Health Association.

Determinants of health

Traditionally when talking about health outcomes the focus is on individual-level medical outcomes and behavioral factors. However, looking more upstream, the root causes of poor population health outcomes (the conditions that provide the context affecting health) are referred to as the determinants of health. These include social, economic, cultural, and environmental factors (Healthy People 2020, n.d.; NASEM, 2017). Since the long-term effects that these factors play in the overall health of the community is significant, it is important to focus on them in public health interventions. Social determinants of health include education, transportation, income and wealth, physical environment, social environment, employment, health systems and services, housing, and public safety (NASEM, 2017). An example of the social determinants playing out is that interventions focused on early childhood development have been effective in helping families maximize their individual and collective community capacity for good health (Fielding et al., 2010).

Fielding et al. say that the factors associated with social determinants are ones that directly benefit communities with their capacity to support community members' health outcomes. Disparities in these factors are related to differences in health outcomes (Fielding et al., 2010). In addition, the authors also say the following:

> Diversity of communities can be a source of great strength, yet discrimination on the basis of age, race, gender, ethnicity, or sexual orientation creates stigmatization and lost opportunity, and translates into challenges to self-efficacy and self-esteem, often resulting in feelings of worthlessness and insufficient capacity to cope with life stresses. It is not surprising that the confluence of these problems fosters environments prone to violence, substance abuse, and lack of hope—elements that destroy the capacity of individuals to live full, rich lives (Fielding et al., 2010, p. 179–180.

According to the National Institutes of Health, *health disparities* refers to differences in access to or availability of health care and other health-related facilities and services (NIH, n.d.). Health disparities also encompass differences in the incidence, prevalence, mortality, burden of disease, and other adverse health conditions that exist among specific populations in the United States (Georgetown University School of Nursing & Health Studies, 2016).

Disparities in the District of Columbia

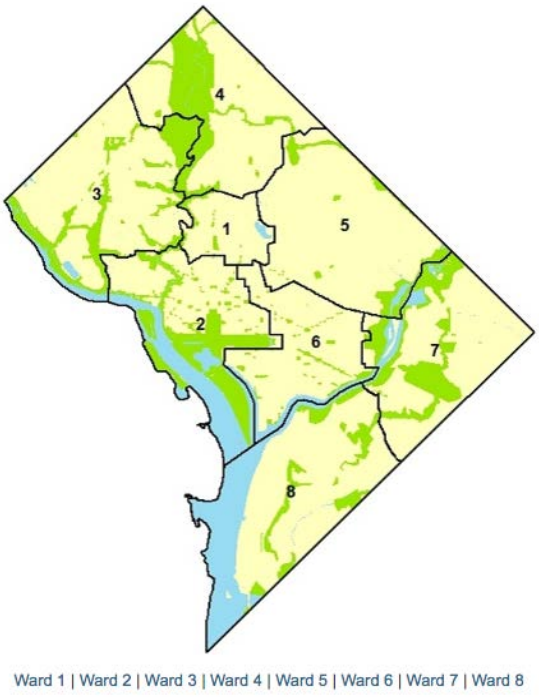


FIGURE 2: DC ward map, 2012.
SOURCE: Neighborhood Info DC, 2012.

Neighborhoods in the District of Columbia are divided into eight wards with distinctive histories, cultures, architectures, demographics, and geography, each briefly highlighted below:

- **Ward 1** is in the central part of the city and has the highest population density of any of the wards in the District. Neighborhoods in Ward 1 have historical significance for local Latino and African American communities and include the Adams Morgan, Columbia Heights, and Mount Pleasant neighborhoods.
- **Ward 2** contains various landmarks, including the White House and the National Mall, and is also home to what is the downtown of the District. It is an approximately 138-block area of 520 residential and commercial properties.
- **Ward 3** is one of the largest residential areas in the District and is home to 80 percent of residents who identify as white (non-Hispanic) compared with an overall population average of 40 percent white (non-Hispanic).
- **Ward 4** is a residential neighborhood that includes Petworth, Takoma, and Sixteenth Street Heights. It is the northernmost neighborhood in the District and is dominated by single-family detached homes.
- **Ward 5** is the most diverse ward in the District, and contains residential streets and shopping areas, as well as high-rise condominiums and industrial parks. The Bloomingdale neighborhood is in this ward.
- **Ward 6** is in the heart of the District and is the only ward to include portions of each of the four quadrants of the city. It has a highly diverse population and housing stock with a myriad of neighborhood characteristics.
- **Ward 7** is east of the Anacostia River and is home to several residential neighborhoods that have a distinct sense of pride and culture within the District. Ward 7 is also home to green spaces such as Kenilworth Aquatic Gardens, Watts Branch Park, Anacostia River Park, and Kingman Island.
- **Ward 8** is also east of the Anacostia River. Its 2015 population was composed of 92.8 percent black, non-Hispanic residents as compared with an overall median of 48.9 percent of black, non-Hispanic DC residents in the rest of the wards combined. Wards 7 and 8 contain some of the poorest areas in all of DC (DC Office of Planning, n.d.).

Demographic shifts within the District of Columbia

Demographic changes in the District of Columbia have become more evident in recent years, largely because of the rapid infrastructure and urban development—or gentrification—that is continuing to and has taken place over the past 20 years (Rabinowitz, 2015). Recently relocated residents in the District are more likely to have higher incomes and be single, white, and without children (Rabinowitz, 2015). This development, in part, has accelerated the economic growth of several wards, mainly the Southeast/Navy Yard area, which experienced a 147 percent growth rate between 1999 and 2012. Within the Southeast/Navy Yard area, median income increased from nearly $38,000 to more than $93,000 (Rabinowitz, 2015).

These indicators were derived from data produced by the U.S. Census Bureau and may differ from data produced by other entities.

2011-2015 American Community Survey, Key Demographic Indicators

Key Indicators	United States	District Total	Ward 1	Ward 2	Ward 3	Ward 4	Ward 5	Ward 6	Ward 7	Ward 8
Total Population	316,515,021	647,484	82,859	77,645	83,152	83,066	82,049	84,290	73,290	81,133
Population by Sex (%)										
Male	49.2%	47.4%	49.9%	50.5%	44.7%	48.6%	47.2%	47.9%	46.3%	43.8%
Female	50.8%	52.6%	50.1%	49.5%	55.3%	51.4%	52.8%	52.1%	53.7%	56.2%
Population by Age (%)										
Under 5 years	6.3%	6.2%	5.7%	2.8%	5.1%	6.7%	7.0%	5.7%	7.1%	9.7%
Youths, Under 18 years	23.3%	17.2%	12.7%	5.6%	15.3%	20.1%	17.9%	12.9%	23.2%	30.2%
18-64 years	62.6%	71.5%	80.1%	85.8%	68.8%	65.6%	68.4%	76.9%	63.9%	62.1%
Seniors, 65 years and over	14.1%	11.3%	7.2%	8.6%	15.9%	14.3%	13.7%	10.2%	12.9%	7.7%
Median Age (years)	37.6	33.7	31.3	30.9	37.0	39.3	35.4	33.9	37.0	29.3
Population by Race (%)										
White	73.6%	40.2%	54.3%	74.2%	80.4%	26.4%	20.3%	55.4%	2.3%	4.8%
Black	12.6%	48.9%	30.3%	8.8%	6.9%	56.4%	70.4%	35.5%	94.2%	92.8%
American Indian & Alaska Native	0.8%	0.3%	0.3%	0.3%	0.2%	0.6%	0.4%	0.3%	0.3%	0.1%
Asian	5.1%	3.7%	4.2%	9.8%	6.2%	2.1%	2.0%	4.2%	0.3%	0.4%
Native Hawaiian & Other Pacific Islander	0.2%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Some Other Race Alone	4.7%	4.2%	7.6%	3.2%	2.2%	11.6%	4.6%	1.5%	1.7%	0.9%
Two or More Races	3.0%	2.7%	3.1%	3.7%	4.0%	2.8%	2.3%	3.0%	1.2%	1.1%
Hispanic/Latino Population (# and %)	54,232,205 17.1%	65,803 10.2%	17,104 20.6%	8,116 10.5%	8,208 9.9%	16,501 19.9%	6,991 8.5%	5,290 6.3%	2,303 3.1%	1,290 1.6%

TABLE 1: Total population by ward, age, sex, and race.
SOURCE: U.S. Census Bureau, 2016.

The 2016 United States Census Bureau reported the estimated population of the District of Columbia to be 681,170. Of the total population, African Americans make up an estimated 47.7 percent, and whites alone represented approximately 44.6 percent (U.S. Census Bureau, 2016). These estimates show a decline of 3 percent in the African American population and an increase of 6.1 percent in the white population (Table 3) (U.S. Census Bureau, 2016). The five-year estimate published by the Census Bureau in 2015 shows the concentration of the African American population to be largely in Wards 7 and 8 (Table 2) (U.S. Census Bureau, 2016).

These indicators were derived from data produced by the U.S. Census Bureau and may differ from data produced by other entities.

2011-2015 American Community Survey, Key Demographic Indicators

Key Indicators	United States	District Total	Ward 1	Ward 2	Ward 3	Ward 4	Ward 5	Ward 6	Ward 7	Ward 8
Income										
Median Household Income	$53,889	$70,848	$82,159	$100,388	$112,873	$74,600	$57,554	$94,343	$39,165	$30,910
Mean Household Income	$75,558	$107,594	$106,388	$140,459	$176,921	$111,933	$77,329	$117,002	$53,093	$44,245
Per Capita Income	$28,930	$47,675	$47,982	$72,388	$83,452	$43,880	$32,449	$58,354	$22,917	$17,596
Poverty (%)										
Families in Poverty	11.3%	14.3%	11.0%	4.7%	1.9%	8.7%	13.5%	9.6%	23.6%	35.3%
Individuals in Poverty	15.5%	18.0%	13.5%	13.4%	9.4%	11.9%	19.0%	12.5%	27.2%	37.7%
Under 18 years in Poverty	21.7%	26.7%	23.7%	6.1%	2.9%	16.3%	21.3%	16.5%	39.9%	49.6%
Housing Occupancy										
Total Housing Units (#)	133,351840	303,312	37,673	43,695	41,582	32,900	35,751	43,638	33,717	34,356
Vacant Housing Units (%)	12.3%	9.9%	7.3%	11.0%	7.2%	7.2%	11.5%	8.1%	13.2%	14.2%
Occupied Housing Unit (%)	87.7%	90.1%	92.7%	89.0%	92.8%	92.8%	88.5%	91.9%	86.8%	85.8%
% Owner-occupied Units	63.9%	41.2%	34.1%	35.1%	51.6%	59.8%	47.2%	42.2%	38.0%	20.5%
% Renter-occupied Units	36.1%	58.8%	65.9%	64.9%	48.4%	40.2%	52.8%	57.8%	62.0%	79.5%
Homeowner Vacancy Rate	1.9	1.8	0.7	1.9	0.7	1.9	1.9	2.3	2.6	4.2
Renter Vacancy Rate	6.4	5.5	3.1	6.1	4.7	4.1	7.4	4.8	7.3	6.7
Median Value of Owner-occupied Housing	$178,600	$475,800	$542,100	$623,500	$823,800	$491,300	$379,800	$573,200	$238,900	$229,900
Median Monthly Gross Rent	$928	$1,327	$1,459	$1,871	$1,772	$1,124	$1,088	$1,574	$911	$960

TABLE 2: Income and housing distribution by ward.
SOURCE: U.S. Census Bureau, 2016.

Race and Hispanic Origin	District of Columbia
Population estimates, July 1, 2016, (V2016)	681,170
PEOPLE	
Race and Hispanic Origin	
White alone, percent, July 1, 2016, (V2016) (a)	44.6%
White alone, percent, April 1, 2010 (a)	38.5%
Black or African American alone, percent, July 1, 2016, (V2016) (a)	47.7%
Black or African American alone, percent, April 1, 2010 (a)	50.7%
American Indian and Alaska Native alone, percent, July 1, 2016, (V2016) (a)	0.6%
American Indian and Alaska Native alone, percent, April 1, 2010 (a)	0.3%
Asian alone, percent, July 1, 2016, (V2016) (a)	4.1%
Asian alone, percent, April 1, 2010 (a)	3.5%
Native Hawaiian and Other Pacific Islander alone, percent, July 1, 2016, (V2016) (a)	0.2%
Native Hawaiian and Other Pacific Islander alone, percent, April 1, 2010 (a)	0.1%
Two or More Races, percent, July 1, 2016, (V2016)	2.7%
Two or More Races, percent, April 1, 2010	2.9%
Hispanic or Latino, percent, July 1, 2016, (V2016) (b)	10.9%
Hispanic or Latino, percent, April 1, 2010 (b)	9.1%
White alone, not Hispanic or Latino, percent, July 1, 2016, (V2016)	36.4%
White alone, not Hispanic or Latino, percent, April 1, 2010	34.8%

TABLE 3: Demographic shift in the District of Columbia.

Socioeconomic status, income, and poverty

Social and economic factors such as income, poverty status, marital status, living arrangements, and education are known to affect health outcomes. Low socioeconomic status encompasses individuals and families who are unemployed or have low-paying jobs, families and individuals living in substandard housing, and single-parent households (DC Department of Health, 2013).

According to the U.S. 2015 American Community Survey, the District of Columbia's median household income was listed at $70,848 compared with the U.S. median household income of $57,617. Households in Ward 3 and some parts of Wards 2, 4, and 6 showed higher median income within the District, regardless of race or ethnicity (U.S. Census Bureau, 2016). However, the census bureau also reported the poverty rate in the District of Columbia to be higher at 18.6 percent, compared with a nationwide rate of 13.5 percent (U.S. Census Bureau, 2016).

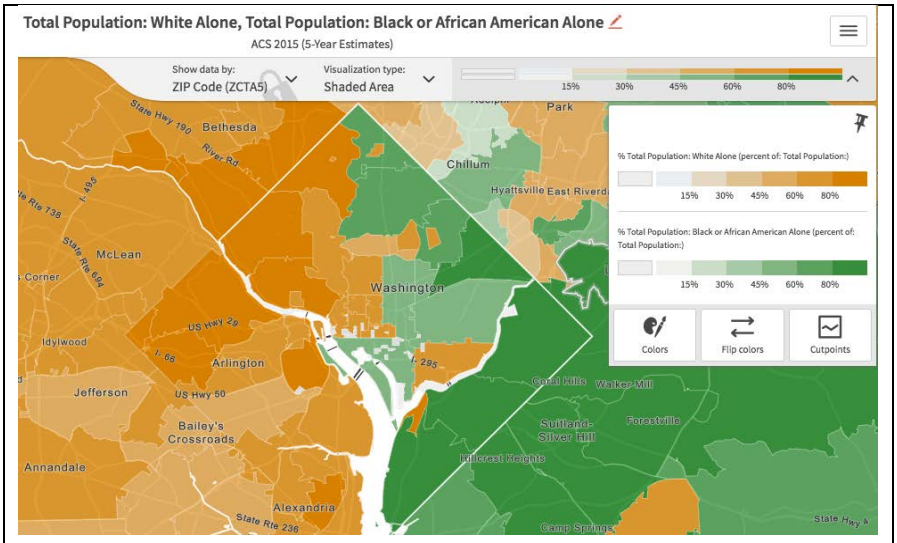


FIGURE 3: Concentration of the African American population in the District of Columbia.

Poverty is also associated with several other factors that affect health status, such as food insecurity, unsafe or unhealthful housing, and exposure to crime and violence. The percentage of African American families living at or below the federal poverty level is higher at 22 percent than the rate for all other racial and ethnic groups within the District (Georgetown University School of Nursing & Health Studies, 2016).

Income Characteristics in DC by Race and Ethnicity

	DC	Black Alone	White Alone	Asian Alone	Hispanic/Latino
Individuals in Poverty (%)	19%	28%	8%	14%	18%
Under 18 yrs in Poverty (%)	29%	40%	5%	13%	21%
Unemployed (%)	11%	20%	4%	2%	11%
Female Head of Household (%)	16%	30%	3%	5%	14%
Median Household Income ($)	$70,354	$41,394	$113,631	$84,146	$62,631

Sources: American Community Survey 2011-2013

TABLE 4: Income Characteristics in the District by race and ethnicity.

Housing

Throughout the District, longtime African American residents have been disproportionately affected by gentrification. Over the past three decades, the District's African American population has dropped nearly 20 percent because of continuous relocation to neighboring counties or other, more affordable areas (Georgetown University School of Nursing & Health Studies, 2016). A 2016 report published by Georgetown University outlines the close relationship between housing, health, and quality of life, and how destabilized housing and financial burden can lead to homelessness, food insecurity, job loss, and social disconnection (Georgetown University School of Nursing & Health Studies, 2016). In the same report, the following was noted:

> Median gross monthly rent during 2010–2014 was $1,302, compared to a national average of $920.18. In areas of the city with more dense populations of African Americans, the percentage of households spending 30 percent or more of their income on housing is higher than households in other parts of the District (Georgetown University School of Nursing & Health Studies, 2016, p. 9).

Thus, residents of the poorest wards of the District (Wards 7 and 8) face greater financial burden from rising rental and housing prices.

Employment

Unemployment is associated with a number of factors that negatively affect health, and is a strong indicator of residents' ability to access and obtain adequate health care (DC Department of Health, 2013). Many residents obtain health insurance coverage through their employers and lose coverage when they become unemployed. According to the American Community Survey, the overall unemployment rate for the District in 2013 was 11 percent. The same report shows that the unemployment rate in the black population was the highest at 20 percent, followed by 11 percent in the Hispanic and Latino population (Table 4). The 2016 Community Health Needs Assessment conducted in the District shows Ward 8 with the highest unemployment rate at 23 percent, followed by Ward 7 at 22 percent (DC Department of Health, 2013). In addition, it is said that unemployment has negative implications for stress, poor nutrition, poor living conditions, and other factors that negatively affect the health and well-being of individuals and communities (DC Department of Health, 2013).

Education

Wards by Average Risk Level

Low Risk Wards	Average Risk Level	Moderate Risk Wards	Average Risk Level	High Risk Wards	Average Risk Level
2	1.50	1	2.20	5	2.60
3	1.00	4	2.13	7	2.80
6	1.60			8	2.87

TABLE 5: Wards by average risk level
SOURCE: LearnDC, 2013.

In 2012, the District of Columbia Risk and Reach Assessment published a study to explore the reach of public programs supported by the Office of the State Superintendent of Education and Division of Early Learning. The foundations of this study are based on identifying the significance of high-quality education and experiences for the population at an early age to improve future outcomes. The assessment summarizes the need for this:

> Significant differences in children's abilities are apparent long before they begin kindergarten. By age four, gaps in cognitive development, social-emotional development, and health status are already evident between children from disadvantaged homes and their more affluent peers; those gaps are still present at age 10 and can continue through high school (Moodie et al., 2012, p. 5).

The study used the effects of negative socioeconomic factors as indicators to assign risk levels by ward. Based on the risk analysis, Wards 2, 3, and 6 were low risk, Wards 1 and 4 were moderate risk, and Wards 5, 7, and 8 were high risk for adverse early childhood educational experiences (Table 5) (Moodie et al., 2012).

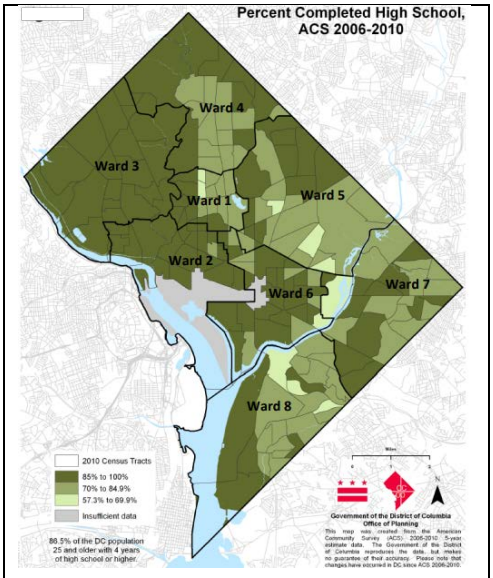


FIGURE 4: Percent completed high school.
SOURCE: DC Department of Health, 2013.

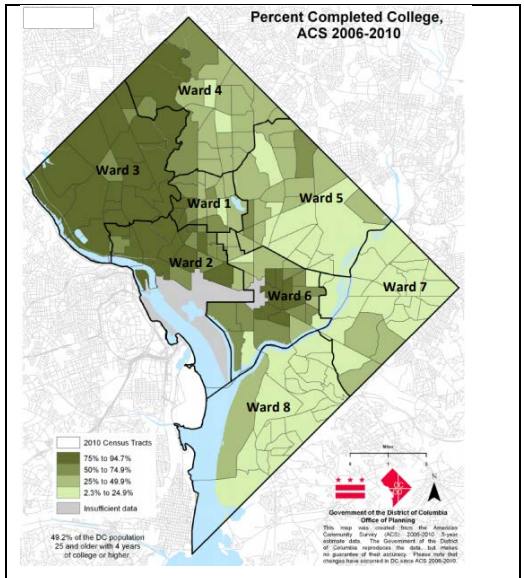


FIGURE 5: Percent completed college.
SOURCE: DC Department of Health, 2013.

Educational attainment for the period 2006–2010 shows that 86.5 percent of the District's population aged 25 years and older had graduated from high school (Figure 4) and 49.2 percent had obtained a bachelor's degree or higher (Figure 5). In

2010, 13.8 percent of District residents had attended college but had not received a degree; 3.2 percent had received an associate's degree, and 23.2 percent had obtained a bachelor's degree. An additional 26.9 percent of the District's residents had a graduate or professional degree (DC Department of Health, n.d.). Although there was a notable increase observed for residents who attained a bachelor's degree or graduate or professional degree, there were no significant changes in educational achievement for residents who obtained a high school diploma, attended college but did not receive a degree, and obtained an associate's degree (DC Department of Health, 2013).

Access to health care

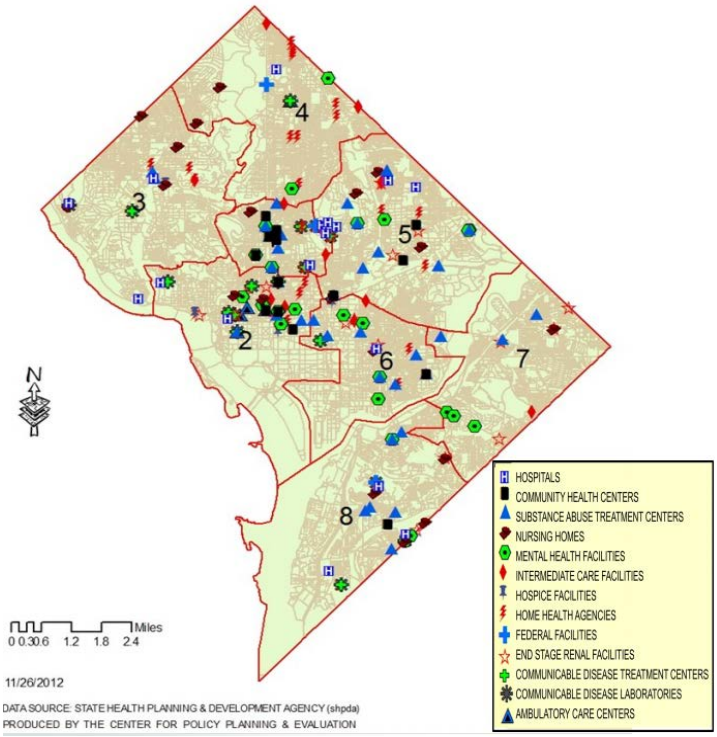


FIGURE 6: Map of health care facilities in the district.
SOURCE: DC Department of Health, 2013.

Uninsured people have disproportionately low levels of income, with many not insured by their employers or unable to afford health insurance. Additionally, for poorer residents who are employed and have insurance, increased premiums make it difficult to retain coverage, leading to an increase in Medicaid enrollment (DC Department of Health, 2013). In addition, a high percentage (23.8 percent) of the District's residents report not having someone they think of as their health care provider, and about 10 percent of adults delayed getting medical care because they could not get an appointment soon enough (DC Department of Health, 2013).

For these and other reasons, numbers of emergency visits and ambulatory services have increased, and the number of long-term inpatient stay days has declined (DC Department of Health, 2013). Furthermore, a large proportion of emergency department visits in the United States are for non-urgent conditions, leading to unnecessary testing, treatment costs, and weaker relationships between patients and their primary care providers (DC Department of Health, 2013). Although there are sufficient numbers of providers serving the general population in Medically Underserved areas in the District, there is still a shortage of providers serving the low-income and/or homeless populations in these areas (DC Department of Health, 2013).

Crime and Violence

According to the FBI's Uniform Crime Reporting program, the category of "violent crimes" includes murder and non-negligent manslaughter, rape or sexual abuse, robbery, and aggravated assault (FBI, 2010). In 2009, 2010, and 2011, nearly all violent crime arrests in the city were for aggravated assault or robbery (Washington Lawyers' Committee for Civil Rights and Urban Affairs, 2013).

One characteristic of a healthy environment is safety, and within the District, some wards have more crime and occurrences of violence than others. In the District, the violent crimes that are on the rise are homicide, robbery with a gun, and assault with a dangerous weapon, whereas the number of property crimes (such as theft and arson) was lower in 2015 (Merrill et al., 2016). Data from 2015 shows that the homicide count in the District was at 135, an increase from 90 in 2014 (Merrill et al., 2016). Additionally, in 2015, homicides increased in every ward except Ward 4, which showed no change in the number of homicides from 2014. The number of homicides in 2015 was greatest in Ward 8 (49 homicides) and lowest in Ward 2 (4 homicides) (Merrill et al., 2016).

There are five wards in the city where nearly nine out of 10 African American residents live.

Figure 2

Ward	Total Population	African American population (number)	African American population (percent)
Ward 1	76,197	24,794	32.5%
Ward 2	79,915	10,079	12.6%
Ward 3	77,152	3,860	5.0%
Ward 4	75,773	44,459	58.7%
Ward 5	74,308	56,489	76.0%
Ward 6	76,598	31,842	41.6%
Ward 7	71,068	67,471	94.9%
Ward 8	70,712	66,131	93.5%
Total	601,723	305,125	50.7%
African American residents in Wards 4 to 8		266,392	87% of African American residents live in five wards

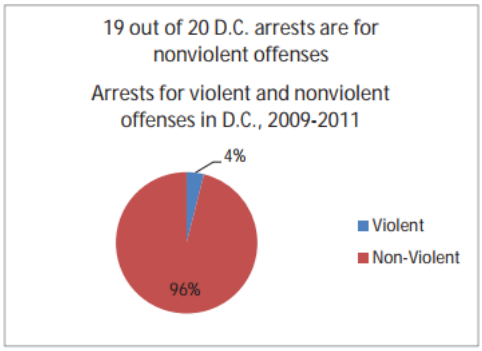
Source: U.S. Department of Commerce, Bureau of the Census (2010).

TABLE 6: African American population within the District of Columbia.

Law Enforcement and the Criminal Justice System

The Washington Lawyers' Committee conducted a review in 2013 that found significant racial disparities in arrests conducted by the Metropolitan Police Department (MPD) (Washington Lawyers' Committee for Civil Rights and Urban Affairs, 2013). The key findings from the report are below:

- More than 8 out of 10 arrests were of African Americans.
- District wards with more African American residents witnessed far more arrests.



Source: Washington Lawyers' Committee analysis of MPD data.

FIGURE 7: Arrests for violent and nonviolent offenses, 2009–2011.

- More than 19 out of 20 arrests were for nonviolent offenses.
- Nine out of 10 individuals arrested for drug offenses were African American.
- Six out of 10 drug arrests were for simple possession, and nearly 9 out of 10 arrests for possession involved African American arrestees.
- Wards with a high percentage of African American residents (Wards 7 and 8) accounted for a disproportionately high percentage of all drug arrests.
- Although there are significant disparities between whites and African Americans in the numbers of drug arrests, drug use survey data showed much less disparity in drug use among the two groups.
- Nearly 7 out of 10 traffic arrests were of African Americans.
- Eight out of 10 individuals arrested for disorderly conduct were African American or Hispanic (Washington Lawyers' Committee for Civil Rights and Urban Affairs, 2013).

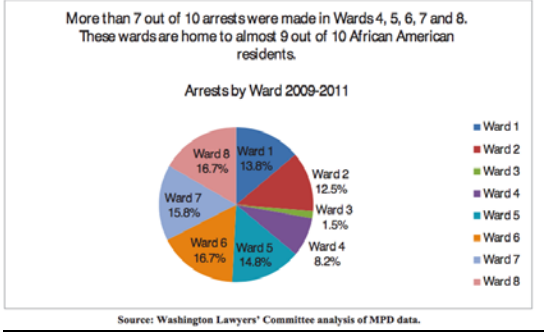


FIGURE 8: Arrests by ward, 2009–2011.

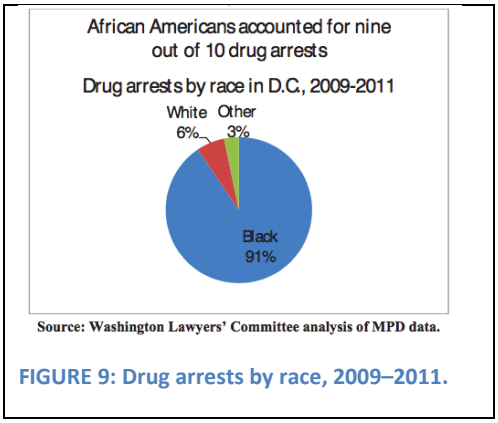


FIGURE 9: Drug arrests by race, 2009–2011.

JUVENILE VS. ADULT ARRESTS IN WASHINGTON, D.C.

Violent Offenses	Number of Arrests in July and August of 2003: Juvenile (under age 18)	Adult (18 and older)
Murder	1	23
Rape	1	3
Robbery	22	75
Aggravated Assault	17	361
Total	41	462

Source: Monthly Arrest Statistics, Metropolitan Police Department, Washington, D.C.

TABLE 7: Juvenile versus adult arrests in the District of Columbia.
Source: Butts, 2003.

JUVENILE ARRESTS IN WASHINGTON, D.C.

	Number of Arrests			Percent Change	
	1995	2002	2003*	1995–2002	1995–2003
Violent Offenses	641	245	307	-62%	-52%
Murder	13	1	1	-92	-92
Rape	7	2	4	-71	-43
Robbery	300	103	132	-66	-56
Aggravated Assault	320	139	170	-57	-47
Other Offenses					
Burglary	74	36	36	-51%	-51%
Larceny	76	55	56	-28	-26
Auto Theft	769	555	662	-28	-14
Other Assaults	262	278	293	6	12
Weapons	253	77	99	-70	-61
Drug Offenses	652	357	341	-45	-48
All Offenses	4,195	2,422	2,599	-42%	-38%

* 2003 figures are weighted estimates, using data from January through October of 2003.
Source: Monthly Arrest Statistics, Metropolitan Police Department, Washington, D.C.

TABLE 8: Juvenile arrests in the District of Columbia.
Source: Butts, 2003.

Although each of the wards in the District has roughly the same number of residents, the number of arrests is not distributed evenly among the wards. Six out of 10 residents live in five wards: Wards 4, 5, 6, 7, and 8. Nearly 9 out of 10 African American residents of the District live in these five wards (Washington Lawyers' Committee for Civil Rights and Urban Affairs, 2013). Arrests conducted by the Metropolitan Police Department under the drug, traffic, and disorderly conduct categories alone accounted for about 19 out of 20 arrests in the District (Figure 7) (Washington Lawyers' Committee for Civil Rights and Urban Affairs, 2013). Offenses in these categories are not considered violent crimes within the definitions used by the FBI's Uniform Crime Reporting system.

Given the disparities in and demographics of the District of Columbia, this case will explore the issues of lead exposure, adverse childhood experiences (ACEs), and structural and environmental racism, and explore some of the actions that have been taken to address these issues from the policy and community engagement perspectives.

Sources and Consequences of Lead Exposure

Sources

The CDC reports that the major sources of lead exposure for children in the United States include lead pipes used in municipal water systems, artificial turfs, and certain imported candy (CDC, 2015a). Other

sources of lead exposure include leaded gasoline, lead-based paint, and toys (CDC, 2015a). These sources, except gasoline, are readily accessible to infants and growing children in their daily lives, and pose the greatest risk for potential exposure. For example, water is needed for cleaning, cooking, and drinking as well as mixing with formula, providing a direct route of exposure. Further, young children and teenagers play on artificial grass during and outside of school, and in communities with limited natural parks these may be the only areas that are safe and accessible. The danger of toys and lead-based paint is especially insidious because infants and toddlers can easily ingest parts of these toys and their paint. Because these objects are everyday items, it is important that measures be taken to ensure they are lead-free.

Even though the use of leaded gasoline has been banned in the United States, there is still a little-known by-product of its use: the lead from the gasoline persists in the soil of urban areas. For example, Mielke and colleagues found that there is a seasonality to the lead in the soil of New Orleans. During the hot summer months, lead enters the atmosphere in a process called resuspension. Once in the atmosphere, it is inhaled by adults and children alike, leading to increased lead burden in the body and health problems (Mielke et al., 2017). This process has also been found to occur in urban areas of Southern California, such as Los Angeles (Young et al., 2002).

In the District of Columbia, the major sources of lead exposure are lead-contaminated water and lead-based paint. In 2003, 2,342 children ranging from 6 months to 6 years of age were tested in a study conducted by the DC Department of Health and The George Washington University Medical Center. The children with the highest lead burden lived in houses that had lead-based paint but no lead drinking-water service lines (Guidotti et al., 2007). However, recent testing identified high lead levels in the drinking water at a number of District schools, underscoring the fact that outside of the lead-based paint exposure, the risk of lead exposure through drinking water in the District of Columbia is still present (Lewis, 2016).

Data reported to the CDC in 2014 from the District of Columbia indicated that out of 16,405 children tested (from a population of 48,854 children less than 72 months old) 286 had blood lead levels (BLLs) greater than or equal to 5 micrograms per deciliter, and 50 had confirmed BLLs over 10 micrograms per deciliter. Further, at least two children had BLLs that were between 45 and 69 micrograms per decilitre (CDC, 2015a).

Consequences

General Health Effects

Lead exposure may be either long term or short term, and determination may be made based on testing: short-term exposure is identified by lead in the blood, but long-term exposure can be determined only by looking at an individual's bones and teeth. Exposure to lead can cause both long- and short-term effects. Many of the long-term effects are neurological, as will be described in the next section. In the short term, lead exposure leads to anemia by interfering with the synthesis of heme, the main compound found in red blood cells, and by reducing iron absorption in the intestines. Severe anemia and iron deficiency have also been linked to disruption in cognitive development (Lidsky and Schneider, 2003). Some non-neurological long-term effects include kidney diseases, although the National Kidney Foundation says that lead poisoning is responsible for less than 1 percent of renal diseases in the United States today, as well as increased risk of cardiovascular disease, although the

mechanism by which this occurs is not fully understood (Benjelloun et al., 2007). These long-term effects lead to decreased quality of life and disability for affected individuals. People who suffer from the long-term effects of lead poisoning may be unable to work or care for themselves, as they must constantly undergo treatment to manage the symptoms of their illnesses.

Neurological Effects

Of all the organs that lead affects, the brain is by far the most sensitive. Lead's neurotoxicity stems from its ability to substitute for calcium ions in the nervous system. The cells of the body absorb lead through the same channels through which calcium is absorbed. The two metals are competitive inhibitors, meaning high levels of lead will decrease the amount of calcium that the body absorbs, because more lead ions are occupying the receptors' active sites. The influx of calcium ion (Ca^{2+}) into the axon terminal of a neuron causes the release of several neurotransmitters. These neurotransmitters include dopamine, glutamate, orexin, serotonin, and norepinephrine. When lead substitutes for calcium at the axon terminal, it can increase the basal release of these neurotransmitters. This means that a greater amount of these substances will be released than there should be (Needleman, 2004). Once the lead cations have gained access to the neurons, they cause mitochondrial dysfunction. Mitochondrial dysfunction in turn leads to the activation of several biochemical pathways that causes cell death. Because of this, there is decreased brain volume from excessive synaptic pruning in the developing central nervous system of children. Synaptic pruning is the process by which neuronal connections are made and excess synapses are removed for more efficient neuronal transmissions. This process continues until about 10 years of age. As children grow and learn, the neuronal connections that are used more often will be spared from removal (Santos and Noggle, 2011). However, because lead exposure can cause excess pruning, these important connections that are used for motor and cognitive function will be removed as well, leading to decreased cognitive ability. Lead is also able to pass through the blood-brain barrier in children, causing edema (swelling) and encephalopathy (altered function of the brain caused by brain disease). As mentioned earlier, lead increases the amount of dopamine that is released from the axon terminals. Dopamine is the neurotransmitter responsible for the reward system in the body. It also influences arousal, and its pathway is involved in the development of substance addiction. Dopamine in excess has been implicated in the development of neurological diseases such as attention deficit hyperactivity disorder (ADHD), Parkinson's disease, and schizophrenia (Brisch et al., 2014). Lead levels have been linked with ADHD-like symptoms, which can severely impair a child's ability to function properly academically, and excess dopamine can also cause irritability and hyperactivity in children (Lou et al., 2004).

Socioeconomic Consequences of Lead Exposure

Research has shown a correlation between increased lead levels in the body and criminal behavior. For example, Rick Nevin, a former consultant for the United States Department of Housing and Urban Development, authored two papers that showed the correlation between gasoline lead and violent crime. (Gasoline lead is one source of lead poisoning that was phased out in the United States in the late 1980s, with leaded gasoline completely banned by 1996; however, lead from those sources persists in dust and soil, as described below.) Nevin found this correlation not just in the United States, but in Britain, Canada, and France as well (Nevin, 2007). Other socioeconomic problems that result from lead exposure include decreased social mobility and decline in socioeconomic status, which follow from the decrease in cognitive ability that occurs during childhood exposure (Reuben et al., 2017). The number of

people whose lives have been upended by childhood exposure to lead in the United States is large, meaning that the accompanying loss of labor capital in the United States is also significant. By working to prevent children's lead exposure, and creating interventions for those who have been affected, the United States could gain an estimated $181 to $221 billion in annual returns (Gould, 2009).

Historical and Recent Lead Exposures

Background

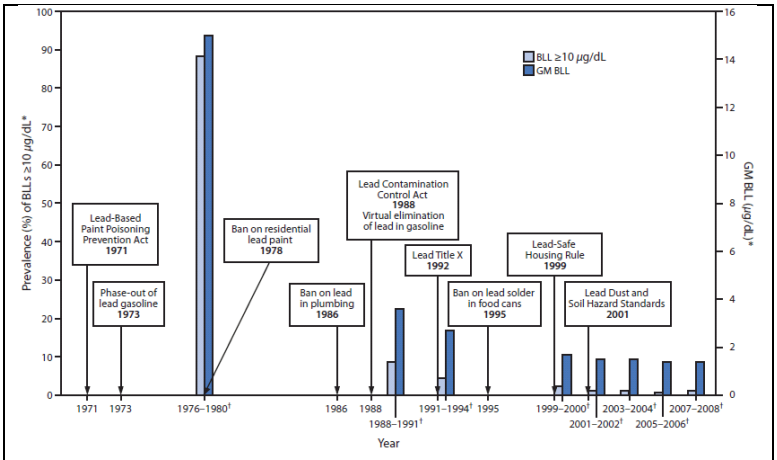


FIGURE 10: Timeline showing major policy changes and BLLs.

Lead exposure and elevated blood lead levels have long been established as issues of public health concern, but they have grown worse with studies indicating a historic rise in blood lead levels from 0.016 micrograms per deciliter (estimated for Native Americans before European settlement) to 1.6 micrograms per deciliter for the 1- to 5-year-old population in the United States between 1999 and 2004 (Brown and Margolis, 2012).

After a sharp increase of blood lead levels and lead poisoning in the first three quarters of the twentieth century, emission regulations and other federal laws have been able to reverse this trend (see the section on federal laws and executive orders related to reducing lead exposure). Although blood lead levels declined in the last decades of the twentieth century (see Figure 10), the public health burden of lead exposure and poisoning is still very present. The CDC estimates that nationwide there are 535,000 children whose blood lead levels are high enough to damage their health, and 24 million homes may contain lead-based paint or lead-contaminated dust (CDC, n.d.-a). Outside of the home, the Environmental Protection Agency (EPA) documented 350 schools and child care centers that failed lead tests between 2012 and 2015, with one facility having 41 times the allowable limit (Fears, 2016; Ungar, 2016; Wang, 2016). In cities across America large numbers of children have been found to have blood lead levels higher than what the CDC and EPA note should result in public health action (presently 5 micrograms per deciliter, although at one point it was 10 micrograms per deciliter with the shift in recommendations from the CDC occurring in 2012) (CDC, n.d.-a). In Pennsylvania, for example, 8.5 percent of children tested had blood lead levels higher than allowable (CDC n.d.-b; Wang, 2016). In late 2016 there was discussion of the CDC yet again lowering the blood lead level, which would initiate public health action, yet this was not changed (Schneyer and Pell, 2016).

In recent years, many of these issues have come to light because of media attention surrounding the crisis in the city of Flint, Michigan. The crisis in Flint sheds light on the complexity of addressing these issues, yet it should be noted that what happened there is not a rare occurrence—there are many examples of cities across the United States that have water or soil lead levels higher than what was found in Flint, such as other cities in Michigan and 11 cities or towns in New Jersey (Wang, 2016). This

section aims to provide a broad overview of the issues that arose in Flint as well as describe the District's past and recent history with lead poisoning.

Flint, Michigan

The water crisis in Flint came to public attention in early 2015 when a group of residents and a city councilman hosted a public meeting to discuss the quality of the city's drinking water, with at least one parent reporting that it was causing her two young children to have skin rashes, despite the city's insistence that the water was safe (Erb, 2015). The crisis in Flint highlights not only the risks of lead poisoning, but the complex nature of how these problems are created, identified, and addressed. The following timeline describes the important events that occurred as the crisis unfolded:

I. **April 2014:** Flint began drawing its water from the Flint River rather than pumping it in from Detroit while waiting for a regional water structure from Lake Huron (CNN, 2017).
II. **August 2014:** Residents of Flint began noticing health issues and discoloration of the water supply. However, they were informed by city officials that despite this, the water was still safe to consume (Kozlowski, 2016).
III. **September 2015:** Mona Hanna-Attisha and a team at the Hurley Medical Center in Flint reported findings from a study comparing blood lead levels before and after the switch to the Flint River as the primary water source for the city's residents. Findings included that the percentage of children with elevated blood lead levels rose from 2.4 to 4.9 percent across the city, with the most afflicted areas seeing a rise of 6.6 percent (Hanna-Attisha et al., 2016). When these findings were released, the Michigan Department of Environmental Quality reemphasized that the water lead levels were in the acceptable range (Erb, 2015).
IV. **September 2015:** Virginia Tech professor Marc Edwards was contacted by a Flint resident and requested that samples be sent to his lab in Virginia. When he tested the samples, he immediately reported the findings of high lead levels to the EPA and waited. Months later, after seeing no action being taken, Edwards formed a team of researchers and traveled to Flint to further investigate the problem (Itkowitz, 2016). Once he arrived in Flint, he began to uncover major problems with how the situation was being handled by authorities, and with the information being communicated to residents. He then went on to expose these problems through a website he established (Roy, 2015).
V. **September 2015:** The governor of Michigan said that the state would act; notably this was the first time the issue had been publicly acknowledged. A month later, Flint was promised nearly $10 million in state aid.
VI. **January 2016:** The governor declared a state of emergency, and federal officials began investigating (CNN, 2017).
VII. **March 2016:** A panel concluded that the state of Michigan is "fundamentally accountable" for what happened (Chicago Tribune, 2016).
VIII. **December 2016:** Michigan's attorney general brought charges against multiple officials for crimes including evidence tampering and failing to protect the residents of Flint.
IX. **February 2017:** The Michigan Department of Civil Rights released a report on their investigation into what occurred in Flint and reported that race was a factor in the events that had transpired. The authors said that "historically, Flint's community of color was long relegated to substandard housing, education, and job opportunities" (Michigan Civil Rights Commission, 2017).

X. **Mid-2017:** The director of the Michigan Department of Health and Human Services was charged with involuntary manslaughter and misconduct in office (Pluta and Kelly, 2017).

The complex story of Flint, Michigan, briefly summarized here, presents a situation where many agencies and levels of public health protection failed to mitigate the risk of lead exposure, particularly for children, through delayed action and an insufficient public health response. Furthermore, the history of Flint and the information uncovered by researchers involved in investigating and remediating the crisis underscore the lack of equity and justice and highlight how these modern-day crises in part stem from historical systemic racism.

The case of lead levels in Flint is widely known but is not the only example of a citywide lead problem. Dr. Edwards, the same professor who exposed the issues in Flint, also exposed lead problems in the District of Columbia. After his work in Flint, Dr. Edwards remarked to a House of Representatives committee that the issue he investigated in the District was "20 to 30 times worse" than what he saw in Flint (Shaver and Hedgpeth, 2016).

District of Columbia

2000–2004 Lead in Water

Background and Initial Reports

In 2004, *The Washington Post* published a story alerting readers that during the summer of 2003 the District of Columbia Water and Sewer Authority (WASA), in their routine testing of homes with lead pipes, had discovered that two-thirds of the more than 6,000 homes they tested had water lead levels above the EPA action levels (Nakamura, 2004). Although the testing and results occurred nearly half a year before this story was published, WASA's trouble with lead pipes began a few years earlier when in 2002 the *Washington City Paper* published a story highlighting lead contamination in American University Park, a wealthier part of the District (Levin, 2002). The story featured a resident whose water was tested and found to be 18 times higher than the allowable limit. When this story broke, it presented a case of WASA taking all appropriate action to address the situation, and much of the issue was laid to rest. However, *The Washington Post* story two years later began to paint a much different picture of WASA officials and their actions, or lack thereof (Nakamura, 2004). The investigation detailed how, despite the revelation of such extensive lead problems, WASA waited months to inform residents, and that when WASA did host meetings, they were less than transparent about the potential danger posed to residents.

After this initial report by *The Washington Post*, the paper organized a team of investigative reporters to continue their work, prompting action from WASA, who responded by distributing free water filters, issuing public health advisories for pregnant women and children, offering free blood testing, and testing all school water fountains, with some shut off because of high lead levels (Cohn, 2005).

The lack of response also resulted in the termination of the health director of the District, and the EPA found that WASA violated the Safe Water Drinking Act by failing to notify the EPA when the problem was first detected and by not conducting sufficient testing (Cohn, 2005; Leonnig, 2004). The problems with the handling of the District's water issue were not limited to the role of WASA, as later studies would uncover.

CDC Morbidity and Mortality Weekly Report (MMWR)

Shortly after the 2004 *Washington Post* story, the CDC released a report on the issue of blood lead levels in the District (CDC, 2004) in response to a request from the DC Department of Health and WASA for CDC and the U.S. Public Health Service to help assess any health effects caused by the increase in lead levels in tap water. The CDC study was a cross-sectional survey to assess blood lead levels of individuals living in homes where the water lead level was over 300 parts per billion (ppb) (CDC, 2004). They found that every individual in their study had blood levels below the CDC's level for concern. The editorial note begins with the statement that "although lead in tap water contributed to a small increase in BLLs in the District, no children were identified with BLLs >10µg/dL, even in homes with the highest water lead levels [WLL]" and goes on to detail that not only were there no acute cases of elevated BLLs found, but that longitudinal data confirmed a decline. The authors noted three major limitations: those who have lead poisoning are tested more frequently, fingerstick tests are more prone to contamination, and their data did not come from a randomized sample. Despite these limitations, the authors concluded that "no threshold for adverse health effects in young children has been demonstrated," and therefore "public health interventions should focus on eliminating all lead exposures in children" (CDC, 2004).

The conclusion that no children had levels above CDC action level and the recommendation that public health action to focus on preventing further exposure was significant at the time, as this report was presented to the public just months after *The Washington Post* story, with the *MMWR* article easing much of public concern. The report also went on to be used as guidance by other city and state officials across the nation, including those in Seattle, Washington, Michigan, and North Carolina, who took its findings as further documentation that there was no evidence of lead poisoning resulting from high WLL and therefore focused their attention on other sources of potential lead exposure (U.S. Congress, 2010).

The Investigation into Lead Contamination in DC

Marc Edwards of Virginia Tech University was contacted by residents of the District of Columbia in March 2003 to assist in trying to understand what was causing residents' copper pipes to be destroyed. During his initial investigation, Edwards checked the lead levels of the water and found that even at a 1/10 dilution they were still too high for his meter to register, meaning the lead values were thousands of parts per billion; the EPA action level was 15ppb (Home-Douglas, 2004). Edwards also found that the worst lead levels were in the water after it had been running for 30–60 seconds. Meanwhile WASA and the EPA were advising residents to flush their water for 30 seconds, believing this would eliminate the problem, when in reality it was causing consumption of the highest levels of lead. Shortly after this revelation, Edwards reported that a subcontract he was awarded to investigate the problem was discontinued, with WASA forcing him to choose to work either solely for them or for the homeowners for whom he had been consulting. When he did not promise to discontinue his monitoring with homeowners, WASA stopped allowing him access to sampling data (Home-Douglas, 2004).

In 2004 Edwards was called to testify before a congressional committee and presented his findings that the switch from chlorine to chloramine was causing the increase in high water lead levels. WASA and the EPA initially questioned the finding, but ultimately confirmed that after switching back to chlorine, the WLLs dropped significantly and that they rose again after switching back to chloramine in May (Edwards and Dudi, 2004; Home-Douglas, 2004).

After his work in 2003, Edwards began to look at data available for the District and found discrepancies in what was originally reported. He then decided to obtain the raw data used for the 2004 *MMWR* article, at which point the anomalies only grew. These discrepancies and the resistance he experienced from the CDC and the CDC Department of Health when inquiring about these issues led Edwards to file a formal complaint alleging the "possible fabrication and falsification" of the data (U.S. Congress, 2010). The CDC responded by informing Edwards that his complaints should be directed to DC's Department of Health, although they did recognize the misinterpretation of their data across the country and posted two notices to readers (CDC, 2010a, 2010b).

In addition to alerting the CDC, Edwards continued to investigate this discrepancy. By collaborating with researchers at Children's National Medical Center, he was able to obtain more comprehensive data and found that although the risk for the city as a whole for elevated blood levels for children under 30 months during 2000–2003 was not significant, the risk was significant when data were stratified by neighborhood (Edwards et al., 2009; Leonnig, 2009b; McCartney, 2010). Edwards and colleagues found that in the high-risk neighborhoods the incidence of elevated blood lead levels was 2.4 times higher in 2003 compared with 2000 (Edwards et al., 2009; Leonnig, 2009b; McCartney, 2010). Edwards et al. also found that these results deviated from national trends, providing further evidence that there were likely health consequences for infants who consumed the lead-tainted water between 2000 and 2003 (Edwards and Dudi, 2004; Leonnig, 2009b; McCartney, 2010). These findings contradicted those of the initial CDC *MMWR* article, and through publicity from *The Washington Post*, a congressional investigation was launched to determine whether the CDC or other agencies had misled the public about the potential for negative health effects in children.

Congressional Review

In response to evidence presented by Edwards and public pressure, a subcommittee of the House Science and Technology Committee was established to investigate the issue. The subcommittee released a report in 2010 titled *A Public Health Tragedy: How Flawed CDC Data and Faulty Assumptions Endangered Children's Health in the Nation's Capital*. The committee's primary findings included failure of the CDC to notify the public of its faulty analysis and other subsequent research, data omission and elimination, the inability to produce the raw data initially used, and failure to provide "reliable public health guidance" (U.S. Congress, 2010).

The congressional investigation found that although the CDC never published subsequent research it had conducted, an additional unpublished study found that a rise in WLL caused lead poisoning in children in the District of Columbia. This work was presented at a public health conference but was otherwise never made available to the public. The fact that the authors eliminated one child with an elevated BLL from the original data set also made it possible to claim in the initial *MMWR* article that there was not a single child with elevated BLL (U.S. Congress, 2010). The committee's investigation uncovered that although the CDC and the District's health department reported 193 children with dangerously high blood lead levels in 2003, this was based on a small subset of data, and through analyzing laboratory records the actual number was found to be 486 (Leonnig, 2009a). The House subcommittee also found that the author of the initial paper was aware of the missing data and did not attempt to track it down for proper analysis and inclusion (Leonnig, 2010; Renner, 2009). The information uncovered from this investigation resulted in the CDC posting a notice to readers acknowledging that statements in its 2004 article were misleading and did not present a fully accurate

story (CDC, 2010a). The CDC eventually did complete and publish a follow-up study in 2010 attributing the crisis to the use of chloramine. The study was published nearly three years after much of the incident, and the congressional report noted that this update should have been included in the *MMWR*, as it is published more frequently than a journal (U.S. Congress, 2010).

Recent Lead Poisoning in the District

Although lead contamination is not currently as significant a problem as it has been in the past in the District of Columbia, many children are still at risk for lead poisoning. Recognizing this risk, the District's Department of General Services conducts WLL testing in all public schools, but water and school fountains are not the sole point of potential lead exposure (DC Public Schools, 2017). As recently as February 2017, FOX5 in the District of Columbia reported that a child received a diagnosis of "extreme lead poisoning" (Limon, 2017). The family of the child was living in low-quality housing when the young girl, only 2 years old, was exposed to lead through paint chips and dust. This story provides an example of how older, low-income housing is at much greater risk of having loose or exposed lead paint, creating a significant disparity in who is exposed to this risk, namely African American and low-income families in the District.

Media-Covered Cases of Lead Poisoning

One high-profile case that brought attention to the issue of lead exposure is the case of Freddie Gray, a 25-year-old African American man who was arrested in Baltimore, Maryland, and later died because of severe neck injury suffered while in police custody (Ali, 2017; McCoy, 2017). The attention to his case brought with it attention to Gray's history as a victim of extreme lead poisoning while living in low-income housing as a child. As noted earlier, lead poisoning has been shown to cause several neurological issues, which can often manifest as behavioral problems. Having blood lead levels that reached 37 micrograms per deciliter (seven times the level the CDC has established for public health follow-up) likely affected Gray's development. He never completed high school and was arrested "more than a dozen times" (McCoy, 2015).

Freddie Gray's story serves as a reminder of how many factors contribute to an individual's health and well-being. As a low-income African American born into poverty, he was at much higher risk of experiencing lead poisoning and its subsequent effects. Although his death in the custody of Baltimore police officers cannot be directly linked to lead poisoning, his story is a reminder that lead poisoning is among the many factors related to the structural injustice experienced by African American communities across the nation and the adverse outcomes across the life course for the residents of these communities.

Adverse Childhood Experiences (ACEs)

Childhood experiences, both positive and negative, largely inform health later in life, especially in the case of violence perpetration and victimization. Many U.S. agencies, including the Centers for Disease Control and Prevention (CDC), have invested significant amounts of funding and other resources to research the impact of childhood experiences. Adverse Childhood Experiences (ACEs) can result in a higher risk of ill health both physically and mentally (CDC, 2016).

Adverse Childhood Experiences and their link to future ill health were extensively studied in 1985 through work in an obesity clinic in California (Stevens, 2012a). This link was then expanded to a much larger study through which doctors in Southern California and the CDC studying a population enrolled in

a Kaiser Permanente HMO discovered that ACEs are strongly related to the development of disease and negative health outcomes such as weight gain, obesity, diabetes, and heart disease. The first clue to this relationship was the high rate of dropout from a weight-loss program where the majority of dropouts were people who had suffered from ACEs. Vincent Felitti, the doctor trying to determine why his patients were dropping out of his weight-loss program, accidentally stumbled upon the link: as he questioned some of the dropouts, he realized most of them had been sexually abused as children. These people saw weight gain as a solution to preventing the same kinds of abusive experiences from happening again. Eating allowed these individuals to combat their anger, anxiety, or depression, and being obese seemed to serve as a defense mechanism against being assaulted or bullied again. Felitti observed that his patients appeared to overeat to help cope with trauma and toxic stress (Stevens, 2012b). Thus, weight gain and addiction problems began to be seen in a new light: they were not only problems but also a method of protection for many people who had been abused as children (Stevens, 2012a).

Since the first ACEs study conducted in 1997, the definition of ACEs has grown to include physical, sexual, and psychological abuse as well as various forms of household dysfunction such as substance abuse, mental illness, criminal behavior, and mother treated violently (Felitti et al., 1998). These categories of ACEs influence well-being throughout the life span and are delineated in Figure 11.

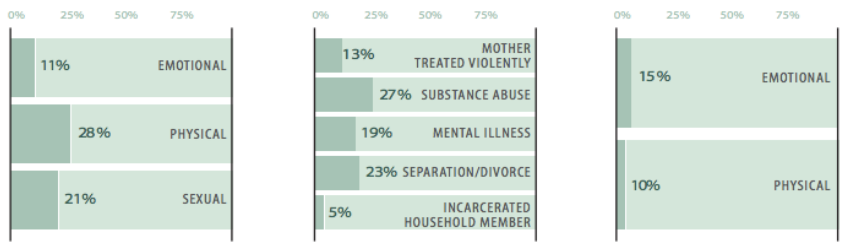


FIGURE 11: ACEs are divided into three different categories of abuse, household challenges, and neglect.
SOURCE: CDC, n.d.-b.

ACEs are interconnected and rarely isolated events. They can occur in the context of many different adversities in an individual's early life (Dube et al., 2002). ACEs can first impact neurodevelopment in early childhood, resulting in social, emotional, and cognitive impairment. These changes in neurodevelopment often manifest in high-risk behaviors among children and teenagers who have experienced ACEs.

Constant exposure to stress, reflected in elevated levels of the hormone cortisol, affects the neural development of a child and alters gene expression through epigenetic modifications that may alter and damage the body's usual protective mechanisms against excessive stress (American Academy of Pediatrics, 2014). This pattern is mirrored in animals as well. Studies show that early stress has a long-term effect on the hypothalamus-pituitary-adrenal axis and norepinephrine. For example, maternally deprived rats had decreased numbers of glucocorticoid receptors in the hippocampus, hypothalamus, and frontal cortex. These stressed animals were unable to halt the glucocorticoid response to stress and displayed a decreased glucocorticoid receptor binding in the hippocampus region of the brain (Bremner, 2006).

The alteration of genetic mechanisms that regulate the body's stress response, which is far more complex than an on/off mechanism, leads to behaviors that may result in disease, disability, social

problems, and eventually early death (Felitti et al., 1998). The authors of one study assigned numeric scores based on the number of ACEs experienced by study participants, and those with an ACE score of seven were 31 times as likely to have attempted suicide during their lifetimes than those with an ACE score of zero (Dube et al., 2001).

Adverse Child or Family Experiences (ACEs) Items	DC	Maryland	National
Extreme economic hardship	23.8%	20.1%	25.7%
Family disorder leading to divorce/separation	15.2%	16.9%	20.1%
Has lived with someone who had an alcohol/drug problem	6.9%	8.3%	10.7%
Has been a victim/witness of neighborhood violence	16.6%	7.9%	8.6%
Has lived with someone who was mentally ill/suicidal	7.5%	7.2%	8.6%
Witnessed domestic violence in the home	8.0%	6.3%	7.3%
Parent served time in jail	8.3%	6.1%	6.9%
Treated or judged unfairly due to race/ethnicity	4.2%	3.9%	4.1%
Death of parent	7.1%	2.7%	3.1%
Child had ≥1 ACEs *(1/more of above items)*	50.6%	41.6%	47.9%

TABLE 9: Greater than half of the District of Columbia's population experience more than one ACE, and many of those people faced extreme economic hardship.
SOURCE: Data Resource Center for Child & Adolescent Health, 2014.

The prevalence of ACEs is high in the District of Columbia's population of children aged 0 to 17 years. In fact, only 51 percent of this population has not experienced any ACEs, whereas 37 percent has experienced one or two ACEs and 11 percent has experienced three or more ACEs (Sacks et al., 2014). Among District residents, the most common ACEs include extreme economic hardship, family dysfunction leading to divorce or separation, and being a victim or witness of neighborhood violence (see Table 9) (Data Resource Center for Child & Adolescent Health, 2014). Realizing that the burden of ACEs in the District's youth was staggeringly high and that ACEs play a large role in the school-to-prison pipeline, District of Columbia officials and community members have started developing strategies to tackle ACEs and support children who face such experiences. David Grosso, a District City Council member and chair of the education committee, has supported legislation that bans school suspension and expulsion for students under the age of 5 and requires a detailed report of the socioeconomic background of students who have faced suspension or expulsion each month. Through such steps, he and the rest of the committee hope to create a welcoming environment where all children can learn and educators can tackle trauma in the classroom and through the school system (Prewitt, 2015).

The District of Columbia residents and lawmakers are turning to solutions inspired by a variety of fields to reduce the burden of ACEs in their community. Many organizations with a focus on creative expressions of feelings, such as Free Minds, encourage incarcerated young individuals in the District to write, sing, or create as a means to help transition back to society after prison and dealing with their childhood trauma. At New Beginnings Youth Development Center in the District of Columbia, all staff are trained in trauma-informed care to better serve young people who are in juvenile detention, because trauma plays a significant role in causing later behaviors that result in detention (Prewitt, 2015).

Addressing Structural and Environmental Racism

Structural Racism

The physical environment plays a major role in the health and well-being of residents. Air quality, natural environment, hazardous materials, water, housing, and exposure to toxins have various health

consequences, so it is important to pay attention to the environmental causes of morbidity, mortality, and negative health outcomes (DC Department of Health, 2013).

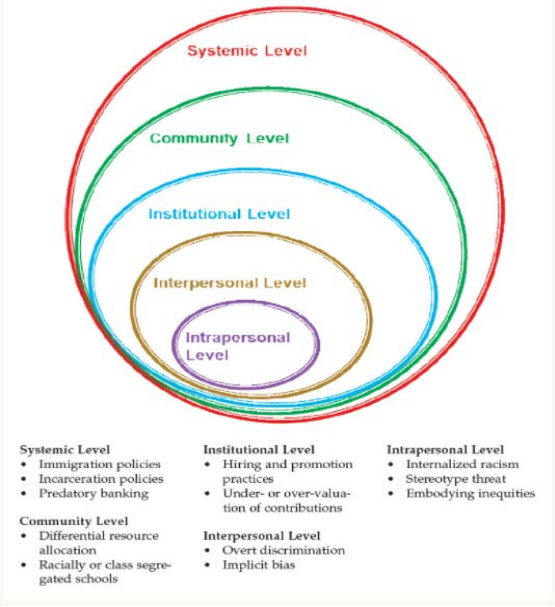


FIGURE 12: Social ecological model with examples of racism constructs.
SOURCE: NASEM, 2017.

Various inequities may occur based on socioeconomic status, sex, and other factors. Disparities based on race and ethnicity remain the most persistent and difficult types of disparities to address (NASEM, 2017). Racism can operate at a number of levels, including intrapersonal, interpersonal, institutional, and systemic levels (NASEM, 2017). Figure 12 highlights how the social ecological model can be used to identify levels and examples of racism.

The Aspen Institute defines structural racism as "a system in which public policies, institutional practices, cultural representations, and other norms work in various, often reinforcing ways to perpetuate racial group inequity. It identifies dimensions of our history and culture that have allowed privileges associated with 'whiteness' and disadvantages associated with 'color' to endure and adapt over time" (The Aspen Institute, n.d.).

Framework and strategies for reducing racial inequity

- **Identify** and recognize community concerns and emerging issues about injustices, as well as gaps in existing regulations, laws, and policies, and innovative approaches for consideration by local leadership.
- **Advocate** for community concerns, through venues such as a Public and Environmental Health Advisory Board, commissions, and town halls. Additionally, build the capacity of residents to advocate on their own behalf and tap existing advocacy groups for leadership.
- **Support** the adoption of laws, policies, and regulations that reduce the disparity in exposure, such as those that decrease exposure to lead-based paint typically found in low-income housing. Work with organizations to change their policies to create healthier environments, and on land use through organized, effective planning.
- **Consult** in the form of educating about the enforcement of laws, policies, and regulations. These activities include providing information and training (including to health providers around assessment and public health advisories), facilitation, and linking of issues back to health and public health consequences (Contra Costa Health Services, 2007).
- **Involvement:** The EPA says that "meaningful involvement means that: a. potentially affected community residents have an appropriate opportunity to participate in decisions about a proposed activity that will affect their environment and/or health; b. the public's contribution can influence the regulatory agency's decision; c. the concerns of all participants involved will be

considered in the decision-making process; and d. the decision-makers seek out and facilitate the involvement of those potentially affected" (CDC, 2011).

Implications of Environmental Racism: Health Disparities

A study conducted by Barker shows that babies born with low birth weight are at an elevated risk of lifelong chronic diseases, heart disease, and stroke (Barker, 2006). A study published in the *Environmental Health Perspectives* journal showed that maternal low-level lead exposure was associated with decreased birth weight (Zhu et al., 2010). In 2017, Boston's Children Hospital found that "any baby born prematurely is more likely to be small. However, there are other factors that can also contribute to the risk of low birthweight" (Boston Children's Hospital, n.d.-b). These include the following:

- **Race**—African American babies are twice as likely as Caucasian babies to have low birth weight.
- **Mother's age**—Teen mothers, especially those younger than 15 years old, have a much higher risk of having a baby with low birth weight.
- **Multiple birth**—Multiple-birth babies are at increased risk of low birth weight because they often are premature.
- **Mother's health**—Babies of mothers who are exposed to illicit drugs, alcohol, and/or cigarettes are more likely to have low birth weight. Mothers of lower socioeconomic status are also more likely to have poorer pregnancy nutrition, inadequate prenatal care, and pregnancy complications—all factors that can contribute to low birth weight (Boston Children's Hospital, n.d.-a).

Environmental Racism and Justice

The concept of environmental racism fits well with the topic of lead hazard and its historical nature. This term has a broad range of meanings and adaptations but is believed to have first been introduced in 1982 after an incident in Warren County, North Carolina, where the placement of a hazardous waste landfill was to be in an area with the county's highest proportion of African American residents. After these protests, environmental racism came to be defined as "racial discrimination in environmental policy-making and enforcement of regulations and laws, the deliberate targeting of communities of color for toxic waste facilities, the official sanctioning of the presence of life threatening poisons and pollutants for communities of color, and the history of excluding people of color from leadership of the environmental movement" (Holifield, 2001). Holifield presents the issue of there being many different definitions of environmental racism, particularly around the question of whether the actions must be deliberate to qualify as environmental racism (Holifield, 2001). This definition, as another author posits, "miss[es] the role of structural and hegemonic forms of racism in contributing to such inequalities" (Pulido, 2000).

Pulido conducted a review of several studies from Los Angeles County, all of which "found that nonwhites were disproportionately exposed" to pollution, and that these discrepancies exist as "a response to conditions deliberately created by the state and capital," highlighting how a history of racism gives rise to environmental racism (Pulido, 2000). Additionally, Pulido acknowledges that "southern California remains highly segregated, despite a reduction in overt forms of racism," a key

point in understanding how environmental racism can continue to play out (Pulido, 2000). This approach to understanding environmental racism, by looking at history and as a problem that is separate from overt racism, serves as a lens through which these topics should be considered (Holifield, 2001). Other national studies supported the finding that hazardous waste facilities were more commonly situated near minority and low-income neighborhoods (Ash et al., 2009; Colquette and Robertson, 1991). Consideration of the historical issues leading to these environmentally motivated health disparities not only enables researchers to better understand the communities they are studying, but also helps public health workers develop interventions that appropriately mitigate ongoing and future public health risks, as discussed in the Trust and Cultural Competency section.

The concept of environmental justice is related to the concept of environmental racism. The EPA defines environmental justice as the "fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies" (EPA, 2017c). Environmental justice differs from the concept of environmental equity in that environmental justice "connotes some remedial action to correct an injustice imposed on a specific group of people," rather than simply "impl[ying] an equal sharing of risk burdens, not an overall reduction in the burdens themselves" (Cutter, 1995). A major step in addressing environmental justice was Executive Order 12898, which, in accordance with Title VI of the Civil Rights Act of 1964, "directed federal agencies to develop environmental justice strategies to help federal agencies address disproportionately high and adverse human health or environmental effects of their programs on minority and low-income populations" (EPA, 2017c). Thinking about environmental justice and environmental racism is critical to understanding the complex issues that communities face and are especially important considerations when tackling the issue of lead and ACEs.

Intervention in issues of lead, ACEs, and racial inequality can occur at numerous levels, but an important one to keep in mind are the policies that often play a guiding role in downstream funding and interventions. Policy also provides a historical perspective of previous attempts to address the issues at hand and can help frame what has been particularly successful or unsuccessful.

Environmental Policy

Several national-level policy tools are available to support action to protect children from environmental health exposures (including some specifically pertaining to lead) that are detrimental to their neurologic and overall health and well-being. Public policy and legislation are vital to making public health issues a national and local priority and for providing the resources needed for research, prevention, and intervention activities. Below are brief overviews of some of the major federal, state, and local policies that directly and/or indirectly aim to mitigate adverse health effects of lead exposure in childhood.

Federal Laws and Executive Orders

TABLE 10: Summary of federal laws and executive orders.

Federal Laws and Executive Orders		
	Executive Orders	Highlights
Environmental Exposures and Child Development	Executive Order 13045: Protection of Children from Environmental Health Risks and Safety Risks (1997)	• Formed the President's Task Force on Environmental Health Risks and Safety Risk to Children • The task force researches and raises awareness of environmental health risks while coordinating efforts to identify and implement strategies to "promote children's health resilience" (NIEHS, 2017)
Environmental Justice and Vulnerable Populations	Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (1994)	• "Direct[s] federal agencies to identify and address the disproportionately high and adverse human health or environmental effects of their actions on minority and low-income populations" • Implemented a national strategy for environmental justice • "Establish[es] an Interagency Working Group (IWG) on environmental justice" (EPA, n.d.)
Exposures	Federal Statutes	• Developed a federal air pollution program • Appropriated funding for air pollution research • Encouraged cooperation among state control agencies • Authorized regulation and enforcement of limiting pollutant quantities in the air[1] (EPA, 2017d, 2017e)
Lead in Air	Clean Air Act (1970)	
Lead in Chemicals	Toxic Substances Control Act (1976)	• Created reporting, record-keeping, and testing requirements • Introduced restrictions relating to chemical substances and/or mixtures • Mandated evaluation of existing chemicals with enforceable deadlines • Established risk-based safety standards • Increased public transparency for chemical information • Appropriated funding to carry out new requirements[2] (EPA, 2016)

[1] Clean Air Act of 1970, 42 U.S.C. §7402. 2006.
[2] Toxic Substance Control Act of 1976, 15 U.S.C. §2601(a). 2006.

Lead in Water	Clean Water Act (1972)	• Prohibits the discharge of toxic pollutants, including lead, through "a point source" into U.S. waters unless they hold a National Pollutant Discharge Elimination System permit (EPA, 2017h) • Developed water pollution control programs[3]
	Safe Drinking Water Act (1972)	• Authorized the EPA to implement scientifically based minimum standards to protect tap water • Addressed lead and copper in drinking water and pipe corrosion by requiring systems to monitor lead concentration levels, and informing the public of protective actions if concentrations of lead or copper exceed specified limits (EPA, 2017f)
Lead in Housing	Residential Lead-Based Paint Hazard Reduction Act (Title X) (1992)	• Developed a national strategy and program to build infrastructure necessary for lead-based hazard abatement • Created "standards for lead-based paint hazards in pre-1978 housing and child-occupied facilities" (EPA, 2017a) • Established a framework for lead-based paint hazard evaluation and reduction to prevent childhood lead poisoning • Established evaluation and reduction of lead-based hazards in federally assisted and owned housing[4]
	Lead-Safe Housing Rule (2000)	• Provides grant funding to state and local governments to enforce the Department of Housing and Urban Development's (HUD's) lead-based paint regulations • Requires "notification, evaluation, and reduction of lead-based paint hazards in federally owned residential property and housing receiving federal assistance" (HUD, n.d.-a) • Amends the definition of "'elevated blood lead levels' in children under the age of 6 [who reside in housing defined in the rule] in accordance with guidance of the CDC" in HUD's lead-based paint regulations, and formalized "testing and evaluation procedures for housing where such children reside" (HUD, 2017)
	Lead-Based Paint Disclosure Rule (1996)	• Established a requirement for disclosure of known lead-based paint hazards in the sales or rentals of homes built pre-1978 (EPA and HUD, 1996)
	Renovation, Repair, and Painting Rule (1998)	• Requires accreditation and training of renovation workers and technicians, and renovation work practices and record keeping for construction on homes built

[3] Clean Water Act of 1972, 33 U.S.C. §1251. 2006.
[4] Residential Lead-Based Paint Hazard Reduction Act of 1992, 42 U.S.C. §4851-§4856. 1994.

		before 1978 to prevent lead contamination from dust and paint chips[5] (HUD, n.d.-b)
Lead Disposal	Resource Conversation and Recovery Act and the Comprehensive Environmental Response, Compensation, and Liability Act (1980)	• Created control standards for hazardous waste management throughout the process of generation, transportation, recycling, treatment, and disposal • Created programs that address the disposal and cleanup of lead waste, including residential lead-based paint removal by contractors as household waste, and limits the release of lead into the environment at Superfund sites[6] (EPA, 2017b)
Lead in Consumer Products	Consumer Product Safety Improvement Act (2008)	• Regulates limits of lead content in children's products (defined as products designed or intended for consumers 12 years of age and younger) • Requires children's products to comply with product safety rules by undergoing compliance testing and requires manufacturers to obtain proof of test completion (U.S. Consumer Product Safety Commission, 2013, n.d.)

Local Laws

In response to increasing concerns over rising blood lead levels in children, the District implemented several lead laws that mirror federal statutes and strengthen local provisions to reduce lead exposure in housing units built before 1978. The District's *Strategic Plan for Lead-Safe and Healthy Homes* provides additional information regarding goals and objectives to address lead exposure.

Lead-Hazard Prevention and Elimination Act[7]

Enacted in 2008 and amended in 2010, the Lead-Hazard Prevention and Elimination Act made the "presence of lead-based paint hazards illegal in all residential dwelling units, in common areas in multifamily properties, and in child-occupied facilities such as daycares, built before 1978" (DC Department of Energy & Environment, n.d.). Provisions in the law grant the District government authority to conduct property risk assessment, provide notice of violation or infraction if lead-based paint hazard is detected, and order hazard elimination guided by lead-safe work practice requirements. The law includes additional provisions for landlords of pre-1978 housing that require them to offer tenants temporary relocation options during repairs, disclose "the discovered presence of lead-based paint in their unit within 10 days of such discovery," and inform tenants of their rights by providing a "Tenant Rights" form supplied by the DC lead program (NCHH, n.d.).

[5] Lead; Renovation, Repair, and Painting Program; Lead Hazard Information Pamphlet; Notice of Availability: Final Rule, 40 C.F.R. §745. 2008.
[6] Resource Conversation and Recovery Act and the Comprehensive Environmental Response, Compensation, and Liability Act. 1980. 40 CFR Part 261
[7] Lead-Hazard Prevention and Elimination Act. DC Code §8-231.01 et seq.

Childhood Lead Screening Amendment Act[8]

In 2006, the District amended the Childhood Lead Poisoning Screening and Reporting Act of 2002, effectively adding a clinical approach to address rising blood lead levels. This act mandates that health care providers and facilities perform a blood lead level test on every child residing in the District. This requirement applies to all children under the age of 6, with tests performed in accordance with a schedule and guidelines from the CDC.

Student Health Care Amendment Act[9]

The Student Health Care Amendment Act revised subsections (a) and (c) of the District's Student Health Care Act of 1985. Cited in §38-602 of the act, this requirement strengthens the Childhood Lead Screening and Reporting Act by mandating that all children under the age of 6 years "furnish the school with a certificate of testing for lead poisoning." Standardized forms to serve as certificates of testing for lead poisoning are developed by the DC mayor's office in accordance with requirements by age group from the American Academy of Pediatrics.

Community/Nonprofit Work

National Coalitions

Lead

From a grassroots advocacy perspective, coalitions are essential in bringing attention and support to a problem. Coalitions comprise stakeholders united to support a common goal on a national, state, or local level. Below are examples of national coalitions addressing lead exposure. Note that this is not a comprehensive list.

Lead Advocacy: One example of a national coalition working toward the elimination of lead exposure and poisoning in children is WE ACT for Environmental Justice (WE ACT). This coalition unites organizations across the country to advocate for a "comprehensive plan to prevent lead exposure" at the federal level (WE ACT, 2016). Coalitions such as WE ACT can be effective at presenting the problem, organizing and mobilizing a campaign through grassroots and/or grasstops advocacy, conducting policy research, lobbying, and performing media outreach. By strategically using coalition members' pooled resources to target decision makers, there is a greater chance of raising awareness and obtaining the desired outcome (usually an evidence-based policy recommendation).

The Lead Outreach Campaign by WE ACT in New York City is an example of a "multi-level collaborative that sought to increase public knowledge" on childhood lead poisoning. The initiative used multiple outlets for information dissemination and pooled resources from partnerships between government agencies and community-based organizations to reach "nearly 20,000 individuals in . . . target[ed] communities where lead poison prevention [was] most crucial" (WE ACT, n.d.-b). WE ACT is also engaged in the Healthy Homes campaign, which advocates for better housing standards in low-income residencies that are disproportionately affected by lead in the home on a community level, in addition to a national advocacy strategy that provides recommendations to several federal agencies on how they

[8] Childhood Lead Screening Amendment Act of 2006, 54 DCR 827 §7-781.01. 2007.
[9] Student Health Care Amendment Act of 1993, 40 DCR 4752 §31-402. 1994.

can amend current legislation (i.e., changing blood lead level standards) (WE ACT, n.d.-a) to align with national lead campaign priorities.

Lead in the Home: The Green & Healthy Homes Initiative, formally known as the Coalition to End Childhood Lead Poisoning, is a 501(c)3 nonprofit in Baltimore, Maryland, and a "national leader advancing the mission to break the link between unhealthy housing and unhealthy children" (GHHI, n.d.). The coalition's work consists of the development, implementation, and promotion of comprehensive programs and policies to address childhood lead poisoning. One such imitative is seen in the organization's proposal, *Strategic Plan to End Childhood Lead Poisoning: A Blueprint for Action*. The plan outlines recommendations, across federal, state, and local agencies, for policy reform and lead reduction activities that can be undertaken by the private sector and other national organizations (GHHI, 2016).

Lead as a Neurotoxin: Healthy Babies Bright Futures (HBBF) is one of many alliances focused on the adverse health effects of lead exposure in children. However, this specific coalition addresses neurotoxin chemicals, such as lead, from the onset of life. Through their three dedicated programs—Bright Choices, Bright Cities, and Science into Action—the effects of lead exposure on brain development (e.g., "stunt[ed] brain development, reduce[d] IQ, behavioral problems") are voiced on the individual to federal levels (HBBF, n.d.-b). One example of this is seen in HBBF's "ask" campaigns to Congress to improve water infrastructures and protect consumers from lead in drinking water by revising current rules to "close . . . loopholes that allow local systems to claim that water is safe when it isn't" (HBBF, n.d.-a).

ACEs

A limited number of community-based organizations specifically target the direct or indirect role of lead exposure in ACEs nationally or locally. States such as Tennessee (ACEs Awareness Foundation), California (Center for Youth Wellness), Wisconsin (SaintA), and others coordinate with community stakeholders to educate the public about ACEs and childhood health outcomes. ACEs Community Network, an online social network community unifying stakeholders within and between states, presents an alternative model of community outreach and integration that advocates and provides resources for those interested in learning to "become trauma-informed, address sources of adversity, and promote health and resilience" (ACEs Connection Network, n.d.).

District of Columbia Initiatives

DC Water Service Map: In the early 2000s, the switch from chlorine to chloramine for water treatment led to widespread pipe erosion and elevated lead levels in the District's water, placing children at high risk for health and behavioral problems (Shaver and Hedgpeth, 2016). Until recently, much of the District relied on lead service lines to supply their water, presenting increased risk of lead exposure in the home. However, DC Water has begun replacing lead pipes with non-lead pipes and introduced an interactive service map that allows the public to view the type of service lines on private properties or public spaces. This information allows the community to assess their exposure risk and make informed decisions such as whether to replace its pipes (DC Water, n.d.).

Trust and Cultural Competency

The communities that are often most at risk for various physical and social hazards, such as lead and ACEs, are often the same communities that have been exploited in the past, sometimes by the same

agencies now tasked with helping them. Historical tragedies highlight this exploitation and provide just one piece of the puzzle to explain the mistrust of government on the part of communities that are marginalized and discriminated against (CDC, 2015b).

Research has shown that before, during, and after natural disasters there are often significant health disparities between different cultural and ethnic groups (Andrulis et al., 2007). To understand what created these disparities, one study notes reasons including "socioeconomic differences, culture and language barriers, lower perceived personal risk from emergencies, distrust of warning messengers, lack of preparation and protective action, and reliance on informal sources of information" (Andrulis et al., 2007). Attempts to address these issues have focused on improving communications, training of health care workers, and different program initiatives, yet often shortcomings limit the acceptability or usefulness of materials and initiatives, such as when resource guides or other materials are simply translated into another language without consideration of whether the initial underlying public health message will still be received (Andrulis et al., 2007). The authors indicate that significant training should be included, and that working with communities to develop emergency preparedness plans tailored to their specific community can be effective in reducing these disparities (Andrulis et al., 2007).

Cultural competence is a vital skill for all health workers working with diverse communities, but it is important to consider the role that this plays when responding to physical and social hazards, such as lead poisoning and ACEs. The technical teams who helped expose lead issues in the District of Columbia and Flint needed to be aware of the various historical issues and to exercise culturally competent and appropriate interventions through gaining the trust of the community. In addition to cultural competence and appropriate interventions, working with established community organizations and networks is vitally important, as local organizations are often well informed about the needs of their community's residents and carry significant influence in their community. Organizations such as the Dudley Street Neighborhood Initiative (DSNI) in Boston, Massachusetts, exemplify the importance of engaging the community and the success that can come from it. DSNI was able to "channel individual concerns into a collective voice" and through this was able to see success in promoting affordable housing, improved access to high-quality education, improved employment opportunities, food security, and other areas to improve their neighborhood. Further, through this experience it was clearly demonstrated that engaging the community from the beginning was important to the project's success (IOM, 2014, 2015; NASEM, 2017; Staples, 2012).

It is important for individuals and organizations who are working to improve the health conditions of a community to consider the various issues that the community has faced historically, those that currently affect the community, and those the community is facing in the future, to better understand and to assist more appropriately and effectively. Furthermore, such organizations need to engage with and include the organizations and community structures in place to more effectively and appropriately implement sustainable solutions.

Appendix A: List of Acronyms and Initialisms

ACE .....Adverse Childhood Experiences
ACHA .....American College Health Association
BLL.....blood lead levels
CDC.....Centers for Disease Control and Prevention
EPA .....Environmental Protection Agency
HPA.....hypothalamus pituitary adrenal
HUD .....Housing and Urban Development
MMWR.....CDC Morbidity and Mortality Weekly Report
MPD.....Metropolitan Police Department
ppb .....parts per billion
ppm .....parts per million
WASA .....District of Columbia Water and Sewer Authority
WLL.....water lead levels

Appendix B: Resource List

National

- ACEs Awareness Foundation
- *CDC Morbidity and Mortality Weekly Report (MMWR)*
- Centers for Disease Control and Prevention
- Environmental Protection Agency
- Flint Water Study
- Green & Healthy Homes Initiative
- Health Impact Project—Pew Trusts
- Healthy Babies Bright Futures
- National Academies of the Sciences, Engineering, and Medicine
- National Institute of Environmental Health Sciences
- National Institutes of Health
- Robert Wood Johnson Foundation
- United States Census Bureau
- *Washington Post* coverage of DC-lead issues and Flint lead issues
- WE ACT for Environmental Justice

DC, Maryland, and Virginia (DMV)

- District of Columbia Department of Energy and Environment
- District of Columbia State Board of Education
- District of Columbia Water and Sewer Authority (known as WASA or DC Water)

Appendix C: References

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Appendix D: List of Figures and Tables

Appendix E: Judging Rubric

DC Regional Case Challenge 2017—Judging Rubric

These criteria will be considered collectively through a facilitated judging discussion to determine the overall grand prize winner and category prizes. The criteria contributing to the three category prizes listed are indicated below.

Category Prizes: *Practicality Prize; ^Creativity/Innovation Prize; #Interprofessional Prize

	Poor	Accept-able	Very Good	Out-standing	Comments
Analysis of Problem/Challenge					
• Astute synthesis of problem • Identification of key issues	☐	☐	☐	☐	
Appropriateness/Justification of Solution					
• Justification of chosen priorities • Justification of chosen intervention(s) • Evidence to support likely effectiveness • Resourcefulness in gathering information	☐	☐	☐	☐	
Acceptability/Uptake of Solution *					
• Acceptability to relevant stakeholders • Cultural acceptability • Social/behavioral considerations	☐	☐	☐	☐	
Implementation Considerations *					
• Implementation plan • Timeline and budget • Feasibility (budget and other resources, time frame, cultural/political constraints, logistical/infrastructure constraints) • Monitoring and evaluation plan	☐	☐	☐	☐	
Potential for Sustainability *					
• Long-term maintenance and growth (feasibility, funding)	☐	☐	☐	☐	
Creativity/Innovation ^					
• Creativity and innovation in solution implementation and resources • Creativity and innovation in resources used for information gathering	☐	☐	☐	☐	
Interdisciplinary/multisectoral #					
• Use of collaborations/interactions among disciplines and/or sectors	☐	☐	☐	☐	
Teamwork #					
• Engagement of whole team in preparation and/or presentation • Clear team understanding and use of each other's roles and expertise	☐	☐	☐	☐	
Presentation Delivery					
• Clarity of content and logic of flow • Time management • Audience engagement • Visual aesthetic • Professionalism, poise, and polish	☐	☐	☐	☐	
Questions and Answers					
• Clarity and thoughtfulness of responses • Ability to draw from evidence	☐	☐	☐	☐	

Appendix F: Case Writing Team Biographies

Wyatt Bensken (Team Lead)

Wyatt Bensken is a 2016 graduate of American University's Department of Health Studies, and is a Fellow at the National Institutes of Health. Wyatt has prior research experience with the National Coalition for the Homeless, the National Park Service Office of Public Health, a small community-based organization in Kibera, Kenya, and with the University of Nairobi School of Public Health. Wyatt was a writer for the 2016 DC Public Health Case Challenge before becoming the Team Lead for 2017.

Amoge Ezike

Amoge Ezike is a senior majoring in biology and minoring in classical civilization at Howard University. She was part of the case team that represented Howard University in October 2016. She is interested in global health and infectious disease research, and hopes to obtain an MD degree and a Master of Public Health degree after graduation. Amoge hopes to eventually contribute to the revamping of medical education in West African countries.

Neha Shah

Neha Shah is a 2017 graduate of Georgetown University's biology department. She is interested in global health and education, and will pursue a Master of Science degree in Public Health in global disease epidemiology and control from Johns Hopkins Bloomberg School of Public Health. She has previously participated in the 2016 DC Public Health Challenge and the 2017 Emory Global Case Competition.

Maria Velasquez

Maria Velasquez is a Master of Public Health candidate at The George Washington University with a concentration in health policy. She received her Bachelor of Science degree in family sciences at the University of Maryland College Park in 2015, and is serving as a case writer for the DC Public Health Case Challenge for the first time. Maria's interests and background include working with vulnerable populations to improve access to and quality of health care services, and she intends to continue advocating for a more equitable health care system after completing her MPH.

Rediet Woldeselassie

Rediet Woldeselassie is a senior pursuing a degree in health administration and policy with a concentration in health systems management at George Mason University. Rediet is a veteran of the United States Marine Corps, where he gained experience working in logistics management and supply chain analysis. He is working as an undergraduate research assistant in the College of Education and Human Development, researching comparative education evaluation and policy. In 2016, Rediet was on the team representing George Mason University at the DC Public Health Case Challenge. He has returned as a case writer for the 2017 challenge.

Appendix G: Guide for Student Teams and Advisors

DC Regional Public Health Case Challenge 2017
Guide for Student Teams and Faculty Advisors

The National Academies of Sciences, Engineering, and Medicine (NASEM) will host the Fifth Annual DC Regional Public Health Case Challenge on October 13, 2017, to promote interdisciplinary, problem-based learning for the betterment of our DC community. Teams will be asked to approach a realistic public health issue facing the DC community and to develop a multifaceted plan to address it. A panel of expert judges will watch student presentations and pick a winning solution.

Organizers

NASEM Health and Medicine Division Staff
Point of Contact: Sophie Yang (syang@nas.edu)
Amy Geller (ageller@nas.edu)
Alina Baciu (abaciu@nas.edu)

Case Writing Team
Wyatt Bensken (American University alum, case lead)
Amoge Ezike (Howard University)
Neha Shah (Georgetown University alum)
Maria Velasquez (The George Washington University)
Rediet Woldeselassie (George Mason University)
Hannah Risheq (American University and Columbia University alum, case editor/adviser)

Theme
This year's case will focus on "Protecting Young Brains in DC: Tackling Neurologic Risks."

Overview
- **Universities form a team** of three to six graduate and/or undergraduate students representing **at least three disciplines, schools, or majors**. The case will require a comprehensive solution and it is advisable that teams be made up of students representing a variety of subjects (health, nursing, public health, law, business, communications, engineering, IT, gender studies, anthropology, economics, sociology, and so on). Teams are encouraged to have both undergraduate and graduate students.
- A **webinar** will take place for all students who will be competing (advisers are also welcome to tune in). The purpose of the webinar is to provide a primer on **upstream evidence-based policy solutions for public health issues**, an overview of the Case Challenge process, and time for questions and answers. The webinar will take place the same day that the case will be released; see the timeline section for more information.
    - A presentation on the importance of upstream public health policy solutions will be provided by Paula Lantz, Ph.D. Dr. Lantz is Professor of Public Policy and Health Management & Policy at the University of Michigan School of Public Health, former

Professor and Chair of the Department of Health Policy and Management at the Milken Institute School of Public Health at The George Washington University, and a member of the Roundtable on Population Health Improvement. She served as a reviewer of last year's case and will provide valuable insight that we hope will benefit the teams.

- **Student teams** are provided with a case that is based on a real-life challenge faced by individuals and organizations in the DC area. Teams are given two weeks to **develop comprehensive recommendations** to **present to a panel of expert judges**. The presented recommendations will be judged on criteria such as content, creativity, feasibility, interdisciplinary nature, and strength of evidence base. The case will include more detailed information on the judging criteria.
  - Information from the **2013–2016 DC Case Challenge events is available at** http://nam.edu/initiatives/dc-public-health-case-challenge/.

Prizes/Incentives for Student Teams

- Experience working with multiple disciplines to tackle a multifaceted public health challenge
- Practice for Emory University's International Global Health Case Competition
- Press release announcing the winning solution through the National Academy of Medicine and the Health and Medicine Division of the Academies
- Publication by NAM summarizing each team's solution written by team members (team members listed as authors). Past publications are available at https://nam.edu/initiatives/dc-public-health-case-challenge/.
- Breakfast, lunch, and a small reception will be provided.
- FREE entrance to the National Academy of Medicine (NAM) annual meeting on **October 16** for ALL interested team members and advisors with the opportunity for one team (selected by Case Challenge staff) to present at the "Future Leaders" luncheon highlighting the work of the 2017 event and other programs on Monday, **October 16**.
  - Attending the NAM annual meeting is an exciting opportunity to meet and connect with leaders in the fields of health, medicine, and beyond. See nam.edu/event/annual-meeting-2017-scientific-program/ for more information.
  - ***A minimum of three team members must be available on October 16 from noon to 1:45, as one team will be chosen on October 13 to present at the luncheon on October 16.***
  - *Advanced registration for the NAM meeting is required for those interested in attending.*
- **Prize money**
  - Grand Prize: $2,500
  - Three "Best in Category" prizes: $1,500

Timeline

- **Friday, September 8:** Deadline for universities to confirm participation (please email Sophie Yang at syang@nas.edu).
- **Friday, September 22**: Deadline to submit *two* lists of names ***(use form on the last page of this guide)***:
  - Team member names with area of study and email addresses for final team registration.
  - The names of all team members and advisors attending the NAM annual meeting on October 16.
    - IMPORTANT NOTE: One team will be chosen at the Case Challenge event on October 13 to present at the "Future Leaders" luncheon at the NAM meeting on October 16. ***At least three team members must be available to present from noon to 1:45 in the event your team is chosen;***

    - ***Advanced registration is required to attend the NAM annual meeting so all interested in attending must let us know on the status form.***
- **Friday, September 29**: A one-hour informational webinar for competing students (and advisors) will take place at 11:00 a.m. It will be recorded and posted online, so any students who are not available can view the recording afterward. Students (and advisors) are welcome to email us questions in advance.
- **Friday, September 29**: Organizers will release the case to teams at approximately 12:00pm once the webinar has ended.
- **September 29–October 13**: Teams will develop their solution to the case.
- **Friday, October 13**: Teams will present solutions to a panel of judges. Presentations will be followed by an awards ceremony. The event will take place from approximately 8:30 a.m. to 3:00 p.m.; we will let you know the exact times once we know the number of participating teams. Breakfast, lunch, and a reception will be provided.
- **Monday, October 16**: NAM annual meeting where teams will have the opportunity to attend the meeting and participate in a luncheon with NAM members and others (including the opportunity for one team to present their case solution at the luncheon).

Getting to the National Academy of Sciences Building

The National Academy of Sciences (NAS) building is at **2101 Constitution Avenue NW**, and is accessible by car or metro.

Driving to NAS: LIMITED visitor parking is available within the NAS building's main parking lot. To park for free, tell the garage attendant that you are participating in this case competition and provide your name and license plate number. Street parking is also available at normal DC rates, as is a ramp at the corner of 23rd Street NW and I Street NW.

Taking the Metro: The closest metro station is Foggy Bottom, along the blue and orange lines. Upon exiting the metro, head west on I Street NW toward 23rd Street NW. Turn left onto 23rd Street NW and walk about half a mile. Turn left onto Constitution Avenue NW, and the NAS building will be on your left.

Upon entering the building, you will need to present a photo ID to the guard at the front desk. Participants may then proceed to the auditorium to check in and receive further instructions.

Case Challenge Guidelines and Rules

<u>Suggested Team Preparation</u>
Teams are encouraged to meet several times before they receive the case to get to know each other, look at examples from previous case competitions (several are provided in the resources section below), and loosely plan an approach. It may be helpful for team members to agree on communication strategies and time commitments for the two weeks during which they will be developing the case response.

<u>Developing the Case Solution</u>
- Organizers will deliver the case electronically to competing teams by 5:00 p.m. on Friday, September 29. The case will be provided to the faculty advisor and team members.

- Designated members of the case writing team will be available to respond via email to questions and requests for clarification during the two weeks while teams prepare their solutions (contact details will be provided with the case). To ensure that all teams have access to all information about the case, all teams will receive a copy of the question and the response within 24 hours of receipt. Questions will NOT be accepted after 9:00 a.m. on Thursday, October 12.
- Teams should not discuss their case presentations or case content with other teams during the Case Challenge period (September 29–October 13) until the judges have completed final scoring.
- The student team can access and use any available resources for information and input, including both written resources (publications, internet, course notes/text, etc.) and individuals within and outside of the team's university. Students are encouraged to ground their solutions in public health theory, particularly the ecological model of health.
- This is a student competition and should reflect the students' ideas and work. The case solution must be generated by the registered team members. Faculty advisors and other individuals who are used as resources should not generate ideas for case solutions, but are permitted to provide relevant information, guide students to relevant resources, provide feedback on ideas and proposals for case solutions and recommendations generated by the students, and provide feedback on draft/practice presentations.
- Participants may not speak individually with the judges until judging has concluded on Friday, October 13. Please help the organizers by adhering to this rule during breaks.

Faculty Advisors

Each team must have at least one faculty advisor. This faculty advisor will serve as a point of contact with the Case Challenge organizers. The faculty advisor will also ensure that the team is made up of only undergraduate and graduate students of their university and that the team has representatives from at least three disciplines. Faculty advisors can also help student teams prepare for the case challenge competition within the following parameters:

- Faculty advisors **CAN**
    - ensure that the case is grounded in public health theory, in particular the ecological model of health;
    - assist teams with practice sessions or practice review of sample cases in the weeks preceding the release of the case;
    - suggest resources relevant to the case;
    - provide feedback on ideas for case solutions and recommendations generated by the students;
    - provide feedback on draft/practice presentations; and
    - communicate with the Case Challenge organizers about case guidelines and logistics.
- Faculty advisors **CANNOT**
    - generate ideas for case solutions and recommendations, or
    - communicate about the case with faculty advisers and students from other competing teams.

Presentations

- Presentation time: Each team will have a total of 25 minutes. (Note: there will be 5 minutes of transition time between presentations.)
    - Fifteen minutes are allotted to present analysis and recommendations.
    - Ten minutes are allotted for Q&A with judges.
    - Timing will be strictly enforced.

    - Any leftover time will be used at the discretion of the judging panel.
    - Teams may not view other teams' presentations until they have delivered their own presentation.
    - Handheld wireless microphones and a podium with a microphone will be available.
    - Team members will advance their own slides with a wireless clicker.
- Format
    - Analysis and recommendations should be presented in Microsoft PowerPoint.
    - Presentations will be loaded onto the computer and projection screen for you by a Case Challenge organizer. Teams will have an opportunity to check the compatibility of their file in advance of the presentation.
    - Judges will receive a printout of each team's slides.
    - Teams are encouraged to build appendix slides to help answer questions that they anticipate from the judges.
    - Judges will not know the university affiliation of teams until after judging is completed. The names of team members can be included in the presentation, but **DO NOT** include the university name or any identifying information in your presentation (e.g., school mascot).
- Presenters
    - As many team members can participate in the presentation as the team sees fit. All team members should stand at the front of the room during the Q&A session at the end of the presentation.
- Dress code
    - Competing teams are encouraged to present their case in business attire. The teams will not be identified by university to the judges, so students should not wear or carry any identifying logos, insignias, etc.
- Deadline to turn in completed case
    - To ensure that each team has an equal amount of preparation time, each team's final presentation should be loaded onto the presentation computer **by 8:30 a.m. on Friday, October 13.** Failure to submit the presentation on time will result in disqualification from the competition. No changes can be made to presentations after that time, and teams should not continue to work on their case solution and presentation while they are awaiting their presentation time.

<u>Judging</u>

- The judges have agreed to participate in this event as volunteers. The judges will be announced one week before the event, and biographical sketches of the judges will be available to student teams at that time.
- In evaluating the proposed case solutions, judges will consider the following:
    - Rationale/justification for strategies proposed
    - Specificity and feasibility
    - Interdisciplinary nature of the solution
    - Creativity and innovation
    - Clarity and organization
    - Presentation delivery
    - Teamwork
    - Ability to respond to questions
- Detailed judging criteria will be provided with the case when it is released on September 29.

Resources

The following links provide information and examples from public health case competitions at other universities. Note that most of these cases focus on an international issue; the DC Case Challenge will address a local public health issue. These are just examples—please use your own knowledge, creativity, and community resources to come up with a unique and compelling presentation!

Emory Global Health Case Competition:
http://globalhealth.emory.edu/what/student_programs/case_competitions/index.html

University of Toronto's presentation from Emory's 2013 competition:
https://www.slideshare.net/TheresaLee5/university-of-toronto-emory-global-health-case-competition

Winning presentation from 2015 Vanderbilt Global Health Case Competition:
http://www.vanderbilt.edu/vigh-sac/case/2015ghcc.pdf

Triangle Global Health Case Competition: http://triangleghcc2013.wordpress.com/

Yale Global Health Case Competition presentations: http://www.slideshare.net/yaleglobalhealthcc

Appendix H: Student Team Guidelines and Rules

Case Challenge Guidelines and Rules

Suggested Team Preparation

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- Teams should not discuss their case presentations or case content with other teams during the case challenge period (September 29–October 16) until the judges have completed final scoring.
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- Participants may not speak individually with the judges until judging has concluded on Sunday, October 16. Please help the organizers by adhering to this rule during breaks.

Faculty Advisors

Each team must have at least one faculty advisor. This faculty advisor will serve as a point of contact with the Case Challenge organizers. The faculty advisor will also ensure that the team is made up of only undergraduate and graduate students of their university and that the team has representatives of at least 3 disciplines. Faculty advisors can also help student teams prepare for the Case Challenge competition within the following parameters:

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    - generate ideas for case solutions and recommendations
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Presentations

- Presentation time: Each team will have a total of 25 minutes. (Note: there will be 5 minutes of transition time between presentations).
    - Fifteen minutes are allotted to present analysis and recommendations.
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- Format:
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- Presenters:
    - As many team members can participate in the presentation as the team sees fit. All team members should stand at the front of the room during the Q&A session at the end of the presentation.
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- Deadline to turn in completed case:
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Presentation on Emory's competition at the Consortium of Universities for Global Health conference: http://www.cugh.org/sites/default/files/2010-annual/presentations/Monday/Kane-220-mon/Ali.pdf

Emory University's 2015 case:
http://globalhealth.emory.edu/what/student_programs/case_competitions/2015_international_cc.html

University of Toronto's presentation from Emory's 2013 competition:
http://www.slideshare.net/TheresaLee5/university-of-toronto-emory-global-health-case-competition

Vanderbilt's 2015 winning presentation: http://www.vanderbilt.edu/vigh-sac/case/2015ghcc.pdf
Triangle global health case competition: http://triangleghcc2013.wordpress.com/

Yale Case competition presentations: http://www.slideshare.net/yaleglobalhealthcc

Appendix I: Presentation Day Agenda

Agenda: DC Public Health Case Challenge 2017

October 13, 2017
National Academy of Sciences Building
2101 Constitution Avenue, NW, Washington, DC
Room 120 and West Court

8:00–8:30 a.m.	**Arrival and Registration** *(Breakfast provided outside Room 120)*
8:30 a.m.	**Deadline to Turn In Presentation** *(Room 120)* *Please take your flash drive to the Case Challenge staff member at the computer. This is when you will draw a card for presentation order.*
	Judges Check In
8:40 a.m.	**Welcoming Remarks** *Victor J. Dzau, M.D., President, National Academy of Medicine*
8:55 a.m.	**Logistics**
9:00 a.m.–12:40 p.m.	**Presentations** *At this time, all but the first team should leave and go to the Members' Room. After your team has presented, you may remain in the room to watch the remaining presentations. At some point during the day, an organizer will gather each team to take a photo at the Einstein statue in front of the NAS building.*
	9:00–9:30 Team 1 9:30–10:00 Team 2 10:00–10:20 Break 10:20–10:50 Team 3 10:50–11:20 Team 4 11:20–11:40 Break 11:40–12:10 Team 5 12:10–12:40 Team 6
12:45–2:15 p.m.	**Lunch** *(West Court)* **Judges' Deliberations** *(Room 118)*
2:15–3:30 p.m.	**Awards Ceremony and Reception** *(West Court)*