A Look Back at Elevated Blood Lead Nursing Case Management Provided by the Children's Healthcare Access Program for Young Children in Flint, Michigan - May 2016 through July 2018

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Executive Summary

On September 24, 2015, researchers from Hurley Medical Center in Flint, Michigan, released results of a study,[1] later confirmed by state[2] and federal public health officials,[3] reporting that the proportion of children with elevated blood lead levels (EBLLs) in Flint had increased after a switch in Flint's drinking water source from Lake Huron to the Flint River in April 2014. A public health emergency was declared on October 1, 2015, and the source of drinking water was returned to Lake Huron on October 16, 2015.[2]

Governmental and philanthropic resources were mobilized in response to the emergency. They were used to provide a host of social and health services including in-home specialized nursing case management services for the children with EBLLs.[4] This report describes the results of services for children under age 6 in Flint who had their first EBLL between May 2016 and April 2018. Follow-up services to eligible EBLL children were provided by the Children's Health Access Program (CHAP). CHAP is a program of the non-profit Greater Flint Health Coalition, a non-governmental organization in Flint that uses a community-based medical home improvement model intended to improve the health outcomes of low-income children.[5] The Michigan Department of Health and Human Services (MDHHS) provided funding to CHAP to implement the state's protocol for EBLL nurse case management.

This report provides summary data on outcomes for EBLL children potentially eligible for CHAP's EBLL NCM services. Data were obtained from three sources: Michigan Department of Health and Human Services' (MDHHS) blood lead surveillance data management system, MDHHS's database of applicants for assistance in removing lead hazards from homes, and the electronic client service database maintained by CHAP. Report highlights follow:

<u>Results summary:</u>

- 231 children under age 6 in Flint were first tested with an EBLL of 5 micrograms per deciliter (µg/dL) or greater between May 2016 and April 2018.
- CHAP provided services to families of all 231 EBLL children, which included at a minimum a mailed package of educational materials
  - 49% (113) of the 231 children were referred for a variety of social and medical services.
  - 16% (37) were directly given household goods, water filters, car seats and other items.
- 48% (110) of the 231 children were eligible for EBLL nurse case management services (NCM) because their blood lead levels were confirmed as elevated.
- 52% (121 children) were not eligible for EBLL NCM because a subsequent blood lead test was no longer elevated, the EBLL was based on a capillary test and a confirmatory venous blood test was not done, or the family moved away.

- Of the 110 children who were eligible for EBLL NCM, 76% (84) received at least one nursing home visit, 10% (11) declined NCM, and 14% (15) could not be contacted.
  - 75% (63) of the 84 children who received NCM lived in homes that were inspected by companies contracted with MDHHS for the presence of lead in paint, soil and dust.
    - 98% of these 63 children lived in homes that had lead hazards in paint, soil or dust.
  - 67% (56) of the 84 children who received NCM lived in homes tested for water.
    - 27% (15) of these children lived in homes with at least one water lead test result that was above the Environmental Protection Agency's "Action Level" of 15 parts per billion.
  - The families of 76% (64) of the 84 children who received NCM were offered assistance in completing an application for assistance with home lead removal.
  - 42% (35) of the 84 children who received NCM lived in homes where the lead abatement process was completed.
  - The blood lead tests for 90% of the 176 children who had at least one follow-up test were no longer elevated (i.e., below 5 µg/dL).

Discussion and Recommendations Summary

- The protocol for case management of Flint's EBLL children placed a strong emphasis on coordination of all services. This reflects best practices for case management as recommended by the Centers for Disease Control and Prevention's Advisory Committee for the Prevention of Childhood Lead Poisoning.
- CHAP worked closely with families to identify all potential sources of lead, take interim prevention measures (e.g., frequent cleaning of hands, toys and horizontal surfaces), and apply for financial assistance from the MDHHS Lead Safe Home Program (LSHP) in completing home renovations needed to eliminate the lead sources (e.g. replacing windows). Steps of this type are essential to the elimination of lead in a child's environment.
- The decision to entrust EBLL NCM to a non-governmental organization, CHAP, in Flint was based on the recognition of the extraordinary circumstances of the Flint water crisis and the need for service delivery from an organization with CHAP's structure and partnerships, which were designed to overcome client distrust (e.g., persistence, communication and non-judgmental care by CHAP staff) and meet families' immediate needs.
- Consideration should be given to funding EBLL NCM programs to cover non-Medicaid as well as Medicaid children for the entire state of Michigan, built on the successes and challenges identified in Flint.

Background

➢ Lead Hazards and Testing

Lead is a poison that acts on the nervous system. There is no safe level of lead in the body; even at very low levels, it can cause developmental delays, learning difficulties, lowered IQ, and behavioral issues.[6] Very high levels of lead can lead to coma and death.[7] Children under the age of 6 years are at the greatest risk of harmful health effects from lead exposure. This is because their brains and nervous systems are still forming and they are most likely to come into contact with lead when they lick, swallow or breathe in dust from old lead paint. Most homes built before the 1978 ban on leaded paint have old lead paint. If paint peels, cracks or is worn down, the chips and dust from the old lead paint can spread onto floors, windowsills and all around the home. Lead can also leach into drinking water from lead pipes and plumbing fixtures, as demonstrated by the Flint water crisis.[8]

> "Michigan children continue to be unnecessarily exposed to lead, and this exposure disproportionately impacts low-income areas and minority children." [8]
>
> --Michigan Child Lead Poisoning Elimination Board

A blood lead test measures the amount of lead in the body, in micrograms of lead per deciliter (µg/dL) of blood. This test is ordered by a child's health care provider, or it can be done in a public health setting. A child with a BLL level of 5 µg/dL or higher is considered to have an elevated blood lead level (EBLL).[9] Children with EBLLs are eligible for education and interventions to find and get rid of lead in their home. Children with very high levels of lead (45 µg/dL or greater) usually require more intensive medical treatment such as chelation therapy.

Laboratories that test blood for lead are required by law to report the results to the Michigan Department of Health and Human Services' (MDHHS) Childhood Lead Poisoning Prevention Program (CLPPP). CLPPP has maintained a database of laboratory reports since 1998. Each year, CLPPP publishes an annual report summarizing this information; the 2006-2016 annual reports are available on the MDHHS website, Michigan.gov/lead. In 2018, the most recent full year of blood lead data, blood lead test results were reported to CLPPP on 142,356 children under age 6 in Michigan, of whom 4,124 (2.9%) had an elevated level. [10]

- **Public Health Response to Children with EBLLs Statewide**

CLPPP shares BLL test results with local health departments, which offer in-home nursing case management (NCM) services where children have confirmed EBLLs. A nurse will visit the home at least twice to assess the child's growth and development, look for potential lead hazards, and refer the family to any needed social and medical services. The nurse also links the family to the MDHHS Lead Safe Home Program (LSHP). The LSHP provides resources and expertise to eligible families for lead home inspections[11] and, if needed, safe removal of lead paint hazards through abatement, replacement of leaded plumbing fixtures, and other remodeling.[12]

The MDHHS Lead Safe Home Program (LSHP) helps qualifying families to remove lead hazards from their homes. LSHP oversees the renovations and certifies that the house is "lead safe" when finished.

- **Public Health Response to Children with EBLLs in Flint Michigan**

Demographics of Flint, MI

- $26,000: median income
- 5.7% population decline 2010-2017
- 41.9% living below poverty
- 10% unemployment
- 54.3% Black; 19% other non-white
- 37% of houses built before 1950 and 92% before 1980

Source: *U.S. Census American Community Survey 2015 5-year estimates*

On April 25, 2014, the City of Flint changed its water supply from Lake Huron (supplied by the Detroit Water and Sewerage Department) to the Flint River.[2] This was done under the direction of state-appointed emergency management to save the city money. Corrosion inhibitors were not added when the water supply was switched, allowing corrosive water to run through aging pipes and fixtures. This resulted in lead leaching into the city's water supply.

Residents repeatedly raised concerns about water quality,[2] but no actions were taken before September 2015, when research showed increased EBLLs in children associated with the time of the different water supply.[1] After the release of this study and water quality studies, an emergency was declared, and the water supply was returned to the Detroit Water Authority on October 16, 2015.[2]

In November 2015, MDHHS provided funding to the Genesee County Health Department to offer NCM services to all Flint children with EBLLs. Previously, because of very limited resources, only children with very high blood lead levels received NCM. While this and other actions were taken to reduce the impact of lead in the water, residents remained distrustful of government.[13] They believed that the Flint water crisis was the result of long-term, unaddressed economic and social problems in Flint.[14] Starting May 1, 2016,

MDHHS contracted with a non-governmental, non-profit organization to administer the NCM program in Flint. The Genesee Children's Healthcare Access Program (CHAP) within the Greater Flint Health Coalition (GFHC) was chosen because of its mission and its extensive partnerships with healthcare and social service agencies in Genesee County.

> "With over 20 years as the community's neutral convener, the Greater Flint Health Coalition works together to achieve true collective impact to improve the health status of Flint and Genesee County residents by establishing a common health agenda, shared measurement systems, mutually reinforcing health activities, and continuous communication among community organizations, public health and healthcare stakeholders."
>
> Kirk Smith, President and CEO
> Greater Flint Health Coalition

CHAP Nurse Case Management Protocol

The goals of NCM were to (1) bring each child's blood lead level below 5 µg/dL and (2) prevent future EBLLs by promoting activities to reduce or eliminate sources of lead in the child's environment. CHAP's protocol, modified from an existing EBLL NCM protocol maintained by MDHHS CLPPP, placed a strong emphasis on coordination of available services beyond those directly related to lead exposure. Inclusion of other social and medical services is recommended by the Centers for Disease Control and Prevention's Advisory Committee for the Prevention of Childhood Lead Poisoning.[15] CHAP was in a unique position to provide these coordinating services because of its partnerships throughout Flint's medical and social services community, which included Medicaid Health Plans, Hurley Medical Center and the other two hospitals in the county (Ascension Genesys and McLaren-Flint), the Genesee County Medical Society, the Red Cross, and many health, community, and social service agencies.

A summary of the protocol is below.

- For all EBLL children, CHAP provides lead education by phone to the parent/guardian and determines if follow-up testing is needed.
    - If the child has only had a capillary test and no confirmatory venous test, the family is urged to get a venous test.*
    - CHAP offers in-home nursing case management services for children who have had a venous EBLL result.

* There are two main methods for collecting blood samples for lead screening, collecting blood from a finger stick (capillary test) or drawn from a vein in the child's arm (venous test). The capillary test is quicker and easier, but it is not as accurate as the venous test leading to false positive results. For this reason, when a capillary test results in a high lead level reading, a venous test is needed to confirm whether the blood lead level actually is high.

- With consent of the parent/guardian, CHAP conducts an initial in-home nursing assessment and creates a plan of care for the child.
    - The initial home visit includes evaluation of the child's health and nutritional history, physical appearance, social and behavioral status (e.g. child's cognitive development), and evaluation of the home for potential lead hazards (e.g., peeling paint, absence of water filters on faucets).
    - From this assessment, the nurse creates a plan of care that includes goals related to nutrition, completion of the LSHP application, and interim measures to reduce contact with lead hazards (e.g. rigorous cleaning, keeping away from peeling paint). Referrals are also made to any needed educational, social or medical services (e.g. "Early On",[16] WIC,[17] Medicaid waiver,[18] transportation, food and clothing assistance).
    - A company under contract with the LSHP conducts an environmental investigation of the home. This includes a detailed visual inspection of the home and property plus collection of dust, paint, soil, and water samples which are tested for lead. The company provides a detailed report of findings and recommendations to the family, CHAP and MDHHS.
    - Even if the family declines NCM outright or will not schedule home visits, CHAP still works with interested families to provide lead education and complete the LSHP application to assist with moving the home towards abatement.
- At least one follow-up nurse case management home visit is done to assess the family's progress in complying with the plan of care and make any needed changes. At this visit, the nurse often assists with interpreting the environmental investigation's findings and makes specific recommendations on ways the family can continue to avoid lead hazards in the home until abatement takes place.
- After completion of home visits, CHAP continues to work with the family as needed to accomplish the goals in the plan of care and to have the child's blood lead re-tested at regular intervals to determine whether the interventions are working.
- The case is closed when the child's blood lead is below 5 µg/dL and/or all interventions are completed as much as possible.
    - The family is sent a letter that includes final recommendations and encouragement to enroll in Family Supports Coordination, a program which continues to coordinate social and medical services.
    - The child's health care provider, and if applicable, Medicaid Health Plan, is sent a letter that summarizes CHAP's findings and recommendations.

Results

This report includes results for children less than age 6 who:

- Had an EBLL for the *first time* between May 1, 2016 and April 30, 2018; and
- Lived in one of the seven zip codes in Flint that closely approximate Flint's municipal water distribution area (48501-48507). (See map in Appendix 1). Zip codes 48529 and 48532 are not included because they are only partially covered by Flint water.

The data on nurse case management were obtained from CLPPP and CHAP through July 2018. Follow-up blood lead testing results and results for the status of home abatements of EBL children were obtained from LSHP through December 2019.

CHAP's efforts to accomplish NCM and service delivery activities involved **2,713** telephone calls and **628** attempted or completed home visits.

The data include demographics, initial blood lead levels, CHAP NCM activities, results of environmental investigations, completion of home abatements, and final blood lead levels. See Appendix 2: Technical Notes for more detailed information on data sources, collection and analysis.

- **Population Profile (Table 1)**

231 children less than 6 years old were identified with an EBLL for the first time between May 1, 2016 and April 30, 2018. Characteristics were:

- **57%** were male.
- **65%** were black and **22%** were white (where this information was known).
- **82%** were enrolled in Medicaid.

Table 1: Sex, Race, and Medicaid Status of 231 EBL children

Sex	**N**	**%**
Male	131	56.7
Female	100	43.3
Total	***231***	***100***
Race*		
Black	90	65.2
White	31	22.5
Bi-racial	14	10.2
Other	3	2.1
Total	***138***	***100***
Medicaid enrollment	**N**	**%**
Enrolled	190	82.3
Not enrolled	41	17.7
Total	***231***	***100***

*Race was available for 138 (59.7%) of 231 children with elevated blood lead levels (EBLL).

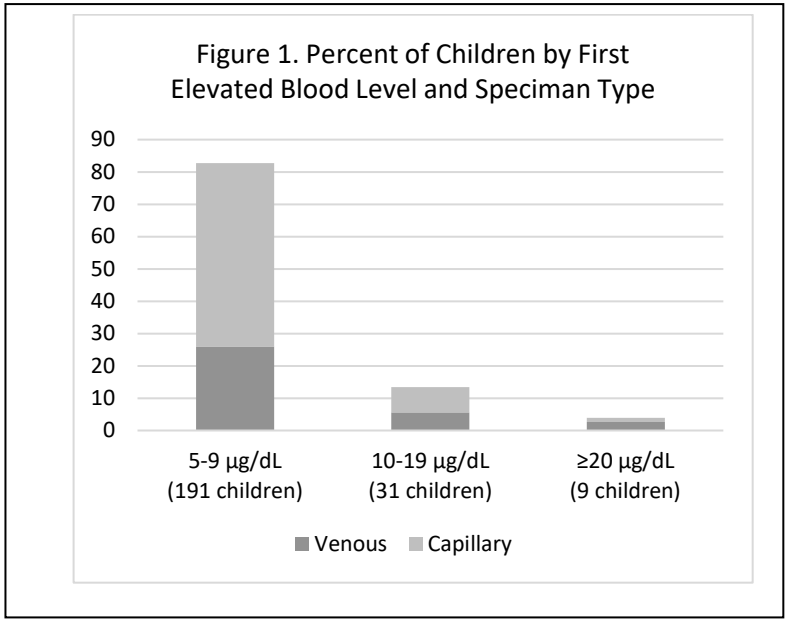
- **First reported BLLs (Table 2 and Figure 1)**

The 231 EBLL children's first reported blood lead levels ranged from **5 to 34 µg/dL.** (Note: Capillary tests are screening tests and all elevated capillary results should be confirmed with a venous test as capillary testing often reports false positive results.)

- **83%** of the children's first reported tests were between 5 and 9 µg/dL.
- **34%** of the 231 tests were venous tests.

Table 2: Number/percent of blood lead levels at first report by specimen type

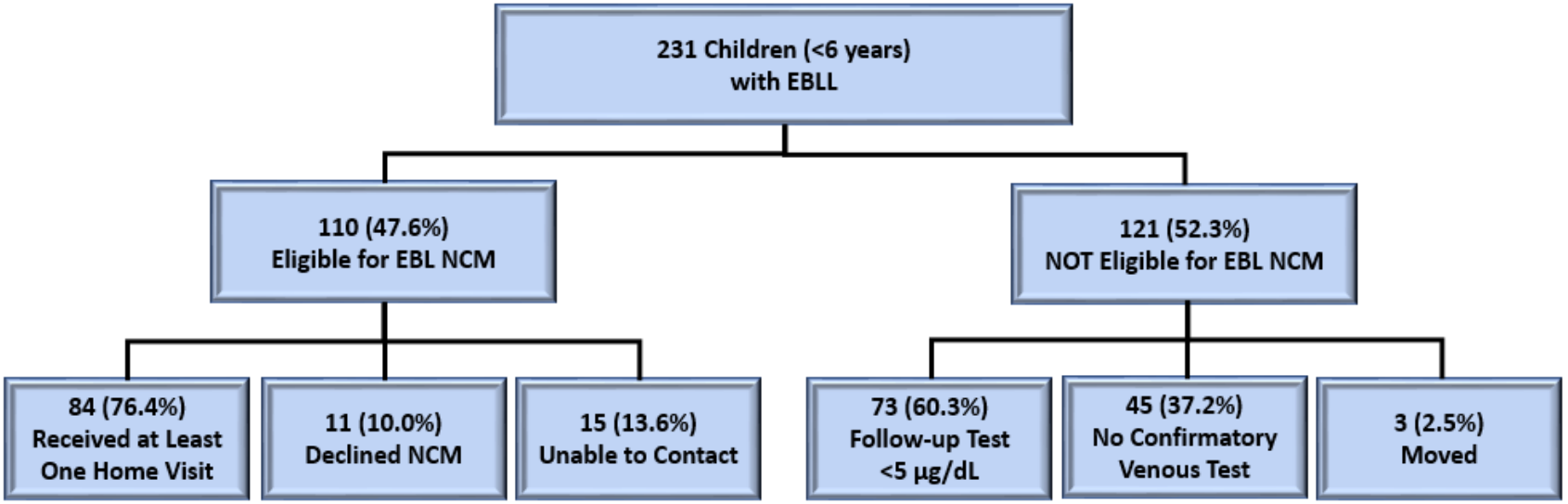
Blood Lead Level (µg/dL)	Capillary		Venous		Total	
	N	%	N	%	N	%
5-9	131	86.1	60	75.9	191	82.7
10-19	18	11.8	13	16.5	31	13.4
≥20	3	2.0	6	7.6	9	3.9
Total	***152***	***100***	***79***	***100***	***231***	***100***



➢ **Eligibility for EBLL NCM (Figure 2)**

- **48%** of the 231 EBL children were eligible for EBLL NCM services based on an initial or follow-up confirmed elevated venous result.
  - **76%** of eligible children received at least one home visit.
  - **10%** declined this service and **14**% were lost to follow-up (e.g., home deserted, phone number no longer valid) before a visit could be scheduled
- The most common reason a child was not eligible for NCM was having a follow-up test with a blood lead level below 5 µg/dL.

Figure 2: EBLL Children's Eligibility for NCM and NCM status



➢ **CHAP Services for EBLL Children (Tables 3a and 3b)**

- **100%** of the 231 children identified with EBLLs (capillary or venous) were provided with lead related educational materials. (Table 3a)
- 166 service referrals were made for nearly half (**49%)** of the 231 children. (Table 3b)
- **16%** were given or referred for household necessities including car seats, water filters, clothing and other items. (Table 3a)

Table 3: Number/percent of children who were provided or referred for social/medical services.

3a. Number/percent of 231 children who were provided services, by types of services provided

Types of Services Provided	N	%
All Household supplies	36	15.6
Household goods	*11*	*4.8*
Water filters	*20*	*10.0*
Car seats	*12*	*5.2*
Educational materials	231	100

3b. Number/percent of 231 children with service referrals, for each type of service

Types of Service Referrals	N	%
WIC	22	9.5
Early ON	45	19.5
Head Start	23	10.0
Food assistance	12	5.2
Enrollment in Medicaid Waiver	20	8.7
Health care provider	23	10.0
Other referrals	51	22.1
Total referrals	***166***	***100***
Children receiving referrals*	112	48.5

*54 children received more than one referral

➢ **Children who received NCM: Environmental Investigations of their homes (Tables 4, 5a, 5b)**

- **75%** of the 84 children who received NCM lived in homes that had an environmental investigation. (Table 4)
  - **98%** of these children lived in homes where hazardous levels of lead in paint, dust or soil were detected. (Table 5a)
  - **27%** of the 56 children whose homes were tested for water lived in homes that had levels of lead that exceeded the EPA's Action Level of 15 parts per billion. (Table 5b)
  - **All** 15 children whose homes were found to have water hazards lived in homes that also had lead paint/soil/dust hazards. (Table 5b)

Table 4. Number/percent of 84children who received NCM, by Environmental Inspections (EI) status of homes.

EI Status	N	%
EI completed	63	75.0
No EI	21	25.0
Total Children	***84***	***100***

Table 5a. Number/percent of the 63 children who had NCM and whose homes were inspected for lead paint/soil/dust hazards, by type of hazard found.

Lead Hazards: Paint, Dust, Soil	N	%
Paint only	2	3.2
Paint plus dust	39	52.4
Paint plus dust plus soil	28	38.1
Dust plus soil	1	4.8
No paint, dust, soil hazards found	1	1.6
Total Children	***63***	***100***

5b. Number/percent of the 56 children who had NCM and whose homes were tested for lead in water, by water hazard found*

Lead Hazard: Water*	N	%
Water hazard found	15	26.8
Also with lead paint/soil/dust hazards	*15*	*100*
No water hazard found	41	73.2
Total Children	**56**	**100**

* Defined as having at least one sample that exceeded the EPA's Action Level of 15 parts per billion.

➢ **Children who received NCM: Completion of Home Lead Abatement Process (Tables 6a and 6b)**

- CHAP promoted and/or assisted in completion of the LSHP application for lead abatement assistance for families of **76%** of the children who received NCM. (Table 6a)
- **42%** of the children who received NCM lived in homes that had a completed lead abatement, and **2%** of the children lived in homes that were approved and awaiting abatement as of December 2019. (Table 6b)

6a. Number/percent of 84 children who received NCM, by CHAP assistance in preparing the LSHP Application

LSHP application	N	%
Application completed prior to CHAP involvement	4	4.8
CHAP promoted/assisted in application process	64	76.2
Unknown	16	19.0
Total children	***84***	***100***

6b. Number/percent of 84 children who received NCM, by status of lead abatement of their homes

Lead abatement status	N	%
Home in process of being abated	2	2.4
Home abatement completed	35	41.7
No information about home*	47	55.9
Total children who received NCM	***84***	***100***

*Abatement status data does not include information about any homes that may have been abated without financial assistance from the MDHHS LSHP.

- **Final Blood Lead Levels: Children with at least one follow-up test (Table 7)**

176 children received at least one follow-up test for blood lead. Of these:

- **90%** no longer had an EBLL. (Table 7)
- BLLs of 82% of the 17 children whose final BL tests were => 5 µg/dL had declined from the first test.
- The average decrease in BLLs among those that decreased was 5.1 µg/dL, and the range of decrease was from 1 to 29 µg/dL.

7. Blood lead levels at close of reporting, for the 176 children with at least one follow-up test

Blood Lead level (µg/dL)	Total	
	N	%
<5	159	90.3
5-9	12	6.8
10-15	5	2.8
Total	***176***	***100***

Discussion and Recommendations

All 231 children under 6 years old with EBLLs living in Flint and their families were referred or provided with one or more services by CHAP to reduce exposure to lead, including those not eligible for EBLL nurse case management. Seventy-six percent of the 110 children eligible for in-home EBLL nurse case management received at least one home visit. Forty-two percent of the children who received EBLL NCM had their homes abated of lead hazard.

One of the public health goals for preventing the adverse health effects of lead is that BLLs of all children with EBLLs subsequently fall below 5 µg/dL. By December 2019, the BLLs of 90% of the 176 children who had a repeat test were below 5 µg/dL. It should be noted, however, that there could have been various reasons for this, and no conclusions can be drawn from the data collected for this report about the contribution of EBL NCM to this decline.

- **Coordination of Services**

Children and families served by CHAP had a multitude of social and medical needs including those related to periodic homelessness, caregiver unemployment, multiple foster parents, homes without furniture or utilities, hunger, and many others. Lack of basic needs like transportation, food and clothing were everyday challenges. This prevented access to appropriate medical care, including lead testing and retesting. These same issues interfered with provision of NCM services and completion of the environmental assessments. In response,

Observations from CHAP staff about program implementation

"As with any new program, plans and requirements inevitably needed to be modified as the program gained experience with the families. Ongoing communications with MDHHS ensured that changes to the protocol were made as needed, strategies were developed to improve acceptance of NCM and the Environmental Investigation services, and service delivery to the families was coordinated with other community resources."

"CHAP's successes in leading families to and through NCM were often directly tied to their work in addressing the social determinants of health. This meant assisting families with their more immediate needs such as food and utilities so that the families could then focus on the issues of lead in the home."

"Persistence, communication, and non-judgmental care were widely recognized attributes of CHAP staff that contributed to effective NCM. "

"CHAP instituted a warm handoff process to improve completion rates for scheduled Environmental Investigations, utilizing trust established with participating households to ensure processes to identify sources of environmental lead were completed at a higher rate."

"Knowledge gained by CHAP's 'boots on the ground' experiences with families of EBLL children supported some of the significant innovations in Flint, including a reduction in prior notice for Medicaid families needing transportation to doctors' appointments, Medicaid Waiver Expansion to allow children to enroll in Medicaid with incomes up to 400% of poverty, and participation in the Family Supports Coordination program and the Flint Registry."

"Ongoing engagement and collaboration with partners in all sectors – government, healthcare, community advocacy, non-profit social services, housing – were essential."

--- compiled by Susan Schneberger, CHAP Senior Program Director

CHAP provided social and medical service referrals for many of these children, even those who were not eligible for NCM. In addition, CHAP directly provided some families with essential appliances, beds, diapers, car seats, bus passes, and other necessities. Fortunately, the Family Supports Coordination (previously, "Targeted Case Management") program was available through Medicaid for many families to continue social and medical services coordination after EBLL NCM was completed in Flint.[19] CHAP informed families of EBLL children of the availability of this program.

CHAP's protocol for case management of Flint's EBLL children placed a strong emphasis on coordination of all services, ranging from social and medical services to lead inspection and abatement of the children's homes. This reflects best practices for case management as recommended by the Centers for Disease Control and Prevention's Advisory Committee for the Prevention of Childhood Lead Poisoning.[14] CHAP was in a unique position to provide these coordinating services because of its mission and its location within the Greater Flint Health Coalition. The GFHC's extensive partnerships throughout Flint's medical and social services community included Medicaid Health Plans, Hurley Medical Center and the other two hospitals in the county (Ascension Genesys and McLaren-Flint), the Genesee County Medical Society, the Red Cross, and many health, community, and social service agencies.

- **Elimination of Lead from the Children's Environments**

There is limited evidence that parent education and housekeeping alone can lower children's blood lead levels.[20,21] The most effective action is to eliminate the sources of lead in the child's environment.[6] CHAP worked closely with families to identify all potential sources of lead, take interim prevention measures (e.g., taping peeling paint on window frames), and apply for financial assistance in completing home renovations needed to eliminate the lead sources (e.g., replacing windows).

CHAP also addressed concerns about lead in drinking water. They educated families about the sources of lead (including in-home lead pipes and fixtures) and assisted in making sure that faucets had water filters. Water was tested from all faucets during the environmental investigations; home abatement included replacement of faucets and plumbing when lead levels were above EPA's Action Level of 15 ppb. The City of Flint is in the process of replacing all 18,000 leaded water service lines with completion expected in 2020.

CHAP's EBLL Services beyond the Scope of this Report

The focus of this report is on the outcomes of EBLL children in Flint that were less than 6 at the time of their first EBLL and whose first EBLL occurred between May 1, 2016, and July 31, 2018. It should be noted that CHAP also provided NCM services to EBLL children who lived outside of Flint in Genesee County and Genesee County children who were between age 6 and 18. CHAP also completed NCM services for children with EBLLs for whom NCM had been initiated by the Genesee County Health Department between October 2015 and May 2016.

- **Use of a Non-Governmental Organization (NGO) for NCM in Flint**

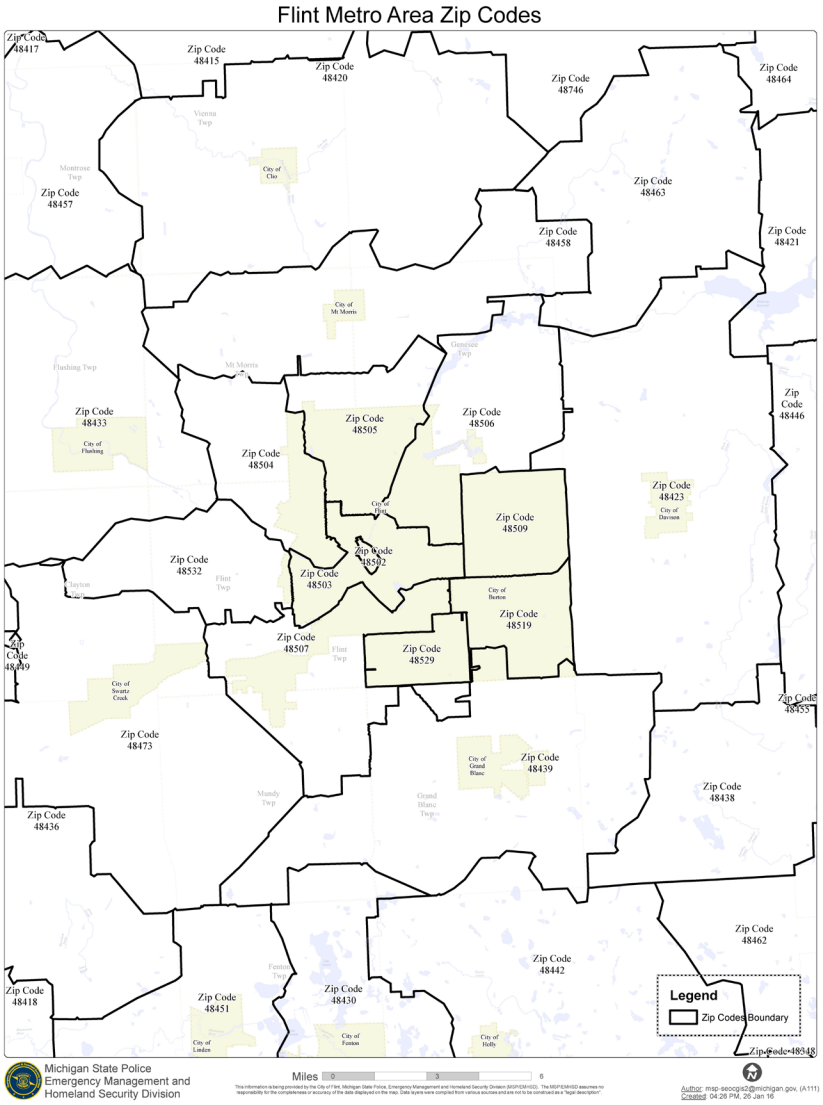
The decision to entrust EBLL NCM to an NGO was based on the recognition of the extraordinary circumstances of the Flint water crisis and the need for service delivery from an organization with deep connections to the community's medical and social services and a focus on services that address

social determinants of health. The EBLL NCM protocol, developed in partnership between MDHHS and CHAP, provided the detailed roadmap for reaching and serving EBLL children. Success in carrying out these requirements can be attributed to the CHAP program's structure and strategies, which were designed to overcome client distrust (e.g., persistent communication and non-judgmental care by CHAP staff) and meet families' immediate needs.

- **Recommendations**

Genesee County is the only jurisdiction in Michigan where an organization is funded to provide NCM services to every child under 6 years old with an EBLL, regardless of Medicaid status. Considerable efforts are required to identify, contact, serve and coordinate lead exposure mitigation activities for EBL children. Medicaid currently provides reimbursement to Michigan's local health departments for NCM for Medicaid-enrolled EBL children only. MDHHS provides very limited additional funding to five high risk jurisdictions for NCM for non-Medicaid children. Consideration should be given to funding EBLL NCM programs to cover non-Medicaid as well as Medicaid children for the entire state of Michigan, built on the successes and challenges identified in Flint.

Appendix 1: Map of Flint



Appendix 2: Technical Notes on Data Collection and Analysis

Data were abstracted from the records of each child in three databases: (1) the MDHHS Healthy Homes and Lead Poisoning Surveillance System (HHLPSS); and (2) a weekly shared spreadsheet between MDHHS and CHAP with summary information about Nurse Case Management activities for each child with an EBLL ($\geq$ 5 µg/dL), and CHAP's electronic database. (HHLPSS is populated by data from the CLPPP's surveillance database of blood lead reports from laboratories and data entered by nurse case managers.)

Data were included on children who were referred to CHAP when they had their first EBLL between May 1, 2016 and April 30, 2018. Data on nurse case management and other services provided by CHAP were collected through July 31, 2018. The following information was collected:

- Demographics
    - Age at time of first EBLL
    - Gender
    - Race/ethnicity
    - Addresses
    - Medicaid status
- First and last blood lead test
    - Date of sample
    - Sample type
    - Results
- Number and dates of NCM Activities, including
    - Phone calls attempted and completed with the family
    - Calls made to the child's health care provider or others
    - NCM home visits completed
    - Visits to the home address for reasons other than NCM (e.g. delivering water filter, going to home because family not answering phone).
    - Services provided directly to the family (e.g., delivering a water filter, household items)
    - Social/medical services referrals

Children were categorized as eligible or not eligible for EBLL NCM. Those not eligible for NCM services met at least one of the following criteria: no confirmatory venous test following a capillary EBL, a follow-up blood lead test less than 5 µg/dL, or the family

moved. If eligible for NCM, the categories of dispositions included: NCM was completed, family declined NCM, NCM was started but not completed because family declined, moved, or were lost to follow-up as the family could no longer be found despite several attempts at phone calls and drop by home visits.

Information about environmental investigations, status of LSHP applications, and status of home abatements were obtained from HHLPSS and from the LSHP database through December 2019 by matching on street addresses of the EBLL children referred to CHAP.

Information abstracted from the environmental inspection included results of paint, dust, soil, and water sample testing, including results exceeding standards established by federal or state agencies, and whether an adult living in the home worked in a lead-exposed industry.

Some children lived in more than one home, and some homes had more than one EBLL child in the home. Because this report is about EBLL children, not homes, counts for environmental investigations and home abatements are related to children, not homes.

Each child's record of blood lead testing subsequent to the initial elevated test was tracked through December 2019, and the final blood lead test result was recorded.

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