Childhood Lead Poisoning: The Good, the Bad, and the Ugly

Kevin Kennedy, MPH CIEC

Environmental Hygienist

Environmental Health Program Director

2015 Winner-
HUD Secretary's Award
for Healthy Homes

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Children's Mercy

Disclosure

I have no relevant financial relationships with the manufacturers(s) of any commercial products(s) and/or provider of commercial services discussed in this CME activity

I do not intend to discuss an unapproved/investigative use of a commercial product/device in my presentation.

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Environmental Health Program (2001-)

Anita DiDonna – Coordinator, Comm. Health Spec.

Atenas Mena – EHealth Nurse Coordinator

Kaitlin Emke – Environmental Hygienist

Eric Bowles – Lead Poisoning Prevention Progr. Mgr

Ryan Allenbrand – Healthy Home Progr. Mgr.

Luke Gard – Healthy School Progr. Mgr.

Kevin Kennedy – Program Director

816-234-3059 (xt. 53059)

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CMH- Healthy Home Program (2003-)

<u>>1600 Families received home visits including:</u>

- Healthy home education
- Visual environmental assessment
- Indoor environmental assessment (Advanced)
  - Air flow and ventilation assessment
  - IAQ gas measurement
  - Dust particle and allergen assessment
  - Moisture and mold assessment
- Home maintenance and product surveys
- Home safety check up

- and a Healthy Home Resource Manual

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The annual costs of environmentally attributable childhood diseases is high

U.S Total = $54.9 billion.

- **$43.9 Billion from Lead Poisoning**
- **$ 9.2 Billion from Neurobehavioral Disorders**
- **$ 2.0 Billion from Asthma**
- **$ 0.3 Billion from Childhood Cancer**

- **Additional costs (e.g., lost days of school/work).**
- **Asthma contributes 3% of total health care costs.**

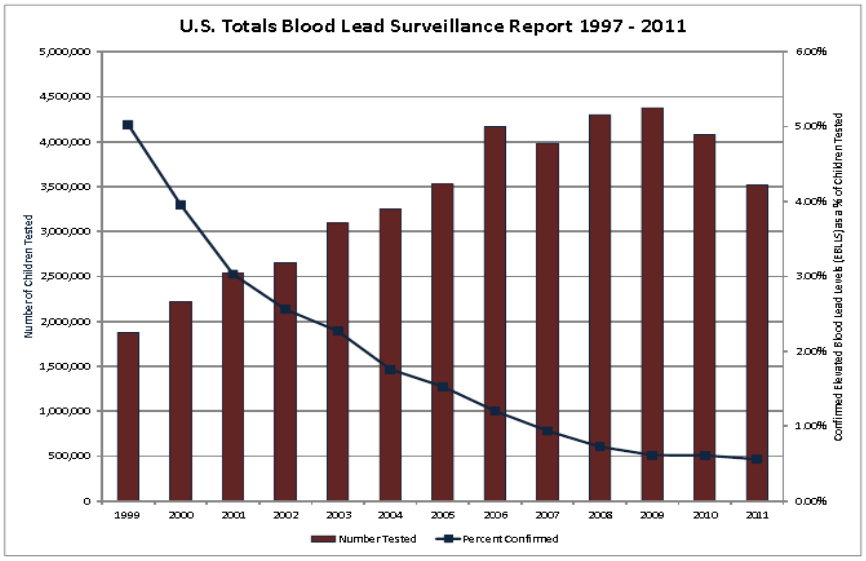
Landrigan, Phillip J., Textbook of Children's Environmental Health, Oxford Press, 2013.

Although mean blood lead levels are much lower, if every child 0 to 6 yrs old had a blood lead level of <1 ug/dl,

$1 Trillion would be contributed back to American society during their lifetimes.

Muennig. The Social Costs of Childhood Lead Exposure in the Post–Lead Regulation Era. Arch Pediatr Adolesc Med. 2009;163(9):844-849.

Lead poisoning appears to be going down, but…



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http://www.cdc.gov/nceh/lead/data/national.htm

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The US population shows extensive evidence of exposure to chemicals

- Blood and Urine analysis from participants
- First samples collected in 1999, new sample analyses and report generated ~every 2 years.

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4th National Report on Human Exposure to Environmental Chemicals, Updated Tables, January 2019, Vol 1

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Blood Lead continues a downward trend- slowly

Blood Lead (1999 – 2010)

CAS Number 7439-92-1

Geometric mean and selected percentiles of blood concentrations (in µg/dL) for the U.S. population from the National Health and Nutrition Examination Survey.

Categories (Survey Years)	Geometric Mean (95% conf. interval)	50th Percentile (95% conf. interval)	75th Percentile (95% conf. interval)	90th Percentile (95% conf. interval)	95th Percentile (95% conf. interval)	Sample Size
Total population (1999 - 2000)	1.66 (1.60-1.72)	1.60 (1.60-1.70)	2.50 (2.40-2.60)	3.80 (3.60-4.00)	5.00 (4.70-5.50)	7970
Total population (2001 - 2002)	1.45 (1.39-1.51)	1.40 (1.40-1.50)	2.20 (2.10-2.30)	3.40 (3.20-3.60)	4.50 (4.20-4.70)	8945
Total population (2003 - 2004)	1.43 (1.36-1.50)	1.40 (1.30-1.50)	2.10 (2.10-2.20)	3.20 (3.10-3.30)	4.20 (3.90-4.40)	8373
Total population (2005 - 2006)	1.29 (1.23-1.36)	1.27 (1.20-1.34)	2.01 (1.91-2.11)	3.05 (2.86-3.22)	3.91 (3.64-4.18)	8407
Total population (2007 - 2008)	1.27 (1.21-1.34)	1.22 (1.18-1.30)	1.90 (1.80-2.00)	2.80 (2.67-2.96)	3.70 (3.50-3.90)	8266
Total population (2009 - 2010)	1.12 (1.08-1.16)	1.07 (1.03-1.12)	1.70 (1.62-1.77)	2.58 (2.45-2.71)	3.34 (3.14-3.57)	8793

Blood Lead (2011 – 2016)

CAS Number 7439-92-1

Geometric mean and selected percentiles of blood concentrations (in µg/dL) for the U.S. population from the National Health and Nutrition Examination Survey.

Categories (Survey Years)	Geometric Mean (95% conf. interval)	50th Percentile (95% conf. interval)	75th Percentile (95% conf. interval)	90th Percentile (95% conf. interval)	95th Percentile (95% conf. interval)	Sample Size
Total population (2011 - 2012)	.973 (.916-1.04)	.930 (.880-.980)	1.52 (1.41-1.61)	2.38 (2.17-2.61)	3.16 (2.77-3.68)	7920
Total population (2013 - 2014)	.858 (.813-.906)	.830 (.780-.870)	1.32 (1.24-1.42)	2.10 (1.96-2.30)	2.81 (2.49-3.14)	5215
Total population (2015 - 2016)	.820 (.772-.872)	.780 (.740-.840)	1.32 (1.21-1.42)	2.14 (2.02-2.24)	2.75 (2.50-2.98)	4988

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4th National Report on Human Exposure to Environmental Chemicals, Updated Tables, January 2019, Vol 1

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Blood Lead Screening Rate Region 7: 2012 – 2017

Blood Lead Levels (µg/dL) among U.S. Children < 72 Months of Age, by State, Year, and Blood Lead Level (BLL) Group

Year	State	Total Population of Children < 72 Months of Age	Number of Children Tested < 72 Months of Age	Percentage of Children Tested < 72 Months of Age	Children with Confirmed BLLs ≥ 5 µg/dL		Children with Confirmed BLLs ≥ 10 µg/dL	
					Number	Percent	Number	Percent
2012	Iowa	238,018	47,155	19.8%	3,045	6.5%	300	0.6%
2013		N/A	N/A	N/A	N/A	N/A	N/A	N/A
2014		N/A	N/A	N/A	N/A	N/A	N/A	N/A
2015		N/A	N/A	N/A	N/A	N/A	N/A	N/A
2016		N/A	N/A	N/A	N/A	N/A	N/A	N/A
2017		N/A	N/A	N/A	N/A	N/A	N/A	N/A
2012	Kansas	243,692	24,228	9.9%	538	2.2%	138	0.6%
2013		N/A	N/A	N/A	N/A	N/A	N/A	N/A
2014		N/A	N/A	N/A	N/A	N/A	N/A	N/A
2015		N/A	N/A	N/A	N/A	N/A	N/A	N/A
2016		N/A	N/A	N/A	N/A	N/A	N/A	N/A
2017		N/A	N/A	N/A	N/A	N/A	N/A	N/A
2012	Missouri	458,744	89,344	19.5%	2,588	2.9%	600	0.7%
2013		454,749	105,286	23.2%	2,686	2.6%	634	0.6%
2014		453,154	131,391	29.0%	3,118	2.4%	559	0.4%
2015		451,955	83,161	18.4%	1,816	2.2%	423	0.5%
2016		451,997	93,585	20.7%	1,938	2.1%	516	0.6%
2017		450,038	83,780	18.6%	1,619	1.9%	444	0.5%
2012	Nebraska	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2013		N/A	N/A	N/A	N/A	N/A	N/A	N/A
2014		N/A	N/A	N/A	N/A	N/A	N/A	N/A
2015		N/A	N/A	N/A	N/A	N/A	N/A	N/A
2016		N/A	N/A	N/A	N/A	N/A	N/A	N/A
2017		N/A	N/A	N/A	N/A	N/A	N/A	N/A

Report: CDC National Childhood Blood Lead Surveillance Data, https://www.cdc.gov/nceh/lead/data/national.htm
Table URL: https://www.cdc.gov/nceh/lead/docs/CBLS-National-Table-Update-042619.xlsx

Kansas Blood Lead screening rate remains low

County	2010 (Rate per 1000)	2011 (Rate per 1000)	2012 (Rate per 1000)	2013 (Rate per 1000)	2014 (Rate per 1000)	Population of Kids <6 Years (2013-2017 ACS 5-Year Estimate)
Sedgwick	4084 (90.3)	4815 (104.6)	4057 (86.6)	3525 (74.8)	5221 (109.6)	45,627
Johnson	3862 (84.8)	3881 (84.8)	3004 (65.1)	3522 (75.8)	3460 (74.38)	46,646
Wyandotte	3515 (228.9)	3558 (227.1)	3238 (203.0)	3108 (191.8)	2704 (164.1)	16,122
Riley	492 (92.5)†	510 (87.5)*	400 (68.6)	275 (45.5)	383 (61.8)	5349
Douglas	588 (78.3)	592 (80.2)	442 (59.5)	416 (56.3)	437 (59.5)	7814
Shawnee	1556 (105.0)	1571 (106.1)	1168 (80.0)	1100 (74.5)	1764 (120.0)	14,421
KANSAS TOTAL	34,091 (143.1)	34,621 (144.35)	25,903 (106.5)	25,968 (106.3)	22,113 (90.0)	238,389

† Population estimates for 2010 were unavailable in the ACS. Population estimates for 2009 were used to calculate the screening rate.

* Population estimates for 2011 were unavailable in the ACS. Population estimates for 2012 were used to calculate the screening rate.

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Table provided by Megan Sparks, MPH, Sedgwick County Health Department
email: megan.sparks@sedgwick.gov

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Case management at Children's Mercy

600 Cases monitored since 2014:

- Average EBL – 19 ug/dL
- Most common EBL result - 19 ug/dL

32 EBL investigations performed in last 2 years

- Average # of days between referral & home investigation – 53 days
- Most common time frame – 27 days

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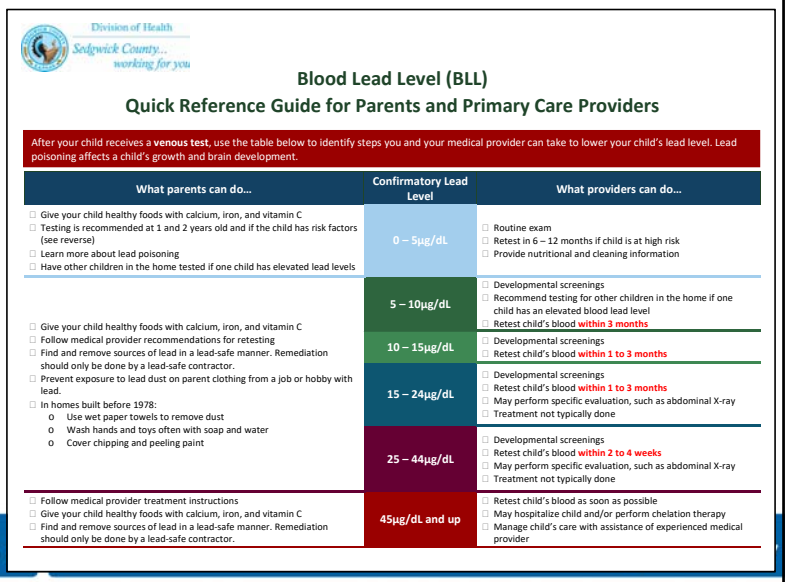
Educational reference form example from Sedgwick County Health Dept.

Form from Megan Sparks, MPH, Sedgwick County Health Department
email: megan.sparks@sedgwick.gov



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Sedgwick County... working for you

Blood Lead Level (BLL)
Quick Reference Guide for Parents and Primary Care Providers

After your child receives a **venous test**, use the table below to identify steps you and your medical provider can take to lower your child's lead level. Lead poisoning affects a child's growth and brain development.

What parents can do...	Confirmatory Lead Level	What providers can do...
☐ Give your child healthy foods with calcium, iron, and vitamin C ☐ Testing is recommended at 1 and 2 years old and if the child has risk factors (see reverse) ☐ Learn more about lead poisoning ☐ Have other children in the home tested if one child has elevated lead levels	0 – 5µg/dL	☐ Routine exam ☐ Retest in 6 – 12 months if child is at high risk ☐ Provide nutritional and cleaning information
☐ Give your child healthy foods with calcium, iron, and vitamin C ☐ Follow medical provider recommendations for retesting ☐ Find and remove sources of lead in a lead-safe manner. Remediation should only be done by a lead-safe contractor. ☐ Prevent exposure to lead dust on parent clothing from a job or hobby with lead. ☐ In homes built before 1978: o Use wet paper towels to remove dust o Wash hands and toys often with soap and water o Cover chipping and peeling paint	5 – 10µg/dL	☐ Developmental screenings ☐ Recommend testing for other children in the home if one child has an elevated blood lead level ☐ Retest child's blood **within 3 months**
	10 – 15µg/dL	☐ Developmental screenings ☐ Retest child's blood **within 1 to 3 months**
	15 – 24µg/dL	☐ Developmental screenings ☐ Retest child's blood **within 1 to 3 months** ☐ May perform specific evaluation, such as abdominal X-ray ☐ Treatment not typically done
	25 – 44µg/dL	☐ Developmental screenings ☐ Retest child's blood **within 2 to 4 weeks** ☐ May perform specific evaluation, such as abdominal X-ray ☐ Treatment not typically done
☐ Follow medical provider treatment instructions ☐ Give your child healthy foods with calcium, iron, and vitamin C ☐ Find and remove sources of lead in a lead-safe manner. Remediation should only be done by a lead-safe contractor.	45µg/dL and up	☐ Retest child's blood as soon as possible ☐ May hospitalize child and/or perform chelation therapy ☐ Manage child's care with assistance of experienced medical provider

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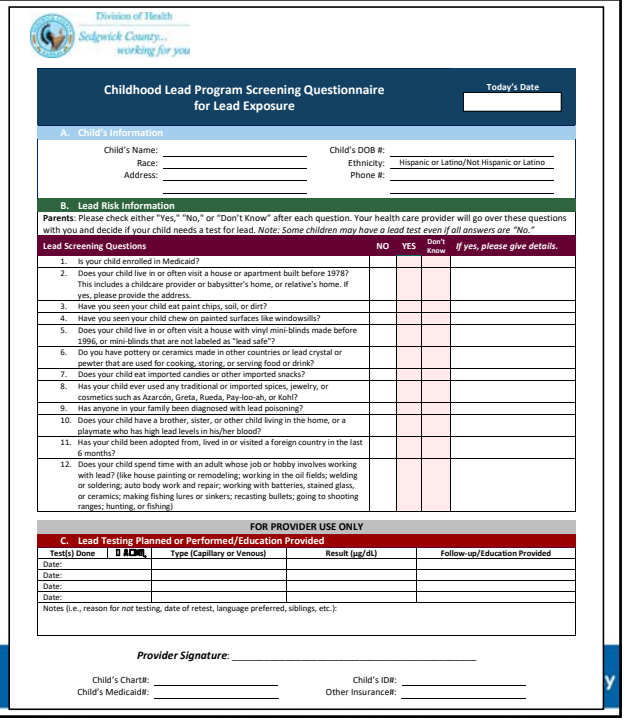
Screening form example from Sedgwick County Health Dept.

Form from Megan Sparks, MPH, Sedgwick County Health Department
email:
megan.sparks@sedgwick.gov



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Childhood Lead Program Screening Questionnaire for Lead Exposure

Today's Date

A. Child's Information

Child's Name: _____ Child's DOB #: _____
Race: _____ Ethnicity: Hispanic or Latino/Not Hispanic or Latino
Address: _____ Phone #: _____

B. Lead Risk Information

Parents: Please check either "Yes," "No," or "Don't Know" after each question. Your health care provider will go over these questions with you and decide if your child needs a test for lead. *Note: Some children may have a lead test even if all answers are "No."*

Lead Screening Questions	NO	YES	Don't Know	*If yes, please give details.*
1. Is your child enrolled in Medicaid?				
2. Does your child live in or often visit a house or apartment built before 1978? This includes a childcare provider or babysitter's home, or relative's home. If yes, please provide the address.				
3. Have you seen your child eat paint chips, soil, or dirt?				
4. Have you seen your child chew on painted surfaces like windowsills?				
5. Does your child live in or often visit a house with vinyl mini-blinds made before 1996, or mini-blinds that are not labeled as "lead safe"?				
6. Do you have pottery or ceramics made in other countries or lead crystal or pewter that are used for cooking, storing, or serving food or drink?				
7. Does your child eat imported candies or other imported snacks?				
8. Has your child ever used any traditional or imported spices, jewelry, or cosmetics such as Azarcón, Greta, Rueda, Pay-loo-ah, or Kohl?				
9. Has anyone in your family been diagnosed with lead poisoning?				
10. Does your child have a brother, sister, or other child living in the home, or a playmate who has high lead levels in his/her blood?				
11. Has your child been adopted from, lived in or visited a foreign country in the last 6 months?				
12. Does your child spend time with an adult whose job or hobby involves working with lead? (like house painting or remodeling; working in the oil fields; welding or soldering; auto body work and repair; working with batteries, stained glass, or ceramics; making fishing lures or sinkers; recasting bullets; going to shooting ranges; hunting, or fishing)				

FOR PROVIDER USE ONLY

C. Lead Testing Planned or Performed/Education Provided

Test(s) Done	☐ ACHL	Type (Capillary or Venous)	Result (µg/dL)	Follow-up/Education Provided
Date:				
Date:				
Date:				
Date:				

Notes (i.e., reason for *not* testing, date of retest, language preferred, siblings, etc.):

Provider Signature: _____

Child's Chart#: _____ Child's ID#: _____
Child's Medicaid#: _____ Other Insurance#: _____

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Lead and Lead-Based Paint

- Peeling, Chipping Paint / Deteriorated Paint
- Dust
- Soil
- Drinking water
- Consumer Products such Pottery, Cribs, Jewelry, Candle Wicks
- Cultural Items
- Contaminated Sites

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Many in the population are at risk

- Age <6 years (12-36 months)
  - Poorly developed blood-brain barrier
- Urban > Rural
- Low-income > middle-income
- Older housing (before 1978)
- Refugees
- Foster children
- Adolescents with environmental exposure

Wright et al. (2003)
CDC website
Beaucham (2014)

The most common health effects from lead exposure include

- Reduced IQ
- Learning disabilities
- Impaired hearing
- Reduced attention spans, behavior problems
- Anemia
- Kidney damage
- Damage to central nervous system
- Coma, convulsions, death

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Environmental Sources

Homes/Buildings
Lead-containing paint/pigment
Soil/dust near lead industries
Plumbing leachate
Ceramic ware (especially imported)
Leaded gasoline
Vinyl miniblinds*
lead-painted homes

Hobbies
Glazed pottery making
Target shooting at firing ranges
Lead soldering (eg, electronics)
Painting
Preparing lead shot
Stained-glass making
Car or boat repair
Home remodeling

Other sources
Folk remedies
Tobacco smoking
Cosmetics
Moonshine whiskey
Gasoline "huffing"

Lead: Age of Housing Matters

Year House Was Built	Percent of Houses with Lead-Based Paint
Before 1940	87 percent
1940-1959	69 percent
1960-1978	24 percent
All US Housing Stock	40 percent

Foreign Body Ingestion

Over 100,000 calls to Poison Control Centers each year

- Folk remedies
- Fishing sinkers
- Curtain weights
- Buckshot
- Toys (jewelry, plastic, paint)

VanArsdale et al. (2004)

A wide array of possible lead sources around the home have to be considered

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These pellets were being ground up and added to the child's food. Testing showed a very high lead concentration.

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Many occupations can cause exposure

- Plumbers, pipe fitters
- Lead miners
- Lead smelters and refiners
- Auto repairers
- Glass manufacturers
- Shipbuilders
- Printers
- Plastic manufacturers
- Police officers
- Steel welders or cutters
- Construction workers (especially renovation and rehabilitation)
- Rubber product manufacturers
- Gas station attendants (past exposure)
- Battery manufacturers
- Battery recyclers
- Bridge reconstruction workers
- Firing range instructors

KC HEALTHCORE
COMMUNITY-ORGANIZED RESOURCE EXCHANGE

KC Health CORE is a data-sharing and research consortium of regional organizations principally concerned with the mitigation of population health disparities. It grew out of an original collaboration between the UMKC Center for Economic Information and the Children's Mercy Hospital Environmental Health Program on a three-year study of the relationship between housing conditions and the risks for childhood asthma and lead poisoning, funded by a grant from the U.S. Department of Housing and Urban Development. It is presently funded as a three-year special initiative by the Health Forward Foundation with additional support provided by the Global Institute for Sustainable Prosperity, after which it will continue to operate as a self-sustaining enterprise.

KC Health CORE - the Three CORE Elements

1. IT Infrastructure and Curated Data Repository
2. The Research Consortium for Regional Health Disparities
3. Robust Community Engagement

KC Health CORE - Administrative and Research Services

KC Health CORE - Regional and Community Impact

KC Health CORE - Project Staff and Contact Information

UMKC CEI Center for Economic Information

Children's Mercy KANSAS CITY

Health Forward FOUNDATION

Global Institute for Sustainable Prosperity
People. Planet. Prosperity.

MARC
MID-AMERICA REGIONAL COUNCIL

Lead Poisoning and Housing Conditions

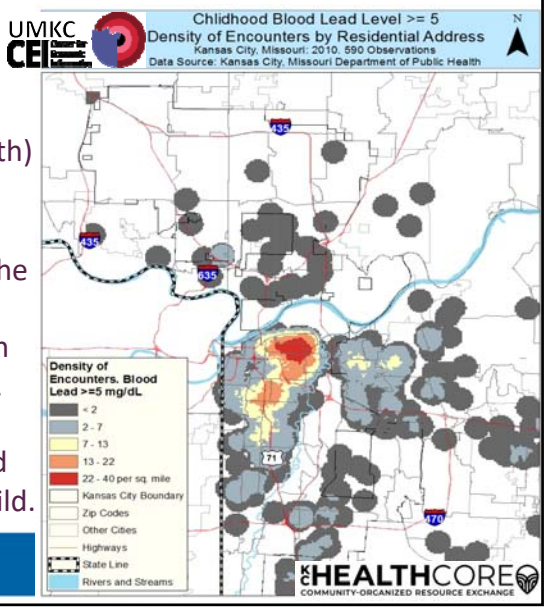
PhD dissertation- Neal Wilson, UMKC-CEI, 2017

Geo-code Health Data 2000-2015:

Lead testing data (KCMO Health) – 120,000+ lead tests

Blood lead testing results for the pediatric population on the KCMO side of the metropolitan area for the years 2000 - 2012.

Individual encounters matched to the home address of the child.



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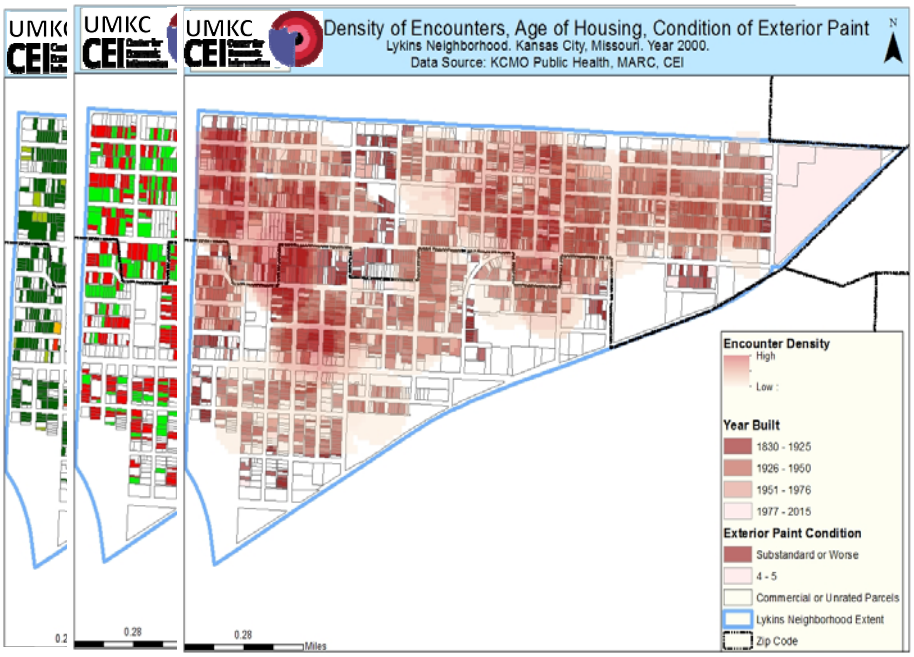
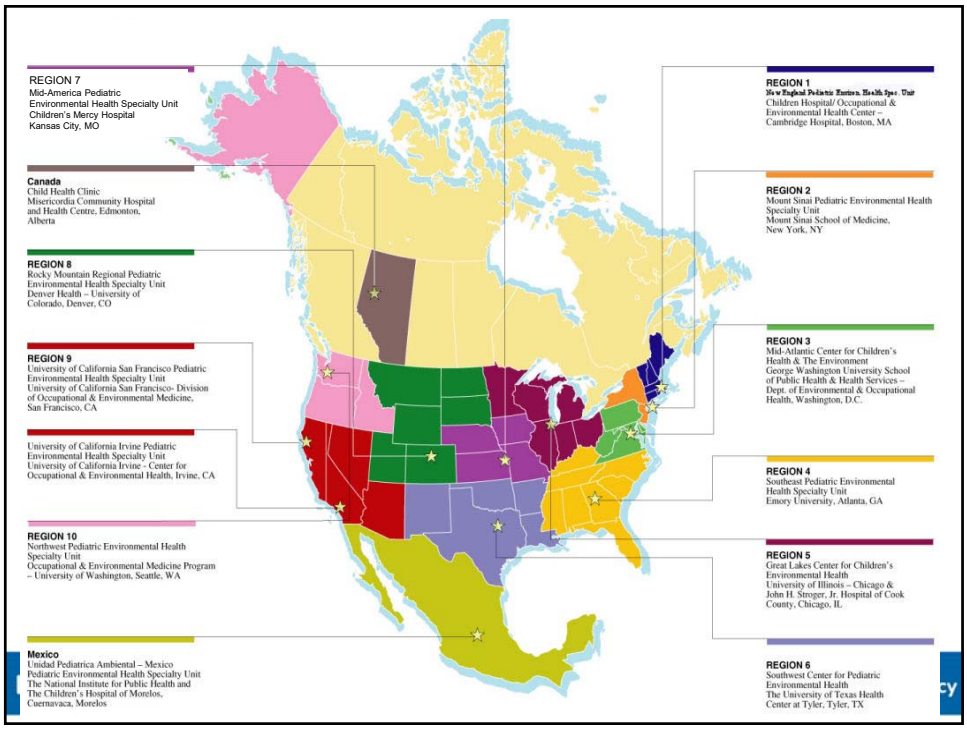


Based on PhD dissertation work of Neal Wilson, UMKC-CEI, 2017

Children's Mercy

Pediatric Environmental Health Specialty Unit (PEHSU)

- PEHSU sites are a collaboration between pediatrics, medical toxicology and reproductive medicine funded through a cooperative agreement between ATSDR and ACMT (West) and AAP (East)
- A typical PEHSU staff includes a regional director, dedicated staff, core and regional consultants and a call center.
- The Regional Director must have expertise in pediatric environmental health and board certification in Peds., MT, OB/Gyn, Occ. or Prev. Med and/or Fam. Prac.



Thanks for Listening!

Kevin Kennedy
kkennedy@cmh.edu

Mid-America PEHSU (Region 7)
Phone: (913) 588-6638
Toll Free: (800) 421-9916
E-mail: mapehsu@cmh.edu
Website: http://www.childrensmercy.org/mapehsu

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