



Message from Director Shah

Welcome to the second issue of the Illinois Morbidity and Mortality Bulletin (IMMB), a Department-wide publication that we created last year to present topics of interest to public health communities in Illinois through scientific analysis and interpretation of data.

In this issue, Judy Kauerauf and Stacey Hoferka review the IDPH's experience with and challenges surrounding meaningful use of clinical data for public health in Illinois.

In the second article, Dr. Frida Fokum of the Division of Environmental Health and Dr. Mohammed Shahidullah of the Illinois Center for Health Statistics collaborated with Emile Jorgensen of the Chicago Department of Public Health and Dr. Helen Binns of the Ann & Robert H. Lurie Children's Memorial Hospital of Chicago to analyze childhood blood lead data as reported to the Department over the period of 1996 to 2012.

We hope you find these articles interesting and we look forward to continued dissemination of health data and information from IDPH. We would also encourage contributions from public health professionals at the state and local levels. Please send your manuscripts to the bulletin's editor, Dr. Tiefu Shen at Tiefu.Shen@illinois.gov (217.785.1873)

Nirav D. Shah, M.D., J.D.
Director
Illinois Department of Public Health

Meaningful Use of Clinical Data for Public Health in Illinois: A Review of Experience and Challenges

Meaningful Use is a term well known in the clinical health data and exchange world, but how does it affect public health practice? For years, public health agencies have been the recipients of data from the medical community for purposes of identifying outbreaks, conducting disease surveillance, and analyzing trends. Often, that data flow was delayed, incomplete, and only available after much effort by local health departments. Advances in the adoption of electronic medical records (EMRs) and laboratory systems provide public health agencies with new opportunities to receive those data directly from automated, electronic submissions in near real-time. Contrast this with legacy systems...[read more](#)

Childhood Lead Exposure, Testing Rate, and Blood Lead Poisoning Prevalence in Illinois and Chicago, 1996-2012

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Meaningful Use of Clinical Data for Public Health in Illinois: A Review of Experience and Challenges

Judy Kauerauf¹
Stacey Hoferka²

Introduction

Meaningful Use is a term well known in the clinical health data and exchange world, but how does it impact public health practice? For years, public health has been the recipient of data from the medical community for purposes of identifying outbreaks, conducting disease surveillance and analyzing trends. Often, that data flow was delayed, incomplete and only available after much effort by health providers and local health departments. Advances in the adoption of electronic medical records (EMRs) and laboratory systems provide public health agencies with new opportunities to receive those data directly from automated, electronic submissions in near real-time. Contrast this with legacy systems that require health care staff persons to 1) identify that a medical encounter is reportable, 2) know what information to report and to whom it is reportable, 3) understand abstract relevant data elements, and 4) send in the information, and it's easy to recognize the significance to public health surveillance.

The potential impact on the role of public health agencies is broad. Public health agencies have the opportunity to use information technology to improve population health. Access to real-time and complete datasets for public health indicators, such as disease morbidity, mortality, body mass index (BMI), blood pressure, asthma, and immunizations, will allow public health epidemiologists to study health issues in new ways. With aggregate electronic health data on a significant portion of the population, health systems can look more meaningfully at the needs of populations and offer targeted interventions for disease prevention and control. Further, through bidirectional exchange, public health can work with electronic health record (EHR) systems to enable decision-support to providers for public health-related activities such as immunizations, prenatal testing, and outbreak response. This type of EHR integration forms the basis for a public health information exchange.

The U.S. Office of the National Coordinator (ONC), as part of the HITECH (Health Information Technology for Economic and Clinical Health) Act of 2009 has allocated \$19.2 billion dollars in incentive payments to health care providers for their adoption of meaningful use standards. ONC's goals include utilizing data for improved patient care and safety, care coordination, patient engagement, and lower per-capita health care costs. Starting in 2011, eligible hospitals and professionals began the process of progress through three defined stages of EHR implementation and data exchange, each lasting two years. Upon completion of various benchmarks, hospitals and providers receive incentive payments. Examples of benchmarks include successfully sending test messages to the public health authority (Stage 1) or sending production-level reportable lab results, immunization records or emergency room chief complaint data to the public health authority (Stage 2).

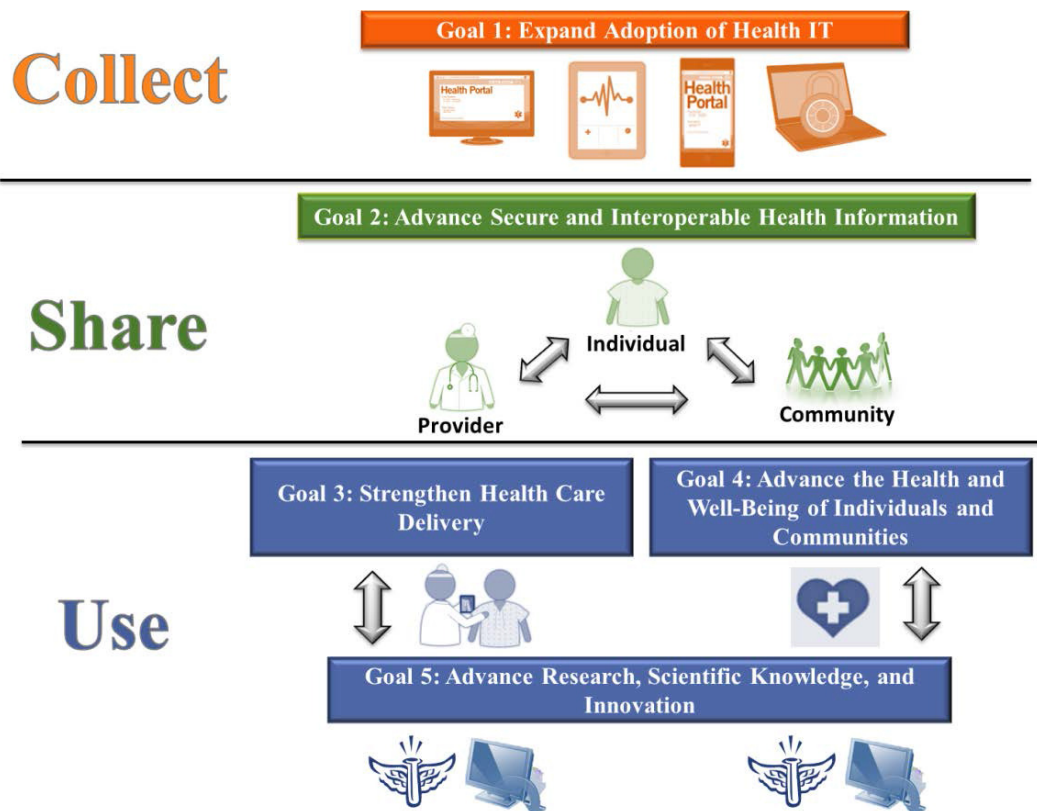
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The ONC recently updated its Federal Health IT Strategic Plan 2015-2020 (drafted February 6, 2015). The document reiterates the five overarching goals of its plan (Figure 1).

Figure 1. Draft Federal Health IT Strategic Plan 2015-2020 (ONC, February 6, 2015)



As illustrated in Figure 1, public health agencies have a distinct role to play in Goal 2 for onboarding and sharing provider data for surveillance and registry purposes that will be described in more detail below. In addition, Goal 4 provides new opportunities to participate in advancing health among Illinoisans. By building a robust technical and administrative infrastructure, IDPH can receive and make use of an increasing volume of health-related information. “Improved access to health information among public health entities ... increases their abilities to conduct and contribute to medical product safety surveillance, analyze public health trends, address local social and health determinants, protect communities during public health emergencies, and promote healthy choices for all populations and communities” (Draft: Federal Health IT Strategic Plan 2015-2020¹; <http://www.healthit.gov/sites/default/files/federal-healthIT-strategic-plan-2014.pdf>)

Activities

In Stage 1, hospitals must demonstrate the ability to send at least one test file to their state public health agency for electronic lab reporting (ELR), immunization reporting **or** syndromic surveillance. Providers must be able to send one immunization test file. For public health departments, Stage 1 requirements result in a lot of work without a lot of reward; however it's crucial in establishing connections with hospitals and providers.

Within the first few months of Stage 1, IDPH staff quickly realized that they could not solely manage the challenges brought on by Meaningful Use and, specifically, the onslaught of new data providers demanding attention. In an effort to avoid missing this unprecedented opportunity to leverage these data, IDPH formed partnerships with the Illinois Department of Healthcare and Family Services (DHFS), the Illinois Health Information Exchange (ILHIE), and Medical Research Analytics and Informatics Alliance (MRAIA). DHFS is the Illinois agency responsible for Medicaid reimbursements and provides IDPH with auditing guidance, as well as resources and linkages to ONC.

In 2011, ILHIE was established as the state's health exchange authority. Early in Stage 1, IDPH declared that all hospital and ambulatory providers that wish to participate in Meaningful Use must send their data to ILHIE for syndromic surveillance and electronic laboratory reporting. IDPH also required a portion of immunization data providers to send data through the ILHIE with multiple no cost or low cost connection options. The adoption of ILHIE as the central point for all public health and Medicaid reporting objectives provided consistency to our messaging and streamlined the expansion of our surveillance efforts. Interagency partnerships, such as those with ILHIE shifted resources for initial recruitment, connectivity, and onboarding activities to this partner, which conserved IDPH resources. In the fall of 2015, a technical transition plan for public health reporting was finalized to switch connection from ILHIE directly to the Public Health Node.

The Public Health Node (PHN) was established when IDPH and ILHIE partnered with medical informatics experts at MRAIA to serve as an agent of the state, providing technological expertise to support Meaningful Use public health reporting activities. The PHN provides hardware, software, and personnel resources to support extensive ELR mapping, syndromic surveillance data aggregation, and novel solutions to new applications, such as quality health metrics. The PHN achieved ONC's 2014 technology certification for the three required public health reporting objectives. The PHN's software development platform, the Public Health Reporter, allows hospital and providers with limited resources to fulfill Meaningful Use by submission of data through ILHIE, where it is transformed into a certified message at the PHN, as shown in Figure 2 below. This process also results in better quality and complete data.

As a new requirement beginning with Meaningful Use Stage 2, state public health authorities were required to implement two new processes. The first was to declare publically the public health options for which IDPH has

the technical and administrative resources and capacity to enroll and onboard hospitals and providers. For the three mandatory public health options for hospitals (ELR, Syndromic Surveillance and Immunization reporting) and the one for providers (immunization reporting), IDPH was able to declare its capacity. This information is maintained on the [Illinois Health Information Exchange \(ILHIE\) website](#). The second requirement was that IDPH had to implement a registration system for hospitals and providers to register their intentions to establish ongoing reporting with IDPH. IDPH's IT staff, working within a short timeframe, borrowed the Michigan Department of Public Health's registration system software code to use as a starting point. After modification, the IDPH Meaningful Use Registration System (MURS) was launched in October 2014. By registering, hospitals and providers indicated their readiness to send IDPH data from a certified EMR within 30 days of IDPH's request for onboarding.

Hospitals entering Meaningful Use Stage 2, which began in 2014, have to submit ongoing, "real" data for all three Stage 1 public health options (ELR, Syndromic Surveillance and Immunization Registry reporting) and providers must submit Immunization Registry data. Providers also may select Cancer Registry reporting, Ambulatory Care Syndromic Surveillance, or Specialized Registry Reporting from the menu set. IDPH has the capacity to accept data from the first one and is piloting ambulatory care syndromic surveillance and EMR reporting to an STD Registry.

In addition to improving the quality of care, Meaningful Use works to ensure the privacy and security protection of personal health information (PHI). The infrastructure and data exchange processes described herein were all designed to fulfill this goal, as well as to act within the rule and authority provided by state and federal laws. Electronic transmission of reportable data by hospitals and providers to public health agencies is permitted within the federal Health Insurance Portability and Accountability Act (HIPAA),² sanctioning disclosure of protected health information without consent when the disclosure is allowed by law, for public health activities and for health oversight activities, as long as the data are encrypted. Access to IDPH applications is role based, restricted to only those whose job duties require access.

Results

To date, the Illinois Meaningful Use Registration System (MURS) has registered 12,134 Stage 2 providers. The measures available to both hospitals and providers (I-CARE and Syndromic Surveillance) contain the bulk of registrants.

From the MURS registrants, IDPH and ILHIE prioritize onboarding based on facility size and volume of previously reported data. A recruiter makes initial contact with hospitals and providers, explains the process for onboarding and the data requirements, both in terms of a standardized vocabulary and file format. Both elements are essential for successful health exchange. Implementation guides, developed by CDC, ONC and CSTE collaborative workgroups, are provided to specify message structures, content, and format, providing a

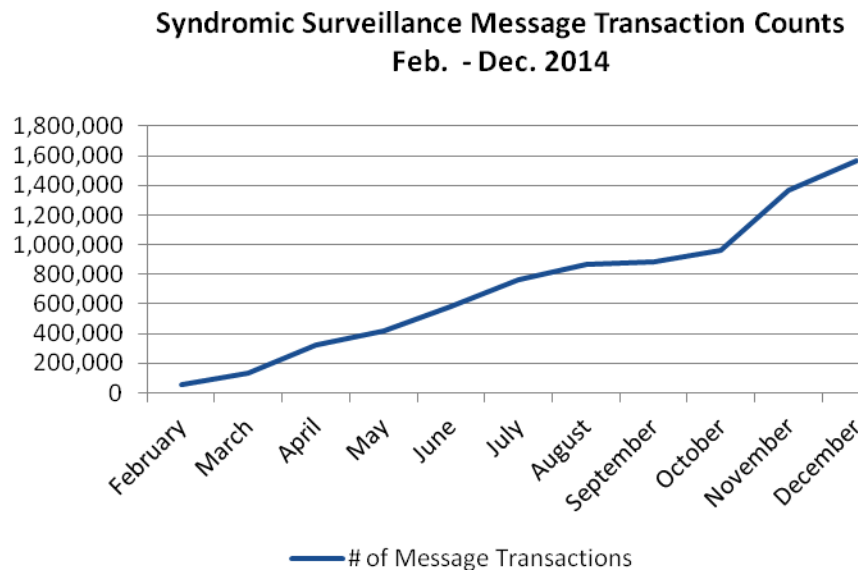
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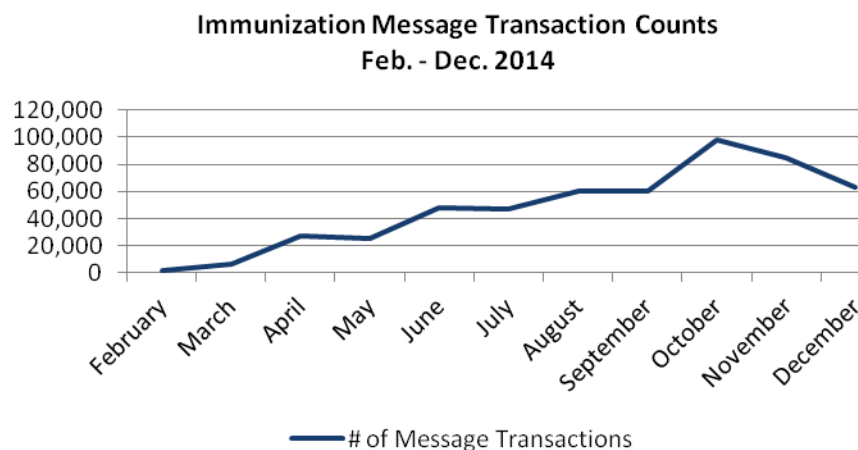
comprehensive framework for health data exchange, integration, sharing, and retrieval. Data use agreements for exchange of Protected Health Information (PHI) are established. Figure 2 to Figure 4 illustrate the growth in message transaction from Illinois facilities, February through December in 2014 for the three mandatory public health options.

Figure 2. ILHIE Public Health Message Transactions Counts for Syndromic Surveillance (February – December 2014)



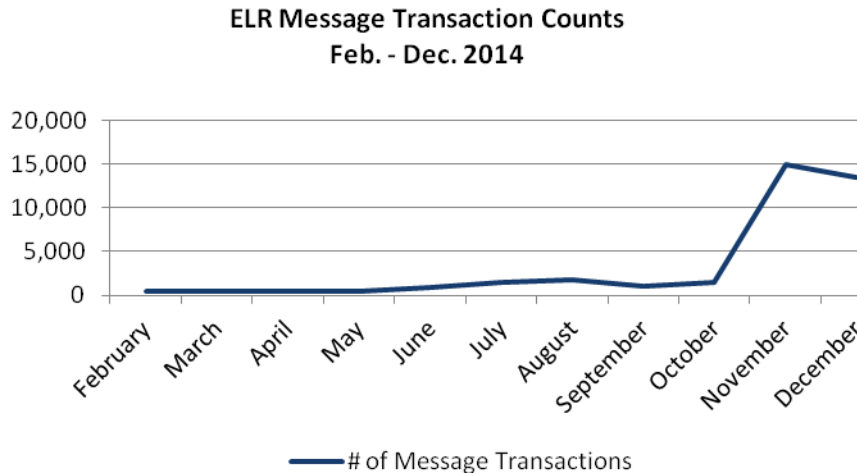
Source: Illinois Health Information Exchange
*data for June and November are based on estimates

Figure 3. ILHIE Public Health Message Transactions Counts for Immunization (February – December 2014)



Source: Illinois Health Information Exchange

Figure 4. ILHIE Public Health Message Transactions Counts for ELR (February – December 2014)

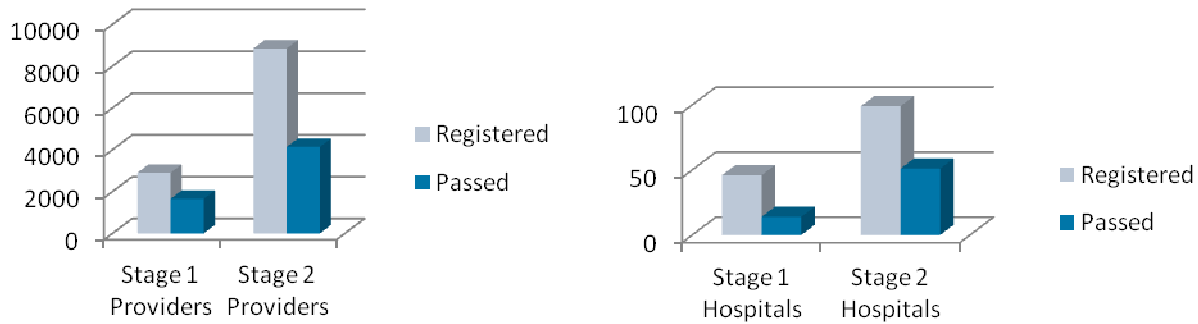


Source: Illinois Health Information Exchange

The volume of ELR and immunization data is dwarfed by syndromic surveillance data due to the fact that hospital EMRs send syndromic surveillance feeds daily with chief complaint data from every Emergency Department visit, while ELR and Immunization data are only for those patients with reportable lab results and immunizations given, respectively.

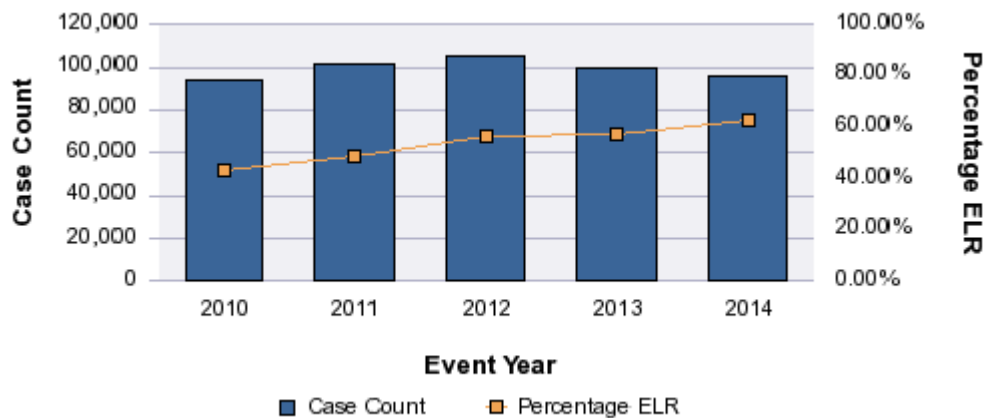
Immunization Registry reporting has sharply increased since Meaningful Use implementation. Beginning in 2011, I-CARE had a total of 760 active facilities sending electronic immunization data. That number increased seven fold by the end of 2014 with 5,430 facilities reporting. More importantly than the number of facilities sending data, however, is the 78% increase in the number of persons with vaccination histories contained in the immunization registry. As shown below in Figure 5, a large number of providers and hospitals are still in the testing phase for Stage 2 so that number will continue to increase.

Figure 5. I-CARE Stage 1 and 2 Meaningful Use Hospitals and Providers by Number Registered and Number Passed through March 10, 2015



IDPH has been receiving ELR data since 2005. In addition to laboratory test results for more than 72 reportable conditions managed in the state’s electronic disease surveillance system, ELR also obtains HIV, syphilis, and clinical lead results that are parsed to the appropriate applications. The number of labs submitting ELR has grown from two in 2005 to 46 (as of March 2015) with twelve new labs added in 2014 alone. More importantly, the percentage of data from ELR has steadily increased as shown in Figure 6. In 2010, 43% of cases in I-NEDSS contained a lab report obtain via ELR compared to 62% in 2014.

Figure 6. Total counts of reportable confirmed and probable cases in I-NEDSS from 2010 to 2014 and the percentage of cases that contain an ELR



**2014 data are provisional until final counts are reported to CDC.*

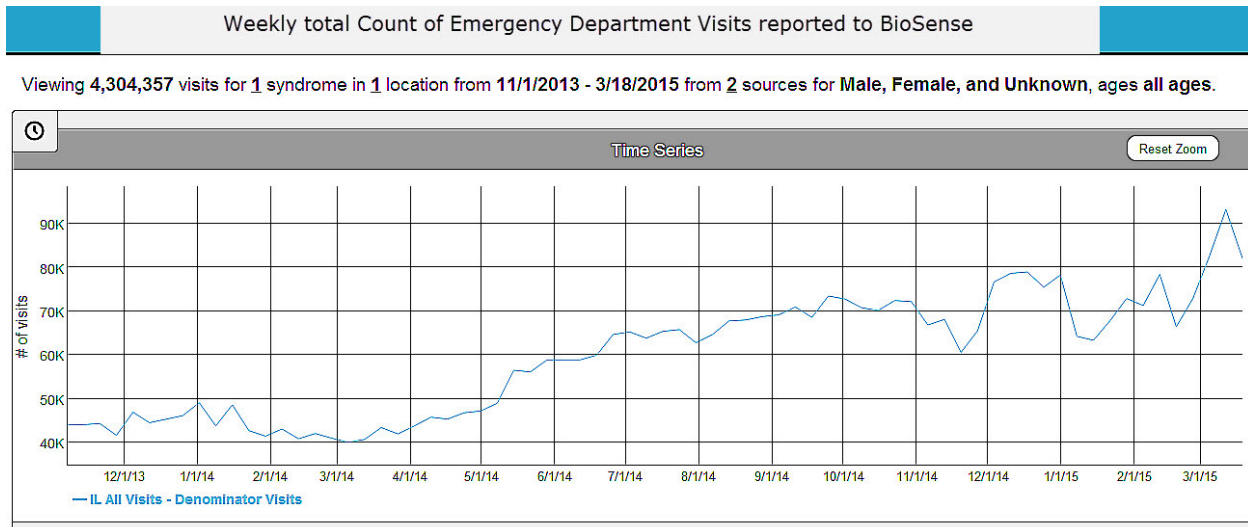
An additional 59 labs are in various stages of testing and validation to ensure that the file is delivered correctly with essential data elements and, to confirm that the laboratory results are reportable and complete with specific details about the test, such as specimen source and reference range. This process can be very labor intensive and usually spans a period from three to six months during which time a lab submits data daily to a test server. This lengthy testing phase is required to ensure that IDPH has reviewed a comprehensive sample

of the laboratory's data. In addition, if a laboratory changes its vendor or technology, the entire validation/testing process needs repeating.

Due to the high volume of cases, STD reporting in I-NEDSS can be labor intensive. ELR data provides information on positive results, but additional work is required by either the hospital infection professional or the local health department to confirm and enter treatment information. Last year alone, more than 75,000 chlamydia and gonorrhea cases were confirmed in I-NEDSS. These facts, coupled with the limited amount of data required for STD reporting, made it an ideal first EMR import project. IDPH IT development staff, in partnership with the PHN and CDPH, is in the final testing phase of a pilot project to import STD data from EMRs. Once the project is finished, and needed changes made to the messaging guide and I-NEDSS import process, IDPH plans to declare its capacity to accept STD data as a specialized registry for providers. Additionally, PHN staff is engineering novel approaches to merge together ELR and EMR data, and match those data against the I-NEDSS database to further minimize the amount of data processing required by local health department staff.

Syndromic surveillance reporting in Illinois was initiated in 2012 as part of the public health reporting objectives for Meaningful Use. Illinois utilizes the CDC's BioSense system to develop and support data storage and analysis. Currently 85% of daily Emergency Department (ED) visits are captured with the reason for visit from 155 hospitals in Illinois. Data have been utilized for monitoring heat-related illness, Enterovirus-like illness, influenza like-illness, and potential importation of Middle-East Respiratory Syndrome (MERS) and Ebola. A pilot project is also underway that will expand syndromic surveillance reporting to ambulatory settings. Figure 7 shows the increasing trend of all ED visits reported weekly, from January 1, 2014 through February 28, 2015 and includes 3.67 million visits.

Figure 7. Volume of Syndromic Surveillance reports (January 1, 2014 to February 28, 2015)



Discussion

Meaningful Use has significantly advanced technologies for health information exchange between public health agencies and health care providers and systems. IDPH and its state and university partners are working to improve adoption and consumption of large amounts of population health data. This includes implementing new standards and technologies to maximize onboarding success and to transport and import large amounts of data into disparate applications. Training a new workforce with the required skill sets both in terms of IT staff as well as trained informaticians is required in order to validate and analyze data. All of these efforts require resources. IDPH has applied for and received CDC funding to maintain and enhance its applications, but these funds are inadequate to manage the volume of data and providers participating in Meaningful Use. Approval of an ONC funding request is pending to support the costs of onboarding and validating provider data.

While electronic data does eliminate the need for data entry of information and can improve timelines and completeness; it does bring new challenges to the public health workforce. Electronic data increases disease reporting thereby increasing the workload for local health departments. With no new funding sources to expand resources, state and local health department infectious disease staff must prioritize their efforts. During the first complete year of ELR (2006), the reported number of Hepatitis C cases increased by 60% over the previous year. Data quality is also an issue. For example, hospital immunization data can be incomplete with regard to the child's first name due to the simple fact that the baby leaves the hospital before the name is determined. There are more than 85,000 records where the child's first name is infant, baby, or male/female.

The ultimate success for the public health field in the Meaningful Use era will be dependent on its ability to translate the increasing volume of data into actions that prevent and control disease. This is as much a cultural shift in public health thinking and action as it is a technical and resource-allocation shift. Technically, public health agencies can break down the silos that exist in our current surveillance systems. Rules need to be reviewed and modified as needed to allow for exchange of data when it's in the best interest of the public's or the patient's health. This type of language already exists within HIPAA and the Control of Communicable Disease code.

Exchange of electronic health data will allow IDPH to leverage technologies, such as the master patient index (MPI) to link health data from multiple sources and enable bidirectional exchange. Current methods to match individual-level data across systems securely and confidentially can improve our understanding of risk factors and disease outcomes and can support alerting and notification of high-risk cases and contacts with infectious diseases. Using bidirectional exchange of data, persons seen in the hospital can be matched against XDRO registries, Ebola, or measles contact lists.

Projects in other healthcare sectors and academic institutions are setting a higher bar for population health, data management, and interoperability. When the public health sector is at the table, the benefits become clear. The University of Chicago has included IDPH as a partner in HepCCATT (Hepatitis C Community Alliance to Test and Treat), a project to increase treatment and case management to chronic hepatitis C cases. At Northwestern University, PCORI (Patient-Centered Outcomes Research Institute) funded projects are also utilizing new technologies to better merge health data. These projects, with true population health and patient-centered components, will improve public health if we learn from each other and follow the examples set and lessons learned to establish best practices in the 21st century.

Author Affiliations

¹ Illinois Department of Public Health, Office of Health Protection, Data and Informatics Manager

² Illinois Department of Public Health, Office of Health Protection, Surveillance and Informatics Epidemiologist

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2. Health Insurance Portability and Accountability Act of 1996. Pub. L. No. 104-191, 110 Stat. 1936 (1996); (45 CFR Part 164.512(a)(1), (b)(1)(i), (b)(1)(iii), (d), as amended August 14, 2002).

Childhood Lead Exposure, Testing Rate, and Blood Lead Poisoning Prevalence in Illinois and Chicago, 1996-2012

Frida D. Fokum, MS, PhD¹
Mohammed Shahidullah, PhD, MPH²
Emile Jorgensen, MPH³
Helen Binns, MD, MPH⁴

Abstract

Lead is neurotoxic and particularly harmful to the developing nervous system of young children. Lead exposure can affect a child's ability to think, learn or behave. Illinois ranks second nationally in number and percentage of lead poisoned children. In this report, child blood lead data reported to the Illinois Department of Public Health (IDPH) were analyzed over the period of 1996 to 2012. The analysis shows that sustained efforts in Illinois to identify lead-exposed children and sources of exposure, and enforced remediation or control of lead hazard sources have resulted in a 93 percent reduction in the number of children with blood lead levels of 10 µg/dL or greater.

Introduction

Lead poisoning is a preventable environmental health disease. Lead can affect every organ system in children and adults including the brain and the nervous system. It can cause neurologic damage and behavior disorders, including lower IQ, attention deficits, and reduced academic achievement.¹ The common risk factors for lead exposures during childhood are older housing built before 1978, young age (two years and younger), low socioeconomic status, and African-American race.²

Deteriorated lead-based paint, commonly found in older housing, is the most common source of lead in children with higher blood lead levels. In a home with deteriorated lead-based paint, the dust is contaminated by lead. Children get lead on their hands by touching the floor or a painted surface and then they ingest the lead by putting their hands in their mouths. Such hand-to-mouth behavior is typical for a normally-developing young child. Other sources of lead include exterior soil, water, and cultural products such as cosmetics and traditional (folk) medicines, including Ayurvedic medicines.⁴

While some manufacturers voluntarily reduced lead concentration in paint after 1950, lead was banned from paint by regulation in 1978. As such, pre-1978 homes and, especially pre-1950 homes, have the highest likelihood of having deteriorating lead-based paint.⁵ In 2012, there were more than 3.5 million pre-1978 housing units in Illinois (987,000 in Chicago) and about two million of them were estimated to contain lead-based paint.²

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Since 1995, Illinois has required assessment for blood lead testing based on the child's age and living environment. From 1996 onward, an average of 270,000 children have been tested for blood lead annually.² Based on the blood lead level (BLL), children were considered to receive nursing case management services and an environmental inspection of the children's living environment – usually their primary residence – to assess the presence of lead-based paint hazards, primarily, and order remediation of those hazards, if warranted.

Data and Methods

Population estimates from the U.S. Census Bureau;⁶ blood lead testing data from Illinois,² Chicago² and the U.S.;⁷ and age of housing data from the American Housing Survey⁸ were used for this report. Medicaid data from the Illinois Department of Healthcare and Family Services (HFS) were matched to blood lead testing data following an interagency data-sharing agreement.

Illinois law requires health providers to either obtain a blood lead test or to apply a targeted blood lead testing approach. The option to apply the targeted blood lead testing approach was only applicable if the child lived in a state-assigned low risk ZIP code area. Children receiving a targeted evaluation first had the Childhood Lead Risk Assessment Questionnaire⁹ completed by a parent/guardian to identify those at high risk for lead exposure (i.e., those with any "YES" or "I DO NOT KNOW" answer to any question on the questionnaire;) and only those who were at high risk received a blood lead test. Blood lead testing and assessment were encouraged at ages one and two years. All children enrolled in medical assistance programs such as Medicaid, Head Start, All Kids, or Women, Infants and Children (WIC) were required to have a blood lead test performed at ages one and two years. Illinois law also requires evidence of a blood lead test or risk assessment using the questionnaire before a child attends a licensed day care center, school, or kindergarten.

The blood lead testing data included the child's name, birth date, test date, blood lead level, race/ethnicity, and home address for blood samples drawn in 1996 through 2012, during which period, Illinois required providers to assess child risk of exposure to lead hazards and perform blood lead tests, if indicated. In Chicago, blood lead tests were a required testing for all health care providers to children. Children aged one and two years were most likely to be tested, but older children also were frequently tested. Approximately 97 percent of children in this report were 6 years of age or younger at time of blood lead testing.

HFS administers the Medicaid Program. Beginning in 2011, HFS provided an incentive payment through Illinois Health Connect to health providers based on their enrollees receiving a blood lead test before age 24 months.¹⁴ By regulation, blood lead test results of children six years of age and younger were reported directly to the IDPH by health providers, hospitals, local health departments, laboratories, and medical professionals who diagnosed, performed blood lead analyses, or treated lead poisoned children in Illinois.¹⁰

Reported blood lead tests in the IDPH's Lead Program Surveillance Database were used for this data analysis. Children with multiple tests matched to each other by date of test, patient last name, first name, date of birth, and testing laboratory were de-duplicated and consolidated using an established data cleaning method. Data

hereby reported included the highest venous blood lead test result per child. If there was no venous test, then the highest capillary test result was used. Blood lead results with incomplete addresses for the tested patient were excluded from the analyses. Note that the Centers for Disease Control and Prevention (CDC) only reports blood lead data for children younger than six years of age, so comparisons of Illinois and the U.S. should be cautiously interpreted.

In this analysis, prevalence was defined as the percentage of children with a BLL of 10 µg/dL or greater among the total number of children tested in a year. The child's BLL used to compute prevalence was determined by taking all BLLs from a given year to determine the peak venous sample result for each child. If no venous blood was drawn, the highest capillary test result was used. The BLLs do not follow a normal distribution, so the geometric mean was determined based on the peak BLL for a given child in a given year.³ Children with test results below a limit of detection were ascribed a value equal to the limit of detection. The imputation of values below the detection limit as used in this report would undoubtedly inflate the geometric mean values. As a result, caution is advised for comparing and interpreting the geometric mean values.

Results

Current Presence of Lead-based Paint

Deteriorating lead-based paint has been identified as a primary source of lead poisoning in houses built prior to the residential lead paint ban of 1978. According to the 2012 American Community Survey 5-year estimates,⁶ there were 66 and 82 percent pre-1978 housing units in Illinois and Chicago, respectively. Approximately 3.5 million Illinois housing units were built pre-1978 with 28 percent of them in the city of Chicago. Fifty-nine percent of the pre-1978 housing units were estimated to have lead-based paint. About 1.4 million Illinois housing units were estimated to have significant lead-based paint hazards (i.e., deteriorating lead-based paint) with 36 percent of those units in the city of Chicago alone (Table 1).

The Illinois Department of Public Health designated ZIP codes in the state where children were at highest risk for blood lead poisoning based on age of housing, age of child, poverty level and elevated blood lead prevalence using the U.S. Census Bureau data files tabulated by ZIP Code areas (Figure 1). Figure 2 displays the percent of pre-1980 housing units by county in Illinois. Out of 1.2 million housing units in Chicago, 53.3 percent were pre-1950 and 29 percent were built from 1950 to 1979 for a total of 82.3 percent pre-1980.

Blood Lead Testing Rate

The blood lead testing rate was based on the percentage of all children tested using U.S. Census Bureau population data for the year the test was completed. On average, 270,000 (margin of error \pm 24,000) Illinois children, of which about 41 percent (110,140 \pm 5,726) resided in Chicago, completed a blood lead test during any one year period. Annual testing ranged from 235,290 to 304,807 children accounting for 20-30 percent of Illinois population of children ages six years and younger. The testing rate for blood lead in Illinois increased steadily from 19 percent in 1996 to 25 percent in 2012 (Figure 3). Nationally, the Centers for Disease Control and Prevention (CDC) reported a national blood lead testing rate of 10.4 percent for 2012 for children less than six years of age. The Illinois testing rate for the most recent year was clearly higher than that of the U.S.

Blood Lead Prevalence

In 1997, approximately 19 percent of Illinois children were identified with a BLL of 10 μ g/dL or higher; by 2012, the percentage had dropped to 1.0 percent.² The significant decline in the number of Illinois children with lead poisoning defined as a BLL at or above 10 μ g/dL is a tremendous public health success story. Prevalence of children with BLLs of 10 μ g/dL or greater fell steadily across the 16 year study period (Figure 4). The state of Illinois accounted for 25 percent in 1997 but the percentage dropped to 14 percent in 2012 for the nation's lead-poisoned children.⁷

Lead Prevalence by Race/Ethnicity

While the information about a child's race and ethnicity is requested in the mandatory BLL reporting process, much of this data is unreported, likely because such information is not transmitted to the laboratories or is not systematically recorded in the child's medical record. Nevertheless, among those with reported race/ethnicity information Black or African American children were disproportionately burdened by lead poisoning compared to their white counterparts (Figure 5).

Lead Prevalence by Gender

Male children tended to have a slightly higher lead prevalence compared to females (Figure 6).

Lead Prevalence by Medicaid Status

Medicaid status was used as a proxy for poverty in this report. More children enrolled in medical assistance programs including Medicaid and/or WIC had elevated blood lead levels (EBLLs) compared to other children who had other forms of medical insurance coverage (Figure 7).

Lead Prevalence by Illinois Counties

Blood lead prevalence has significantly decreased across Illinois counties through the years. In 1996, all Illinois counties had at least 1.8 percent of children with BLLs of 10 µg/dL and greater, with the percentage ranging from 5 to 40 percent by county. In 2001, six counties had less than 1.8 percent of children with a BLL of 10 µg/dL and greater. By 2007, a total of 53 counties had less than 1.8 percent of children with a BLL of 10 µg/dL and greater (median 1.6 percent and maximum 7.8 percent). As of 2012, a total of 69 counties reported less than 1.8 percent of lead poisoned children (median of 1.3 percent) (Figure 8a).

Similarly, blood lead prevalence in certain Chicago community areas have decreased through the years. In 1996, all 77 Chicago community areas had at least 1.8 percent of children with BLLs of 10 mg/dL and greater. In 2001, 69 Chicago community areas had at least 1.8 percent of children with a BLL of 10 mg/dL and greater with an annual prevalence of 12.5 percent. By 2007, only 30 Chicago community areas had at least 1.8 percent of children with a BLL of 10 mg/dL and greater. As of 2012, a total of 10 community areas had at least 1.8 percent of lead poisoned children (annual prevalence of 1.0 percent). Universal testing was recommended for all children living in Chicago, a designated high risk area for lead exposure. Some of the difference between Chicago and Illinois is attributable to more wide-spread testing in Chicago that includes lower risk children (Figure 8b).

Mean blood lead level

The geometric mean BLL of children clearly and steadily decreased over time from 1996 to 2012 (Figure 9).

Discussion

Lead poisoning has been a prevalent, yet preventable environmental health hazard that can affect any family. Although the burden of Illinois childhood lead poisoning still remains one of the highest in the nation, sustained prevention efforts have led to the dramatic decrease in the number of children with elevated blood lead levels as the evidence has shown. Nationally and in Illinois, the large racial and ethnic disparities in lead exposure by socioeconomic status have been reduced on an absolute level.^{2, 3}

The mission of the Illinois Lead Program is to eliminate childhood lead poisoning and provide a lead safe environment for all Illinois children. The program began primarily as a blood lead registry with local programs operating from their own budgets in cities such as Chicago, East St. Louis, Kankakee, and areas of Cook County. In 1992, IDPH realized that a coordinated, statewide effort would be more productive. A strategic plan was developed, new testing and reporting laws were adopted, and high-risk areas for childhood lead poisoning were identified. Since that time, IDPH has been spearheading the delivery of services to Illinois children with EBLLs and fostering programs and partnerships to reduce exposures to lead.

The goal of the Illinois Lead Program is to prevent childhood lead poisoning through community education and public awareness; identify lead poisoned children; provide prompt interventions to reduce lead exposures;

and improve health and developmental outcomes. Lead poisoning prevention activities require the development of policies, delegation, collaboration, and partnership, in order to be successful.

Policy

As required by Public Act (410 ILCS 45/1) (from Ch. 111 1/2, par. 1301),¹⁰ health care providers and directors of clinical laboratories must report all blood lead analyses to IDPH. Illinois law requires children who live in high risk areas to complete a blood lead test before attending a licensed day care, school, or kindergarten. Children living in lower risk areas are required either to be assessed for risk of lead exposure using established questions or to receive a blood lead test.⁹

Delegation

Annually, IDPH enters into grant agreements with 83-87 of Illinois' 102 counties and 5-8 municipal health departments to serve as delegate agencies. The delegate agencies provide case management care for lead poisoned children in 91 of 102 counties. In addition, 18-23 of the delegate agencies also provide services to identify the sources of the lead poisoning. In counties where no delegate agency agreements exist, IDPH provides case management and lead investigation services.

Collaboration

The formation of the Illinois Lead Poisoning Elimination Advisory Council in 2003 with the mission to develop and implement a comprehensive statewide strategic plan has fostered partnership in primary prevention, intervention, surveillance, and evaluation. The Advisory Council consists of professionals from governmental agencies, local health departments, and community organizations. IDPH staff members have partnered with Advisory Council members to provide educational materials and training sessions; to develop and promote new guidelines for lead testing; and to partner with provider organizations to promote blood lead testing and risk assessment strategies.

Partnership

In order to better serve lead-poisoned children enrolled in Medical Assistance Programs like Medicaid, All Kids, and WIC, a partnership was established through an interagency agreement to share data with the Illinois Department of Healthcare and Family Services, the Illinois Department of Human Services and the Illinois Department of Children and Family Services.

An ever increasing body of research data has revealed that there is no safe level of lead in the body.^{2, 11} While this report focuses on children with BLLs of 10 µg/dL or greater, in May 2012, CDC established a new reference BLL that is used to identify children who have been exposed to lead and who require case management. The reference level, currently set at 5 µg/dL, is based on the 97.5th percentile of the National Health and Nutritional Examination Survey (NHANES) BLLs and will be revised on a four-year cycle.¹² Based on this new reference value, approximately 500,000 U.S. children are affected and about 30,000 of these children reside in the state of Illinois.^{3, 2, 15} Based on the recommendation, the number of Illinois children requiring services to

reduce lead exposures increased from about 3,000 to over 30,000. The Illinois Lead Poisoning Prevention Program is committed to the Healthy People 2020 goal of reducing lead exposures for all Illinois children.

Sustained prevention efforts culminated in a significant decrease in the number of lead poisoned children. Primary prevention activities implemented included the designation of high and low risk ZIP codes for childhood lead poisoning; regional lead poisoning prevention training sessions; a comprehensive lead education, reduction, and window replacement program; and licensing of lead contractors in Illinois. Secondary prevention was solely intervention through case management follow-up of children with lead in their blood and inspection of dwellings and common play areas of children to identify and remediate the sources of lead poisoning. Severe cases of lead poisoned children for chelation were rare.

This report has limitations. Blood lead data in this report have an inherent sampling bias. This is due to differential requirements for blood lead testing based on lead exposure risks. Illinois included areas where blood lead testing for all children is required (children living in high-risk ZIP codes and Chicago) and targeted areas where blood lead testing was based on individual child risk assessment methods. Illinois did not have state-wide representative data comparable to the National Health Nutrition and Examination Survey (NHANES) data, which is a representative sample of all U.S. children. The race and ethnic classification data were very sparse and no data on socioeconomic variables were available during this reporting period. The estimate of the annual geometric mean BLL is of limited use because of the substitution of values below a limit of detection with the detection value, and variable limits of detection due to equipment upgrades and re-certification through the years by different reference laboratories. Additionally, annually, approximately 5-13 percent of blood lead test results were excluded from analysis because of incomplete addresses. Research is underway to improve the quality of race and ethnicity data for children tested for lead poisoning.

Conclusion

Although the burden of Illinois childhood lead poisoning still remains one of the highest in the nation, prevention efforts, including improvements in housing and strategies focused on improvements to medical care, led to the dramatic 93 percent decrease in the number of children with BLLs of 10 µg/dL or greater between 1996 and 2012 (from 45,647 children in 1996 to 3,035 children in 2012). In recognition of the fact that there is no safe level of lead in the body, in 2012 a new reference BLL used to identify children who have been exposed to lead was set at 5 µg/dL.¹² The Illinois Lead Program is currently evaluating how the new reference value will affect the Program and what additional resources will be needed to implement the changes so the Program can adequately serve Illinois children. IDPH is committed to the Healthy People 2020 goal of reducing lead exposures for all children.¹³

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Author Affiliations

¹ Illinois Department of Public Health, Office of Health Protection, Division of Environmental Health;

² Illinois Department of Public Health, Office of Policy, Planning and Statistics, Illinois Center for Health Statistics and member of the Illinois Lead Poisoning Elimination Advisory Council.;

³ Chicago Department of Public Health;

⁴ Ann & Robert H. Lurie Children's Hospital of Chicago and Chair, Evaluation Committee of the Illinois Lead Poisoning Elimination Advisory Council.


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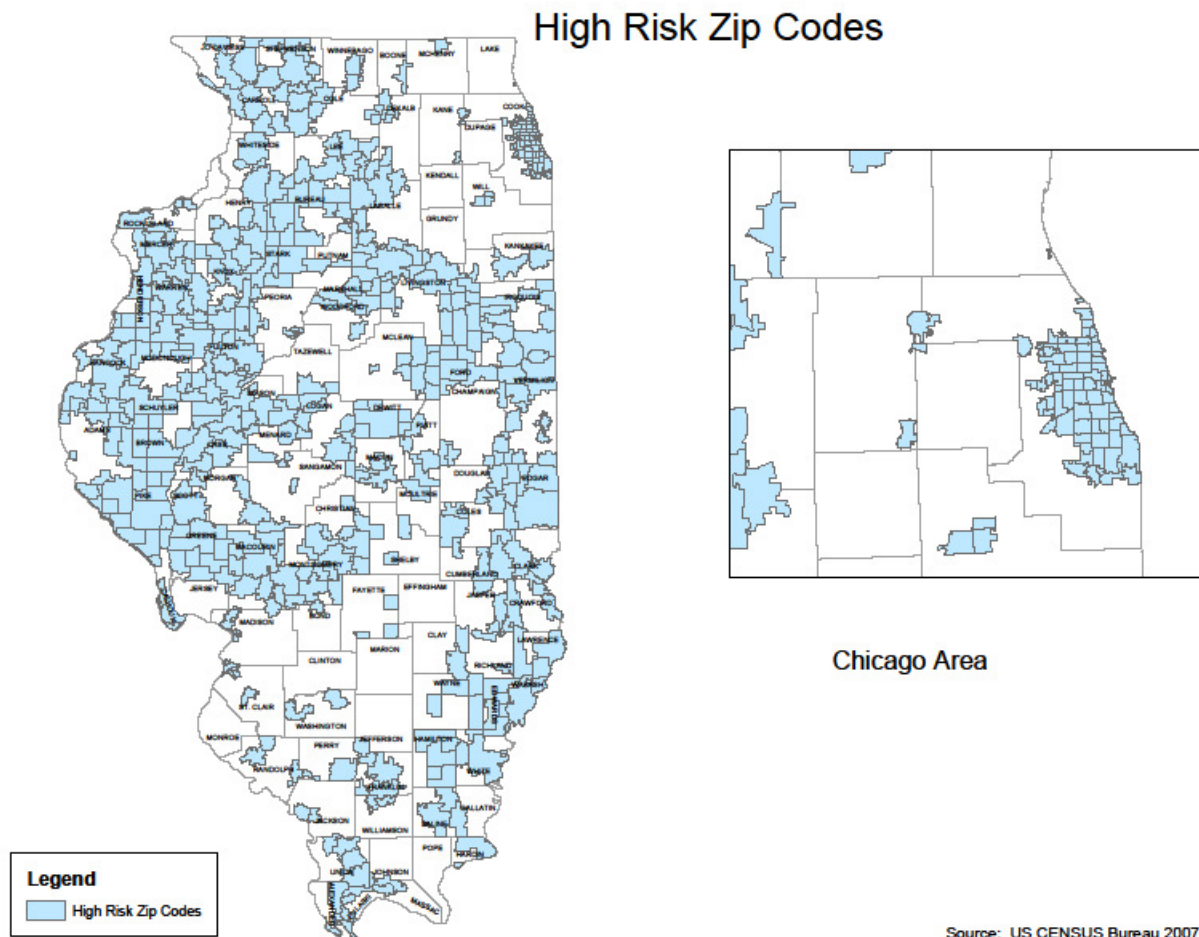
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Table 1. Estimates of the Number of Housing Units in Illinois and Chicago with Lead Hazards by Year Structure was Built

Year Structure Built	Estimated Number of Housing Units ¹		Significant Lead Based Paint Hazard ²			Prevalence of lead-based paint in the Midwest ³		
	Illinois	Chicago	% with Lead ²	Units with Lead		% with Lead ³	Units with Lead	
				Illinois	Chicago		Illinois	Chicago
Pre-1978	3,515,998	987,240	41.1	1,446,147	514,096	59.2	2,082,053	685,553
1960 to 1977	1,238,000	181,171	7.7	95,326	13,950	23.8	294,644	43,119
1940 to 1959	1,058,626	262,684	48.7	515,551	127,927	73.7	780,207	193,598
Pre-1940	1,219,372	543,385	68.5	835,270	372,219	82.6	1,007,201	448,836
Total Units	5,293,619	1,197,248						

Sources: ¹U.S. Census Bureau, 2008-2012 American Community Survey 5-year estimate
^{2,3}American Health Homes Survey, Table 5-1 Midwest and ²Table 4-1 page 20. Available at http://portal.hud.gov/hudportal/documents/huddoc?id=AHHS_REPORT.pdf.

Figure 1. High Risk ZIP Codes for Childhood Lead Poisoning in Illinois and the City of Chicago



Source: US CENSUS Bureau 2007-2011 American Community Survey

Source: Illinois Department of Public Health, Lead Program Surveillance Database and U.S. CENSUS

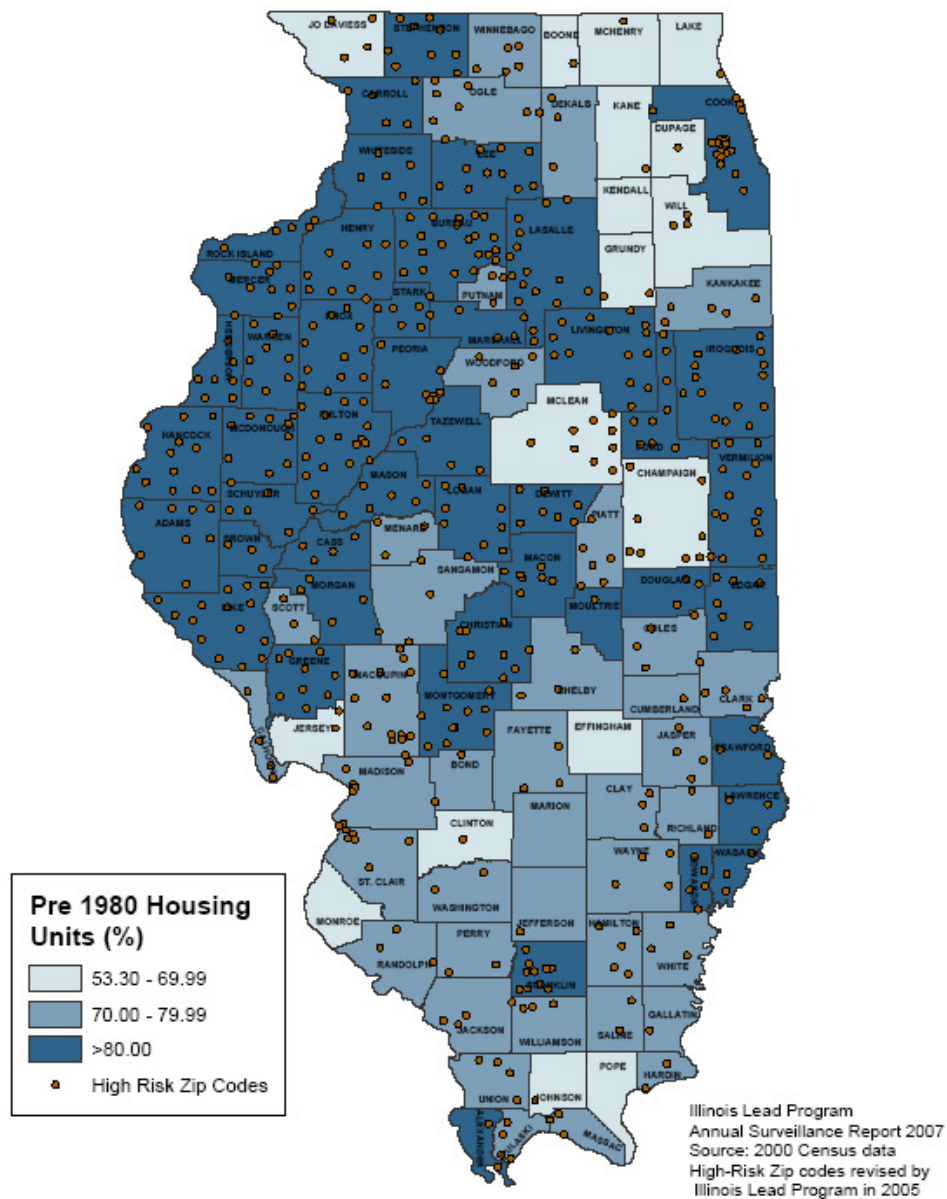
Note: All of the city of Chicago is designated by the Department as a high risk area for childhood lead poisoning.

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Figure 2. Percent of Pre-1980 Housing Units by Illinois County and High-Risk ZIP Codes for Childhood Lead Poisoning.



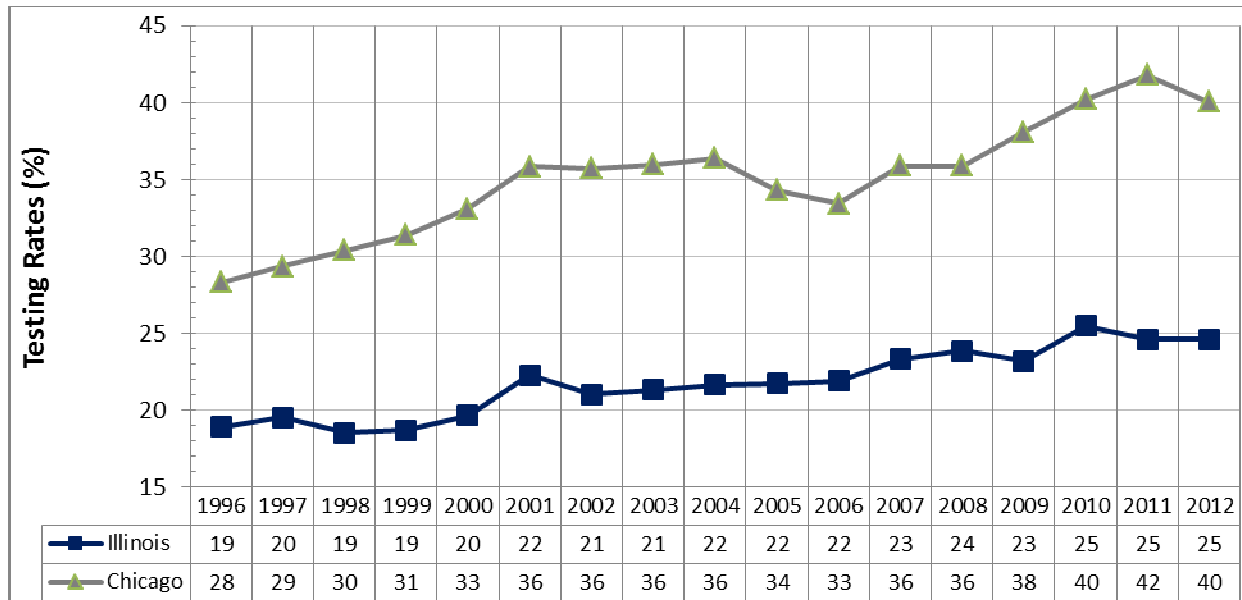
Note: All ZIP codes of the city of Chicago are designated by the Department as high risk areas for childhood blood lead poisoning. Out of 1.2 million housing units in Chicago, a total of 82.3 percent were pre-1980.

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Figure 3. Testing Rates for Childhood Blood Lead Prevalence in Illinois and Chicago, 1996-2012

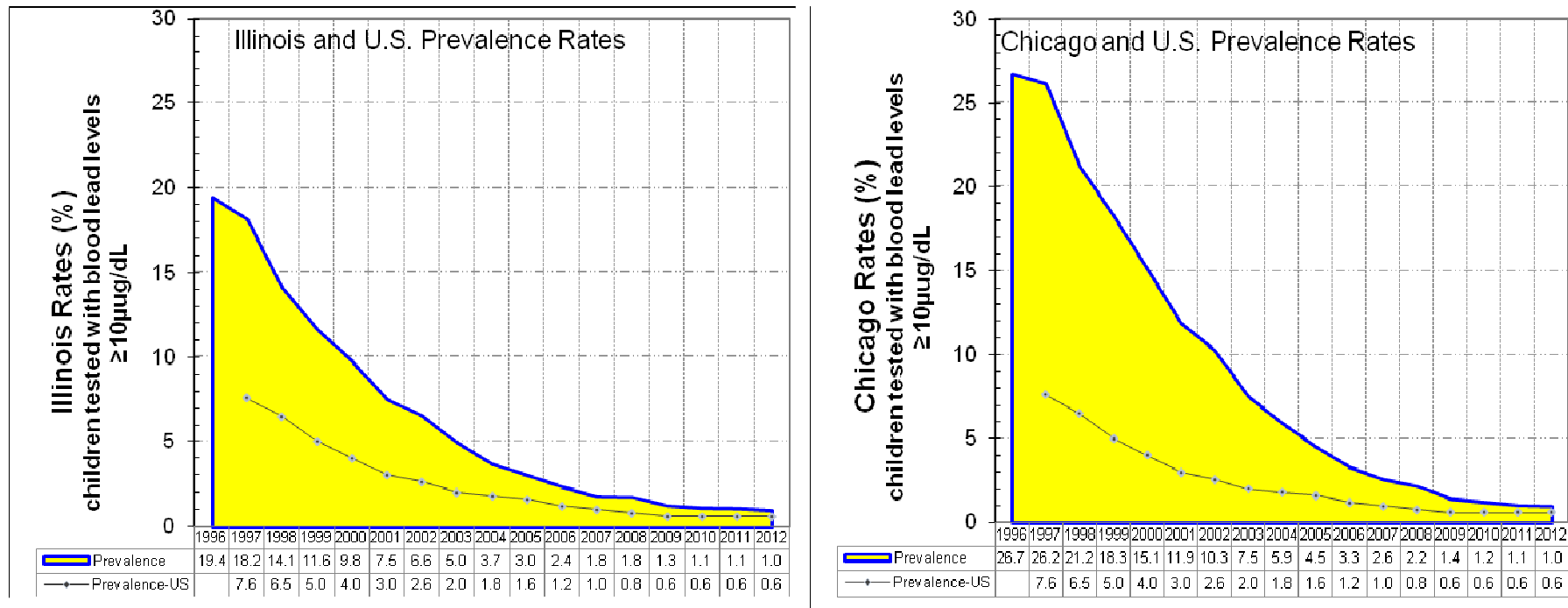


Source: Illinois Department of Public Health, Lead Program Surveillance Database, 1996-2012; U.S. Census Bureau; Illinois Department of Public Health, Illinois Center for Health Statistics

Notes: Intercensal Estimates: 1991-1999, 2001-2009; Postcensal Estimates: 2011 and 2012; Census year distribution for children 0-6 was used to estimate intercensal and postcensal year estimates for 0-6 years population

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Figure 4. Childhood Blood Lead Prevalence Rates for Illinois and Chicago by Year, 1996-2012



Source: Illinois Department of Public Health, Lead Program Surveillance Database, 1996-2012.

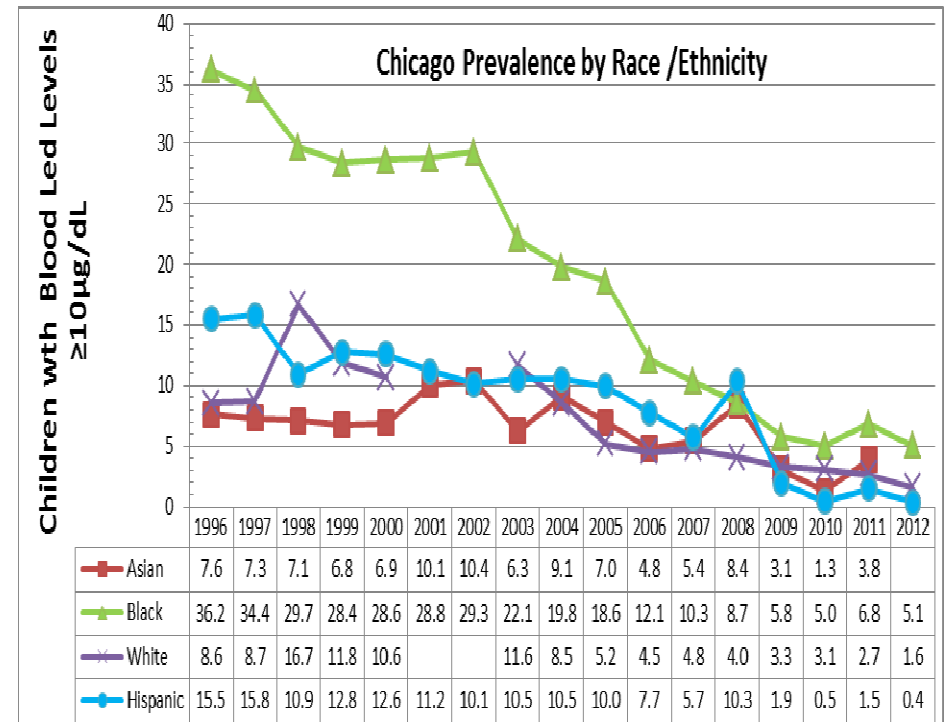
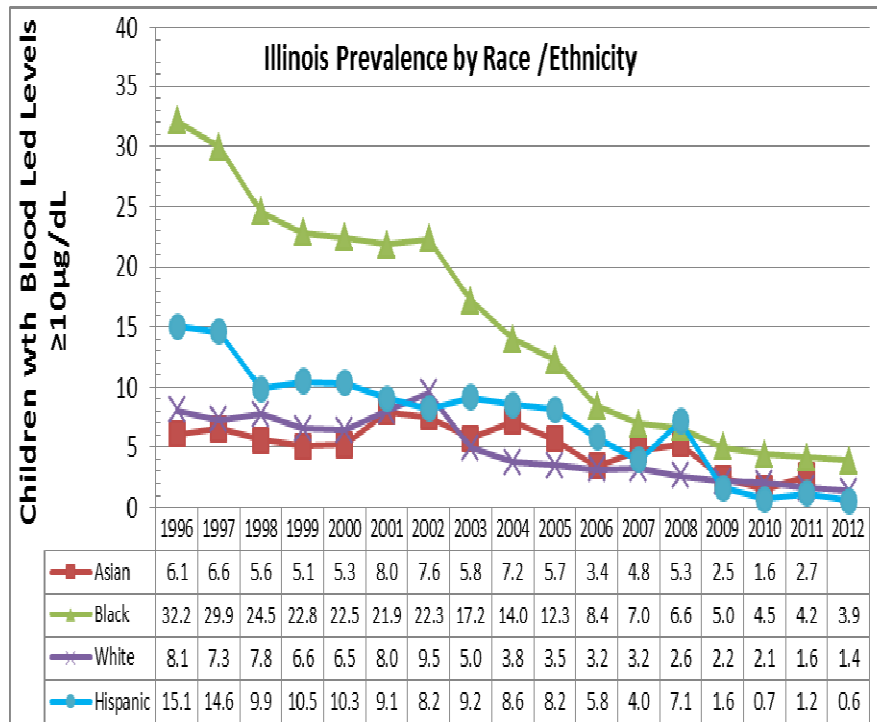
Note: U.S. prevalence added here only to show the trend in lead poisoning decline with time based on children less than 6 years of age. Be cautious in relating the U.S. prevalence rate with the Illinois prevalence rate.

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Figure 5. Blood Lead Prevalence in Illinois and Chicago Children by Race/Ethnicity, 1996-2012



Source: Illinois Department of Public Health, Lead Program Surveillance Database, 1996-2012.

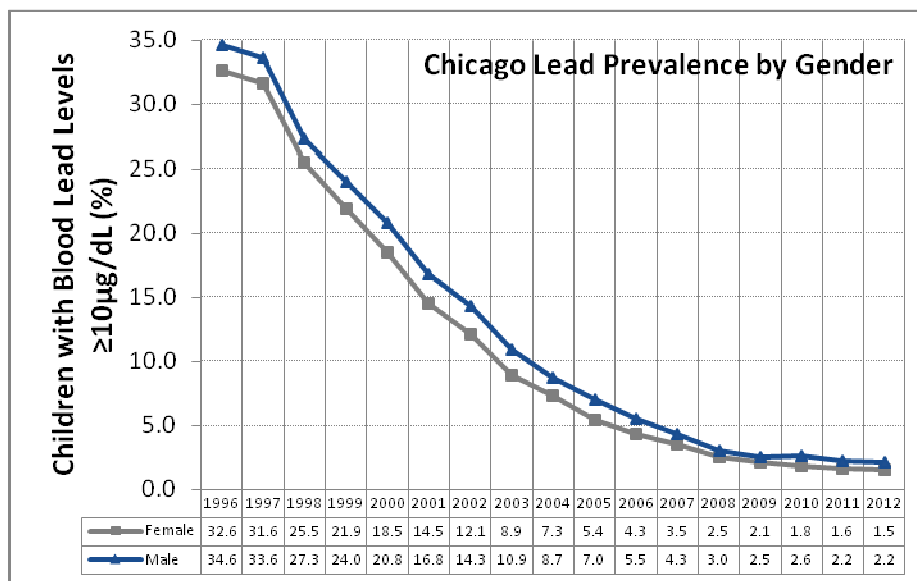
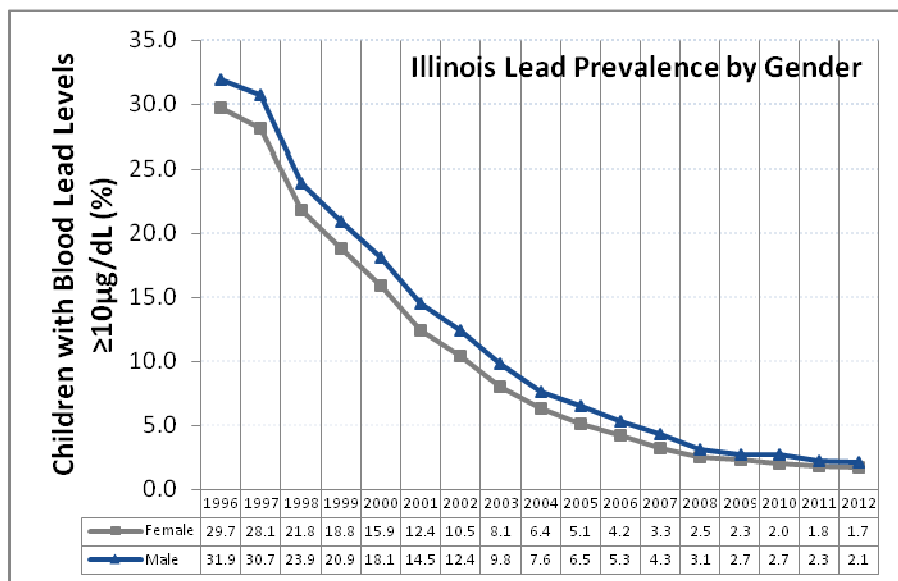
Note: Other races were too few to be reported. Lead prevalence between 2001-2002 in Chicago was not included for White children due to very few test records.

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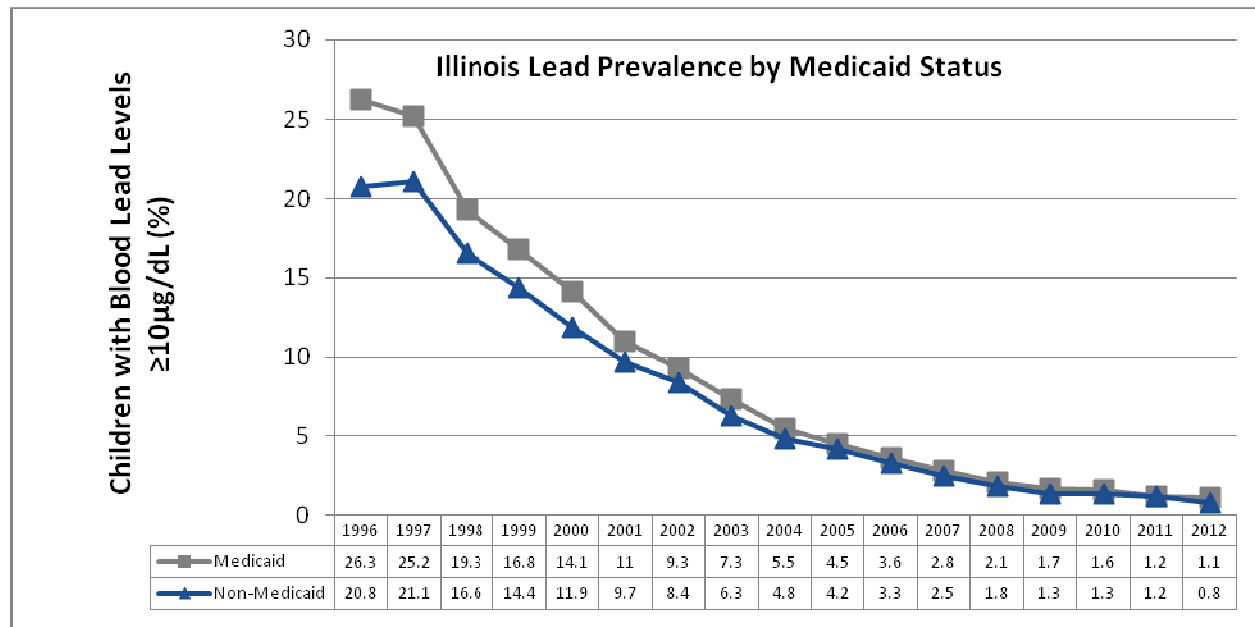
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Figure 6. Blood Lead Prevalence in Illinois and Chicago Children by Gender and Year, 1996-2012



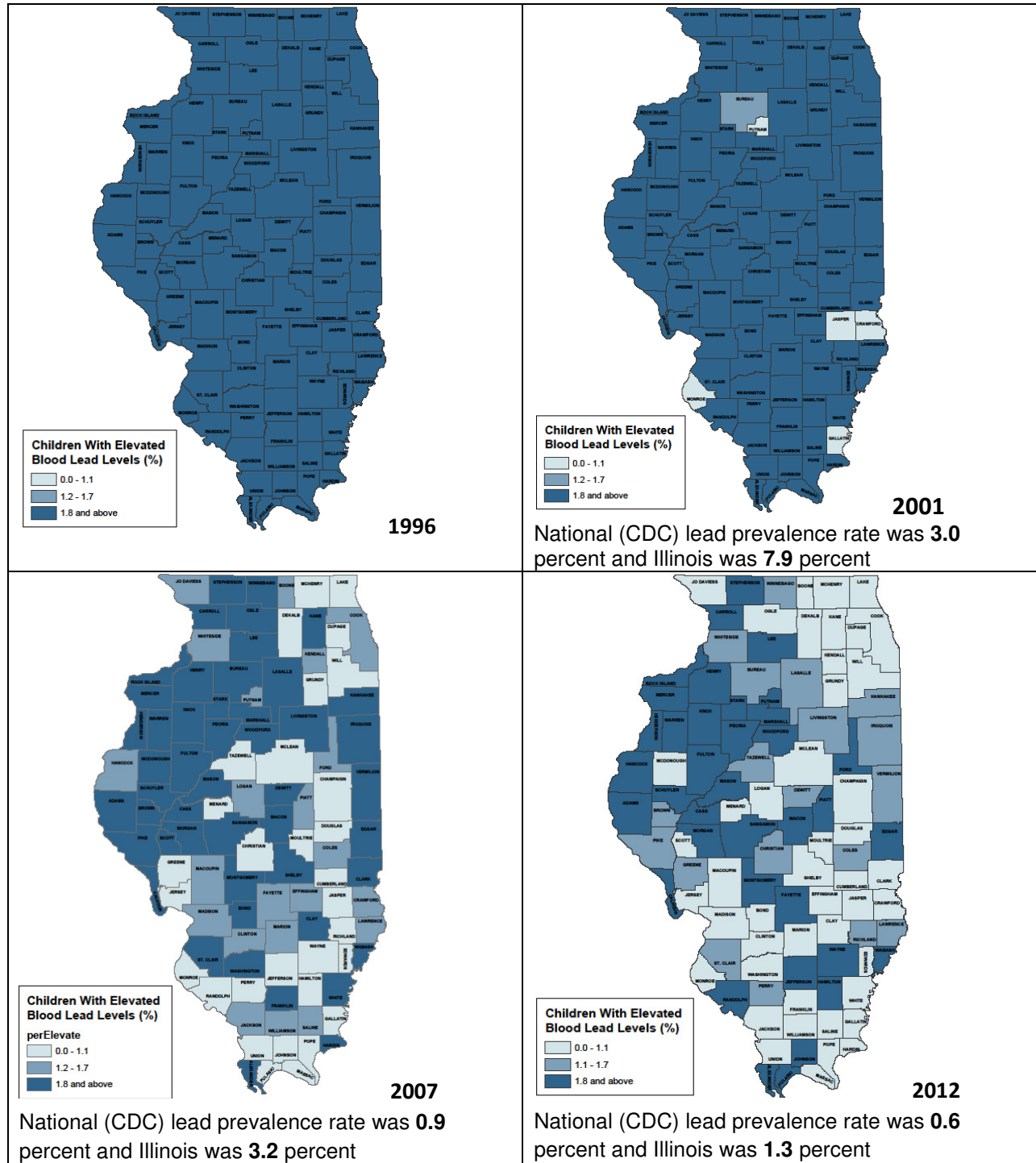
Source: Illinois Department of Public Health, Lead Program Surveillance Database, 1996-2012.

Figure 7. Blood Lead Prevalence Rates by Medicaid Status and Year, 1996-2012



Sources: Illinois Department of Public Health, Lead Program Surveillance Database, 1996-2012; the Department of Healthcare and Family Services, Enterprise Data Warehouse.

Figure 8a. Decrease in Illinois Childhood Blood Lead Prevalence by County by Year



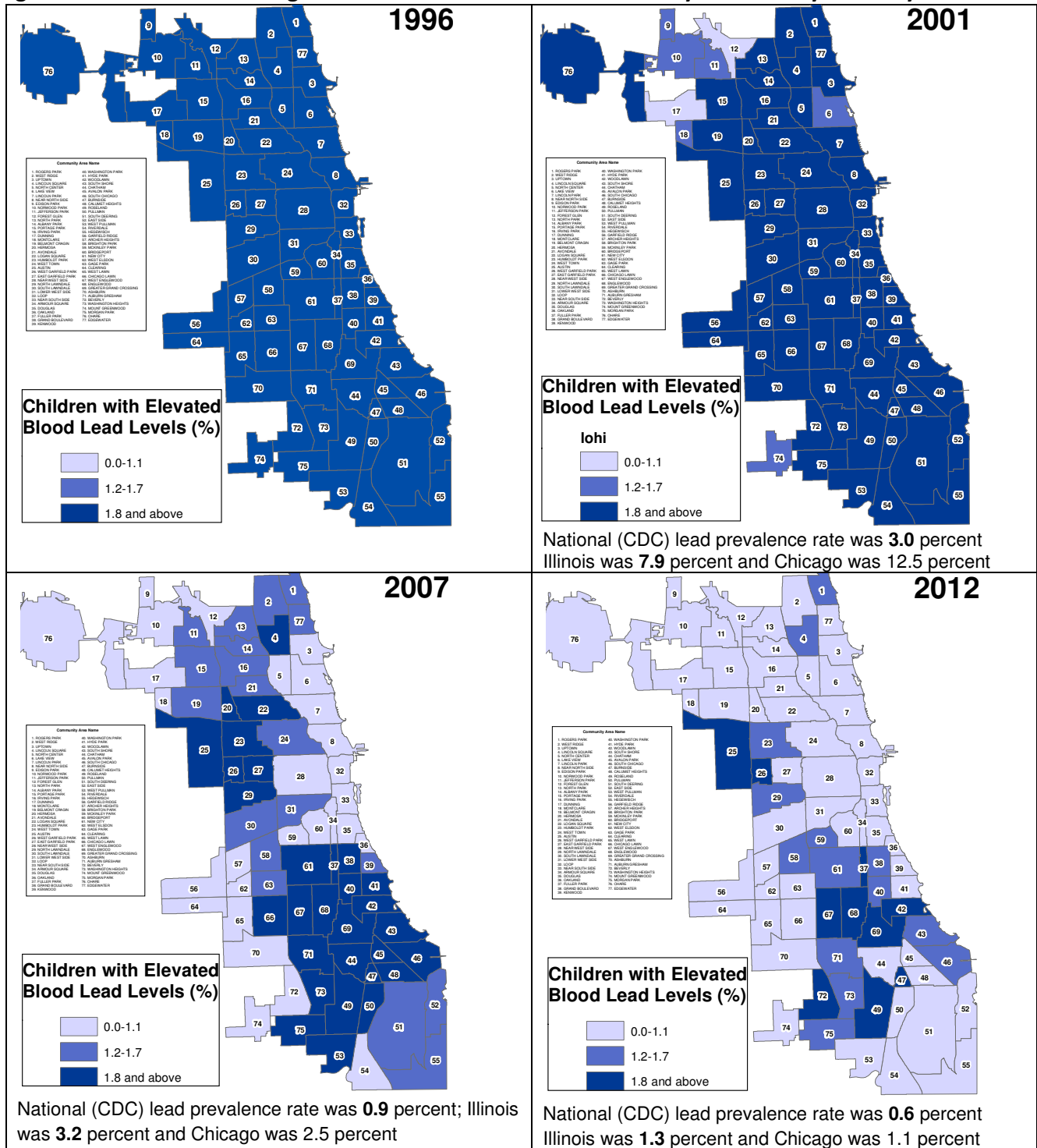
Source: Illinois Department of Public Health, Lead Program Surveillance Database, 1996-2012.

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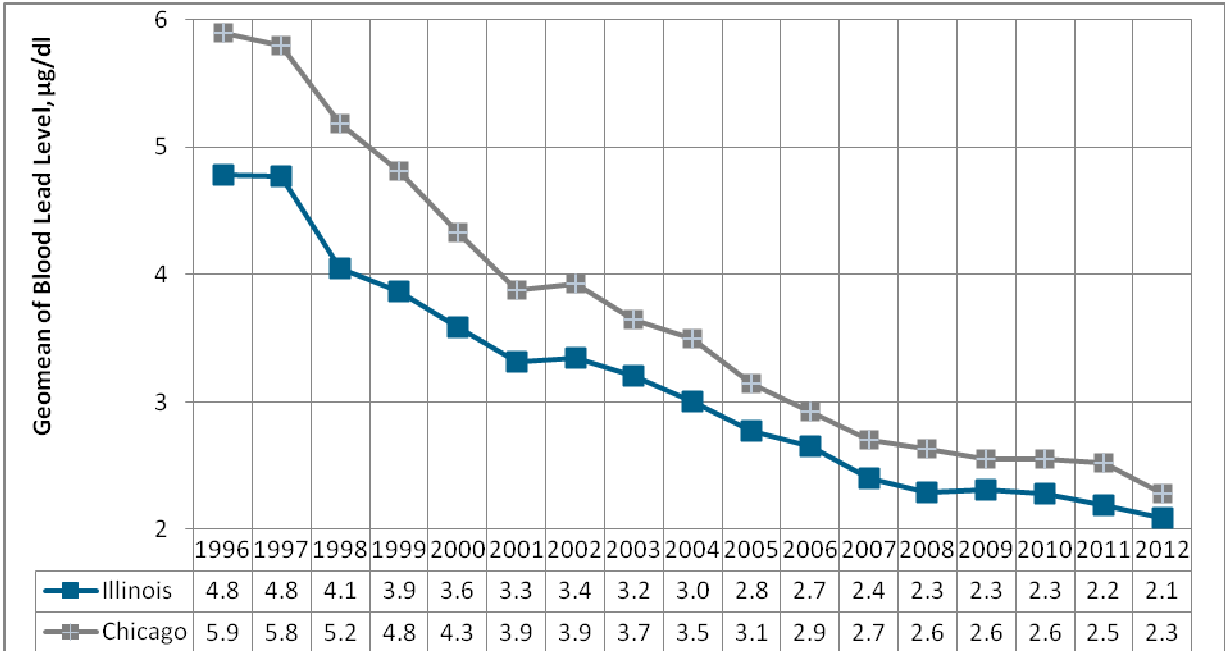
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Figure 8b. Decrease in Chicago Childhood Blood Lead Prevalence by Community Areas by Year



Source: Illinois Department of Public Health, Lead Program Surveillance Database, 1996-2012 and the Chicago Department of Public Health's Lead Poisoning Prevention Program.

Figure 9. Geometric Mean Blood Lead Levels for Illinois and Chicago Children by Year, 1996- 2012



Source: Illinois Department of Public Health, Lead Program Surveillance Database, 1996-2012.