Life Course Indicator: Capacity to Assess Lead Exposure

Basic Indicator Information

Name of indicator: Capacity to Assess Lead Exposure (LC-46)

Brief description: Capacity of states to assess lead exposure

Indicator category: Organizational Measurement Capacity

Indicator domain: Service/Capacity

Numerator: State level: Yes or No to the question, does your state have an explicit requirement that blood lead test results be reported to the state health department; National level: Number of states/districts/territories with an explicit requirement that blood lead test results be reported to the state health department

Denominator: State level: no denominator; National level: Number of states, districts and territories

Potential modifiers: None

Data source: Council of State and Territorial Epidemiologists (CSTE) State Reportable Conditions Assessment (SRCA)

Notes on calculation: At the state level, this indicator will be binary (Yes/No) to the question: Does your state have an explicit requirement that blood lead test results be reported to the state health department?

Similar measures in other indicator sets: None
Life Course Criteria

Introduction
Lead exposure in early childhood, even at very low levels, has consequences for brain development, including intelligence quotients (IQ), ability to pay attention, and academic achievement (CDC 2014). Children are particularly vulnerable, not only because of the critical and sensitive periods of growth and development, but also in how their bodies handle exposure. Children absorb 40 percent of a dose of lead compared to 10 percent in adults, and retain 30 percent of lead absorbed compared to 1 percent in adults (Rosin, 2009). Major sources of lead exposure, including gasoline, paint, pipe solder, and ceramic products, have been removed from the commercial market for decades, but exposure to lead can still occur, particularly in housing built before lead paint was banned from use in 1978. A state or jurisdiction’s monitoring of childhood exposure to lead through blood lead level testing is key to preventing further exposure, remediating exposure sites, and intervening early to minimize exposure impact. Although lead poisoning is already listed as a nationally notifiable condition by CSTE, the condition is only reported to the Centers for Disease Control and Prevention (CDC) as a notifiable disease if the disease is already reportable at the state level. Therefore, a state or jurisdiction’s commitment to lead exposure prevention can be quantified to some extent by determining whether lead poisoning is reportable at a state level, which would then be transmitted to the CDC for national surveillance efforts.

Implications for equity
Although overall numbers of lead poisonings in children have declined dramatically over the past 20 years, disparities of lead poisoning have persisted (National Center for Healthy Housing, 2008). There are multiple risk factors for elevated blood lead levels (EBLs), and these have been identified through national, state, and local exposure assessments over the past half century. These risk factors include age, race, income, location and age of housing, and parental occupation (Levin et al. 2008). A recent Morbidity and Mortality Weekly Report (MMWR) article also reported persistent disparities in the geometric mean of blood lead levels (GM BLL) by factors such as race/ethnicity and income level (CDC 2013a). Non-Hispanic Black children ages one to five are twice as likely to have lead poisoning than non-Hispanic White children ages one to five (National Center for Healthy Housing, 2008). Hicken et al. (2012) found a significant interaction between blood lead levels (BLLs), blood pressure and race, concluding that “social disadvantage exacerbates the deleterious health effects of lead.” The Advisory Committee on Childhood Lead Poisoning Prevention observed that these disparities can be traced to differences in housing quality, environmental conditions, nutrition, and other factors designed to control or eliminate lead exposure (CDC 2013a). The intersection of poverty, older housing, and the impacts of racial residential segregation create a vulnerable population of low income minority families living in older housing and therefore at increased risk for childhood lead exposure and adverse health outcomes. Due to the localized and concentrated nature of elevated BLLs in these low-socioeconomic areas, statistical national prevalence could decline to a level near zero even though children are still being affected by lead poisoning (Alliance for Healthy Homes). Continued analysis of BLLs from children in high-poverty, high-risk areas are important to identify communities posing risk of elevated BLLs (Alliance for Healthy Homes).

Additionally, in documenting the substantial disparities between racial/ethnic groups in notifiable infectious diseases, the CDC also has noted substantial gaps in collection of racial/ethnic data (CDC 2005). Interventions designed to reduce children’s exposures to lead will have more impact if their results can be quantified through nationally reported data.

Public health impact
At least four million households in the United States are exposing children to high levels of lead and about a half million children one to five years of age have a BLL of five μg/dL, which is the level that the CDC recommends public health intervention (CDC 2013b). The negative health effects of lead exposure in children have been well researched and include lifelong, incurable intellectual and behavioral problems (CDC 2013a). Children are highly susceptible to lead poisoning because their bodies absorb lead more easily than adults and lead interferes with the development of their brains, organs and other systems (National Center for Healthy Housing, 2008). There is no safe level of exposure to lead (Child Trends Data Bank, 2013). Even at low levels, lead exposure causes reduced IQ and attention span, hyperactivity, impaired growth, learning disabilities, hearing loss, insomnia, and other health problems (Child Trends Data Bank, 2013). These adverse effects on a child’s neurodevelopment can persist beyond early childhood into adolescence (Child Trends Data Bank, 2013). High BLLs have severe health consequences including seizures, coma and death (Child Trends Data Bank, 2013).
Lead poisoning at low levels can occur without any observable symptoms, resulting in the condition going unrecognized (Child Trends Data Bank, 2013). In order to identify cases of lead poisoning, regular BLL testing is needed (Child Trends Data Bank, 2013). Eliminating elevated BLLs in children and reducing the mean BLL in children from 1.5 μg/dL to 1.4 μg/dL by 2020 are goals of the Healthy People 2020 initiative (Child Trends Data Bank, 2013). Activities identified to support these goals include increasing the proportion of older houses that are tested for lead, increasing the proportion of older houses found to be safe for children and families, inspecting school drinking fountains for lead, and increasing state monitoring of lead poisoning (Child Trends Data Bank, 2013).

There are economic benefits to be gained from reducing children’s exposure to lead. A 2009 cost analysis by the Economic Policy Institute in Washington, DC estimated each dollar invested in lead paint hazard control results in a return of between $17 to $221, which produces a net savings of $181 billion to $269 billion through health care savings, lifetime earnings, tax revenue, special education costs, reduction in attention deficit-hyperactivity disorder, and crime costs (Gould, 2009). Despite the cost savings potential of lead exposure reduction, the CDC Lead and Healthy Homes Program budget was cut from $29 million to $2 million in 2012 (National Center for Healthy Housing, 2013). The results of these cuts have been the elimination of grants for lead poisoning prevention to local and state health departments and a 57 percent reduction in state Childhood Lead Poisoning Prevention Program positions (National Center for Healthy Housing, 2013). Although funding was increased to $15 million in 2014, funds are still just over half of what they were in 2011. Without federal funding, crucial activities including surveillance efforts, may be eliminated (National Center for Healthy Housing, 2013).

Not all states require reporting of EBLs by health care providers or clinical laboratories. In order to determine the true prevalence of EBLs and create public health lead poisoning prevention programs, reporting of all EBLs by clinical laboratories is essential (Council of State and Territorial Epidemiologists). Including lead test results as reportable conditions under state and territorial jurisdiction may increase the likelihood of use of the data for prevention and intervention programs.

**Leverage or realign resources**

Reliable data collection and reporting on EBLs can help to focus lead poisoning prevention efforts. EBLs have been a nationally notifiable non-infectious condition since 2010; however, a disease with notifiable status is not necessarily reportable in each state (CDC 2014). Notifiable diseases are voluntarily reported to the CDC by state and territorial jurisdictions for nationwide monitoring of disease data (CDC 2014). Reportable disease cases must be reported to state and territorial jurisdictions when identified by a health provider, hospital, or laboratory (CDC 2014). CDC partners with 57 state, local, territorial and health departments to improve their National Notifiable Diseases Surveillance System (NNDSS) (CDC 2014) and also runs the Healthy Homes and Lead Poisoning Prevention Program, a goal of which is to provide funding to state and local health departments to screen for EBLs (CDC, 2013). CSTE is responsible for defining and recommending which diseases are reportable within states and which diseases should be voluntarily reported to the CDC (CDC, 2014), making CSTE and CDC relevant partners in obtaining state reportable status for EBLs.

Environmental justice or specific lead poisoning advocacy organizations have had success in helping to pass tough lead poisoning laws and regulations in the past. In 2004, the environmental justice organization, WE ACT, in New York City, helped the passage of Local Law 1, one of the toughest lead poisoning prevention laws in the United States (We Act, 2010). In New Hampshire, the New Hampshire Charitable Foundation performed an advocacy campaign to enact legislation to enhance lead paint poisoning prevention and enforcement (New Hampshire Charitable Foundation). Local environmental health or child health organizations such as these may be helpful in influencing state policy toward a system of lead poisoning as a reportable condition.

In addition to making lead poisoning a state reportable condition, partners in the housing sector can be engaged to reduce lead exposure in children and families. The U.S. Department of Housing and Urban Development (HUD) funds a Healthy Homes Initiative (HHI) to protect children from housing-related health hazards (USHUD, 2014). The HHI addresses multiple housing-related hazards, one of which is elevated lead levels (USHUD, 2014). State and local governments, nonprofits, Indian Tribes, colleges, and universities are all eligible to apply for a Healthy Homes grant for effective home hazard assessment and intervention activities (USHUD, 2014). Activities eligible for funding include development of hazard assessments and interventions, evaluation of interventions, and educating high-risk residents of lead exposure dangers (USHUD, 2014). The Environmental Protection Agency (EPA) requires firms that deal with renovation or repair
projects in homes built before 1978 are certified by EPA-approved trainers and follow lead-safe work practices (USEPA, 2014). EPA also has launched several lead outreach campaigns including Get Lead-safe, Lead-Free Kids, and observes the National Lead Poisoning Prevention Week to draw public attention to the health effects of lead exposure (USEPA, 2014).

**Predict an individual’s health and wellness and/or that of their offspring**

Childhood exposure to lead has lifelong consequences. EBLs, even at low levels, can cause intellectual, learning, and behavioral deficits, and also are associated with many other serious health conditions including asthma, high blood pressure, and degenerative diseases of the elderly (Child Trends Data Bank, Joseph et al, 2005, Zhang et al, 2012, Rosin, 2009). Lead poisoning interfere with brain development in children leading to long-lasting neurological problems (Child Trends Data Bank).

Blood lead concentration of infants is often similar to maternal blood lead concentrations, which may be due to lead’s ability to cross the placenta (American Academy of Pediatrics, 2005). Pregnancy is a critical and sensitive period in the life course for lead exposure. Toxicity from increased blood lead concentration in infancy can occur following high lead exposure in the mother during pregnancy (Rosin 2009). Mid-pregnancy EBLs have been associated with decreased three-to seven-year IQ, regardless of post-natal exposure (Schnaas et al, 2006). Additionally, a study in Cincinnati found maternal EBLs between six and 28 weeks of gestation were associated with adolescent attention scores (Ris et al, 2004). Evidence supports the early third trimester of pregnancy is a critical period for later intellectual development in childhood and lead exposure during this period can result in long-term intellectual deficits (Schnaas et al, 2006).

The American Academy of Pediatrics has stated the best approach to lead poisoning is to prevent exposure entirely, although this is a long-term goal (American Academy of Pediatrics, 2005). Currently, state surveillance, including case finding, case management, and prevention of additional exposure, is required to identify children with excess lead exposure and intervene in that exposure (American Academy of Pediatrics, 2005). Accurate lead exposure case identification, in conjunction with public health programs that rely on this data to identify where intervention is necessary, can lead to a reduction in lead poisonings (American Academy of Pediatrics, 2005). Nationally representative data also is crucial for the national public health response to lead poisoning and improvement in state monitoring trends of blood lead test results can in turn improve collective national data reported to the CDC (American Academy of Pediatrics, 2005).

**Data Criteria**

**Data availability**

CDC funding of state level lead programs through the STELLAR program has been greatly curtailed in recent years, limiting its usefulness as a capacity indicator for lead screening. Many different programs, e.g., the Medicaid Early Periodic Screening, Diagnosis, and Treatment program, continue to emphasize blood lead testing of children. However, the results of those tests are not automatically available for public health surveillance; whether these data are readily available can serve as an indicator of a state’s ability to use its data for program planning and evaluation.

"Disease reporting in the United States is mandated by legislation or regulation at local, state, or territorial levels only. States and territories determine which conditions to include on reportable condition lists, who is required to report, what information should be reported, and how quickly disease information must be reported to public health authorities. The list of reportable conditions varies across states and from year to year.

Some reportable conditions are designated by CSTE as being nationally notifiable. CSTE recommends that all states and territories enact laws or regulations making these diseases or conditions reportable in their jurisdictions. Currently, states and territories voluntarily report data (without direct personal identifiers) about nationally notifiable conditions (NNCs) that are reportable in their respective jurisdictions to the CDC. Not all NNCs are reportable for each state or territory." (Jajosky et al., 2011). "Each state determines which conditions are reportable within its jurisdiction, including which conditions are reportable from various entities (e.g., facilities, providers, laboratories), within what time frame, to whom within the health department, by what method, and in what format” (PHIN, 2012).

CSTE added lead poisoning to the nationally notifiable conditions list in 2010, which means that if it is reportable at the state level then the information will be transmitted to CDC. When reportable, lead screening results (positive or negative)
are required to be submitted quarterly for children and twice a year for adults. The CDC gathers these data in a State Reportable Conditions Assessment (SRCA) that also tracks the reporting authority: whether the condition is mentioned by name in the jurisdiction’s laws or reportable condition list (“explicit authority”), not specifically listed as reportable but would be considered reportable under general language, e.g., “any condition of public health importance” (“implicit authority”), or not reportable. An important use of the SRCA data is clarification of NNDSS (includes both infectious and non-infectious conditions) data tables published in the CDC MMWR, allowing readers to “distinguish between when no notification of cases for reportable conditions has occurred and when no notification occurred because a condition was not reportable for a state or territory” (Jajosky 2011). The SRCA, which has a marginally intelligible query system, is thus expected to be a long-term, stable source of data.

Data quality
Although disease reporting is mandated by legislation or regulation at the state and local levels, state notification to CDC is voluntary. According to the national Biosurveillance Strategy for Human Health, reporting completeness of notifiable disease is highly variable and related to the condition or disease being reported. CSTE and CDC have promoted standardized data elements and case detection algorithms for identification and reporting of nationally notifiable conditions from health care entities to local and state public health. Implementation guides are being developed to enable electronic exchange of these data. This work, combined with widespread adoption of electronic health records, has the potential to improve case detection capabilities for reportable public health conditions. Further development, testing, and implementation of algorithms and data exchange standards are necessary to enhance capabilities (U.S. DHHS, 2010). SRCA staff has diligently searched for reporting and data limitations, and has worked to address those challenges as much as possible (Jajosky, 2011).

Simplicity of indicator
This indicator is simple to calculate and relatively easy to explain.

References


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