



Health Department

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January 29, 2018

Honorable Tom Barrett, Mayor
Ashanti Hamilton, Common Council President
The Members of the Common Council
City of Milwaukee
Milwaukee, WI 53202

Dear Mayor Barrett and Common Council Members:

In early January 2018, the City of Milwaukee Health Department informed Mayor Tom Barrett of an ongoing assessment into potential mismanagement and shortfalls of the Department's Childhood Lead Poisoning Prevention Program. Upon notification, the Mayor requested that the Department immediately undertake efforts to better understand the scope of the issues and their impact on the Milwaukee community, including a full accounting of actions taken to date (provided at January 17, 2018 Steering and Rules Committee) in addition to a corrective action plan.

The following report details the results of this ongoing assessment to date, and outlines the program operations, findings, and recommendations for improvement.

Appreciation is expressed to all community partners who have offered their support and Department staff who have been diligently working behind the scenes to better understand the scope and address the problems. I look forward to working with you over the coming months to implement the recommendations described in this report, and extend the continued cooperation of the Department in further analysis of the issues identified.

Sincerely,

Angela Hagy, MSPH
Director of Disease Control & Environmental Health
City of Milwaukee Health Department

Think Health. Act Now!



City of Milwaukee Health Department Childhood Lead Poisoning Prevention Program

Assessment of Operations and Recommendations for Corrective Actions

January 29, 2018



Executive Summary

OVERVIEW

Lead was once used to make a variety of products commonly found in our environments, including our homes. However, lead is also a potent neurotoxin which has significant effects on childhood health and development. Even at very low levels of childhood exposure, many of these effects may persist into adulthood. It is the role of public health departments to mobilize resources at the local, county, state, and national level to increase community resources to prevention childhood lead poisoning.¹

The responsibility for childhood lead poisoning prevention is a shared responsibility across many sectors. Community agencies, health care providers, policymakers, funders, and others each have their roles.

The City of Milwaukee Health Department's primary responsibilities are to make policy recommendations, issue medical guidance to area clinicians specific to local circumstances, track the epidemiology of lead poisoning within city boundaries, provide primary prevention services commensurate with available funding, and provide mandated public health follow-up services to children under the age of 6 with elevated blood lead levels.

The purpose of this report is solely to assess the programmatic operations of the City of Milwaukee Health Department Childhood Lead Poisoning Prevention Program. A broader assessment of lead poisoning prevention efforts citywide is beyond the scope of this report. However, the Department suggests that the findings and recommendations in this report be used to drive a broader community discussion related to childhood lead poisoning prevention, and the capacity of its local government and community agencies to respond to local needs.

PROGRAM SUMMARY

Childhood lead poisoning prevention has been a key public health priority for the City of Milwaukee Health Department (MHD) for more than two decades. The MHD's lead-related activities are predominantly housed in its Division of Disease Control and Environmental Health and are divided into Primary Prevention (mitigating lead hazards before a child becomes exposed) and Secondary Prevention (mitigating lead hazards and minimizing adverse effects of health after a child has been lead poisoned) efforts.

There are many potential sources of childhood lead exposure. The most important are deteriorating lead-based paint (and its associated dust), lead in drinking water (in homes with lead service lines or plumbing), and lead in soil. The MHD prevention efforts include all three of these sources, and the Department's recommendations regarding prevention, including recommendations for blood lead testing and the prevention of lead exposure through paint, water, soil and other sources, remain consistent with – or more protective than – national recommendations.

FINDINGS

Despite significant progress, as shown in declines in the overall prevalence of childhood lead poisoning in the city of Milwaukee, this report finds that the City of Milwaukee Health Department Childhood Lead Poisoning Prevention Program is deficient in several areas of its Primary Prevention and Secondary Prevention Program activities.

The number of housing units that MHD provides paint (and soil) mitigation to has decreased substantially over the past six years (compared to the prior six-year period), as has funding available to the program. *This report finds that the MHD has significant opportunities to streamline and strengthen effective primary prevention efforts.*

Secondary prevention requires different levels of intervention, increasing in intensity as the blood lead level (BLL) increases. *This report finds that the MHD, through its secondary prevention efforts, has not provided the necessary level of assurance of appropriate follow-up to elevated BLLs during 2015-2017.*

RECOMMENDATIONS

The Department has identified multiple areas for improvement in departmental/divisional structure and operations, in primary prevention activities, in secondary prevention activities, and in policy development. These recommendations are detailed in Section 5 of this report.

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Section 1

The Public Health Significance of Lead

OVERVIEW OF LEAD POISONING

Lead exposure, even at low levels, has been shown to harm the developing brains and bodies of infants and young children. This includes increased behavior problems, impaired school performance, increased juvenile delinquency, and increased health problems such as speech and language delays, hearing problems, kidney damage, seizures, and in rare cases, death. Adults can also be exposed to lead; pregnant and breastfeeding women are a particular concern because of the risk of exposure to a developing baby.

The scientific understanding of lead toxicity has evolved over time. In 1960, developmental problems were recognized at blood lead levels above 60 micrograms per deciliter ($\mu\text{g}/\text{dL}$). As more scientific data became available, the cutoff level for “lead poisoning” was progressively lowered; for the past several decades, the cutoff was a blood lead level of $10 \mu\text{g}/\text{dL}$. Most recently, in 2012, the U.S. Centers for Disease Control and Prevention (CDC) lowered the reference level (level at which public health actions are recommended) from a blood lead level of $10 \mu\text{g}/\text{dL}$ to $5 \mu\text{g}/\text{dL}$. Although the reference level was lowered to $5 \mu\text{g}/\text{dL}$, the committee added that, “Because no measureable level of blood lead is known to be without deleterious effects, and because once engendered, the effects appear to be irreversible in the absence of any other interventions, public health, environmental and housing policies should encourage prevention of all exposures to lead.”ⁱⁱ

Reference levels are determined by evaluating the 97.5th percentile of blood lead distribution in children. As a result, the reference level will likely continue to be revised downward as the population blood lead levels falls.

SOURCES OF LEAD POISONING

There are many possible sources of lead exposure. Of these, deteriorating lead paint is generally considered to be the most important source of lead exposure in children, followed by two other important sources: drinking water and soil. Additional sources of lead exposure can include items such as food, cosmetics, pottery, medicines and more, as well as traditional or folk remedies.

Deteriorating lead-based paint and its associated lead-contaminated dust are the most common sources of lead poisoning. Paint containing lead was not banned in the United States until 1978. Homes built before 1978 may contain some lead-based paint, which can eventually chip, peel or flake. Young children are most vulnerable to this environmental hazard because they are more likely to ingest contaminated dust or objects due to their hand-to-mouth behaviors.

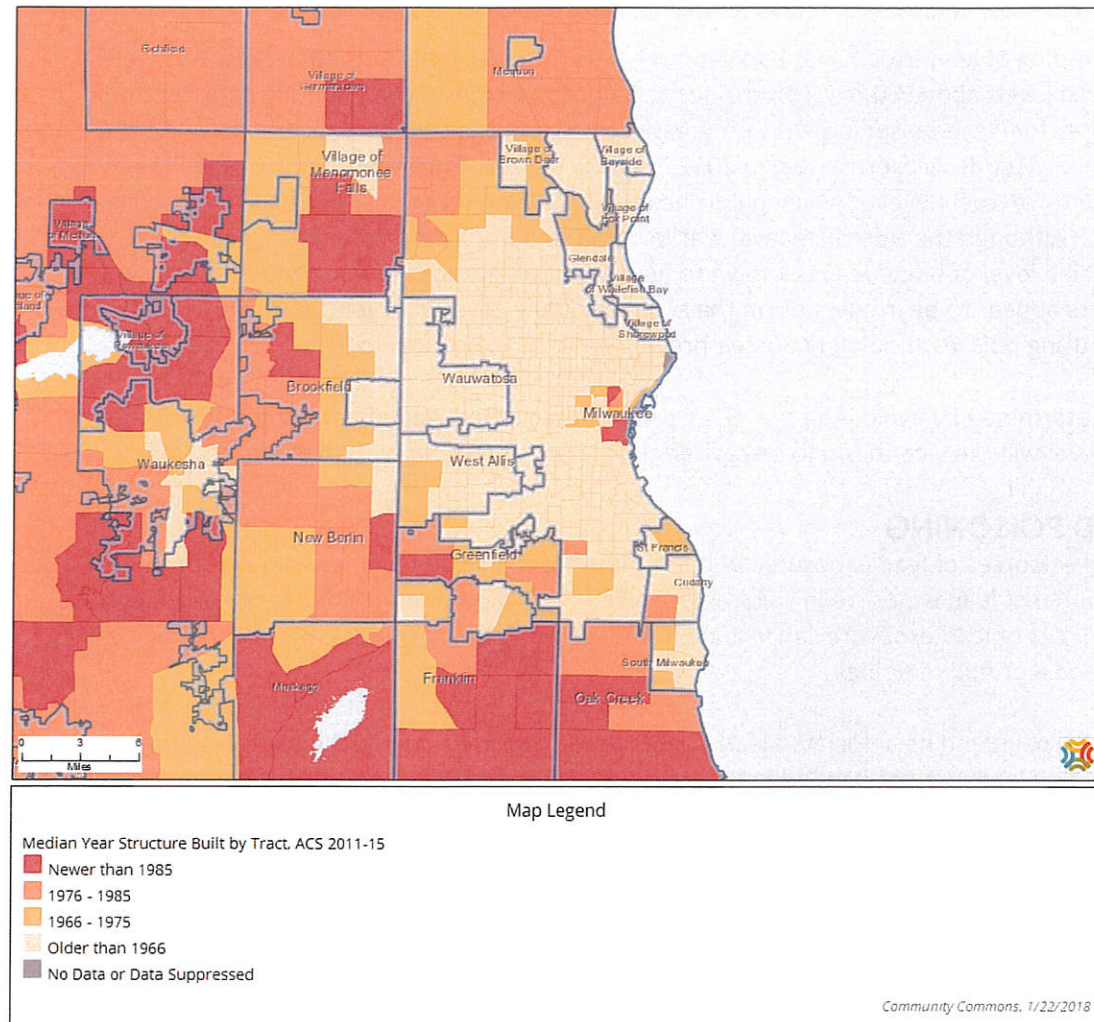
Table 1.1 shows the percentage of Milwaukee County housing units by date constructed. Figure 1.2 provides a visual distribution of that construction throughout Milwaukee County. Importantly, not only is nearly 62% of the housing stock in Milwaukee County built before 1960, more than 80% was built before 1978. This represents more than 100,000 residential structures.

Table 1.1 Percentage Housing Units by Age (Time Period Constructed)

Location	Before 1960	1960-1979	1980-1999	2000-2010	After 2010
Milwaukee County	61.9%	21.8%	10.9%	4.9%	0.6%
Washington County	23.6%	26.2%	32.2%	17.2%	0.9%
Waukesha County	24.3%	29.6%	31.6%	13.4%	1.2%
Wisconsin	37.3%	24.6%	23.9%	13.1%	1.1%
United States	29.2%	26.6%	27.7%	14.9%	1.6%

Source: Community Commons, US Census American Community Survey 2011-2015

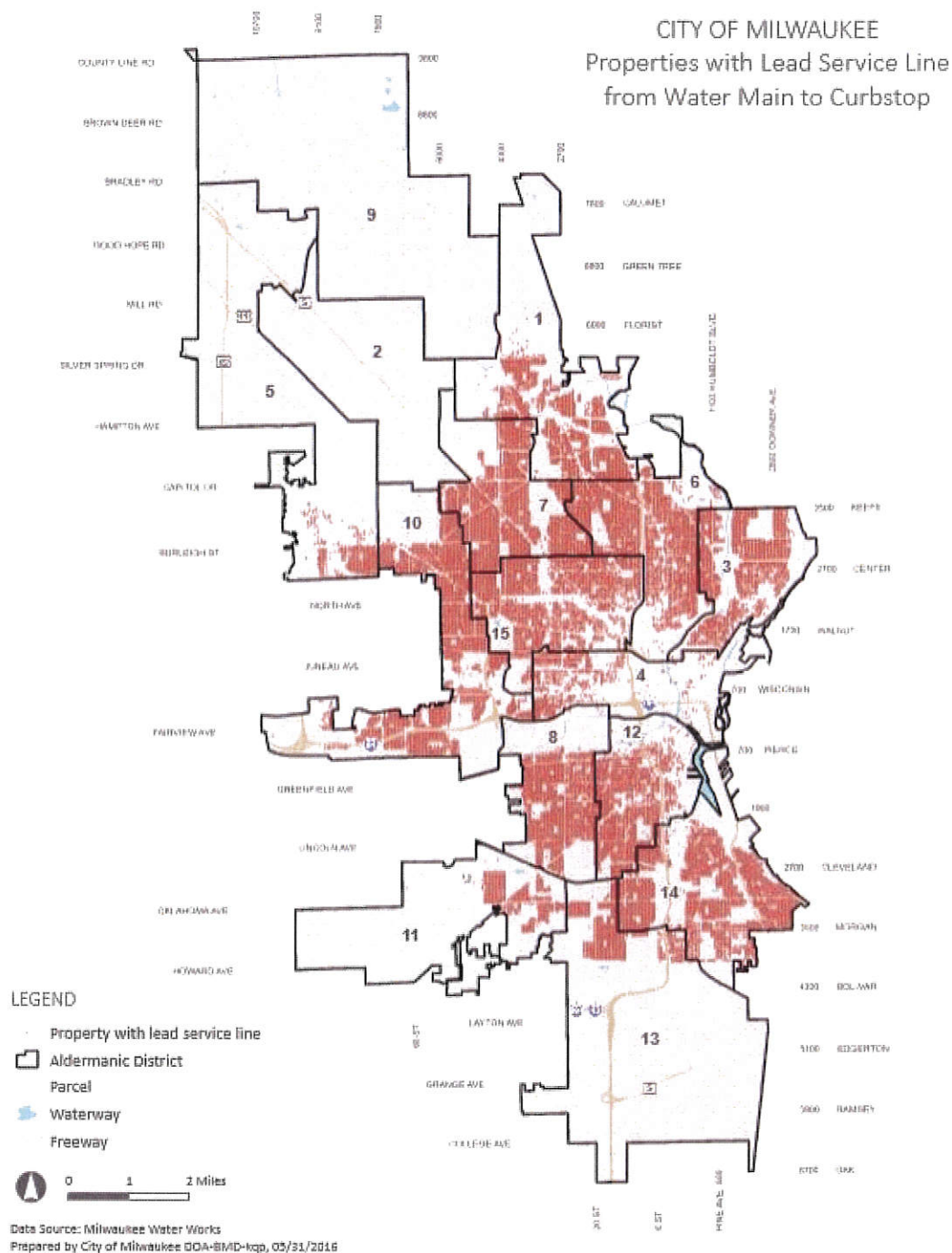
Figure 1.2: Median Year Structure Built by Census Tract, Milwaukee MSA



Another common source of lead exposure is drinking water. Lead may enter drinking water as the result of contact with pipes or plumbing fixtures containing lead. In the U.S., an estimated 6 to 10 million homes receive their water through lead service lines.ⁱⁱⁱ In the city of Milwaukee, more than 74,000 properties have active lead service lines, of those 93% are residential properties. Compared to the total 169,816 water services in the city, 46% are lead.^{iv} *Figure 1.3 provides a map of known lead service lines in Milwaukee.* The U.S. Environmental Protection Agency (US EPA) requires the use of corrosion control to reduce the risk of lead in drinking water, and

Milwaukee's drinking water remains in compliance with federal testing standards.^v To further reduce the risk of lead in drinking water, point-of-use filtration systems certified to remove lead are very effective, however the only effective long-term solution is the full removal of lead pipes and plumbing.

Figure 1.3: Map of Housing Units with Lead Service Lines by Zip Code



Children may also be exposed to lead through contaminated soil when they play outside. Lead in dirt can be encountered outside of a home, or tracked into a home where it clings to fingers, toys, and other objects children normally put in their mouths. Lead may contaminate soil as a result of industrial processes or from nearby buildings, structures, or roads. Soil contamination can also persist from past widespread use of leaded gasoline, even though leaded gasoline has been outlawed for several decades.

Additional sources of lead include some candies, toys, makeup, jewelry, clay pots, and home remedies that have been found to contain levels of lead that may have a serious health risks to children.

EPIDEMIOLOGY OF LEAD POISONING IN MILWAUKEE

Nationally, the prevalence of lead poisoning has declined significantly since the bans on lead-based paint, lead in plumbing, and lead in gasoline were enacted. However, environmental lead from these sources remains.

The following maps show the distribution of elevated blood lead levels (EBLL) for children under the age of 6 across the city of Milwaukee by ZIP code (Figure 1.5) and Aldermanic District (Figure 1.6). In 2016, EBLL were most dense in the following ZIP codes: 53205, 53206, 53208, 53210, 53212, and 53215. EBLL were most dense in the following aldermanic districts: 6, 7, 8, 12, and 15.

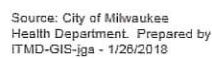
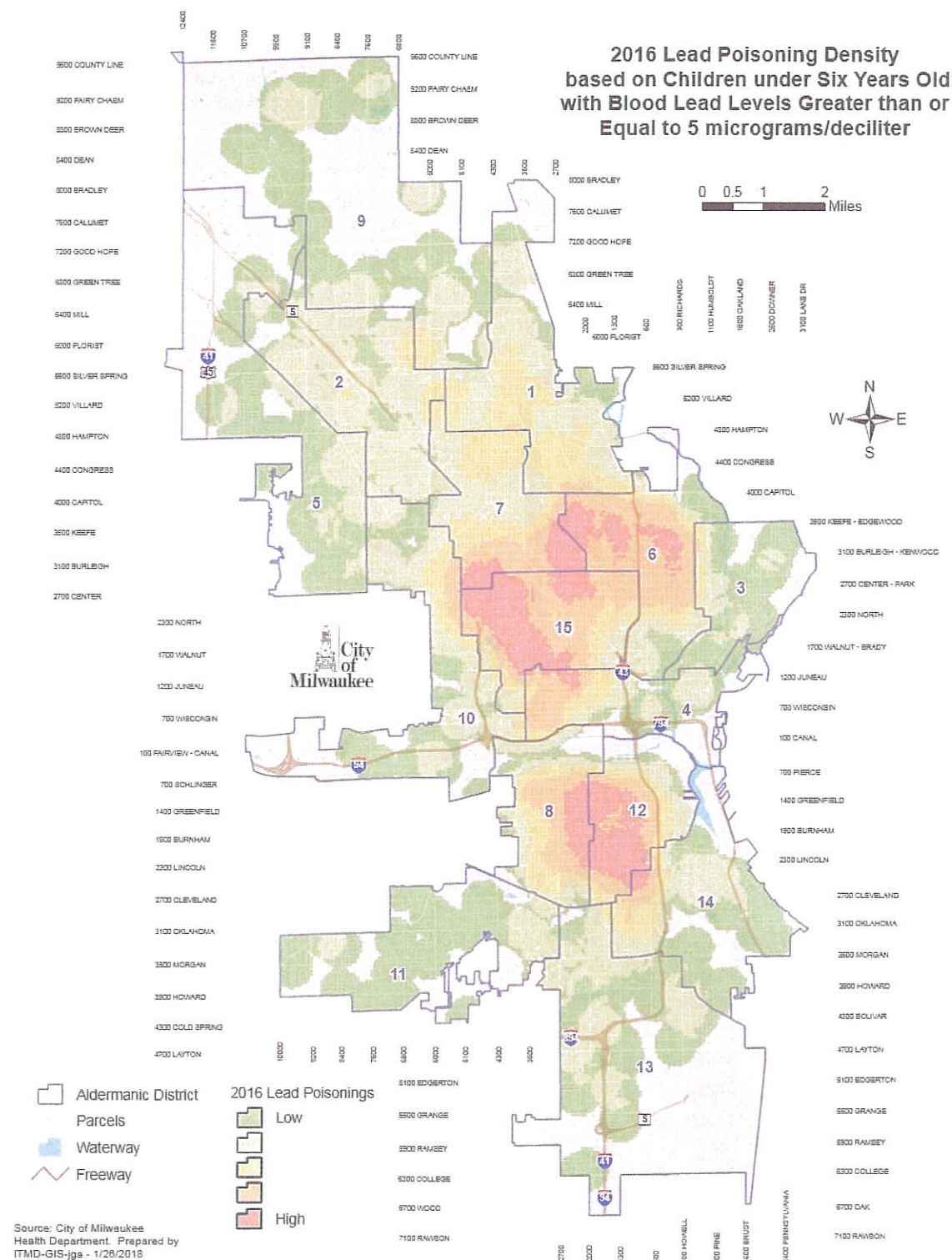


Figure 1.6: Map of Lead Poisoning Density by Aldermanic District, 2016



The city of Milwaukee has seen a significant decline in reported EBLL in recent years. In 1997, 31.9% of children tested had BLL greater than or equal to 10 µg/dL, whereas in 2016, 3.3% of children tested at this level. Although great progress has been made over the 20-year period, much work remains to eliminate BLL at or above 10 µg/dL, and far too many children remain exposed at a lower level of 5 µg/dL. Over a 14-year period, the prevalence of poisoning at this level decreased from 37.9% in 2003 to 11.6% in 2016. Figure 1.7 below demonstrates the BLL trends in the city of Milwaukee for those children tested between 1997 and 2016.

Figure 1.7: Prevalence Rate for Children 6 Years of Age & Younger, City of Milwaukee

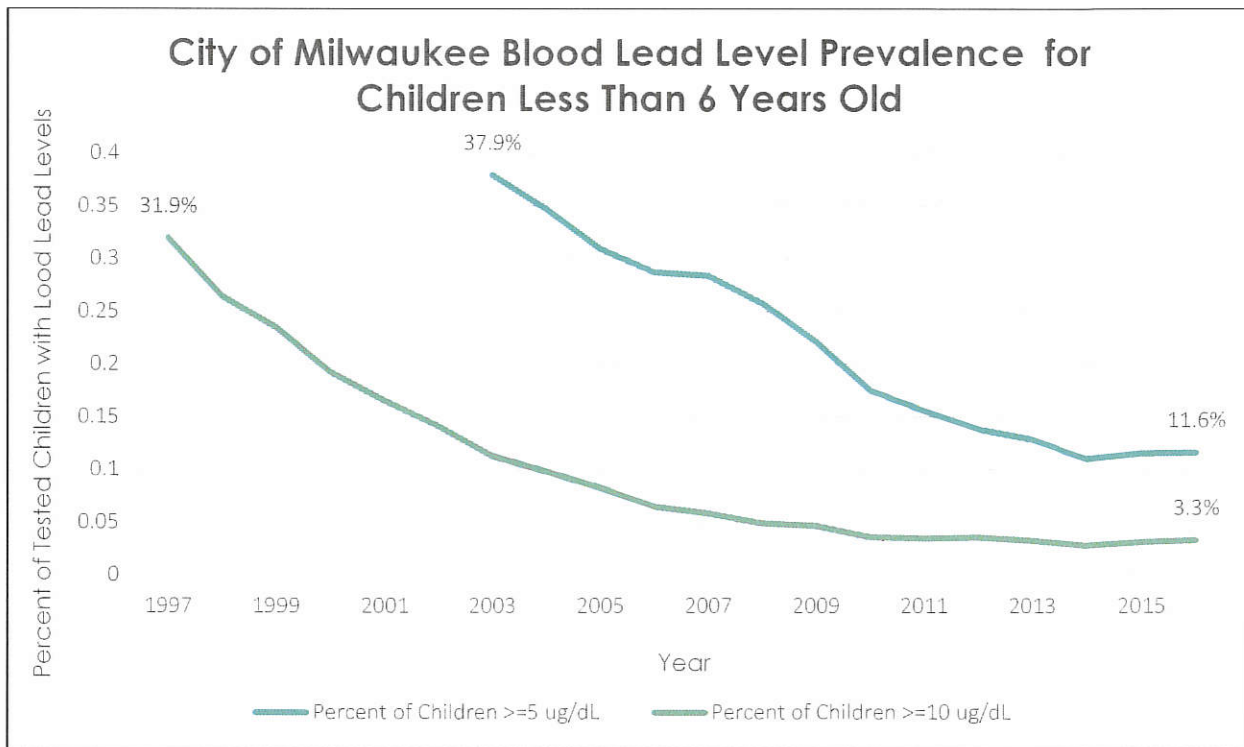
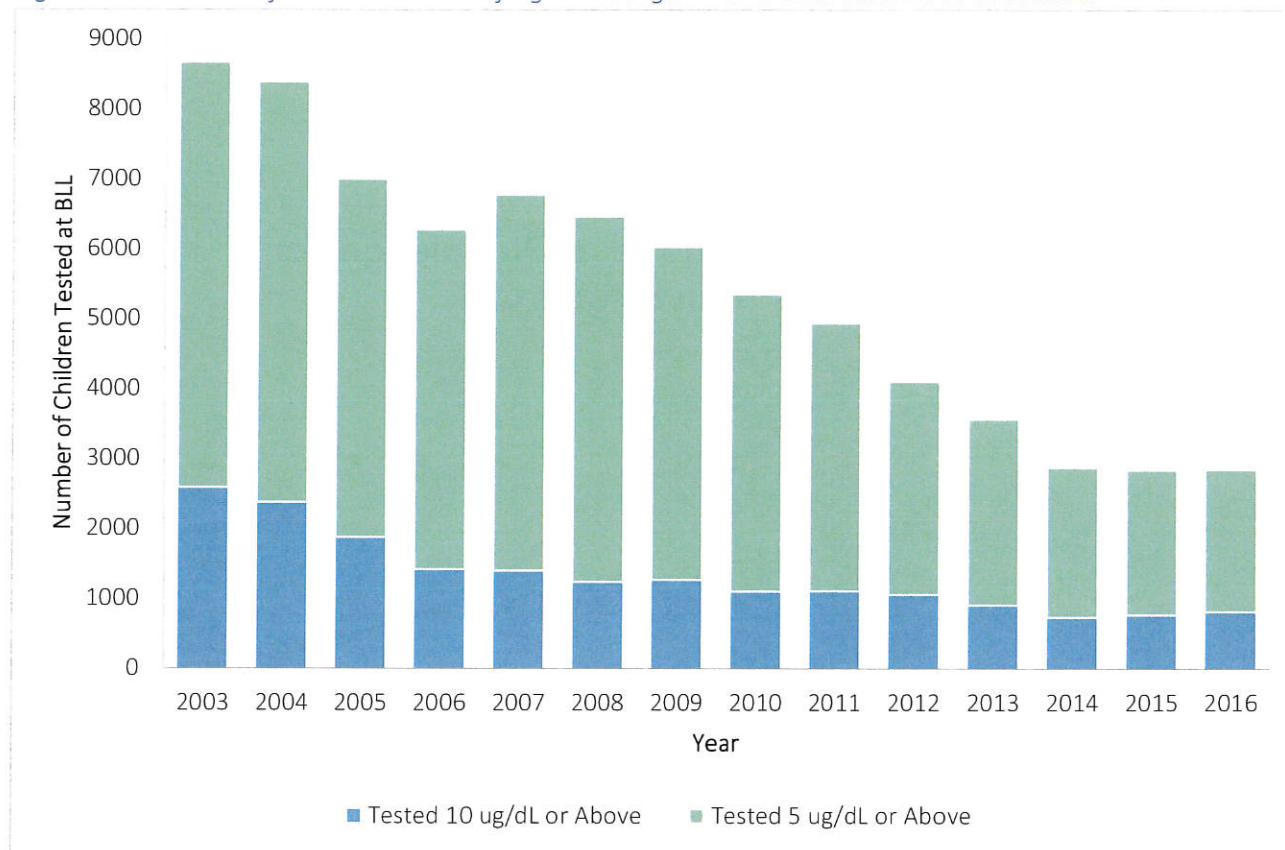


Figure 1.8 shows the number of children under the age of 6 who had EBLL at 10 µg/dL and 5 µg/dL between 2003 and 2016.

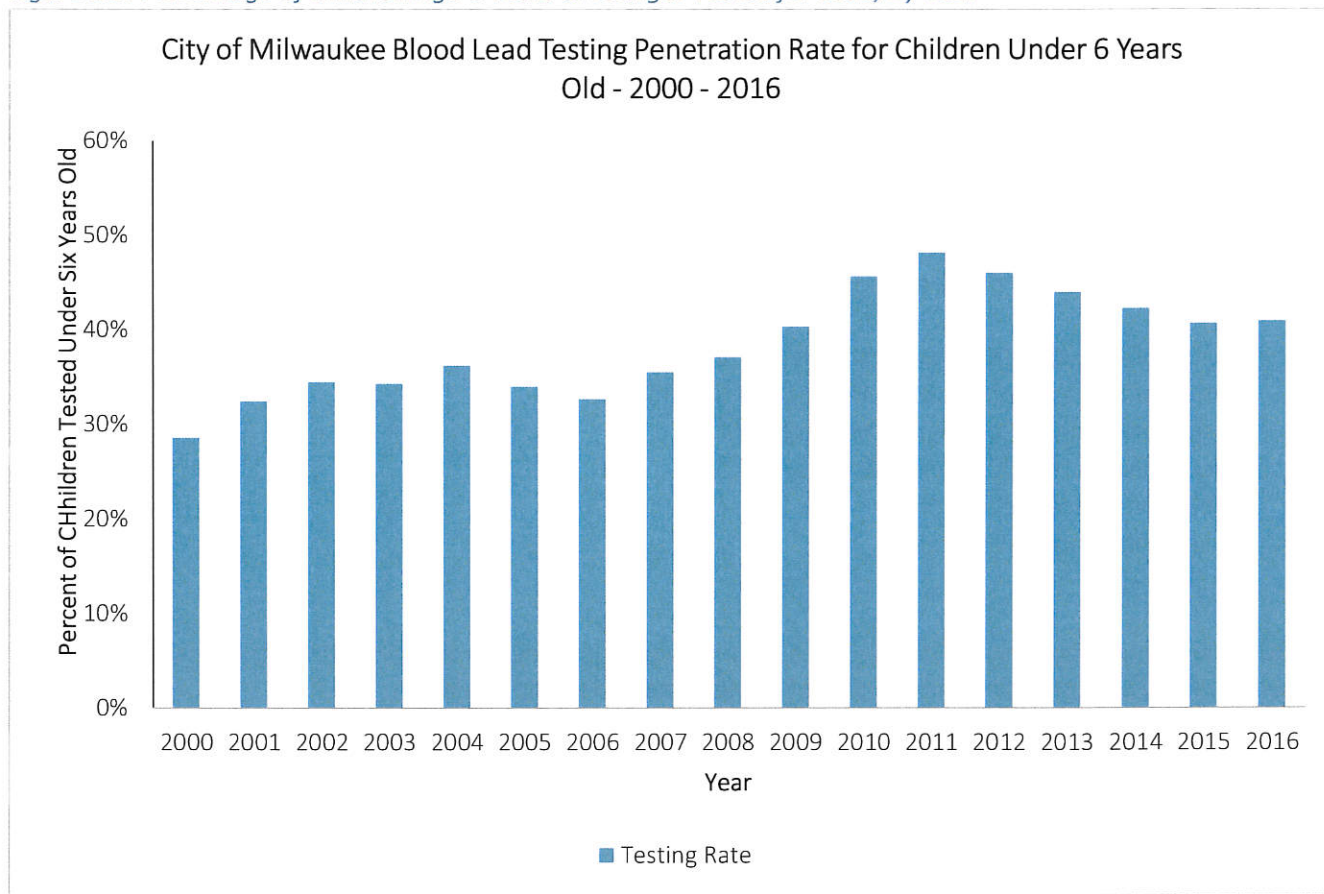
Figure 1.8: Number of Children 6 Years of Age & Younger with an Elevated Blood Lead Level



The MHD recommends that all children receive at minimum three blood lead tests before the age of 3. Typically, these tests are done by health care providers between the ages of 12 to 35 months. Approximately 64% of Milwaukee children under the age of 3 receive the recommended blood lead testing. Additionally, the MHD recommends that children under the age of 6 be tested if they have no record of a previous test, have a history of lead exposure, or if they are at greater risk for lead exposure. Current federal rules require that all children enrolled in Medicaid receive a blood lead test.

Figure 1.9 shows the number and the percent of children under the age of 6 who received a test during the reporting year. Over the past several years, between 40-50% of children under the age of 6 received a blood lead test.

Figure 1.9: Percentage of Children Age 6 Years & Younger Tested for Lead, By Year



Section 2

Department & Division Operations

This section provides a general overview of the City of Milwaukee Health Department (MHD) structure as well as within the Division of Disease Control and Environmental Health (DCEH). It is meant to provide context regarding departmental operations related to childhood lead poisoning prevention.

DEPARTMENT ORGANIZATIONAL STRUCTURE

The MHD carries out its mission through the provision of direct services, evidence-based programs, partnership development, and policy development through seven divisions and offices under the direction of the Commissioner of Health. The divisions and offices of the MHD are:

- Division of Consumer Environmental Health (CEH)
- Division of Disease Control & Environmental Health (DCEH)
- Division of Family & Community Health (FCH)
- Office of Public Health Planning & Policy
- Office of Violence Prevention
- Public Health Laboratory (Lab)
- Administration

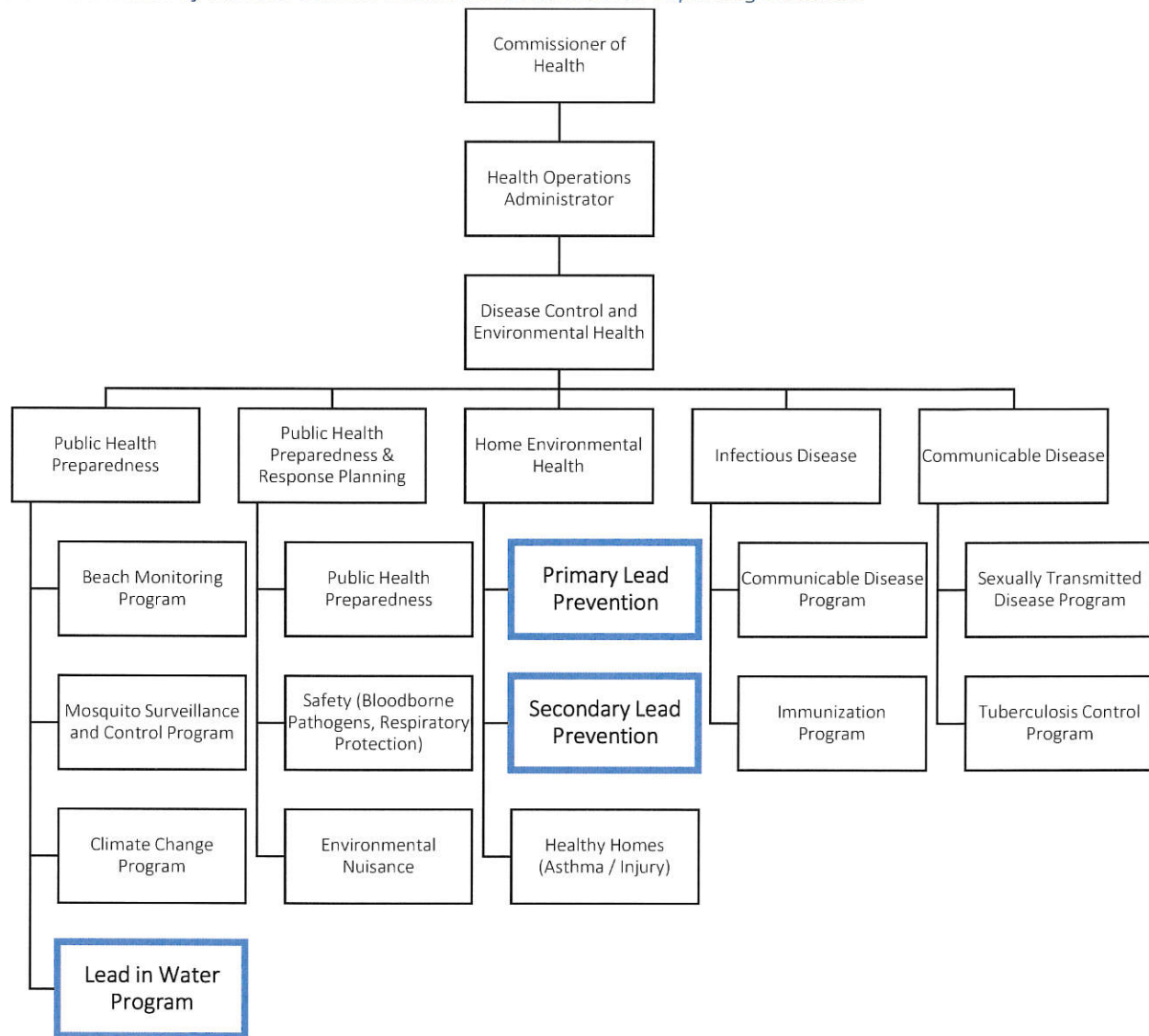
Additionally, medical consultation, guidance, and support is provided to the MHD through a partnership with the University of Wisconsin-Madison School of Medicine and Public Health.

Division Directors provide oversight to the programs and services within each functional division, and are responsible for assuring program activities, outcomes, and effectiveness. Division Directors are also responsible for assuring program policies are up to date and assuring program management and staff receive effective oversight. In turn, the Commissioner of Health is responsible for assuring Division Directors are carrying out their responsibilities, and for providing sufficient resources and support for the department to carry out its function.

DIVISION OF DISEASE CONTROL & ENVIRONMENTAL HEALTH ORGANIZATIONAL STRUCTURE

The Division of Disease Control and Environmental Health (DCEH) was formed by merging three previous divisions and currently operates a wide variety of programs and services (see Figure 2.1). Childhood lead poisoning prevention efforts are housed within this division in two distinct groups: Home Environmental Health and Public Health Preparedness. These efforts are also divided by focus area: Primary Prevention (controlling lead hazards before a child is identified with an elevated blood lead level); and Secondary Prevention (follow-up to reports of elevated blood lead levels from health care providers).

Figure 2.1: Division of Disease Control & Environmental Health Reporting Structure



PROGRAM STAFFING

The MHD Childhood Lead Poisoning Prevention program has approximately 20 staff divided across primary and secondary prevention activities. These staff are entirely grant funded and reported to a single manager. There are two other management-level positions within program, however these positions did not have any direct reports.

Additionally, lead-in-water activities were conducted by a 1.0 FTE tax-levy funded Environmental Disease Control Specialist who reported to a grant-funded manager. (Figure 2.2)

Figure 2.2: DCEH Structure Related to Lead, prior to June 2017

(Grant-funded positions are shaded in blue, tax-levy funded positions are shaded in gray)

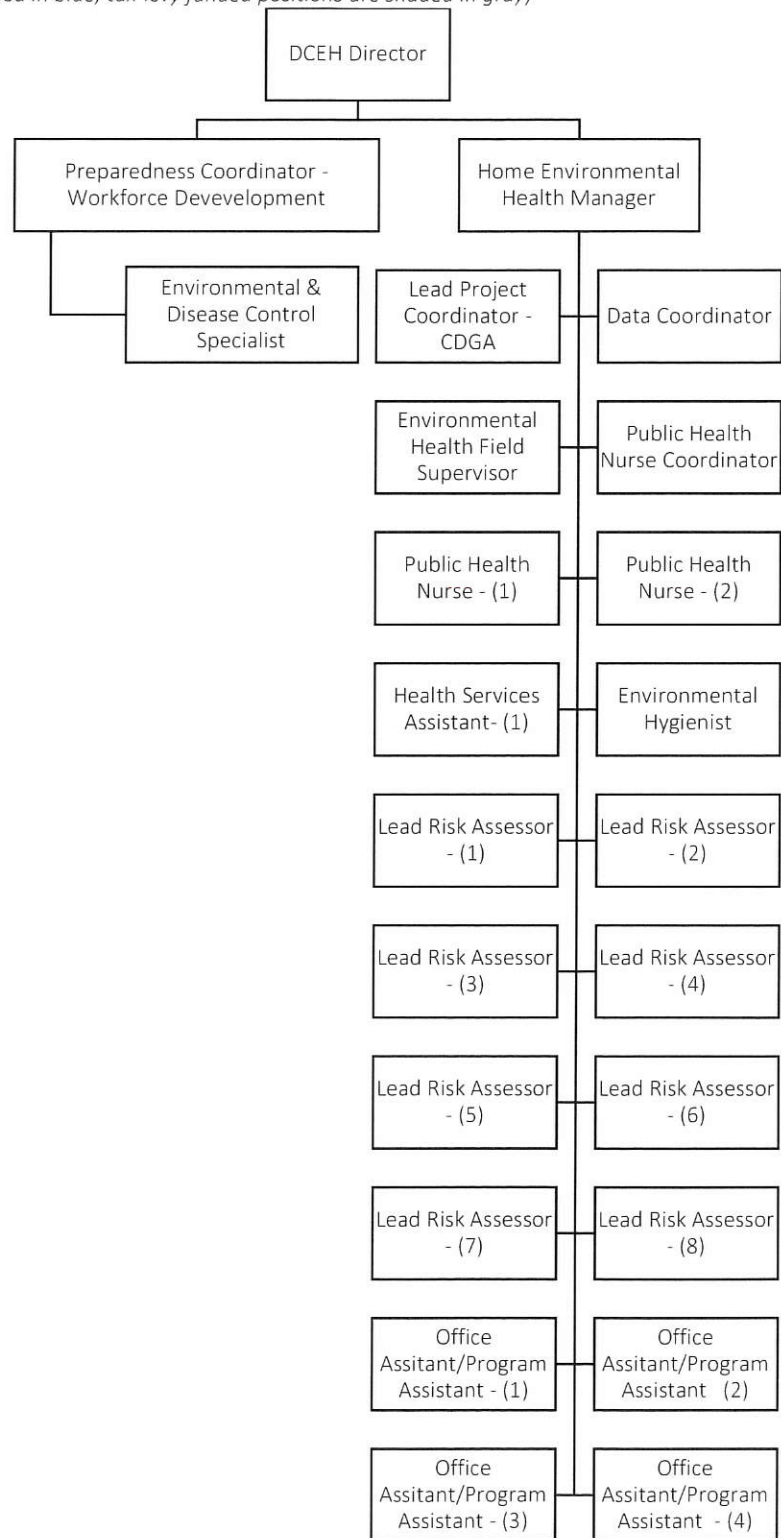


Table 2.3: Lead Staffing, 2006 to 2018*

Title	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Community Lead Program Mgr	1	1	0	0	0	0	0	0	0	0	0	0	0
Emergency Prep. Coord. - Workforce Dev.	0	0	0	0	0	0	0	1	1	1	1	1	1
Environmental & Disease Control Spec.	5	4	4	3	3	2.5	2.5	2	2	2	2	3	3
Environ. Health Field Supv.	1	1	1	1	1	1	1	1	1	1	1	1	1
Environmental Health Services Mgr.	0	0	0	0	0	0	0	0	0	0	0	0	1
Environmental Hygienist	1	1	1	1	1	1	2	1	1	1	1	1	1
Health Education Assistant	0	0	1	0	0	0	0	0	0	0	0	0	0
Health Project Coordinator	1	1	0	0	0	0	0	0	0	0	0	0	0
Health Services Assistant II	3.5	2.5	2	4	3	3	3	1	1	1	1	1	2
Home Environ. Health Mgr.	1	1	1	1	1	1	1	1	1	1	1	1	1
Lead Education Assistant	1	1	0	0	1	1	1	1	1	0	0	0	0
Lead Hazard Prevention Mgr.	1	1	2	1	0	0	0	0	0	0	0	0	0
Lead Program Information Specialist	1	1	1	1	1	1	1	1	1	1	1	1	1
Lead Project Coordinator (CDBG)	1	1	1	1	1	1	1	1	1	1	1	1	1
Lead Project Coordinator (LDG)	1	1	1	1	1	1	1	0	0	0	0	0	0
Lead Risk Assessor II	14	12	10	11	12	12	12	9	9	8	8	7	8
OA IV	0	0	0	0	1	1	1	0	0	0	0	0	0
OA III	3	3	3	3	3	3	2	2	2	2	1	1	1
OA II	1	1	1	1	1	1	0	0	1	1	2	2	2
PA I	1	1	0	0	0	0	0	0	0	0	0	0	0
PA II	3	3	2	2	2	2	2	2	2	2	2	2	2
PHN/PHN Coord.	5	5	4	4	4	4	3	3	3	3	3	3	3
PHN Supervisor	1	1	1	1	1	1		0	0	0	0	0	0
Public Health Educator II	1	1	1	1	1	1	0	0	0	0	0	0	0
Public Health Emer. Res. & Planning Co.	1	1	1	1	1	1	1	1	1	1	1	1	1
Total	48.5	44.5	38	38	39	38.5	34.5	27	28	26	26	26	28

Source: City of Milwaukee Budget Documents

*Includes all environmental health staff in the department other than Consumer Environmental Health as well as preparedness staff other than those assigned to communicable disease.

Table 2.3: Funding Allocated to City of Milwaukee Health Department Childhood Lead Poisoning Prevention Program Annually by Source, 2005-2018

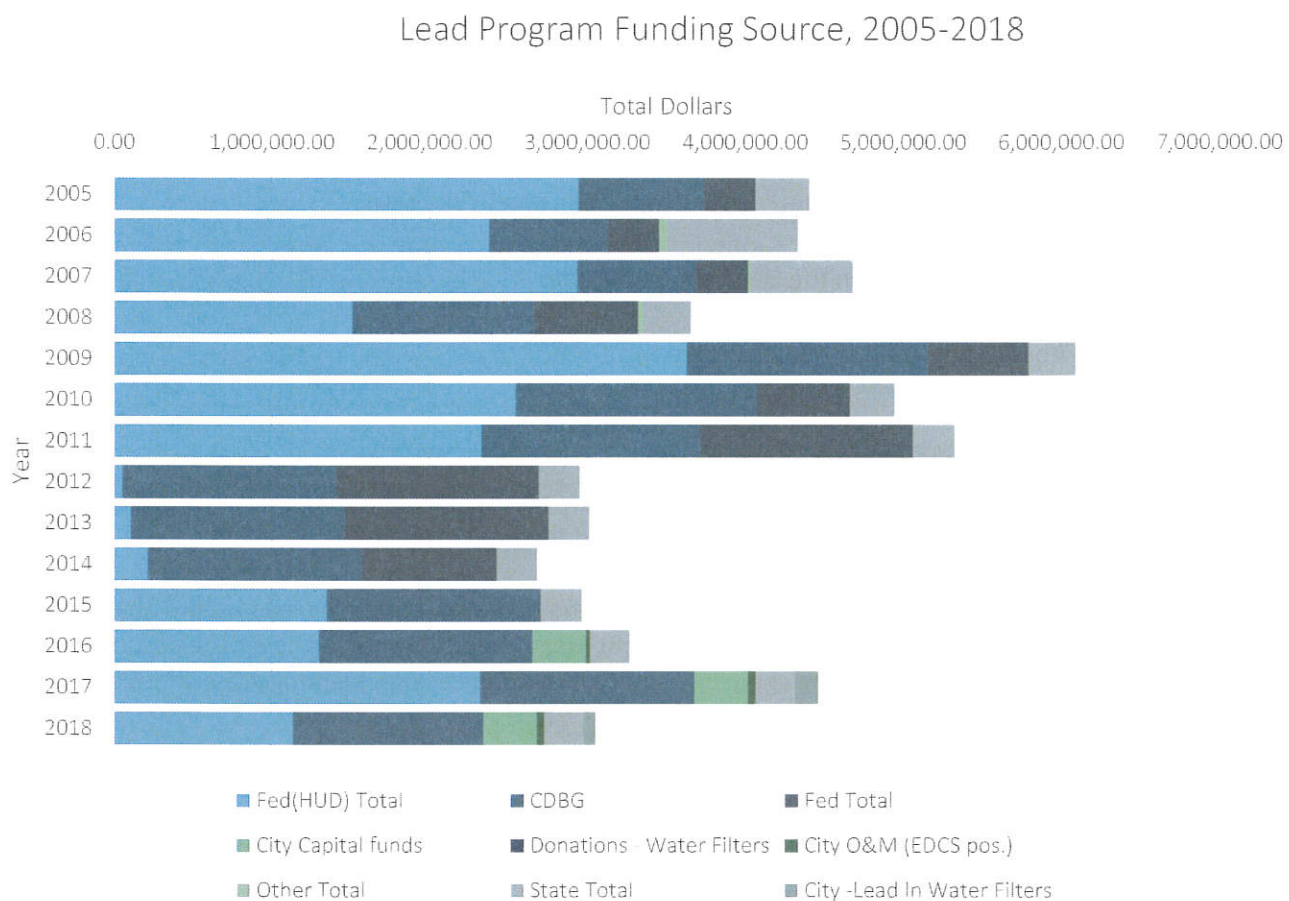
	City O&M (1)	City Capital	Water Filters		State (3)	Federal		CDBG	Other (5)	Total
			City	Donation		HUD	Non-HUD (4)			
2005					344,517	2,947,212	323,798	794,852		4,410,379
2006					830,976	2,383,080	323,798	750,063	50,000	4,337,917
2007					652,145	2,940,476	329,497	750,063	16,667	4,688,848
2008					302,337	1,514,286	653,270	1,155,484	33,333	3,658,710
2009					302,337	3,632,522	637,834	1,526,484		6,099,177
2010					283,596	2,549,189	592,039	1,526,484		4,951,308
2011					266,499	2,332,522	1,349,407	1,385,693		5,334,121
2012					261,492	52,564	1,285,714	1,357,993		2,957,763
2013					259,869	105,128	1,295,714	1,357,993		3,018,704
2014					259,869	213,461	857,143	1,358,000		2,688,473
2015					259,869	1,352,564		1,358,000		2,970,433
2016	23,333	340,000	Footnote (2)		251,134	1,300,000		1,358,000		3,272,467
2017	47,583	340,000	150,000	1,400	251,000	2,325,667		1,358,000		4,473,650
2018	47,583	340,000	75,000		251,000	1,134,000		1,210,977		3,058,560
Total	118,499	1,020,000	225,000	1,400	4,776,640	24,782,671	7,648,214	17,248,086	100,000	55,920,510

Footnotes:

- (1) S&W for 1 FTE Environmental & Disease Control Specialist
- (2) Purchase of 75,000 of water filters donated by community partners
- (3) Reflects Childhood Lead Detection grants & Child Lead Poisoning Prevention grants
- (4) Reflects Childhood Lead Poisoning Prevention grants & Lead Hazard Reduction Demolition grant
- (5) Reflects Bader Lead Abatement grant & DuPont Lead Safe Kids grant

*Purchase of \$75,000 of filters donated by community partners: United Way of Greater Milwaukee & Waukesha County, Aurora Health Care, Ascension Wisconsin, Children's Hospital of Wisconsin, and Froedtert and the Medical College of Wisconsin, with additional financial support from Aquasana, an A.O. Smith Company.

Figure 2.4: Lead Program Funding by Source, 2005-2018



Section 3

Primary Prevention

The City of Milwaukee Health Department (MHD) addresses childhood lead poisoning through two types of activities: Primary and secondary prevention efforts. Primary prevention involves actions to mitigate lead hazards *before* a child becomes exposed in order to reduce the risk to children who reside in the dwelling now and in the future, while secondary prevention efforts focus on mitigating lead hazards and minimizing adverse effects on health *after* a child has been reported as lead poisoned.

OVERVIEW

This section provides an overview of the primary prevention activities of the MHD.

Lead primary prevention activities within the Department include:

- Lead Hazard Abatement (Paint and Soil)
- Lead Hazard Abatement (Lead-in-Water Program)
- Lead Education and Awareness

LEAD HAZARD ABATEMENT (PAINT AND SOIL)

Since 1997 the MHD's lead hazard abatement efforts have made thousands of housing units in Milwaukee lead safe through enforcement efforts, innovative partnerships, and federal funding (see Table 3.1).

The program pays to abate lead hazards in the home to make the home lead safe. The lead hazard abatement program stretches the funds awarded to the program by requiring property owners to cover the cost of some of the abatement certain lead hazards (peeling chipping paint on walls and ceilings, planting grass or covering areas of bare soil) while grant funds pay for window replacement.

The following is the comprehensive list of MHD's eligibility requirements for the primary prevention program as of June 2017. The requirements were applied regardless of funding source even though many of the requirements were not required by the funder.

- Home must be located in the 53204, 53205, 53206, 53208, 53209, 53210, 53212, 53215 and 53216 zip codes
- Properties must be assessed at or under \$150,000
- Rental properties must have low-income tenants
- Owner-occupants must be low-income and have a pregnant woman or children under 4 years of age
- Vacant units must be made available to low-income families
- Property taxes must not be delinquent
- Properties must have no open building code violations
- Owner must be willing to pay \$30 per window plus \$57 permit fee
- Owner must be available for inspection with lead inspector
- Owner must be willing to abate other lead paint and soil hazards founds (water hazards are not included in the assessment or requirements for abatement)

Exceptions to the requirements were made on a case by case basis for properties with lead poisoned children. HUD specifically prohibits the use of grant funds for “Chelation or other medical treatment costs, including case management, related to children with elevated blood lead levels (EBLs).

As part of the program a property owner receives:

- A full lead risk assessment of the property, including X-ray fluorescence (XRF) testing and dust wipe sampling in compliance with HUD Chapter 5. A copy of the report is provided to the property owner.
- A grant of \$400 per window less the \$30 owner’s share, plus a onetime \$57 permit fee. (Note: The typical grant for a single-family home averages \$5,000 and for a duplex averages \$9,600).
- For families with diagnosed asthma, additional assessment services can be provided, with grants of up to \$5,000 for home improvements offered per unit to improve air quality and safety

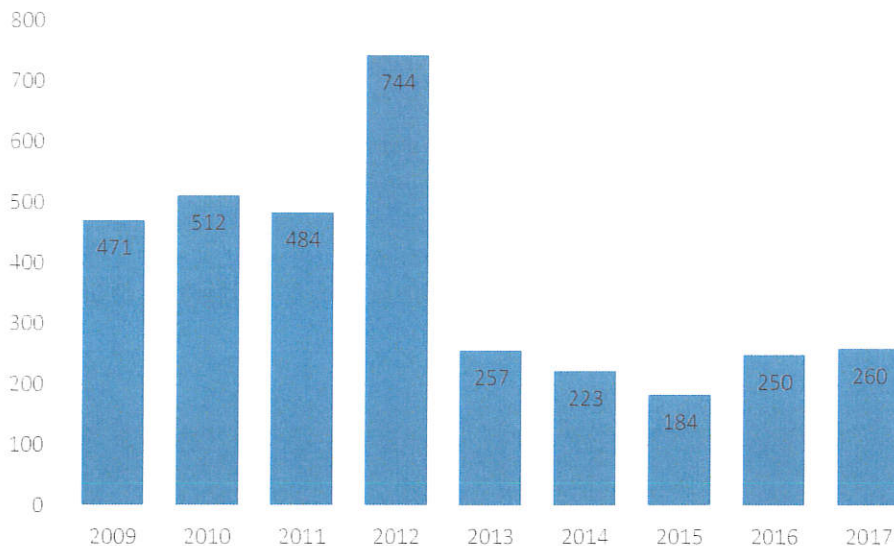
Table 3.1: Units Abated per Year by Funding Source and Total Program Funding, 2009 to 2017

Year	CDGA	City Capital Funding	HUD	Units Abated with Grant Funds	Total Privately Funded Projects	Total Units Abated	Total HEH Program Funding Available	Total HEH Funding Expended
2009	204	-	267	471	270	741	\$ 6,099,177	\$3,215,489
2010	154	-	358	512	243	755	\$ 4,951,307	\$3,628,554
2011	159	-	325	484	141	625	\$ 5,334,121	\$3,396,141
2012	106	-	638	744	163	907	\$ 2,957,763	\$4,828,725
2013	78	-	179	257	221	478	\$ 3,018,704	\$2,433,866
2014	93	-	130	223	212	435	\$ 2,688,473	\$2,013,153
2015	87	-	97	184	222	406	\$ 2,970,433	\$2,018,257
2016	89	25	136	250	200	450	\$ 3,272,467	\$2,406,660
2017	69	1	190	260	TBD	TBD		
Total	1,039	26	2320	3,385	1,672	4,797	\$31,292,446	

Source: Home Environmental Health Program Data

Abatement year is determined by year the project is started, 2017 data is still pending.

Figure 3.2: Units Abated Funded Under Departmental Lead Hazard Prevention Grants by Year, 2009 to 2017



FUNDING

The program is funded by two lead hazard reduction grants from HUD (2014 and 2016), two CDGA grants (abatement and prevention) and city capital funds. Refer to Table 2.3 for a breakdown of funding by source. *Note: HUD grant funds do not support soil abatement.*

Lead Hazard Reduction Grants (HUD)

The MHD lead hazard abatement activities are currently supported through two Lead Hazard Reduction Grants from the U.S. Department of Housing and Urban Development (HUD), a 2014 award and a 2016 award. The same reporting and administrative processes apply to each. Within each grant is an allocation of funds called Healthy Homes Supplemental, which focuses on safety and asthma control. The Healthy Homes funding is essentially a grant within a grant, with separate eligibility requirements. It is important to note to qualify for Healthy Homes funds you must first qualify for Primary Prevention Funds.

The 2014 Lead Hazard Reduction Grant awarded by HUD is for \$3,900,000 inclusive of the \$400,000 Healthy Homes Supplemental. The grant period is 12/1/14 to 11/30/17. There is a three month close out period where projects under contract by 11/30/17 can be completed and grant funds can be spent down through 11/28/18.

The 2016 Lead Hazard Reduction Grant awarded by HUD is for \$4,000,000 inclusive of the \$400,000 Healthy Homes Supplemental. The grant period is 11/1/16 to 10/31/19. There is a three month close out period where projects under contract by 10/30/19 can be completed and grant funds can be spent down through 1/31/19.

In both the 2014 and 2016 Lead Hazard Reduction Grants the entire \$400,000 Healthy Homes Supplemental was done as a sole source no-bid contract with the Housing Authority of the City of Milwaukee (HACM).

HUD assesses grant progress every quarter based upon three factors: 1) the number of assessments performed, 2) the number of units abated, and 3) the total grant expenditures. All three factors are assessed in comparison to the program's submitted project plan. While Healthy Homes Supplemental spending can impact the overall grant score, progress towards Healthy Homes assessments and abatements are not counted in the overall program score.

For the 2016 grant award, the program received multiple failing performance scores from HUD (see table below). The letters were emailed directly to the Commissioner, Program Manager, and Program Coordinator but not broadly shared outside the MHD until the third failing report was received in November.

Table 3.3: Obtainment of Failing HUD performance score (RED) Score

Date Received	Funding Quarter	Performance Period	Score
6/8/17	Y1 Q2	January to March 2017	46
9/22/17	Y1 Q3	April to June 2017	58
11/17/17	Y1 Q4	July to September 2017	65
TBD	Y2 Q1	October to December 2017	Pending

Community Development Block Grant (CDBG)

CDBG has three components. First, CDBG funding accounts for the City's required matching funds to HUD grant awards and is administered identically to the HUD program. Second, CDBG funds support the nursing and environmental follow-up to reported elevated blood lead levels (secondary prevention), which HUD funding cannot support per HUD stipulations.

LEAD HAZARD ABATEMENT (WATER)

Through its primary prevention activities, the MHD provides public health guidance to the City's Lead Service Line Replacement Program and operates a Drinking Water Filter Distribution Program.

Child Care Lead Service Line Replacement: As part of its efforts toward full lead service line replacement citywide, the City of Milwaukee is funding full lead service line (LSL) replacements at all licensed child care facilities in the city of Milwaukee. The MHD supports Milwaukee Water Works in this infrastructure project by assisting in outreach and education of licensed child care providers in Milwaukee. Both prior to and immediately after LSL replacement, the MHD offers drinking water filters certified to remove lead to each facility.

Table 3.4: Child Care Lead Service Line Replacement Project Metrics

Total child care facilities licensed in city of Milwaukee	360
Full replacement completed	146
Full replacement in progress/scheduled	110
No response to initial outreach	104

Water Filter Distribution Program: The distribution of point-of-use (POU) filtration devices is part of a comprehensive strategy to reduce exposure to lead through drinking water by vulnerable populations in the city of Milwaukee. In 2016, the MHD received funding from United Way of Greater Milwaukee & Waukesha County, Aurora Health Care, Ascension Wisconsin, Children's Hospital of Wisconsin, and Froedtert and the Medical College of Wisconsin to coordinate a pilot program for distribution of POU filtration devices certified to remove lead. The devices were distributed in coordination with external organizations and internal MHD programs. Eligibility for a free drinking water filter certified to remove lead through the Pilot Program required only that an individual reside at a home with a lead service line. Messaging through community organizations and media emphasized the recommended populations for filter use. The Drinking Water Filter Pilot Program distributed a total of 1,779 filters to Milwaukee residents. However, only 43% of the filters went to housing units where vulnerable populations resided.

Based upon analysis of the pilot program, the MHD modified its distribution program in 2017 to prioritize availability and access to the populations most at-risk for exposure to lead hazards. The 2017 program screens participants to identify if they live in a housing unit with a lead service line and are within the targeted vulnerable populations (children under 6 years of age, especially bottlefed infants, children with reported blood lead levels greater than 5 ug/dL, pregnant women, breastfeeding women, and women who may become pregnant). Additionally, the MHD has partnered with community-based organizations to provide targeted clientele with a voucher for a free drinking water filter certified to remove lead as well as lead safety educational materials. Filter voucher forms refer recipients to the Social Development Commission (SDC) to redeem their voucher.

Using a 2017 City Budget allocation of \$150,000, the MHD sought to distribute approximately 3,000 POU filtration devices in 2017. The program will continue in 2018 with a \$75,000 City Budget allocation while seeking additional private funding.

Table 3.5: 2016 Drinking Water Filter Pilot Program Distribution Data

2016 Pilot Filter Distribution		
Distribution Partner	# of Filters Received from MHD	# of Filters Distributed to Community
Social Development Commission	820	820
Sixteenth Street Community Health Centers	791	791
Department of City Development	15	0
MHD, Family and Community Health Services	129	0
Totals:	1,755	1,611

Table 3.6: 2017 and 2018 Drinking Water Filter Program Distribution Data

Filters Distributed 2017 through January 29, 2018		
Distribution Partner	# of Filters Received from MHD	# of Filters Distributed to Community
Sixteenth Street Community Health Centers	450	402
Social Development Commission	252	44
WIC - MLK Heritage	140	129
WIC - Wee Care	283	219
WIC - West Allis	66	47
WIC - 16th Street	75	75
Department of City Development	60	10
MHD, Lead Program	150	47
MHD, Disease Control & Environmental Health	278	203
MHD, Family and Community Health Services	75	30
MHD, Men's Health	24	13
MHD, WIC	650	550
Totals:	2,503	1,769

LEAD EDUCATION & AWARENESS

Historically, the MHD has conducted various awareness and education efforts to inform the public about lead hazards, lead poisoning prevention, and available programmatic resources. These efforts have included but are not limited to marketing and advertising, community events and presentations, and direct outreach to families and high-risk neighborhoods.

The program once had a position dedicated to lead education and community outreach. Graphic design and media outreach and awareness support services are conducted by MHD Communications staff in accordance with MHD Policy. MHD Communications staff have declined from 3.0 FTE to 1.0 FTE in recent years, limiting capacity. There is no dedicated MHD budget allocation for marketing or public awareness. In addition, funding for printing of education and promotional materials must adhere to grant funding requirements.

Most recently, the MHD partnered with Milwaukee Water Works to launch the Lead-Safe Milwaukee public awareness campaign.

Section 4

Secondary Prevention

The City of Milwaukee Health Department (MHD) addresses childhood lead poisoning through two types of activities: Primary and secondary prevention efforts. This section provides an overview of the secondary prevention activities of the MHD.

Secondary prevention is considered a response (or intervention) initiated after an elevated blood lead level is identified. A blood test is used to assess exposure to lead. There are two types of blood lead tests, a capillary (finger stick) test which is considered a preliminary test, and a venous (from the arm) test which is considered a confirmatory test. The type of intervention initiated depends upon the level of lead found in a child's blood and the type of test received (see Table 4.1). From a public health perspective, an intervention may include both a clinical component which entails management of the child and an environmental component management of the property.

OVERVIEW

Under Wisconsin State Statute 254.166, the MHD is obligated upon receipt of a report of a child under the age of 6 with single elevated blood lead level (EBLL) of 20 ug/dL or above, or two venous blood lead level of 15 ug/dL or above taken 90 days apart, to perform a thorough environmental investigation of the child's dwelling or premises in order to attempt to identify the source of the lead. It is important to note that this is different than the CDC case definition of an elevated blood lead level. Per the CDC, as of 2012 an elevated blood lead level is *"a single blood lead test (capillary or venous) at or above the reference range value of 5 µg/dL."*

A vast majority lead tests in Milwaukee are done by primary care providers. Primary care providers are expected to notify parents of the test results and provide appropriate follow-up recommendations. In addition, in Milwaukee all blood lead tests for children are required to be reported to the MHD, however the MHD should not be the sole source of notification to parents, as the primary responsibility for notification rests with the provider who orders the test.

The MHD does provide blood lead testing on a limited basis, for example, in the home as part of the MHD Primary Prevention Program and at events such as the MHD's annual Back-to-School Health Fairs. On average, the number of blood lead tests provided by the MHD totals less than 300 per year, or less than 1% of tests reported annually citywide. The MHD also operates a WIC program, which provides lead testing to clients according to WIC guidelines.

Table 4.1 MHD Intervention Levels for Children by Blood Lead Level, 2015 to 2017

Level	Status	Intervention
<5 µg/dL	All	No Intervention, level is not considered to be elevated
5 to 9 µg/dL	Confirmed	Letter with test result mailed to family providing educational materials, prevention information, and contact information for MHD to provide further information.
	Preliminary	
10 to 19 µg/dL	Confirmed	A Public Health Services Assistant conducts a home visit to provide educational information, a walk-through home assessment, and wet washing and/or HEPA vacuuming to remove immediate lead hazards. These services are delivered in the client's home until the service goals are met.
	Preliminary	Letter with test result mailed to family providing educational materials, prevention information, recommendation for confirmatory testing, and contact information for MHD.
20 to 39 µg/dL	Confirmed	A Public Health Nurse (PHN) conducts a home visit to provide educational information, conduct a growth and development assessment of the child, and provide ongoing monitoring of the child. The PHN will coordinate closely with a Lead Risk Assessor who will inspect the child's home for lead hazards. These services are delivered in the client's home until the service goals are met.
	Preliminary	A PHN should call to get the child retested. If the PHN is unable to contact the child a letter is sent.
≥40 µg/dL	Confirmed	At this level, an immediate MHD lead poisoning response will be initiated. A Public Health Nurse (PHN) conducts a home visit to provide educational information, conduct a growth and development assessment of the child, and provides ongoing monitoring of the child. The PHN will coordinate closely with a Lead Risk Assessor who will inspect the child's home for lead hazards. These services are delivered in the client's home until the service goals are met.
	Preliminary	A PHN should call to get the child retested within 48 hours with a confirmatory test. If the nurse is unable to contact over the phone, a home visit should be attempted.

TESTING DATA

Approximately 33,000 blood lead level (BLL) tests are reported to the MHD each year. Many children receive multiple tests in a given year, and some children older than 6 are also tested. Of those 33,000 tests, there are about 25,000 unique children under the age of 6 who receive at least one capillary or venous test each year. Capillary tests are considered preliminary while venous tests are considered confirmed. The following review focuses on these unique children.

Importantly, data used in this audit is based on a child's highest reported BLL, whether capillary or venous, in the given year. For example, a child could have received two tests within a year each within a different intervention category. This analysis captures the child's highest test.

<5 µg/dL

On average, between 2015 and 2017, approximately 23,000 (92%) of the 25,000 children who were tested annually had a highest blood lead level less than 5 µg/dL. Although private providers or clinics who order such tests are expected to notify parents of the results, MHD does not provide additional case management services for BLLs lower than 5 µg/dL.

5-9 µg/dL CASE MANAGEMENT

On average, between 2015 and 2017, approximately 2,000 of the 25,000 children who were tested annually had elevated blood lead levels (EBLL) between 5-9 µg/dL. In 2017, STELLAR records show that the MHD sent follow-up letters providing information and recommendations for recommended future testing to 72.2% (or 1,500 of 2,078) of children who had capillary or venous blood lead test results between 5-9 µg/dL. Data on the follow-up letters for this group is not well documented for 2015 and 2016. Based on the available data, 6,022 children should have received letters from the MHD over this three-year period, but electronic records document only 1,500 letters being sent.

Table 4.2: 5-9 µg/dL Case Management Services

	2015		2016		2017		Total 2015-17*
Total Tested, under 6	25,360		24,525		25,564		
	N	%	N	%	N	%	
5-9 µg/dL Case Rate	1,902	7.5%	2,042	8.3%	2,078	8.1%	6,022
Letter and Educational Materials Provided	--	--	--	--	1,500	72.2%	1,500
*Aggregate data should not be interpreted as unique cases. Only the highest reported test for a child is reported in each year, but children may be counted more than once when totaled across the three-year period). How to interpret this table (Examples based on 2017 data): - In 2017, 8.1% (or 2,078 of 25,564) of children tested had a highest reported blood lead level between 5 and 9 micrograms per deciliter. - In 2017, there is documentation that 72.2% (1,500 of 2,078) of children at this level received a letter and education materials from the health department.							

10-19 µg/dL CASE MANAGEMENT

Between 2015 and 2017 there were 1,897 children who had a highest reported BLL between 10-19 µg/dL (some preliminary and some confirmatory). Referrals for early intervention are based on confirmatory tests. Over 70% did not report a confirmatory test as their highest test result in that year and therefore may not have received a referral for an early intervention. On the other hand, many of these children may have had a confirmatory test that was lower than their preliminary test; these would not be reflected in this preliminary analysis. Of the 522 known confirmed cases of EBLL between 10-19 µg/dL, 44.8% (or 234 of 522) received a referral for early intervention. However, as the number of known confirmed cases increases with investigation, the percent who received referrals for early intervention services will decline further.

Table 4.3: 10-19 µg/dL Case Management Services

	2015		2016		2017		Total 2015-17*
Total Tested, under 6	25,360		24,525		25,564		
	N	%	N	%	N	%	
10-19 µg/dL Case Rate	598	2.4%	647	2.6%	652	2.6%	1,897
No Confirmatory Test Received	443	74.1%	459	70.9%	473	72.5%	1,375
Received Referral for Early Intervention	--	--	--	--	--	--	
Confirmatory Test Received	155	25.9%	188	29.1%	179	27.5%	522
Received Referral for Early Intervention	63	40.6%	58	30.9%	113	63.1%	234
*Aggregate data should not be interpreted as unique cases. Only the highest reported test for a child is reported in each year, but children may be counted more than once when totaled across the three-year period). How to interpret this table (Examples based on 2017): • In 2017, 2.6% (or 652 of 25,564) of children tested had a highest reported blood lead level between 10 and 19 micrograms per deciliter. • Of the 652 children, only 27.5% (or 179 of 652) reported a confirmatory test as their highest test. • 63.1% (or 113 of 179) of the confirmed cases received a referral for an early intervention. The early intervention includes education, HEPA vacuuming, wet washing, and/or capillary blood lead testing.							

20-39 µg/dL CASE MANAGEMENT

Less than 1% of children under the age of 6 who received a BLL test had highest reported blood lead levels between 20 and 39 µg/dL. The majority (69.2% or 320 of 465) of cases did not report a confirmatory test as their highest test result in that year and therefore may not have received public nurse case management. On the other hand, many of these children may have had a confirmatory test that was lower than their preliminary test; these would not be reflected in this preliminary analysis. Of the 145 known confirmed cases, 97.9% (or 142 of 145) received a referral for case management. However, as the number of known confirmed cases increases with investigation, the percent who received referrals for early intervention services will decline further.

During the initial audit, MHD nurses reviewed each case management file for 20-39 µg/dL cases, 14 additional cases were flagged as potentially needing additional follow-up and subsequently received a referral for additional PHN case management outreach.

Table 4.4: 20-39 µg/dL Case Management Services

	2015		2016		2017		Total 2015-17*
Total Tested, under 6	25,360		24,525		25,564		
	N	%	N	%	N	%	
20-39 µg/dL Case Rate	143	0.6%	148	0.6%	174	0.7%	465
Highest Reported Test was Capillary	98	68.5%	97	65.5%	125	71.8%	320
Not Eligible for PHN case management referral							
Highest Reported Test was Venous	45	31.5%	51	34.5%	49	28.2%	145
Received Referral for PHN Case Management	45	100.0%	50	98.0%	47	95.9%	142
Received Referral for Additional PHN Case Management based on audit	2		7		5		14
*Aggregate data should not be interpreted as unique cases. Only the highest reported test for a child is reported in each year, but children may be counted more than once when totaled across the three-year period). How to interpret this table (Examples based on 2017): • In 2017, 0.7% (or 174 of 25,564) of children tested had a highest reported blood lead level between 20 and 39 micrograms per deciliter. • Of the 174 children, only 28.2% (or 49 of 174) reported a confirmatory test as their highest test. • 95.9% (or 47 of 49) of the confirmed cases received a received case management from the department. ○ During an initial electronic chart audit, 5 cases (5 of 49) were identified as needing additional follow-up.							

GREATER THAN 40 µg/dL CASE MANAGEMENT

The greater than 40 µg/dL intervention category includes the most severe cases of EBLL, and as a result a more robust audit is being completed. This audit required nurses to search each case file that had a highest reported EBLL greater than 40 µg/dL to determine if proper case management referrals were made. During this review, 54 cases had a preliminary or confirmed EBLL of 40 µg/dL or higher. However, some cases that were originally considered preliminary were found to be confirmed at this level while others were confirmed at lower intervention levels. A few remained preliminary.

Specifically, between 2015 and 2017, the more robust audit resulted in 11.1% (or 6 of 54) still being considered preliminary at greater than 40 µg/dL. The remaining 48 cases were considered confirmed and 100% (or 48 of 48) received a referral for case management services. However, during the review, an additional 12 cases were flagged by nurses as potentially needing additional follow-up and subsequently received a referral for additional PHN case management outreach.

Table 4.5: Greater than 40 µg/dL Case Management Services

	2015	2016	2017	Total
--	------	------	------	-------

							2015-17*
Total Tested, under 6	25,360		24,525		25,564		
	N	%	N	%	N	%	
Greater than 40 µg/dL Case Rate	15	0.1%	14	0.1%	25	0.1%	54
Only Reported Test was Capillary	0	0.0%	1	7.1%	5	20.0%	6
Record of PHN Outreach Attempts							
Highest Reported Test was Venous	15	100.0%	13	92.9%	20	80.0%	48
Record of PHN Outreach Attempts	15	100.0%	13	100.0%	20	100.0%	48
Received Referral for Additional PHN Case Management based on audit	0		2		10		12
*Aggregate data should not be interpreted as unique cases. Only the highest reported test for a child is reported in each year, but children may be counted more than once when totaled across the three-year period). How to interpret this table (Examples based on 2017): • In 2017, 0.1% (or 25 of 25,564) of children tested had a blood lead level (i.e. capillary or venous) greater than 40 micrograms per deciliter. • Of the 25 children, 80.0% (or 20 of 25) had a confirmatory test. • 100.0% (or 48 of 48) of the confirmed cases received a received case management from the department. ○ During the electronic chart audit, 10 cases (10 of 20) were identified as needing additional follow-up.							

CHELATION

Children with BLLs of 45 µg/dL or above qualify for chelation therapy. Chelation, which can be done in a hospital or at home, is a medical technique to remove lead from the body. During 2015-2017, approximately 32 Milwaukee children received chelation. It is imperative that children receiving therapy return to a lead-safe home environment, and MHD is responsible for assuring that. In at least two cases during 2015-2017, that was not assured. Additional, intensive investigations are underway to carefully assess the records for other children who received chelation to determine that appropriate protocols were followed with regard to case management and a lead-safe home environment.

ENVIRONMENTAL INVESTIGATIONS

Environmental investigations are initiated at a confirmed BLL of 20 µg/dL. The scope of these investigations depends on the degree of BLL elevation. An environmental investigation seeks to identify the primary source(s) of lead in the child's immediate or secondary environments.

With regard to water, both CDC and HUD are consistent on their recommendations which are as follows "Drinking water in older housing should be tested as a source of lead exposure when the local drinking water system is not

in compliance with LCR or when another source of lead exposure cannot be identified for children with high BLLs.”

Table 4.6: Statutorily Required Environmental Investigations

	2015	2016	2017	Total
Total Number of Addresses where Environmental Investigations Required by State Statute	105	98	117	320
Addresses with a Physical Record of an Environmental Investigation referral	68	75	58	201
Addresses with no Physical Record of an Environmental Investigation referral	37	23	59	119
Addresses with an Electronic Record of an Environmental Investigation referral	32	18	39	89
Addresses with an EBL of ≥ 40	7	1	5	13
Addresses with an EBL of 20-39	23	16	34	73
Addresses with an EBL of 15-19	2	1	0	3
Addresses with no Electronic Record of an Environmental Investigation referral	5	5	20	30
Addresses with an EBL of ≥ 40	0	0	6	6
Addresses with an EBL of 20-39	2	1	8	11
Addresses with an EBL of 15-19	3	4	6	13

- An audit of environmental investigations is still taking place.
- Based on preliminary data, 320 housing units between 2015-2017 should have received an investigation based on the State of Wisconsin statutory requirements.
 - This includes all reported addresses based on venous cases 20 and above and two venous cases 15-19 more than 90 days apart.

Based on an initial audit of paper records, 62.8% (or 201 of 320) units had paperwork indicating that an environmental investigation was referred and attempts were made.

Section 5

Findings & Recommendations

Based on a preliminary assessment of program activities, this report outlines a series of findings and recommendations in the MHD's Childhood Lead Poisoning Prevention Program. These findings and recommendations are divided into four sections: A) Department/Division Structure and Operations; B) Primary Prevention Activities; C) Secondary Prevention Activities; D) Policy Recommendations.

A. DEPARTMENT / DIVISION STRUCTURE AND OPERATIONS

The following findings and recommendations are based on section 2 of this report.

Finding A.1: Program capacity was limited due to both insufficient staffing and existing staff responsibilities not reflecting functional duties.

Between 2006 and 2018 the number of FTEs assigned to program-related activities was reduced by 19.5 FTEs (reduction of 6 FTE Lead Risk Assessors, 2 FTE Public Health Nurses, 1.5 FTE Health Services Assistant, etc.). In part, this was due to reductions of grant funding; however, generalists within the environmental program have historically been vulnerable to departmental budget proposals developed to meet reductions in funding allocations. Even if the program was fully staffed, there is still insufficient capacity to follow up on the number of cases at each of the proposed elevated blood lead level interventions.

Furthermore, staff capacity was not maximized due to out-of-date job descriptions and functional duties. For example, a review of the public health nurse coordinator job description revealed lack of requirement to do field work, even though home visiting is a critical requirement of lead case management.

Grant funding is overly relied on and basic foundational infrastructure within the department has not been maintained. This makes it difficult to meet community needs of a program with statutorily required services.

Recommendation A.1.1: Review and revise job descriptions to ensure they reflect the qualifications needed to fulfil the job and describe accurate job duties.

Implementation status: In progress.

Recommendation A.1.2: Recruit for and fill vacant management, environmental, and nursing positions.

Implementation status: In progress.

Recommendation A.1.3: Explore implementation of a community health worker program to assist with follow-up of EBLs at low levels.

Implementation status: In progress.

Finding A.2: Program staff are inadequately trained for job duties. In addition, the program has insufficient policies and procedures in place to support ongoing program operations.

Well-defined orientation and training curriculums do not exist for any positions within the program. Instead, training was provided largely by coworkers on an ad hoc basis, resulting in insufficient and inconsistent training for staff members. Program policies and procedures were also incomplete (lacking sufficient detail to perform the task), outdated (some were more than a decade old), or non-existent. In addition, changes to policies and procedures were often made verbally during staff meetings and not documented in writing. Staff training on procedures was also inconsistent and often not documented. Staff were not cross-trained and lacked an understanding of how their role supported larger program goals and objectives.

Recommendation A.2.1: Develop and implement an orientation and training curriculum for all program staff (Lead Risk Assessors, Nurses, Health Services Assistants).

Implementation status:

Recommendation A.2.2: Draft and/or revise program policies and procedures, and maintain compliance with the MHD's policy 100-600-PP, Developing and Maintaining Written Policies and Procedures requiring review every 24 months.

Implementation status: In progress.

Recommendation A.2.3: Create a system to ensure that staff have received revised policies and procedures and have adequate training to follow the procedures.

Implementation status:

Recommendation A.2.4: Develop and implement periodic joint field assessments with the supervisor to ensure quality service provision.

Implementation status:

Recommendation A.2.5: Train all primary prevention lead risk assessors and environmental and disease control specialists on secondary prevention case investigation.

Implementation status: In progress.

Finding A.3: Program infrastructure decreased program accountability.

STELLAR, the system used by the program for data collection, does not meet the program's needs. Not only are time parameters unavailable, but multiple data extractions are required and additional data analysis software is needed to get even basic information on key performance measures. Additionally, environmental investigation documentation within the system is virtually nonexistent, which means that some files for the program are on paper while others are electronic. Furthermore, the system cannot be used to issue permits nor can it be used to issue orders.

Recommendation A.3.1: Work to implement new data system for tracking EBLs (Healthy Housing in Lead Poisoning Surveillance System, HHLPS), EBL case management and EBL environmental investigations.

Implementation status: In progress, spring 2018

Recommendation A.3.2: Develop and implement a performance management dashboard to regularly monitor key performance measures and program statutory requirements.

Implementation status: In progress.

Recommendation A.3.3: Explore the Implementation of Healthspace for lead permitting and order writing.

Implementation status: In progress.

Recommendation A.3.4: Request technical support from the State of Wisconsin or the CDC to further assist in auditing the program data.

Implementation status: In progress.

Recommendation A.3.5: Create a routine auditing schedule. Partner with other state or local units to audit files and procedures to identify deficiencies.

Implementation status:

Recommendation A.3.6: Program staff, program managers, and division managers must be held accountable for assuring that program activities are carried out, and that program objectives and requirements are being met.

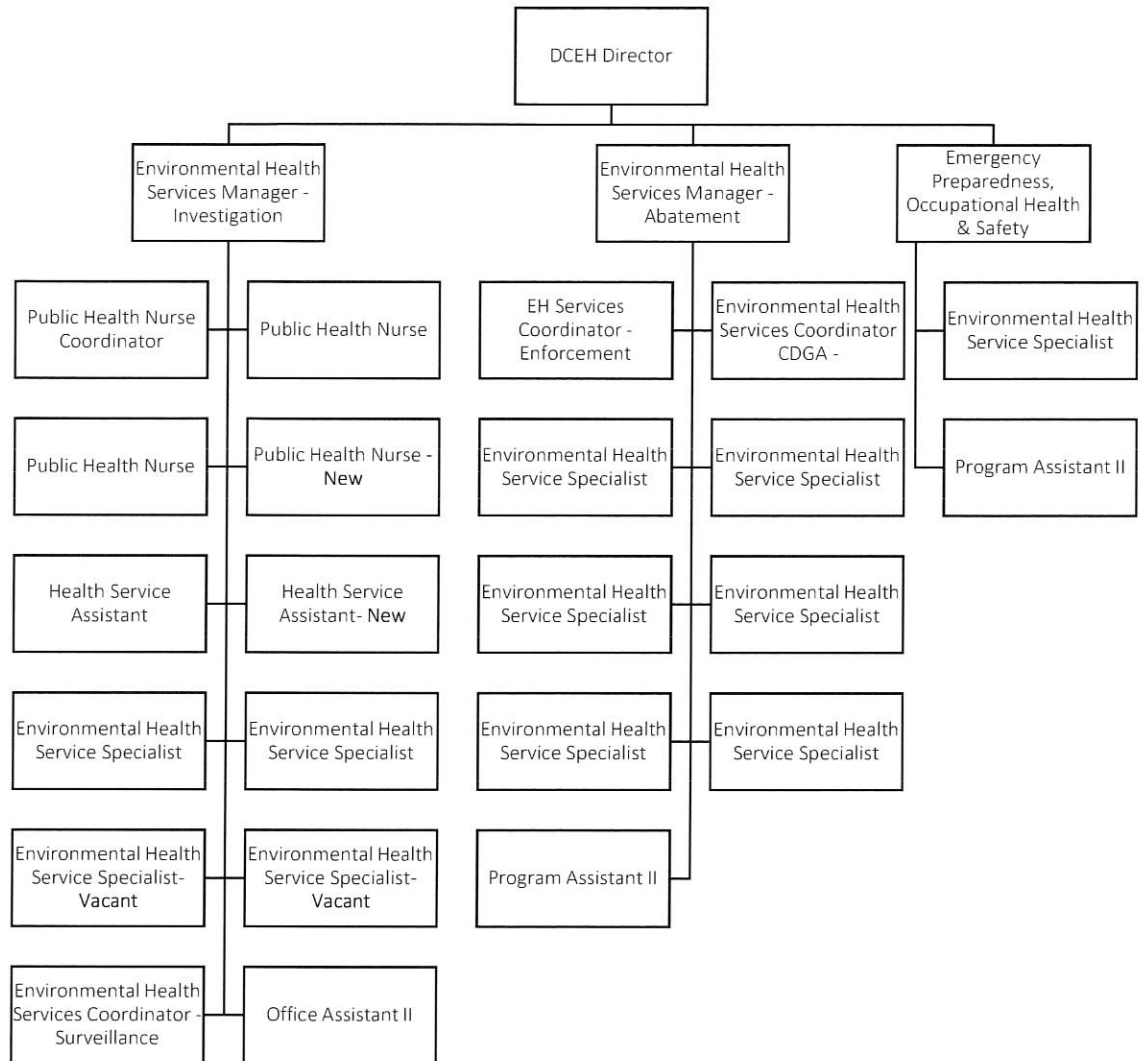
Implementation status:

Finding A.4: Department Primary and Secondary Prevention activities were not fully coordinated and integrated.

Staff within the program were based out of separate locations, and operated in almost complete isolation of one another. This resulted in a lack of integration between primary and secondary prevention activities, as well as a lack of oversight and accountability for the program.

Recommendation A.4.1: Create a single cohesive Environmental Health Program (refer to current program organization chart on Figure 2.2)

Implementation status: In progress.



Recommendation A.4.2: Move all program staff to the Zeidler Municipal Building to foster collaboration, integration, and trust, and to further integrate and align activities within MHD structure.

Implementation status: In progress.

Finding A.5: Low program morale has led to high turnover among program staff (particularly Lead Risk Assessors), further decreasing program capacity.

Significant turnover was seen among lead risk assessors dating back to at least 2013. Recruitment and retention of qualified staff in these positions has been challenging and vacancies have significantly impacted program performance.

Recommendation A.5.1: Develop and implement a career ladder for environmental staff to increase employee retention.

Implementation status:

Recommendation A.5.2: Fully implement the MHD's 2018-2020 Workforce Development Plan, which includes activities to increase employee morale and employee recognition.

Implementation status: In progress.

B.PRIMARY PREVENTION ACTIVITIES

The following findings and recommendations are based on section 3 of this report.

Note: Many of the issues identified in primary prevention are addressed through Department/Division Structure and Operations Recommendations.

Finding B.1: Program promotional and education materials require updating and enhancements.

Program staff did not regularly review and/or request updates to the content of existing health education and promotion materials (e.g. flyers, pamphlets, website, etc.), and did not utilize new education materials developed and in-use by lead-in-water staff.

Lead program staff did not consistently bring materials to content experts and communications staff for review per MHD policy, nor were materials updated in an appropriate or timely fashion. At the same time, the number of MHD communications staff declined from 3 FTE to 1 FTE through budgetary processes, limiting capacity to support programs across the MHD.

Recommendation B.1.1: Program staff should track the use of promotion and education materials, implementing a regular review process to update content as necessary using the assistance of MHD Communications staff.

Implementation status: In progress.

Recommendation B.1.2: Increase the staff capacity of MHD Communications and allocate funds for public health education and awareness messaging.

Implementation status:

Recommendation B.1.3: Work to educate the public about lead hazards, prevention, and available resources.

Implementation status: In progress.

Finding B.2: Relationships with community partners deteriorated, reducing the MHD's reach in the community.

Due to capacity issues, the program had not invested time in cultivating new strategic relationships with community partners that serve high-risk populations.

Recommendation B.2.1: Develop relationships with Head Start, K-3, and K-4 programs to identify new strategies for prevention education and awareness activities, including connecting families to existing program resources (i.e. lead paint/window abatement and drinking water filter distribution).

Implementation status:

Recommendation B.2.2: Reestablish relationships with primary care providers, federally qualified health centers, and local clinics to identify new strategies for prevention education and awareness activities, including connecting families to existing program resources (i.e. lead paint/window abatement and drinking water filter distribution).

Implementation status:

Finding B.3: The program has developed adversarial relationships with contractors who carry out abatement work.

The program has developed an adversarial relationship with contractors. In part, this was due to the lengthy rules that the MHD placed on the contracts as a condition of doing business with the program. Contractors have also reported difficulties receiving reimbursement for services (e.g. late payments or fees), contacting staff, and having a system for grievances.

Recommendation B.3.1: Conduct a meeting with contractors to identify challenges in working with the MHD and explore solutions that meet mutual interests.

Implementation status: In progress.

Recommendation B.3.2: Suspend the use of the "Requirements of Doing Business with the Lead Program," which outlines unnecessary constraints on doing business with the MHD.

Implementation status: Completed November 28, 2017.

Recommendation B.3.3: Reimburse contractors for payment adjustments/fees for failed dust wipes.

Implementation status: In progress.

Recommendation B.3.4: Assess whether there is sufficient lead abatement contractor capacity in the city, and if insufficient, open the RFP process to increase the pool of contractors.

Implementation status:

Recommendation B.3.5: Collaborate with contractors and DHS to support contractors in complying with lead abatement requirements.

Implementation status:

Finding B.4: The program did not consistently meet HUD grant performance benchmarks and assure an adequate spend down of funds.

The MHD's primary prevention activities are mostly funded through two HUD grant awards (2014-2016 and 2016-2019). While the 2014 Award received good performance reports, the program failed to address underperforming subcontractors and also failed to reallocate unspent funds. As a result, due to poor performance on the 2016 grant, a no-cost extension was denied. A significant amount of money will be returned to HUD from the 2014 grant award. The 2016 grant award received multiple failing performance scores.

Recommendation B.4.1: Establish and implement a corrective action plan with HUD

Implementation Status: In progress.

Recommendation B.4.2: Partner with established HUD grantee to serve as a mentor on program requirements/processes.

Implementation Status: In progress.

Recommendation B.4.3: Explore adding additional partners for Healthy Homes Supplemental to assure timely completion of HUD grant objectives.

Implementation Status:

Finding B.5: The program established unnecessary and burdensome eligibility criteria on property owners.

Eligibility requirements above and beyond those required by HUD were placed on applicants seeking enrollment into Primary Prevention. This was initiated when requests exceeded program capacity, but ultimately resulted in property owners being disqualified from receiving financial support to abate lead issues unnecessarily. Properties linked to cases with lead poisoned children (secondary prevention) were often excluded from participation in the primary prevention program, despite it being encouraged by HUD.

Recommendation B.5.1: Update program eligibility requirements to align with less restrictive HUD requirements.

Implementation status: In progress.

Recommendation B.5.2: Develop criteria for paying property owner's share when cost is a barrier to participation in primary prevention.

Implementation status:

Recommendation B.5.3: Create an expedited pathway for elevated blood lead level properties to receive abatement funds. Assure properties are prioritized for abatement funding within program funding limitations.

Implementation status:

Finding B.6: The program failed to create a pipeline of homes to enroll in primary prevention, leading to gaps in workload.

At one time the program had a network of partners that it leveraged to create a pipeline of applications to its primary prevention activities. Over the past several years, the MHD stepped back from nearly all of those partnerships. In addition, the Program did not permit Section 8 landlords to obtain assistance from the program.

Recommendation B.6.1: Expand neighborhood canvassing in high-prevalence areas to develop an adequate pipeline of primary prevention applications.

Implementation status: In progress

Recommendation B.6.2: Obtain a list of Section 8 landlords to increase a pipeline of new applicants.

Implementation status: In progress.

Recommendation B.6.3: Partner with Federally Qualified Health Centers and primary health care providers to enroll individuals into primary prevention activities.

Implementation status:

Recommendation B.6.4: Coordinate and collaborate with City governmental partners (Department of Neighborhood Services and Department of City Development) to expand primary prevention activity reach.

Implementation status: In progress.

Finding B.7: The program should explore additional funding sources and opportunities to improve the distribution of drinking water filters certified to remove lead.

The MHD's activities related to distribution of water filters certified to remove lead are relatively new. Over the past two years, different distribution methods have been tested to optimize distribution to target populations. Assessments of current distribution practices (within and outside of the MHD) are still required to ensure efficient processes are in place.

Recommendation B.7.1: Obtain additional and sustainable funding source(s) for water filters certified to remove lead. Ensure that limited resources are distributed to those who are most vulnerable to potential lead exposure through drinking water.

Implementation status:

Recommendation B.7.2: Identify additional partners to distribute filters to targeted populations.

Implementation status:

Recommendation B.7.3: Explore opportunities to evaluate the MHD's filter distribution program to find efficiencies.

Implementation status: In progress.

C. SECONDARY PREVENTION ACTIVITIES

The following findings and recommendations are based on section 4 of this report.

Note: Many of the issues identified in secondary prevention are addressed through Department/Division Structure and Operations Recommendations.

Finding C.1: The program had insufficient documentation practices, making it difficult to determine what level of service was provided to children with confirmed elevated blood lead levels.

The program utilizes both electronic (STELLAR) and paper filing systems to track case management and environmental investigations. A preliminary audit discovered that the program had inadequate documentation practices, making it difficult to determine what level of services the department provided.

Recommendation C.1.1: Implement new data system for tracking EBLs (Healthy Housing in Lead Poisoning Surveillance System, HHLPS), EBL case management and EBL environmental investigations.

Implementation status: In progress, spring 2018.

Recommendation C.1.2: Create a system to regularly review referrals and ensure proper documentation at every intervention level.

Implementation status:

Finding C.2: More focus should be placed on increasing community capacity for confirmatory tests so proper interventions can be provided without delay.

The MHD only provides services for confirmed elevated blood lead tests as preliminary tests can result in false elevated results. When children are tested for lead with a capillary (preliminary) test and have an elevated blood lead level, children do not consistently receive the subsequent, necessary venous (confirmatory) testing. While venous testing is the gold standard, two capillary tests collected less than 12 weeks apart is also considered confirmatory. It is unclear to what degree these cases were identified and referred for follow-up.

Recommendation C.2.1: Work with providers to establish a system of follow up for children who receive an elevated capillary test to ensure venous testing is received within the appropriate timeframe.

Implementation status:

Recommendation C.2.2: Improve outreach and education to local clinicians and community partners to raise awareness about latest research on lead and on lead testing recommendations.

Implementation status: In progress.

Recommendation C.2.3: Update tool kits for area clinicians specific to local lead poisoning prevention recommendations to develop materials specifically in support of perinatal lead testing.

Implementation status: In progress.

Recommendation C.2.4: Work with community partners to educate parents/guardians about the importance of follow-up confirmatory testing.

Implementation status:

Recommendation C.2.5: Develop a system to identify children who received two elevated capillary tests within 12 weeks to ensure that they receive the proper intervention.

Implementation status:

Finding C.3: The program was not consistently delivering interventions to children with elevated blood lead levels.

The MHD provides various case management services to children depending on their confirmed blood lead level. The preliminary audit found that some services, particularly at lower intervention levels, were not being offered to children. The process for determining what case management services should be offered is overly complex and likely to result in error, and there is insufficient staff to provide adequate services.

Environmental investigations were not consistently completed as required by state statute and MHD programmatic goals and policies. Inconsistencies were found at every step of the process, and documentation was substandard.

Recommendation C.3.1: Revise and streamline the process flow for MHD staff who provide interventions to children with elevated blood lead levels.

Implementation status: In progress.

Recommendation C.3.2: Ensure that adequate staffing capacity exists for appropriate elevated blood lead level case management and environmental investigations.

Implementation status:

Recommendation C.3.3: Refine the case management follow-up algorithm and ensure proper referrals are made in a timely manner.

Implementation status:

Recommendation C.3.4: Revise approval process for returning chelated children to lead-safe homes.

Implementation status:

Recommendation C.3.5: Implement electronic documentation for environmental investigations.

Implementation status:

D. POLICY RECOMMENDATIONS

Based on this report, the MHD makes the following policy recommendations:

Finding D.1: City of Milwaukee policies around lead poisoning prevention could be strengthened and better coordinated with other city departments to ensure public health goals are met.

Recommendation D.1.1: Seek a sustainable funding source to support necessary staffing levels to provide desired service levels beyond statutory requirements.

Implementation status:

Recommendation D.1.2: Explore lead-safe certification for rental properties.

Implementation status:

Recommendation D.1.3: Review lead abatement enforcement strategies with the City Attorney's office to ensure timely resolution of abatement orders.

Implementation status:

Recommendation D.1.4: Enhance partnership with DNS Landlord Training Program to educate landlords on lead hazards and available resources.

Implementation status: In progress.

Recommendation D.1.5: Amend the Milwaukee Code of Ordinances to allow property owners to participate in the lead service line replacement program if their water tests high for lead as part of an EBL investigation.

Implementation status: In progress.

Recommendation D.1.6: Amend the Milwaukee Code of Ordinances to allow the Health Department to require child care facilities to participate in the lead lateral replacement program.

Implementation status:

Recommendation D.1.7: Advocate for state legislation requiring lead-free or lead-safe certification at the point of property sale or at minimum full disclosure of all lead hazards, including lead service lines.

Implementation status:

Recommendation D.1.8: Develop a system of billing for environmental and nursing services.

Implementation status: In progress.

Recommendation D.1.9: Ensure all billing revenue generated from EBL case management and environmental intervention returns to program to fund future outreach.

Implementation status:

Recommendation D.1.10: Seek state cooperation to submit a Medicaid waiver to use Medicaid funds to pay for remediation in homes of children with elevated blood lead levels.

Implementation status:

Recommendation D.1.11: Explore ways to maximize the City's ability to bill Medicaid for services provided by MHD for children with blood lead levels greater than 5 µg/dL, including inspections and case management services.

Implementation status:

Finding D.2: Local policies related to lead in water are not aligned with federal funding streams and federal guidance documents. This creates a disconnect between public health recommendations, local expectations, and resources available for implementation.

A directive was given to the program to offer water testing routinely in homes of children who have been lead poisoned. This directive is in conflict with CDC and HUD recommendations to only test the water if other sources of lead cannot be found. Furthermore, Title X, which funds HUD lead abatement activities, does not fund lead in water activities. In addition, it is MHD policy to recommend the use of NSF/ANSI certified filters in homes with lead services lines and vulnerable individuals, regardless if water tests positive or negative.

Recommendation D.2.1: If local policy for property water testing remains, a sustainable funding source must be found.

Implementation status:

Definitions

Abatement-A measure or set of measures designed to permanently eliminate lead-based paint hazards and/or lead-based paint. (Source: HUD and EPA)

BLL – Blood lead level

Case management-The follow-up care of a child with an elevated blood lead level. Case management includes a) client identification and outreach; b) individual assessment and diagnosis; c) service planning and resource identification; d) linkage of clients to needed services; e) service implementation and coordination; f) monitoring of service delivery; g) advocacy; and h) evaluation. (CDC)

Clearance examination-Visual examination and collection of lead dust samples by an inspector or risk assessor and analysis by an accredited laboratory upon completion of an abatement project, interim control intervention, or maintenance job that disturbs lead-based paint (or paint suspected of being lead-based) above the minimum levels. HUD and EPA have established maximum allowable lead dust levels on surfaces (e.g., floors, window sills, and window troughs). (HUD)

DCEH – City of Milwaukee Health Department, Division of Disease Control and Environmental Health

DNS-Department of Neighborhood Services

Elevated BLL: A single blood lead test (capillary or venous) at or above the reference range value of 5 µg/dL established in 2012.

- Confirmed elevated BLL ≥ 10 µg/dL: A child with one venous blood specimen ≥ 10 µg/dL, or two capillary blood specimens ≥ 10 µg/dL drawn within 12 weeks of each other.
- Unconfirmed elevated BLL ≥ 10 µg/dL: A single capillary blood lead test ≥ 10 µg/dL, or two capillary tests ≥ 10 µg/dL drawn more than 12 weeks apart.

Incidence - Defined as the number of children less than 6 years old who have exceeded a limit of lead in the blood (identified at 10 µg/dL) for the very first time in their blood lead history.

Lead hazard-Accessible paint, dust, soil, water, or other source or pathway that contains lead or lead compounds that can contribute to or cause elevated BLLs. (CDC)

Lead-based paint-Paint or other surface coating that contains lead equal to or exceeding 1.0 milligram per square centimeter or 0.5% by weight or 5,000 parts per million by weight. (HUD and EPA)

Lead risk assessment-An onsite investigation of a residential dwelling to discover any lead based paint hazards and description of options to eliminate them, which includes lead dust and soil sampling. (HUD and EPA)

Lead-safe-Housing with no lead paint hazards as determined by a lead risk assessment or by dust sampling at the conclusion of lead hazard control activities. If lead-based paint remains in the housing unit, its condition and any hazard control systems must be monitored to prevent new lead hazards.

Percent of children with elevated BLLs: The number of children less than 72 months of age with an elevated blood lead level ≥ 5 µg/dL divided by the number of children less than 72 months of age tested for blood lead, multiplied by 100. Also referenced as "Case Rate."

Percent of children tested: The number of children less than 72 months of age tested for blood lead divided by the total number of children less than 72 months of age based on 2000 (years) or 2010 (years) U.S. Census data, multiplied by 100

Primary prevention (PP)-Interventions undertaken to reduce or eliminate exposures or risk factors before the onset of detectable disease. This includes measures to a) prevent the dispersal of lead in the environment through regulations or other measures that prevent harmful uses of lead and b) remove lead from the environment before children are exposed. (CDC)

Prevalence - Defined as the number of children less than 6 years old who have exceeded a limit of lead in the blood (identified at both 5 µg/dL and 10 µg/dL) divided by the total number of children tested for lead in their blood and expressed as a percentage. The time period and age category must be identical for both.

Secondary prevention-Response to a problem after it has been detected. This involves identifying children with elevated BLLs and eliminating or reducing their lead exposure. (CDC)

Screening test: A blood lead test for a child age <72 months who previously did not have a confirmed elevated BLL. (NOTE: A child may be screened in multiple years or even multiple times within a given year, but would be counted only once for each year.)

Test: Any blood lead draw (capillary, venous or unknown sample type) on a child that produces a quantifiable result and is analyzed by a Clinical Laboratory Improvement Amendments (CLIA)-certified facility or an approved portable device. A blood lead test may be collected for screening, confirmation, or follow-up.

Testing penetration - Defined as the percentage of children in the city of Milwaukee who were reported to be tested at least once in any calendar year. These percentages are based upon the number of blood lead tests reported and the total number of children estimated by the reported birth rate.

Appendix: Methods

Organizational Structure Review

To assess the effectiveness of Department and DCEH organization structure the following factors were considered:

- Does the current structure facilitates effective workflow?
- Does the current structure enhances partnership and synergy?
- Does the current structure enables individual or programmatic performance?
- Does the current structure facilitates communication, shared goals and understanding?

Staffing Review

To evaluate staffing the following factors were considered:

- Is there adequate staffing to complete the required duties?
- Do job descriptions reflect the duties assigned, do they reflect the required knowledge skills and abilities as well as licensures required to be successful at the position, is the pay range adequate to be able to recruit and retain qualified applicants?
- Is the supervisor to staff ratio adequate to assure span of control?
- Is there a system of employee performance management in place?
 - Job specific structured orientation and training curriculum?
 - Clear performance expectations and benchmarks for staff that are tracked and shared?
 - Is there adequate training provided prior to independent practice?
 - Is there a system of auditing to assure that skills are maintained?
 - Do supervisors routinely have scheduled meetings with staff?
- How has staffing changed versus program expectations over the past 5 to 10 years?
- How has employee morale been? What has employee turnover rate been and if it has been high what has been driving that?

Program Policy and Procedure Review

To evaluate policies and procedures the following factors were considered:

- What percentage of the original polices identified by the Office of Planning and Policy that needed to be created were finished?
- Were the policies and procedures, adequate, could a person perform the task by reading the policy?
- How complete was the list of policies to be created by planning and policy?
- What is the percentage of the total number of policies regardless of the form it is on had a documented revision date within the last two years in compliance with the PHAB standards?
- Do the policies that exist conform to MHD standards?

Secondary Prevention Review

The City of Milwaukee Health Department's (MHD) preliminary internal audit of its Childhood Lead Poisoning Prevention Program (CLPPP) was completed using both electronic data extracted from the Systematic Tracking of Elevated Lead Levels and Remediation (STELLAR) database and paper records from the CLPPP. The CLPPP uses STELLAR to enter blood lead levels (BLL) and to document case management services. The CLPPP primarily uses a paper filing system for environmental investigations.

Data was exported from STELLAR using the CLARION Report Writer. This software allows the user to design queries and produce reports to extract data from the STELLAR database with specific fields and under specific conditions. **It is important to note that the data presented in this report is reflective of the time the data was exported from STELLAR.** Data in STELLAR changes daily as new case reports are entered.

Case Management Preliminary Audit

It is important to note that the data used in this audit is based on a child's highest reported BLL, whether capillary or venous, in the given year. This was done to ensure that the MHD could evaluate program response based on the highest reported level for each child. As a result, some of those children may have actually had a confirmed test at a lower level.

To understand if proper case management services were offered the following reports were run in STELLAR to generate four databases:

- Database 1: All records of children who received a test between 2015 and 2017, their BLL, type of test received, and basic demographic information,

- Database 2: All records for children with a referral for initial Public Health Nurse (PHN) home visitation service (event code HVNIN),

- Database 3: All records with a referral for initial Health Service Assistant (HSA) home visitation services (event code HVOAB), and

- Database 4: All records with a record of an initial outreach letter being sent (event code LTRRE).

Databases 2-4 were based on initial referral events for interventions. This means that referrals were made to initiate the intervention, but does not indicate successful completion of the intervention. The databases also do not identify children who are receiving ongoing case management as those events are recorded under different event codes.

After the four databases were generated, database 1 was then narrowed to include only the highest reported test result in a given year for children under the age of six. Database 1 was then merged with database 2, 3, and 4 respectively based on a unique child ID. The resulting data sets allowed the MHD to determine what services a child received based on their highest reported blood lead level. Databases were sorted based on a child's test results and findings from the analysis are described below.

Client Chart Reviews: Elevated Blood Lead Levels >20 µg/dL

The STELLAR database was queried to identify cases that did not have record of a completed Public Health Nurse (PHN) home visit or appropriate follow-up attempts from 2015 through 2017. These case records were reviewed to determine if a home visit and appropriate follow up occurred. The electronic records of these cases were thoroughly reviewed by looking at events and memos in STELLAR to determine if a completed home visit and/or telephone and home visit attempts were made. The majority of the cases did receive a home visit and appropriate follow-up previously and were being monitored to ensure that lead levels were declining. Cases that were identified as needing additional follow-up have been re-assigned to a PHN.

Environmental Investigation Preliminary Audit

To identify the addresses of required environmental investigations, data from STELLAR was sorted to identify all venous tests in a given year. The data was then further sorted by reported blood lead levels to indicate those children, and the associated addresses of those children at the time of testing, at the levels requiring an

environmental investigation. A final query was used to determine if venous results in the 15 – 19 range were 90 days apart or more. This produced a list of all children and the addresses reported with that elevated BLL that should have received an environmental investigation under state statute.

To determine whether an address that received an environmental investigation met the established closure criteria, an inventory of paper records was completed. The initial inventory of paper records found, collected, and organized existing paper records, recorded information from that file in a spreadsheet, and identified the end result of the investigation at the address. This initial audit was used to determine the addresses where paper records exist for an environmental investigation having being referred. This list was merged with the list of addresses where environmental investigations occurred to identify those without paper records.

The list of addresses without paper records in the initial inventory then underwent an electronic audit in STELLAR to determine if an electronic records of a referral or environmental investigation existed. This process identified those addresses that did not have either a paper record or electronic record of an environmental investigation having occurred.

An ongoing, more robust audit of paper records is taking place to catalogue the contents and determine those addresses where the paper record is incomplete or deficient. This audit is ongoing and will produce a list of addresses where additional follow-up is required.

Environmental Chart Review Methods

A total of 320 EBL files requiring environmental investigations by state statute were found for the time period 2015-17. Files were reviewed to determine if outcomes (clearance examination) had been achieved with the property investigations. For each environmental investigation, the following should be included in the case file: 1.) Upon arrival to a property, the EBL inspector interviews the family to find possible sources of poisoning. 2.) The inspector then searches for hazards that could contribute to the poisoning of a child. Hazards can include deteriorated walls, windows, children's toys, ceramics and other items from overseas or other surfaces. If none of these are found to contain lead, then the inspector considers lead in water. 3.) The inspector takes note of the cleanliness of the home as lack of cleaning can contribute to child poisoning. 4.) On the exterior, the inspector will look for debris, leaded paint chips around the drip line of the home and bare soil as all of these areas--where a child plays--can be sources of lead poisoning. 5.) If no hazards are found, other sources of lead are investigated. For instance, other residences the child spends significant time in may require investigation as well. Due to the transient nature of many EBL families, getting all the information to complete a comprehensive investigation may be a difficult task. 6.) However, if hazards are found, interim controls are completed. This can include wet washing and/or taping deteriorated walls, window wells, jambs or other surfaces. Orders are written for lead hazards, if necessary. Property owners are responsible for all hazard repairs. If repairs to a dwelling are de minimus (disturbs less than 6 SF of interior surfaces or 20 SF of exterior surfaces) the owner may repair deteriorated surfaces without any certification, but must work in a lead safe manner. When work is complete and visually cleared, repairs will be photographed by the inspector. If repairs are above de minimus amounts, it is recommended that the child be physically removed from the property immediately until the house is again safe. For larger repairs, the owner must obtain a Renovation, Repair and Paint (RRP) certification or hire a lead certified contractor to remedy the hazards found in the investigation. Additionally, if a project is large enough, a clearance that includes dust wipes will be performed by the city inspector.

Again, this chart review focused on finding evidence of the above activities, with close attention paid to whether or not a visual clearance or clearance wipes were necessary at the property.

ⁱ Wisconsin Childhood Lead Poisoning Prevention and Control Handbook.

<https://www.dhs.wisconsin.gov/publications/p00660.pdf>

ⁱⁱ CDC. [Interpreting and Managing Blood Lead Levels <10 µg/dL in Children and Reducing Childhood Exposures to Lead: Recommendations of CDC's Advisory Committee on Childhood Lead Poisoning Prevention](#). *MMWR*. November 2, 2007; 56(RR08):1-14;16. [Erratum: Vol. 56, No. RR-8](#) *MMWR*. November 30, 2007; 56(47):1241-1242

ⁱⁱⁱ <https://www.edf.org/health/recognizing-efforts-replace-lead-service-lines>

^{iv} Milwaukee Water Works Lead Service Line Semi-Annual Update. Presented to City of Milwaukee Public Works Committee January 24, 2018.

^v Milwaukee Water Works Lead Service Line Semi-Annual Update. Presented to City of Milwaukee Public Works Committee January 24, 2018.

