# NEVADA CHILDHOOD LEAD POISONING PREVENTION PROGRAM

## 2023 Blood Lead Testing and Response Plan

LEAD FREE NV NvCLPPP Nevada Childhood Lead Poisoning Prevention Program

Revised September 2023

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# List of Acronyms

| Acronym | Definition |
|---|---|
| ATSDR | Agency for Toxic Substances and Disease Registry |
| BLL | Blood lead level |
| BLRV | Blood lead reference value |
| CDC | Centers for Disease Control and Prevention |
| CLRQ | Childhood Lead Risk Questionnaire |
| CPSC | Consumer Product Safety Commission |
| EPA | Environmental Protection Agency |
| FDA | Food and Drug Administration |
| GFAAS | Graphite Furnace Atomic Absorption Spectrometry |
| HBBF | Healthy Babies Bright Futures |
| HUD | Department of Housing and Urban Development |
| ICP/MS | Inductively Coupled Plasma Mass Spectrometry |
| IQ | Intelligence Quotient |
| LBP | Lead-based paint |
| LERI | Lead Exposure Risk Index |
| NHANES | National Health and Nutrition Examination Survey |
| NNDSS | National Notifiable Diseases Surveillance System |
| NRS | Nevada Revised Statutes |
| NvCLPPP | Nevada Childhood Lead Poisoning Prevention Program |
| OSHA | Occupational Safety and Health Administration |
| POC | Point-of-care |
| ppb | Parts per billion |
| ppm | Parts per million |
| SNHD | Southern Nevada Health District |
| WHO | World Health Organization |
| WIC | Women, Infants, and Children |
| XRF | X-ray fluorescence |

# Mission and Vision Statement

## Vision

The vision of the **Nevada Childhood Lead Poisoning and Prevention Program (NvCLPPP)** is to promote a lead-safe home environment so that all Nevada children can achieve their full potential.

## Mission

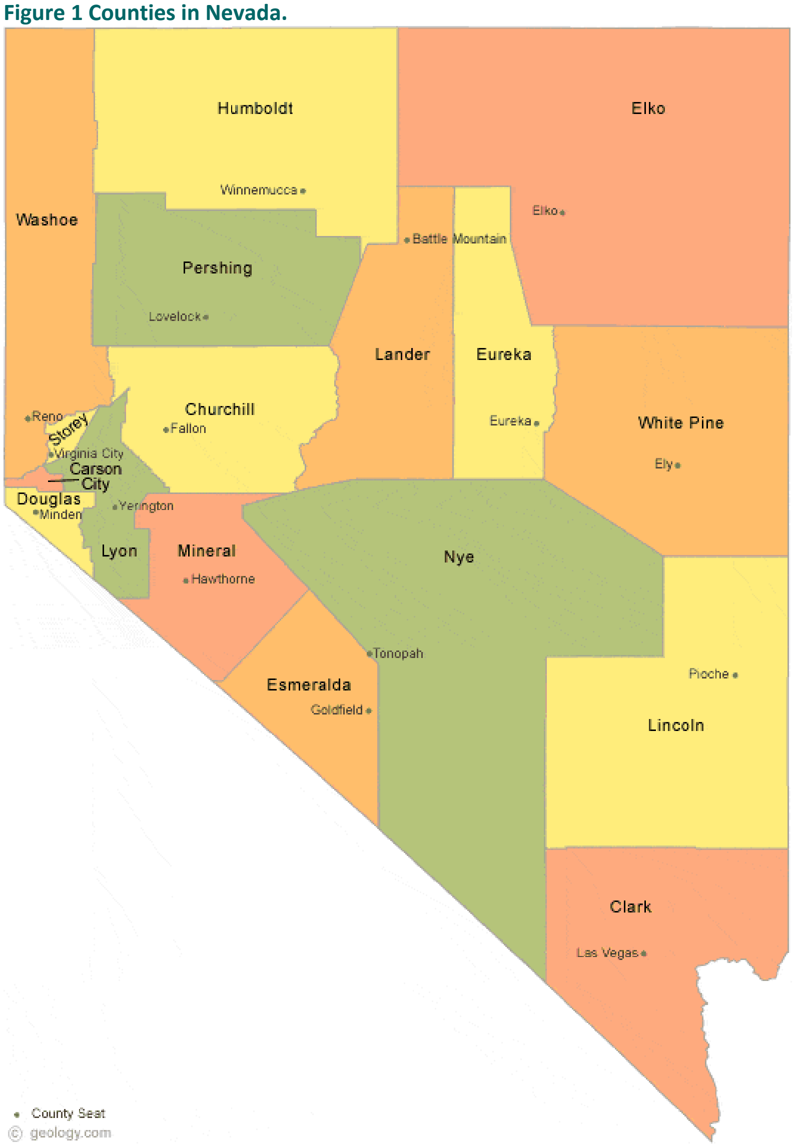
NvCLPPP aims to reduce the long-term health risks of childhood lead poisoning through prevention, education, and surveillance. b

# Nevada at a Glance

Nevada has over 3.1 million residents distributed across 17 counties (United States Census Bureau, 2021). Three counties house most of the population— with over 2.2 million living in Clark County, over 479,000 in Washoe County, and over 57,000 in Carson City (United States Census Bureau, 2021). The rest of the population lives in rural/frontier areas. Nevada is home to over 218,000 children under six years of age (United States Census Bureau, 2021).

Five health authorities serve the state. The **Southern Nevada Health District (SNHD)** is located in and serves Clark County. Northern Nevada Public Health is located in and serves Washoe County. The Carson City Health and Human Services is located in Carson City and serves Carson City and Douglas County. The Central Nevada Health District serves Mineral, Pershing, Churchill, and Eureka county. The Nevada Division of Public and Behavioral Health oversees the remaining rural counties.

**Figure 1 Counties in Nevada.**



# Preface

Childhood lead poisoning is one of the most preventable environmental health hazards in history. While childhood lead poisoning rates have decreased substantially since the 1970s, mounting evidence suggests that chronic, low-level exposure in early childhood can have long-lasting impacts on children. In Nevada, there are over 218,000 children under the age of 6 but only 3% are tested for lead – making Nevada one of the lowest testing states in the **United States (U.S.)**.

The **Nevada Childhood Lead Poisoning Prevention Program (NvCLPPP)** staff and Advisory Committee hope that stakeholders use this blood lead testing plan as guidance to prevent and address local issues. It is imperative that we ensure that children in our state have healthy environments in which they can live, learn, and play.

**QUICK FACTS**

**218,000+**
children under the age of 6 live in Nevada

**Only 3%**
are tested for lead

Nevada has one of the
**lowest**
screening rates in the United States

## A Call to Action

In 2021, the **Centers for Disease Control and Prevention (CDC)** lowered the **blood lead reference value (BLRV)** from 5 **micrograms per deciliter (µg/dL)** to 3.5 µg/dL. The updated BLRV is based on the 97.5$^{th}$ percentile of the blood lead distribution in U.S. children ages 1-5 years from the most recent **National Health and Nutrition Examination Survey (NHANES)** data. The BLRV is not a health-based threshold – there is no safe amount of lead in the blood. Instead, it is a population-based measurement that indicates that 2.5% of U.S children aged 1-5 years have **blood lead levels (BLLs)** at or above 3.5 µg/dL, representing about 470,000 children (Ruckart, et al., 2021; United States Census Bureau, 2022). The BLRV is intended to be used as a screening tool to identify children who have higher levels of lead in their blood compared with most children.

The risk of lead exposure is marked by racial, ethnic, and socioeconomic disparities (Centers for Disease Control and Prevention, 2022). A recent study supports that children from low-income groups have higher BLLs and more negative outcomes (e.g., smaller brain volume) associated with lead exposure compared to high-income groups (Marshall, et al., 2020). It is critical that young children are tested for lead as effects may only be noticed once children reach school age, disproportionately impacting low-income children who are already at higher risk for school-based challenges.

## Challenges in Blood Lead Testing in Nevada

Testing children for lead in the primary care setting has been a critical tool in identifying lead-poisoned children. Thus, states with low testing rates face a major problem. It is estimated that in Western states, including Nevada, three times as many children go untested than are diagnosed (Roberts, Mardrigal, Valle, King, & Kite, 2017). Nevada has the second lowest ratio of childhood lead poisoning ascertainment.

Two recent studies support these results. In one study evaluating BLL testing in Clark County, researchers found that only 5% of children had been previously tested (Haboush-Deloye, Marquez, & Gerstenberger, 2017). In another study, the NvCLPPP surveyed Clark County physicians who work with children under six about their BLL testing practices and barriers to parental compliance (Haboush-Deloye, Marquez, & Gerstenberger, 2017). The study identified two major barriers to lead testing among physicians in Nevada:

- A lack of adherence to recommendations for lead testing by local physicians
- Parents not following through doctor orders to be tested, presumably due to financial reasons or to the absence of major lead poisoning symptoms in the child

## An Opportunity for Nevada

Nevada has a rapidly diversifying population, and mostly rural geography. Nearly 25% (295,524) of homes in Nevada were built before the 1978 ban of **lead-based paint (LBP)** (Marquez, López, Osterholt, & Campos-Garcia, 2020). In the last decade, the Latino population grew by 37% and the Black population grew by 39% (Corbin Girnus, 2021). Nevada also has unique geography with two urban centers within 400 miles of each other while the majority of the state's land mass consists of rural and frontier areas, including prominent mining towns. Racial/ethnic minorities, those living in poverty or in older housing, and those living in rural communities may be at risk for lead exposure (Centers for Disease Control and Prevention, 2022; Carrel, et al., 2017).

At present, blood lead surveillance data is sparse – making it difficult to identify at-risk communities within urban and rural settings. Strengthening the NvCLPPP offers the opportunity to enhance epidemiologic data to identify at-risk communities, mitigate health disparities in blood lead poisoning that have been identified in the literature, and increase testing rates. By using surveillance data to better understand the population in Nevada, at-risk children who may otherwise go untested can be identified and linked to vital resources.

# Lead Poisoning

## Case Definitions

Lead in the blood is the best biomarker of lead exposure (National Notifiable Diseases Surveillance System, 2023). A blood lead test is the only acceptable laboratory method for confirming lead poisoning. Lead poisoning may be confirmed with a single venous sample or two capillary samples. **Table 1** summarizes the CDC laboratory criteria for **confirmatory** and **supportive** laboratory evidence for lead poisoning in children. It is important to note that these case definitions are used to uniformly classify and count cases, as reporting blood lead test results is mandated in all states (National Notifiable Diseases Surveillance System, 2023).

**Table 1 Lead poisoning case definitions.**[1]

| Specimen | BLRV | Criteria | Type of Evidence |
|---|---|---|---|
| Venous | 3.5 µg/dL | A single venous sample tested by GFAAS or ICP/MS that is at or above the reference value | Confirmatory |
| Capillary | 3.5 µg/dL | Two capillary samples at or above the reference value collected within 12 weeks of each other | Confirmatory and Supportive |
| Capillary | 3.5 µg/dL | A single capillary sample at or above the reference value in a child under 16 years of age | Supportive |

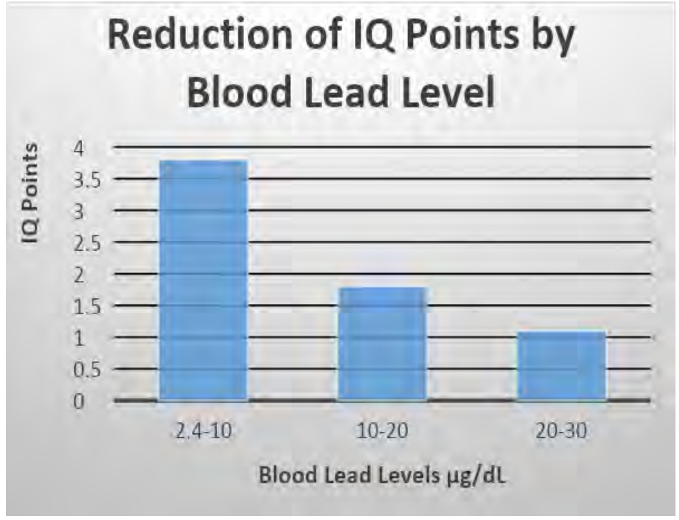
## Impacts of Lead Poisoning

Lead poisoning is associated with a range of general, nonspecific symptoms (Miracle, 2017; Ying, et al., 2018). In fetuses and newborns, lead exposure can cause major congenital abnormalities, low birth weight, and preterm birth or spontaneous abortion (American Academy of Pediatrics, 2016; Wong, et al., 2015). In children, transient digestive and neurologic symptoms such as constipation and fatigue are commonly reported (Miracle, 2017; Ying, et al., 2018). However, lead exposure can also cause permanent learning disabilities and attention deficits (American Academy of Pediatrics, 2016; Lanphear, 2007). The type and severity of health effects highly depend on the duration and intensity of exposure.

[1] Source: *CDC National Notifiable Diseases Surveillance System (NNDSS)*

**Acute (short-term, high level) lead exposure** leads to a quick increase in BLLs. Common symptoms of acute lead poisoning for BLLs less than 50 µg/dL include abdominal pain, constipation, diarrhea, and muscle pain or weakness (Oregon Health Authority, 2018). Very high lead levels (>70 µg/dL) can result in more severe symptoms including protracted vomiting, encephalopathy, coma, and death (American Academy of Pediatrics, 2016; World Health Organization, 2010).

**Figure 2. Estimated IQ loss in US children ages 5-10 years of age at different blood lead levels.**




*Source: Lanphear et al., 2019*

**Chronic (long-term, low level) lead exposure** does not usually cause overt symptoms but can cause permanent developmental, intellectual, and neurobehavioral disorders (American Academy of Pediatrics, 2016). BLLs once thought to pose little to no risk have shown to be risk factors for reading problems, intellectual delays, school failure, attention deficit-hyperactivity disorder, and antisocial behavior (American Academy of Pediatrics, 2016; Lanphear, 2007). Recent research shows that greater aggregate BLLs at the population level are associated with increased occurrences of violent and non-violent crimes (Boutwell, et al., 2016).

Notably, chronic lead exposure causes a significant reduction in IQ points. Children with BLLs ≥5 will, on average, experience a larger IQ deficit over their lifetime. Each increase of 10 µg/dL in the lifetime average blood lead concentrations is associated with a 4.6 decrease in IQ (Canfield, et al., 2003). However, the majority of IQ points lost due to lead exposure occurs in children with low BLLs. **Figure 2** demonstrates that steepest loss of IQ points was at BLLs under 10 µg/dL (Lanphear, et al., 2019). This relationship may seem counterintuitive, but evidence suggests that cellular defense mechanisms may not be fully operational until a high concentration of heavy metals is achieved in the body (Bae, Gennings, Carter, Yang, & Campain, 2001; Canfield, et al., 2003).

Chronic lead exposure can also lead to elevated blood pressure and increased rates of hypertensive events like heart disease, strokes, and cardiovascular episodes (World Health Organization, 2010). Low-level lead exposure has been linked to greater mortality from cardiovascular disease and ischemic heart disease (Lanphear, Rauch, Auinger, Allen, & Hornung, 2018).

# Risk Factors

No child is immune to lead poisoning, however, individual factors put certain groups at increased risk for lead exposure. Disparities by race, ethnicity, and socioeconomic status persist despite the overall decline in BLLs (Sampson & Winter, 2016).

Young children living in poverty and in old or deteriorated housing, who are of a minority racial or ethnic group or of refugee status, are at highest risk (Centers for Disease Control and Prevention, 2013b).

## Age

Children aged six months to three years of age are more susceptible to increased BLLs because of their physiology and behaviors (Lanphear, et al., 2002; Tarragó & Brown, 2017). Compared to adults, children are able to absorb 4 to 5 times more lead due to the efficiency of their stomachs and because they eat more food and breath in more air per kilogram of weight (Tarragó & Brown, 2017; World Health Organization, 2019). Once lead has been absorbed by their body, a child's liver is also less efficient at removing lead. Children under age three are at higher risk of exposure due to their proximity to the ground, and their inclination for placing things in their mouth, exposing them to dust and soil that may be contaminated with lead.

Younger children are especially susceptible to the negative effects of lead exposure because of their ongoing neurological development (Lanphear, et al., 2002). Once lead enters the body, it enters the blood stream and has the opportunity to cross the blood-brain barrier and reach the brain (Sanders, Liu, Buchner, & Tchounwou, 2009). Within the brain, lead-induces damage in the prefrontal cerebral cortex, hippocampus, and cerebellum which can lead to a variety of neurological disorders and behavioral problems. Among children with lead exposure, lead levels are known to peak around age two (Lanphear, et al., 2019).

In Nevada, there are over 218,000 children under 6 years old. Of these children, a large portion are under 3 years of age (**Table 2**).

**Table 2 Percentage of population of children under 6 in Nevada by age and jurisdiction.**[1]

| | Clark | Washoe | Carson City | Rural |
|---|---|---|---|---|
| **<3 years** | 48.21% | 47.29% | 53.19% | 47.20% |
| **3 and 4 years** | 34.88% | 35.38% | 28.79% | 33.69% |
| **5 years** | 16.90% | 17.34% | 18.02% | 19.11% |

## Race and Ethnicity

Among children ages one through five, BLLs are highest among racial and ethnic minorities. Non-Latino Black children have higher average BLLs compared to non-Latino White children (Centers

[1]*Source: U.S. Census Bureau. (2021) 2017-2021 American Community Survey 5-Year Estimates Retrieved from https://data.census.gov/*

for Disease Control and Prevention, 2013b). For non-Latino Black people, BLLs are inexorably linked to the legacy of racial residential segregation and discriminatory lending practices (i.e., redlining) that contributed to the devaluation of Black-owned properties and subsequent financial strain (Sampson & Winter, 2016). Children living in households receiving housing assistance are at high risk of lead poisoning, with black children disproportionately represented among those affected. African American households have significantly more LBP hazards than White households (Department of Housing and Urban Development, 2011).

Compared to the general population, a higher percentage of Latino children have elevated BLLs (Brown & Longoria, 2010). Exposure to lead among Latinos is multi-dimensional and incorporates environmental, cultural, and social dimensions (Brown & Longoria, 2010). Within the social dimensions, ethnic subpopulation, generation status (i.e., first- versus third-generation), nativity (i.e., US-born versus foreign-born), and length of time in the US are associated with BLLs. With regard to ethnic subpopulation, 2.7% of Puerto Ricans, 1.6% Mexican-Americans, and 0.9% of Cubans have been found to have BLLs over >25 µg/dL (Carter-Pokras, Pirkle, Chavez, & Gunte, 1990). First-generation Mexican-American children have higher BLLs compared to third-generation Mexican-American children (Morales, Gutierrez, & Escarce, 2005). Similarly, Mexican-born children had higher BLLs compared to US-born Latino children (Snyder, Mohl-Boetani, Palla, & Fenstersheib, 1995). Lastly, greater time spent in the US is associated with lower BLLs (Rothenberg, et al., 1999).

Nevada is home to approximately 3,143,991 people (United States Census Bureau, 2021). With a growing diverse population, some counties in the state are approaching majority-minority status (**Table 3**). In 2010, about 34% of the state's population identified as non-White, in 2020 that percentage rose to 49% (Corbin Girnus, 2021). In particular, Nevada houses a large growing Latino population with approximately 897,000 Latinos comprising 29% of the state's population (United States Census Bureau, 2021). Nevada also has a steadily growing Black population, with an estimated 273,070 Black or African American residents that comprise about 8.9% of the state's population (United States Census Bureau, 2021).

**Table 3 Percentage of total population by race/ethnicity by jurisdiction.**[1]

| | Clark | Washoe | Carson City | Rural |
|---|---|---|---|---|
| Hispanic or Latino (of any race) | 31.80% | 25.30% | 24.90% | 18.28% |
| White | 40.60% | 61.10% | 64.90% | 71.33% |
| Black/African American | 11.50% | 2.30% | 1.90% | 1.55% |
| American Indian and Alaska Native | 0.40% | 1.00% | 1.70% | 2.80% |
| Asian | 9.80% | 5.30% | 2.50% | 1.47% |
| Native Hawaiian and Pacific Islander | 0.70% | 0.70% | 0.10% | 0.17% |
| Other | 0.50% | 0.40% | 0.20% | 0.34% |
| Two or more races | 4.80% | 4.00% | 3.80% | 4.05% |

[1] *Source: U.S. Census Bureau. (2021) 2017-2021 American Community Survey 5-Year Estimates Retrieved from https://data.census.gov/*

## Poverty

Childhood lead exposure is also associated with socioeconomic status: BLLs are higher in low-income populations (Marshall, et al., 2020). Historically, children from low-income families that are served by public assistance programs, such as Medicaid and the Special Supplemental Nutrition Program for **Women, Infants, and Children (WIC)**, have been considered to be at greater risk for lead exposure compared to those not enrolled in these programs (Aoki & Brody, 2018; Wengrovitz & Brown, 2009). Economically disadvantaged families that are eligible for public assistance are more likely to live in older, poorly maintained housing that may contain lead hazards (Aoki & Brody, 2018; Marshall, et al., 2020).

In Nevada, there are an estimated 728,429 families, 9.10% of which live below the poverty level (United States Census Bureau, 2021) (**Table 4**).

**Table 4 Percentage of families living in poverty by family income and jurisdiction.**[1]

| | Clark | Washoe | Carson City | Rural |
|---|---|---|---|---|
| Family income below 50% of poverty level | 4.41% | 2.25% | 1.72% | 2.93% |
| Family income below 125% of poverty level | 13.77% | 9.57% | 10.41% | 10.75% |
| Family income below 150% of poverty level | 18.13% | 12.69% | 14.49% | 14.01% |
| Family income below 185% of poverty level | 23.84% | 17.88% | 20.96% | 19.44% |
| Family income below 200% of poverty level | 26.63% | 19.89% | 22.69% | 21.61% |

[1] *Source: U.S. Census Bureau. (2021) 2017-2021 American Community Survey 5-Year Estimates Retrieved from https://data.census.gov/*

## Age of Housing

Age of housing is one of the biggest risk indicators for lead exposure. Homes built before the ban of LBP in 1978 are likely to contain lead, and the older the home the more likely. Approximately 87% of homes built before 1940, 69% of homes built between 1940-1959, and 24% of homes built between 1960-1977 contain LBP (United States Environmental Protection Agency, 2023b).

While most homes in Nevada were built after 1980 (**Table 5**), there are still a significant number of homes across the state that have the potential to expose children to deteriorating LBP. Approximately 25% Nevada homes were built prior to the ban of LBP, and it is estimated that about 49,100 of them contain potential lead risks (Marquez, López, Osterholt, & Campos-Garcia, 2020).

**Table 5 Percentage of housing by year built and by jurisdiction.[1]**

| | Clark | Washoe | Carson City | Rural |
|---|---|---|---|---|
| Built since 1980 | 81.2% | 63.2% | 50.5% | 69.9% |
| Built 1970 – 1979 | 10.6% | 18.9% | 33.3% | 15.1% |
| Built 1960 – 1969 | 4.9% | 8.6% | 10.1% | 5.5% |
| Built 1950 – 1959 | 2.1% | 4.7% | 4.1% | 3.2% |
| Built 1940 – 1949 | 0.7% | 2.3% | 0.7% | 2.0% |
| Built before 1940 | 0.4% | 2.2% | 1.3% | 4.3% |

## Refugee and Immigrant Populations

Refugee and foreign-born children are disproportionately impacted by lead poisoning compared to U.S.-born children. Overall, foreign-born children tested for lead poisoning are five times more likely to have an elevated BLL than children born in the U.S. (Tehranifar, et al., 2008). Additionally, newly arrived refugee children ages 1-5 years are 10 times more likely to have elevated BLLs than those in the general U.S. population (American Academy of Pediatrics, 2019). Some subgroups of refugees have seen elevated rates up to fourteen times that of the general U.S. population (Tanaka, et al., 2018). Potential lead exposure risks for refugee children include pre-settlement exposure to leaded gasoline, paint, batteries, industrial emissions, food, ceramics, and traditional medicines/cosmetics (Shakya & Bhatta, 2019).

In addition to pre-settlement exposure, refugee children are at risk of lead poisoning post-resettlement. Many children who were already exposed to lead in their native countries may continue to be exposed to lead in the U.S. due to contamination in their new surroundings, living in older urban housing, use of imported goods, and environmental inequalities stemming from a lack of funding, legislation, and advocacy (Lupone, et al., 2020). Lead exposure in refugee

*[1] Source: U.S. Census Bureau. (2021) 2017-2021 American Community Survey 5-Year Estimates Retrieved from https://data.census.gov/*

populations can be further compounded by malnourishment, as deficiencies of nutrients like calcium and iron allow for greater uptake of lead into the body (Mahaffey, 1995).

Nevada has a growing foreign-born (**Table 6**) and refugee population (**Table 7**). Nearly one fifth of the state's residents were born in a foreign country. Most of Nevada's foreign-born population originate from Mexico, the Philippines, El Salvador, Cuba, and China (American Immigration Council, 2020). Between 2011 and 2017, Nevada received over 12,800 refugees. Most of the refugees in Nevada are from Democratic Republic of the Congo, Eritrea, Iran, Somalia, and Syria (Refugee Council USA, 2019).

**Table 6 Percentage of foreign-born population from total population and percentage of non-U.S. foreign-born population by jurisdiction.**[1]

| | Clark | Washoe | Carson City | Rural |
|---|---|---|---|---|
| Foreign-born population **Total % of Population** | 22.0% | 14.1% | 12.8% | 6.6% |
| Not U.S. Citizens **Total % of Foreign-Born Population** | 47.6% | 50.6% | 52.9% | 55.3% |

**Table 7 Number of refugees resettled in Nevada by year and jurisdiction**[2]

| | Clark | Washoe | Carson City | Rural |
|---|---|---|---|---|
| 2011 - 2015 | 8380 | 0 | 0 | 0 |
| 2016 | 3128 | 40 | 0 | 0 |
| 2017 | 1295 | 32 | 0 | 0 |

## Children with Developmental Disabilities

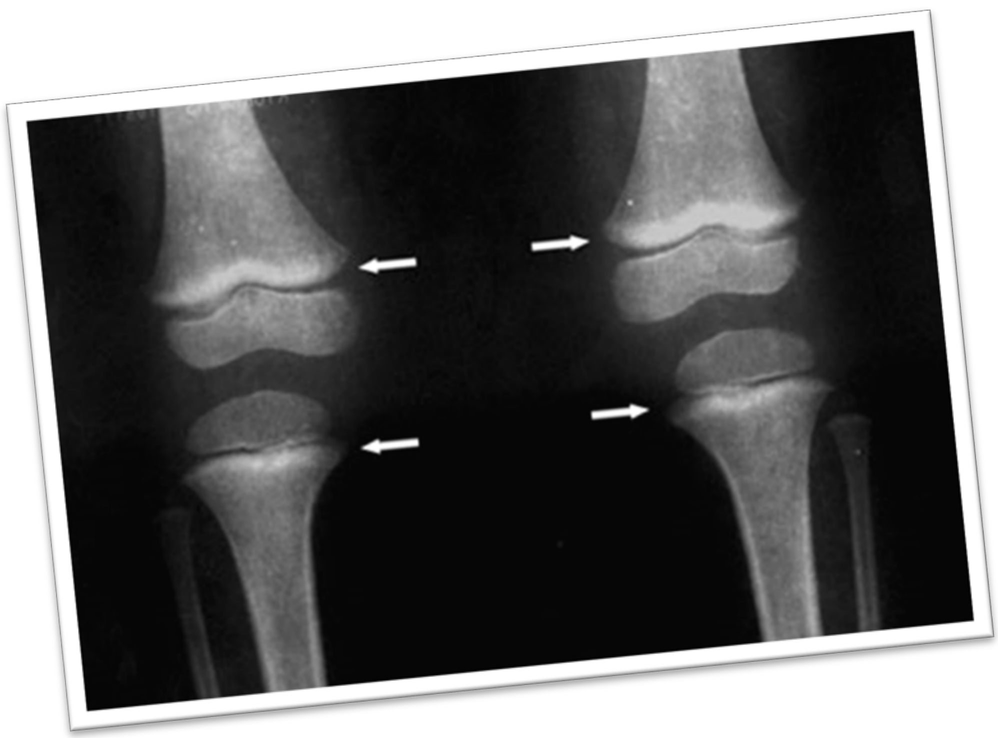
Past research has demonstrated that there is an association between elevated BLLs and developmental disabilities (Delgado, et al., 2018). However, it is unclear which occurs first. Children with developmental disabilities and those with a mental age of a child under six may exhibit behaviors that put them at higher risk for lead exposure: spending time on the floor, increased hand-to-mouth behaviors, and pica. Pica occurs at a higher rate in persons with developmental and/or intellectual disabilities including those with autism spectrum disorder, increasing their risk of ingesting lead-contaminated non-food items such as soil and paint chips (Centers for Disease Control and Prevention, 2019c; Hauptman, Stierman, & Woolf, 2019; Matson, Belva, Hattier, & Matson, 2011).

In Nevada, it is estimated that as many as 8,500 school age children have been diagnosed with autism spectrum disorder, with most living in the Las Vegas Valley area (Real Autism Difference, n.d.).

[1] Source: U.S. Census Bureau. (2021) 2017-2021 American Community Survey 5-Year Estimates Retrieved from https://data.census.gov/
[2] Source: Southern Nevada Catholic Charities

## Pregnant and Lactating Persons

If a pregnant person has been exposed to lead in the past, the lead stored in their bones can be released back into the blood during pregnancy (Meyer, Brown, & Falk, 2008). This can cause increased BLLs, which can negatively affect the pregnant person and their developing baby. The effects of lead in pregnant persons include an increased risk for miscarriage, gestational hypertension, and preeclampsia (Hertz-Picciotto, 2000; Poropat, Laidlaw, Lanphear, Ball, & Mielke, 2018). Since lead can cross the placenta, the effects of lead for the fetus include an increased risk for pre-term birth, low birth weight, congenital disorders, and damage to the brain, kidneys, and nervous system (Bellinger, 2005; Hu, et al., 2006; Mason, Harp, & Han, 2014; Sanders, et al., 2018).



# Lead Exposure

## Pathways of Exposure and Absorption

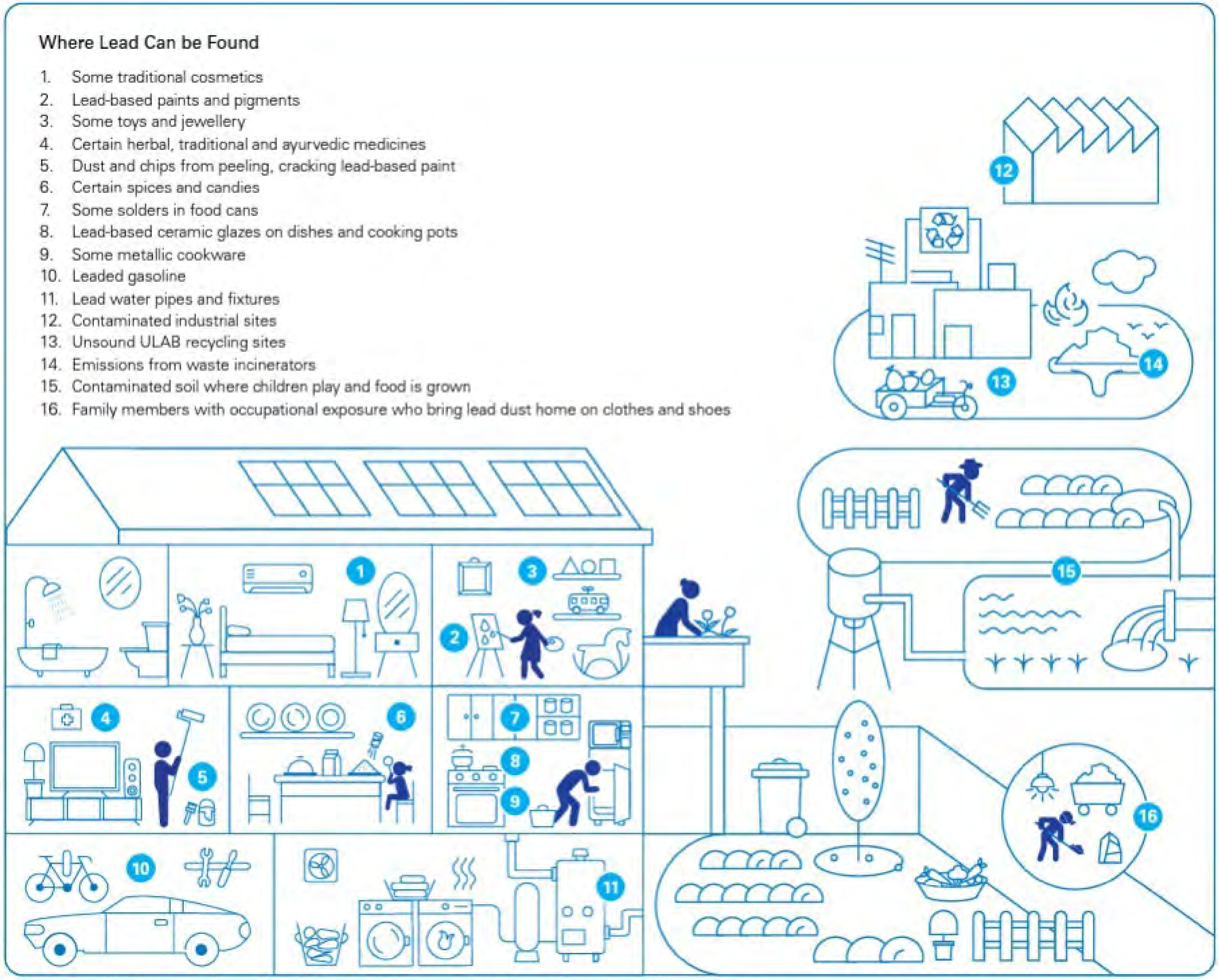
Lead absorption primarily occurs via inhalation and ingestion, but can also occur via dermal absorption, and endogenous routes such as trans-placental exposure (Agency for Toxic Substances and Disease Registry, 2023). Once lead enters the body, the rate of absorption is affected by various factors: age, nutritional status, health, and particulate size of the lead source. Children are more susceptible to the effects of lead than adults and it is estimated that their bodies can absorb 50% of ingested lead on a full stomach, and up to 100% on an empty stomach. Proper nutrition with meals high in iron and calcium and low in fats may slow the rate of lead absorption (Oregon Health Authority, 2018; Tennessee Department of Health, n.d.). Lastly, smaller lead particulate size (inhaled lead dust versus ingested lead paint chips) are more readily absorbed by the body.

In the body, blood serves as the first receptacle of absorbed lead and distributes it among the bones and soft tissues. Most of the lead in the body tends to accumulate in bone regions undergoing calcification. The body can accumulate lead over time and usually releases it very slowly. During certain events, such as pregnancy, lactation, broken bones, and illness, the stored lead may leave the bones and reenter the bloodstream, which can cause high BLLs long after exposure has ended (Agency for Toxic Substances and Disease Registry, 2023).

## Sources of Lead Exposure

Federal, state, and local regulations have played a significant role in reducing childhood lead poisoning by regulating the use of lead in specific products (Kemper, Cohn, Fant, Dombkowski, & Hudson, 2005) (**Appendix A** and **Appendix B**). Nevertheless, the potential for childhood lead exposure remains. Common sources of lead, also known as **traditional sources**, include LBP, dust, and soil. Less common sources, also known as **non-traditional sources**, include consumer goods such as folk remedies, cosmetics, toys, and jewelry (**Figure 3**).

**Figure 2 Sources of lead exposure.**[1]




**Note:** The above infographic is an illustrative example only of likely sources of lead exposure. It is not meant to be fully comprehensive of all possible exposure pathways.

[1] Source: Pure Earth, 2020

## Traditional Sources of Lead Exposure

### Paint

Figure 3 Peeling lead paint.

**Lead-based paint (LBP)** is the major source of lead exposure in U.S. children (American Academy of Pediatrics, 2023). The **Department of Housing and Urban Development (HUD)** estimates that as of 2021, 34.6 million U.S. homes contain LBP. Lead was commonly used in paint to increase its durability, but was banned for residential use in 1978 (Centers for Disease Control and Prevention, 2022a).

Lead hazards in older homes result from peeling, disintegrating, and chipping of LBP (**Figure 4**). Additionally, interior home renovations and lead abatement can increase the risk of childhood lead exposure due to dust and soil contamination and improper clean-up (Spanier, Wilson, Ho, Hornung, & Lanphear, 2013). Renovation of houses where lead has been identified is significantly associated with increased BLLs of children living in the home (Spanier, Wilson, Ho, Hornung, & Lanphear, 2013). In addition to residential LBP, LBP may also be found on old or imported products.

### Dust

The HUD estimates that 21.9 million homes in the U.S. have lead dust hazards. Most lead dust in homes comes from LBP (New York State, 2010). As LBP deteriorates or is improperly removed, it can contaminate house dust and may enter a child's body through hand-to-mouth activity or inhalation (Centers for Disease Control and Prevention, 2022b). Other sources of lead dust can come from tracking in lead dust from outside the home, such as from lead-contaminated soil and take-home lead from hobbies or industrial sources (Oregon Health Authority, 2018).

### Soil

Lead-contaminated soil persists as a source of lead exposure with estimates of 2.4 million U.S. homes having lead-related soil hazards (HUD User, 2022). Soil can contain lead from deteriorated paint, deposits from leaded gasoline, and industrial emissions (New York State, 2010; Oregon Health Authority, 2018). Homes near busy roads or industrial factories are more likely to have lead-contaminated soil. Children can be exposed by swallowing or breathing in lead-contaminated soil while playing or by eating fruits and vegetables that were grown in contaminated (United States Environmental Protection Agency, 2020).

## Non-Traditional Sources of Lead Exposure

### Why is lead in traditional medicines, foods, spices, and other cultural items?

There are a variety of reasons why lead may be found in traditional medicines, foods, spices, and other cultural items. For instance, lead in the environment may pollute water and soil, contaminating herbs, fruits, vegetables, and crops growing in the area (Angelon-Gaetz, Klaus, Chaudhry, & Bean, 2018). Some foods, like leafy greens and root crops, are particularly good at drawing and storing heavy metals (Houlihan & Brody, 2019). In addition to plants naturally absorbing lead, some food products may inadvertently be contaminated during the manufacturing or packaging process (Food and Drug Administration, 2016). For instance, a grinding wheel used to grind spices may contain lead parts, which may contaminate spices with lead. Lead can also leach into food through containers and packaging (Diaz-Ruiz, et al., 2017; Lynch, Boatright, & Moss, 2000; Meyer, Brown, & Falk, 2008).

In other instances, lead may be deliberately added to products. In the case of Ayurvedic medicines and kohl/surma, lead is added for its perceived unique medicinal properties (Tiffany-Castiglioni, Barhoumi, & Mouneimne, 2012). Lead may be intentionally added to turmeric and other spices to increase the weight for sale and to make colors more vibrant (Cowell, Ireland, Vorhees, & Heiger-Bernays, 2017). It is also regularly used in paints and plastics to create vibrant colors, stabilize them from heat, and soften plastics, allowing for flexibility while retaining its original shape (Centers for Disease Control and Prevention, 2019a).

## Traditional Medicines and Cosmetics

Lead has been found in some traditional cosmetics and medicines used by Middle Eastern, Asian, and Latin cultures. Kajal, kohl, surma, and tiro are commonly used in Asian and Arab cultures, and may contain more than 50% lead (Centers for Disease Control and Prevention, 2012; Centers for Disease Control and Prevention, 2013a; Parry & Eaton, 1991). Some ayurvedic medicines from India and other South Asian countries, such as *rasa shastra* medicines, may contain up 200,000 µg/g of lead (California Department of Public Health, 2019). Litargirio, used among Dominicans and other Latinos as a deodorant and folk remedy, can contain up to 36% lead content (Centers for Disease Control and Prevention, 2005). Other common Latin American folk remedies such as *greta* and *azarcon* from Mexico may contain up to 97% and 95% lead, respectively (Centers for Disease Control and Prevention Work Group on Lead and Pregnancy, 2010). In some cases, greta is mixed with milk, sugar, and cooking oil to be incorporated into a child's milk or in tortilla mix (Gorospe & Gerstenberger, 2008).

## Imported Food and Spices

The average lead content in imported foods and spices is often higher than those purchased in the U.S. (Hore, Alex-Oni, Sedlar, & Nagin, 2019). For example, a recent New York study collected samples of products suspected to contain lead and found that 70% of the spice samples from the country of Georgia exceeded the allowable lead limit of 2 **parts per million (ppm)** (Hore, Alex-Oni, Sedlar, & Nagin, 2019). Lead has also been found in tamarind candies, candy wrappers, chili powders, and chapulines (dried grasshoppers) imported from Mexico (Centers for Disease Control and Prevention, 2002; Oregon Health Authority, 2018). Other countries found to commonly sell food products that exceed the allowable lead limit include Bangladesh, Morocco, Nepal, and Pakistan (Hore, Alex-Oni, Sedlar, & Nagin, 2019).

## Case Notes: Lead in Las Vegas

In March of 2019, a blood lead test revealed that a Las Vegas child had a **BLL of 48 µg/dL** due to the consumption of lead tainted turmeric.

The turmeric was brought from Afghanistan by the child's parents and was being given to the child for its medicinal properties. Further investigation revealed that multiple of the child's family members also had lead poisoning.

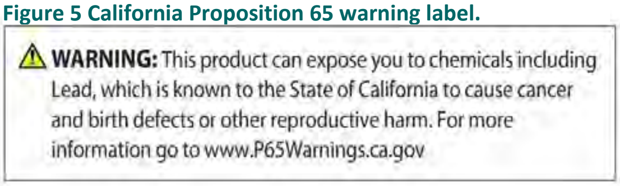
The environmental investigator who tested the turmeric by **X-ray fluorescence (XRF)** found that it contained 15,000 PPM of lead (Marquez, Kappel, López, & Haboush-Deloye, 2022).

**Turmeric** is a popular spice that may be contaminated with lead. Often, imported foods and spices do not disclose the risk of lead exposure on the label, making it hard for consumers to be aware of the lead in their products.
**Figure 5** shows a label on the bottle of ground turmeric that warns of potential lead exposure.

**Figure 4 A bottle of turmeric with a lead exposure warning label.**


California's Proposition 65 requires consumer products, foods, and beverages that contain excessive lead content to be properly labeled with the P65 warning label (**Figure 6**) (Cox & Hirsch, 2019). Additionally, in 2007 California limited the allowable amount of lead in candies to 0.1 ppm. Similar recent legislation in Mexico has established a program to monitor the level of lead in food, water, and consumer products (Tamayo-Ortiz, et al., 2020).

**Figure 5 California Proposition 65 warning label.**


⚠ **WARNING:** This product can expose you to chemicals including Lead, which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov

Although the reduction of lead in candies in California and Mexico is promising news, Nevada has no such labeling mandate for products that contain lead. As such, this is fertile ground for future policy change.

## Baby Food and Formula

Baby foods containing grain and root vegetable ingredients such as rice, quinoa, and sweet potatoes have been found to contain traces of lead (Gardener, Bowen, & Callan, 2019; Parker, Gillie, Miller, Badger, & Kreider, 2022). Food pouches and jarred baby foods are more likely to exceed lead limits and some baby formulas have been found to have quantifiable amounts of lead (Gardener, Bowen, & Callan, 2019). Although the concentrations of lead found in baby foods and formulas may be considered low, continuous efforts are being made to further reduce lead levels in baby foods.

In January of 2023 the **Food and Drug Administration (FDA)** released draft guidance for lead levels in baby foods as part of their *Closer to Zero* action plan. The draft guidance suggests the following lead action levels: 10 **parts per billion (ppb)** for fruits, vegetables, mixtures, yogurts, custards/puddings, and single ingredient meats, 20 ppb for root vegetables, and 20 ppb for dry cereals (Food & Drug Administration, 2023).

While these guidelines provide recommendations for industry, they are not legally enforceable.

## Ceramic Dishware

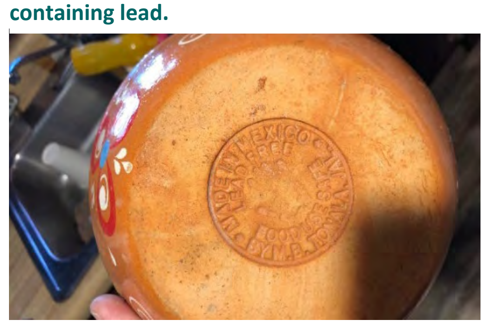
Ceramic dishware and cookware may contain lead in the glaze, paint, or clay. Lead in ceramic dishware poses a hazard because of lead leaching. Lead leaching into foods and beverages is most likely to occur with highly acidic products, long-term storage, and cracked, chipped, or deteriorating dishware. Additionally, putting dishware in the microwave or dishwasher speeds up deterioration, which can lead to greater lead leaching (Centers for Disease Control and Prevention, 2004b) .

**Figure 6 Traditional bean pot with over 9000 ppm of lead outside and 520000 ppm inside.**


The FDA regulates the sale of dishware and cookware that contains lead. Although products that exceed FDA regulations cannot be legally sold in the U.S., imported, old, handmade, poorly made, or improperly labeled dishware may contain lead and continue to be used in the U.S. (**Figure 7**).

Additionally, dishware labeled as “lead free” may not truly be lead free. **Figure 8** shows a bowl labeled as “lead free”. Through XRF testing, this bowl was revealed to contain 695 PPM of lead. Per the FDA, as long as the dishware does not leach excessive lead, the use of “lead free” labeling is permissible.

**Figure 7 Bowl labeled as "lead free" despite containing lead.**



## Toys

Lead can also be found in the paint, metal, and plastic parts of toys and toy jewelry, particularly those made cheaply or in other countries, as well as in antique toys and collectibles (Centers for Disease Control and Prevention, 2019a; Shen, et al., 2018). Notably, toys made with PVC plastic and/or yellow colorant are more likely to contain excessive concentrations of lead (Greenway & Gerstenberger, 2010).

**Figure 8 Children's bead maze toy containing lead.**

Young children are at risk for ingesting lead from toys due to normal hand-to-mouth activity (Schnur & John, 2014). Additionally, toys with lead paint can taste sweet, which might further encourage children to mouth them (World Health Organization, 2019).

Toys containing lead that exceeds the 2008 **Consumer Product Safety Commission (CPSC)** Lead Limit of 90 ppm are not uncommon. In 2010, an analysis of toys from day care centers in Las Vegas revealed that about 5% of the sampled toys contained lead in excess of 600 ppm (Greenway & Gerstenberger, 2010). The number of toys with excessive lead content would have been higher had the analysis compared toys against the current 2008 CPSC standard of 90 ppm. The NvCLPPP recently XRF tested a child's bead maze toy that was found to contain 2,893 ppm of lead with 528 ppm in the green wire alone (**Figure 9**).

## Occupations and Hobbies

It is estimated that more than 1.64 million workers in the U.S. are exposed to up to 50 $\mu g/m^3$ lead on a daily basis in the workplace (Occupational Safety and Health Administration, 2012). Workers in specific occupations such as demolition, smelting, mining, radiator repair, and gun range work have been found to have higher BLLs (Occupational Safety and Health Administration, n.d.). Children of lead-exposed workers have disproportionately higher BLLs when compared to children of non-lead exposed workers (Porter, et al., 2015). This is largely attributed to "**take home lead dust**" which can be brought into the home and vehicle via the worker's clothes, shoes, skin, and hair (Occupational Safety and Health Administration, 2014). One nationwide study estimated that 48,000 families have children under age 6 living with household members who are occupationally exposed to lead (Roscoe, Gittleman, Deddens, Petersen, & Halperin, 1999).

Many adult hobbies involve the use of lead or lead-contaminated products. Home remodeling and painting, hunting and fishing, casting and soldering, auto repair, gardening, and ceramic glazing are common hobbies that can be sources of take-home lead (Oregon Health Authority, 2018). Lead dust can be tracked into home and on to surfaces that a child may touch. Hobbies that involve heating or melting lead are particularly dangerous due to the formation of lead vapor which can be inhaled (Oregon Health Authority, 2018). To reduce the incidence of take-home lead exposure, it is important to shower and change into clean clothes and shoes before entering the home or vehicle after work or engaging in hobbies.

# Blood Lead Surveillance in Nevada

## Blood Lead Surveillance

The Nevada Department of Health and Human Services and all local health districts receive blood lead testing data from healthcare providers and laboratories via **EpiTrax**, the state electronic disease surveillance system. This surveillance system serves a key method to identify children with BLLs at or above the BLRV.

## Blood Lead Reporting

In Nevada, childhood blood lead screening laws are defined by the **Nevada Revised Statutes (NRS)** 442.700. In summary, NRS 442.700 states the following:

1. Each provider of health care or other services who:
    a. Is qualified to conduct a blood lead test is encouraged to perform, or cause to be performed, a test when a child reaches 12 and 24 months, or at least once before the child reaches 6 years of age
    b. Provides early and periodic screening, diagnostic and treatment services to children is encouraged to conduct a blood lead test in accordance with the guidelines of the Centers for Medicare and Medicaid Services
2. Any blood lead test performed using a capillary sample that results in a blood lead level greater than the reference value should be confirmed by a follow-up venous blood lead test.
3. All blood lead tests, regardless of results, should be reported to the appropriate health authority. The report must include:
    a. The name, sex, race, ethnicity and date of birth of the child
    b. The address of the child, including the county and zip code in which the child resides
    c. The date on which the sample was collected
    d. The type of sample that was collected
    e. The name and contact information of the health care provider who ordered the test

BLLs responses are conducted by corresponding health authorities including the SNHD, Northern Nevada Public Health, Carson City Health and Human Services, Central Nevada Health District, and the Nevada Department of Health and Human Services. Responses within each jurisdiction vary widely based on capacity

## Blood Lead Testing Rates

There are over 218,000 children under the age of 6 in Nevada. Between October 2021 and September 2022, only 3% (6,834 children) received a blood lead test. Nevada currently has one of the lowest blood lead testing rates in the country.

**Table 8 Number of children tested for lead poisoning by age and blood lead level (BLL) in µg/dL from October 2021 to September 2022.**[1]

| | Value not reported or cutoff <10.0*[2] | <3.5 | 3.5-9.9 | ≥10 | Total |
|---|---|---|---|---|---|
| Under 12 months | 0 | 324 | 2 | 3 | **329** |
| 12-23 months | 5 | 3181 | 28 | 4 | **3218** |
| 24-35 months | 2 | 1108 | 15 | 2 | **1127** |
| 36-47 months | 2 | 926 | 8 | 1 | **937** |
| 48-59 months | 4 | 831 | 6 | 0 | **841** |
| 60-71 months | 3 | 378 | 1 | 0 | **382** |
| **Total** | **16** | **6748** | **60** | **10** | **6834** |

# NvCLPPP Testing Recommendations

## Recommendations for Children

### Testing Schedule

Due to low testing rates, it is difficult to ascertain the extent of lead poisoning in Nevada. Therefore, the NvCLPPP recommends universal testing as a method to adequately assess the epidemiological data. At a minimum, providers are recommended to:

- Test all Medicaid-eligible children at 12 and 24 months of age, or at least once before the child reaches 6 years of age
- Test all refugee children ages 6 months to 16 years within 90 days of arrival
- Test children who are symptomatic, regardless of the child's age
- Test children if a potential lead risk exposure is identified, regardless of the child's age
- Test children with developmental disabilities, regardless of the child's age[3]
- Test children under the age of 6 with at least one answer of "**Yes**" or "**Don't Know**" when screened with the **Childhood Lead Risk Exposure Questionnaire**

[1] Source: Southern Nevada Health District and Nevada Division of Public and Behavioral Health Surveillance Data

[2] Due to equipment limits of detection, some blood lead test reports do not indicate a definite blood lead value and may be reported as <10 µg/dL or as a range.

[3] Additionally, it may be helpful to ask the following question to parents of older children (5+ years old) with developmental disabilities who fall outside of the general lead testing periodicity schedule:
"Does your child have a habit of eating nonfood substances (e.g., dirt, pebbles, paint chips) or have frequent hand-to-mouth activity?"

## Testing Methods

A blood lead test is the only way to confirm if a child has lead poisoning (National Notifiable Diseases Surveillance System, 2023). Two types of blood lead tests may be used for initial testing: a **capillary** test or a **venous** test.

A capillary test uses a finger prick to take a small sample of blood. Capillary samples may be analyzed using a **point-of-care (POC)** lead testing instrument, such as Magellan Diagnostics' **LeadCare II**. The LeadCare II is the only FDA-approved CLIA-waived POC lead testing instrument in use today (Maryland Department of Health and Mental Hygiene, 2014). Capillary POC is often used for initial testing because it is a quick, easy, and minimally-invasive. As such, parents tend to be more amendable to test their children via the capillary method. However, capillary testing is less accurate than venous testing as capillary samples are more prone to contamination from lead in the environment and due to instrument limits of detection.

A venous blood lead test uses blood drawn from a vein in the child's arm. Blood collected from the vein is less likely to be contaminated with lead during the collection process and venous samples are more reliable at identifying lower blood lead levels than capillary samples when analyzed using higher complexity methods; results are therefore more accurate. However, venous testing requires a trained phlebotomist to take the sample and shipment to a laboratory for spectroscopy can take a few days to produce results.

## Childhood Lead Risk Questionnaire

The **Childhood Lead Risk Questionnaire (CLRQ)** is a screening tool used to assess the risk of potential exposure during well-child visits. The **American Academy of Pediatrics (AAP)** Bright Future's Periodicity Schedule recommends that providers should screen children at: 6 months, 9 months, 12 months, 18 months, 24 months, and at 3, 4, 5 and 6 years of age.

If the answer to any question on the screening tool is "Yes" or "Don't know," a blood lead test should be performed.

The following CLRQ was adapted from the Illinois Department of Public Health (Illinois Department of Public Health, 2015).

**NvCLPPP Childhood Lead Poisoning Risk Questionnaire**

The CLPRQ should be completed during a health care visit for children under 6 years of age.
**A blood lead test should be performed according the AAP Bright Future's Periodicity Schedule or more often if deemed necessary.**

Child's name: ______________________________Today's date:_________

Age: __________________ Birthdate: ___________________________ Zip Code: ____________________

**Respond to the following questions by circling the appropriate answer.** **RESPONSE**

| | Question | Response | | |
|---|---|---|---|---|
| 1. | Is this child eligible for or enrolled in Medicaid, Head Start, or WIC? | Yes | No | Don't Know |
| 2. | Does this child have a sibling with a blood lead level of 3.5 µg/dL or higher? | Yes | No | Don't Know |
| 3. | Does this child live in or regularly visit a home built before 1978? | Yes | No | Don't Know |
| 4. | In the past year, has this child been exposed to repairs, repainting or renovation of a home built before 1978? | Yes | No | Don't Know |
| 5. | Is this child a refugee or an adoptee from any foreign country? | Yes | No | Don't Know |
| 6. | Has this child ever been to Mexico, Central or South America, Asian countries (i.e., China or India), or any country where exposure to lead from certain items could have occurred (for example, cosmetics, home remedies, folk medicines or glazed pottery)? | Yes | No | Don't Know |
| 7. | Does this child live with someone who has a job or a hobby that may involve lead (for example, jewelry making, building renovation or repair, bridge construction, plumbing, furniture refinishing, or work with automobile batteries or radiators, lead solder, leaded glass, lead shots, bullets or lead fishing sinkers)? | Yes | No | Don't Know |
| 8. | At any time, has this child lived near a factory where lead is used (for example, a lead smelter or a paint factory)? | Yes | No | Don't Know |
| 9. | Does this child reside in a high-risk zip code? (refer to the **2023 Blood Lead Testing Plan** for a list of high-risk zip codes) | Yes | No | Don't Know |

If there is any "**Yes**" or "**Don't Know**" response a blood lead test is not needed if both of the following apply:

- The child has proof of two consecutive blood lead test results (documented below) that are each less than 3.5 mcg/dL (with one test at age 2 or older), **and**
- There has been no change in the child's living conditions

Test 1: Blood Lead Result: _________ Date: ________ Test 2: Blood Lead Result: _________ Date: _________

**If responses to all the questions are "No":**

- Re-evaluate according the AAP Bright Future's Periodicity Schedule or more often if deemed necessary

Refer to the **2023 NvCLPPP Blood Lead Testing Plan** (BLTP) for special considerations about testing children with developmental/intellectual disabilities who may be at increased risk for lead exposure.
The BLTP can be found on the NvCLPPP website: nvclppp.org

## Recommendations for Pregnant and Lactating Persons

The prevalence of lead poisoning in women of child-bearing age is less than 1% (Centers for Disease Control and Prevention Work Group on Lead and Pregnancy, 2010). Given the overall low prevalence of lead exposure in this population, the CDC does not recommend universal blood lead testing for pregnant persons in the U.S. However, routine blood lead testing may be warranted in specific U.S. subpopulations at increased risk for lead exposure due to local environmental sources of lead and/or the demographics of the population (Centers for Disease Control and Prevention Work Group on Lead and Pregnancy, 2010) .

## Risk Factors

In the absence of local data on the distribution of blood lead levels in pregnant persons, the CDC has provided a table of risk factors that can be used to help determine if individuals are at risk of lead exposure (**Table 9**).

**Table 9 Risk factors for lead exposure in pregnant and lactating persons.**[1]

| Risk Factors | Examples |
|---|---|
| Recent immigration or residency | Immigration from or residency in areas with high lead contamination.[2]<br>• South Asia<br>• Sub-Saharan Africa<br>• East Asia and Pacific<br>• Middle East and North Africa<br>• Latin America and Caribbean |
| Living near a source of lead exposure | • Lead mines<br>• Lead smelters<br>• Industrial or manufacturing facilities<br>• Auto repair shops<br>• Major highways<br>• Airports with propeller-driven airplanes (leaded aviation gasoline) |
| Renovating/remodeling homes built before 1978 | Activities that disturb lead paint or create lead dust<br>• Do It Yourself home projects |
| Hobbies/occupations with lead exposure | • Making ceramics with leaded glazes and paints<br>• Jewelry making and electronics (with lead solder)<br>• Making stained glass and glass blowing<br>• Print-making<br>• Refinishing old furniture<br>• Hunting and target shooting<br>• Casting ammunition, fishing weights, or lead figurines<br>• Enameling copper<br>• Casting bronze<br>• Welding<br>• Glass manufacturing<br>• Recycling of metals, electronics, and batteries<br>• Distilling liquor |
| Use of imported traditional medicines, spices, or ceramics | In Indian, Middle Eastern, West Asian, and Latin American cultures<br>• Azarcon<br>• Greta<br>• Kohl/surma<br>• Bhasma<br>• Rasa Shastra<br>• Turmeric<br>• Georgian saffron<br>• Lead glazed ceramics used for cooking, serving or storing food |
| Pica | Eating or mouthing non-food items that may be contaminated with lead:<br>• Dirt<br>• Clay<br>• Crushed pottery<br>• Paint chips |
| History of previous lead exposure or living with someone with current lead exposure | • Previous lead exposure of any level<br>• Especially for individuals deficient in calcium and iron<br>• Living with someone with an elevated blood lead level or who works in lead-industries (take-home lead) |

[1] Adapted from Centers for Disease Control and Prevention (2010) Table 4-1. Risk Factors for Lead Exposure in Pregnant and Lactating Women

[2] Rees & Fuller (2020)

## Lead Exposure Questionnaire for Pregnant and Lactating Persons

Obstetric health care providers should consider the possibility of lead exposure in pregnant women by evaluating risk factors for exposure as part of a comprehensive health risk assessment (American College of Obstetricians and Gynecologists, 2012). The NvCLPPP has constructed a lead exposure risk questionnaire for pregnant and lactating persons based on risk factors identified by the CDC. The following questionnaire should be administrated at the earliest contact with the pregnant patient.

If the answer to any question is "Yes" or "Don't know," a blood lead test should be performed. Venous blood sample is recommended for maternal blood lead testing.

## NvCLPPP Lead Exposure Questionnaire for Pregnant and Lactating Persons

1. Were you born outside of the United States, or recently spent time outside of the United States? Check all that apply.

☐South Asia
☐Sub-Saharan Africa
☐East Asia and Pacific
☐Middle East and North Africa
☐Latin America and Caribbean

2. Do you live near any of the following, which could indicate exposure to lead? Check all that apply, even if the establishment is closed.

☐Lead Mines
☐Lead smelters
☐Industrial or manufacturing facilities
☐Auto repair shops
☐Major highways
☐Airports with propeller-driven airplanes (aviation gasoline)

3. Do you have a hobby or job that can expose you to lead? Check all that apply.

☐Making ceramics with leaded glazes and paints
☐Jewelry making and electronics (lead solder)
☐Making stained glass and glass blowing
☐Print-making
☐Refinishing old furniture
☐Hunting and target shooting
☐Casting ammunition, fishing weights, or lead figurines
☐Enameling copper
☐Casting bronze
☐Welding
☐Glass manufacturing
☒Recycling of metals, electronics, and batteries
☐Distilling liquor
☐Renovation/remodeling activity/Do it yourself home projects

4. Do you use traditional medicines, spices, or ceramics known to contain lead? Check all that apply.

☐Azarcon
☐Greta
☐Kohl/surma
☐Bhasma
☐Rasa Shastra
☐Turmeric
☐Georgian saffron
☐Lead glazed ceramics used for cooking, serving or storing food

5. Do you ever get the urge to eat or mouth non-food items—even accidentally? Check all that apply.

☐Dirt/soil
☐Clay
☐Crushed pottery
☐Paint chips

6. Do you live in or regularly visit a home built before 1978 with recent or ongoing renovation/remodeling activity?

☐Yes ☐No ☐Don't know

7. Have you experienced any of these other risk factors for lead exposure? Check all that apply.

☐Previous lead exposure of any level
☐Deficient in calcium and/or iron
☐Living with someone with an elevated blood lead level

If you answered "yes" or "don't know" to any of these questions, ask your doctor for blood lead test to determine if you have been exposed to lead.

Adapted from the 2010 Centers for Disease Control and Prevention "Guidelines for the Identification and Management of Lead Exposure in Pregnant and Lactating Women".

Blood lead testing early in the course of a pregnancy has the benefit of early identification of chronic, ongoing, or historical cumulative exposures (Hu, Hashimoto, & Besser, 1996; Hu & Hernandez-Avila, 2002). Recommendations for early blood lead testing in pregnancy do not mean there are no risks later in pregnancy, however. In some cases, behaviors such as pregnancy-related pica may occur after the initial blood lead test in the first trimester (Centers for Disease Control and Prevention Work Group on Lead and Pregnancy, 2010). Therefore, testing at multiple times during the course of a pregnancy may be warranted as well as during lactation (**Table 10**).

**Table 10 Recommended follow-up actions and frequency of lead up testing during pregnancy by initial venous result.**[1]

| Venous[2] BLL (µg/dL) | Perform follow-up test(s)[3] |
|---|---|
| **<5** | None (no follow-up testing is indicated). |
| **5-14** | Within 1 month. Obtain a maternal BLL[4] or cord BLL at delivery. |
| **15-24** | Within 1 month and then every 2-3 months. Obtain a maternal BLL or cord BLL at delivery. More-frequent testing may be indicated based on risk factor history. |
| **25-44** | Within 1-4 weeks and then every month. Obtain a maternal BLL[C] or cord BLL at delivery. |
| **≥45** | Within 24 hours and then at frequent intervals depending on clinical interventions and trend in BLLs. Consultation with a clinician experienced in the management of pregnant women with BLLs in this range is strongly advised. Obtain a maternal BLL or cord BLL at delivery. |

[1] Adapted from Centers for Disease Control and Prevention (2010) Table 5-3. *Frequency of Maternal Blood Lead Follow-up Testing During Pregnancy*
[2] Venous blood samples are recommended for maternal blood lead testing.
[3] The higher the BLL on the screening test, the more urgent the need for confirmatory testing.
[4] If possible, obtain a maternal BLL prior to delivery since BLLs tend to rise over the course of pregnancy

# Follow-up and Case Management for Blood Lead Test Results

## Responding to Lead-Exposed Children

The NvCLPPP recommends following CDC guidelines for follow-up testing and response actions.

The CDC guidelines can be found online at
https://www.cdc.gov/nceh/lead/acclpp/actions_blls.html and are summarized in **Table 11**

**Table 11 Follow-up schedule and case management by blood lead results for children.**

| Initial BLL Test Results (µg/dL) | Venous Confirmation By[1] | Recommended actions based on BLL | Venous Retest – after recommended actions |
|---|---|---|---|
| **<3.5** | None | • Education on the sources and prevention of lead exposure[2]<br>• Routine assessment focusing on iron and calcium intake<br>• Follow-up blood lead monitoring at recommended intervals | Retest according to AAP Bright Futures Periodicity Schedule |
| **3.5-9** | 3 months | Above actions, plus:<br>• Environmental exposure history to identify potential lead sources<br>• Refer to health department for environmental investigation of home<br>• Lab work: iron status, hemoglobin, hematocrit<br>• Discuss child's diet and nutrition with focus on calcium and iron and refer to supportive services if needed (WIC)<br>• Developmental monitoring and referral to support services if needed | 3 months for first 2-4 tests<br>6-9 months after BLLs are declining |
| **10-19** | 1 month | | 1-3 months for first 2-4 tests<br>3-6 months after BLLs are declining |
| **20-44** | Within 2 weeks | Above actions, plus:<br>• Complete history and physical exam<br>• Environmental investigation of home and refer for lead hazard reduction program<br>• Consider abdominal x-ray (if lead ingestion is suspected)<br>• Contact **Pediatric Environmental Health Specialty Unit** or **Nevada Poison Center** for guidance | 2 weeks-1 month for first 2-4 tests<br>1-3 months after BLLs are declining |
| **≥45** | ASAP<br>Within 48 hours | Above actions, plus:<br>• Complete history and physical exam with detailed neurological exam<br>• Perform abdominal X-ray and, if needed, bowel decontamination<br>• Consider hospitalization if lead-safe environment cannot be assured, or source of lead has not been identified and further exposure is possible<br>• Commence gastrointestinal decontamination or chelation therapy with consultation from medical toxicologist or pediatrician experienced in lead poisoning | ASAP or medically indicated |

[1] Notes: If the initial BLL test was performed using a venous sample, then the child patient does not need another venous draw to confirm the BLL. Proceed to CDC's recommended actions for the next steps. If the initial test was performed using a capillary sample, then the provider must perform a confirmatory venous blood lead test

[2] The NvCLPPP has prepared numerous educational materials to share with families. The resources can be freely accessed online at https://nvclppp.org/handouts-and-materials/

## Responding to Lead-Exposed Pregnant and Lactating Persons

For pregnant persons with BLLs less than 5 µg/dL at initial testing, no follow-up testing is required. For those with BLLs ≥5 µg/dL, follow-up blood lead testing and treatment should be performed in accordance with the CDC's recommended schedules (**Table 12**).

Lactating parents with a confirmed BLL of 40 µg/dL or higher should not initiate breastfeeding until their BLL has decreased to less than 40 µg/dL. Blood lead tests should be repeated every 1–2 weeks after the source of exposure has been identified and removed. After the lactating parent's BLL is below 40 µg/dL, breastfeeding should be initiated and accompanied by monitoring of infant BLLs (American College of Obstetricians and Gynecologists, 2012).

**Table 12 Follow-up schedule and case management by blood lead results for pregnant persons.[1]**

| Venous[2] BLL (µg/dL) | Perform follow-up test(s)[3] | Recommended actions based on BLL |
|---|---|---|
| **<5** | No following testing indicated | • CDC has not identified any allowable lead exposure level safe for mother and fetus<br>• Provide dietary guidance (calcium and iron) and environmental and health education materials |
| **5 -14** | 1 month | Above Actions, plus:<br>• Attempt to determine source(s) of lead exposure and counsel patients on strategies to reduce exposure, including identification and assessment of pica behavior<br>• Obtain a maternal BLL[4] or cord BLL at delivery and perform newborn follow-up testing<br>• Assess nutrition adequacy and counsel on a balanced diet with adequate daily intake of iron and calcium<br>• Maintain a daily intake of 2,000 mg of calcium through diet or in combination with supplementation<br>• Encourage breastfeeding consistent within safety provisos<br>• If exposure is in the workplace, women should be eligible for medical removal from the exposure environment. Review proper use of personal protective equipment and recommend contacting the employer to encourage reducing exposure<br>• For those above 10µg/dL: refer to occupational medicine specialists and remove from workplace lead exposure |
| **15 -24** | 1 month and then every 2-3 months | Above Actions, plus:<br>• Environmental investigation of the home, lead hazard reduction, and case management by local or state health department<br>• Consultation with a physician specialized in the management of blood lead levels |
| **25 -44** | 1-4 weeks and then every month | |
| **≥45** | 24 hours and then at frequent intervals depending on clinical interventions and trend in BLLs | Above Actions, plus:<br>• Treat as high-risk pregnancy and consult with an expert in lead poisoning on chelation and other treatment decisions<br>• Hospitalize and commence chelation therapy in conjunction with consultation from a medical toxicologist or a pediatric environmental health specialty unit |

[1] Notes: Adapted from Centers for Disease Control and Prevention (2010) Table 5-3. Frequency of Maternal Blood Lead Follow-up Testing During Pregnancy

[2] Venous Blood sample is recommended for maternal blood lead testing.

[3] The higher the BLL on the screening test, the more urgent the need for confirmatory testing.

[4] If possible, obtain a maternal BLL prior to delivery since BLLs tend to rise over the course of pregnancy.

# Nevada's Lead Exposure Risk Index

The Nevada **Lead Exposure Risk Index (LERI)** was developed at the ZIP code level using the following methodology. Initially, we identified the key variables to incorporate into the index. To inform this selection process, we referred to the work of Jacob and colleagues (Jacobs, et al., 2002), who conducted an extensive study estimating the prevalence of significant LBP hazards in housing units across the country. We extracted household data by ZIP code pertaining to six critical characteristics from the American Community Survey, specifically focusing on **age of housing**, **housing unit type**, **occupant status**, **household income**, **race**, and **ethnicity**. These variables were chosen based on their inclusion in Jacob et al.'s study, and we obtained the percentages of housing units with lead hazards from **Table 13** in their research.

**Table 13 Percentage of homes with lead hazards by household characteristics.**

| Characteristic | Percent with lead hazards |
|---|---|
| **Age of housing** | |
| After 1980 | 3% |
| 1960-1979 | 8% |
| 1940-1959 | 43% |
| Before 1940 | 68% |
| **Housing unit type** | |
| Single family | 26% |
| Multifamily | 19% |
| **Occupant status** | |
| Owner occupied | 23% |
| Renter occupied | 30% |
| **Household income** | |
| <$30,000/year | 35% |
| ≥$30,000/year | 19% |
| **Race** | |
| White | 25% |
| African American | 29% |
| Other | 23% |
| **Ethnicity** | |
| Hispanic/Latino | 32% |
| Non-Hispanic/Latino | 24% |

We made slight adjustments to the first two age of housing categories, "after 1980" and "1960-1979", to align them with the available categories in our household data.

The subsequent step involved calculating $R_i$, the weighted risk score for each household characteristic, using the following formulas:

- Age of housing

$$R_{AH} = \frac{HH_{80+} \times 0.03 + HH_{60-79} \times 0.08 + HH_{40-59} \times 0.43 + HH_{40-} \times 0.68}{Total\ Households}$$

- Housing unit type

$$R_{TP} = \frac{HH_{single} \times 0.26 + HH_{multi} \times 0.19}{Total\ Households}$$

- Occupant status

$$R_{OS} = \frac{HH_{owner} \times 0.23 + HH_{renter} \times 0.30}{Total\ Households}$$

- Household income

$$R_{HI} = \frac{HH_{<30k} \times 0.35 + HH_{\geq 30k} \times 0.19}{Total\ Households}$$

- Race

$$R_{RA} = \frac{HH_{White} \times 0.25 + HH_{AA} \times 0.29 + HH_{Other} \times 0.23}{Total\ Households}$$

- Ethnicity

$$R_{ET} = \frac{HH_{hisp} \times 0.32 + HH_{nonhisp} \times 0.24}{Total\ Households}$$

, where $HH_i$ indicates the number of households of a specific household characteristic.

The third step involved formulating the LERI, recognizing that it constitutes a weighted summation of the aforementioned weighted risk scores. Furthermore, we incorporated the percentage of children ages 6 and under years ($Child6$) and the poverty rate ($Poverty$) into the LERI formula. As a result, the LERI formula appears as follows:

$$LERI = w_{AH} \times R_{AH} + w_{TP} \times R_{TP} + w_{OS} \times R_{OS} + w_{HI} \times R_{HI} + w_{RA} \times R_{RA} + w_{ET} \times R_{ET} + w_{Child6} \times Child6 + w_{Poverty} \times Poverty$$

, where $w_i$ indicates the risk weight for a given risk score $R_i$.

Nonetheless, because of the lacking theoretical support to estimate the eight weights ($w_{AH}, w_{TP}, w_{OS}, w_{HI}, w_{RA}, w_{ET}, w_{Child6}, w_{Poverty}$), the fourth step applied factor analysis to reconstruct the formula using a reduced number of factors that could still adequately represent the original eight variables. The updated formula is expressed as:

$$LERI = \sum_{i=1}^{p} w_p \times FS_p + c$$

where $p$ is less than eight, $w_p$ is the weight of the $p$th factor score $FS_p$, and c is a constant used to scale the LERI, ensuring that it remains strictly positive.

We identified the first four factors, accounting for 31.49%, 21.44%, 13.34%, and 12.18% of variance explained. This collective explanation of 78.44% of the variance from the original eight variables demonstrates the effectiveness of these factors in capturing the underlying patterns.

The fifth step was to compute the weights of the four selected factors.
We rescaled their proportions of variance ($Prop_x$) explained by $w_j = \frac{Prop_j}{\sum_{i=1}^{2} Prop_i}$ to make the total weights equal to 1. The four weights were computed as:

$$w_1 = \frac{0.3149}{0.3149 + 0.2144 + 0.1334 + 0.1218} = 0.40$$

$$w_2 = \frac{0.2144}{0.3149 + 0.2144 + 0.1334 + 0.1218} = 0.27$$

$$w_3 = \frac{0.1334}{0.3149 + 0.2144 + 0.1334 + 0.1218} = 0.17$$

$$w_4 = \frac{0.1218}{0.3149 + 0.2144 + 0.1334 + 0.1218} = 0.16$$

Therefore, the final index score can be formulated as:

$$LERI = 0.40 \times FS_1 + 0.27 \times FS_2 + 0.17 \times FS_3 + 0.16 \times FS_4 + 1.12$$

The factor analysis was exclusively applied to ZIP codes with households. ZIP codes without households are postal routes that correspond to address groups or delivery routes and are not a representation of physical boundaries, buildings, or populations. Consequently, a total of 15 ZIP codes without households were excluded from the analysis.

Lastly, we categorized the calculated LERIs into deciles, with each decile representing 10% of the remaining 175 ZIP codes in Nevada. **Table 14** provides the LERI ranges for each decile.

**Table 14 Lead exposure risk index range by decile for Nevada's ZIP codes.**

| Decile | LERI |
|---|---|
| 1st | 0.10-1.33 |
| 2nd | 1.33-1.75 |
| 3rd | 1.75-2.09 |
| 4th | 2.09-2.31 |
| 5th | 2.31-2.46 |
| 6th | 2.46-2.52 |
| 7th | 2.52-2.56 |
| **8th** | **2.56-2.62** |
| **9th** | **2.62-2.68** |
| **10th** | **2.68-2.95** |

## Geographic Areas of Priority

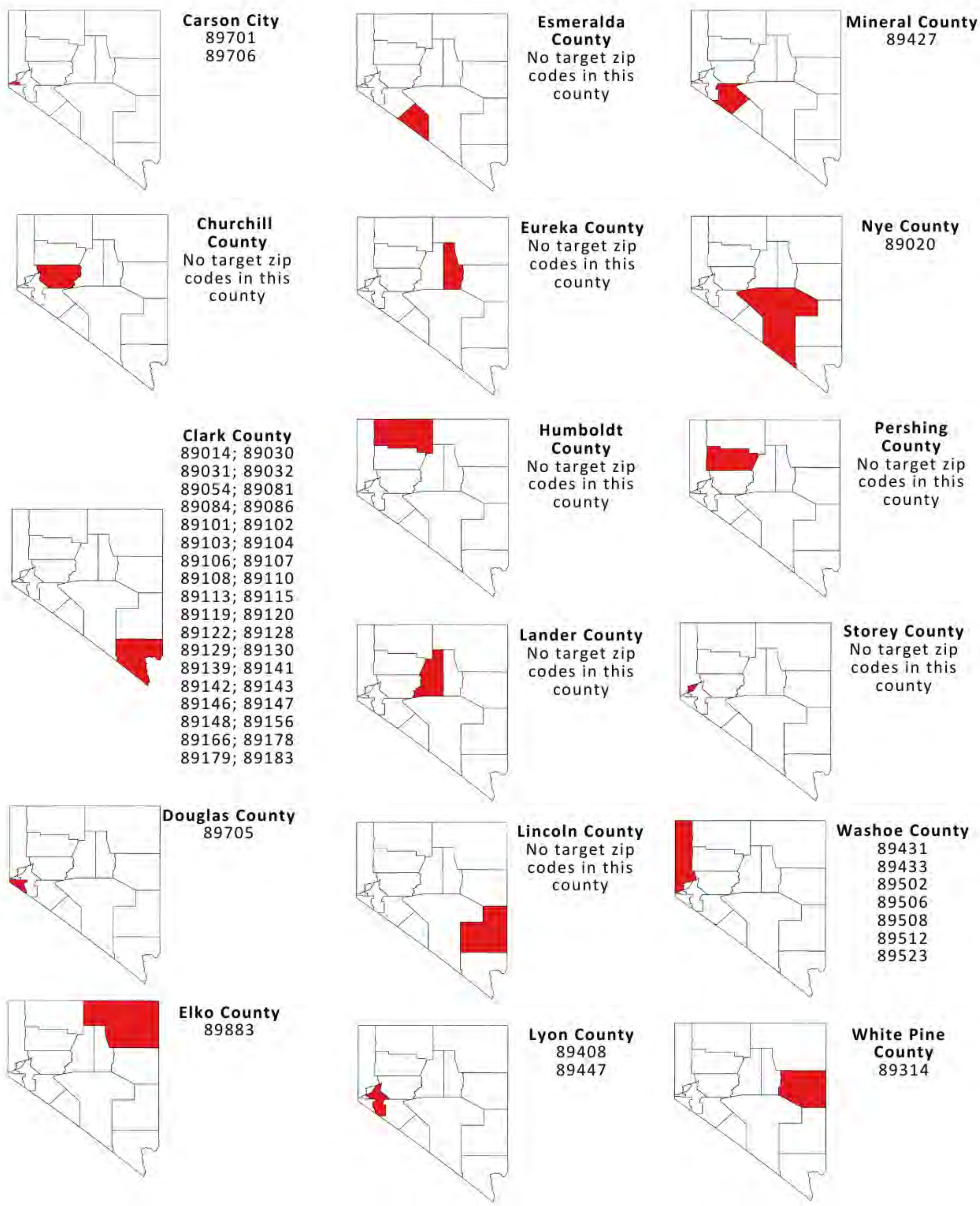
ZIP codes in deciles 1, 2, and 3 are considered low-risk. ZIP codes in deciles 4, 5, 6, and 7 are considered medium-risk. Lastly, ZIP codes in deciles 8, 9, and 10 are considered as areas at high-risk for lead exposure and are NvCLPPP's areas of priority (**Table 15**).[1] While blood lead surveillance data was not incorporated at this time due to low screening rates, the NvCLPPP plans to improve the collection of epidemiologic data to be able to include race and ethnicity of BLL above the BLRV and other BLL data in future surveillance maps. **Figure 10** highlights high-risk ZIP codes for the state.

**Table 15 LERI by risk ranking for Nevada's ZIP codes.**

| Decile Range | LERI Range | Ranking |
|---|---|---|
| $1^{st}$-$3^{rd}$ | 0.10-2.09 | Low-risk |
| $4^{th}$-$7^{th}$ | 2.09-2.56 | Medium-risk |
| $8^{th}$-$10^{th}$ | 2.56-2.95 | High-risk |

[1] DISCLAIMER: The Lead Exposure Risk Index and its associated data are meant for broad planning purposes only. This tool was created to target outreach and education efforts in high risk zip codes, based on the relative risk of childhood lead exposure across all zip codes with households in NV. A residential zip code LERI score is not a substitute for a clinical risk assessment using a childhood lead risk questionnaire as nationwide datasets and risk factor weights used as inputs for the LERI may not be representative of local data. Please keep in mind that historical and current lead hazards in surrounding areas can also increase the risk of lead exposure to your patients, regardless of the LERI score of their residential zip code.

**Figure 9 ZIP codes with the highest lead exposure risk by county.**[1]




[1] Source: U.S. Census Bureau. (2021) American Community Survey Five-year Estimates Retrieved from https://data.census.gov/

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# Appendix A

**Federal Lead Policies**

| Year | Policy |
|---|---|
| **1966** | **Federal Hazardous Substances Act –** Ban on toys and child products with high levels of lead. |
| **1970** | **Clean Air Act (CAA) -** A comprehensive federal law that regulates air quality, including lead in the air. Lead in the air is regulated as one of the six common pollutants under the National Ambient Air Quality Standard and as a toxic air pollutant by regulations set for industrial facility emissions. Under the CAA, the use of gasoline containing lead or lead additives for use as motor vehicle fuel was prohibited after 1995. |
| **1971** | **Lead-Based Paint Poisoning Prevention Act** – Prohibited the use of lead-based paint in residences constructed or rehabilitated by the federal government or with federal assistance and defined paint chips as the primary health hazard of lead-based paint. |
| **1972** | **Clean Water Act -** Prohibits anyone from discharging pollutants including, lead, through a point source into a water of the United States unless they have a National Pollutant Discharge Elimination System (NPDES). |
| **1973** | The **Environmental Protection Agency (EPA)** initiated a health-based regulation to begin phasing out lead in gasoline. |
| **1973** | **Consumer Product Safety Commission (CPSC)** banned hazardous amounts of lead in toys and other products intended for use by children and required warning labels on other lead-containing products. |
| **1973** | EPA initiates a phasedown of lead levels in motor vehicle gasoline to reduce health risks from lead emissions. |
| **1974** | **Safe Drinking Water Act** – Set limits on lead and other contaminants in drinking water. It also required lead-free solder, flux, fittings, and pipes. Lead in drinking water is regulated under the Lead and Coper Rule. |
| **1976** | **Toxic Substance Control Act** - Limits the manufacture, processing, commercial distribution, use, and disposal of chemical substances including PCB's, asbestos, radon, and lead-based paint. |
| **1976** | **Resource Conservation and Recovery Act**– Regulates how waste, such as lead-based paint debris, dust, and chips with a concentration of lead less than or greater than 5 mg/L should be handled. |
| **1978** | The federal government banned **lead-based paint** for residential use. |
| **1978** | A federal ban was put in place prohibiting toys and other children's items from having more than 0.06 percent lead (by weight) in paints or surface coatings. |
| **1980** | **Comprehensive Environmental Response, Compensation, and Liability Act (Superfund) -** Provides a federal "Superfund" to clean up sites contaminated with hazardous waste, as well as preventing contamination of future sites. |
| **1986** | Lead in plumbing banned. |
| **1988** | **Lead Contamination Control Act** – Authorized the Centers for Disease Control to support local and state agencies to develop comprehensive childhood lead poisoning prevention programs (CLPPPs). |
| **1991** | **Lead and Copper Rule –** Regulation to control lead and copper in drinking water. The rule established a maximum contaminant level goal of zero for lead. It also allowed publicly owned sectors to conduct partial service line replacements. |
| **1991** | Lead shot banned for all waterflow hunting in the United States. |
| **1992** | **Residential Lead-Based Paint Hazards Reduction Act (Title X) –** Comprehensive law to protect families from exposure to lead from paint, dust, and soil. Section 1018 of the Act directed the United States HUD and the EPA to require the disclosure of known information on lead-based paint and lead-based paint hazards before the sale and lease of most housing built before 1978. The Act also authorized the administration of grants to state and local entities for lead-based paint hazard reduction activities in homes. |
| **1995** | **Federal Food, Drug, and Cosmetic Act** – The use of lead solder in food cans, including imported cans, was banned. |
| **1999** | **Lead Safe Housing Rule** – lead-based paint in federally owned and assisted housing regulated. |

| | |
|---|---|
| **1999-2001** | Standards for lead in paint, dust, and soil created by the EPA. |
| **2008** | **Renovation, Repair and Painting Rule** – Enacted to protect the public from lead-based paint (LBP) hazards associated with renovation, repair, and painting activities. The rule requires contracts that disturb LBP in pre-1978 homes and child-care centers to be EPA – or – state-certified and to follow specific work practices to prevent lead contamination. |
| **2008** | **Consumer Product Safety Improvement Act** – mandated reducing the lead limit in children's products to 0.009% by weight. |
| **2008** | **The Ridley-Tree Condor Preservation Act** – Requires the use of nonleaded centerfire rifle and pistol ammunition when taking big game and coyote within specific areas. |
| **2011** | Total lead in children's products limited to 100 ppm. |
| **2016** | **The Water Infrastructure Improvements for the Nation Act** – A comprehensive legislation to address the needs of America's harbors, locks, dams, flood protection, and other water resource infrastructure. Under the Act, $35 million was allocated to CDC to enhance childhood lead poisoning prevention activities; to establish a voluntary Flint, Michigan, lead exposure registry, and to establish the Lead Exposure and Prevention Advisory Committee. |
| **2017** | HUD updates lead-paint regulations. |
| **2021** | **Bipartisan Infrastructure Law** – investment in the nation's water and wastewater infrastructure, including $15 billion dedicated to lead service line replacement and $11.7 billion of general Drinking Water State Revolving Funds that can be used for lead service line replacement. |

# Appendix B

**U.S. Standards for Lead Levels**

| Agency | Media | Current limits and action levels |
|---|---|---|
| **EPA** | Water[1] | 15 ppb |
| **EPA** | Dust[2] | • Floor: 10µg/ft²<br>• Window sill: 100 10µg/ft² |
| **EPA** | Soil[3] | 400 ppm |
| **CPSC** | Consumer products[4] | 90 ppm |
| **OSHA** | Workplace air[5] | 50 µg/m³ |
| **CDC** | Children's blood[6] | ≥3.5 µg/dL |
| **FDA** | Baby and child food[7] | • 10 ppb for fruits, vegetables (excluding single-ingredient root vegetables), mixtures (including grain and meat-based mixtures), yogurts, custards/puddings and single-ingredient meats<br>• 20 ppb for root vegetables (single ingredient)<br>• 20 ppb for dry cereals |

[1]United States Environmental Protection Agency. (2022.) Lead and copper rule. EPA. https://www.epa.gov/dwreginfo/lead-and-copper-rule

[2]United States Environmental Protection Agency. (2023). Hazard standards and clearance levels for lead in paint, dust, and soil. EPA. https://www.epa.gov/lead/hazard-standards-and-clearance-levels-lead-paint-dust-and-soil-tsca-sections-402-and-403

[3]United States Environmental Protection Agency. (2020). Lead in soil. EPA. https://www.epa.gov/sites/default/files/2020-10/documents/lead-in-soil-aug2020.pdf

[4]Consumer Product Safety Commission. (n.d.). Lead in paint. CPSC. https://www.cpsc.gov/Business--Manufacturing/Business-Education/Lead/Lead-in-Paint

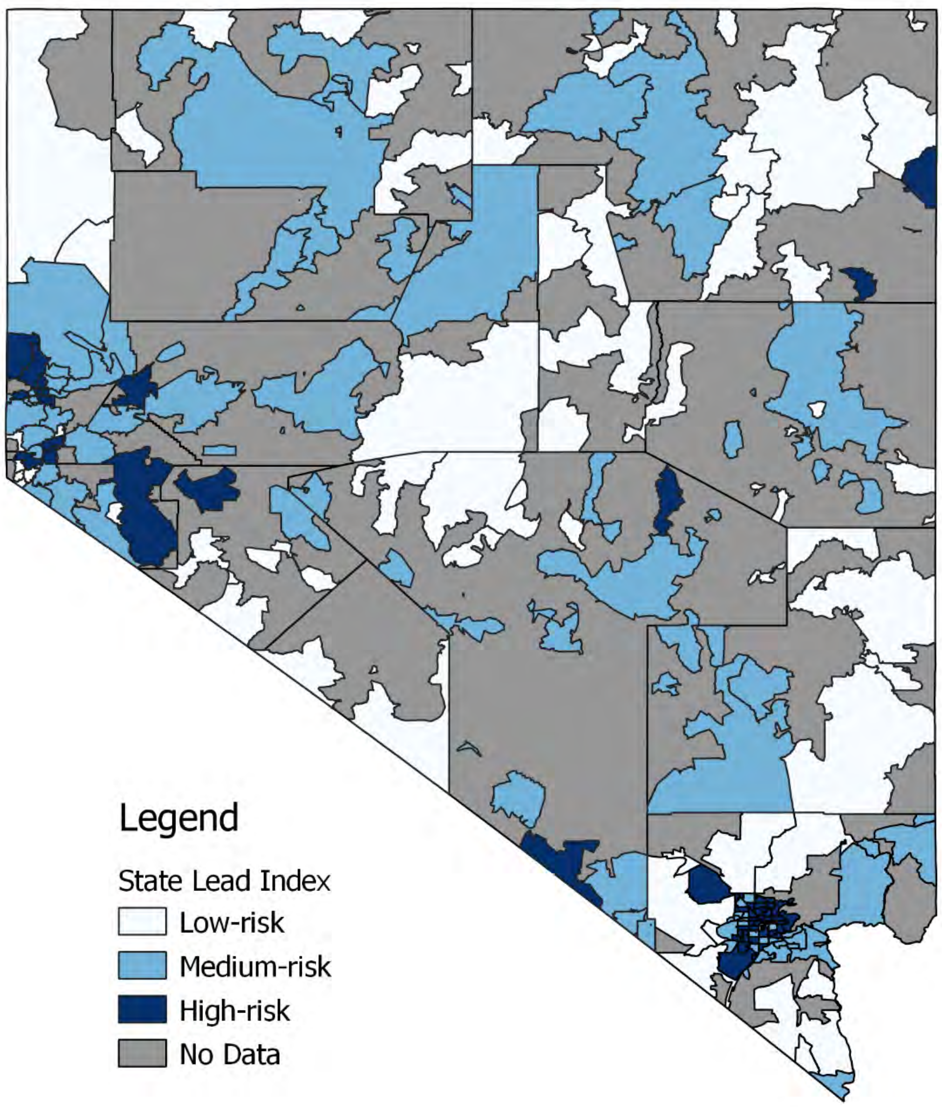
[5]Occupational Safety and Health Administration. (n.d.) Standard 1926.62 – Lead. Retrieved from https://www.osha.gov/laws-regs/regulations/standardnumber/1926/1926.62

[6]Centers for Disease Control and Prevention. (2022). Blood lead levels in children. CDC. https://www.cdc.gov/nceh/lead/prevention/blood-lead-levels.htm

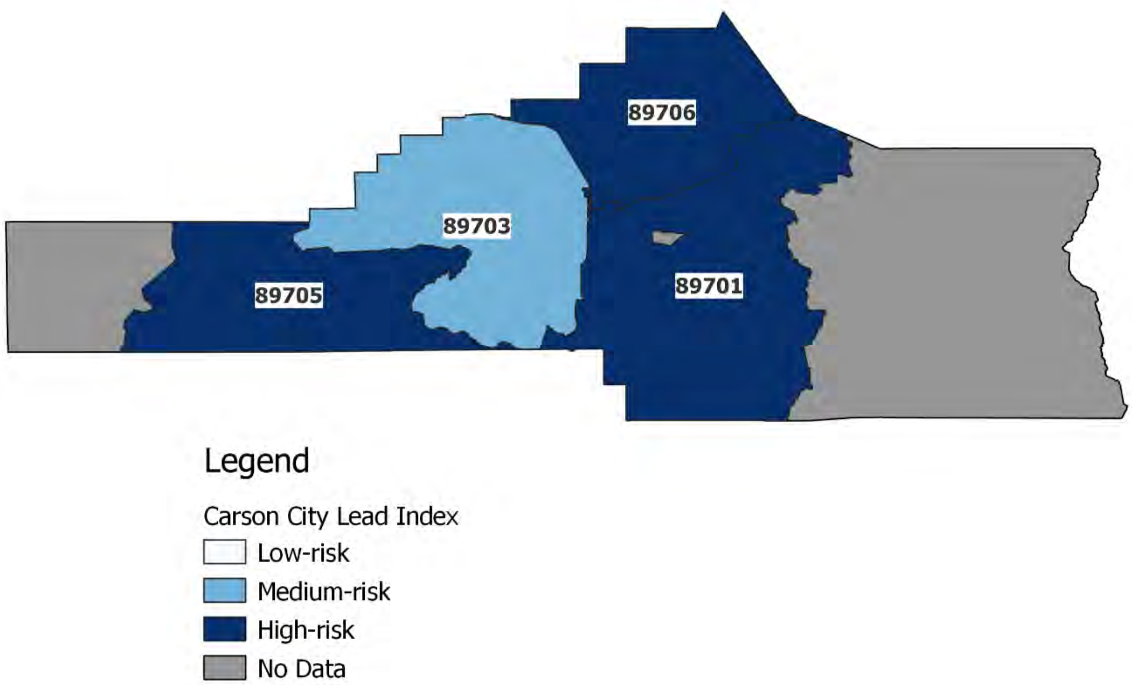
[7]United States Food & Drug Administration. (2023). Draft guidance for industry: Action levels for lead in food intended for babies and young children. Retrieved from https://www.fda.gov/regulatory-information/search-fda-guidance-documents/draft-guidance-industry-action-levels-lead-food-intended-babies-and-young-children

# Appendix C

## State Lead Index – Nevada



## Carson City Map



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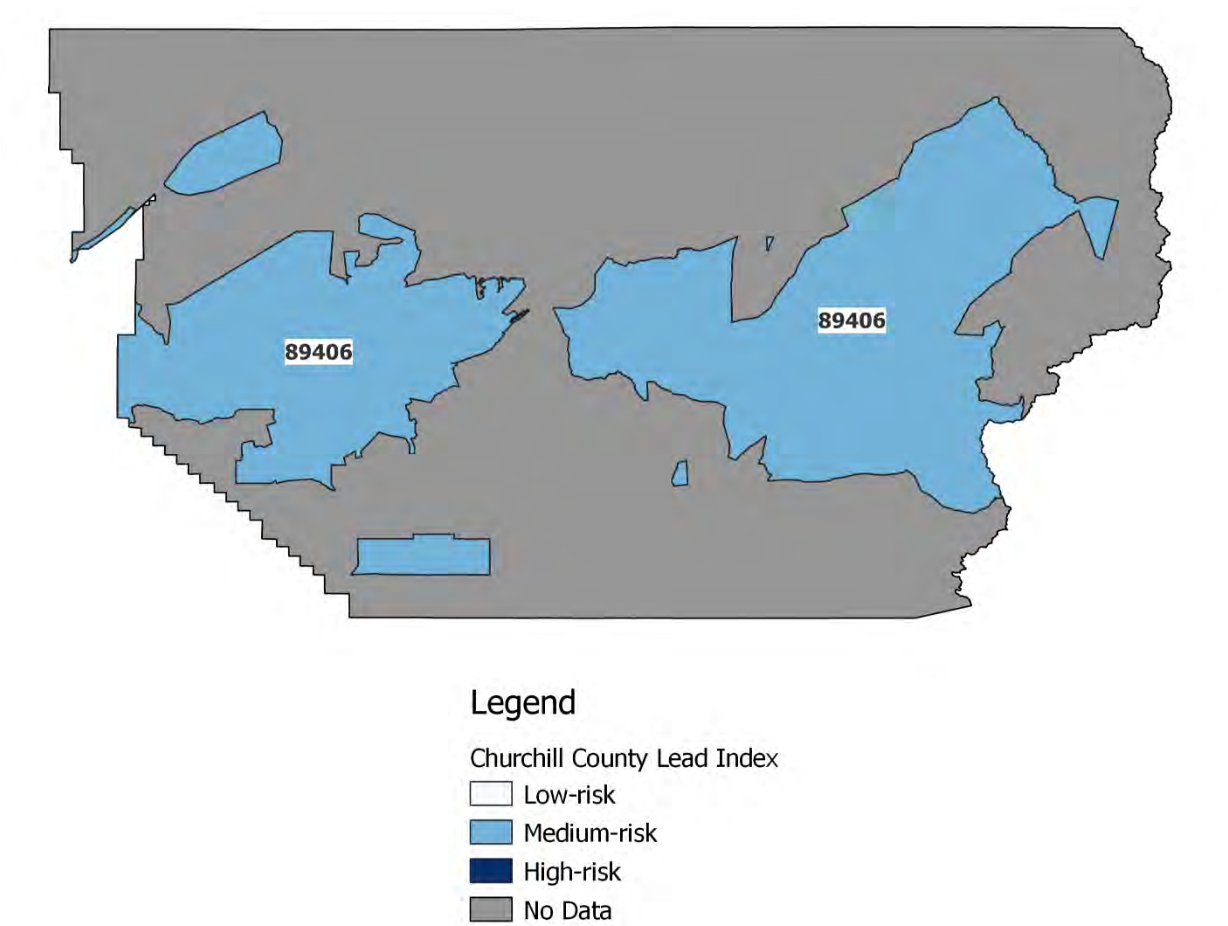

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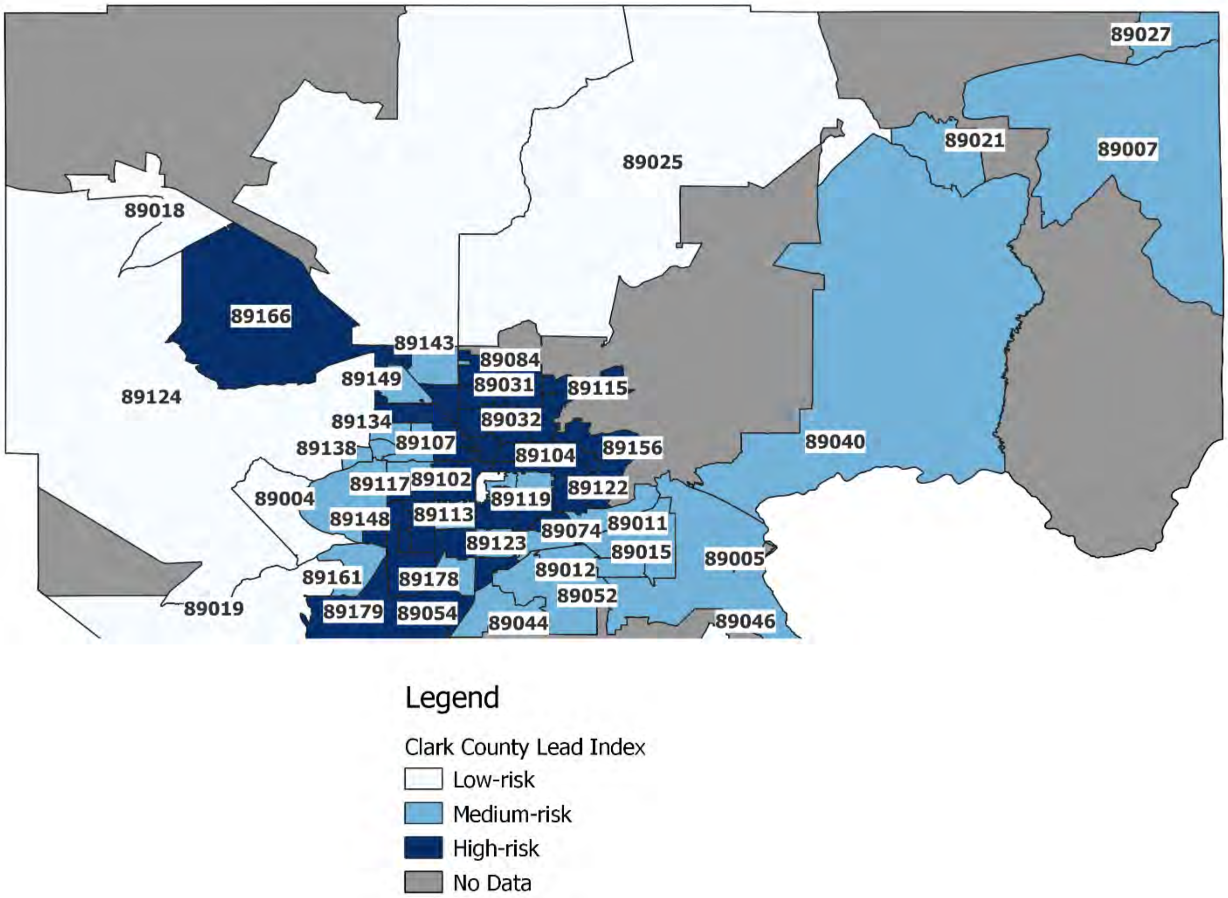

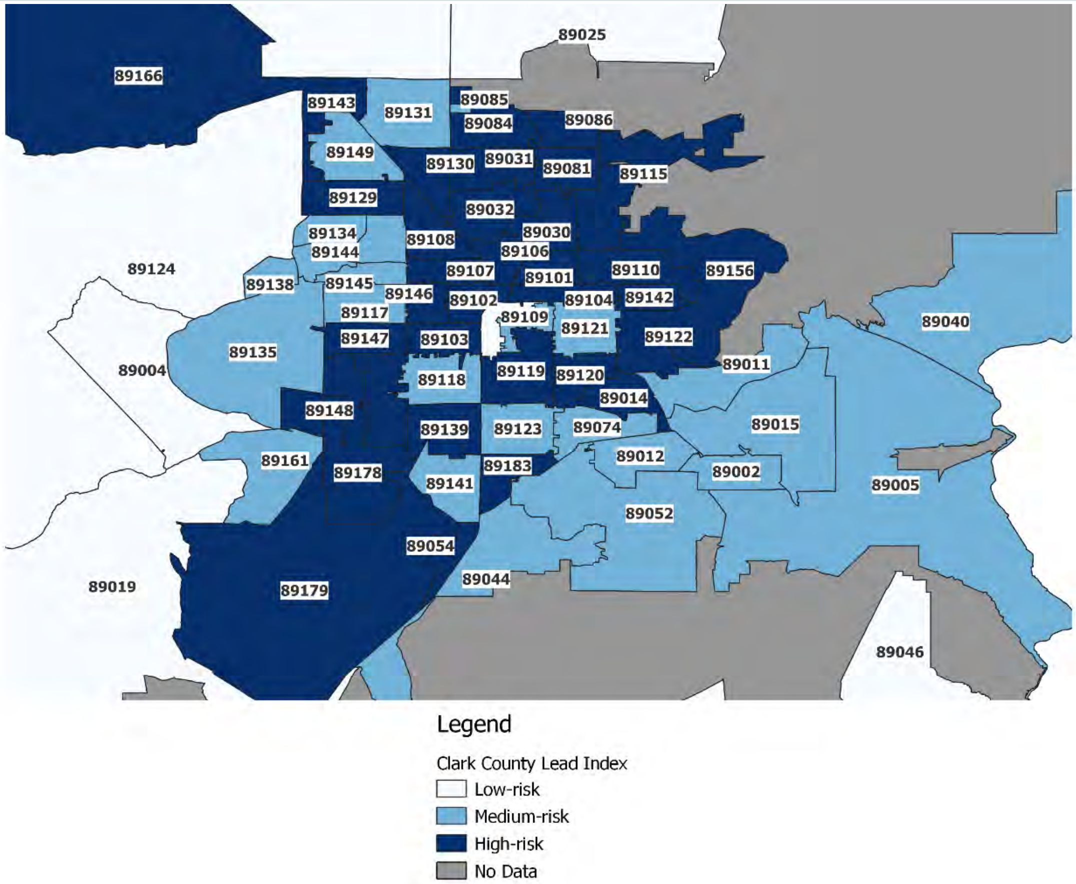
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89012
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89183
89002
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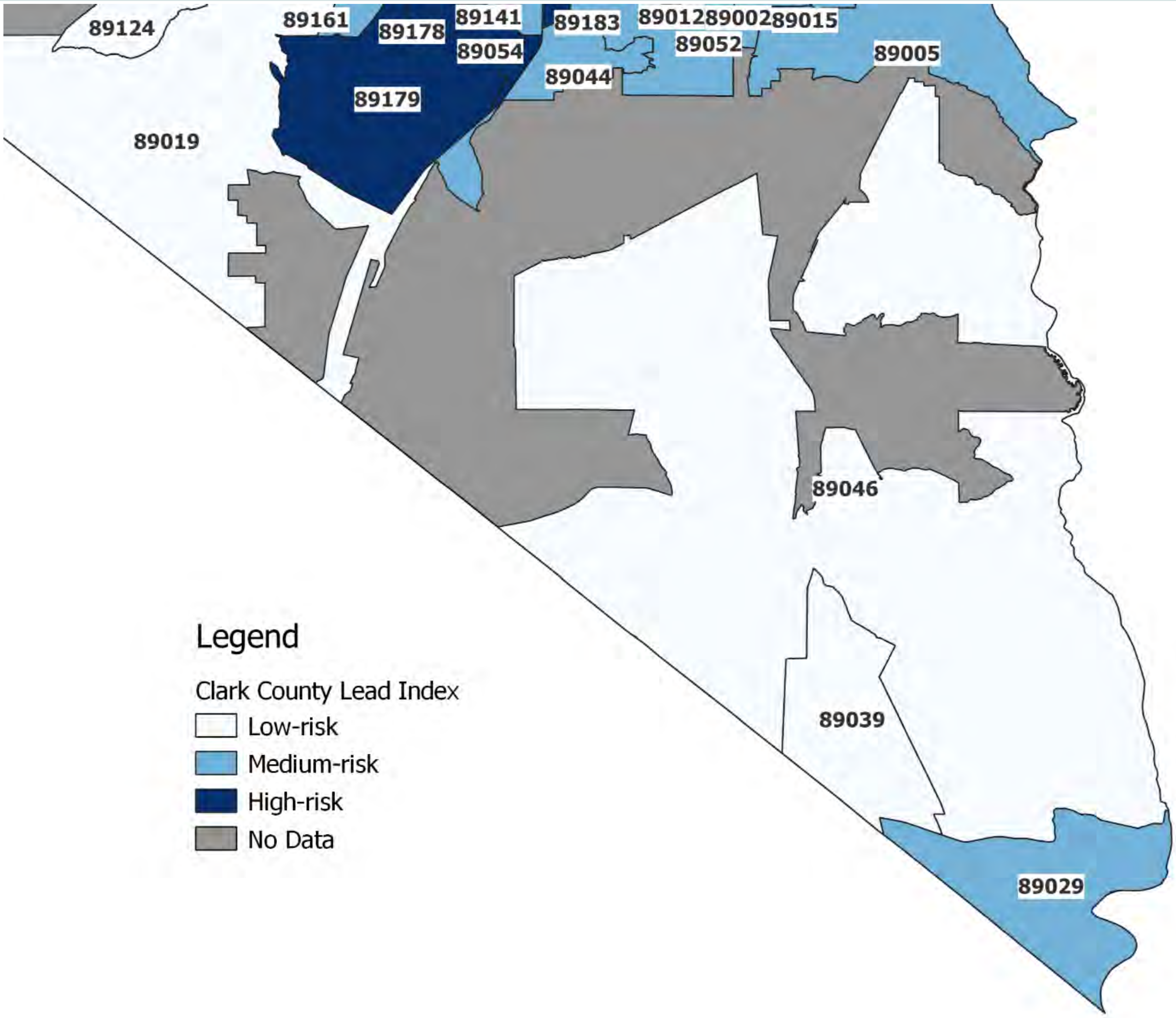
89046
Legend
Clark County Lead Index
Low-risk
Medium-risk
High-risk
No Data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Legend
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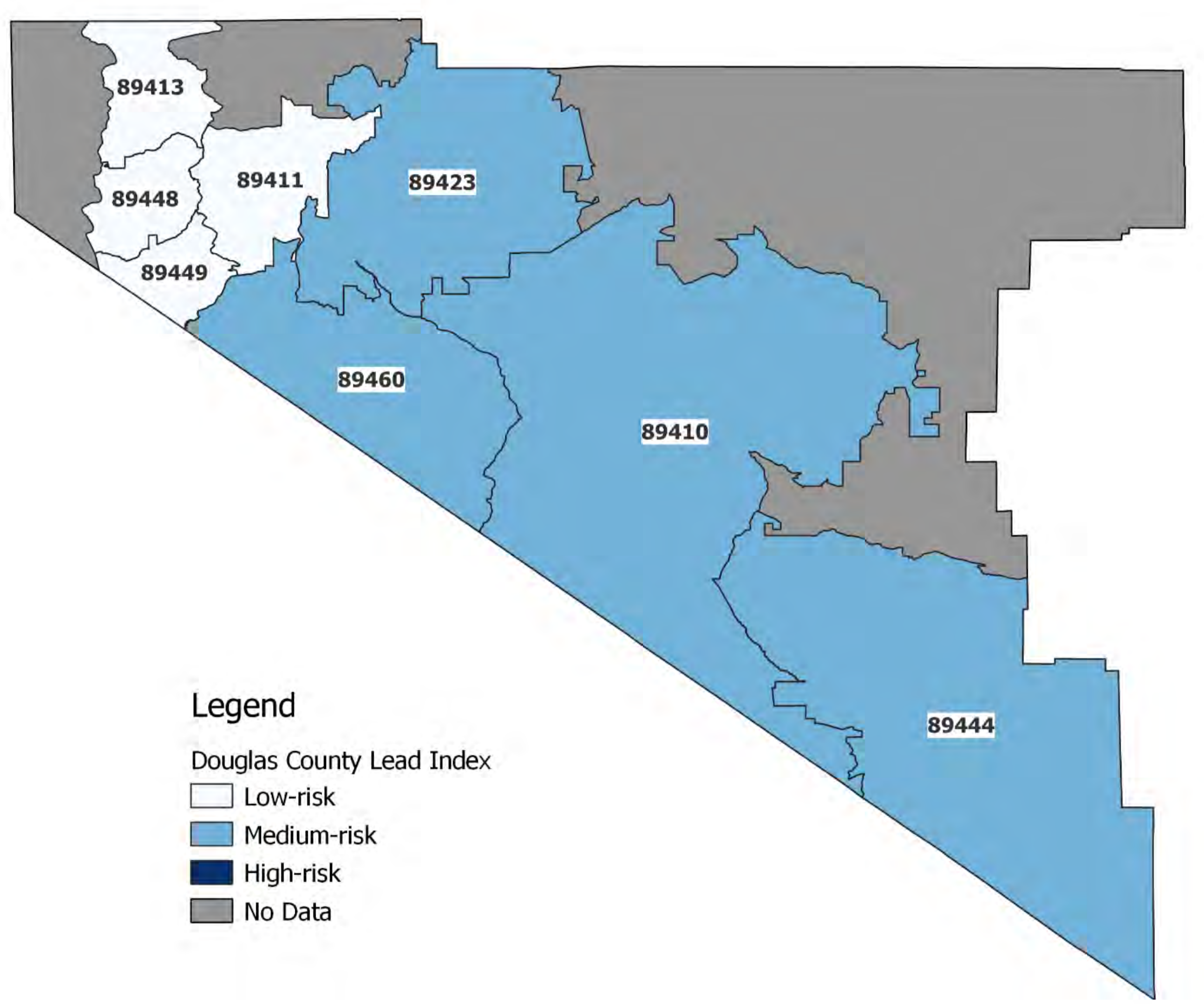
Low-risk
Medium-risk
High-risk
No Data

## Douglas County Map



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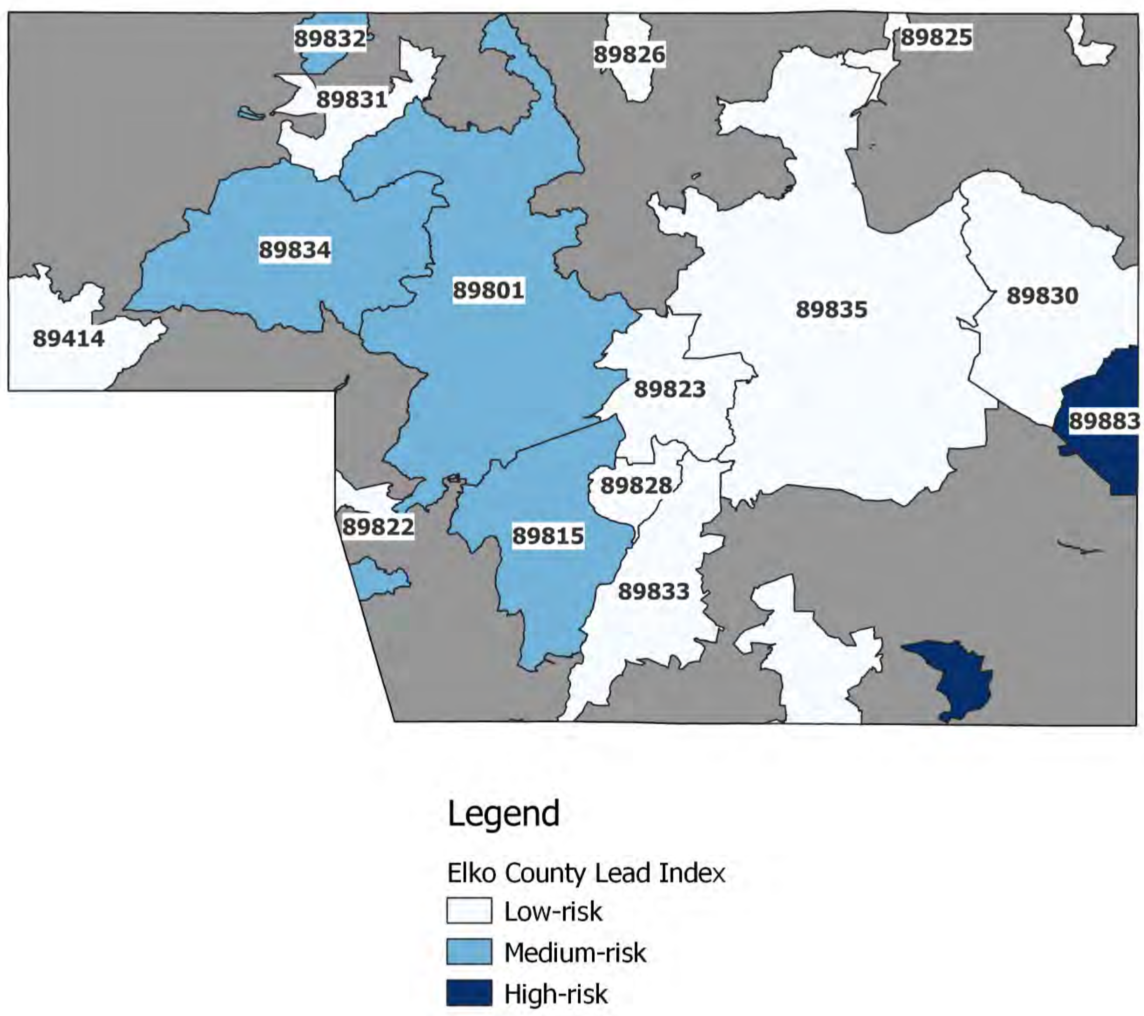
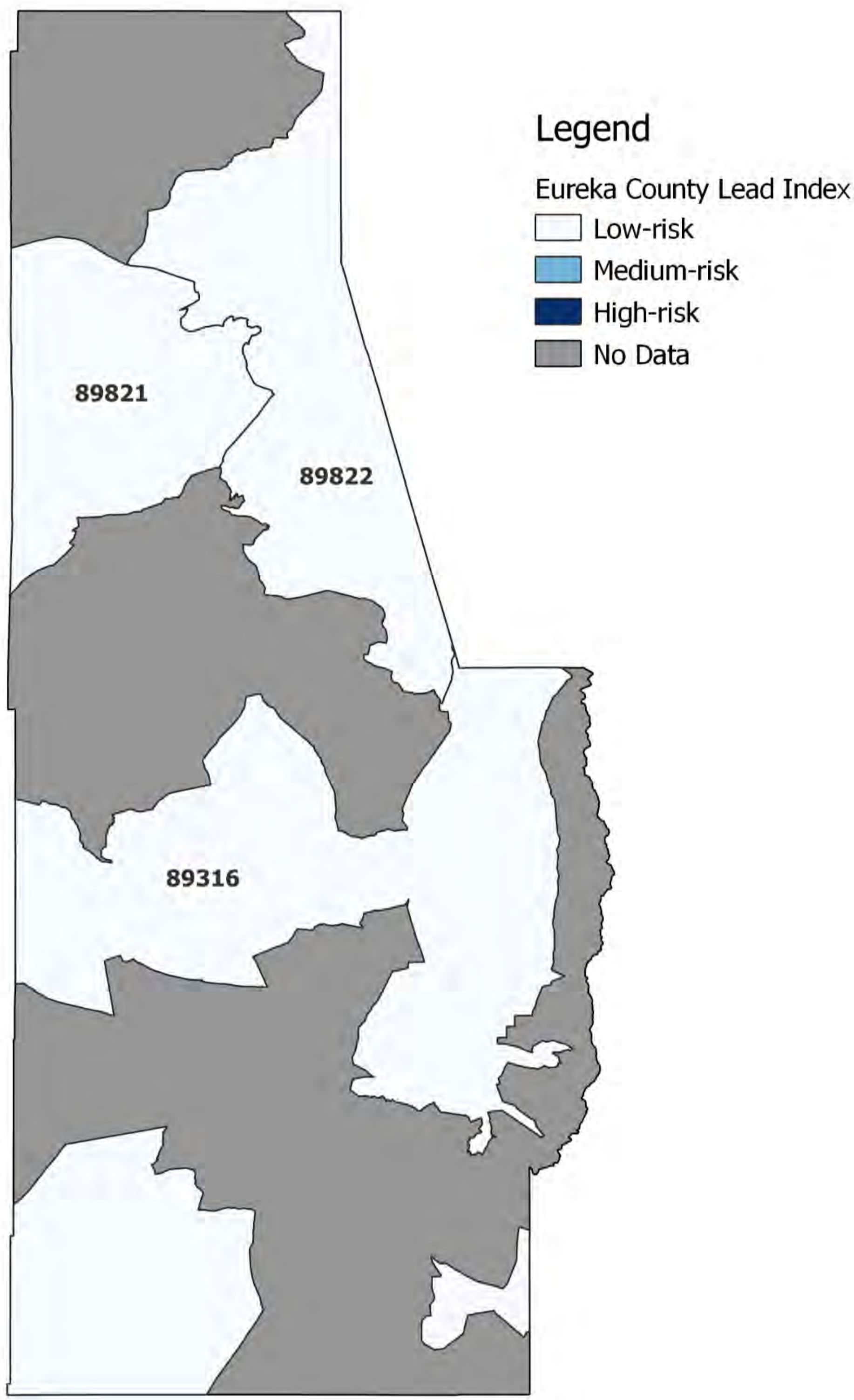


## Esmeralda County Map

## Eureka County Map



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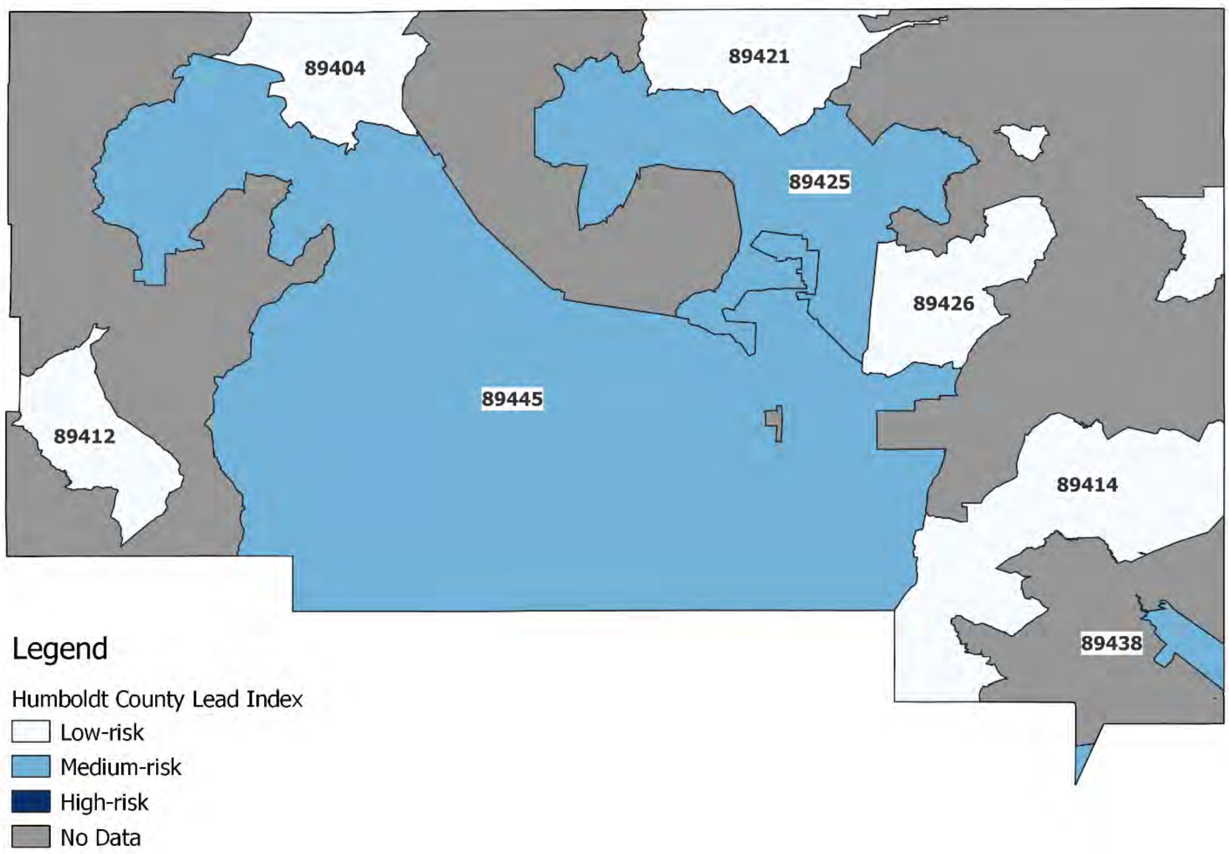

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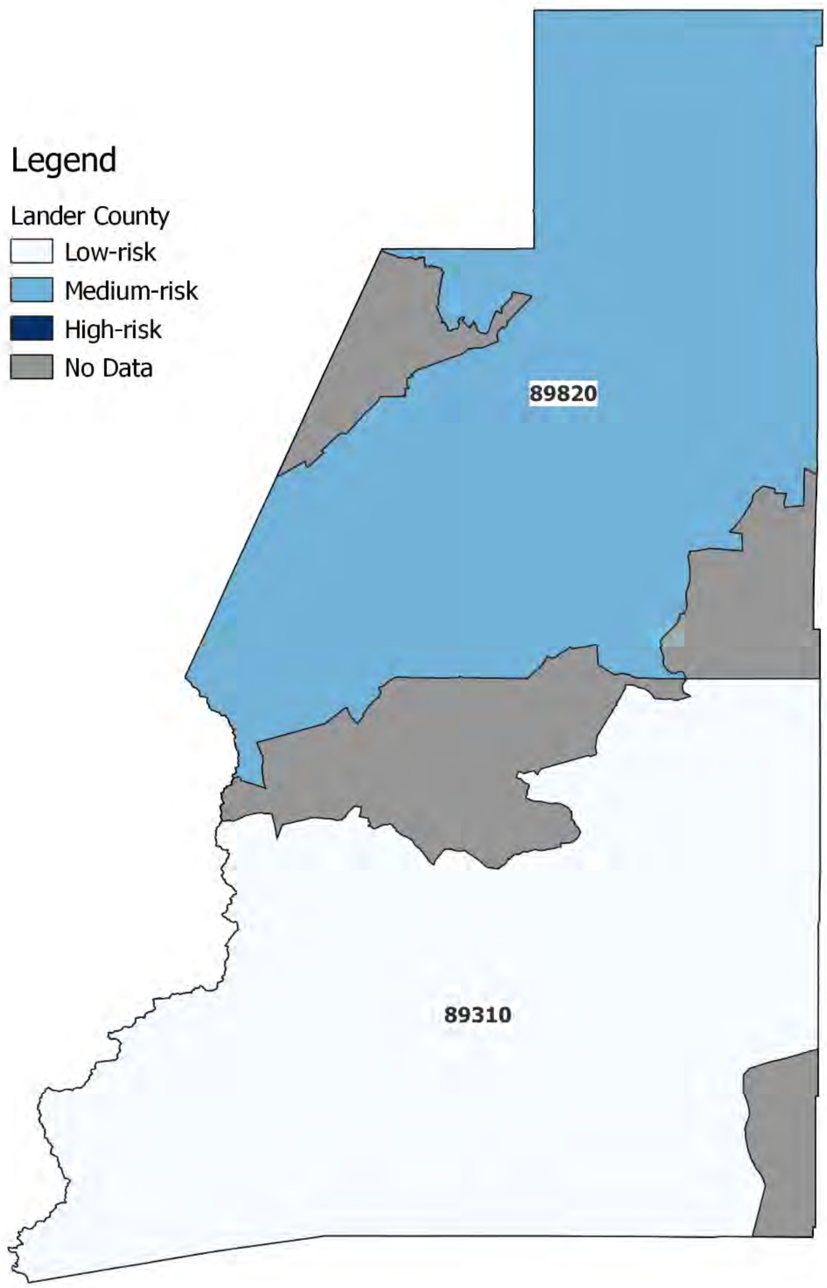
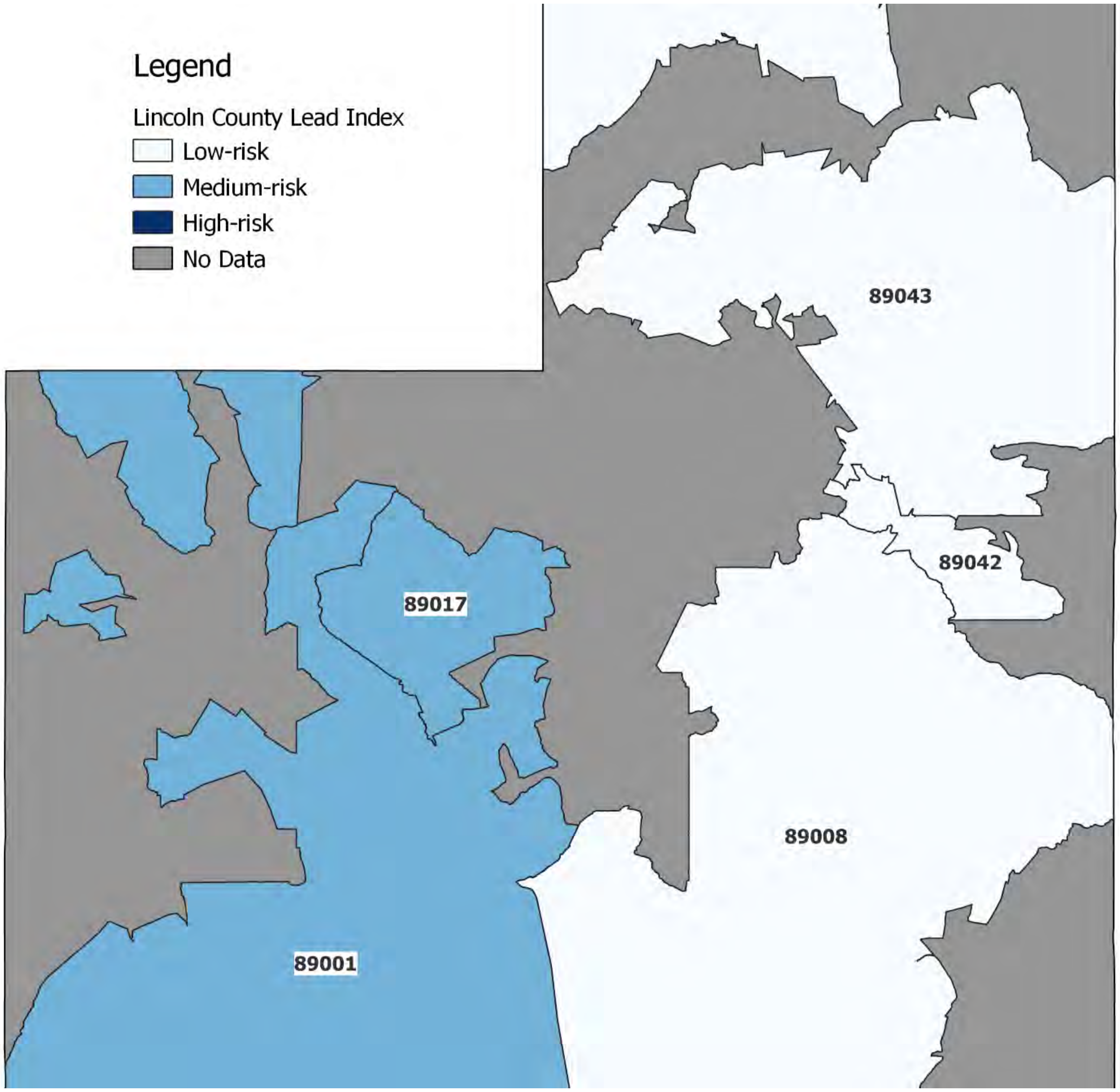


## Lincoln County Map



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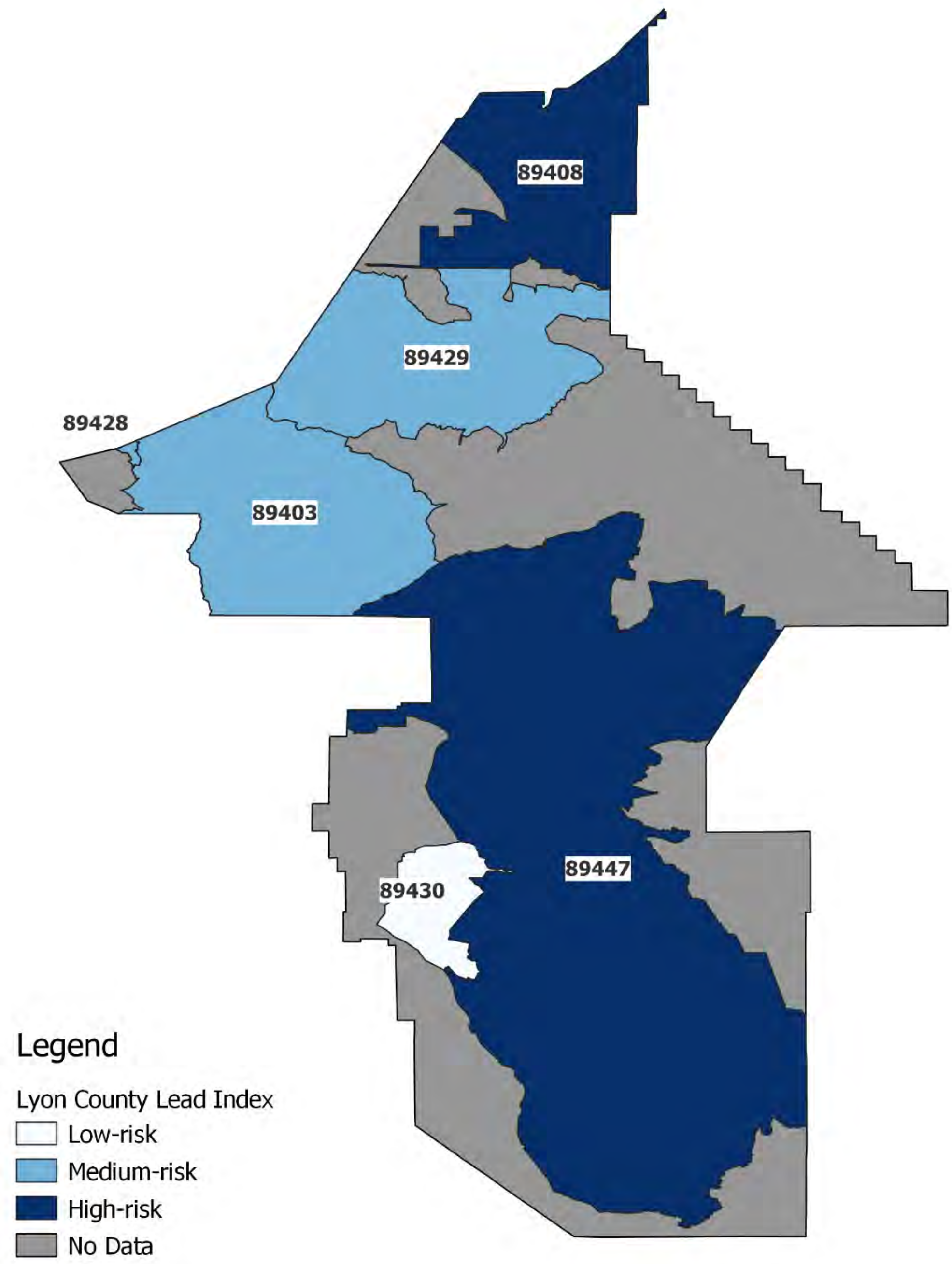
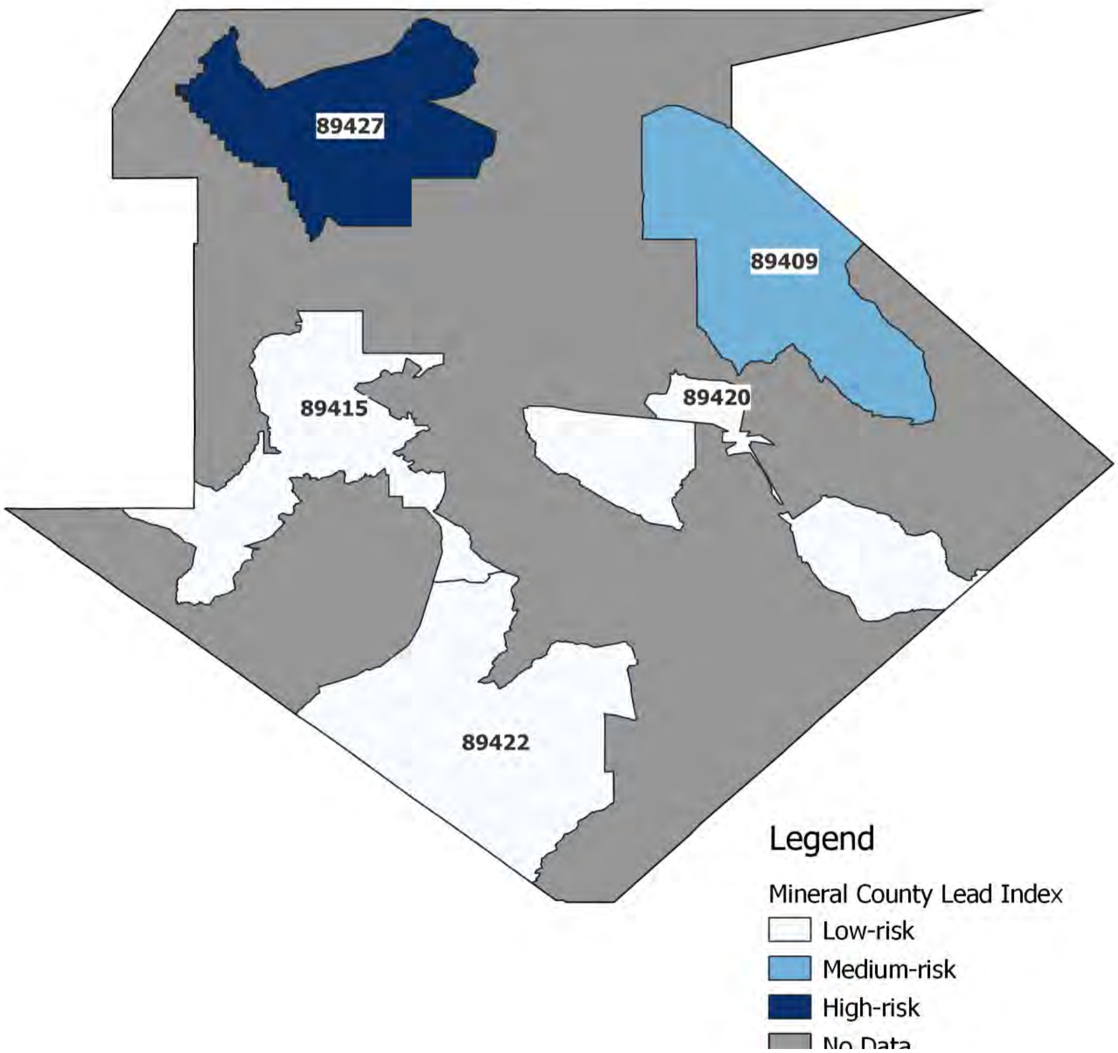


## Mineral County Map



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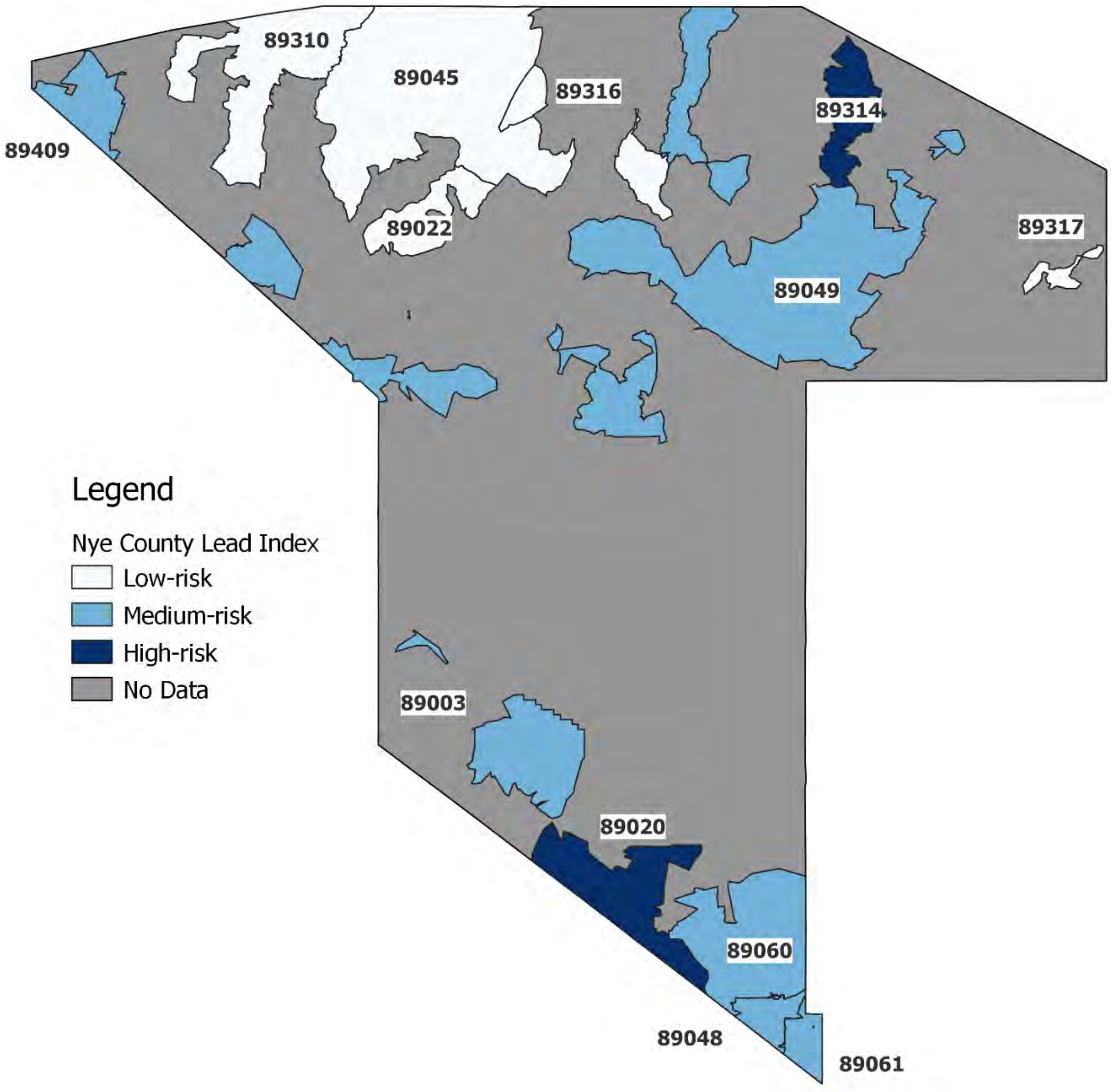

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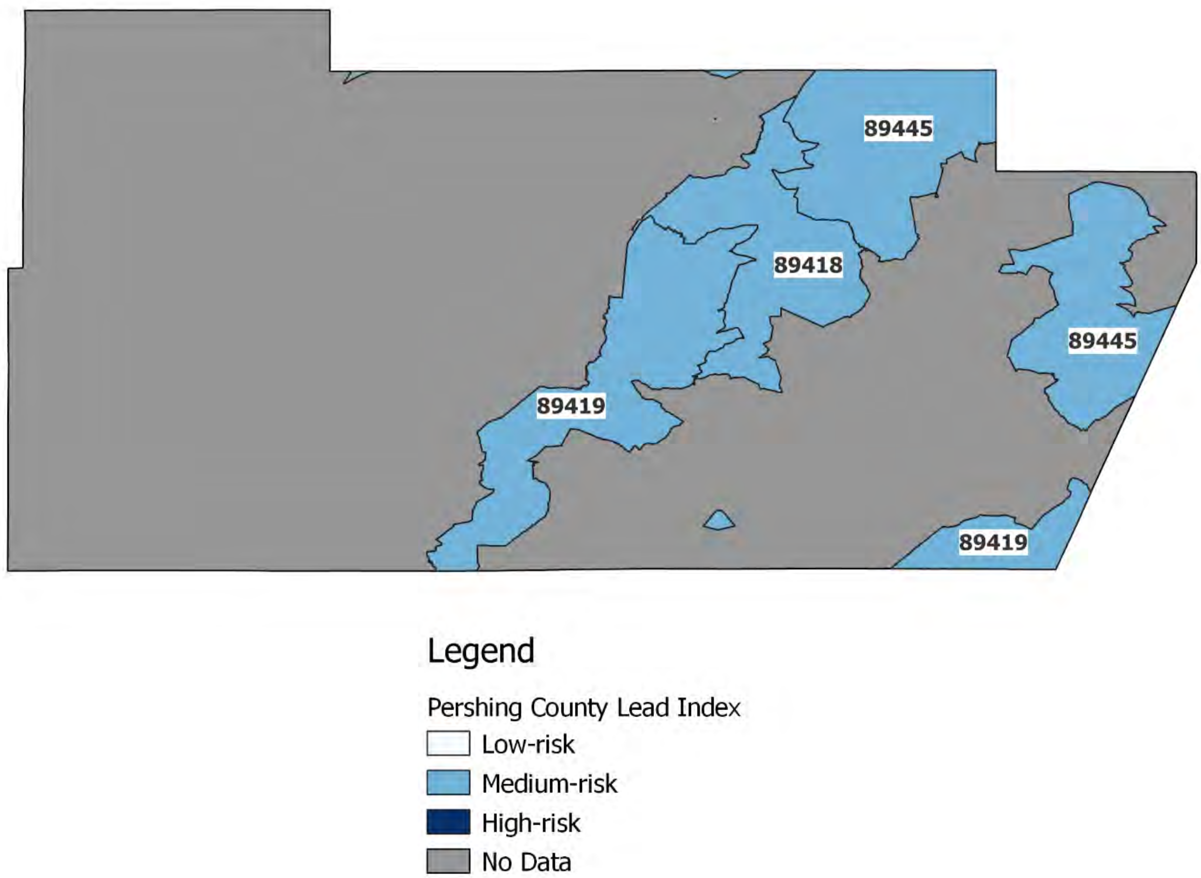
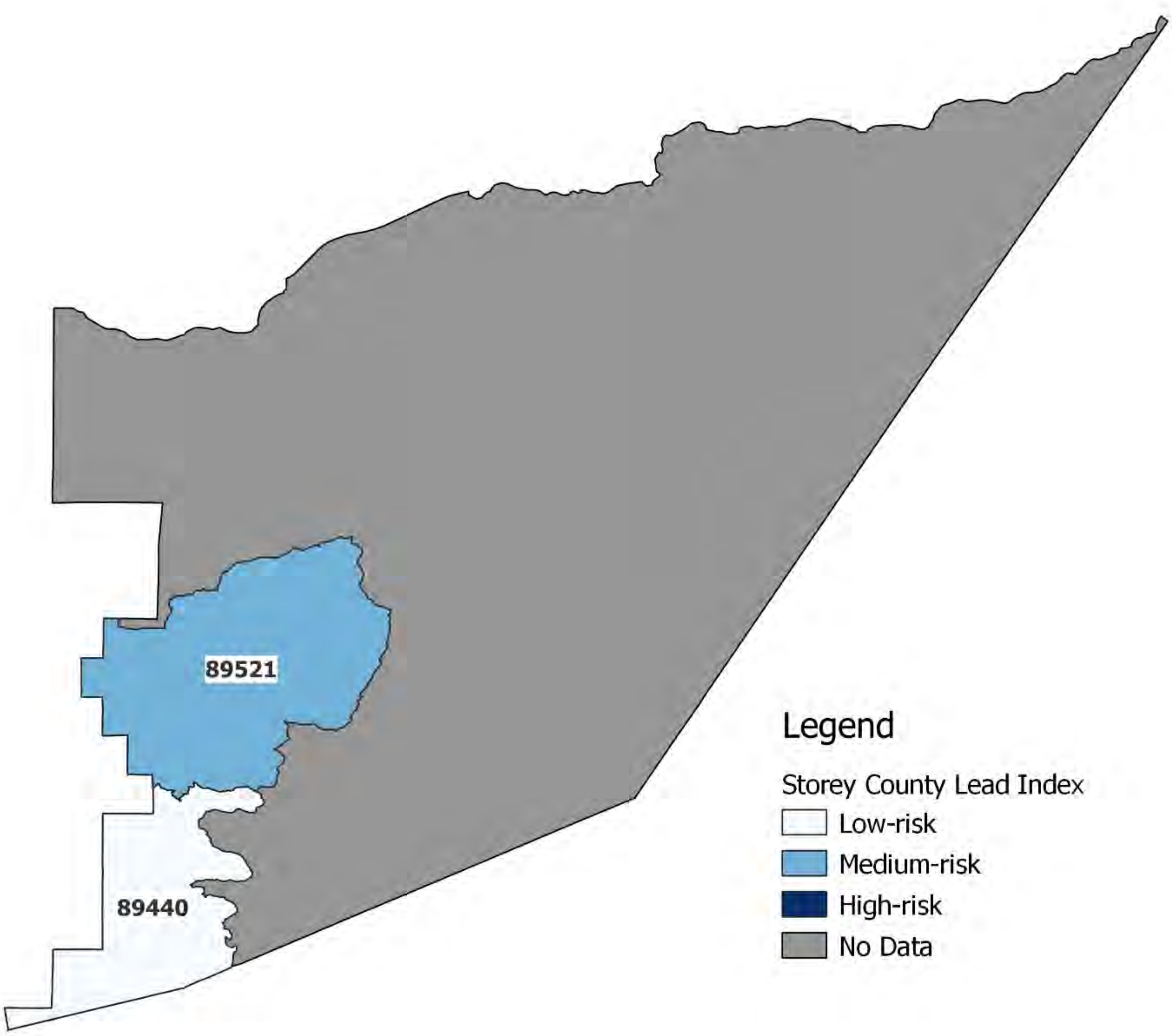
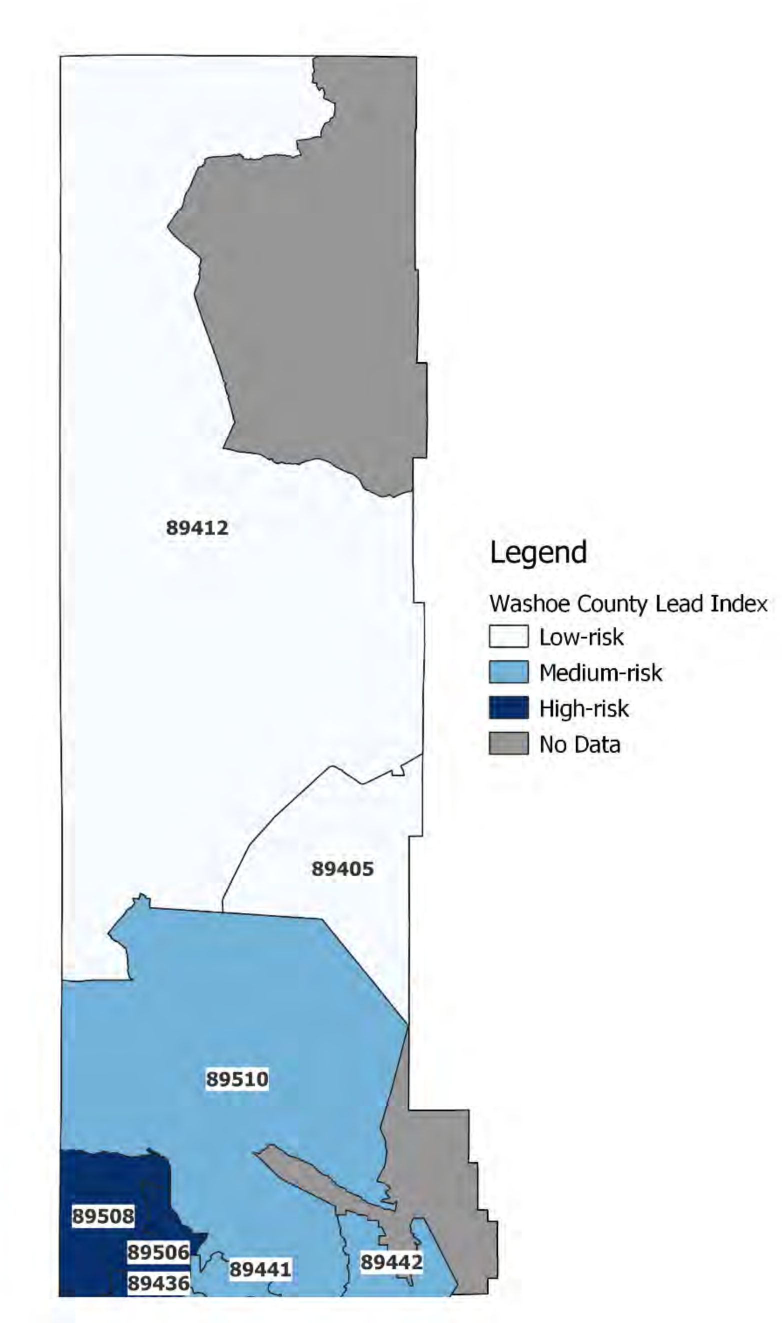
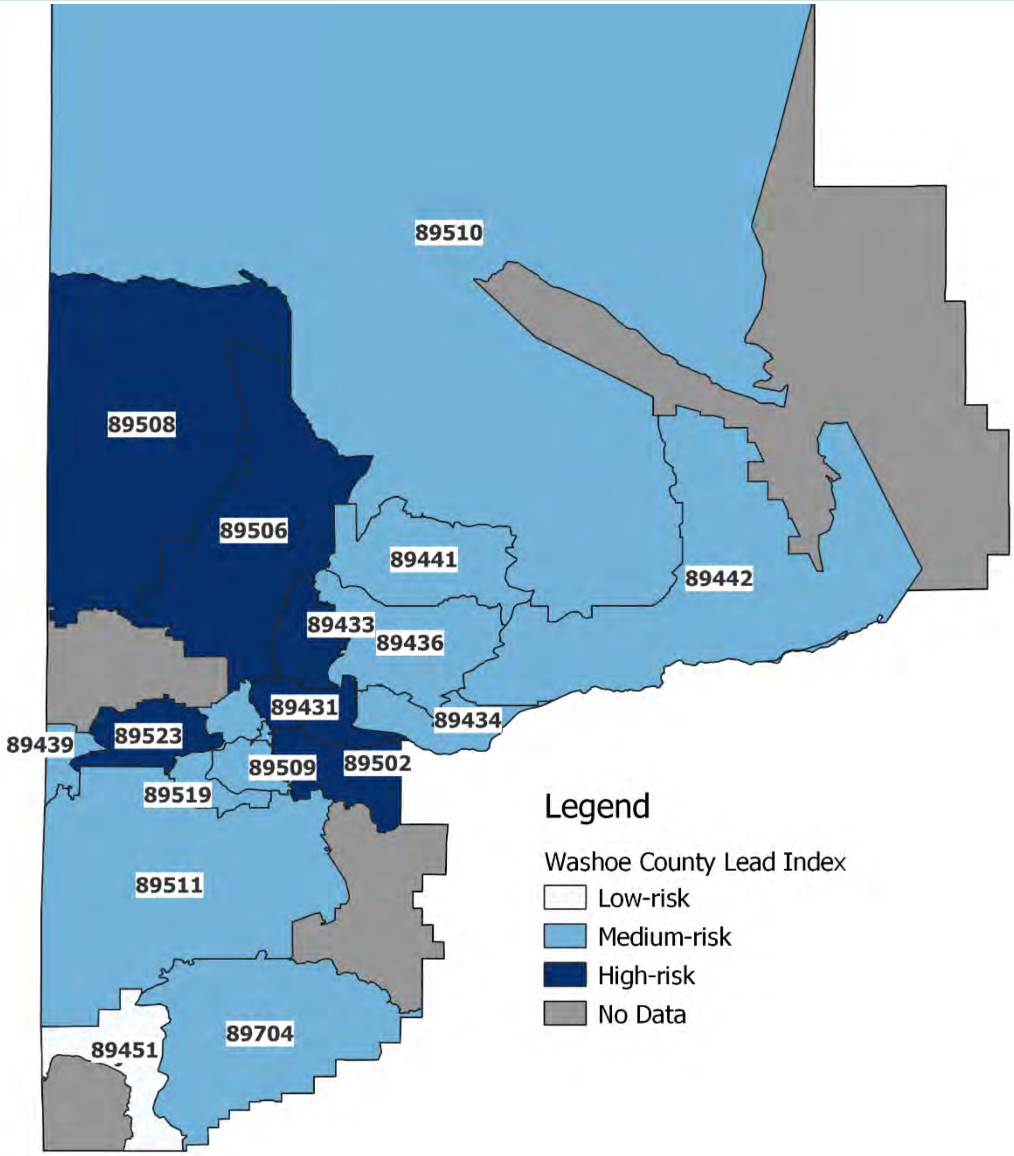


## Storey County Map



## Washoe County Maps




89510
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89442
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89436
89431
89434
89523
89439
89509
89502
89519
89511
89704
89451
Legend
Washoe County Lead Index
Low-risk
Medium-risk
High-risk
No Data

## White Pine County Map