Child Lead Poisoning Elimination Board

A Roadmap to Eliminating Child Lead Exposure

November 2016

November 4, 2016

Governor Snyder,

On May 20, 2016, you created the Child Lead Poisoning Elimination Board through Executive Order No. 2016 – 9 because "…there exists a need in state government for a coordinated effort to design a long term strategy for eliminating child lead poisoning in the state of Michigan…."

The 12-member board, which includes medical, environmental, and child education experts, academics, civic leaders, and state department representatives, was created to develop a roadmap for eliminating child lead poisoning in the state and was charged with making policy recommendations to you by November 4, 2016, concerning the following five key areas:

1. Testing of children for elevated blood lead
2. Follow-up monitoring and services, including case management
3. Environmental lead investigations
4. Remediation and abatement
5. Dashboards and reporting

The full board met 12 times from June through October, with five workgroups holding discussions in between full board meetings. As more fully detailed in the report, the board focused its recommendations on primary prevention—the identification and elimination of lead hazards before they impact a child. To that end, the board supplemented the EO's charge in 2 significant ways: first, by expanding the scope of the key areas, where necessary, to accommodate a primary-prevention focus, and second, by expanding the scope of the roadmap from one focused on eliminating child lead *poisoning* to one focused on eliminating child lead *exposure*.

The accompanying report includes recommendations in response to your charge to the board and additional recommendations flowing from the expansion in scope mentioned above. One specific item that we would like to highlight is the board's support of the Flint Water Advisory Task Force's recommendation to create a permanent commission to coordinate efforts in this area.

Child lead exposure is a national problem and we anticipate that additional recommendations will be released in the next few months that Michigan may wish to consider implementing. Should additional recommendations be released that strengthen the policy recommendations contained in this report, we will issue a supplement to this report early next year.

Thank you for your leadership in creating this board. The report presented to you today is the first step down the road to eliminating child lead exposure. The board looks forward to its continued work on this important issue.

Brian Calley

Brian Calley
Lt. Governor
Chair, Child Lead Poisoning Elimination Board

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≥5 µg/dL – Current CDC reference level for elevated blood lead.

CDC – Centers for Disease Control and Prevention

CLPPP – Childhood Lead Poisoning Prevention Program

EBL – Elevated Blood Lead or Elevated Blood Lead Level, depending on the context.

EO - Executive Order

EPA – U.S. Environmental Protection Agency

FWICC – Flint Water Interagency Coordinating Committee **–** created by Executive Order 2016-1 to bring together a wide range of experts to work on long-term solutions to the Flint water situation and ongoing public health concerns affecting residents.

GIS – Geographic information system

HEDIS – Healthcare Effectiveness Data and Information Set

HHLPSS – Healthy Homes and Lead Poisoning Surveillance System

HiAP – Health in All Policies

HUD – U.S. Department of Housing and Urban Development

IEUBK - Integrated Exposure Uptake Biokinetic Model

IT – Information technology

LBP – Lead-based paint

Lead Safe Housing Registry – Public-facing database that includes properties built prior to 1978 that are offered for rent or lease, as well as child-occupied facilities, where lead inspection or abatement activities have taken place. Registry is not currently maintained.

LCR - Lead and Copper Rule (through U.S. EPA)

LIRA – Lead inspection risk assessment

MDEQ – Michigan Department of Environmental Quality

MDHHS – Michigan Department of Health and Human Services

MIOSHA – Michigan Occupational Safety and Health Administration

MQIC – Michigan Quality Improvement Consortium

MSHDA – Michigan State Housing Development Authority

ppb – Parts per billion

ppm – Parts per million

RRP – Renovation, Repair and Painting Rule (through the U.S. EPA)

WIC – Woman, Infants, and Children (food and nutrition service)

Introduction

The recent events in Flint, Michigan have highlighted the problem of child lead exposure and child lead poisoning both throughout the state of Michigan and across the nation. Over the past 17 years, there has been a dramatic reduction in the number of Michigan children with elevated blood lead levels (EBLs); however, in that same time period, science has taught us that there is no safe level of lead in a child. Michigan children continue to be unnecessarily exposed to lead, and this exposure disproportionately impacts low-income areas and minority children.

By far the most common identified form of lead exposure for children is through lead paint and lead dust in older homes—young children, with their propensity for hand-to-mouth activity and exploration, ingest lead that is found on window sills, floors, and soil; however, Flint has served as painful proof that exposure to lead in water can also be a serious threat to children, impacting a younger and more developmentally vulnerable age group in a vehicle made for ingestion. And residual lead in the environment from years of leaded gas use and industrial emissions also poses a risk.

Lead is a neurotoxin, and its effects on a child's brain are irreversible. While early intervention, case management, and access to supplemental educational and nutritional services can mitigate the impact of exposure on a child's development, lead exposure detrimentally impacts a child's cognition and behavior, affecting the child's entire life trajectory. According to a recent report, two-year-olds with EBL in 2014 were expected to experience a loss in lifetime earnings totaling $171 million. [i]

Child lead exposure is also costly for the state. That same report estimates the total 2014 cost of lead exposure in Michigan to total approximately $270 million, with $112 million of that amount estimated to be passed along to the taxpayer.[ii] Those figures include the decline in lifetime earnings mentioned above, along with the cost of increased healthcare and special education services, and increased crime.[iii] Regarding the latter, 10% of juvenile crimes in Michigan are associated with lead exposure – costing an estimated $13.4 million in incarceration annually – and adult crimes linked to lead exposure cost an estimated $64 million annually (cost to victims, legal proceedings, incarceration, and loss of earnings for victim and offender).[iv]

To do a proper cost/benefit analysis of any policy to eliminate child lead exposure, it is essential to consider the totality of the costs associated with exposure, from a societal perspective (increased crime), from a tax perspective (increased need for educational, medical, and support services and corrections/law enforcement funding), and most importantly, from the perspective of the children exposed.

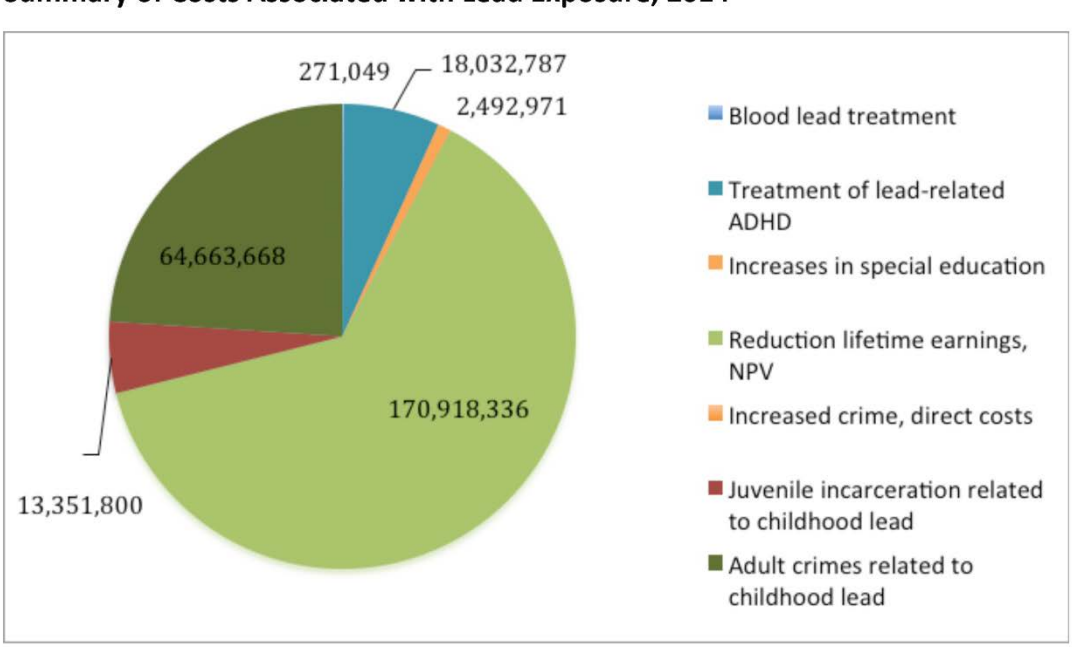

Figure 1: Summary of costs associated with lead exposure in 2014. Source: Costs of Lead Exposure and Remediation in Michigan: Update, Ecology Center and the Michigan Network for Children's Environmental Health (2016).

Historic approach to combating lead exposure and the new paradigm

The state has made a number of concerted efforts to attack the problem of child lead exposure over the years. Most recently, the Michigan Childhood Lead Poisoning Prevention and Control Commission[v] (2005-2010) dove deeply into the issue. It produced 3 reports from 2006-2007 and a 2009 letter that together include numerous thoughtful proposals to address the problem, many of which were subsequently implemented. But while that body stressed the importance of primary prevention, we still largely operate in a secondary prevention world. Much of what the state and other governmental entities do to address the problem of exposure—blood lead testing and monitoring, environmental investigations, case management, and remediation and abatement—occurs once a child has been exposed.

Primary prevention prevents exposure. **Secondary prevention** is a response to lead exposure.

While appropriately testing and providing needed services to children with EBLs should remain a high priority for the state, the state, along with every individual and entity that possesses the ability to combat exposure, must take a much more proactive approach to preventing exposure from occurring in the first place. This will require additional resources, changes in policy, and the committed efforts of all units of government, the medical profession, property owners, business interests, advocacy groups, and every resident of this state.

A greater focus on primary prevention will also require the recognition and coordinated targeting of all lead dangers. For example, historically, federal, state, and local health departments have not considered water to be a significant source of lead exposure. As a consequence, funding to address

water exposure and coordination among the governmental agencies charged with lead exposure prevention and water quality (Centers for Disease Control and Prevention [CDC]/ U.S. Environmental Protection Agency [EPA] at the federal level, Michigan Department of Health and Human Services [MDHHS]/ Michigan Department of Environmental Quality [MDEQ] at the state level, and local departments of public health and environment) has been limited. In order to eliminate child lead exposure, funding and coordination must be increased so that all exposure risks are identified and eliminated.

Primary Prevention vs. Secondary Prevention

Primary Prevention	Secondary Prevention
Proactive	Reactive
Focuses on exposure	Focuses on poisoning
All children	At-risk children only (typically those poisoned)
Emphasizes testing environments for hazards (testing houses)	Emphasizes testing children's blood
Stops the problem	Chases the problem

In addition, our ability to effectively collect, share, and utilize data must become much greater. It is the stark reality of our current system that there are houses and apartments in our cities and towns that have poisoned generations of kids. We walk by them every day, but because of our current response protocol and the way we collect, maintain, share, and analyze data, from an individual risk perspective we don't see them. We can and must address this situation now by connecting dots that exist in various data silos throughout the state. Until we have a system in place that allows us to clearly see these ongoing exposure situations using an integrated network of currently available data, more ambitious efforts at primary prevention will face significant challenges.

While developing such a comprehensive, coordinated, and primary prevention-friendly data system will not be cheap, the cost is essentially an investment in critical state infrastructure. Just as good roads and access to sufficient power make a state more productive, so too does efficient access to high-quality, comprehensive data. In the new paradigm, a single, unified data system housing comprehensive real-time data that is capable of being dissected and shared among experts and the public will be central to eliminating child lead exposure.

Flint Water Advisory Task Force and permanent commission

In its March 2016 report, the Flint Water Advisory Task Force recommended that the Michigan Childhood Lead Poisoning Prevention and Control Commission be reestablished.[vi] We agree that a permanent commission should be formed to coordinate efforts to eliminate child lead exposure into the future. Eliminating exposure risk throughout the state requires the coordination of all levels of government, and collaboration with the medical community, property owners and contractors, businesses, civic organizations, families, and others. The permanent commission that we envision should be vested with the power to achieve such coordination.

It is this board's purpose to develop an initial roadmap that may be used by policymakers, including the permanent commission, to eliminate child lead exposure throughout the state. The permanent commission should work collaboratively with all stakeholders to implement and monitor the

progress of the recommendations contained in this report and other initiatives that will further the ultimate goal of eliminating child lead exposure.

Executive Order

Through Executive Order (EO) No. 2016 - 9[vii], the governor created the Child Lead Poisoning Elimination Board on May 20, 2016, to address the need for "…a coordinated effort to design a long term strategy for eliminating child lead poisoning in the state of Michigan…." The board is a temporary commission and is set to dissolve in June of 2018.

Board creation and charge

The board was created to develop a roadmap for eliminating child lead poisoning that could be used by policymakers, including a future permanent commission. The board's main charge is to make policy recommendations to the governor by November 4, 2016, concerning the following five key areas:

1. Testing of children for elevated blood lead
2. Follow-up monitoring and services, including case management
3. Environmental lead investigations
4. Remediation and abatement
5. Dashboards and reporting

According to the EO, such recommendations shall include, but not be limited to, the following:

1. Changes to improve the blood lead testing rate of children in Michigan, especially in high-risk areas and for children under the age of six (6) years old
2. Changes to improve the percentage of families utilizing follow-up services when a child tests positive for elevated blood lead and ensure the adequacy of those services
3. Changes to improve the availability of environmental lead investigations to families when a child tests positive for elevated blood lead, particularly with respect to children under the age of six (6) years old, and ensure the adequacy of such investigations
4. Achievable improvements to current remediation and abatement efforts aimed at reducing child lead poisoning dangers throughout Michigan and in particular hotspots, including individual homes
5. Improvements to existing collection, maintenance, sharing, and reporting efforts regarding child lead poisoning data, including recommendations for the implementation of dashboards, websites, apps, and other means of conveying information

The board is also charged with creating a master inventory of existing resources and programs that touch the above areas and making recommendations regarding coordination and supplementation of those resources and programs where appropriate. That inventory is to include at least the following:

- Local, state, and federal lead laws, regulations, and policies
- Local, state, and federal programs, resources, and funding sources related to child lead exposure and poisoning prevention
- Data on concentrations of old housing stock with lead hazards and areas with a high incidence of child lead exposure and poisoning

Board activity

The board convened its first meeting on June 20, 2016, and met 12 times between June and October. Workgroups tasked with developing recommendations covering the 5 key areas met or held teleconferences frequently between meetings of the full board. Along with developing recommendations, the board has been actively engaged in creating the master inventory of resources described in the EO.

Supplementation of EO charge

The board supplemented the EO's charge in 2 significant ways: first, by expanding the scope of the key areas, where necessary, to accommodate a primary-prevention focus, and second, by expanding the scope of the roadmap from one focused on eliminating child lead *poisoning* to one focused on eliminating child lead *exposure*.

Regarding the former change, the board recognized early in its discussions that the EO's key areas were based on the structure and chronology of the current system, with most of the described activities taking place after an exposure. For example, under the current system, an exposed child would receive a blood test, along with follow-up monitoring and services; the exposed child's home would receive an environmental investigation; and if hazards were found, those hazards would be remediated or abated. As expanded by the board, the key areas have both a pre- and a post-exposure component. "Testing" includes universal testing of children to prevent exposure, "monitoring" includes monitoring of the environment for hazards, and investigations and abatement flow from this proactive monitoring activity, not just from the identification of an exposed child.

Regarding the latter change, the board simply does not believe that eliminating child lead poisoning is sufficient. Because there is no safe level of lead in a child, the threat of exposure itself must be eliminated. Furthermore, ending child lead poisoning is impossible to achieve without eliminating exposures before the child is poisoned. Responding to poisonings alone will not solve the problem.

Themes and guiding principles

In the course of its discussions, the board identified a number of themes and guiding principles that shaped its vision for a new approach to child lead exposure prevention. The most dominant theme was an emphasis on primary prevention and protecting children from initial exposure, but a number of significant subthemes were also identified, including the following:

- Eliminating all lead exposure is the goal.
- Health equity must be the foundation of all policy and funding recommendations, with areas of disparate lead exposure given higher priority.
- The state's approach to eliminating child lead exposure must be coordinated and consistent throughout the state via the implementation of a permanent child lead exposure elimination commission.
- Funding and capacity must be increased. The cost of elimination must be weighed against the total/life course human, societal, and budgetary costs of exposure.
- Universal access to environmental investigations, blood lead testing, and mitigation and remediation services and resources is essential.
- Lead monitoring standards and regulations/policies must be comprehensive, implemented consistently, and enforced with consequences.

- A comprehensive, integrated, and transparent data system with an emphasis on data sharing is essential to primary prevention. Data from secondary prevention efforts such as post-exposure testing, investigations, and abatement must feed back into the primary prevention system. Data systems must facilitate problem solving, regardless of agency or political boundaries.
- Family engagement and trust building are critical to success.
- Everyone must be empowered by having access to information and education on how to prevent exposure.
- Eliminating exposure requires the committed efforts of all units of government, the medical profession, property owners, business interests, advocacy groups, and every resident of this state.

Vision statement

The board incorporated its core guiding principles into the following vision statement in order to guide its discussions and provide consistency across its recommendations:

The board believes that government and its citizens must strive for the complete elimination of child lead exposure in Michigan and that achieving elimination requires the implementation of a proactive, comprehensive, and systematic approach that focuses on primary prevention. All available resources must be inventoried and coordinated to ensure earlier intervention and universal access to information and services across the state, and families must be empowered to utilize such resources.

The board also believes that timely identification of child lead exposure, parental engagement, and access to comprehensive post-exposure services must be the norm for all children across the state.

The board understands that certain challenges (financial, legal, institutional, cultural, behavioral, environmental, and technological, to name a few) currently exist that must be addressed in order to achieve complete elimination. As such, the board believes that its recommendations should include a mix of both the immediately achievable and the aspirational, in order to ensure steady and significant progress towards the ultimate goal of complete elimination of child lead exposure.

Structure of the report and board process

Consistent with the EO, this report is organized by key area. Individual workgroups were tasked with developing recommendations for specific key areas, and their final recommendations were voted on and approved by the full board.

To guarantee consistency across the recommendations, the board began its process by developing guiding principles, which were incorporated into a vision statement. That vision statement was then used by each workgroup to develop the concept of an ideal state for its key area. Each workgroup also developed its own guiding principles and vision statement for its particular key area, consistent with the board's overall vision, to guide its recommendations.

This report is structured to parallel the board's process for developing its recommendations. Each key area begins with a discussion of why that area is relevant to the state's goal of eliminating child lead exposure. The ideal state is defined and contrasted with the current state, and obstacles to achieving the former are identified. Themes and guiding principles specific to that key area are identified and incorporated into a vision statement. Finally, the board's recommendations are listed, beginning with any recommendations specifically required by the EO.

It should be noted that the discussions related to the EBL testing and follow-up monitoring key areas have been combined due to the significant overlap of issues affecting those areas.

Prioritization

The board proposes that its recommendations be prioritized so that *known sources of ongoing exposure* (those houses, apartments, and other structures and areas where child lead exposure has been identified and where families continue to live or visit) are addressed first.

The board further proposes that prioritization of its recommendations to eliminate *exposure risk* be based on the likelihood that a particular type and level of exposure will result in child EBLs.

Key areas

Testing of children for elevated blood lead/Follow-up monitoring and services, including case management

Importance of key area to eliminating child lead exposure

The only way to truly eliminate child lead exposure is to test every child in Michigan and then target well-defined, high-risk areas to provide a comprehensive, targeted remediation approach.

Identified child lead poisoning has decreased significantly in Michigan in the last 17 years. In 1998, 44% of children under 6 years of age had an EBL of ≥ 5 µg/dL. In 2015, that number was 3.4%.[viii] However, the only way to truly eliminate child lead exposure is to better understand the actual prevalence and incidence of lead exposure, which can only be accomplished through universal screening and 100% reporting of lead test results to a surveillance system for data analysis.

Under the **Michigan Constitution**, the state has an obligation to provide for the public health and general welfare of its people.

STATE CONSTITUTION (EXCERPT)
CONSTITUTION OF MICHIGAN OF 1963

Art. IV, § 51 Public health and general welfare.

Sec. 51.

The public health and general welfare of the people of the state are hereby declared to be matters of primary public concern. The legislature shall pass suitable laws for the protection and promotion of the public health.
History: Const. 1963, Art. IV, § 51, Eff. Jan. 1, 1964

Current targeted blood screening recommendations create gaps in prevention and treatment and miss the identification of exposed children. Compounding these gaps is that blood screening, by nature of the short half-life of lead (28 days), underestimates lead exposure and only detects recent and/or ongoing exposures.

We recommend universal blood lead testing at the ages of 9-12 months and again at 24-36 months. Universal testing can be implemented for a period of years and can then be transitioned to identified high-risk areas.

The universal testing of children will ensure that every child with an EBL receives treatment, case management, follow-up monitoring, and ongoing monitoring when necessary. This process will also ensure that family members are tested as indicated and that children are not exposed again. Case management and follow-up monitoring flow from the testing process and, if comprehensive, start the process of mitigating

the detrimental effects of exposure. Further, a critical outcome of testing is the initiation of remediation or abatement of lead exposure risks.

The collection of critical public health surveillance data from universal lead screening tests is essential for designing and carrying out effective primary prevention activities.

Current state

MDHHS blood lead screening rates are very low. The department is responsible for overseeing both the testing of children for lead poisoning and the provision of case management and follow-up services; however, MDHHS lacks infrastructure capacity and adequate funding to implement current law and program requirements. Funding at the federal and state levels has not kept pace with current Michigan requirements for EBL testing of all children in the Michigan Medicaid and Woman, Infants, and Children (WIC) programs. With inadequate funding, local public health infrastructure has also been depleted, leading to the inability to fully implement the current laws and regulations. This has resulted in county-level variability across the state in testing rates and/or follow-up.

Significant socioeconomic obstacles impede outreach, testing, family education, engagement, and case management. With the risk of lead exposure higher for children in areas of poverty, families experience challenges with healthcare access and testing. The mobility of families in poorer areas often leads to difficulty tracking children with confirmed elevated blood exposures and may add to the risk of child lead poisoning, as families migrate from house to house with lead hazards. Primary care physicians and their staff may not recognize the importance of testing for lead, and that lack of recognition, along with insufficient or non-existent reimbursement rates from insurance companies, may result in less testing, which thwarts appropriate diagnosis and treatment.

These same issues hold true for case management, follow-up services, and monitoring. Case management protocols do not include or offer all necessary services for individualized case management, and these programs vary statewide, by county, or by local health department. Current program rules do not promote consistency of implementation or designate role responsibilities, including through Medicaid managed care plans.

Finally, data sharing and monitoring mechanisms are not comprehensive and often are not available in real time to stakeholders. This prevents critical collection, organization, and analysis of information that can help design effective primary prevention activities.

Ideal state

The ideal state requires the following:

- One hundred percent of children are tested for lead exposure, and 100% of children testing ≥5 μg/dL (or the current reference level) receive comprehensive treatment and case management services.
- MDHHS provides on-going monitoring, enforcement, and technical assistance for local health department outreach, education, and testing, with adequate funding to maintain high-quality services.
- Local public health systems have the infrastructure to deliver high-quality services, including appropriate technology and resources for outreach and education.
- Local public health is equipped with the infrastructure and funds to create a broad coalition for case management.

- Case management support is offered to all children with EBL ≥5 μg/dL (or the current reference level), with 1-2 visits from a trained educator, and nursing support is offered monthly for those with EBL >10 μg/dL until the EBL is brought down below the current reference level.
- Support services include comprehensive preventive education, housing abatement, micronutrient fortified foods, medical home access, and transportation support.
- Public and private health insurance companies, primary care providers, educators, non-profits, and early childhood organizations work with local public health in a coordinated efficient system to ensure the provision of testing, case management, and follow-up services.
- Once a child is identified with EBL, the local public health department or a designated agency initiates remediation and abatement of all exposures to lead.
- MDHHS and the local public health system have the tools necessary to engage all appropriate community stakeholders, private and public, to ensure elimination of lead exposures for the child.

Obstacles to achieving ideal state

A systemic breakdown has occurred in the testing and treating of children for EBL. State and local public health infrastructure has not been supported to implement current requirements for lead testing, much less to achieve 100% testing rates. Public health infrastructure varies widely. Whether rural or urban, local public health departments may not have the capacity to test or process tests and then respond to EBL cases. They also do not have the capacity to reach out and educate stakeholders, including families, caregivers, medical providers, insurance companies, and schools. Further, many primary care providers do not recognize the need for universal lead testing, or even the need to screen children for risk factors that may prompt a blood lead test.

The risk of lead poisoning is greater in higher poverty areas where families often live in older, poorly maintained housing and may not have the transportation or resources to get lead testing for their children, let alone follow-up testing. When outreach does occur, families often mistrust or do not understand the need for testing, or the risk of lead poisoning. Some of these same families move repeatedly to different houses, many with lead hazards, making it difficult to find, track, and treat children with EBL.

Once a child is diagnosed with EBL, local public health departments may not have the capacity to engage in comprehensive case management, much less provide follow-up services and on-going monitoring. Under Michigan Medicaid managed care, case management responsibilities are vague and confusing, with lack of clarity on leadership roles and even who is included on the team. This lack of clarity in case management roles can lead to dropped cases. Public health workers also do not have the capacity to ensure that all stakeholders are included on the case management team.

Both at the state and local level, lack of investment in technology for data processing and sharing impedes the ability to target the highest risk areas, protect privacy, or efficiently disseminate educational materials.

Education on the individual, family, and societal costs of lead poisoning is fragmented and often ignored, resulting in the marginalization of families with lead poisoning and a lack of support for eliminating lead exposures.

Themes and guiding principles

Key themes include:

- The wellbeing of children and their families must come first.
- Health equity must underlie all policy and funding recommendations.
- Areas with high incidence of EBLs and multiple cases must receive priority.

Lead exposure is unacceptable for any child in Michigan. Unfortunately, the children with the greatest incidence of lead exposure and the most risk for poisoning live in higher poverty areas. This leads to an inequitable burden on these communities and families. Policy decisions and funding priorities must begin here. Families often mistrust government or are difficult to track. Trust must be rebuilt, with families as partners in protecting their children. Because policies and funding decisions may impact communities differently, a health equity lens is critical to ensuring the highest risk children and communities receive the resources necessary for all children to be tested and receive effective case management.

Vision statement

To create public impact by leveraging policy, partnerships, programs, and public engagement to ensure that 100% of children in Michigan are tested for elevated blood lead levels and receive high-quality case management, including indicated follow-up and monitoring services.

Executive Order recommendations for testing of children for elevated blood lead

A capillary test is a finger poke blood sample and can be done at a local health department, or at a doctor's office if they have the appropriate testing equipment. A **venous test** is taken from an arm vein and must often be facilitated at an offsite testing location. If a child has EBL based on a capillary test, then the results must be confirmed with a venous test.

EO charge to board: Recommend changes to improve the blood lead testing rate of children in Michigan, especially in high-risk areas and for children under the age of six (6) years old.

- Require that 100% of children are tested for lead poisoning at 9 to 12 months and at 24 to 36 months of age. Confirmation of a capillary EBL should occur within 1 month by a venous blood sample. EBL will be designated at the current accepted reference level.
- Improve information technology (IT) and infrastructure support to local health departments (administered through state department/agency) for the development of sustained, coordinated, and jurisdiction-wide lead testing and processing. This includes developing and implementing a centralized data reporting system accessible to local public health, schools, medical providers, and insurers to track testing rates and cases of children with EBL, to determine whether and which follow-up services are being provided, and to measure the effectiveness of case management activities.
- Enhance the distribution of educational toolkits distributed annually by the MDHHS Childhood Lead Poisoning Prevention Program (CLPPP) to local and community partners throughout the state; ensure the inclusion of Great Start Collaborative, Head Start, community centers, childcare centers, birthing centers, and maternal infant support programs; and improve communication of risk to parents/caregivers.
- Design a model assigning roles to responsible parties to ensure that 100% blood lead testing is fully implemented.

- Ensure all licensed Michigan providers caring for children (e.g., pediatricians, family nurse practitioners, family practitioners, general practitioners, etc.) receive professional education regarding lead testing and EBL management.
- Work with insurance companies to educate medical providers on the importance of blood lead testing.
- Recommend the utility of routine prenatal blood lead screening for pregnant women.
- Work with Michigan Quality Improvement Consortium (MQIC) to recommend universal testing coverage for all, as opposed to just coverage for Medicaid and WIC populations. MQIC provides best practices to all health plans /insurance companies for Michigan.
- Mandate that insurance plans sold on the Michigan Health Insurance Marketplace cover the four types of recommended clinical preventive services without cost-sharing, including lead screening. Advocate to include measures for lead testing for all children at the ages of 9-12 months and again at 24-36 months in the Healthcare Effectiveness Data and Information Set (HEDIS). This will promote universal testing. (Note: 2016 HEDIS measures include lead screening, but some states just include lead screening for Medicaid.)
- Utilize plan-specific and provider-specific measures to enhance screening rates.
- Utilize the Detroit Physician Detailing Program as a model to enhance provider screening rates across the state.

The **Detroit Physician Detailing Program** is currently under development. The goal of this program is to create a health ecosystem in Detroit where all partners are engaged, and resources and strategies are aligned. This clinician and health system engagement will take many forms—regular newsletters, forums, continuing medical education opportunities, timely notification of potential public health threats, individual visits with physician offices and clinics, and partnerships with health systems on special projects.

<u>Executive Order recommendations for follow-up monitoring and services, including case management</u>

EO charge to board: Recommend changes to improve the percentage of families utilizing follow-up services when a child tests positive for elevated blood lead and ensure the adequacy of those services.

- The state should provide funding, IT, and infrastructure support to local departments and organizations (including local departments of the environment, buildings and safety, housing, and water, and those organizations impacting early childhood, such as lead-involved and early childhood non-profits and healthcare providers) to encourage the development of sustained, coordinated, jurisdiction-wide lead case management efforts throughout Michigan.
- Within CLPPP, the state should develop and manage a centralized data reporting system for the above coordinated bodies to track cases of children with EBL, to determine whether and/or which follow-up services are being provided, and to measure the effectiveness of case management activities.

The **Lead Safe Detroit Coalition** is coordinated by the Detroit Health Department and is a citywide lead poisoning prevention and mitigation effort that engages key partners in the city to increase the efficiency of providing lead services to children and to reduce the amount of lead exposure. Key participating organizations include Detroit's Buildings, Safety Engineering & Environmental Department (BSEED); Detroit Water and Sewerage Department (DWSD); Great Lakes Water Authority (GLWA); Detroit Land Bank Authority (DLBA); Detroit's Housing and Revitalization Department (HRD); CLEARCorps/Detroit; and Wayne State University's Green & Healthy Homes Initiative. This coalition provides lead education, screening, testing, case management, enforcement, abatement, and inspection services to families. Each month, leaders from each organization meet to coordinate care and services for children with elevated blood lead levels and identify opportunities to improve lead prevention and service coordination across Detroit.

- Case management assistance should be comprehensive, equipping local public health departments with the infrastructure and funds to create a broad coalition for the case management team. Case management support should be offered to all children with EBL ≥5 µg/dL (or the current CDC reference level), with 1-2 visits from a trained educator. Nursing support should be offered monthly for those with EBL >10 µg/dL until the EBL level is brought down below the current reference level. Support should include comprehensive education, housing abatement, micronutrient fortified foods, and transportation support for the healthcare needs of affected children.

Environmental lead monitoring and investigations

Importance of key area to eliminating child lead exposure

High-quality, comprehensive environmental lead monitoring and lead investigations involving homes, soil, water, products, and air are critical for the elimination of child lead exposure in Michigan. Environmental lead monitoring and investigations help ensure that all possible sources of child lead exposure are identified, allowing hazards to be remediated to prevent further exposure and harm. They serve as the best primary prevention tools for eliminating lead hazards in the environment and, consequently, child lead exposure.

Current state

Elimination of child lead exposure in Michigan will not occur unless all lead hazards are eliminated to the greatest extent possible. The vast majority of environmental lead investigations are triggered by a child's EBL. This reactive strategy, an action of secondary prevention, does not allow for the elimination of child lead exposure, because it requires, by its very nature, that children be exposed prior to an investigation.

The primary sources of lead contamination for most children with EBL are lead paint in old houses, lead dust, and lead in soil. Efforts to reduce lead poisoning concentrate on remediation or abatement of homes where a child has been found with an EBL. Adequate funding does not exist to cover the full need for EBL investigations and follow-up abatement efforts. Capacity at state and local levels is inadequate to deliver high-quality testing, monitoring, and investigation, particularly in high-risk areas and for high-risk populations. Further, in addition to a lack of funding for abatement, there are not enough certified lead inspection and abatement firms to safely clean up identified lead hazards.

Regulations and funding flow through both the EPA and the U.S. Department of Housing and Urban Development (HUD) at the federal level, and through MDHHS and the Michigan State Housing

Development Authority (MSHDA) at the state level, with cities and counties sometimes receiving funding for lead abatement. National health-based standards for environmental media (i.e., soil, groundwater, surface water, air, sediments, etc.) and best practices for monitoring and investigations are not implemented similarly across or within states, making it difficult to establish testing and monitoring baselines that will prevent EBL. In addition, regulations do not cover all sources of child lead exposures, and present standards do not meet or exceed the most stringent action levels for blood lead based on the latest accepted research. Reliable enforcement mechanisms for local, state, and federal codes, and standards for monitoring and investigations, are limited or do not exist, and lack of available funding is limiting current enforcement capacity and efforts.

The private sector is not fully engaged in lead elimination. Few incentives and/or penalties are available to encourage private property owners to address existing, even known, hazards on their properties. Likewise, there are insufficient incentives or penalties available to encourage businesses to transition away from lead containing practices and products and to reduce sources of lead exposure.

Data sharing and monitoring mechanisms are often not available to stakeholders, and when available, the data are generally not comprehensive nor provided in real time. For example, the current Lead Safe Housing Registry is limited to providing information on houses, duplexes, apartments, and childcare centers that have received a professional lead service. The registry is in need of updating and expansion to cover all structures with lead exposure hazards.

Ideal state

The ideal state requires the following:

- Environmental monitoring and investigations, followed by abatement, are the focus of primary prevention; that is, monitoring and investigations are used to identify and initiate remediation and abatement and eliminate all sources of environmental lead exposure before a child is exposed.
- State and local standards for actionable levels of environmental lead exposure meet or exceed the most stringent standards in the country and are based on sound science. State standards also take into account the additive nature of multiple exposures (e.g., they make use of the Integrated Exposure Uptake Biokinetic Model (IEUBK) in assessing potential childhood total lead exposure levels).
- State and local agencies have the funding and infrastructure to deliver high-quality testing, monitoring, investigation, and follow-up services, such as abatement, as well as adequate enforcement capacity.
- Public-private partnerships and academic and private sector collaboration form an integral part of achieving the goal of eliminating child lead exposure.
- Adequately trained and certified lead abatement firms are available to carry out the lead abatement work in a timely fashion.

Obstacles to achieving ideal state

In order to fully implement a primary prevention strategy, the public, private, non-profit, and academic sectors must be committed and involved. Currently, there is a lack of understanding of the heavy societal costs of child lead exposure. Consistent and fully protective regulations, guidelines, and expectations, and reliable enforcement mechanisms, do not exist. The lack of coordination between local and state agencies, investigators, nurse case managers, hospitals, physicians, property

owners, and lead abatement administrators impedes efficient and effective elimination of lead hazards. Due to insufficient funding for inspections, risk assessments, EBL investigations, abatement, and enforcement efforts, many lead hazards, especially in older homes, remain untreated, and children continue to be exposed, if not poisoned. Because no workable, consistent definition of "high-risk area" exists with respect to lead exposure, state and local health departments cannot currently prioritize areas for investigation and abatement. And when a lead investigation indicates a need for remediation and abatement, the lack of a certified and skilled workforce slows the process of eliminating the risk. The lack of adequate IT infrastructure and data sharing also makes it difficult to prioritize prevention efforts and measure progress and efficacy.

In addition, further information/research is needed to identify all sources of lead that cause child lead exposure and determine how these sources interact in the environment and in the human body.

Themes and guiding principles

- Lead investigations and monitoring, followed by abatement, should be used as primary prevention tools for eliminating child lead exposure throughout the state.
- Health equity must underlie all policy and funding recommendations.
- High-risk and high-need areas must be prioritized for increases in funding and capacity building.

Vision statement

To create public impact by leveraging policy, partnerships, programs, and public engagement to ensure that sources of lead exposure in the state are either prevented or identified and eliminated.

Executive Order recommendations

EO charge to the board: Recommend changes to improve the availability of environmental lead investigations to families when a child tests positive for elevated blood lead, particularly with respect to children under the age of six (6) years old, and ensure the adequacy of such investigations.

- The state should conduct, or require local code enforcement to conduct, a proactive rental certification program that includes lead inspection and risk assessment (LIRA) in high-risk housing until the housing is deemed to be lead-free. Rental certification shall not be valid for more than 5 years, and interim requirements, such as clearance testing, may be required to ensure occupant safety.
- Increase the Medicaid reimbursement rate for local health department risk assessments and EBL investigations to the current rate of service and build in an annual cost inflation factor. The rate should also include laboratory sample analyses.
- Establish a permanent source of funding to perform EBL investigations that are not covered by Medicaid, HUD, or general fund funding.
    - Provide local health departments with greater incentives to begin (or resume) performing, and to build capacity to perform, EBL investigations. Such incentives could include continued stipends for training and certifications (MDHHS current practice), funding for XRF machines and their maintenance, increased Medicaid reimbursement rates, and continued mentoring from established EBL investigators.
- Allocate funding at state and local levels for follow-up at housing units where an EBL investigation determines risk and the property owner fails to remediate the hazard. Support is needed to prepare the case for the local prosecutor or to enforce local housing ordinances (e.g., Kent County condemnation notices).

- Require a mandatory LIRA at point of sale or transfer for homes older than 1978.
    - If a full removal abatement of all lead in the home has occurred, then no LIRA is required.
    - If there has been abatement without full removal, then at the point of sale or transfer, if the home has been held for 5 years, a LIRA is required.
    - If the LIRA identifies lead hazards, then abatement is required at point of sale or transfer.
- Allocate funding for LIRAs in homes in high-lead neighborhoods where children or pregnant mothers are living.
- Expand soil testing programs through:
    - Increasing availability of soil sampling kits and the lab analysis of those kits at affordable rates in identified high-risk areas. A model for this could be Michigan State University Extension's Edible Flint program.
    - Establishing baseline soil testing in high risk areas, including community gardens, parks, and areas around schoolyards and childcare centers.
    - Requiring basic soil sampling in areas deemed as high-risk areas before commencing urban gardening.
    - Ensuring HUD guidelines are implemented, including testing soil in the yards of pre-1978 residential properties, especially within 36 inches of the drip line.
        - Develop model requirements for local code testing and enforcement that local entities can use to ensure hazards related to soil around drip lines are remediated, particularly in high-risk/high-access areas. The state should also seek to encourage the local adoption of these codes.
    - Providing funding for soil lead testing kits and analysis every two years for residences in zip codes where lead prevalence is greater than 7% or where more than 50% of the housing stock was built before 1978.
        - Develop soil testing algorithms for land around demolition sites.
- The state should support continued research and development of policy and procedures for water testing in homes and for the interpretation of test results.

Additional recommendations

Home exposure mitigation:

- The state's "Landlord Penalty" law should be updated to allow for use in cases where the child's blood lead level is ≥5 μg/dL (or the current CDC reference level) and to allow for a presumption of non-compliance when an affirmative defense is lacking.
- Ensure regulations protect against predatory landlords by placing a freeze on any eviction proceeding against a family within 6 months of a finding of an EBL in a child or a finding of any lead hazards in the home. The freeze should stay in place until all lead hazards have been abated.
    - The state should develop a fund for the legal defense of families who are renting and have children with elevated blood lead levels and an identified lead hazard in the home.

Michigan's **landlord penalty law** addresses lead-based hazards under MCL 333.5475a in the public health code. The enforcement of this code is largely dependent on the municipality and county. MDHHS may be involved with enforcement in more serious cases, along with subsidizing repairs and removing hazards for landlords.

    - The state should require that the Lead Safe Home Registry or its successor include updated information related to all lead exposures, remediation and abatement, and inspection history.
    - The state must allocate sufficient funding for the maintenance and upkeep of the Lead Safe Housing Registry.

Soil exposure mitigation:

- Ensure that maximum allowable limits of lead in soil intended to be used as fill for neighborhood construction or demolition projects and for abatement projects are equal to or lower than the most stringent standards based on accepted research.
- Implement statewide regulations for metal content in fertilizer and soil amendment products (which include topsoil).
- Develop state regulations that require lead testing for urban farms, agricultural fields, parks, schools, and for licensed childcare areas, as well as the submission of lead mitigation plans for these affected areas.
- Develop soil testing guidelines or algorithms for areas where interim remediation measures have been implemented or where exposure control or engineered barriers have been put in place in lieu of soil removal, and periodically monitor soil lead levels.
- Require soil testing programs in areas where shooting ranges once existed and/or exist today.

Water exposure mitigation:

- The state should adopt and implement the position of the Flint Water Interagency Coordinating Committee (FWICC) in its *FLINT WATER INTERAGENCY COORDINATING COMMITTEE RESOLUTIONS 2016-15 THROUGH 2016-13*.[ix]
    - A health-based standard should be set that is based on best available evidence for household action limit levels for water that should not exceed 10 parts per billion (ppb) or the current scientifically acceptable standard, if more stringent.

Product exposure mitigation:

- Importers and manufacturers should be required to disclose the presence of lead in consumer products with a concentration greater than 100 ppm (or lower, as federal standards become more stringent) on product labeling and through online reporting, and policymakers should consider banning such products.
    - The state should develop an infrastructure with expanded capacity to enforce this requirement within 3 years.
- Prohibit lead in fishing tackle, establish a fishing tackle trade-in program to encourage consumers and industries to transition away from lead-based tackle, and encourage further study of lead in fishing tackle.
- Establish regulations to protect against lead exposures through the use of firearms by:
    - Establishing an ammunition trade-in program.
    - Establishing a wild game meat testing program for donated products.
    - Developing a health education program and public education materials for lead exposures in hunting and wild game consumption.
- Ban the sale and installation of lead in wheel balancing weights.

- Advocate for the federal regulation of acceptable levels of lead in all aviation fuels to meet existing commercial requirements.

Air exposure mitigation:

- Standardize health-based regulations and best practices for demolition and renovation to establish a baseline understanding consistent with sound scientific methodologies. The state should encourage and incentivize a "health-in-all-policies" approach to approving construction projects.
- Reduce lead exposures in occupational spaces to protect children, pregnant mothers, and the unborn by encouraging the Michigan Occupational Safety and Health Administration (MIOSHA) to lower blood lead levels to below 10 µg/dL, or the most stringent scientifically accepted standard, in occupational settings in industries where workers are exposed to high levels of lead.
- Facilitate access to quarterly air quality monitoring, emissions testing, and other testing plans (including frequency of testing), and to waiver acquisitions, which would include information about lead emissions.
- Provide incentives to companies to improve their scrubbing processes and to integrate the best emission-reduction technologies into their facilities. There should be rigorous enforcement of state regulations restricting lead air emissions.
- Assess whether a state standard more stringent than the EPA standard is needed for lead emissions.

"**Health in All Policies** (HiAP) is a collaborative approach that integrates and articulates health considerations into policymaking across sectors to improve the health of all communities and people. HiAP recognizes that health is created by a multitude of factors beyond healthcare and, in many cases, beyond the scope of traditional public health activities."[a]

Remediation and abatement

Importance of key area to eliminating child lead exposure

Remediation and abatement describes an umbrella of actions by which lead is physically addressed in our indoor and outdoor environments. Remediation and abatement is done in response to a lead poisoning (secondary prevention) and to prevent future exposures (primary prevention). In all cases, remediation and abatement are the irreducible steps by which the actual causes of lead exposures are corrected. Lead metal has been isolated, concentrated, and added to a large number of man-made products from gasoline and paint to solder and plastics. For decades, homeowners, builders, and contractors coated buildings with lead paint, connected pipes with lead solder, and installed standard lead water service lines. As each of these actions took the time and effort of many individuals, each will take the time and effort of different individuals to undo. This is remediation and abatement, and it is the foundation on which safer environments are made.

It is important to understand the legal distinction between remediation and abatement, as they are treated quite differently under the law. *Abatement* is defined by federal and state law as work designed to permanently eliminate lead-based paint (LBP) or lead hazards. By law, a notification must be sent to the MDHHS three business days before abatement work may begin, with information such as the start and end dates, certification information, scope of work, etc. Abatement work, lead

inspections, risk assessments, and clearances may only be performed by state-certified lead professionals. Though it can include privately-funded work where permanently addressing lead paint is the design, abatement is most commonly done on projects using public funds, such as those available through HUD.

Remediation, for the purposes of this report, is a more broadly defined term that encompasses the wide range of renovation activities not meeting the definition of abatement. These range from homeowner Do It Yourself (DIY) projects to contractor rehabilitations and from remodeling to demolitions. Remediation includes measures designed to temporarily address lead paint and its associated hazards, such as specialized cleaning or re-painting (i.e., HUD's "Interim Controls"). Remediation in this context would also include activities to correct plumbing and water service line issues.

Current state

Title X "...requires that potential buyers and renters of housing built prior to 1978 receive certain information about lead and lead hazards in the residence prior to becoming obligated to buy or rent, and provides the opportunity for an independent lead inspection for buyers. Sellers, landlords, and agents are responsible for compliance."[b]

Abatement work has been regulated since the late 1990s when, under the national strategies set forth in the Residential Lead-Based Paint Hazard Reduction Act of 1992 ("Title X"), EPA and HUD promulgated rules defining the newly created specialty. These regulations included provisions for the training, testing, and certification of a trained workforce to deal with lead paint and lead hazards, as well as enforcement provisions. In practice, most of the demand for lead abatement comes from publically-funded projects, such as HUD rehabilitations, where abatement may be specifically required. Missing from these early efforts was any rule to govern the lead-safety aspects of privately-funded renovation contractors, who account for the large majority of work done in homes.

This remained so until the EPA promulgated the Renovation, Repair and Painting Rule, or RRP. RRP, which went into full effect in 2010, requires renovation contractors, plumbers, electricians, or any other for-profit entity (such as landlords collecting rent) working in pre-1978 homes and disturbing painted surfaces to undergo basic training regarding lead-safe work practices and pass a test to become certified. When working on pre-1978 homes, these individuals must test for the presence of LBP, employ lead-safe work practices, and conduct a visual clearance at the end of the renovation.

Today, in theory, both remediation (renovation) and abatement should employ trained and certified personnel and follow lead-safe work practices. In practice, compliance with federal RRP falls short of the intended goals, as the program is administrated and enforced from EPA Region 5 in Chicago. This remote administration, combined with a lack of consistent RRP follow-through in Michigan's codes and in Michigan's licensing and permitting processes, has caused a sharp decrease in new RRP certifications and renewals among Michigan contractors.

Complete abatement of all lead paint or soil in all homes is prohibitively expensive. Most programs addressing lead, with the exception of full "gut rehab" projects, use a mixture of renovation, HUD interim controls (temporary measures to reduce lead paint or hazards, such as repainting and cleaning), and abatement to address lead and lead hazards. Priority in these programs is given to families with children under 6 years old, especially when a lead-poisoned child has been identified. Once a home or component is made lead-safe through any combination of remediation or abatement,

diligent maintenance and monitoring for any remaining lead becomes the key to reducing any future potential for exposure.

With disrepair and lack of maintenance being significant risk factors for the creation of lead hazards in older homes, property maintenance becomes a central issue of primary prevention. Current property maintenance code requirements in Michigan are inconsistent from municipality to municipality and the vast majority do not explicitly address lead paint hazards. Additionally, current code enforcement systems rely largely on a complaint-based model that can allow substandard conditions to endure, increasing the risks for exposure, especially in rental housing where tenants may be reluctant to make complaints for fear of eviction.

In some cases, the amount of work necessary to make a home lead-safe is very large, even greater than the home's worth. In that situation, it may actually be more cost effective to relocate the family than to fix the current home. Because of the complicated and largely unanswered legal questions related to such an effort, no program currently exists that would identify such homes or provide the resources for family relocation.

Lead in drinking water, which is largely governed under EPA's Lead and Copper Rule (LCR), has gained widespread recognition as an important lead exposure. In Michigan, the work to identify and replace lead water service lines continues in communities such as Flint, Detroit, and Grand Rapids. Leaded fixtures and solder in pipes are also receiving new attention.

DIY work done by homeowners is largely unregulated and potentially disastrous to families. DIY work is often done during peak times of developmental vulnerability (during pregnancy and/or after the birth of a child). As untrained persons, homeowners may be unaware of lead's dangers, and with limited tools and budget, they may be more likely than trained professionals to choose expedient methods for surface preparation (e.g., dry scraping, machine sanding, etc.), demolition, or deconstruction of painted surfaces that don't protect against the spreading of dust or against direct exposure. Homeowner education and outreach efforts need to be enlarged so the pertinent messages permeate our commercial DIY/home improvement sector and real estate space.

Ideal state

Remediation and abatement is the collective work of many individuals physically addressing lead hazards in homes, childcare centers, and schools. Whether it is painting or plumbing, remediation and abatement work is unavoidably time- and resource-intensive. Any ideal state, then, must first meet the need for adequate, dedicated, and sustained funding, both to promote and enable privately-funded renovations and to ensure that governmental lead hazard reduction programs are able to adequately function and respond. Other states have provided funding solutions through actions such as a paint tax, licensing and permit surcharges, general fund allocations, and third-party settlement monies.

Directing and tracking resources is best accomplished with a complete and centralized data system. Ideally, such a system has statewide, parcel-level data about homes and rental properties that includes renovation histories, history of lead poisonings, etc. Such a system is available to public health professionals statewide to coordinate case management and remediation and abatement efforts, but it also has a more limited public-facing side, where prospective homebuyers, renters, or parents can engage the data to learn the lead status of homes, rental properties, childcare centers, and schools.

To be most useful, such a data system must be complete. This will require substantially more data on homes, schools, and childcare centers than currently exists. Ideally, then, requirements would exist for buildings to undergo periodic testing to both ensure that they are currently lead-safe and to provide valuable data. For example:

> In pre-1978 homes, a combination LIRA, including water testing, should occur at time of transfer of the property or upon the occurrence of some other reliable event. If the home already had a previous lead inspection, a repeat risk assessment, including water testing, should be performed.
>
> In post-1978 homes, dust, soil, and water testing should be conducted at the time of transfer of the property or upon the occurrence of some other reliable event, or whenever there are indications of a high-risk activity, such as stained-glass window work or ammunition reloading, being done in the home.

In an ideal state, a consistent message and emphasis on lead permeates the language and policies of state and local agencies involved in public health, housing, licensing, and education. These policies refer to and make use of existing laws and requirements. For example, a contractor must not only be knowledgeable about lead but must also demonstrate that knowledge on their builders or plumbers licensing exam. Additionally, local building departments would require proof of RRP certification, a federal requirement since 2010, before granting a building permit for pre-1978 housing.

In an ideal state, a proactive building code that explicitly addresses the causes of lead exposure, that is consistent across municipalities, and that provides the authority to "red-tag" unsafe housing would help to ensure that homes and rental properties that fall into disrepair do not stay long in that condition. It would also help encourage routine maintenance, which, when combined with regular cleaning, is the most powerful form of primary prevention of lead poisoning.

Lastly, the layers of federal, state, and local laws governing remediation and abatement would be revisited and coordinated to reduce redundancies, address shortcomings, and update the underlying assumptions and approaches of each (when the EPA and HUD rules were written in the late 1990s, there was no requirement, as there is now, for private renovation work to be done lead-safe).

Obstacles to achieving the ideal state

Dedicated and sustained funding sufficient to eliminate lead exposure does not currently exist. With only occasional exceptions, most funding for lead hazard reduction programs has come from federal grants or authorizations. No mechanism for predictable year-over-year funding exists.

A centralized data system to target remediation and abatement resources, coordinate case management efforts, and inform the public does not exist. Privacy concerns will need to be addressed and vetted, as will comprehensive data-sharing agreements between agencies. However, even if such a system did exist, there are currently few opportunities to collect the data necessary to populate it, outside of publically-funded programs. While the tools to gather lead information exist, requirements for more widespread testing and reporting do not. Additionally, the cost of such services can be a significant hurdle. A typical LIRA can run several hundred dollars and may only be the start of a longer process wherein the findings of the LIRA are remediated. Rental property owners, childcare facilities, homeowners, and schools would all need to shoulder the costs associated with any requirement for additional testing.

Various federal, state, and local regulations govern remediation and abatement activities. Most build off the definitions and requirements set forth in Title X and the original EPA and HUD regulations of the late 1990s. Many recommendations in this report and elsewhere invoke these terms generally—such as abatement, lead inspection, risk assessment, and clearance—however, some have specific limitations on who may perform the action and what may be done, and so some recommendations may initially clash with those restrictions when put into practice.

To fit many of the recommendations coming from this board and from others across the country into the regulatory framework that has defined remediation and abatement operations for the past 20 years, it will be necessary to convene a workgroup of empowered federal, state, and local officials to update and harmonize these regulations.

Themes and guiding principles

An estimated 1.3-1.4 million Michigan housing units contain active lead hazards.[x] Each of these homes has the potential to create lead risks when paint is disturbed. Even without LBP (which was banned for residential use in 1978) and its associated hazards, a significant number of additional households have exposures to lead in dust, soil, or drinking water.

It will take a sustained effort to address all these concerns in furtherance of the goal of effectively eliminating lead exposure in Michigan. Remediation and abatement are irreplaceable elements to bring about a future free of child lead exposure and act as both a response (secondary prevention) and a proactive measure (primary prevention).

Vision statement

Maximize the benefits of a robust and effective remediation and abatement process in achieving the elimination of child lead exposure in Michigan. Remediation and abatement, which are resource- and regulation-intensive, must figure prominently in any solution to child lead exposure. Craft novel, innovative, and effective solutions to the barriers that arise from overlapping regulatory, resource, and policy elements surrounding remediation and abatement efforts.

Executive Order recommendations

EO charge to board: Recommend achievable improvements to current remediation and abatement efforts aimed at reducing child lead poisoning dangers throughout Michigan and in particular hotspots, including individual homes.

- The state must find adequate, dedicated, and sustained funding sources to support the gamut of measures necessary to treat and prevent lead exposure (testing, data, remediation and abatement, training, outreach, etc.). Other states facing this same problem have found at least partial solutions in actions such as a paint tax, real estate and licensing surcharges, general fund allocations, and settlement monies.
- A centralized data system to target remediation and abatement resources, coordinate efforts, catalogue tests and home data, and improve coordination among public health case managers is needed. A workgroup of knowledgeable data and legal professionals should be created to identify the challenges in privacy, data sharing, funding, and the division of responsibilities in creating this system.
- Require a one-time lead inspection and risk assessments before the transfer or leasing of a pre-1978 home, including water testing. The owner must then disclose this information to any future buyers or renters under federal law. Provisions will be necessary to prevent these

and other rental property requirements from being waived in the event of sale through land contract.

- Require post-1978 homes to have tests done for dust, soil, and water. The owner must then disclose this information to any future buyers or renters under federal law.
- Adopt a consistent, statewide code enforcement model that is proactive and explicitly addresses exposure from LBP and its causes (e.g., deteriorated paint, water damage, etc.).
- Pass legislation requiring a contractor seeking a building or renovation permit on a pre-1978 home to provide proof of his/her Lead-Safe Certification as required by the federal Renovation, Repair and Painting Rule of 2010.
- Streamline the conversion of current RRP certified individuals and firms to full lead abatement firms (would require formal variance of state and federal laws).
- Add multiple lead questions or a lead module to the state residential builders and plumbers licensing exams.
- Convene a meeting with EPA and HUD to discuss interpretation of, and updates to, federal regulations affecting remediation and abatement that coordinate and harmonize the requirements of both agencies. Subjects to include:
    - Creation of a smaller steering group to outline priorities, organize event, and establish agenda.
    - Expensive and unnecessary dual clearances required for some buildings in mid-construction.
    - Lowering training and certification threshold between RRP firms and lead abatement firms to facilitate a greater supply of lead abatement professionals in the state.
    - Need for mixed lead professionals in one "work area" (i.e., trained and certified renovators should be able to work in the same area as lead abatement firms).
    - Adequacy of current lead clearance levels in light of falling EBL reference levels.
    - Adding water assessment to risk assessment standard.
    - More active, state-administered and operated enforcement of HUD regulations.
- Update Michigan Lead Abatement Act and Rules to include RRP authorization and other needed revisions. Bringing RRP authorization to Michigan will have the added advantages of creating revenue by keeping certification fees from leaving the state and providing for more local administration of the law.
- Review and recommend changes to current licensing requirements and grandfathering provisions for childcare and adult-care facilities to:
    - Require a one-time lead inspection and a risk assessment, including water, every 2 years, coinciding with state renewal requirements for facilities operating in pre-1978 buildings. Require dust, soil, and water testing at facilities operating in post-1978 buildings.
    - Address the exemption for in-house (family) childcare centers from this assessment requirement, recognizing that relief resources will need to be provided to mitigate any adverse effects upon the market from this requirement.
    - Require removal or remediation of all identified lead hazards, including water hazards.
    - Require childcare and adult foster care facilities to keep a copy of the lead inspection and risk assessment on file.
- Propose a collaborative partnership with construction trades to expand training and mentoring and create job opportunities for individuals starting out in the lead abatement industry in order to increase the number to individuals available to perform this work.

- Require schools to have an initial lead inspection and periodic follow-up risk assessments on all student-accessible buildings.
    - Remove or remediate all reported lead hazards, including water hazards.
    - Require schools to keep a copy of the lead inspection and risk assessment on file.
- Collaborate with identified state departments for increasing lead abatement workforce in Michigan.
- Create an interagency group that includes external stakeholders to develop a voluntary relocation option for remediation and abatement programs (particularly for high EBL cases in homes where remediation/abatement cost exceeds the cost of relocation), and conduct a pilot to understand the challenges and logistics of offering this option statewide.
- Require paint retailers to:
    - Carry lead-check swabs in their paint department.
    - Make available EPA's *Protect Your Family* brochure.
    - Require at least one clerk/salesperson to be lead educated for consumers.
- Encourage hospitals to use community benefit dollars towards lead elimination efforts.
- Build the capacity for completing abatements by encouraging local public health and housing departments and non-profits to operate abatement programs with fund allocations.
- Adopt HUD's "Prohibited Work Practices" (i.e., flame treatment, dry sanding/scraping, blasting, machine sanding, etc.) in state law for general renovation.
- Require all schools with remaining LBP in student-accessible areas to maintain a fund for future identification/remediation and abatement/clearance activities.
- Require follow-up every 5 years with renters or homeowners who have had remediation work done in their homes to advise them that the "expected life" of the remediation is coming to an end.
- Every 2 years, remind homeowners/renters who use interim controls about the lifespan of those controls.
- Encourage communities to develop DIY Tool Libraries where homeowners can check out tools and safety supplies (plastic sheeting, masks, disposable gloves, etc.) and receive guides on working lead-safe and on the dangers of lead.
- Embed proof of RRP clearance ("white glove test") into the building permit process.
- Require full dust-wipe clearance, instead of RRP clearance.
- Produce a guide to the Uniform Relocation Act of 1970 to better guide agencies on the requirements of this law as it relates to temporary relocation of families whose homes are undergoing lead hazard control work.
- Broaden training and outreach to homeowners and tenants regarding lead safety on DIY projects, lead awareness, health effects of lead exposure, and the availability of testing and remediation options.
- Consider implementing rental property owner incentives or requirements for property maintenance specific to LBP.

Dashboards and reporting

Importance of key area to eliminating child lead exposure

While the majority of this report uses the term "exposure" when referring to lead, this key area uses the term "poisoning" because poisoning can be numerically defined.

Carefully capturing, organizing, recording, sharing, and reporting information on child lead poisoning is critical to our ability to protect children, treat them, remediate their homes, and protect other children from hazards. Doing this well, doing it efficiently, and doing it in a highly coordinated way will be critical to our effort to eliminate child lead exposure. This is why we must clearly reform the information infrastructure surrounding lead poisoning.

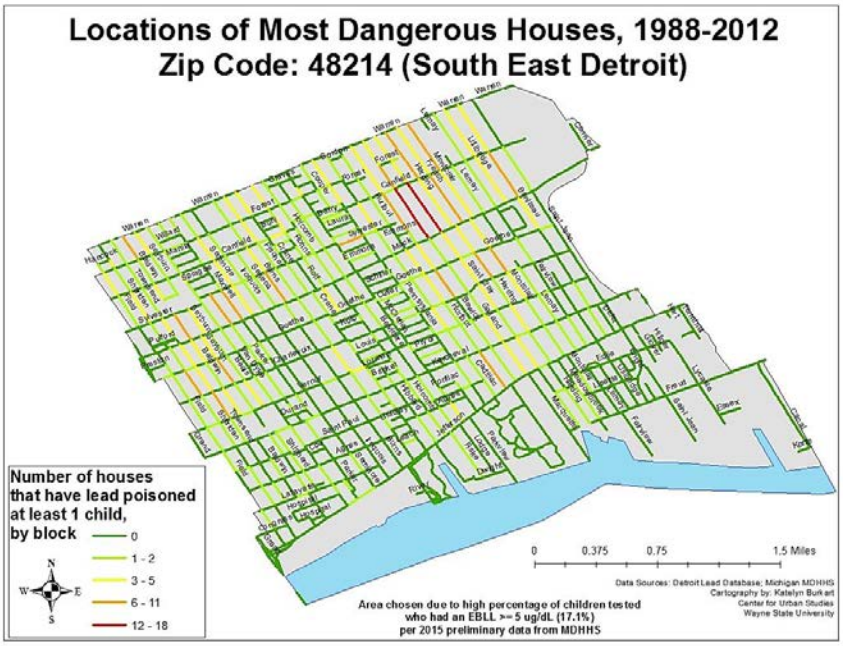

Figure 2 The most dangerous houses in the 48214 zip code located in South East Detroit shown at the block level. Source: Katelyn Burkart, Center for Urban Studies at Wayne State University.

Current state

Currently, Michigan captures information in a differentiated, uncoordinated array of databases and paper files. We have a variety of state, local, and non-profit agencies largely operating as silos, each with its own databases and/or paper files. The databases are written in different languages and cannot talk with each other. Privacy restrictions and agency restrictions prevent, or create obstacles to, the sharing of information. They reinforce barriers between the silos. All of this acts to restrain cooperation and slow efforts to help children or remediate houses. It creates enormous drag and inefficiency.

The current state of affairs also means there is no effective or efficient way to see the big picture of lead poisoning in the state, including all aspects from testing to poisoning to remediation, abatement, and regulation. Nor can the current system allow one to easily drill down to find hotspots or bad actors so that efforts toward improvement can be concentrated.

Ideal state

The ideal state is a single, up-to-date data system that captures both blood lead testing data and environmental data regarding sources of potential exposure in the environment. Regarding blood lead testing, the system captures data on testing of children, identifies children who are lead poisoned, facilitates their case management, links data about the home(s) and any lead investigation-risk assessment, facilitates referral to lead abatement programs, supports making a referral for code enforcement or law enforcement, tracks lead clearances, and links to systems that might identify lead safe homes for either temporary or permanent relocation. Such a system has built in controls to maintain privacy for appropriate medical concerns, but it makes available as much data as possible. Regarding environmental data, the system also tracks all housing units and whether or not objective point-in-time data about the presence of LBP and other leaded components (e.g., plumbing) exist and any investigated relative hazard of those sources of lead.

Figure 2 was created using aggregated data for lead poisoned children for the City of Detroit from 1988 to 2012 using data from the City of Detroit and MDHHS. Each time a child was identified as lead poisoned at a Detroit address (using the old criterion of 10 µg/dL), that address was counted once. This map tracks how many houses on a block had at least one lead poisoned child during that time period.

With the necessary funding and expertise, it is likely that similar maps could be created for other areas throughout the state using MDHHS data.

The overall system facilitates the eradication of lead poisoning through dashboards, reports, heat maps, incident maps, and infographics that can be readily produced by non-experts at various levels of geography. It engages the broad community of experts, advocates, and non-profit agencies, as well as the state and local employees who work on this issue. It is built on the principle that facilitating the broadest access to the maximum amount of high-quality information will help support an authentic, concerted effort to eliminate the scourge of lead poisoning from Michigan.

Obstacles to achieving ideal state

A major obstacle to achieving the ideal state is the sunk costs of investments in existing partial data systems currently supported by agencies and organizations. For example, the CDC and MDHHS have invested heavily in the Healthy Homes and Lead Poisoning Surveillance System (HHLPSS) that captures data on testing and poisoning. However, this key system has a number of shortcomings, including:

- It does not facilitate case management at the local level and many local agencies either case manage using paper files or various other software solutions.
- HHLPSS doesn't work very well as an electronic medical case management system.
- It has a lot of errors left over from the transfer from a previous system.
- The housing/environmental side is not (well) developed yet. HHLPPS does not link all children and all addresses.
- Locals cannot see the detail on all children in HHLPPS.

Local and state lead abatement programs funded by HUD are required to use the Healthy Homes Grants Management System. This database, used by the MDHHS Lead Safe Home Program and some cities, captures major details regarding lead and other hazards noted during hazard identification. While it may be replaced by another HUD system, it does not link to the HHLPPS that MDHHS uses for tracking lead poisoning cases. The upshot is that three major functions—testing, case

management, and abatement and remediation—all rely on different and incompatible software systems.

It is important to see clearly that the normal way of managing problems in the intergovernmental system is that agencies at the federal level (i.e., CDC, EPA, HUD) align with their counterparts at the state level (i.e., MDHHS, MDEQ, MSHDA) and local level (i.e., health departments, water departments, housing agencies) to solve a problem. Here, the software challenges mirror this structure, and instead of facilitating a solution, the software reinforces the vertical silos that the intergovernmental system creates. What is needed is a recognition that the challenge of protecting children from lead exposure should dominate, break through, and create integration across silos. This will not happen without political will and resources.

A further impediment is the retrospective focus of the data systems, which concentrate heavily on children already lead poisoned and the housing units they occupy. Much data exists to support a more proactive approach that will lead to primary prevention of lead exposure, but data systems are not organized to support this approach and project resources are not available to create or identify safe homes for children, particularly low-income children, so that they do not become lead poisoned because of inaction.

Themes and guiding principles

Key themes include:

- Fragmentation of data systems undermines the continuity and coordination that is needed to ensure the protection and treatment of children and the remediation of their homes.
- Data systems are incomplete.
- Data systems are retrospective in their orientation.
- Data is not transparent to families.

Key guiding principles:

With the use of multiple data systems, it is important to have the ability to coordinate systems so they can talk to each other and share information. One way to do this is by using **data bridges** that stand above databases and link data.

- Protecting children is paramount.
- The systems should facilitate solving the problem, regardless of boundaries of agencies and levels of government.
- A unitary system for Michigan is desirable. Data bridges can feed information back to the federally required systems as necessary.
- Privacy should be protected, but protocols can be developed that facilitate dissemination and collaborative study to achieve greater understanding of the problem and proactive protection of children.
- A proactive, primary prevention part of the system must be developed in order to bend the curve downward dramatically.

Vision statement

To assure that all available data is collected, managed, integrated, shared, and reported to maximize the primary and secondary prevention of child lead exposure.

Executive Order recommendations

EO charge to board: Recommend improvements to existing collection, maintenance, sharing, and reporting efforts regarding child lead poisoning data, including recommendations for the implementation of dashboards, websites, apps, and other means of conveying information.

- Database: The state should support the development of a single data system that captures child testing data, children poisoned, data necessary to assist case management, data regarding lead hazards in housing unit(s), housing status relative to the elimination of hazards, and code and law enforcement status. Appropriate data would be available to those intervening to remove hazards and to those enforcing applicable statutes, codes, or regulations. This system would be supported by point of collection apps that support staff collecting data in the field, including taking pictures or samples (XRF readings) in the field. This system would be searchable by child or by residence and would be anchored to parcel data so as to facilitate spatial, geographic information system (GIS) analyses. The system would be accessible to state government, local governments, and non-profit organizations, including people authorized to work with families and housing units. Privacy protections would be built into the system to assure only appropriate, legal access. Standard agreements would be put in place to facilitate various levels of data sharing, assuring privacy while providing a broad range of monitoring and performance programs. The state should immediately establish a workgroup to determine the essential data to be included and the key functions and extent of the system.
- Dashboards: A dashboard should be created to present publicly across time and geographies (i.e., state, counties, and cities over 5,000) key indicators of the fight to eliminate lead poisoning in Michigan. The state should release an aggregated, anonymized version of its database at least quarterly to support these dashboards. The indicators should include, at a minimum, the number and percentage of children tested (by ages), number of children lead-poisoned (by level), number of housing units with hazards remediated or abated, number of lead clearances, an estimate of remaining housing units with lead paint, and available funding. Where possible, the indicators would be tracked at the state level against national averages and against states that are leaders in the reduction of childhood lead poisoning. Each year, a panel of state officials and experts would set stretch targets for testing, reduction of childhood lead poisoning, lead remediation and abatement, and clearances. At the end of the year, the panel would consider the results and make recommendations for statewide improvements in practice and resource allocation to achieve progress toward the goal of eliminating childhood lead poisoning in Michigan.
- GIS: Authorized analysts, recognized experts, and other key actors would use the quarterly and annual database to create a set of base maps and mapping routines that could be used any time to produce heat maps, incident maps, time series charts and other displays for:
    - Each county
    - Each city over 5,000
    - Zip codes and census tracts where at least 6 children are identified

  This system would have the capability to produce historical maps and to aggregate data across the years of data coverage (late 1990s forward). These maps would be made publically available. Exact street locations would be masked by one of several techniques to protect the privacy of families, as needed.
- Primary prevention: The state should explore and support an analysis to determine whether data on past poisonings, age of housing, housing condition, propinquity to other lead

poisoned houses, and other factors can accurately indicate homes where primary prevention of lead hazards could reduce childhood lead poisonings.

- Reporting of addresses: A workgroup should be formed to explore under what conditions the state could publish publically the addresses of homes that have historically been locations where lead poisoned children and/or lead hazards were identified. Many homes have poisoned multiple children, but the owners have faced no consequences, and the homes are still being offered for sale or rent.
- Dissemination of lead information: Information on lead testing and lead poisoning levels at the state, county, and local levels should be public and widely disseminated. These results should be provided to the public on websites, through the news media, and through public notices sent to households (perhaps with utility bills or other regular communications such as tax bills). Information regarding the risks and sources of lead exposure and the methods of protecting children and adults should accompany these reports. Dissemination should also include direct contact to such groups as:
    - Local public health departments
    - Municipal, county planning, and community development officials
    - Local Great Start Collaboratives
    - School superintendents and publically-elected board of education officials
    - Non-governmental organizations identified as working on children's health and wellbeing, housing, or the environment
- In zip codes with a substantially elevated number of lead poisoning cases, the local health department should conduct a hearing and/or training(s) of local residents.
- Supporting survivors and their families: The state should consider requiring case managers and others working directly with families of lead poisoned children to provide those families with the contact information for organizations and advocates that provide support and advocacy for survivors and families of survivors of lead poisoning. This process is widely used to support and facilitate collective action for other groups of survivors or those with challenges.
- Reporting of abatements and lead clearances: Another kind of information on lead poisoning is data on houses that have been abated or that have lead clearances. These data should be made available on the state's registry of lead abated homes. And that registry of abated homes should be substantially improved and linked with other publically-accessible databases on available homes.

Next steps

As noted in the board's vision statement, the recommendations contained in this report are intended to represent a mix of the immediately achievable and the aspirational. This report should serve as an initial roadmap to the ultimate destination: a state in which the scourge of child lead exposure has been eradicated. Armed with this roadmap, the journey can and should begin now with the implementation of the following recommendations:

- A permanent commission should be created in early 2017 to coordinate all efforts to eliminate child lead exposure throughout the state. Eliminating child lead exposure requires the coordination of all levels of government, and collaboration with the medical community, property owners and contractors, businesses, civic organizations, families, and others. The permanent commission should be vested with the power to achieve this coordination, working collaboratively with all stakeholders to implement a statewide plan for the

elimination of child lead exposure based on the recommendations contained in this report, other initiatives the commission develops, and emerging models from across the globe. The commission should continually monitor progress towards the ultimate goal of eliminating child lead exposure. Further, it should look beyond lead-focused programs to programs that may, as a consequence of their primary objective, reduce lead risk. (For example, energy efficient window replacement programs and blight removal programs can both have a positive effect on eliminating lead exposure risk.) To enhance the ability of the permanent commission to coordinate child lead exposure elimination efforts throughout the state, a funding mechanism should be considered where all dollars related to the elimination of child lead exposure run through the commission.

- State departments and agencies should begin working with local governments, private sector/academic experts, privacy law experts, and others to:
    - Develop protocols for improving the collection of high-quality data, data analysis, and data sharing, with a focus on primary prevention. Such protocols should be founded on the understanding that the key to eliminating exposure is to identify all risks and to deploy resources accordingly.
    - Develop pilot programs to assess primary prevention protocols in selected local units, determine data shortcomings, recommend improvements to the collection, analysis, and sharing of relevant data, develop budget proposals to implement recommendations, execute revised protocols, and assess the impact on child lead exposure rates in the local units.
    - Develop a protocol specifically targeted at identifying residence "hot zones" where young children are currently being exposed to lead and implement this protocol throughout the state.
- This board should work with stakeholders and the permanent commission to prioritize the recommendations contained in this report. Priority must be given to recommendations that ensure the elimination of ongoing exposures. Furthermore, to facilitate the elimination of these exposures, priority should be given to recommendations that ensure the collection of comprehensive, high-quality data that are accessible to experts and the public and that are maintained in a way that allows the data to be utilized and analyzed efficiently. No data collection protocol that results from these recommendations should operate like a security camera, only recording what appears in its field of view. A successful protocol must encourage curiosity and the active searching for problems.
- This board should continue to meet, as needed, to ensure that these next steps are implemented.

Conclusion

No child should ever be exposed to lead. While much progress has been made over the last 17 years in reducing child lead exposure risk and identified child EBLs have gone down significantly, there is no safe level of lead exposure. Further, exposure disproportionately impacts low-income areas and minority children.

The impact of lead exposure on a child can be life altering, affecting the child's cognition, behavior, and future earnings. Child lead exposure also results in significant societal and budgetary costs, including increased crime and increased need for services. All of these impacts must be considered when weighing the costs and benefits of programs and initiatives aimed at eliminating exposure.

Eliminating child lead exposure requires the creation of a new paradigm focused on primary prevention and health equity. Additional resources, changes in policy, and the concerted and

coordinated efforts of all will be needed to ensure success. The new paradigm also requires the recognition and targeting of all lead dangers and the development of a much greater ability to effectively collect, share, and utilize data—a new data infrastructure.

The roadmap contained in this report provides initial guidance to policymakers, including a to-be-created permanent commission, on how to make this new paradigm a reality, but it is just the first step. As stated in the board's vision statement, certain challenges (financial, legal, institutional, cultural, behavioral, environmental, and technological, to name a few) currently exist that must be addressed in order to achieve the complete elimination of child lead exposure. We recommend that these challenges be addressed steadily and aggressively starting today, so that current and succeeding generations of children do not have their futures impacted by lead.

[i] *Costs of Lead Exposure and Remediation in Michigan: Update*, Ecology Center and the Michigan Network for Children's Environmental Health (2016), http://www.ecocenter.org/just-released-updated-lead-report, p. 7.
[ii] *Costs of Lead Exposure and Remediation in Michigan: Update*, Ecology Center and the Michigan Network for Children's Environmental Health (2016), http://www.ecocenter.org/just-released-updated-lead-report, p. 6.
[iii] *Costs of Lead Exposure and Remediation in Michigan: Update*, Ecology Center and the Michigan Network for Children's Environmental Health (2016), http://www.ecocenter.org/just-released-updated-lead-report, p. 8.
[iv] *Costs of Lead Exposure and Remediation in Michigan: Update*, Ecology Center and the Michigan Network for Children's Environmental Health (2016), http://www.ecocenter.org/just-released-updated-lead-report, p. 7.
[v] Childhood Lead Poisoning Prevention and Control Commission, http://www.michigan.gov/mdhhs/0,5885,7-339-71550_2955_2983-76907--,00.html.
[vi] *Flint Water Advisory Task Force Final Report,* Office of Governor Rick Snyder (2016), https://www.michigan.gov/documents/snyder/FWATF_FINAL_REPORT_21March2016_517805_7.pdf, p. 10.
[vii] *Executive Order No. 2016 - 9: Creation of the Child Lead Poisoning Elimination Board*, State of Michigan Executive Office (2016), http://www.michigan.gov/documents/snyder/Executive_Order_2016-9_524968_7.pdf.
[viii] *Michigan: Percentage of Children Less than Six Years of Age with Elevated Blood Lead Levels (EBLL) (≥5 µg/dL), 1998-2015*, MDHHS Data Warehouse, http://www.michigan.gov/documents/lead/Percent_EBL_1998_2015_11_14_16_541934_7.pdf (created August 11, 2016).
[ix] *Flint Water Interagency Coordinating Committee Resolutions 2016-05 through 2016-13: Resolutions in Response to the Flint Water Advisory Task Force Recommendations*, Flint Water Interagency Coordinating Committee (2016), http://www.michigan.gov/documents/snyder/20160826_FWICC_Resolutions_2016-5_thru_2016-13_in_Response_to_FWATF_Reco..._533638_7.pdf.
[x] The figure of 1.3 - 1.4 million Michigan housing units with active lead hazards was derived by cross-referencing data from the U.S. Census Bureau with a 2011 report from the U.S. Department of Housing and Urban Development (HUD) Office of Healthy Homes and Lead Hazard Control. Census data for the calculation came from American FactFinder - 2014 American Community Survey 5-Year Estimates. The segmentation of the housing units by "year built" in the Census data is slightly different than those used in the HUD report: 1980-2014, 1960-1979, 1940-1959, and <1940. Data tables referenced were: DP04 SELECTED HOUSING CHARACTERISTICS 2010-2014 American Community Survey 5-Year Estimates for Michigan and S2501 OCCUPANCY CHARACTERISTICS 2010-2014 American Community Survey 5-Year Estimates for Michigan. The April 2011 HUD report referenced is titled *American Healthy Homes Survey: Lead and Arsenic Findings* and can be found online at http://portal.hud.gov/hudportal/documents/huddoc?id=AHHS_Report.pdf.

Information boxes
[a] *Health in All Policies*, Centers for Disease Control and Prevention, http://www.cdc.gov/policy/hiap/ (last updated June 9, 2016).
[b] *Lead Residential Lead-Based Paint Disclosure Program (Section 1018 of Title X)*, U.S. Environmental Protection Agency, https://www.epa.gov/lead/lead-residential-lead-based-paint-disclosure-program-section-1018-title-x (last updated September 8, 2016).