



Lead in Drinking Water: Post-Flint Media Coverage and Policy Changes in the Northeast-Midwest Region

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Cover: Water fountains on the first floor of the Cannon House Office Building in Washington, D.C., courtesy the author

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The Northeast-Midwest Institute is a Washington, D.C.-based, nonprofit, nonpartisan public policy organization committed to economic vitality, environmental quality, and regional equity for the 18 states of the Northeast and Midwest. As a policy-focused institute with a 40-year track record of producing first-rate research, developing policy options, and building and supporting regional coalitions, the Institute has unique standing in that it was founded in response to calls by the Congressional Northeast-Midwest Coalition for a stable and trusted source of regional data and research as well as policy options and analysis. It is precisely these roots and relationships on Capitol Hill which now position the Northeast-Midwest Institute to chart a future that encompasses an expanded agenda of critical regional issues and to embark on a strategy to achieve increased impact.

Reviewers

This report benefitted from the valuable comments provided by the following reviewers. The author is responsible for any remaining errors.

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I. Executive Summary

The Flint water crisis not only endangered the lives of the city's residents, creating one of the largest public health crises and environmental justice disasters, it also re-awakened the country to poor quality infrastructure and inadequate safeguards protecting drinking water in our homes, schools, and communities. The Northeast-Midwest (NEMW) region is especially affected by this issue due to its many older cities and aging infrastructure. Municipal-level details on the state of the water infrastructure with respect to lead are not readily available, as confirmed by two recently-issued reports by the government watchdog agency, Government Accountability Office (GAO).

This report attempts to capture the response to the Flint water crisis in the NEMW region. The report catalogs the severity of the lead crisis in the NEMW cities during 2015-2017 by using a novel, yet established methodology of reviewing news media coverage as a proxy for the severity of drinking water issues related to lead contamination. Additionally, this report presents a comprehensive analysis of post-Flint statewide laws and regulations enacted in the NEMW states to improve water quality, as well as testing, reporting, and notification of lead results, and replacement of infrastructure.

A review of 153 news articles published in newspapers and newswires found that the coverage was geographically spread across the NEMW region, but most concentrated in a few states such as Michigan, Pennsylvania, Illinois, Wisconsin, and Ohio. Overlaying the locations of these articles on a map of Congressional Districts revealed numerous regions, apart from larger urban areas, as being affected; more than half of the 158 districts featured at least one location-specific article. A closer examination of the article content revealed temporal trends as well as differences between the coverage of municipal and school water issues. The media coverage was most intense in mid-2016, when the severity of the lead crisis was felt in many cities in the NEMW region, and then continued to decline as the ongoing crisis receded in visibility.

Coverage of municipal articles was well-distributed across several focus areas, while school articles were largely focused on lead testing. Additionally, school articles were more likely to mention the lead action level under the LCR (or equivalent), describe test results, and report elevated levels of lead. Media coverage is a useful, even if imperfect, proxy for municipal- and district-level data on important issues such as lead in drinking water. It can provide enough information to ascertain temporal, spatial, and thematic trends, while also serving as a barometer of the civic and public discourse.

In the absence of a strong and proactive federal response to the crisis, states have addressed various aspects of this issue, but a comprehensive approach is lacking. While elements of certain

state laws are laudatory (for instance, affordability provisions in Wisconsin and mandatory school lead testing every year in Pennsylvania), no state – with the sole exception of Michigan, which significantly revised its state Lead and Copper Rule – has taken a comprehensive approach, which could serve as a template for other states. In fact, only three states – Illinois, New Jersey and Pennsylvania – implemented post-Flint laws that address the lead issue in both municipal and school settings, and even there, the Pennsylvania law does not address daycare centers.

Nearly three years after the Flint crisis, more than half of the NEMW states introduced no new laws or regulations to address the significant problems associated with lead contamination in municipal drinking water. Of the states that did introduce new laws or regulations, with the exception of Michigan, none was comprehensive in nature and instead only addressed certain aspects of this complex issue.

In contrast, NEMW states have been much more active on the issue of lead in school water supply – particularly testing, remediation, and notification. Post-Flint, half of NEMW states have laws mandating compulsory lead testing in schools, with a few additional states instituting voluntary programs, but the remaining NEMW states – one-third of them – have neither mandatory nor voluntary lead testing programs. The state programs on lead testing vary widely in their coverage, frequency of testing, and accountability and transparency provisions. Four states require lead testing in daycare centers, but only one state – Illinois – covers home daycare centers under that provision. While no particular state has a comprehensively strong lead testing mandate, there are several strong provisions in these state efforts that could be included in federal legislation to expand the coverage of these provisions to the rest of the region and indeed to the entire country. Despite the focus on testing, the lack of mandated rehabilitation of affected fixtures in schools and the absence of dedicated funding is a cause for concern.

The November 2018 elections have brought significant changes to the makeup of Congress, Governors, and state legislatures in the NEMW region, which could bring a new wave of legislative and policy solutions to the various aspects of the lead crisis. The post-Flint policy achievements are a true testament to the American democracy, where determined legislators worked with policy analysts, researchers, and citizen activists to craft meaningful reforms to address policy lacunae. While gaps remain, the results so far provide a template for achieving policy solutions for complex issues involving multiple stakeholders. Such participatory governance comes a bit too late for Flint and other cities but, if advanced, has the potential to protect future generations in the years to come.

II. Introduction

The very mention of the words “Flint, Michigan” is now synonymous with the contamination of water supply with lead, but that was not always the case. Flint was once a thriving, industrial city that was well known for automotive manufacturing. But it experienced a deep economic depression and population loss from the 1970s to the present day (Ruble, 2016). Today, the city is infamous for its water crisis, which resulted in elevated blood lead levels in children, as well as an outbreak of Legionnaire’s disease that led to at least 10 deaths (Hanna-Attisha et al., 2016; Hersher, 2018). The root cause of the problem can be traced back to switching the city’s water source from Lake Huron to the Flint River in April 2014 and the lack of adequate corrosion control to treat water from this new source (Masten et al., 2016). Almost immediately, the corrosive water from Flint River interacted with the coating in the water pipes, contaminating the city’s drinking water supply with lead. The inadequate corrosion control treatment did nothing to stop the leaching of lead from these pipes, thereby affecting the entire city’s water supply (Vedachalam, 2018).

There was widespread concern among residents in cities across the country, but especially in the older cities in the Northeast-Midwest (NEMW) region, about the quality of water supply in their residences, schools, and other public facilities.

Over a period of months, a seemingly bureaucratic decision to terminate a contract became a critical lesson in the limits of austerity governance, protections offered by current regulations, bureaucratic ineptitude, and much more. Although it took months before the state government in Michigan paid attention to the concerns raised by citizens, activists, and scientists, and recognized the problem, the public nature of the outcome – contaminated water supplies and rising lead levels in children’s blood – ensured that the crisis reverberated across the nation. There was widespread concern among residents in cities across the country, but especially in the older cities in the Northeast-Midwest (NEMW) region, about the quality of water supply in their residences, schools, and other public facilities.

The Northeast-Midwest (NEMW) region is home to a large proportion of the lead service lines (LSLs) in the country. A study by the American Water Works Association produced state-wide estimates for LSLs across the country (Cornwell et al., 2016). The study found that the top five states with the most number of LSLs are all in the NEMW Region, with the top four located in the Great Lakes Basin – Illinois, Ohio, Michigan, and New York.

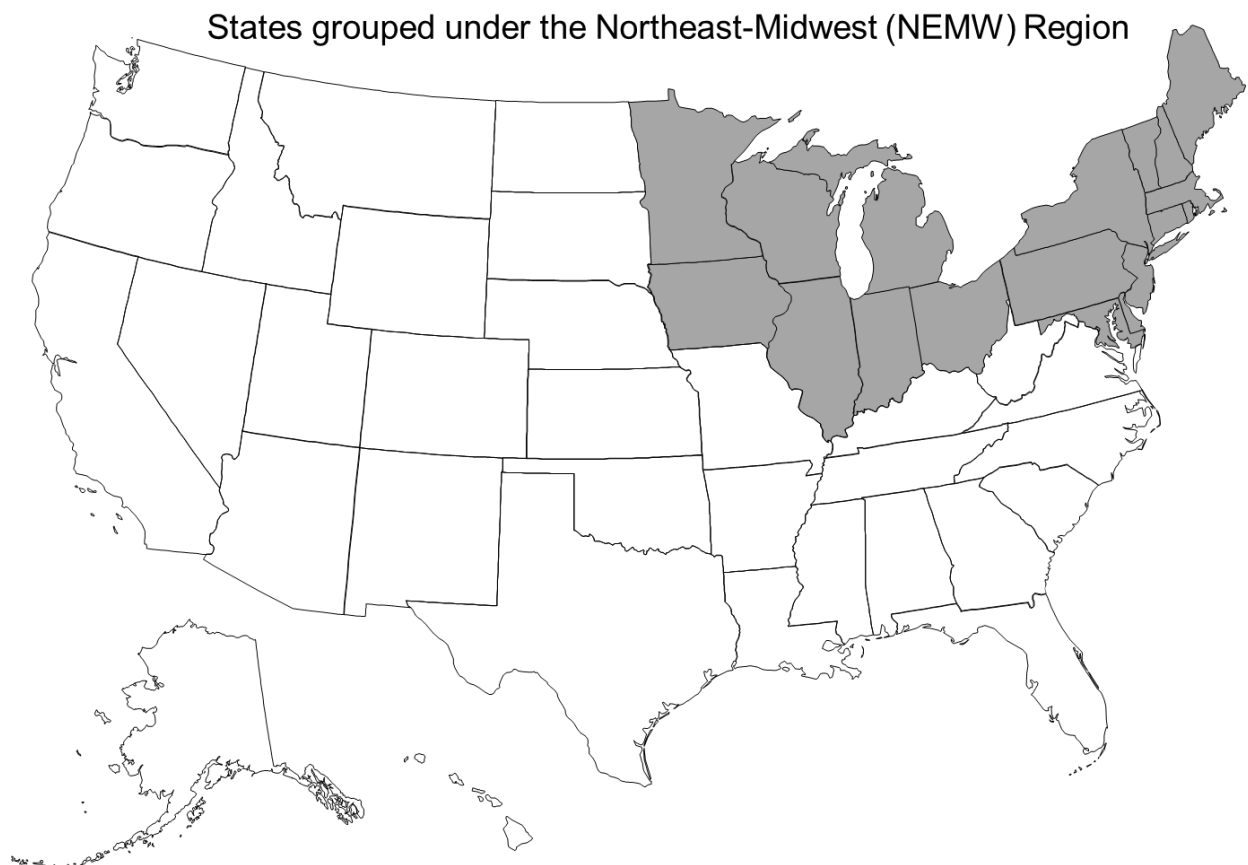


Figure 1. The Northeast-Midwest states highlighted on a map of the United States. The states are (in alphabetical order): Connecticut, Delaware, Illinois, Indiana, Iowa, Maine, Maryland, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, and Wisconsin. Editable map courtesy Free Vector Maps.

This report is an attempt to capture the fallout from the Flint water crisis, especially as it pertains to the NEMW region. Although the report intended to catalog the severity of the ‘lead in water’ crisis in the NEMW cities, there was no direct way of doing so. Two recently issued reports by the government watchdog agency Government Accountability Office (GAO), described later in the report, confirm this view. To get around this limitation, the report uses a novel, yet established methodology of reviewing news media articles as a proxy for location-specific data gathering on a particular topic. Following that, the report presents an analysis of post-Flint laws enacted to improve water quality, as well as testing, reporting, and notification of lead results, and replacement of infrastructure.

III. Federal Laws Governing Lead in Water

Lead in drinking water is regulated under a few key federal laws and regulations that include the requirement to use “lead-free” pipe, solder, and flux¹ in water installations through the Safe Drinking Water Act (SDWA) Amendments of 1986 and 1996, the voluntary lead monitoring and reporting requirements for schools and child care centers under the Lead Contamination Control Act (LCCA) of 1988, and the Lead and Copper Rule (LCR) promulgated in 1991 (USEPA, 2018b) and its subsequent revisions.

The LCR requires public water suppliers to monitor for lead in drinking water and to provide treatment for corrosive water if lead or copper are found at unacceptable levels. Under the LCR for public water systems, a lead action level (AL) of 15 parts per billion (ppb) is established for 1 liter samples taken by public water systems at high-risk residences. If more than 10 percent of the samples at residences exceed 15 ppb, system-wide corrosion control treatment may be necessary. As the USEPA states, the 15 ppb AL for public water systems is therefore “a trigger for treatment rather than an exposure level” (USEPA, 2006). The LCR does not directly apply to schools, unless they are labeled a public water system. For schools, USEPA recommends collection of 250 mL first-draw samples from water fountains and other outlets used for consumption, and that those outlets be taken out of service at elevated lead levels.²

The Flint water crisis exposed limitations of the lead testing and monitoring framework under the LCR. This became particularly evident in the case of multi-family housing, daycare centers and K-12 schools. Daycare centers and schools, in particular, house young children – who are most vulnerable to lead absorption in blood – for several hours each day seasonally or annually. Unless the daycare center or school is labeled a community water system³, they are not required to test the water being provided there.

As of this date, these bills have languished, not even seeing committee action, and thus they are unlikely to become legislation in the current session of Congress.

Many lawmakers sought to correct this federal oversight by introducing various pieces of legislation in the U.S. Congress. This report identified eight key legislative bills introduced in the 115th Congress (2017-

¹ “Lead-free” refers to solders and flux containing not more than 0.2 percent lead, and pipes and pipe fittings containing not more than 8.0 percent lead. The lead content was dropped to 0.25 percent in 2014 based upon the Reduction of Lead in Drinking Water Act of 2011.

² Elevated lead levels are not defined, but in the past, the USEPA’s “3Ts” manual recommended 20 ppb as the AL.

³ There are three types of public water systems. Community Water Systems (CWS) are those that serve the same people year-round. Most schools, on the other hand, may serve the same people for more than six months, but not year-round, and are thus classified as Non-Transient Non-Community Water Systems. Places such as gas stations and campgrounds serve different people year-round and are classified as Transient Non-Community Water System.

2018) pertinent to this discussion (see Appendix Table A1). They addressed various aspects of lead testing, monitoring, and rulemaking process such as requiring the USEPA to revise the LCR by a certain date, setting action levels lower than the current federal level of 15 parts per billion (ppb), requiring public water systems to test for lead in schools and daycare centers, and providing additional funding for lead testing in schools and other public facilities. As of this date, these bills have languished, not even seeing committee action, and thus they are unlikely to become legislation in the current session of Congress. It is worth noting that all of these bills were introduced by members representing NEMW states.⁴ One of the few lead-related bills to become legislation after the Flint crisis was the Water Infrastructure Improvements for the Nation (WIIN) Act of 2016 (P.L. 114-322) – approved in the 114th Congress – which, among other things, established a grant program for lead reduction in municipal water, and established a \$20 million competitive grant program for lead testing in schools and daycare centers. Funding for lead testing was later appropriated in the Omnibus Consolidated Appropriations Act of 2018 (Schumer, 2018). Additional funding for voluntary lead testing in schools and daycare centers was authorized under America’s Water Infrastructure Act of 2018 (P.L. 115-270).

IV. Public Data Availability

Municipal-level details on the state of the water infrastructure with respect to lead are not readily available. Two recently-issued reports by the federal government watchdog agency, Government Accountability Office (GAO), confirm this. Following the Flint water crisis, the EPA encouraged all states to work with public water systems (PWS) and publicly post the “materials inventory” of lead service lines (LSLs), along with any additional updated maps or inventories of LSLs. The Lead and Copper Rule, issued in 1991, required water systems to conduct a materials inventory of LSLs, but did not require making them publicly available. Despite the EPA directive, a GAO report found that the total number of LSLs is unknown and approaches used to count them vary (Government Accountability Office, 2018a). The report identified significant sampling limitations in a study conducted by the American Water Works Association that, up to this date, provides the best estimate of LSLs.

In the absence of a nationwide standard for school testing, the GAO conducted a survey to review school practices for lead testing and remediation (Government Accountability Office, 2018b). The survey found that only about 43 percent of the school districts tested for lead in the years 2016 or 2017. A similar proportion – 41 percent – did not test, while the remaining did not know if a test had been conducted. Thus, everyone – from policymakers to residents – is in the dark about the extent of the problem with lead contamination in municipal and school water supply, and the possible solutions.

⁴ All members introducing lead-related legislation in the U.S. Congress were Democrats.

V. Media Coverage as a Proxy

In the absence of comprehensive data on the state of infrastructure, alternative methodologies need to be considered to obtain a better understanding of the state of water infrastructure, policies being considered or adopted, and the quality and extent of public discourse on these important issues. One such method is an analysis of news media coverage on this topic.

Although imperfect, newspapers remain a reliable source of information for the public, especially for addressing local issues (Pew, 2013). News media's role in setting a national agenda and in influencing public opinion is well documented (McCombs, 2002). The widespread use of social media such as Facebook and Twitter has only sought to amplify the news coverage on key issues through sharing among social networks.

Researchers have conducted analyses of media coverage to identify trends, confirm hypotheses, and analyze public discourse in the case of infrastructure issues. A newspaper content analysis of the 2001 municipal elections in Florida drew connections between the incumbents' positions and decisions on infrastructure issues to their election results (MacManus, 2004). Specific to water infrastructure, Vedachalam et al. (2016) conducted a content analysis of print media articles published over a 14-year period to assess trends and explore the discourse on aging water infrastructure. In cases where primary data may not be readily available, an analysis of news media coverage can generate proxy data to assess temporal, spatial, and thematic trends. In this report, media coverage is employed as a proxy for municipal- and district-level data on the severity of the lead in drinking water issue.

A. Methods

To identify articles published on the lead contamination issue, a standard search was developed using the database LexisNexis Library Express, since it provides a reproducible way to search for articles. The timeframe for data selection was January 1, 2015 to December 31, 2017 to capture the Flint water crisis and its after-effects on other cities. Data collection occurred during January-April 2018. The search terms were “lead AND water,” along with the index terms “water resources” and “lead,” and the geotag “United States.” The search terms used were purposefully broad to allow a wide range of articles to be included in the analysis. The search process was restricted to articles appearing in newspapers and newswires. The search process yielded 13,687 results, which were preliminarily screened for duplication, content relevance and geographic focus. The study was restricted to states within the NEMW region. The preliminary screening yielded 84 newspaper articles and 165 newswire articles, for a total of 249 articles.⁵

⁵ The widespread use of the word “lead” as a noun (e.g., leader) or verb (e.g., lead the campaign) was a key factor, along with duplication, content relevance, and geographic focus, in the significant reduction in the number of relevant articles.

These articles were read in detail and coded. During this screening stage, several articles were found to be not relevant and outside the geographic focus, and therefore removed from the pool. For each article, the following were coded:

- **Newspaper identification** (news agency type, name, state and city of publication, etc.).
- **Article profile** (date, state and city of focus, word count, etc.).
- **Relevance:** A 4-point categorical scale that assesses the relevance of the article for this study.
- **Focus:** Six categories were developed to identify the primary and secondary focus areas of the article.
- **Details from the article and contextual information:** Binary and categorical variables to code article description about detection of elevated lead levels, identification of sources, lead testing process, discussion of test results, and other relevant policy discussion.

The data were recorded in Microsoft Excel, and analyzed using Stata v14.1 (StataCorp, 2015).

B. Results

After two rounds of screening, a total of 153 articles were found to meet the criteria for the study. Based on the content of the articles, there appeared to be two main strands of news coverage – one focused on municipal water issues (95 articles) and the other focused on the water supply in schools (58 articles). The incomplete cataloging of news articles in LexisNexis may be the cause for the less than expected total number of articles obtained in this search process.⁶ Despite this limitation, LexisNexis provides a methodical and reproducible way of searching for archival news items. Rather than providing an accurate assessment of the lead in water crisis being experienced in many cities, these search results should be taken as a broad representation of the media coverage on this issue.

Even though the search period started from January 2015, chronologically, the first article to appear in our dataset is from October 15, 2015, which coincides with the public revelation of the crisis in Flint. On September 29, 2015, Michigan Governor Rick Snyder acknowledged for the first time that the increased lead levels in Flint’s water supply were cause for concern, and pledged to take action (Associated Press, 2017).

Starting from this first article, all the articles were categorized into three-month time-periods (“quarters”), with October-December of 2015 as the first quarter (Q1). Categorization of the 153

⁶ LexisNexis licenses content from producers, and thus maintains content only as long as the license is in force. Lack of licensing agreements with major publishing companies (which may own several publications) can preclude inclusion of content in their database.

articles across nine quarters allowed us to conduct temporal analyses. The intensity of media coverage on lead-related issues peaked in Q3 (April-June 2016), when several cities started discovering lead contamination in their water systems (Figure 2). It was during this period that President Obama visited Flint and famously drank a glass of the city’s municipal water to reassure residents that the water was safe. The interest in school issues declines steadily after that point, whereas municipal coverage undergoes a small increase in Q6 (January-March 2017), when various cities undertake policy discussion on lead mitigation and replacement of LSLs. A search for the term “lead water” for web searches in *Google Trends* shows a similar profile, with a peak in early 2016, followed by declining attention.⁷

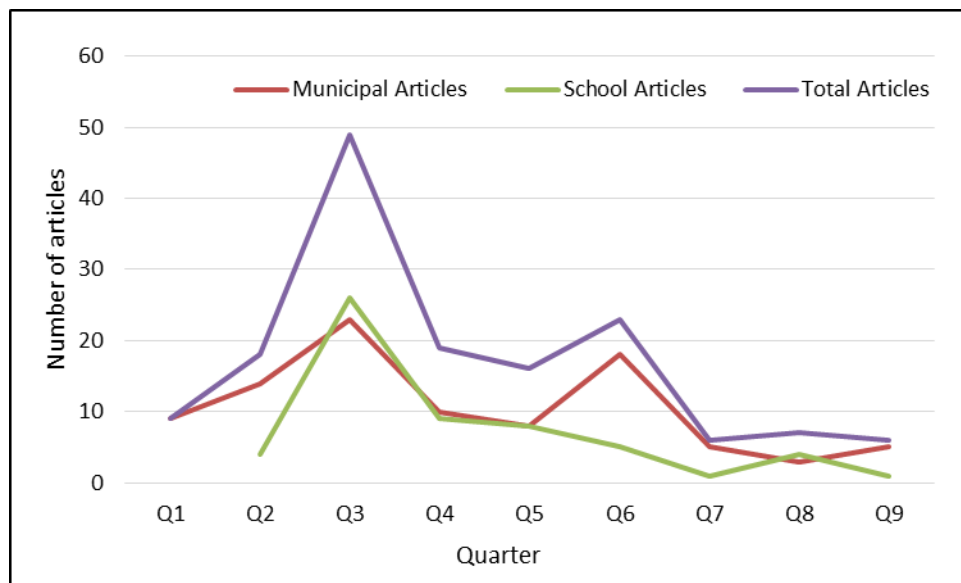


Figure 2. Articles on municipal and school lead issues across the study period. Q1 denotes the period October-December 2015. Quarters Q2...Q9 denote the subsequent three-month periods.

C. Geographical Spread

The articles were geographically spread across the NEMW region, but most concentrated in a few states such as Michigan, Pennsylvania, Illinois, Wisconsin, and Ohio (Figure 3). These states are home to some of the oldest cities in the country, and contain the most number of lead service lines (LSLs). The only NEMW states that were not featured in the articles were Delaware, Minnesota, and Vermont.

⁷ See archived results of that search at: <https://trends.google.com/trends/explore?date=2015-01-01%202017-12-31&geo=US&q=lead%20water>

Media Coverage of the Lead Contamination Issue by State

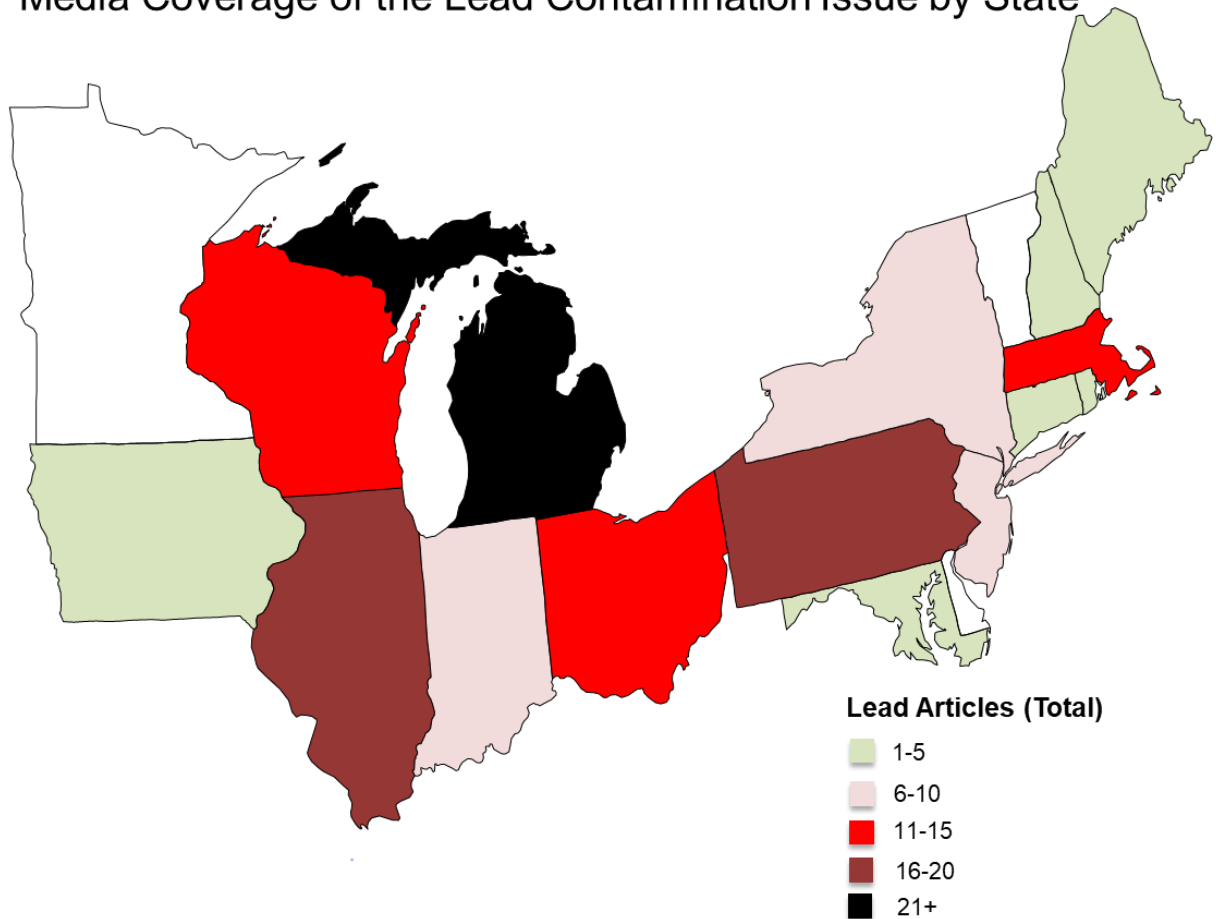


Figure 3. Media coverage of the lead contamination issue in the NEMW region by state. Editable map courtesy Free Vector Maps.

Flint was the most featured city in the dataset, appearing 14 times. This was not surprising, given the intense national focus devoted to the city’s lead in water crisis. What was surprising, however, was that all 14 articles discussed municipal issues, with none focused on water quality in Flint schools. Other cities, including suburbs, featured prominently include Chicago (four municipal articles and six school articles), Pittsburgh (eight articles, all municipal-focused), New York City (seven articles, all schools-focused), Boston (six articles, all school-focused), Philadelphia (three municipal articles and three school articles), and Detroit (one municipal article and four school articles). In addition to these large cities and their suburbs, a few smaller towns appeared in the dataset. The most prominent among them was Sebring, OH (five municipal articles), which was described as the “next Flint” in media reports and faced a criminal investigation from Ohio EPA for failing to provide clean drinking water to its residents (CBS News, 2016). The smallest town to appear in the dataset was King, WI (population: 1,750).

There were three articles focused on Washington, DC that appeared in the search results. These articles were not about water service to the city residents or its schools, but specifically focused on lead contamination in the office buildings that serve the members and staff of the House of Representatives. Though Washington, DC is not part of the NEMW region, these articles were retained in the dataset due to its broader significance – lawmakers tasked with addressing a major crisis nationwide faced a crisis of their own, perhaps making them more alert to this issue. Unfortunately, the issue in the House office buildings is unresolved as of the publication of this report (see Figure 4).



Figure 4. “Out of service” signs placed above water fountains on the first floor of Cannon House Office Building. Although unspecified, the state of disrepair is caused by high lead levels in the building. Photo credit: author.

Although most articles were focused on a specific city or county, some discussed national or statewide issues too. Seven articles were nationally-oriented and 17 discussed statewide issues. The statewide articles featured Wisconsin (5 articles), Indiana and Massachusetts (3 articles each), Illinois and New Jersey (2 articles each), and Pennsylvania and Rhode Island (1 article each).

Next, the locations of the articles were overlaid on a map of Congressional Districts (CDs) for the 116th Congress (Figure 5).⁸ In the case of larger cities, any CD that included a small portion of the city was counted as having an article featured. The analysis reveals that 83 CDs – more than half of the 158 CDs in the NEMW region – featured at least one location-specific article.⁹ A little more than two-thirds of the CDs are represented by Democrats (57) in the 115th Congress. The 5th District of Michigan (MI-5), which includes Flint, is the clear outlier here, garnering the most media coverage. It is followed by several districts representing larger cities like Chicago, New York, Pittsburgh, and Philadelphia. OH-6, which includes Sebring, Ohio, is the most prominent rural district to receive intense media coverage. Although lead contamination is largely an urban issue, gerrymandering of CDs presents an opportunity to engage members representing largely rural districts with some urban areas, expanding the coalition of the safe drinking water advocates. Based on Figure 5, however, it is clear that apart from large cities, several other areas such as western Illinois, parts of Wisconsin, Michigan’s Upper Peninsula, southern Ohio, western Massachusetts, and eastern Maine are experiencing this issue.

Media Coverage of the Lead Contamination Issue by Congressional District

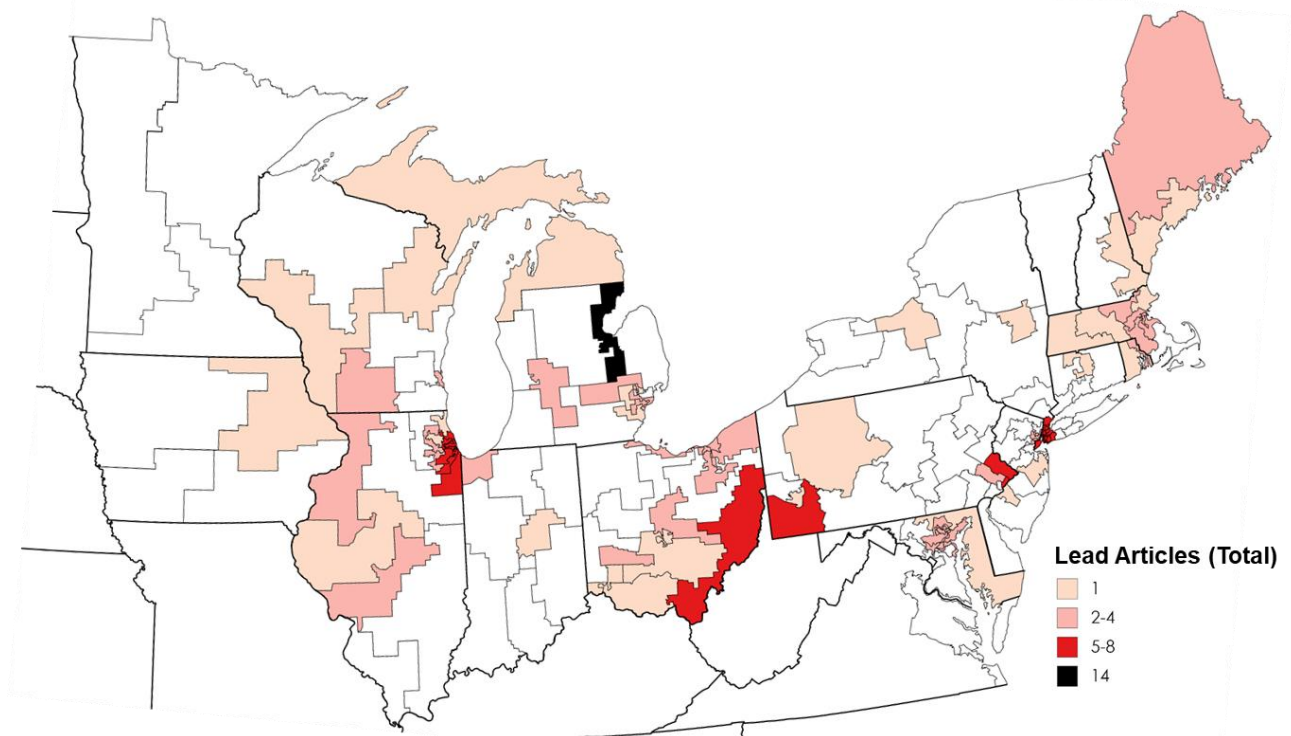


Figure 5. Media coverage of the lead contamination issue in the NEMW region by congressional district. The District of Columbia is not highlighted on this map due to software limitations. Editable map courtesy mapchart.net (<https://mapchart.net/usa-congressional-districts.html>).

⁸ Districts in 116th Congress incorporate changes in Pennsylvania’s electoral map due to court-mandated redistricting.

⁹ This number excludes the national and statewide-focused articles.

D. Reference to Flint

Overall, a majority of the articles made a reference to the Flint water crisis, in an attempt to make the issue of lead contamination familiar to the readers. Municipal articles referred to Flint (57%) just slightly more than school articles (45%) (the difference was not significant, $p > 0.05$).

References to non-Flint lead contamination incidents were less common, overall. However, school articles (22%) made significantly higher ($p < 0.01$) references to non-Flint lead contamination incidents than municipal articles (6%). Figure 6 shows the references to Flint and non-Flint lead contamination incidents in the articles over time. References to Flint decline consistently over time, as Flint fades away from national discussion and readers become more aware of the lead contamination issues in their own community without the need for an additional reference. Eventually, references to Flint nearly track those of non-Flint incidents, which were uniform throughout the study period.

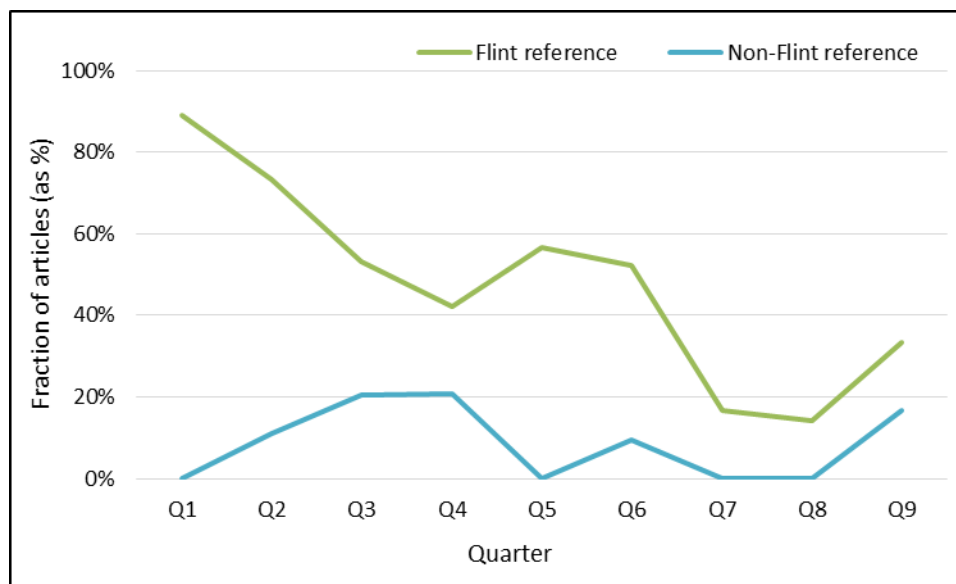


Figure 6. References to Flint and non-Flint lead contamination incidents.

E. Relevance and Article Focus

The article's relevance to the study was assessed using a four-point scale, which in turn depended on six focus areas, described in the next paragraph, designed to categorize the articles.

The article's relevance was assessed the following way:

1. The primary focus of the article could be described by any one of the six focus areas
2. The focus areas do not describe the primary focus, but are the subject of a secondary focus in the article
3. Lead in water is mentioned, but none of the six focus areas describe the primary or secondary focus of the article
4. There is no discussion of lead or lead contamination

All articles, except those scoring “4” on the above-described scale, were deemed relevant to this study. Nearly all the articles scored “1,” while five articles (all focused on municipal issues) scored “2” or “3.” None of the articles in our dataset scored “4.” The six focus areas were:

- **Lead testing:** A description of the testing process, policy announcement, or a negative finding
- **Reporting of elevated levels** of lead in water, or its subsequent remedy
- **Policy discussion**, including the LCR
- **Lead Service Line discussion**, including its replacement and alternatives such as corrosion control
- **Financing** of testing, remediation, and LSL replacement
- Discussion on the **effects or symptoms of lead intake** or poisoning

Figure 7 (a) and (b) shows the distribution of municipal and school articles, respectively, across the six focus areas. There is considerable disparity between the municipal and school articles on the focus areas. Municipal articles were nearly evenly distributed across several focus areas such as LSLs and their replacement, lead testing, and policy discussion. A fifth of the municipal articles reported elevated levels and discussed financing, either as a primary or secondary focus. School articles, on the other hand, were lop-sided in their discussion of lead testing. Nearly all of the articles (57 of the 58) focused on lead testing as a primary or secondary focus. Over 40 percent of the articles reported elevated lead levels, mostly as a secondary focus. The remaining four focus areas were covered in 10-20 percent of the articles, mostly under the secondary focus.

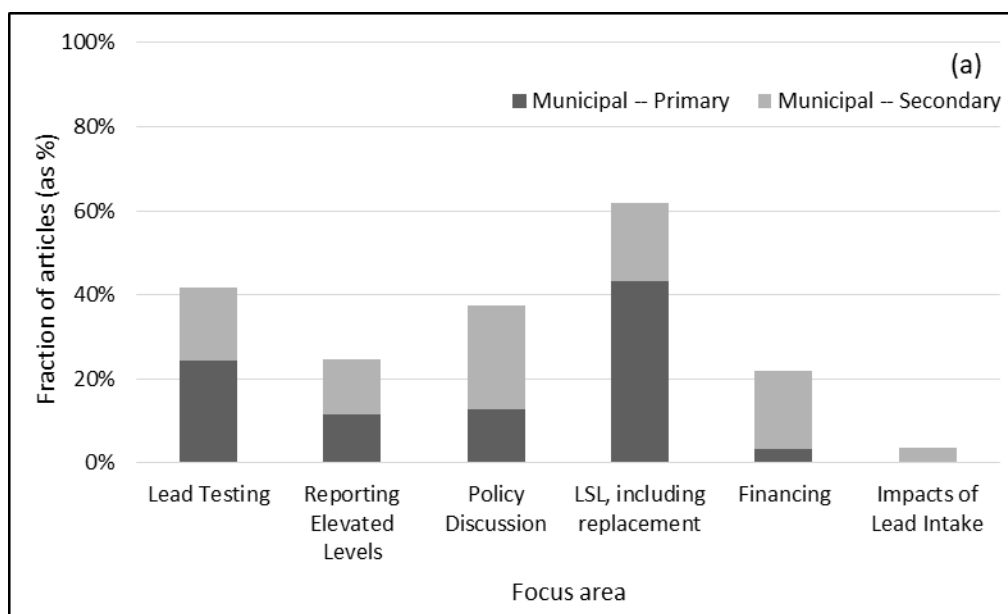


Figure 7a. Distribution of articles across six focus areas in municipal articles.

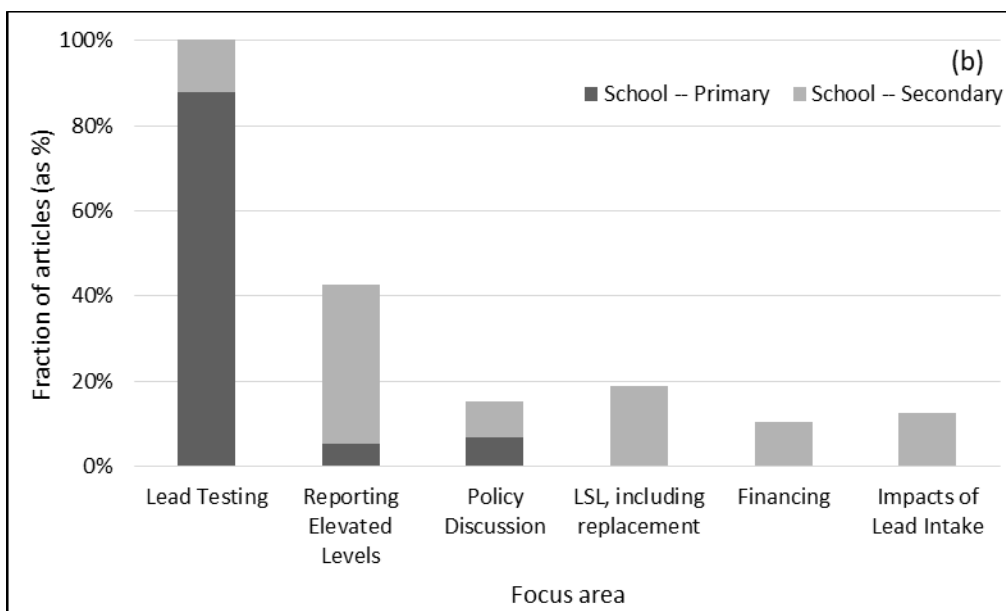


Figure 7b. Distribution of articles across six focus areas in school articles.

Reviewing the same distribution across time reveals additional details. The primary focus of the municipal articles was roughly split between lead testing and LSL discussion in the early part of the study period (Q1-4). However, starting with Q5, much of the focus shifted to LSL and policy discussion, and less attention was given to other topics such as lead testing.

F. Lead Levels

A little more than half the school articles mention the contaminant limits related to lead regulation – either the action levels (ALs) set under the LCR for municipal water or the EPA guidance set for schools (Figure 8). This is significantly higher than the 22% mentions in the case of municipal articles ($p < 0.05$). A much smaller set of articles, however, provide test results. There is no significant difference between municipal articles and school articles in their description of the test results ($p = 0.065$), with only a fifth of the articles describing the results of lead testing.

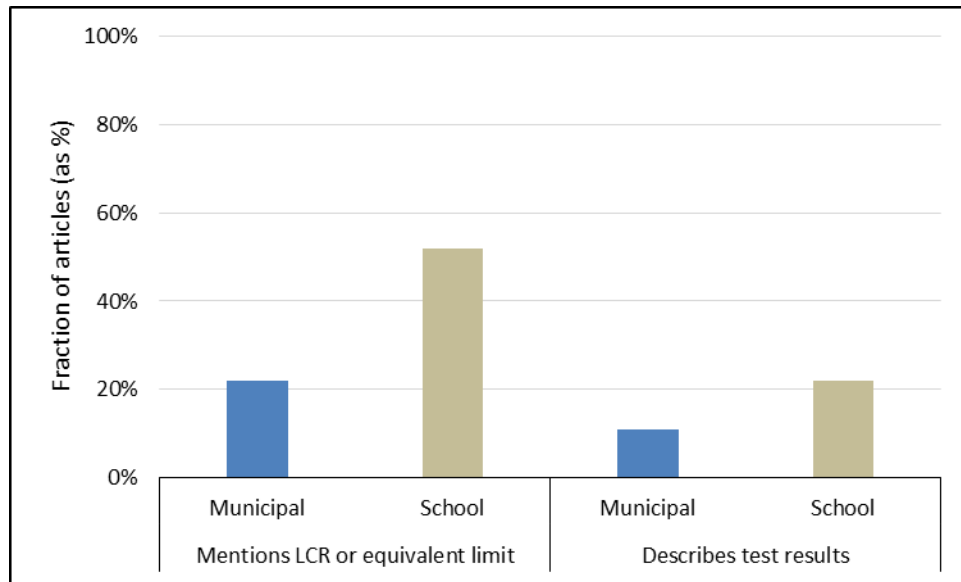


Figure 8. Mention of the LCR limit (left) and a description of the lead testing results (right).

Figure 9 shows the reporting of elevated levels of lead in municipal and school articles for all sources and drinking water sources only. In both cases, a significantly higher proportion of school articles described elevated levels of lead over municipal articles ($p < 0.05$). Drinking water sources are a subset of “all sources”, and thus expectantly, a slightly smaller proportion of articles described elevated test results in drinking water sources only when compared to all sources. The drop-off was more noticeable in the case of municipal articles.

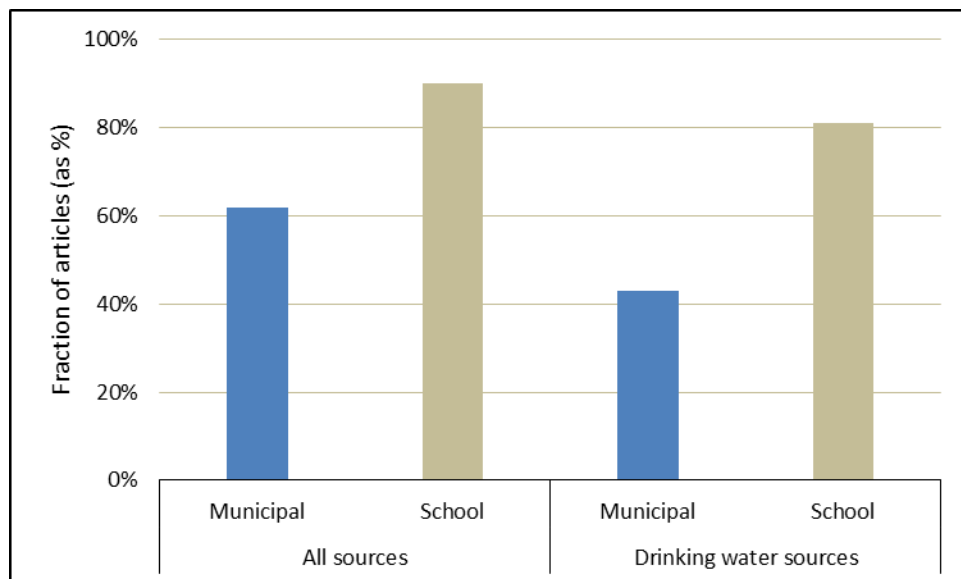


Figure 9. Elevated levels of lead in all sources (left) and drinking water sources only (right)

Next, we reviewed the articles for any discussion on symptoms of lead contamination or poisoning as well as a mention of increased susceptibility among vulnerable populations such as

young children. At least one-third of the articles presented a discussion on both these topics, with no significant differences between municipal and school articles ($p < 0.05$; results not displayed). This was a bit surprising as we expected school articles to place a greater focus on the health effects of lead, given the increased vulnerability of the student population. When observed over time, the discussion on the health effects of lead seemed to drop steadily (Figure 10). This could be attributed to the increased awareness among readers on lead issues due to the continuous media coverage (thereby reducing the need for contextual information). However, such an approach fails to inform new readers tuning in late, who may miss important aspects of the issue.

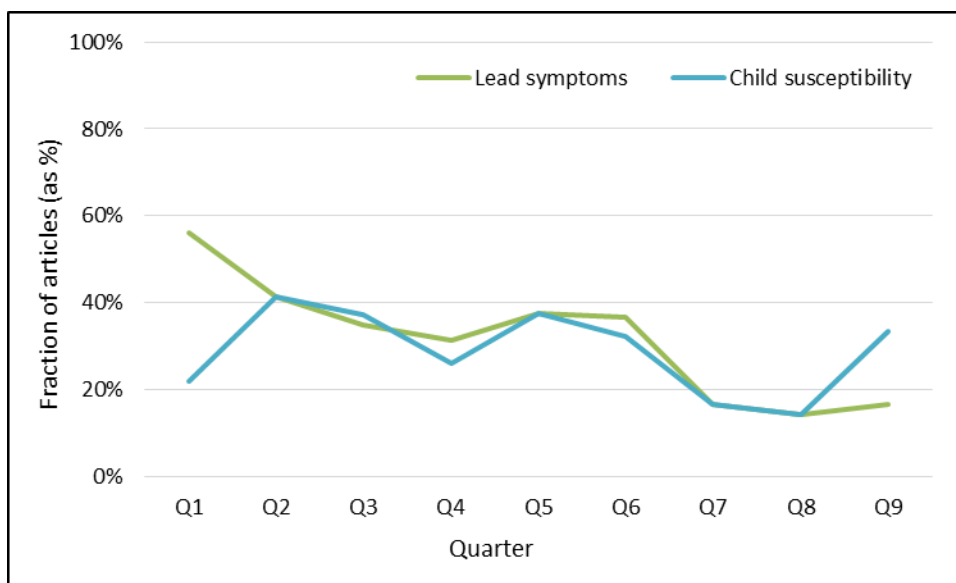


Figure 10. Discussion on lead symptoms and increased susceptibility to children from lead contamination.

As noticed in Figure 7, discussion on LSLs, including replacement, was a dominant theme in the case of municipal articles. We analyzed the article content to assess whether LSL replacement plans were in the planning stages or already implemented (Figure 11). Overall, a greater proportion of municipal articles discussed planning or implementation of LSL replacement as compared to school articles ($p < 0.05$). Nearly two-thirds of the municipal articles discussed plans for LSL implementation, while 39 percent described implementation of the plans. The corresponding numbers were much lower for school articles, since lead testing and not replacement of pipes, has been the object of focus in school articles in our dataset.

A small set of municipal and school articles discussed current and pending legislative efforts at the state and local levels. The Flint crisis and its aftermath highlighted the inadequacy of the existing laws related to lead testing, notification, and infrastructure management. The next chapter is devoted to a discussion of legislative and regulatory efforts to address the issue of lead contamination in water.

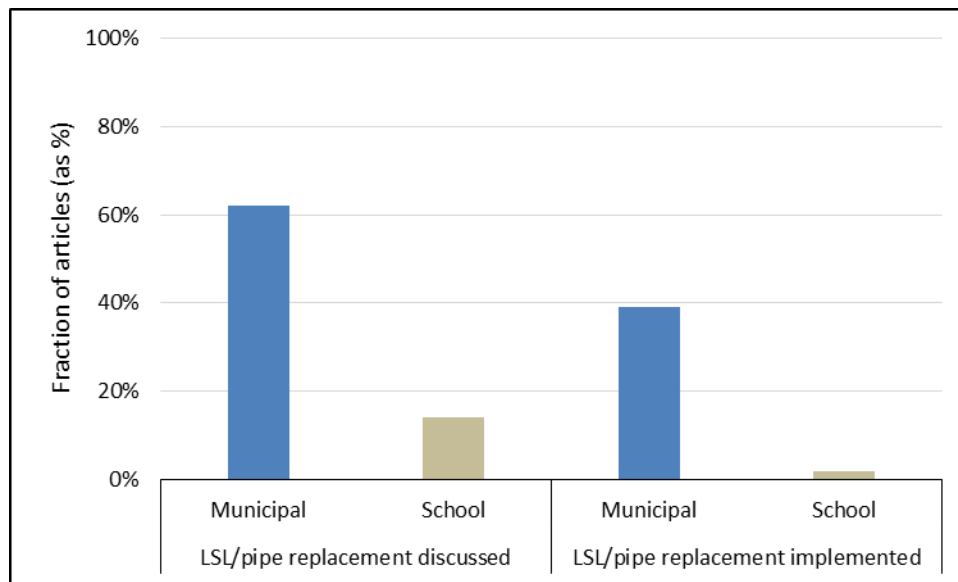


Figure 11. Replacement of lead service lines (LSL) – discussion and implementation of plans

G. Closing Thoughts

In the absence of comprehensive data, an analysis of media coverage is a useful proxy for municipal- and district-level data on lead contamination of water. The media coverage was most intense in mid-2016, when the severity of the lead crisis was felt

The coverage was geographically spread across the NEMW region, but most concentrated in a few states such as Michigan, Pennsylvania, Illinois, Wisconsin, and Ohio.

in many cities in the NEMW region, and then declined. Two distinct strands of news coverage – one focused on municipal water issues and the other focused on water supply in schools – were identified. The coverage was geographically spread across the NEMW region, but most concentrated in a few states such as Michigan, Pennsylvania, Illinois, Wisconsin, and Ohio. Overlaying the locations of these articles on a map of Congressional Districts reveals numerous regions, apart from larger urban areas, as being affected. A closer examination of the article content revealed temporal trends as well as differences between the coverage of municipal and school water issues. References to Flint, and discussions on lead symptoms and increased susceptibility of children declined over time, leaving new readers and recent residents with inadequate contextual information. Coverage of municipal articles was well-distributed across several focus areas, while school articles were largely focused on lead testing. Additionally, school articles were more likely to mention the lead action level under the LCR (or equivalent), describe test results, and report elevated levels of lead. Media coverage is a useful, even if imperfect, proxy for municipal- and district-level data on important issues such as lead in drinking water. It can provide enough information to ascertain temporal, spatial, and thematic trends, while also serving as a barometer of the civic and public discourse.

VI. Federal Structure

The federal structure of governance in the U.S. – division of powers between two levels of government – is a significant driver of policy innovation in every sector, but much more so on environmental and infrastructure issues. Even as the federal government enforces existing laws and proposes new laws that apply nationwide, states play an active role in implementing those laws, often augmenting them with other laws and regulations to adapt to local needs and conditions. At the same time, states have the flexibility to innovate and go beyond the federal laws. Quite significantly, this positions states to be laboratories of innovation and change, testing ideas and introducing innovative approaches into policy development in both states and at the national level as well. There are many examples of this dynamic process, most notably California's Clean Air Act exemption and Massachusetts' health insurance mandate, demonstrating how this state-federal interaction results in a multiplicity of approaches to policy issues, which in turn creates an enormous opportunity to examine and evaluate alternate approaches and to share best practices.

On the flip side of this issue, a multiplicity of approaches to policy issues can complicate any potential gains from these policies. This is especially true in cases where inaction on part of the federal government prompts states to set their own standards, presenting technological challenges along the way, not to mention the public health risks when the standards widely vary across neighboring states. A recent example are the spate of state laws setting standards for a broad class of chemical contaminants called per- and polyfluoroalkyl substances (PFAS). A similar situation exists with lead in water, especially related to setting regulatory standards, testing and notification requirements, and risk management. The following sections cover federal and state laws (and pending legislation) that target various aspects of the lead in water issue as they relate to supply of drinking water in residences and schools.

VII. Lead and Copper Rule

The Flint crisis exposed limitations of the lead testing and monitoring framework under the federal LCR, starting with the testing protocol. The process involves sampling cold tap water, which has been sitting in the pipes for 6-8 hours (an immediate sample, followed by another sample after five minutes of continuous run), but does not factor the range of possible ways the public may choose to consume tap water (immediately without flushing, using warm water that utilizes water heaters not tested for lead, etc.). Additionally, the number of samples collected by utilities under the rule is too few and too infrequent, and the focus on the 90th percentile values may not factor in excessive spikes in lead levels observed in some households.

The LCR's limitations extend to other system-wide processes too. One such instance is the “materials inventory” of lead service lines (LSLs), which would include cataloging pipes and goosenecks made of lead, under both public and private ownership. The LCR required public water systems (PWS) to conduct a materials inventory of all LSLs in their system, but they were not required to be made public. The exact number of PWS who conducted this inventory between 1991 and 2015 is unknown. In response to the Flint crisis, the USEPA sent a letter to all states in February 2016, encouraging them work with PWS to publicly post the materials inventory. Despite this directive, as of July 1, 2018, only 13 states nationally, of which eight are in the NEMW region, have some type of an inventory (Neltner et al., 2018).

Although the Flint crisis spurred a national conversation on lead, changes in federal laws and regulations have been slow to come by. A substantial revision of the

LCR – which was repeatedly

characterized as ‘dumb and dangerous’ by Michigan Governor Rick Snyder (Smith, 2017) – has been in the works for the past few years, but a draft regulation has not yet been released for public review. The proposed regulation’s release has been postponed three times so far, and it is now expected in early 2019. Legislative efforts, introduced mostly by Democrats, to force USEPA to take action, have been unsuccessful too.

The federal Lead and Copper Rule is dumb and dangerous... Unless the federal rules are changed, this tragedy will befall other American cities.

– Michigan Governor Rick Snyder

The federal inaction has left it to state and local governments to consider addressing various aspects of this issue. Furthermore, the decentralized structure of water supply and management requires state and local action on many aspects of this issue. This report will not address changes in municipal laws, but will focus exclusively on state laws and regulations revised in the wake of the Flint crisis.

VIII. State Laws focused on Municipal Water Supply

Within PWS, the Safe Drinking Water Act and its related provisions such as the LCR apply to Community Water Systems (CWS; described earlier in Section 2), but not to Non-Transient Non-Community Water Systems such as schools and Transient Non-Community Water Systems such as gas stations and campgrounds. As a result, unless a daycare center or school is labeled a CWS, they are not required to test the water being provided there. This policy lacuna is now being addressed by legislation specifically targeted at schools, which will be discussed in the following section. This section addresses state laws that are focused broadly on municipal water supply, or in more appropriate terms, community water systems.

Following the Flint crisis, several states have enacted laws that target various aspects of lead in water. Predominantly, they have addressed the issue of LSL replacement, with some narrowly focused on risk identification from LSLs. The most comprehensive change occurred in Michigan, where the state's Department of Environmental Quality (MDEQ) overhauled the state's LCR in June 2018, adopting higher standards than the federal LCR and making significant changes to its LSL provisions such as their inventory, replacement, and public notification. Since 2015, new laws or regulations that address lead in water have been approved in Illinois, Indiana, Michigan, Ohio, Pennsylvania, and Wisconsin (see Figure 12).

Post-Flint Laws on Lead in Municipal Water in NEMW States



Figure 12. States that enacted post-Flint laws or regulations on lead in municipal water. Editable map courtesy Free Vector Maps.

The first post-Flint legislation to target lead contamination in water was Ohio's Sub H.B. 512 (2016), which required water systems to identify and map areas of the systems that are known or are likely to contain LSLs, and identify characteristics of buildings that may contain lead piping, solder, or fixtures. Although the Flint crisis was a much-needed catalyst in initiating legislative and regulatory discussions in states across the country, this legislation may have been prompted by the significant water quality issues related to lead contamination experienced in the small town of Sebring, Ohio, soon after the Flint crisis became a national story.

After the state acknowledged the crisis in Flint, it took more than a year before Michigan took its first legislative action. In the final days of the 98th legislature (2015-2017), Michigan approved Public Act 478 that required cities to provide notices to residents of dangerous lead levels in drinking water within three days of being informed of the contamination by the public water supply provider. Table 1 provides details on the laws and regulations approved in the NEMW states that target lead contamination in municipal water supply.

Table 1. State laws and regulations on municipal lead in water issues enacted since the Flint crisis

State	Source regulation or law	Description	Issue addressed	Themes	Law effective
Ohio	Sub H.B. 512	Requires water systems to identify and map areas known or likely to contain LSLs; maps to be updated every 5 years	LSL	Risk identification	September 9, 2016
Illinois	Public Act 99-0922	CWSs are required to create a comprehensive LSL inventory (including privately owned) and provide notice to affected occupants. Utilities, including IOUs, allowed to charge a hazard recovery fee to undertake activities	LSL	Risk identification, financing	January 16, 2017
Michigan	Public Act 478	Requires cities to provide notices to residents of dangerous lead levels in drinking water within three days of being informed of the contamination by the PWS	LCR	Public notification	March 29, 2017
Indiana	Public Law 91; HEA-1519 (2017)	Allows the Indiana Utility Regulatory Commission to approve a request from IOUs to fold the cost of LSL replacement into water rates paid by customers	LSL	Financing	April 20, 2017
Pennsylvania	Act No. 44; HB 674	Authorizes municipalities to replace or remediate private water and sewer laterals using public funds and municipal employees if the work improves public health	LSL	Financing	October 30, 2017
Wisconsin	Act 137 (2017); SB 48	Allows water utilities to provide assistance to homeowners in replacing LSLs	LSL	Financing, affordability	February 21, 2018
Michigan	Revisions to the state LCR*	Revised LCR to set 12 ppb as the action level; mandates replacement of LSLs at the rate of 5% every year over a 20-year period and institutes a ban on partial replacements	LCR, LSL	Risk identification, replacement	June 14, 2018
New Jersey	Public Law 2018, Chapter 114	Authorizes special assessments and bond issuance to replace LSLs; allows utilities to remediate private LSLs, if undertaken as an environmental infrastructure project.	LSL	Financing	August 24, 2018
Ohio	PWS-06-001*	Requires PWS to provide notification to residents 45 days before making repairs to lead service lines, and provide filters for upto three months after repair completion	LCR, LSL	Public notification, risk management	November 1, 2018

Legend: CWS: Community water supply; IOU: Investor-owned utility; LCR: Lead and Copper Rule; LSL: Lead service line; PWS: Public water supply.

Notes: * Revisions to Michigan's LCR and Ohio's public notification policies were achieved through the regulatory approval process led by the Michigan Department of Environmental Quality and Ohio Environmental Protection Agency, respectively.

A. Key Challenges Addressed by Post-Flint Laws and Regulations

A few notable observations can be made based on these post-Flint laws and regulations. First, the legislative and regulatory activity is restricted to a little more than a third of the states in the NEMW region. However, they seem to be broadly concentrated in states that are most affected by the lead crisis, as measured by news media articles presented earlier or other markers such as the number of LSLs identified by Cornwell et al. (2016). Second, these revisions fall under certain common themes such as public notification, risk identification, and financing. Sections II and III of this report identified the principal federal laws governing lead in drinking water and its shortcomings that became apparent during and after the Flint crisis. Listed below are a few of the key challenges that state laws and regulations have attempted to address post-Flint:

1. Risk identification

As the recently released GAO report summarized, the total number of LSLs is unknown (Government Accountability Office, 2018a), which means that municipalities and states are unable to identify the risk posed by LSLs, and undertake mitigating actions. The actions taken in Ohio, Illinois, and Michigan seek to correct this oversight, even as they differ in specifics. The Ohio law does not address LSL inventory, and requires utilities to submit maps that have limited use. The Environmental Defense Fund labels the approaches taken by the three states as limited (Ohio), strong (Illinois), and comprehensive (Michigan) (Neltner and McCormick, 2018).

2. LSL Replacement

During the Flint crisis, the presence of LSLs in the distribution system was causally attributed to the elevated lead levels in drinking water, and thus, its replacement was identified as a policy goal. Until Flint, replacement of several miles of lead pipes hadn't been a priority due to two critical factors: financing (discussed below) and regulations under LCR. A key factor in case of LSLs is that service lines have a public component for which the city or utility is responsible, and a private component for which the homeowner is responsible. Federal LCR requires utilities to replace 7 percent of the total stock of LSLs owned by the utility annually if water testing showed lead levels to be above the AL. If testing shows lead levels to be below the AL for two consecutive monitoring periods, the LSL replacement process could be stopped, until it is triggered by another exceedance above AL. This process relies on homeowner participation to remove the private LSLs, and requires utilities to proactively complete the LSL replacement process, above and beyond that required under the law. After the Flint crisis, Michigan became the only state in the NEMW region (and the country) to adopt a stringent version of the LCR at the state level, preempting changes at the federal level. Beginning 2021, Michigan requires water utilities to replace all LSLs (public and private) within 20 years at the utility's expense, and, beginning 2025, AL is lowered to 12 ppb from the existing 15 ppb set by USEPA.

3. Financing

One of the key impediments to replacement of LSLs is the cost of undertaking a massive capital improvement project. USEPA estimates that a full replacement of a service line could cost anywhere from \$2,500 to \$8,000 (USEPA, 2016). Municipalities have been reluctant to undertake such projects without some measure of support from states and federal governments. However, recent discussion about the role of LSLs in contributing to elevated lead levels in drinking water has accelerated the pace of action on this front. Cities like Milwaukee have adopted rules to replace LSLs in the city. In some instances, state laws are ambiguous as to whether municipalities can use public funds to replace the private LSLs (Vedachalam, 2018). To get around this limitation, innovative financing mechanisms and changes to state or local laws are required that will allow the municipality to use public funds and employee time to replace the private portion of the LSL and to reflect the cost of pipe replacement in the user rates spread over a long period. In addition, subsidies may need to be provided to low-income residents to ensure wider replacement of private LSLs.

Legislative measures in Illinois, New Jersey, Pennsylvania and Wisconsin specifically seek to override this restriction on municipalities. Indiana's measure allows the regulatory body overseeing private water companies (referred to in official parlance as investor-owned utilities or IOUs) to approve requests from IOUs to absorb the cost of LSL replacement into water rates paid by customers. The Wisconsin law addresses the issue of affordability, allowing utilities to subsidize the cost of replacement of private LSLs. A notable exception among states addressing the issue of financing is Michigan, which did not create new mechanisms or provide guidance on how municipalities would meet the new mandate to replace all LSLs at their own expense. Lastly, there are instances of states addressing the issue of financing independently. In 2017, New York created a LSL replacement grant program and allocated \$20 million in the FY 2018 budget (New York State, 2017). Indiana plans to use financing obtained through the Water Infrastructure Financing and Innovation Act (WIFIA) program to replace LSLs in two cities (USEPA, 2018a).

B. Federal Actions

Lead regulations in drinking water are under the purview of the USEPA, although Congress can require USEPA to take certain regulatory action. Since the Flint water crisis, USEPA is under pressure to update its LCR to incorporate lessons learned from the Flint crisis and to keep it updated with current science and monitoring know-how. As discussed in Section VI, revisions to the LCR are not likely to be released in a draft form until February 2019. Members in Congress have tried to force USEPA to take action by introducing several pieces of legislation (see Table

A1 for a complete listing). None of the bills have received even a committee hearing, so the chances of their approval in the 115th Congress are slim.

The most prominent legislative proposal that addresses municipal lead issues is H.R. 1974 National Opportunity for Lead Exposure Accountability and Deterrence (NO LEAD) Act, introduced by Rep. Dan Kildee (MI), and its Senate counterpart, S.2000, introduced by Sen. Tammy Duckworth (IL). H.R.1974/S.2000 requires the USEPA to revise the federal LCR based on the provisions listed in the bill. Those provisions include developing a sampling protocol and instructions for compliance and requiring on-site investigations for source identification when individual samples exceed specified levels of lead or copper. The bill also requires USEPA to develop and make publicly available an inventory of the material composition of the service lines at residential and nonresidential facilities. Finally, the bill requires lowering the AL for lead in drinking water to 10 ppb by the end of 2020, and to 5 ppb by the end of 2026. There are some additional provisions that apply to schools and daycare centers, which will be addressed in the next section. Nearly all the provisions in H.R. 1974/S.2000 could be addressed by the USEPA through its rulemaking process for LCR, without requiring legislation.

C. Closing Thoughts

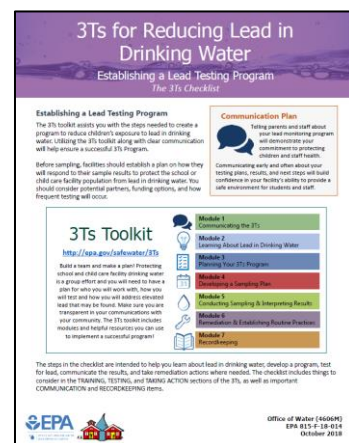
Even after the Flint crisis, more than half of the NEMW states introduced no new laws or regulations to address the significant problems associated with lead contamination in municipal drinking water.

In the absence of federal action on lead in municipal water, state action has been less than robust. The Flint crisis was a true test of federalism espoused in our Constitution and the role of

citizen activism in determining locally-appropriate laws on important issues affecting the citizenry. Even after the Flint crisis, more than half of the NEMW states introduced no new laws or regulations to address the significant problems associated with lead contamination in municipal drinking water. Of the states that did introduce new laws or regulations, except for Michigan, none was comprehensive in nature and only addressed certain aspects of this very complex issue. Michigan's rule change was the most comprehensive among the lot, even as it suffered from omissions such as financing support for LSL replacement. The landscape on state laws focused on municipal water supply is rapidly changing, with three states undertaking policy changes in just the last six months. The turnover among governors and legislators in NEMW states during the 2018 elections and the increasing citizen activism and awareness of lead contamination and various public health issues will likely result in more states revising their existing laws and regulations in the coming years.

IX. State Laws focused on Water Supply in Schools and Daycare Centers

As discussed earlier in this report, the Safe Drinking Water Act and its related provisions such as the LCR apply to Community Water Systems such as those serving municipal entities like cities, towns, and villages, but not to Non-Transient Non-Community Water Systems such as schools. Thus, unless a daycare center or school is labeled a CWS, they are not required to test the water being provided there. While the SDWA does not require testing of water at most schools and daycare centers, states have the ability to set stricter requirements. Until Flint, however, no state law required mandatory testing of drinking water at schools and daycare centers – locations that house vulnerable populations for part or most of the year. Most states asked their school districts to follow the guidance manual issued by USEPA, “3Ts for Reducing Lead in Drinking Water in Schools: Revised Technical Guidance” that focused on training school officials, testing drinking water, and telling students, parents, and staff (USEPA, 2006), which was just recently revised.¹⁰



The updated 3Ts checklist issued by the USEPA in 2018.

In the aftermath of Flint, several states, predominantly those in the NEMW region, approved new laws and/or regulations that mandate testing of drinking water in schools and daycare centers. This was prompted, in large part, by media reports showing elevated lead levels in testing at various schools. Since 2016, new laws or regulations that require public schools to test drinking water sources in their premises have been approved in Illinois, Maryland, Minnesota, New Hampshire, New Jersey, New York, Pennsylvania, and Rhode Island (see Figure 13). This is quite a contrast to the lackluster action on municipal water supply observed in the earlier section. Independent of the state law, school districts such as the Detroit Public Schools Community District and the School District of Philadelphia have incorporated mandatory lead testing.¹¹ In addition, voluntary, state-funded testing programs were started in Indiana, Maine, Massachusetts, and Ohio. Ironically, however, Michigan – the state that brought the issue of lead contamination to light – does not yet have any mandatory lead testing laws for schools. Because the voluntary testing programs do not cover all schools, the rest of this section will focus on the mandatory testing laws.

¹⁰ The 3Ts toolkit was revised by the USEPA in October 2018, with minor changes to the protocol. See: <https://www.epa.gov/ground-water-and-drinking-water/3ts-reducing-lead-drinking-water-toolkit>

¹¹ See <https://www.philasd.org/capitalprograms/programsservices/environmental/water-testing/> and <http://www.detroitmi.gov/schoolwater>

Post-Flint School Lead Testing Programs in NEMW States

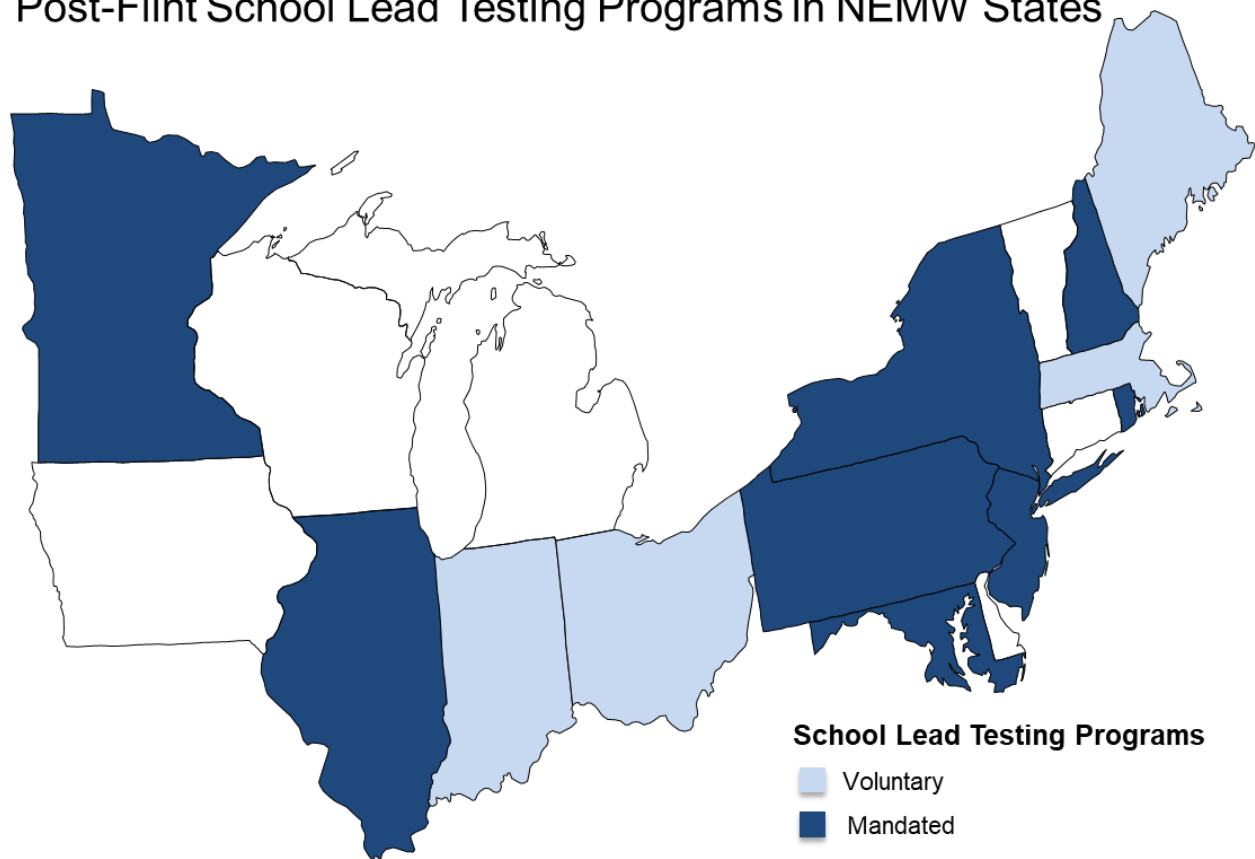


Figure 13. States instituting post-Flint school lead testing programs. Editable map courtesy Free Vector Maps.

Following the Flint crisis, Rhode Island and New Jersey were the first states to adopt mandatory school lead testing laws in July 2016, followed by New York two months later. Adoption of state lead testing laws in the NEMW region is an ongoing process, with Pennsylvania adopting lead testing laws through the annual state budget in June 2018. Table 2 provides details on the eight mandatory school lead testing laws approved in the NEMW states.

Table 2. State laws on mandatory lead testing enacted since the Flint crisis

State	Source regulation or law	Law effective	Applicable Schools		Daycare Centers
			Public	Private	
Rhode Island	2016-H 8127 Substitute A: Lead and Copper Drinking Water Protection Act	July 12, 2016	All		Licensed centers
New Jersey	State Board of Education Regulation N.J.A.C. 6A:26-12.4 Safe Drinking Water	July 13, 2016	All		State-funded centers
New York	A.10740/S.815; 10 NYCRR Subpart 67-4 Lead Testing in School Drinking Water	September 6, 2016*	All		
Illinois	SB 550; Public Act 99-0922	January 16, 2017	Elementary^	Elementary^	Licensed centers; home and group daycare
Maryland	HB 270 (2017); Code of MD Regulations (COMAR) 26.16.07 Lead in Drinking Water - Public and Nonpublic Schools	May 4, 2017	All	All	
Minnesota	H.F. No. 890 – K-12 Omnibus Bill; Minnesota Statutes, Section 121A.335 Lead in School Drinking Water	May 30, 2017	All		
New Hampshire	SB 247 Prevention of Childhood Lead Poisoning	February 8, 2018	All	All	Licensed centers
Pennsylvania	2018 Act 39 Public School Code of 1949 - Omnibus Amendments; HB 1448	June 22, 2018	All ^{\$}	All ^{\$}	

Notes:

Unless noted, charter schools are included as public schools. Among the states that now mandate compulsory lead testing in public schools, New York is the only state that excludes charter schools from that requirement.

* Rules supporting New York's lead testing law were finalized on May 9, 2018.

^ Illinois law mandates lead testing in only those elementary schools (public and private) that were constructed before January 1, 2000.

\$ Under the Pennsylvania law, schools can refuse lead testing, but are then required to discuss the school's lead issues in a public meeting.

New Jersey was the only state that adopted the lead testing requirements solely through the regulatory process. The remaining states went through their respective legislative chambers, and followed it up with a regulatory process. In addition to public schools, Maryland, New Hampshire, and Pennsylvania require testing at all private schools. In addition to schools,

Illinois, New Hampshire, and Rhode Island require lead testing at licensed daycare centers, while New Jersey restricts this requirement to only apply to state-funded daycare centers.

Pennsylvania's lead testing law is unique because even though it mandates lead testing, schools have the option to not test the water. If they were to choose that option, however, schools are then required to discuss lead issues in their buildings in a public meeting.

A. Variability in Lead Testing Laws

Despite the unifying goal of testing all drinking water sources in schools, state laws vary widely in their approach. Table 3 lays out the details of each state's lead testing laws as they relate to the action level, frequency of testing, responsibility for costs, and the availability of state funding.

Table 3. Lead testing program details

State	Action level (AL)	Frequency of testing		State funding availability for testing and remediation
		Current mandate [#]	Testing cycle	
Rhode Island	15 ppb	April 2017		Testing
New Jersey	15 ppb	July 2017	6 years	Testing
New York	15 ppb	October 2016	5 years	Testing and remediation ^{&}
Illinois	2 ppb	December 2018		
Maryland	20 ppb	July 2020*	3 years	
Minnesota	2 ppb and 20 ppb [@]	July 2023 [^]	5 years	Testing and remediation
New Hampshire	15 ppb	July 2019	5 years	
Pennsylvania	15 ppb	June 2019 ^{\$}	Annual	

Notes:

[#]Refers to the completion date of testing

[&]Funding requests to be made prior to 2019

^{*}Depending on the building age and student grade, schools in Maryland are required to begin testing by July 2018, or 2019, or 2020. There is no requirement that testing be completed by a certain date.

[@]Minnesota has set two action levels for lead in water – 2 ppb and 20 ppb – requiring different remedial actions at each level.

[^]Schools in Minnesota are required to begin testing by July 1, 2018 and complete them in 5 years.

^{\$}The Pennsylvania law requires testing to be completed within the 2018-19 school year, which was assumed to begin in September 2018 and end in June 2019.

Most states have set 15 ppb as their action level (AL), which corresponds to the AL set by USEPA under the LCR for residential water samples. Maryland's AL is set higher at 20 ppb, which likely corresponds to the earlier USEPA recommendation for schools under the 3Ts guidance manual (that standard has now been replaced by the term "elevated lead levels"). Minnesota has set two ALs – an actionable standard of 20 ppb and an advisory standard of 2 ppb. When a water fixture detects lead at 20 ppb or higher, schools are *required to not* use the fixture

for cooking and drinking purposes, and identify remedial measures. Detection below 2 ppb is considered acceptable. If lead levels between 2 ppb and 20 ppb are detected, the affected water fixtures *may* be used for cooking and drinking, while remedial measures are explored. Illinois' AL is any detectable level (2 ppb, based on current technology) – the lowest in the region, and indeed, the nation.

Since there is no safe level of blood lead level in children (CDC, 2018), the USEPA has set a Maximum Contaminant Level Goal (MCLG) – a non-enforceable health standard – of zero for lead in water. The American Academy of Pediatrics (2016) recommends 1 ppb as the standard for water fountains and fixtures in schools. Health Canada (2017) has an enforceable standard of 5 ppb for lead in drinking water sampled at any tap or water fixture. Except Illinois' 2ppb standard, none of the state ALs come close to the health standards and recommendations described above, highlighting a serious shortcoming in the state standards, despite recent efforts. Pending revisions to the LCR by the USEPA could bring down the AL for residential samples and could even result in enforceable standards for schools that are lower than the current recommendations, all of which could force states to lower their own ALs.

Except Rhode Island and Illinois, all state laws require periodic testing of water fixtures in school buildings, after the first round of testing is completed. Pennsylvania law is the most rigorous, requiring annual testing, while New Jersey only requires that a school be tested every 6 years. A longer testing cycle would mean that some students could undergo elementary schooling and only encounter testing during their final year of school, even as they are at the greatest risk in the early years of their schooling.

School districts are largely responsible for the costs associated with testing and remediation. Rhode Island and New Jersey provide state funding for testing only, whereas Minnesota and New York provides funds for both testing and remediation. It should be noted here that remediation only covers immediate steps once the lead levels are found to exceed the AL. It could include shutting off the affected fixtures, re-routing plumbing to enable additional fixtures, installing temporary filters, etc. It would not cover capital expenses like replacement of lead service lines, goosenecks, pipe fittings, etc. State mandates with inadequate or no support for testing and remediation are partial solutions to the lead crisis, as they place the onus to generate the necessary funds on school districts.

B. Accountability and transparency

In the immediate aftermath of the Flint crisis, local governments and agencies experienced a crisis of accountability and confidence. How would residents trust the words and actions of their

elected officials and managers after they had seen the worst play out in Flint? Penalizing non-compliant actions and communicating the results of lead testing are some of the ways governments can ensure accountability of the lead testing mandates. Table 4 presents accountability and communication provisions of the lead testing mandates.

Table 4. Accountability and communication provisions of the lead testing mandates

State	Penalty for testing non-compliance	Communication of results		Notification to agencies	Central repository of all testing results
		Results made public	Notification to families		
Rhode Island				RIDOH	Yes ¹
New Jersey		All	Above AL	NJDOE (above AL)	
New York	Authorized action by state or local health department		All	NYSDOH	Yes ²
Illinois		All	Above 5 ppb*	IDPH	
Maryland			Above AL	MDE, MSDE and local health departments; MDH (above AL)	
Minnesota		All	All		
New Hampshire			All	NHDES	
Pennsylvania				PDE (above AL)	Yes ³

Legend:

RIDOH: Rhode Island Department of Health; NJDOE: New Jersey Department of Education; IDPH: Illinois Department of Public Health; NYSDOH: New York State Department of Health; MDE: Maryland Department of Environment; MSDE: Maryland State Department of Education; MDH: Maryland Department of Health; NHDES: New Hampshire Department of Environmental Services; PDE: Pennsylvania Department of Education

Notes:

*Illinois law states that if the test results are at or below 5 ppb, schools *may* provide notification to parents or post the results on the school's website.

¹Testing results in Rhode Island are available at: <http://health.ri.gov/data/schools/water/>

²Testing results in New York are available at: <https://health.data.ny.gov/Health/Lead-Testing-in-School-Drinking-Water-Sampling-and/rkyy-fsv9>

³As per the Pennsylvania law, testing results are to be made available at the PDE website

Except New York, no state law expressly mentions a penalty for testing non-compliance. While it is possible that states have existing legal, regulatory, and financial mechanisms to ensure full compliance, the omission of the penalty clause in the enabling legislation enacted in most NEMW states is noticeable. New York allows state and local health departments to take action authorized by law, which can include levying civil penalties.

All states, except Rhode Island and Pennsylvania, have a parental notification clause to inform parents of the lead testing results. Half of those states, however, restrict notification only when the lead testing results exceed the AL (5 ppb in the case of Illinois, despite no clear AL being set). Some states require the test results be made public through the school or school district's website. All states, except Minnesota, require that the test results be sent to a designated state agency. Even here, some states like New Jersey and Pennsylvania restrict sharing the test results to only those that exceed the AL. Such a restricted notification to parents and state agencies is problematic for a few reasons: parents may be under a false sense of safety if no notification is received at the conclusion of testing, especially since it is well-established that no lead levels are safe. If and when the EPA decides to revise the LCR and bring down the AL for residential and/or school buildings, states would need to follow suit and decrease the AL for schools. State agencies would then have to devise new rules to obtain results from those schools that met the guidelines earlier but now exceed the new AL. This effort could be reduced by collecting all the results now, and then targeting only those schools where earlier results exceed the new AL.

Three state laws require that all data be collected in a central repository and made available to the public. Data from schools in Rhode Island and New York are already available, since both states have already finished their first round of testing. Massachusetts, which has an optional lead testing program, has also made its data available to the public. Proposed legislation in New Jersey seeks to do the same (Johnson, 2018).¹² Availability of statewide data makes it easier for the public to analyze data pertaining to any school, or compare two or more schools. It also benefits parents who move from another state or school district a few years after a round of testing and notification is completed.

Penalty for non-compliance, open data, and unrestricted notification to the parents, public, and other government agencies on lead testing results will improve public trust toward state and local governments on critical issues like water quality in schools. States must use existing mechanisms to improve accountability and transparency of lead testing laws to ensure the public has full access to the data and that all schools are brought into compliance, making the laws functional and effective.

C. Federal Actions

As discussed earlier in this report, states are taking action on lead testing in schools because the federal government has been unable to address this issue. The federal inaction, however, is not

¹² New Jersey A4121 requires the NJDOE and the New Jersey Department of Children and Families to establish an online reporting system for lead testing results from schools and daycare facilities, respectively. The bill was approved in the Assembly, but is yet to be voted on in the Senate.

due to a lack of trying. Several pieces of legislation have been introduced in the U.S. Congress that specifically address lead testing in schools (see Table A1 for a complete listing). The most prominent ones are the S.1401 Get the Lead Out of Schools Act, introduced by Sen. Tammy Duckworth (IL), and H.R. 1974 National Opportunity for Lead Exposure Accountability and Deterrence (NO LEAD) Act, introduced by Rep. Dan Kildee (MI), and its Senate counterpart, S.2000, introduced by Sen. Tammy Duckworth (IL).

Both S.1401 and H.R.1974/S.2000 use the USEPA's federal authority over public water systems to conduct lead testing in schools within their jurisdictions. The two bills, however, differ on other aspects of lead testing such as schools covered under the proposed law, the AL for lead, funding for testing and remediation, and communication of results (Table 5). The two bills are compared against *median* and *high* provisions in the state laws enacted in the eight NEMW states.

Table 5. Comparison between lead testing provisions in the NEMW state laws and federal legislative proposals

Parameter	State law provision		Federal legislative proposal	
	Median	High	S.1401	H.R.1974
Applicable schools:				
Public	All	All	At-risk*	All
Private	None/Elementary	All	At-risk*	All
Daycare centers	None/Licensed centers	Licensed, group, & home centers		All
Action level	15 ppb	15 ppb	15 ppb	10ppb/5ppb*
Frequency of testing	4 years	3 years		
Responsibility for costs related to:				
Testing	School districts	State	Public water system	Public water system
Remediation	School districts	State and school districts	School districts [#]	School districts [#]
Government funding provided	None/Testing	Testing and remediation	Testing and remediation	
Penalty for non-compliance	None	Authorized action by state or local health department		
Communication of results to:				
Public	None	All results	All results	Above AL [^]
Parents and guardians	Above AL/5 ppb	All results	All results	
Data availability	None	All data made publicly available		

* H.R.1974/S.2000 lowers the action level for lead in drinking water to 10 ppb by the end of 2020, and to 5 ppb by the end of 2026.

[#]This was not explicitly stated in the text of the bill, but inferred by the authors.

[^] H.R.1974/S.2000 requires public water systems to notify the property owners if testing reveals lead concentrations above the AL. Schools would then decide whether to make the results public or not.

The *high* provisions in the recently-enacted state laws and regulations are comparable or stronger than those proposed in the two federal legislative bills, except for the AL. The federal bills do not require subsequent testing after the first round. Moreover, they require testing be done by the public water systems providing water to the schools, whereas state laws require schools to initiate the testing process, for which they may get reimbursed by the states.

D. Closing Thoughts

NEMW states have been much more active on the issue of lead in school water supply – particularly testing, remediation, and notification – as compared to issues

The state programs on lead testing vary widely in their coverage, frequency of testing, and accountability and transparency provisions.

associated with lead in municipal water. Post-Flint, half of NEMW states have laws mandating compulsory lead testing in schools, with a few additional states instituting voluntary programs. The state programs on lead testing vary widely in their coverage, frequency of testing, and accountability and transparency provisions. Although a few states cover daycare centers, more targeted approaches are needed to ensure infants and toddlers are protected in licensed daycare centers and home daycare settings. Despite the implementation of state laws in several NEMW states, universal lead testing is only possible through federal legislation. Proposed bills in the 115th Congress addressing lead testing, described in Table A1, languished and did not even see committee action, leaving the task of passing any federal legislation to the upcoming 116th Congress. Federal legislative efforts would benefit from incorporating some of the stronger provisions included in state laws such as expanding lead testing to all schools and daycare centers, frequent testing after the first round, funding for testing and remediation, penalty for non-compliance, and making all results available to the public and the parents, including all data made publicly available for analysis and research purposes.

Post-Flint state policies on lead in school water have focused largely on testing and less on remediation. Although states recommend discontinuing faucets and fixtures reporting elevated levels of lead, funds for replacement and rehabilitation of those fixtures are likely to come out of the capital improvement budgets of the respective school districts, which may only be partially supported by certain states through special grants. Lack of dedicated funding for replacement of lead-bearing faucets and fixtures – much like the replacement of LSLs in the municipal setting – will prevent several schools from undertaking significant repairs needed to ensure safe drinking water in schools across the NEMW region.

Figure 14 shows a plot of news media coverage of both municipal and school lead issues versus post-Flint state laws on lead. States are stratified into three categories based on the type of post-

Flint laws or regulations on lead – (1) implemented no laws or regulations, (2) implemented laws impacting either municipal or school water supply, and (3) implemented laws impacting both municipal and school water supply. Only three states – Illinois, Pennsylvania, and New Jersey – feature in category (3), while roughly half of the NEMW states feature in category (2). Although greater media coverage of lead issues can be a factor in the implementation of new laws or regulations, no causality is implied in the following figure.

A Plot of News Media Coverage versus Post-Flint Laws on Lead

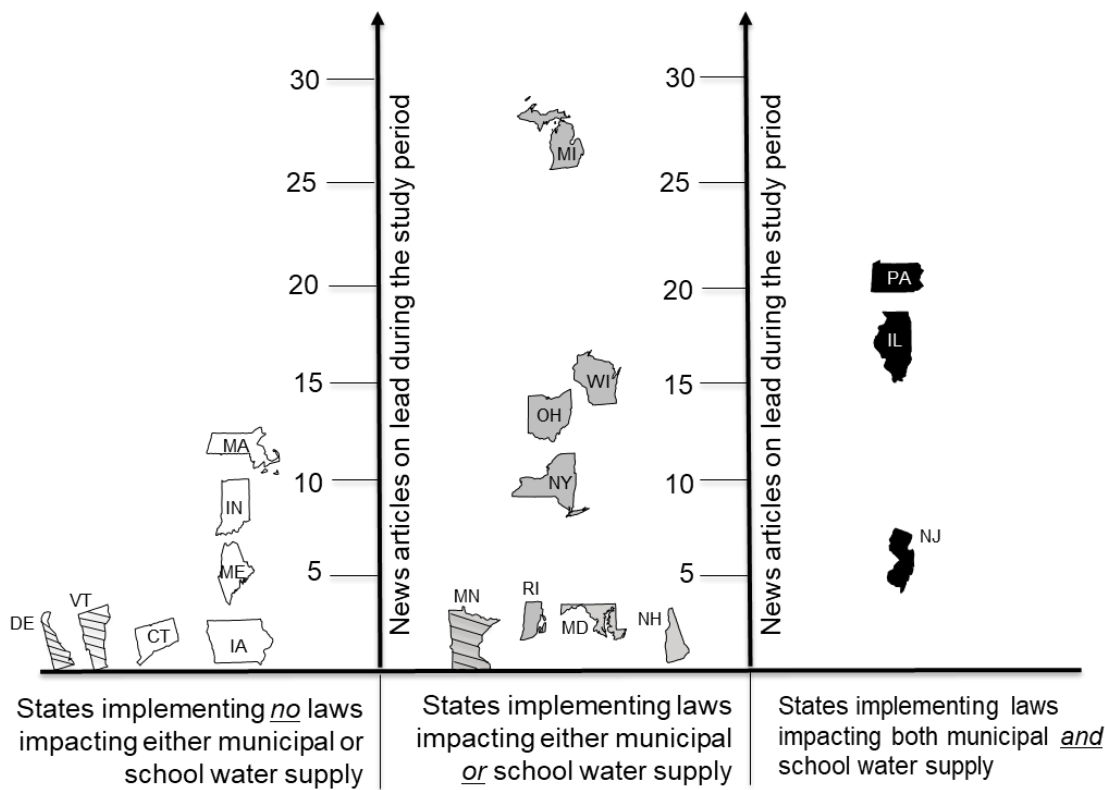


Figure 14. A plot of news media coverage versus post-Flint state laws on lead. States are labeled with their two-letter alphabetical code. States that did not feature in the news media analysis – Delaware, Minnesota, and Vermont – are shown hatched. The images of individual states are not to scale.

Although passing lead-related laws is counted as a measure of progress in this report, the content of the law is extremely important and can make substantive improvements in either our understanding of the problem or its resolution. As seen in this report, these laws can vary widely in their coverage – they can be as comprehensive as the LCR revision in Michigan, or be extremely limited as the map of areas with LSLs in Ohio. Additionally, states can address lead contamination by allocating dedicated funding, even if no new laws are passed.

X. Next Steps in Research and Policy

When the Flint crisis first got national attention, activists and civic leaders hoped for a robust response at the national, state, and local levels. Three Congressional hearings were conducted in early 2016 by the House Oversight and Government Reform Committee, with testimony provided by a number of important players involved in the Flint crisis, including Michigan Governor Rick Snyder and USEPA Administrator Gina McCarthy.¹³ High-profile visits to Flint, Michigan by President Barack Obama and presidential candidates Hillary Clinton and Donald Trump further raised those expectations. The visibility provided by these hearings and visits was not matched by a policy blueprint, let alone action, at the federal level, even as the extent of the crisis was revealed to be much larger in scope than one city in the Midwest. The state level response has been marginally better, but largely disjointed and uncoordinated, to address the various pieces of this extremely complex policy challenge.

The Need for Comprehensive and Systematic Research. The results and analysis presented in this report point to the need for additional research and policy action. In the absence of data on lead issues in municipalities and school districts, the analysis of media coverage provides heuristic value, pointing to serious lead contamination threats across a wide geographic area in the NEMW region, but it goes without saying that more comprehensive and systematic studies are needed to be conducted that provide national or regional impacts of lead contamination in water. The declining media coverage of the lead issue from its peak in early 2016 may fit well within the larger pattern of how sensitive and important issues are covered by the media in an episodic frame with shock value, but it leaves room for a sustained public education and outreach campaign to engage residents and civic leaders on the dangers of lead, how to manage lead risk in older buildings and neighborhoods, and improving local laws and regulations to better address this issue.

Financing and the Essential Role of States and the Federal Government. Although local governments are the appropriate agencies to manage risk from lead pipes and plan for their rehabilitation and replacement, they are poorly equipped to raise all of the financing needed for large-scale capital improvement projects, and thus have to look toward state and federal governments for much-needed funding and access to low-interest financing. Indeed, identifying effective financing strategies could eliminate a major impediment to capital-intensive projects such as LSL replacement, thereby reducing the risk from further lead contamination. The study also points to the need for extensive policy education outreach to state legislators in states impacted by the lead crisis, prominently among them Michigan.

¹³ At the hearings, witnesses from federal, state, and local governments pointed fingers at each other, citing loopholes in the oversight and monitoring process, and avoided taking responsibility.

The Approaching Window of Opportunity. The November 2018 elections have brought significant changes to the makeup of Congress, Governors, and state legislatures in the NEMW region. Resignations, retirements, and incumbent losses produced a historic turnover in the NEMW delegation in the House of Representatives. Similarly, at the state level, new Governors were elected in several states. Additionally, several state legislative chambers also underwent a significant turnover in membership. These changes could bring new legislative priorities in the coming years, including ones focused on safe and affordable access to drinking water. In states that have undertaken post-Flint measures on lead, legislative proposals are already underway to extend the reach and impact of those measures (for instance, lead testing in schools in Michigan, where none exists currently, and extending the lead testing mandate in New Jersey schools and daycare centers to include online reporting of results). In other states, proposals that languished in the current legislative session could receive a favorable outcome in the next session.

The Need for Ongoing Monitoring. The implementation of these new laws and regulations also allows for research and outreach opportunities. States with disclosure laws on the material inventory of LSLs present opportunities for characterizing the risk from LSLs at the household- and neighborhood-scale. Similarly, aggregated data from mandatory school lead testing results can be analyzed to characterize the risk potential for students in certain neighborhoods. The water testing results, paired with blood lead levels can provide accurate assessments of the role of external environment in lead contamination in children. Although some states have included daycare centers in their lead testing laws for schools, more attention is needed to monitor daycare centers that range in settings from institutionalized to home-based, and house the most vulnerable population consisting of infants and toddlers. Citizen groups and watchdog agencies are needed to monitor the implementation of new laws and regulations, and press for any additional ones based on the results seen thus far.

XI. Summary

The fateful decision by the City of Flint, Michigan to switch its water source in April 2014 not only endangered the lives of its residents, creating one of the largest public health crises and environmental justice disasters, it also transformed the relationship between water utilities, government agencies, and residents across the country. In hindsight, federal laws and regulations governing lead in drinking water in residences, schools, and daycare centers turned out to be less than comprehensive, often creating loopholes that could be exploited, and in other instances, proved to be woefully inadequate. News media coverage in the NEMW region during the years 2015, 2016, and 2017 – used as a proxy for determining the severity of drinking water issues related to lead contamination – reached a peak during the second quarter of 2016 and has declined since. A spatial analysis of the article focus locations revealed a wider footprint that covered 83 of the 158 congressional districts in the NEMW region, with some hotspots around large cities where the problem is most severe. There was a noticeable difference in coverage of municipal lead issues and school lead issues, suggesting that separate policy solutions are needed to address the lead issue in these different settings, as indeed some states have already done.

In the absence of a strong and proactive federal response to the crisis, some states have addressed various aspects of this issue, but a comprehensive approach is lacking. While elements of certain state laws are laudatory (for instance, affordability provisions in Wisconsin and mandatory school lead testing every year in Pennsylvania), no one state's approach is comprehensive enough to be used as a template for other states. It is indeed heartening to note that despite increasing political differences, lead testing in schools was a unifying policy objective that eight NEMW states have adopted mandatory rules and four states have addressed with voluntary testing programs, even as the eventual state policies differ from each other in significant ways. The November 2018 elections have brought significant changes to the makeup of Congress, Governors, and state legislatures in the NEMW region, which could bring a new wave of legislative and policy solutions to the various aspects of the lead crisis. The post-Flint policy achievements are a true testament to the American democracy, where determined legislators worked with policy analysts, researchers, and citizen activists to craft meaningful reforms to address policy lacunae. While gaps remain, the results so far provide a template for achieving policy solutions for complex issues involving multiple stakeholders. This participatory governance comes a bit too late for Flint and other cities but, if advanced, it has the potential to protect future generations in the years to come.

XII. References

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XIII. Appendix

Table A1. Legislation related to lead testing and monitoring introduced in the 115th Congress

Bill No.	Title and Description	Lead Sponsor	Current Status
H.R.1068	Safe Drinking Water Act Amendments: revises the process and requirements for setting MCLs in national primary drinking water regulations; directs the EPA to revise drinking water regulations for lead and copper; establishes grant programs for reducing lead in drinking water in schools	Rep. Frank Pallone (NJ)	Awaiting committee action
H.R.1974/ S.2000	National Opportunity for Lead Exposure Accountability and Deterrence Act: Lowers action level of lead permitted in drinking water from current level of 15 parts per billion (ppb) to 10 ppb by 2020, and 5 ppb by 2026; requires water testing of homes at high risk of exposure; replace lead service lines	Rep. Dan Kildee (MI)/ Sen. Tammy Duckworth (IL)	Awaiting committee action
H.R.2094	Lead Free Schools Act: Amends the Safe Drinking Water Act to increase lead testing in schools; provides for competitive grant program to replace water infrastructure in schools	Rep. Josh Gottheimer (NJ)	Awaiting committee action
H.R.2479	Leading Infrastructure for Tomorrow's America Act: Appropriations for programs aimed at reducing lead in drinking water; provides assistance to school districts for replacement of water fountains prior to 1988; requires EPA to publish guidelines on lead testing in schools.	Rep. Frank Pallone (NJ)	Awaiting committee action
H.R.4907	Safe Drinking Water Act Amendments: Establishes a grant program to help schools and day cares in replacing service lines and solder that are not lead free	Rep. Bobby Rush (IL)	Awaiting committee action
H.R.4908	Safe Drinking Water Act Amendments: Establishes a grant program to provide assistance to school districts for replacement of water fountains manufactured prior to 1988.	Rep. Bobby Rush (IL)	Awaiting committee action
S.1401	Get the Lead Out of Schools Act: Ensures periodic testing for lead contamination in schools; provides schools with additional resources to monitor lead levels and replace outdated water infrastructure	Sen. Tammy Duckworth (IL)	Awaiting committee action