Your Name

Instructor Name

Course Number

Date

Title: The Science of Early intervention

Pediatric lead poisoning continues to be the most common and preventable environmental health problem and significantly contributes to childhood disease burden in both developed and developing countries. According to the Center for Disease Control (CDC) data, 6% of children between ages one to two years and 11% of non-Hispanic children between ages one to five years have blood lead levels in the toxic range. Lead poisoning can affect people of any age. In the United States, almost all children are exposed to some lead. The costs that are associated with the lead poisoning morbidities is estimated to be in billions of dollars. Recently the prevalence of high blood lead levels in children decreases due to the regulatory initiative of limited lead content and the use of tetraethyl lead in paints. According to the data from the National Health and Nutrition Examination Survey, between 1999 -2002 the mean lead level declined to 1.9mg/dl. The magnitude of socioeconomic and racial disparities has also declined.

Lead is defined as “multimedia pollutant” due to diverse and numerous pathways and sources of potential exposure. A blood lead test is used to measure the exposure to lead. Many laboratory tests are available for determining blood lead levels. Improved technologies in laboratory analytical methodology have made it possible to measure more precise and accurate blood lead levels. However, special precautions and highly specialized laboratory equipments are needed to avoid external lead contamination during collection, processing, and analysis of blood.

Elemental lead is a dense, soft, flexible and blue-grey metal that is found naturally in rocks and soil. Lead is mined from ores and recycled from scrap batteries and metal. Elemental lead can combine with elements to form organic and inorganic compounds such as tetraethyl lead and lead phosphate. Lead has many uses in manufacturing i.e. solders, batteries, plastics, ceramic glazes metal alloys (bronze and brass) and radiation shielding. In the past, lead was added in residential paints and gasoline. It is also used in plumbing ("CDC - Lead - Home Page").

Before the 1980s the major source of lead exposure was ‘aerosolized lead’ emitted from the combustion engine. Aerosolized lead is either ingested or inhaled after depositing on food crops and surfaces. The main source of lead exposure in children is from soil and dust contamination and deteriorated lead-based paints. Less common lead exposure sources include stained glass farming, lead-glazed ceramic pottery, older plumbing system, and imported children toys. Lead is absorbed into the body after the fumes or fine lead particles are inhaled or after the ingestion of soluble lead compounds. Ingested lead absorption is 5 times more in children as compared to adults. After absorption, lead combines with erythrocytes and then it is distributed to soft tissues and finally into bones. 70% of lead is excreted via urine and small amount via feces. A minute amount of lead is excreted through hair, nails, and sweat. Toxic effects of lead are due to its interference with the physiologic actions of iron, calcium, and zinc. High levels of lead in the body can cause abdominal pain, encephalopathy, anemia, seizures, and paralysis.

A study was conducted among 500 children in Oakland and it was found that 7.6% of children had increased blood lead levels. In this study, most of the communities were affected by “legacy lead” such as industrial waste and crumbling paint. In Flint, about 5% of children had high blood lead levels during the 2014 -2015 water crisis. It was also found that the highest child lead poisoning rates were in rural mining towns and industrial cities in the MidWest ("Child Lead Exposure in Oakland Neighborhood Worse Than Flint"). In United States, by using the available data CDC generates statistics to track progress toward childhood lead poisoning elimination. In collaboration with the Council of States and territorial Epidemiologists, the national surveillance system was developed for monitoring the blood lead levels. In 1995, a high level of lead in blood became the first noninfectious condition that was notified at the national level. By using this information individual case was monitored to identify the high risk areas to target preventive intervention.

Surveillance is carried out for collecting, managing and reporting data on blood lead levels. Another source of data for estimating the number of adults and children with elevated blood lead levels is the National Health and Nutrition Examination Survey (NHANES). These surveys provide estimates of the national prevalence of high blood lead levels among adults and children but it cannot provide any kind of information at the local and state level. Another limitation of these surveys is that it does not directly measure the blood lead level incidence. The data collected from these surveys cannot be used to follow short-term trends. The data collected by NHANES are used to monitor the nation's progress in meeting the objectives of healthy people 2020. The healthy people 2020 objectives for blood lead levels are: To reduce the blood lead level in children aged 1-5 years of age (in 97.5 percentile); To reduce the mean blood lead level in children age 1-5 years. Lead poisoning has a major effect on child behavior and development. Children after being exposed to even a small amount of lead may appear hyperactive, inattentive and irritable. Children are more vulnerable because their developing nervous system is more sensitive to lead effects. Those children who are exposed to a greater level of lead poisoning may have a problem with reading and learning, hearing loss and delayed growth. A high level of lead poisoning can lead to permanent brain damage and even death. Early childhood exposure to lead can lead to many problems in children. One of the most common effects is behavioral problems and cognitive impairment. Elevated blood lead level is also associated with lower IQ scores. Children with increased blood lead levels may also experience agitation, somnolence, loss of appetite and clumsiness. Epidemiological studies were conducted and results showed that children's IQ scores declined 2-3 points per 10mg/dl rise in blood lead level. CDC supports local and state health departments through cooperative agreements. The main purpose is to support the lead poisoning prevention activities in children. These activities include surveillance, blood lead testing and reporting, targeted population-based intervention and linking children to follow up services. Lead poisoning can be prevented at both primary and secondary level. In primary prevention lead hazards are removed from the environment before exposure. It is most effective way to prevent children from harmful long-term effect of exposure of lead. Secondary prevention includes blood testing of lead poisoning and follow up. The lead amount in blood is known blood lead level and it is measured in μg/dl. Lead prevention is costly. According to 2017 survey report an investment of $80 billion is needed to protect the children in United States from having detectable amount of lead in blood. In United States there are many different locations where significant proportion of children exposed to lead. In US high blood lead levels in the children varies by geographical location. This can be due to the variability of lead sources in the environment. Children under 6 years of age are at high risk of lead poisoning (Bellinger). In children no safe blood lead level has been identifies. Even low blood lead level is associated with academic achievement and IQ level.

**Bibliography**

"CDC - Lead - Home Page". *Cdc.Gov*, 2019, <https://www.cdc.gov/nceh/lead/default.htm>.

Bellinger, David C. "Very Low Lead Exposures and Children's Neurodevelopment." *Current opinion in pediatrics* 20.2 (2008): 172-77. Print.

"CDC - Lead - Home Page". *Cdc.Gov*, 2019, <https://www.cdc.gov/nceh/lead/default.htm>.