Fifth Annual 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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In 2017, the National Academy of Medicine (NAM) and the Roundtable on Population Health Improvement at the National Academies of Sciences, Engineering, and Medicine (the National Academies) held the fifth annual District of Columbia (DC) Public Health Case Challenge (https://nam.edu/initiatives/dc-public-health-case-challenge), which was both inspired by and modeled on the Emory University Global Health Case Competition (http://globalhealth.emory.edu/what/student_programs/case_competitions/index.html).

The DC Public Health Case Challenge aims to promote interdisciplinary, problem-based learning in public health and to foster engagement with local universities and their surrounding communities. The Case Challenge brings together graduate and undergraduate students from multiple disciplines and universities to promote awareness of and develop innovative solutions for 21st century public health challenges as experienced by the DC community.

Each year, the organizers and a student case-writing team develop a case based on a topic that is relevant to the DC area and that has broader national and, in some cases, global resonance. Content experts are recruited as volunteer reviewers of the case. Universities located in the Washington, DC, area are invited to form teams of three to six students, all of whom must be enrolled in undergraduate or graduate degree programs. In an effort to promote public health dialogue among a variety of disciplines, the competition requires each team to include representation from at least three different schools, programs, or majors.

Two weeks before the Case Challenge event, the case is released and teams are charged to employ critical analysis, thoughtful action, and interdisciplinary collaboration to develop a solution to the problem presented in the case. On the day of the competition, teams present their proposed solutions to a panel of judges, composed of representatives from DC organizations and other subject matter experts from disciplines relevant to the case. The prize categories vary by year but generally include a grand prize as well as awards for practicality, creativity, and interdisciplinary nature of the solution.

2017 Case: Lead and Adverse Childhood Experiences: Neurological and Behavioral Consequences for Youth in the District of Columbia

The 2017 case focused on the neurological and behavioral consequences of lead poisoning and adverse childhood experiences (ACEs) for youth in DC. The case

asked the student teams to develop a program, with a grant of $2.5 million over five years that would mitigate the negative effects of lead poisoning and ACEs on DC children 6 years old and younger. Each proposed solution was expected to outline a rationale, an intervention, an implementation plan, a budget, and an evaluation plan.

The case framed the issue through four scenarios, illustrating a range of issues faced by youth and young adults in DC who have experienced lead poisoning and/or ACEs that have contributed to ongoing health problems and economic hardships throughout their lives. Though the four illustrative scenarios were fictional, they drew from circumstances faced by DC residents, with an emphasis on DC's most vulnerable groups as the Case Challenge used a health equity lens.

The first scenario described a 19 year old African American male resident who was exposed to lead paint and elevated water lead levels in the first few years of his life. As a teenager, he experienced behavioral and academic problems in school and began to commit crimes ranging from theft to assault. The second scenario presented a 22 year old African American female resident who grew up in a low-income neighborhood. Her father was often absent, but he was verbally and physically abusive to her mother when present, creating a tense home environment that contributed to her dropping out of school at the age of 16. After completing a two-year sentence for repeated drug-related arrests, she became sober but struggled to reintegrate in her community, maintain a job, and take care of her health, which included struggles with obesity, depression, and anxiety. The third scenario described a female teenager living in a northeast DC neighborhood. She was shot by a stray bullet and sustained life-threatening injuries. The incident prompted her family and others in the neighborhood to limit their children's exercise and play time outside. Additionally, residents of the neighborhood have struggled to cope with the increase in gun violence–related incidents in their community, due in part to the high costs of therapy and limited availability of appropriately trained counselors. In the final scenario, a pregnant 25 year old woman was told by her doctor at the beginning of her second trimester that she had high levels of lead in her bones, the primary source of lead exposure to newborn children. She was also told that she had iron deficiency anemia due to childhood lead exposure in the government-subsidized housing where she grew up, which had been apparently full of lead paint.

The teams were provided with background information on the socio-ecological framework and public health approaches for developing interventions to improve health outcomes; health disparities in DC; sources and consequences of lead exposure; historical and recent lead exposures in Flint, Michigan, and in DC; causes and effects of ACEs; impacts of structural and environmental racism; environmental policies intended to protect children from environmental health exposures, including information on relevant federal laws, executive orders, and local laws; community and nonprofit work, including information on national coalitions and DC initiatives addressing lead and ACEs; and the importance of trust and cultural competency when working with communities.

Team Case Solutions

The following brief synopses, prepared by students from the six teams that participated in the 2017 Case Challenge, describe how teams identified a specific need in the topic area, how they formulated a solution to intervene, and how they would implement their solution if they were granted the fictitious $2.5 million allotted to the winning proposal. Team summaries are provided in alphabetical order.

The 2017 Grand Prize winner was Howard University. Three additional prizes were awarded: two Harrison C. Spencer Interprofessional Prizes to the teams from Georgetown University and The George Washington University, and the Practicality Prize to American University. The Interprofessional Prize recognizes strong teamwork and solutions that are interdisciplinary and multi-sectoral. It has been awarded in past years, but beginning in 2016, it was named in memory of Dr. Harrison C. Spencer, who was, until August 2016, the president and chief executive officer of the Association of Schools and Programs of Public Health and a champion of interprofessional dialogue and collaboration to improve the public's health.

American University: Empower & Ab8

Team members: Laurel Booth, Diane Kim, Abhishek Patel, Shyheim Snead, Maile Young

Statement of Need

The problems of lead and ACEs are consequences of systemic dysfunction, and the issues of systemic racism and low socioeconomic mobility are key contribut-

ing factors to these exposures. Within the constraints of the allotted budget, it is not possible to change these damaging systems directly; however, by intervening to reduce the impact of lead exposure and ACEs, the proposed initiative aims to benefit the health of the community and begin to rebuild and reshape these larger systems. Through a reduction in exposure to lead and ACEs, the initiative aims to improve the social determinants of health in the community.

Goal

The American University team designed the initiative Empower & Ab8 with the purpose of reducing the impact of ACEs by identifying and intervening in cases of early lead exposure. The long-term goal of the project is to mobilize a connected and empowered community to advocate for and facilitate policy change to improve community health and other issues related to the social determinants of health.

Intended Outcomes

The initiative works through a multistep, interdisciplinary process that leverages the use of local resources and improves community engagement. Central aims of the intervention are increasing accessibility and compliance with blood lead level testing, providing information on the effects of lead poisoning, increasing access to existing services, fostering community empowerment through support and education groups, and developing subsidized lead abatement and testing services.

Intervention

Target population: The target population for Empower & Ab8 includes residents of DC's Ward 8. Ward 8 has high levels of exposure to both lead and ACEs. Over 76 percent of houses were built before 1979 [1], which makes them a lead hazard. In addition, it is an area of high ACEs exposure [2]. ACEs in DC that are particularly pervasive are extreme socioeconomic distress, witnessing and/or being a victim of neighborhood violence, and family separation [3]. Ward 8 has high rates of families living below the poverty line and of unemployment—23 percent of the population is unemployed [4]. Ward 8 is home to the highest population of children under 5 in the district, of this group in single, female-led households, more than 50 percent earn below the poverty line [1]. Single mothers with children under 5 is a priority group for which special guidance would be offered by Empower & Ab8 in the form of a community health worker/case manager.

Single mothers with children under 5 living in Ward 8 and earning below the federal poverty level are at high risk for ACEs and lead exposure. As such, Empower & Ab8 identified these households as the population most in need of support. Empower & Ab8 recognizes that the issue of lead and ACEs takes a toll on the entire community, as communities are shaped by the larger environmental and systemic forces at play. As such, the intervention aims to share resources with all residents. Finally of note is that 94.5 percent of the population in Ward 8 is African American [1]. This indicates that systemic racism is a factor contributing to the health inequity in the DC area and must be clearly addressed in the intervention's strategy.

Underlying theory: According to a 2016 community health needs assessment of DC [4], community resources should be allocated to the following areas: place-based care, health literacy, care coordination, and mental health services. Empower & Ab8 uses the evidence-based practices described in the health needs assessment and identified by the community as important components of the program and also applies the socio-ecological framework [5]. This aligns with the view that health and wellness is an outcome of many levels of social ecology and their interplay.

Mechanism: A mobile medical trailer will facilitate placed-based care and point-of-care testing for blood lead levels for children in Ward 8. The trailer will target key community areas such as schools, community centers, churches and libraries. Testing will be done with parental consent with a simple on-the-spot blood sample and analysis. Individuals who receive a positive result, indicating lead exposure, will be referred to health promotion materials and a list of resources to help connect them with lead abatement services for lead in paint and water, blood chelation and Medicaid reimbursement information, tenant rights information, and referrals to local partner organizations.

Those who test positive are also encouraged to attend three consecutive meetings of an information and support group. The curriculum includes:

1. **Meeting 1:** An introduction to the symptoms of lead poisoning, information on next steps and resources, and a space to share personal experiences with lead removal or lead poisoning issues and provide a supportive community at-

mosphere.

2. **Meeting 2:** Detailed information on tenant rights under DC law and resources to connect residents with local programs to provide additional support.
3. **Meeting 3:** Guidance on how to use and disperse knowledge from the previous sessions, as well as workshops on self-advocacy, navigating power structures, and dealing with common barriers in accessing resources.

We will incentivize participation by providing dinner, free childcare, and, if all three sessions are attended, a metro card will be issued to the participant. These incentives aim to increase accessibility, as is the flexible meeting schedule.

Services for members of the priority group include targeted identification and referral from partner organizations such as Head Start programs and word of mouth. Participating families will be provided with community resources as well as assigned a community health worker to help navigate service accessibility, increase health literacy, provide care coordination, and ensure follow-up services are provided. A collaboration to serve these priority group families and the greater population is the landlord partnership, which incentivizes landlords to provide lead abatement services for tenants by providing free lead inspections to those with tenants in the priority population. Landlords are required by law [6] to provide lead abatement services, and by defraying the cost of the inspection test we aim to increase the ability of landlords to pay for abatement and connect them with resources for subsidized abatement. We will further incentivize landlords by providing them with a certificate of lead-free housing upon proof of abatement. All certified housing will be publicly documented and viewable by all DC residents in partnership with the DC Department of Energy and Environment.

Empower & Ab8 is adaptable and in its early stages will focus on disseminating knowledge, building access to local resources, and developing further trust and partnerships within the community. In the later stages of the intervention, the focus will shift to emphasize community empowerment and mobilization to advocate for increased funding for lead abatement and ACEs resources as well as local policies to improve the health of the community.

Potential partners: Local Head Start and Early Head Start programs will help with outreach to the priority population. The community health worker program will be conducted with the Institute for Public Health Innovation. Medical vans will reach out to local churches, libraries, schools, health fairs, and community centers on a rotating basis. Partners for referral services and further education include DC Water, Lead Safe Washington, the DC Department of Public Health, the DC Department of Energy and Environment (DOEE), the DC Partnership for Healthy Homes of the DOEE Lead-Safe and Healthy Homes initiative, and local physicians.

Potential Barriers and Responses

There exist a number of barriers and limitations to the Empower & Ab8 approach. An important challenge is navigating cultural barriers around health in DC and tackling distrust of the medical system within the community. This distrust has been brought about by decades of experience with structural racism and economic hardship. We hope that by adapting our strategy to be responsive to community needs and staffed by members of the community and by partnering with existing local organizations we can overcome some of this distrust and work to change social and economic systems.

A logistical challenge is that the Empower & Ab8 program relies on cooperation from a number of local organizations, and such partnerships can be difficult to coordinate, especially when organizational goals do not align. In addition, the success of this intervention will increase demand for a limited supply of resources. To address this barrier, we hope to leverage the intervention's community advocacy component to voice a vocal demand backed by scientific evidence that will increase the supply of these resources.

George Mason University: Learn, Empower, Advocate, Do (L.E.A.D.)

Team members: Divya Gutala, Fareshta Jan, Chelsea Uwanaka, McKinley Dyer, Megan Gooding, Adam Maung

Statement of Need

Widespread poverty and substandard housing drastically increase the risk of exposure to both ACEs and lead, which may lead to severe long-term consequences for exposed children [7]. Assisting vulnerable families and children can be a cost-effective approach if this assistance is respectful and individualized to the target population.

Proposal

George Mason University developed the Learn, Empower, Advocate, Do (L.E.A.D.) program to minimize the current and future impact of neurological risk factors on children and families in the poorest regions of DC. The program will achieve these goals by way of community outreach and a modified nurse-family partnership (NFP) model.

Intended Outcomes

Through L.E.A.D., the NFP model and community events will equip participants with the skills and knowledge to reduce lead exposure and ACEs. *Figure 1* is a logic model that shows L.E.A.D.'s inputs and goal outcomes. The program is projected to reach about 800 families in the DC area over five years on a $2.5 million budget.

Intervention

Target population: Housing in Wards 7 and 8 in DC has a high prevalence of older housing with lead-based paint. These wards also have the highest homicide rates compared to the other wards [4]. The majority of residents in these wards are African American,

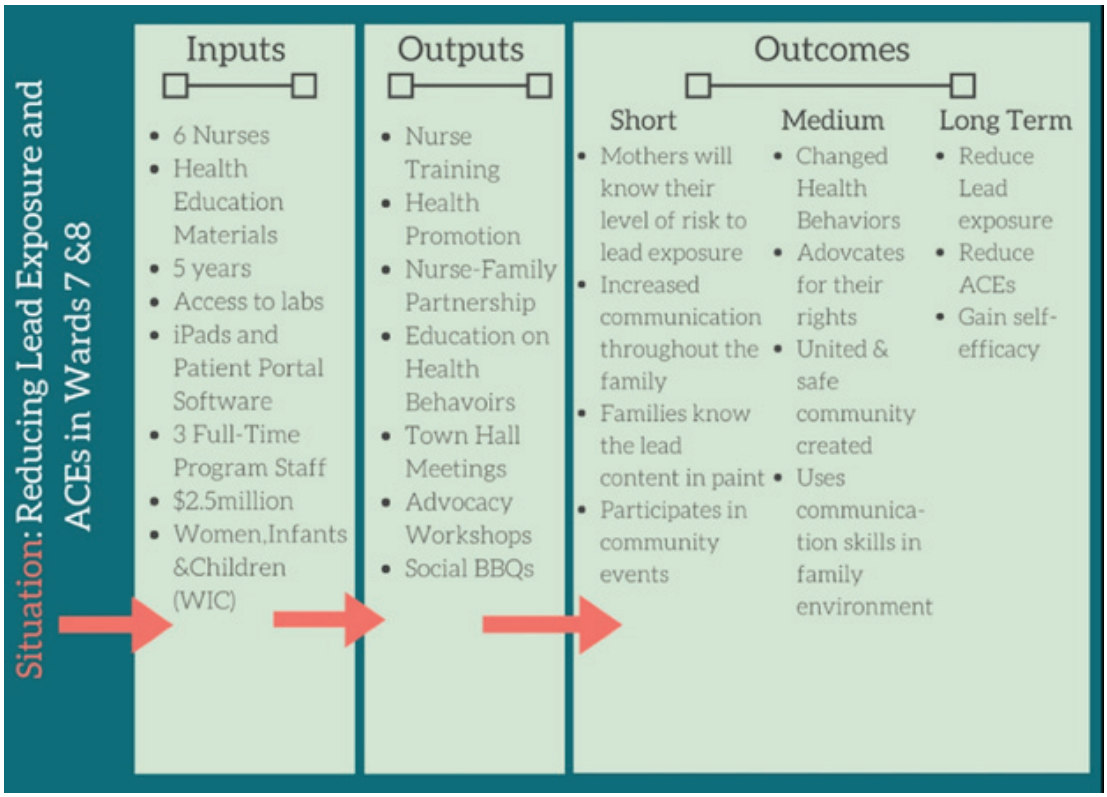

Figure 1 | Logic Model for George Mason University's L.E.A.D. Program
SOURCE: Developed by authors

and they bear most of the burden caused by ACEs and lead exposure.

Underlying theory/rationale: The NFP model has been thoroughly proven to reduce the number of ACEs that occur in partnered households [8]. Successful replications across the United States have shown that, by the age of 2, children in partnered households had 80 percent fewer reported cases of child abuse. By the age of fifteen, these same nurse-visited children had fewer convictions and parole violations than their peers [8].

The cognitive theory of self-efficacy can explain the significant positive impact that NFPs have on adults in a partnered family [8]. According to this theory, a person will choose to adopt a behavior if they believe that it will have a good outcome and that they can successfully complete the behavior. Through educational efforts, L.E.A.D. will increase the self-efficacy of adult participants for specific positive behaviors that minimize neurological risk factors. These include supportive parenting behaviors, planning a healthy diet, and advocating for policy change to safeguard their family and community.

Strategy/mechanism/details: The first six months

of the program will focus on recruitment and promotion efforts. These efforts will be comprised of community events as well as obstetrics/gynecology (OB/GYN) and pediatric office outreach.

Prenatal phase: As an upstream form of intervention, L.E.A.D. will prioritize establishing NFPs with expectant mothers. After a referral from an expectant mother's OB/GYN, a L.E.A.D. nurse will visit her and her family on a bimonthly basis. The initial focus of these nurse visits will be to identify lead exposure barring any other major complications. Educational resources will be provided, and an optional blood draw will be administered. By helping families address lead exposure, a relationship of mutual trust will be established before attempting to confront the more sensitive issues surrounding ACEs exposure. After initial enrollment, the rest of the prenatal phase will be focused on education regarding nutrition and pregnancy complications.

Postpartum phase: In the postpartum phase, the program will transition to educating mothers on child care and fostering healthy mother-child relationships. A cornerstone of this education is baby sign language. In addition to increasing a baby's sense of security and bond with its mother, baby sign language has been shown to jump start neurological development [9], which may counteract some of the neurological damage caused by lead exposure in utero as well as ACEs exposure occurring later in life. Other services will be expanded in this phase, including routine lead screening for children and educating mothers on breast feeding techniques, self-care, and family planning.

Phase-out: After an enrolled child reaches 12 months of age, L.E.A.D. will then focus on empowering families to lead on their own. This will be done through a combination of family and career planning events and community outreach. Community events will be held intermittently throughout the three phases of the program and include neighborhood walks, barbecues, yoga and exercise groups, resume clinics, mindfulness-based meditation groups, and educational workshops. *Figure 2* summarizes the program's educational goals during each phase.

Public policy: L.E.A.D. participants will be informed about their rights, including public policies designed to protect them from lead exposure. Since many families within the target population are renters, it is important that they understand their tenant rights. Participants will learn that, among other tenant rights, they are entitled to live in a property that is free of lead-based paint hazards [10]. Additionally, the "twice by two" law mandates that every child must have two lead blood tests conducted by the age of 2. In addition to education through nurse visits, L.E.A.D.'s community meetings will create a group of informed, vocal citizens who

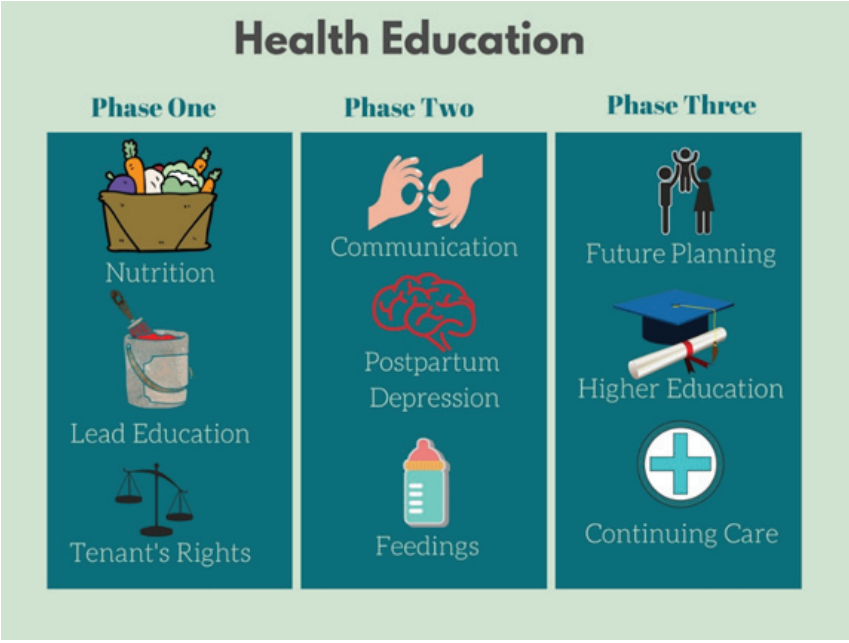

Figure 2 | Summary of L.E.A.D.'s Educational Goals
SOURCE: Developed by authors

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Figure 3 | Focus Points of the Georgetown University Team's Proposal
SOURCE: Developed by authors

will be able to advocate for their families and their community.

Budget and evaluation: The budget will be allocated primarily toward hiring staff, including six part-time nurses from Wards 7 and 8 as well as an administrative team that will communicate with key stakeholders and a board of directors. For program evaluation, collected blood lead level (BLL) data will be documented in a patient portal. Changes in average BLL for the target population will be measured after comparison to a control group using data from the DC Department of Energy and Environment. In addition, program participants will answer pre- and post-program questionnaires to determine the number of ACEs experienced. A ten-year follow-up with child participants will be performed to determine the long-term efficacy of the program.

Potential barriers and responses: The number of mothers enrolling in the program will be crucial to its success. Continuous advertisement and referrals from partner organizations, such as the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), will help enroll as many mothers and families as possible. However, potential partner families could be experiencing issues such as domestic violence, depression, and substance abuse. These issues could prevent potential NFPs. A 2014 study showed that keeping up with appointments and difficulty accepting help were major barriers to success of the NFP model. Cost-effective evaluation and open communication with partnered families will be key to overcoming these challenges [11].

Sustainability: L.E.A.D. will provide referrals for its participants to Unity Health Care services for continued care if additional grant money cannot be obtained before five years have elapsed. Unity Health Care is an expansive network of clinics across the DC area, making it a viable, geographically accessible option for DC families. L.E.A.D.'s greatest legacy will be the children that grow up without significant neurological damage as well as the educated and empowered adults who will go on to lead their families and communities.

Georgetown University: Project Resilience

Team members: Caroline King, Caroline Brailsford, Matthew Simmons, Noah Martin, Emily Shaffer, Prakesha Mathur, Katelyn Shahbazian

Goal

This proposal, Project Resilience, aims to legally protect DC's children and families by targeting gaps in existing policies surrounding the issue of exposure to lead and ACEs and ensuring implementation on the ground in local DC communities.

There are four specific areas through which significant change can be initiated. Though there are innumerable entry points to tackle the health issues pertaining to lead exposure and ACEs, the scope of this proposal must be kept narrow to maximize efficacy. The most important focus points are community building, legal advocacy, outreach, and real-time interventions (see *Figure 3*).

Intervention

Target population: Project Resilience focuses on a region within Ward 8 that is a high-risk area for lead

exposure and incidence of ACEs. A more specific catchment area within the ward (see *Figure 4*) will make the proposed solution particularly effective, as there is already an established community network of health services including community health centers, hospitals, and mental health centers. To identify the highest-risk clients in this catchment area, 500 households will be surveyed.

Underlying theory: Project Resilience is grounded in the principles of localized community-based action. By establishing action in a specific catchment area and following the tried and true method of employing community health workers (CHWs), change will be implemented in both real time and over the long-term. The operative theory behind the solution's structure is that direct community engagement can inform a higher level legal action arm.

Strategy: Outreach efforts will be augmented in the area through CHWs, who will be a direct connection to community residents. CHWs will be responsible for identification of specific catchment areas in which this intervention is most needed. They will also conduct the initial collection of data of the potential cohort, gathering demographic details and relevant medical information (for example, blood lead levels) as well as identification of homes built prior to 1978, which statistically have a higher chance of lead presence. Additionally, CHWs will be responsible for implementing real-time interventions, including nutritional intervention and tips for home maintenance to reduce dust that could contain lead. CHWs will also increase access to family resources and connect community members to resources for free health and legal counseling.

Both outreach and real-time interventions will contribute to Project Resilience's efforts to build the community as the project's legal team negotiates for, in-

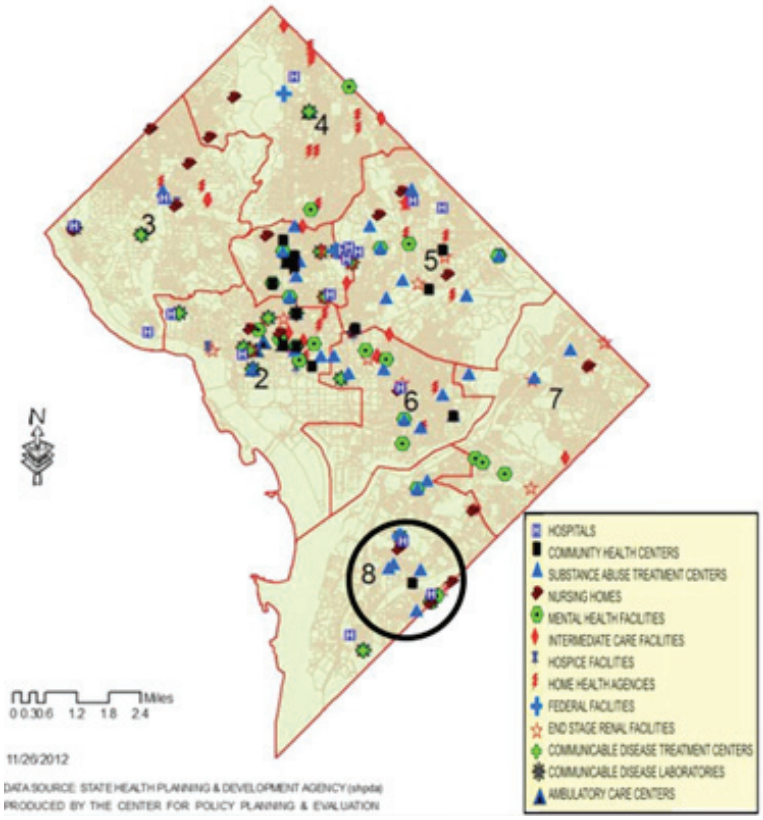

Figure 4 | Catchment Area (Circled)
SOURCE: District of Columbia community health needs assessment, volume 1. 2014. Washington, DC: District of Columbia Department of Health. Data source: State Health Planning and Development Agency (SHPDA). Produced by the Center for Policy, Planning, and Evaluation.

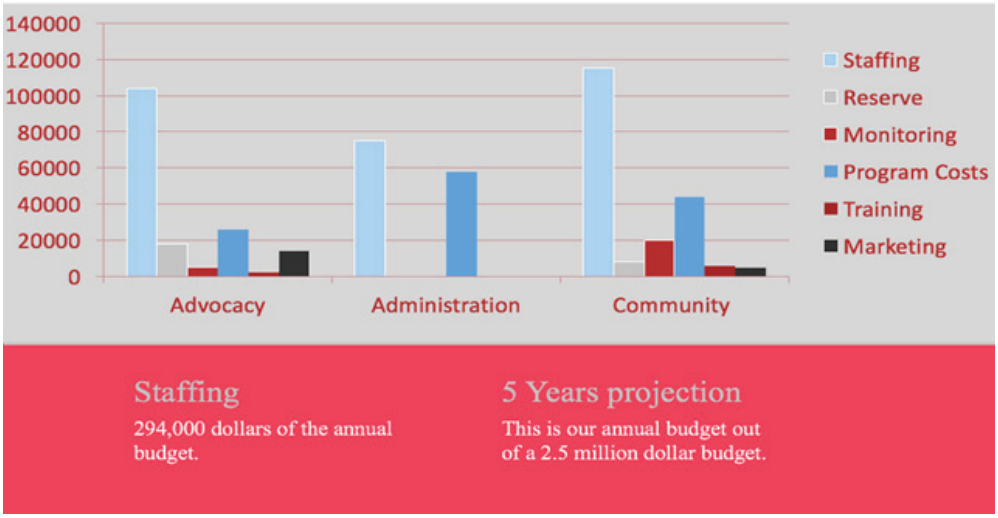

Figure 5 | Annual Budget Allocations of Project Resilience
SOURCE: Developed by authors

forms, and collaborates with community members to work toward empowerment. The hope is that this will contribute to the strengthening of community dynamics, which will provide a solid foundation for the legal advocacy component of the project. The simultaneous focus on immediate solutions and lasting policy change is the aspect of this proposal that makes the solution particularly innovative. Project Resilience will achieve long-term changes by providing legal representation to community members as well as educating them about their rights as tenants to live in a safe environment for their families.

Ultimately, the program aims to lobby for permanent policy revision to protect and not separate families during relocation following displacement. As legal action can require time to achieve results and is part of the long-term solution, real-time interventions will provide fast and temporary solutions to create safer homes for community members in the interim, especially for those who may not have the option to relocate. This proposal relies on the tried and true community health worker model in an effort to strengthen communities while generating long-term changes through a creative approach rooted in reliable political organizing strategies.

Partners: Project Resilience relies on partner support for real-time solutions as well as for building a robust community of volunteers. As such, the intervention will leverage many local resources including the DC Department of Health, the DC Bar's Landlord Tenant Resource Center, and WIC. The program will establish a clear and well-researched catchment area over an extended period of time. By providing a real-time, accurate understanding of community needs, the intervention will offer and facilitate efficient use of existing resources and services.

Budget: The operating budget is $2.5 million over the course of a 5 year period. The bulk of this funding will be allocated to staffing a legal team and community health workers. An overview of the annual budget is shown in *Figure 5.*

Howard University: Communities Advancing Through Child Health (CATCH)

Team members: Nicole McLean, Johnothan Smileye, Mark Lorthe, Nancy Alexis, Camille Robinson, Tahirah Williams

Statement of Need

In 2015, it was reported that there were more than 22,000 children under the age of 3 residing in DC, and roughly 7,610 slots were available with licensed child care centers [12]. This shortage leaves nearly 14,400 children in DC unable to receive care in state-regulated child care centers, indirectly exposing them to environments that may not meet DC Department of Energy and Environment lead exposure standards. Many of the same youth who are at risk of lead exposure are also at an increased risk for experiencing ACEs. The challenge of environmental lead exposure compounded by ACEs and their subsequent impact on children's cognitive and behavioral development is a

complex public health problem within DC, particularly in Wards 7 and 8.

Goals/Intended Outcomes

CATCH tackles the issues of childhood lead exposure and ACEs in Wards 7 and 8 through a multi-faceted approach that uses primary and secondary interventions to:

1. De-lead unlicensed child care centers and provide them with infrastructure grants;
2. Provide child care staff with training and certification opportunities;
3. Support primary caregivers through legal aid and social services as well as provide a curriculum for tackling lead exposure and ACEs;
4. Provide yearly lead screening for children and pregnant women; and
5. Host summertime events to engage and educate the community.

The intervention intends to achieve the following outcomes:

1. Train and certify five child care centers each year (excluding the start-up and evaluation periods) for a total of 20 child care centers by the end of the project timeline;
2. Provide lead screening and ACEs training to a total of 400 families;
3. Organize 15 events over the project timeline; and
4. Serve at least 2,000 community members in Wards 7 and 8.

Intervention

Target population: Communities Advancing Through Child Health (CATCH) plans to reach individuals in Wards 7 and 8. As shown in *Figure 6,* Wards 7 and 8 stand out in comparison to the other wards in the percentage of children under 5 living in families earning below the poverty level (Ward 7 at 44.1 percent and Ward 8 at 58.7 percent), the number of substantiated cases of abuse and neglect (Ward 7 at 360 cases and Ward 8 at 671 cases), and the percentage of the population under 5 (Ward 7 at 6.7 percent and Ward 8 at 9.3 percent) [13]. These data suggest that these wards would benefit most from an intervention providing child care services.

Underlying theory/rationale: The socio-ecological model serves as the underlying theory for CATCH, which was developed to account for the various personal and environmental factors that shape behavior and health outcomes [14]. The theory contains five levels: individual, interpersonal, organizational, community, and public policy. CATCH engages children, parents, and child care staff on the individual and interpersonal levels by offering ACEs training through Second Step, a national program that teaches 10.6 million children and caregivers each year about strengthening their social-emotional learning to ensure children reach their full potential [15]. Organizationally, CATCH will work with child care facilities to de-lead them and provide practice supply grants. As for the community, CATCH will engage with residents of Wards 7 and 8 through summer community events. Lastly, the program will be active at the public policy level through partnerships with community, state, and federal government stakeholders.

Strategy/mechanism/details: Considering the shortages and inaffordability of child care in DC, we determined that an effective method of reaching children of lower income families in Wards 7 and 8 is through unlicensed child care centers. These facilities provide affordable options for many low-income families, but without licensure, there is also an increased risk of lead exposure.

Our approach begins with an implementation phase to hire staff, build trust with the community, and meet with established advisory boards. During the summer, we plan to host events at local parks with the goals of building community involvement, promoting community access to health care services (especially among pregnant women and children), performing blood lead testing, and identifying and providing support to those who are interested in starting a licensed child care center. Interested parties who qualify will be admitted to our program, which would provide coverage for licensing fees, deleading services, new supplies, and training programs such as Second Step to implement ACEs early identification and prevention by child care staff. Parents whose children attend these child care centers will be provided with access to educational services for ACEs exposure (e.g., Second Step and Parenting Wisely) as well as easier access to services including home de-leading by "DC Healthy Homes" and pro bono law services by local student legal clinics. Additionally, children at these child care centers will be screened annually for lead.

Potential partners: Implementation of CATCH will depend greatly on stakeholder involvement. Key stakeholders include the child care centers and families that

Ward	# of Children Under 5*	% Population Under 5*	% Children Under 5 Living in Families Below Poverty Level**	% Births to Single Mothers ***	% Births to Teen Mothers ***	% Low Birth Weight Infants ***	% Births to Mothers who Did Not Receive Adequate Prenatal Care ***	% of Births to Mothers with Less than 12 Years of Formal Education ^	Infant Mortality Rate per 1,000 Live Births ^	% of Children in Families Receiving Aid Through TANF ^^	% Children in Families Receiving Aid Through SNAP (Food Stamps) ^^	% Children in Families Receiving Aid Through Medicaid/ SCHIP ^^^	# of Substan-tiated Cases of Abuse & Neglect ^^^^
	Population Characteristics												
1	3,480	4.6%	23.0%	57.2%	9.9%	7.5%	38.2%	29.6%	6.1	23.7%	38.5%	60.3%	147
2	2,021	2.5%	15.1%	29.5%	5.6%	8.5%	26.3%	12.6%	2.9	11.5%	18.3%	s	86
3	3,377	4.4%	2.4%	6.2%	0.7%	7.4%	13.7%	1.8%	5.1	0.3%	0.9%	5.1%	4
4	4,783	6.3%	10.2%	59.0%	9.7%	8.5%	40.2%	27.7%	10.2	20.8%	35.7%	64.8%	140
5	3,735	5.0%	23.3%	71.2%	16.4%	10.9%	43.4%	18.7%	6	39.9%	53.3%	59.2%	343
6	3,902	5.1%	17.5%	44.6%	8.0%	10.3%	29.3%	10.5%	8	26.4%	32.1%	64.5%	79
7	4,758	6.7%	44.1%	85.8%	18.6%	13.9%	50.8%	20.5%	17.2	57.4%	73.2%	68.5%	360
8	6,557	9.3%	58.7%	89.1%	19.9%	14.0%	50.7%	23.1%	17.7	64.5%	78.2%	62.5%	671
TOTAL	**32,613**	**5.4%**	**28.1%**	**61.0%**	**12.2%**	**10.4%**	**38.5%**	**19.9%**	**10.9**	**35.4%**	**46.9%**	**65.1%**	**2,004**
National Average	**20,860,344**	**6.9%**	**21.2%**	**41%**	**10%**	**8%**	**NA**	**22%**	**7**	**NA**	**NA**	**NA**	**NA**

Figure 6| Family Risk Indicators by Ward
SOURCE: Moodie, S., L. Rothenberg, and S. Daily. 2011. *District of Columbia early childhood risk and reach assessment.* Washington, DC: Child Trends and DC Office of the State Superintended of Education.
NOTES: * Data are from the 2010 Census. ** Data are from the 2005-2009 American Community Survey. *** Data are from 2008 Vital Statistics Data, DC Department of Health and NeighborhoodInfo DC at the Urban Institute. ^ Data are from the 2008 Department of Health. ^^ Data are from 2010 Income Maintenance Administration, DC Department of Human Services and NeighborhoodInfo DC at the Urban Institute. ^^^ Data are from the 2009 Income Maintenance Administration, DC Department of Human Services. ^^^^ Data are from DC Child and Family Services Agency for fiscal year 2009. 174 cases were missing the child's home Ward. s = Data suppressed for this indicator because it does not produce a reliable estimate. NA = Data not available.

the program will serve as well as the community at large. Additional stakeholders include the Department of Health and Human Services Office of Head Start, the DC Child and Family Services Agency, Children's National Medical Center, Unity Health Care, the DC Department of Energy and Environment, the DC Office of the State Superintendent of Education, the DC Department of Behavioral Health, and the Centers for Medicare and Medicaid Services.

Brief budget overview: The $2.5 million budget is sufficient to meet the needs of our proposal over the course of the 5 year grant period. Most of the budget will be designated toward staff salaries (72 percent), child care infrastructure investments (15 percent), and summer events (5 percent). The remainder will be used for office space, advertising, evaluation, and a discretionary fund. Long-term sustainable funding for the program will be achieved primarily through hosting an annual research symposium and gala from year three and onwards that will focus on engaging key stakeholders involved in mitigating childhood neurological risks as sponsors and patrons of CATCH.

Potential Barriers and Responses

The success of this intervention is greatly dependent on community approval. To ensure that the intervention is appropriate for the community of interest, we plan to initiate contact with existing community advisory boards. Subsequent steps will involve reaching out to trusted neighborhood entities, such as barber-

shops and beauty salons, to describe the program's mission and plans for the community. We plan to host several community events over the duration of the intervention; these events will not only bolster community involvement but also serve as a pressure-free environment for unlicensed child care providers—who may otherwise remain unknown—to self-identify and learn more about CATCH. To prevent child care providers from losing income while completing training and licensure certification, we plan to provide paid substitute child care providers. To avoid the possibility of lost wages for child care providers, the CATCH office space will accommodate displaced child care centers during the lead removal process. To ensure family involvement in home lead assessments, blood lead level screenings, and ACEs training, we plan to offer incentives such as monetary compensation and recognition at our major yearly events.

The George Washington University: The Building Relationships, Advocacy, and Intergenerational Network (BRAIN) Project

Team members: Amali Gunawardana, Lauren Hunter-Naples, Nehath Sheriff, Heather Walter, Gabriella Witte, Jordan Wolfe

Statement of Need

Exposure to ACEs and lead are rooted in structural inequities. Although lead screening is required by law in public schools, the most recent data show that only 34 percent of children in DC meet the mandated blood lead level screening requirement upon entering school [16]. Additionally, 37 percent of DC children aged birth to 17 reported experiencing one or two ACEs and 11 percent reported experiencing three or more [17].

Goal

The Building Relationships, Advocacy, and Intergenerational Network (BRAIN) Project is an initiative rooted in and driven by the community to address the glaring gaps in resource connectivity for Wards 7 and 8. Through community health workers—henceforth referred to as "community ambassadors"—we will identify children and families at risk for exposure to both ACEs and lead and connect them to local resources.

Intended Outcomes

The central focus of the BRAIN Project is community connectedness in Wards 7 and 8. We aim to link each community with existing local resources to create a stronger support system for these neighborhoods. It is fundamental to note that our intervention is informed by the concept of mutual regulation: children are healthier when their parents are healthy, and healthy adults are products of strong communities, which are distinguished by a rich network and support system. Research provides strong evidence that the effects of ACEs are often highly stressful, leaving victims disproportionately susceptible to states of crises [18]. Evidence also suggests that early exposure to toxic environments poses significant risks to physical and neurological health and development in both children and adults [19]. Our multi-pronged approach works to address these health challenges.

Intervention

Community ambassadors: The BRAIN Project aims to interrupt the insidious cycle of systemic inequity by empowering communities, increasing self-efficacy through expanded access to resources, and improving the overall health and wellbeing of children and families. By tapping into local community organizations such as churches, libraries, and community centers, the program strives to identify, recruit, and hire committed parents and key community stakeholders to serve as community ambassadors. We will begin by recruiting one ambassador from each of the seven neighborhoods that comprise Wards 7 and 8. The driving force behind the BRAIN Project is the development of a multifaceted intervention that is specifically tailored to meet the unique needs of the community (see *Figure 7*). The community ambassadors will help to implement primary and secondary tiers of prevention. Primary prevention will focus on building community capacity to leverage existing public health policies while simultaneously advocating for new and improved policies. Secondary prevention practices will include development and implementation of enhanced ACEs screening for women and children in the community, connective societal services, and intensive in-home coaching.

Primary prevention and policy advocacy: The BRAIN Project's primary prevention strategy is a two-pronged approach to connect community members with existing policy and programs as well as to advocate for new legislation to address the gaps in existing legislation (see *Table 1*). The program will partner with WE ACT, a national advocacy organization with offices in DC, to provide advocacy training to the program's

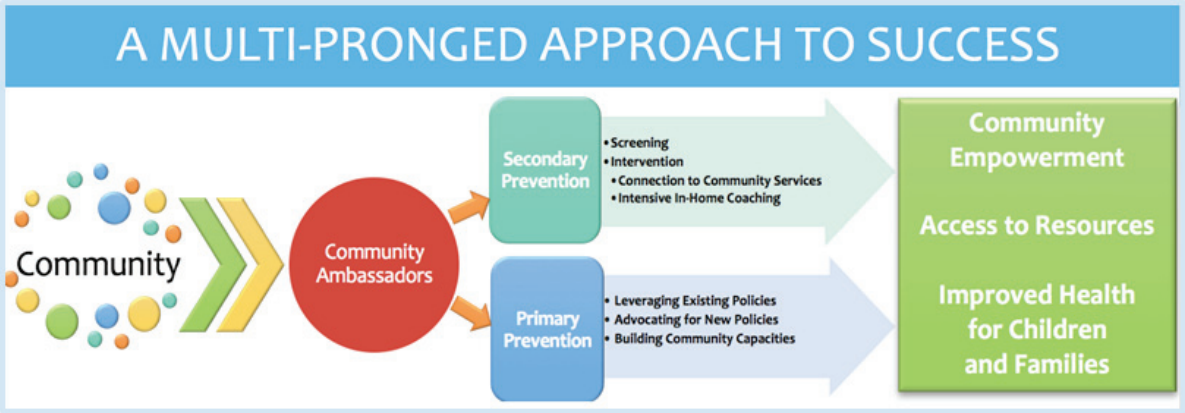

Figure 7 | The BRAIN Project's Conceptual Framework
SOURCE: Developed by authors

Legislation in DC	Gaps in Policy
DC Lead-Hazard Prevention and Elimination Act	More explicit protections for public housing residents
Lead Safe Washington	Shift from lead abatement to lead encapsulation
Lead Pipe Replacement and Disclosure Amendment Act of 2017 (proposed)	Increase subsidy amount for pipe replacement and encapsulation
NEAR Act (unfunded)	Fund community-led violence prevention efforts

Table 1 | Primary Prevention Strategies of the BRAIN Project
SOURCE: Developed by authors

community ambassadors.

Secondary prevention: The BRAIN Project's secondary prevention strategy consists in part of a blood lead level (BLL) screening program for children and expecting mothers. In addition to the high proportion of DC children who do not receive mandated screenings, the primary source of lead exposure in newborn children is maternal-fetal transmission. Notably, 1 percent of U.S. women of childbearing age have BLLs ≥ 5 micrograms/dL [20]. A health professions student volunteer will act as the screener, and screenings will take place at pediatric and obstetric-gynecologic clinics. The primary tools used will be the Accountable Health Communities screening tool, which assesses whether families have lead in their homes through questions on core health-related social needs [21]. An ACEs questionnaire will also be used, and demographic information will be collected [22]. After signing a HIPAA form, patients' most recent BLLs will be obtained from their chart.

In later years, the project will be scaled up to a mobile model. The BRAIN Project hopes to partner with Children's National Medical Center, which currently uses a mobile unit to provide lead screenings. After screening, all families will receive lead-related education and advocacy information. Screening results will also be used to stratify risk. Positive BLLs or one ACE will be considered low risk. Positive BLLs or greater than one ACE will be considered high risk.

In addition to the screening program, the BRAIN Project's secondary prevention measures will include the Participatory Family Capacity Building Intervention, which provides individual and group support to families in areas such as responsive parenting, health, and wellness as they relate to lead and ACEs. Building off Economic Mobility Pathways' (EMPath's) Intergenerational Mobility Project [23], developed in partnership with the Center on the Developing Child at

Harvard University, the Participatory Family Capacity Building Intervention will support families in mitigating the stressors that inhibit healthy neurological development and attachment. The intervention will also allow community ambassadors to build trust with families by providing wraparound services, conducting home visits, and monitoring individual and family goals. This strategy will address gaps in early intervention, in which prevention and intervention strategies are often directed solely at the child, and typically do not include a focus on the parental contributions that are necessary for family development.

Evaluation: Monitoring and evaluation will draw from two sources of data. Firstly, community members linked with services will be contacted for follow-up interviews to provide feedback on utilization and effectiveness of services. Secondly, community ambassadors will provide annual feedback on training and partnership usefulness. Data from these sources will be used to reassess trainings, partners, and services.

Potential Barriers and Responses

Several potential limitations will need to be addressed. This intervention is grounded in the participation of the community and buy-in of partner organizations. Without their support, the BRAIN Project cannot be successful. We also acknowledge the potential for challenges with community ambassador attrition and plan to proactively address this issue through employment, salary, and incentive packages.

Uniformed Services University: Lead Education Awareness Prevention (LEAP)

Team members: Guzal Khayrullina, Carissa J. Pekny, Michael Shaughness, Patricia A. Vu, Alexandra K. Yaszemski

Background and Statement of Need

The age of the housing stock in DC places many children at high risk for adverse health conditions caused by environmental hazards in the home. Almost 90 percent of homes in the District were built before the use of lead-based paint was restricted in 1978 [24]. Federal law mandates that children should be screened for lead twice before the age of 2 and requires documentation of screening completion prior to school matriculation [25]. However, of the 16,000 children under the age of 5 in DC, only 30 percent have completed the required screening at the mandated time points [24].

The DC Department of Energy and Environment (DOEE) attributes low screening rates to lack of access for blood draws and difficulty with patient follow-up. To address these challenges, we determined that a mobile intervention was most feasible and focused our efforts on an established mobile clinic organized by MedStar Georgetown University Hospital (MedStar Georgetown) and the Ronald McDonald House Charities, who have provided care to underserved communities in DC for more than 25 years [26]. Recently, the mobile clinic's primary care focus has expanded to include preventive measures such as improving fitness and nutrition.

Goal and Intended Outcomes

As the mobile clinic does not currently offer lead screening, we propose a pilot program to extend its reach and provide an environmental tier to the mobile fleet to focus on overall community health and wellbeing and to meet the DOEE's goal of reaching a screening rate of 100 percent.

The DOEE considers an elevated blood lead level (BLL) to be ≥10 micrograms per deciliter of blood [24]. Unfortunately, people with lower blood lead level values may still be susceptible to lead toxicity. The risks associated with lead poisoning that are also symptoms of ACEs include attention deficit disorder, aggressive behavior, and episodes of outburst. These behaviors are often misdiagnosed. Federal law as well as the Code of the District of Columbia require children to be tested twice by the age of 2, with the first test occurring between 6 and 14 months and the second between 22 and 26 months [27]. Even if one or both of these screenings are missed, the law still requires that children be tested twice before 6 years of age, a critical period when lead is most efficiently absorbed by the body [26]. The highest percentage of screened children less than 6 years of age with elevated BLL are observed in Wards 1, 4, and 5 in DC [24].

Combined, these wards account for 65 percent of children under 6 years of age in DC with an elevated BLL result in 2010 [24]. Furthermore, populations residing in Wards 5, 7, and 8 earn the lowest household incomes [4]. These data suggest Ward 5 to be the most vulnerable. Ward 5 is also known to be the most diverse in ethnicity, language, and religion, as well as having the greatest disparity in income. Currently, MedStar Georgetown provides pediatric care at their mobile clinic to 900 of the 38,000 children in Wards 5 through 8; of these 38,000 children, 8,000 are residents of Ward

5 and 1,800 are under the age of 6 [28]. Unfortunately, only 26 percent of this critical age group has been tested for lead [26]. Through partnership with the KIDS Mobile Medical Clinic/Ronald McDonald Care Mobile and additional partnerships detailed below, this small percentage of treated children will increase.

Intervention

The goal of our intervention, Lead Education Awareness Prevention (LEAP), is to provide a one-stop shop for our participants through partnerships with established and trusted local organizations. Services provided will include lead screening and education, legal education regarding household lead exposure and tenant rights, and food services. We will connect with staff at the Ronald McDonald Care Mobile and Mary's Center to provide lead screening services and preventive education. Partnering with Martha's Table and So Others Might Eat will allow us to provide healthy food that participants in the program can take home with them. Legal education will be provided through partnerships with pro-bono lawyers. Additionally, we will recruit community leaders from religious organizations and housing assistance programs (such as New Endeavors by Women) to help educate families on sources and consequences of lead exposure as well as spread the word about LEAP's services. We will perform lead testing for children and expecting mothers as well as hand out long-lasting Brita pitchers and filters that remove lead from water. While patients wait to be screened at the mobile clinic, they will have access to lead education services as well as services provided by the Mobile FITNESS Program for children, which was recently launched by Medstar Georgetown and the Ronald McDonald House Charities.

Through 25 years of service, the KIDS Mobile Medical Clinic/Ronald McDonald Care Mobile has established trust with underserved communities in Wards 5 through 8. By adding a third mobile clinic to their existing fleet, LEAP aims to overcome barriers to entry in engaging underserved populations in Ward 5. Furthermore, a third mobile clinic focusing on environmental health hazards will extend the reach of MedStar Georgetown by increasing the variety of available services. To assess the effectiveness of the LEAP pilot program, we will strictly focus on Ward 5. Similar to the operation of the Ronald McDonald Care Mobile, LEAP will operate five days a week at the locations listed in *Table 2*, which enables LEAP to partner with existing medical services and food distribution centers to provide our services.

We plan to launch an aggressive advertising plan to spread awareness of the LEAP pilot program. To reach the intervention's target population of Ward 5 communities, we will use wraparound bus ads, which are three times more effective than other advertising modalities in urban settings [29]. Evaluation metrics will be drawn from data collected on services used. Working with the DC Department of Housing, we will record the number of lead paint test kits used as well as test results and create a database of locations with high risk of lead exposure. Working with DC Water, we will track the number of free water lead test kits requested, anticipating an increase post-implementation of the intervention's educational and empowerment outreach sessions. Working directly with lawyers and primary care providers, we will monitor how many individuals take advantage of the mobile clinic's services. We will also administer paper and electronic surveys to evaluate the efficacy of the intervention's initial efforts and to identify areas for improvement. Lastly, we will monitor website traffic to gauge the spread of LEAP's educational and awareness messages. *Table 3* shows the distribution of the 5 year, $2.5 million budget.

Day of Week	Mobile Clinic Location
Monday	Capital Area Food Bank at North Michigan Park Recreation Center
Tuesday	Children's Hospital - GPAC (WIC clinic location)
Wednesday	Mary's Center
Thursday	Ronald McDonald Care Mobile at DC General Family Shelter
Friday	Family Health and Birth Center, a branch of Community of Hope

Table 2 | Weekday Locations of LEAP Mobile Clinic
SOURCE: Developed by authors

Budget Item	Cost
Mobile clinic assembly and maintenance	$650,000
Staff salaries for a project manager, coordinator, phlebotomist, and support staff	$695,000
Clean drinking water intervention	$450,000
Lead test kits	$320,000
Advertising	$375,000
Overhead	$10,000

Table 3 | Budget Distribution
SOURCE: Developed by authors

In conclusion, LEAP is a multifaceted project of community outreach events, clean water intervention, home lead detection kits, and educational programs that will increase knowledge and awareness about the sources and dangers of lead. Our services will empower citizens to take action to reduce the prevalence of lead in the community, improve access to health and legal resources and services, and create a community safe from lead for future generations.

Conclusion

Reflections

Solutions developed by the competing teams were innovative and generally included cross-sector partnerships and community participation. Most proposed strategies paired evidence-based interventions with promising new approaches. However, the judges' questions and comments underscored that not all teams were clear or realistic in their proposals about the staff and time needed to implement certain aspects of their interventions. In addition, the judges noted that referral to a health care provider is not an intervention and that more attention should be focused on closing the loop on referrals. Finally, the judges emphasized that proposed interventions should have an underlying framework to guide the intervention and be grounded in a strong evidence base. The teams' presentations and judges' questions underscore the complex relationship between lead exposure and ACEs in DC and the need for innovative solutions, such as those developed by the competing teams.

Stakeholder Event

To continue engagement of the student participants in the Case Challenge subject matter and in its practical application in the local community, in February 2018, the National Academies convened a stakeholder event to follow up on some of the themes that emerged from the Case Challenge competition. The purpose of the event was to engage relevant public and private sector leaders in a dialogue around ACEs and lead contamination in DC by soliciting feedback to two of the top solutions and proposals crafted by student teams that competed in the 2017 Case Challenge, and to explore possibilities for making progress on the topic of focus. The event was also an opportunity for the university students who competed to hear more about the realities of implementing programs to address threats to children's health and development and to get more exposure to real-world local work. The event also provided the opportunity to build connections among the National Academies, the local DC community, and up-and-coming public health and social services sector professionals from undergraduate and graduate programs at DC-area universities.

The event highlighted the work of government agencies and nonprofit organizations working to improve outcomes for DC residents. The event focused on two themes that emerged from the student solutions to the Case Challenge: (1) early child care and education as a site for intervention and (2) informing policy to prevent and mitigate the harm of lead exposure and ACEs. The event brought together two panels (one focused on each theme) of representatives from DC-based nonprofit organizations that work on related issues and those with relevant roles to improve the health of youth.

The keynote address was provided by Debbie Chang, senior vice president of policy and prevention and corporate officer at Nemours Children's Health System. Dr.

Chang emphasized the importance of interdisciplinary, multisector work; the intersection of place and health; and moving from the individual to the population level when designing interventions. Dr. Chang spoke about creating "360 degrees" of child health promotion by breaking down silos and addressing the needs of children in the places where they live, learn, and play (i.e., at home with their families, at child care, in their communities) in addition to clinical settings, such as hospitals, where children receive primary care. She also noted that policy changes can bring the demand for change on the ground; that multisectoral partnerships need to be selectively developed, with consideration of how systems relate and integrate; that technology can serve as an accelerator of these partnerships; and that developing community partnerships takes time and dedicated resources, not just volunteers, to be sustainable.

Two teams from the competition presented to the panels their solutions in the two focus areas. The presentations and resulting dialogue served as an opportunity for experts on these topics to engage with the students in a rich discussion on how to improve their proposed solutions and inform action to address the neurological and behavioral consequences of lead and ACEs on youth in Washington, DC.

The Howard University team presented its solution, focused on lead abatement in unlicensed child care centers, as a kick-off to the panel on early child care and education as a site for intervention. Panel members and other participants noted that the intervention directly addressed the significant lack of available child care centers, taking into consideration the importance of supply and demand for child care along with health. Another noted that a strength of the intervention was that the identification of hazardous child care centers also provided a means to identify families whose homes potentially also contain hazards. In discussing the implementation of specific programs and policies that focus on issues of most concern to families within a community, it was noted that programs need to be able to change and grow based on what concerns are voiced by the community. Finally, it was noted that working with children and families experiencing ACEs may be personally triggering for those directly affected and that responsiveness and sensitivity to trauma and trauma history are critical.

The American University team presented its solution, focused on a mobile trailer conducting blood lead level testing, which served to launch the panel on informing policy to prevent and mitigate the harm of lead exposure and ACEs. An important discussion point that emerged was that at times, a community most in need may be a community where programs and other efforts may already be underway, so disruption may be necessary to identify the true concerns of and hardships faced by residents, as well as the resources most needed by the community. Other points emphasized that social media strategies may help reach individuals and families difficult to reach through conventional means and that a single intervention may be designed and/or implemented in a way that could solve multiple problems or reach more than one population. Participants also noted the importance of explicitly naming structural racism, practicing cultural humility, and acknowledging the lived experiences of individuals and families. It was noted that indigenous organizations and individuals from the community could be involved in organizational leadership and/or included as partners in programs. Finally, the notion of "leading from where you are" was raised, emphasizing that residents of the nation's capital can have an impact on the federal government and be advocates for broader change.

Future Plans

The Case Challenge has brought the work of the Health and Medicine Division (HMD) to both university students and the DC community. The NAM and the HMD are therefore committed to continuing this activity with the 2018 DC Public Health Case Challenge, on the topic of "Cancer in DC: Eliminating Disparities." It will be sponsored and implemented by the HMD Roundtable on Population Health Improvement, with the support of the NAM's Kellogg Health of the Public Fund and the engagement of related activities of the National Academies, including the Global Forum on Innovation in Health Professional Education, the National Cancer Policy Forum, and the Roundtable on the Promotion of Health Equity. HMD and NAM staff continue to look for new ways to further involve and create partnerships with the next generation of leaders in health care and public health, and the local DC community through the Case Challenge.

In past years, the solutions brought forward in the Case Challenge have not always considered the complex, but critically important, upstream and multilevel factors that affect health. To address this, the Case Challenge organizers planned two approaches for the 2017 event that will be used again for future events.

First, they will ensure the ecological model [30] and upstream factors are represented in the case document sent to the competing teams in advance of the event. Second, a webinar will again be held before the case is released to the competing teams, to provide the teams with a primer on evidence-based policy solutions for public health issues and to provide an overview of the Case Challenge, best practices, and a question-and-answer period (questions may be asked during the webinar and submitted ahead of time). The webinar will be recorded so that students have future access to it.

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- Joshua M. Sharfstein, MD, associate dean, public health practice and training, Johns Hopkins Bloomberg School of Public Health
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The following served as judges at the 2017 event:

- Al McGartland, PhD, director, National Center for Environmental Economics; chief economist, US Environmental Protection Agency; member of the National Academies' Roundtable on Environmental Health Sciences, Research, and Medicine
- Torey Mack, MD, chief, Family Health Bureau, Community Health Administration, DC Department of Health
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Disclaimer

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