

# LEAD POISONING in the 21<sup>st</sup> Century

## *Putting Guidelines into Practice*

### **Jerome A. Paulson, MD, FAAP**

Professor of Pediatrics & Environmental & Occupational Health

*George Washington University*

Medical Director for National & Global Affairs

Child Health Advocacy Institute

Director, Mid-Atlantic Center for Children's Health & the Environment

*Children's National Medical Center*



# Disclosures

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- Dr. Paulson has consulted with lawyers in lead poisoning cases



# OBJECTIVES

- After attending this session the participant will be able to
  - discuss why lead poisoning is still a problem
  - discuss the extent of lead poisoning in the US
  - explain the importance of primary prevention
  - utilize pediatric environmental health specialty units as a clinical and educational aid



# Scope of the Problem

- Have the potential to eliminate childhood lead poisoning
  - least 4 million households have children living in them that are being exposed to lead
  - About 500,000 children with blood lead levels over 5  $\mu\text{g}/\text{dL}$

<http://www.cdc.gov/nceh/lead/>



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# Primary Prevention is the Only Appropriate Approach to the Resolution of the Lead Poisoning Problem

- Screening of children may have been appropriate in the past & must continue until...
- Making housing lead-safe is what is appropriate now and in the future

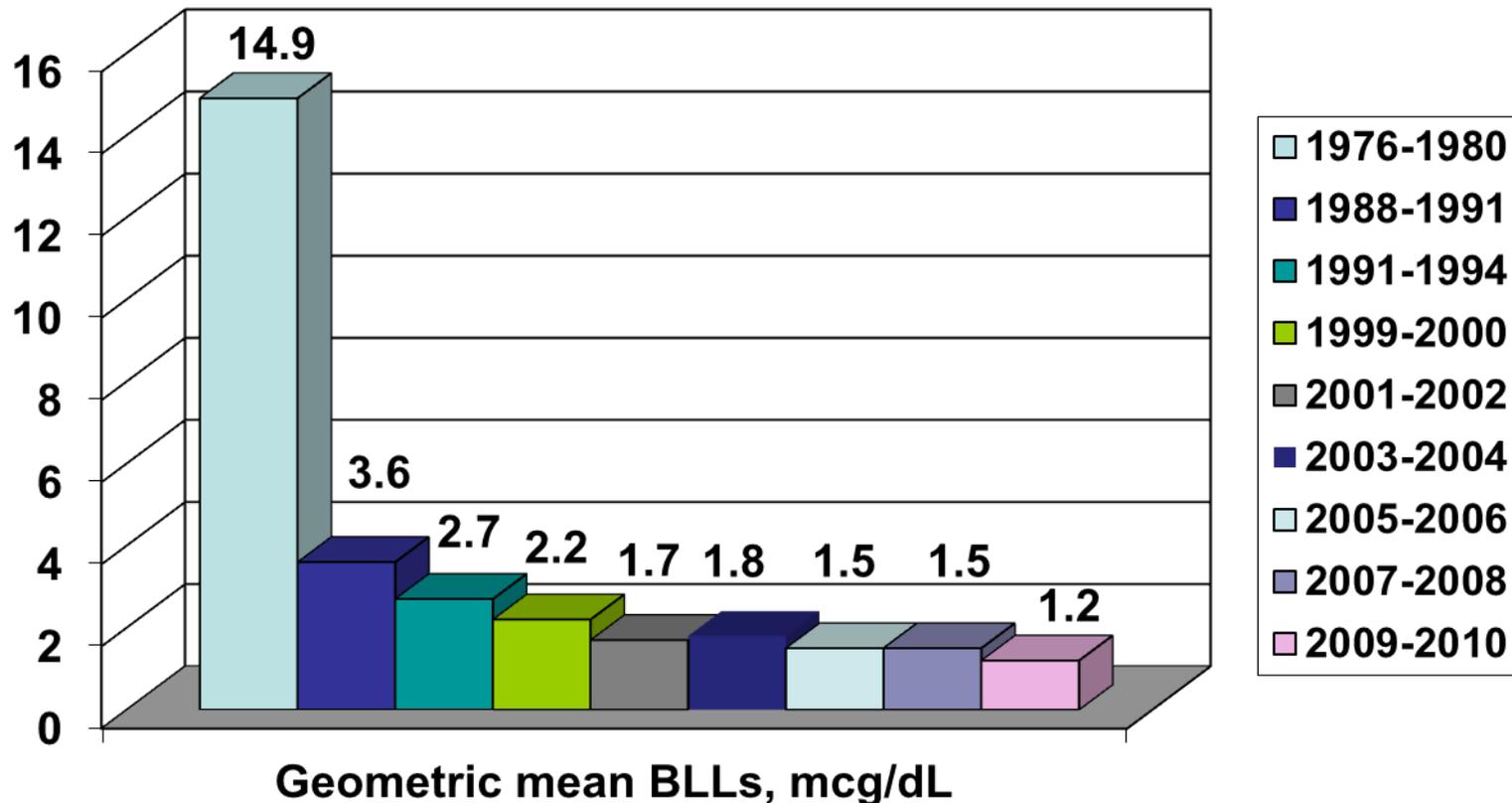


# “Low Level Lead Exposure Harms Children: A Renewed Call of Primary Prevention”

- Most recent CDC document – June 2012
- “Elimination of the use of the term “blood lead level of concern” based on the compelling evidence that low BLLs are associated **with IQ deficits, attention-related behaviors, and poor academic achievement.**”
- The absence of an identified BLL without deleterious effects, combined with the evidence that these effects appear to be irreversible, underscores the critical importance of primary prevention.



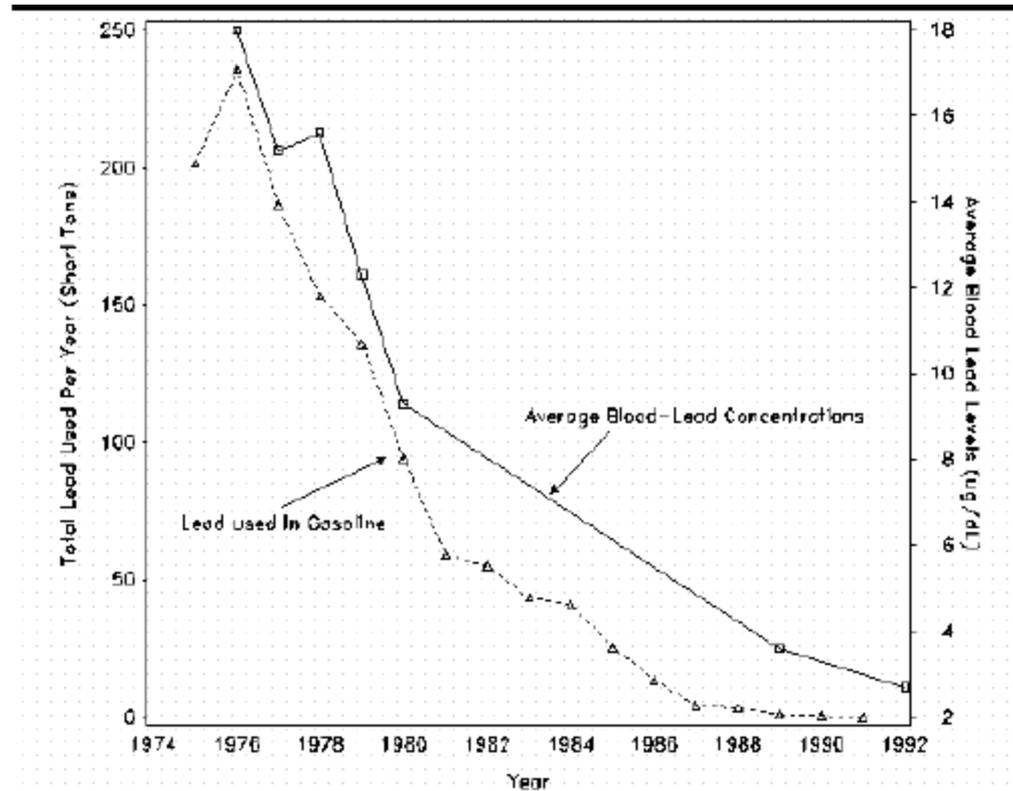
# Blood Lead Level for Children Aged 1-5 Years by Year of NHANES, US



Centers for Disease Control. (2012). Fourth National Report on Human Exposure to Environmental Chemicals: Updated Tables September 2012. Accessed at: <http://www.cdc.gov/exposurereport/>  
 Jones, R., Homa, D., Meyer, P., Brody, D., Caldwell, K., Pirkle, J., & Brown, M. (2009). Trends in blood lead levels and blood lead testing among US children aged 1 to 5 years, 1988-2004. *Pediatrics*, 123(3), e376-e385. doi:10.1542/peds.2007-3608  
 Mahaffey KR, Annett JL, Roberts J, Murphy RS. National estimates of blood lead levels: United States, 1976-1980. *N Engl J Med* 1982;307:573-9.

# Where Did Success In Lowering Lead Levels Come From?

- Gasoline
- Paint
- Cans
- Water
- Ceramics



[http://www.epa.gov/bns/lead/Fig\\_01.gif](http://www.epa.gov/bns/lead/Fig_01.gif)



# How Do Children Get Lead Poisoned Today?

- Old paint
- Lead on the ground
  - From paint
  - From past use of leaded gasoline
  - Industrial sources – smelters
  - Solder
- As lead paint becomes less common, “Other” becomes proportionately more important



# Other Potential Sources Of Lead In The Environment

- Lead glazed pottery
- Brass fittings in well pumps
- Lead water pipes
- Imported home remedies, cosmetics, spices, ayurvedic medications
- Firing ranges
- Automotive repair
- Casting ammunition, fishing weights or sinkers
- Burning lead painted wood or lead batteries

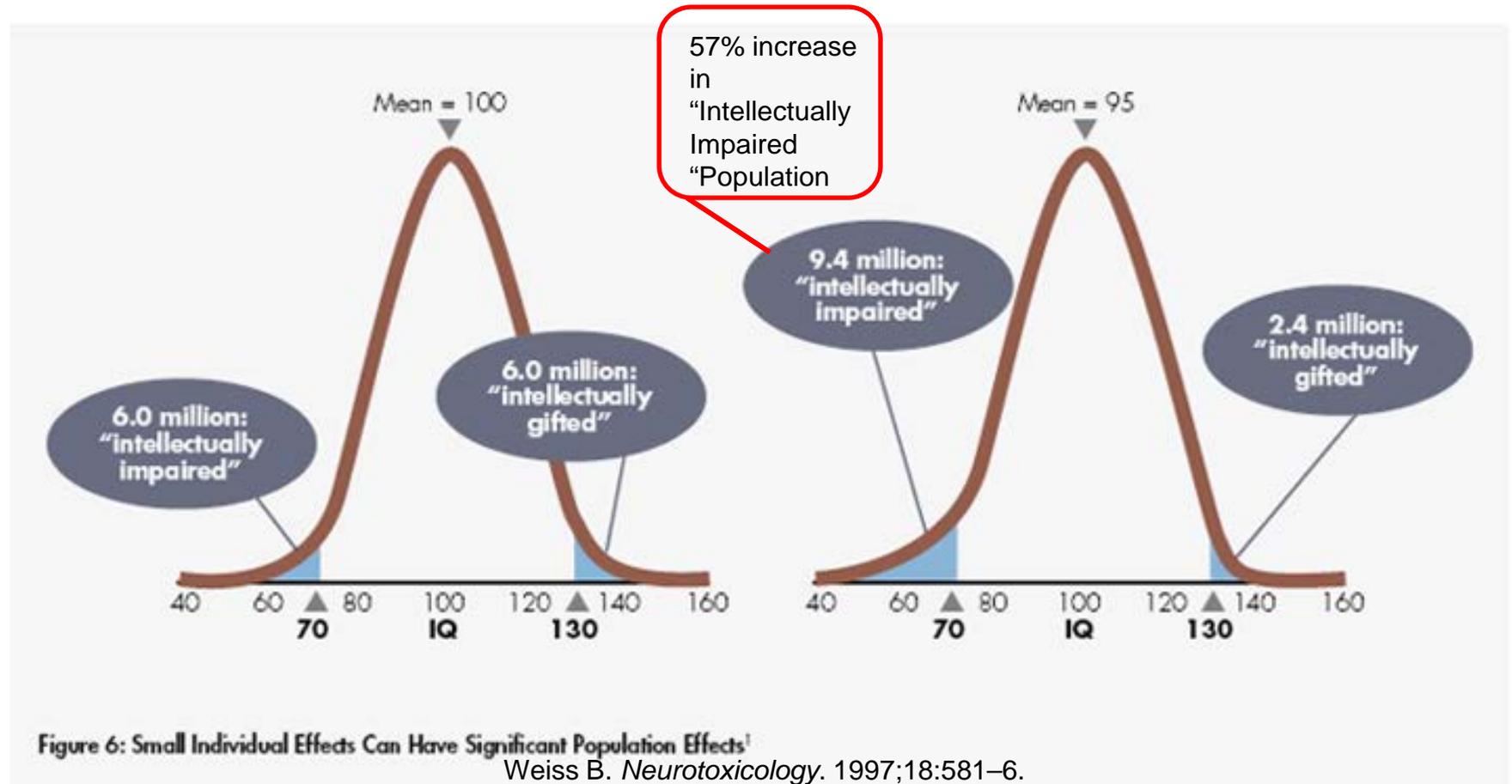


# Neurobehavioral Effects of “Low” Lead Levels

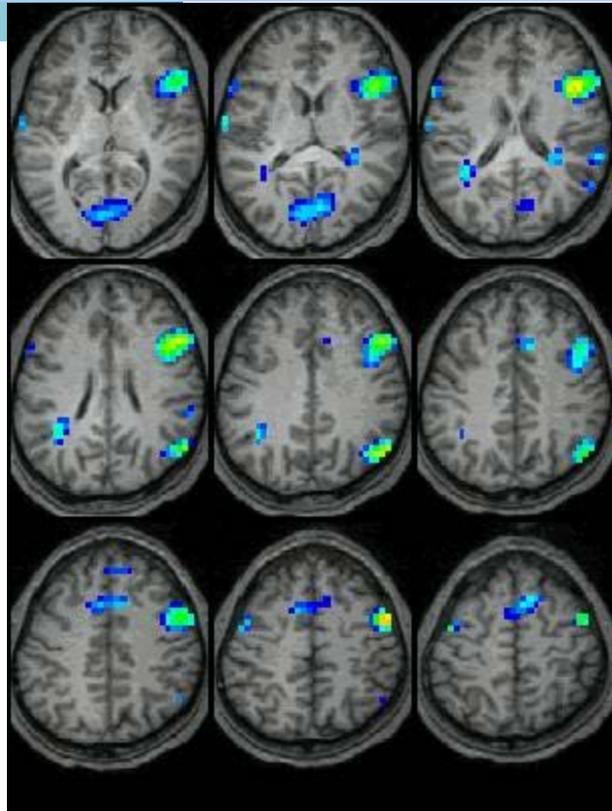
- Lowers IQ
  - Individual impact small - about 4 IQ points for blood lead levels of 2.4-10 mcg/dL
  - Population impact very significant
    - Quadruple risk of IQ < 80: 16% vs. 4%
    - 5% of low leads with IQ > 125, 0% of high leads.



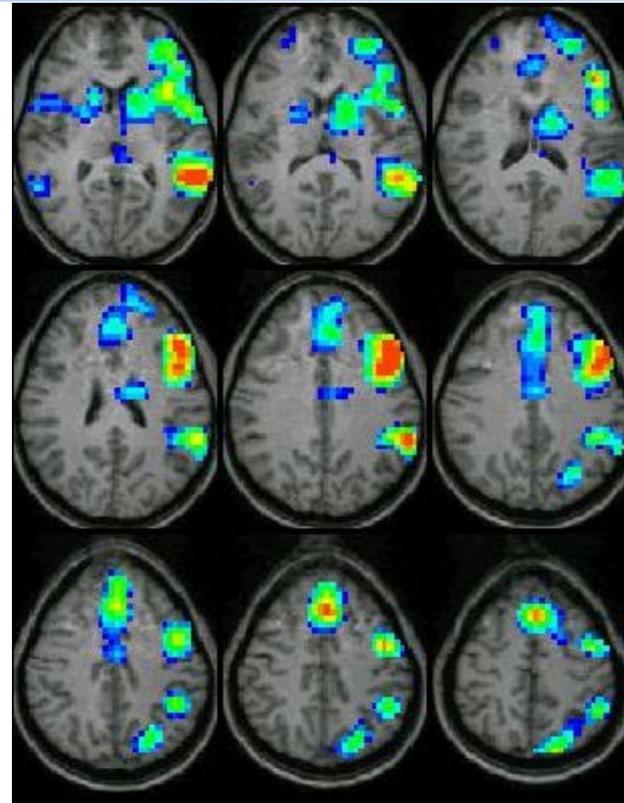
# Small Individual Effects Can Have Large Population Effects



# Childhood lead exposure has a significant and persistent impact on brain organization associated with language function



High Lifetime Mean Blood Lead (26  $\mu\text{g}/\text{dL}$ )



Low Lifetime Mean Blood Lead (7.6  $\mu\text{g}/\text{dL}$ )

Activation in left frontal cortex, adjacent to Broca's area, and left middle temporal gyrus, including Wernicke's area, were found to be significantly associated with diminished activation in subjects with higher mean childhood blood lead levels, whereas the compensatory activation in the right hemisphere homolog of Wernicke's area was enhanced in subjects with higher blood lead levels.

Yuan, et al. 2006



# What Is The Current Blood Lead Reference Value?

5  $\mu\text{g}/\text{dL}$



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# Case 1

- This is a 2-year old Hispanic male who had a blood lead level of 42 mcg/dL on a routine screening test.
- What do you want to know?



# Case 1

- Where does he live?
- How old is the home?
- Is there any lead in the water?
- What other exposures could there be?

# Case 1

- Possible exposure sources in Hispanic families
  - candy produced in Mexico (tamarind candy)
  - pottery
  - folk remedies used in some Hispanic households to treat "empacho,"
    - lead oxide, a yellow-orange powder (greta),
    - lead tetroxide, a bright orange powder (azarcon(also known as reuda, liga, coral, alarcon and maria luisa)

CDC. Lead Poisoning Associated with Ayurvedic Medications---Five States, 2000--2003. *MMWR*. July 9, 2004; 53(26):582-584.



# Role of Primary Care Pediatrician

- Clinicians should be a reliable source of information on lead hazards and take the primary role in educating families about preventing lead exposures. This includes recommending environmental assessments PRIOR to blood lead screening of children at risk for lead exposure.

CDC Response to Advisory Committee on Childhood Lead Poisoning Prevention Recommendations in *"Low Level Lead Exposure Harms Children: A Renewed Call of Primary Prevention"* 05-12

# PEHSUs' Recommendations for Operationalizing the New CDC Recommendations

- **BLL < 5 mcg/dL**
  - **Review lab results with family.** For reference, the geometric mean blood lead level for children 1-5 years old is less than 2 mcg/dL .
  - **Repeat the blood lead level in 6-12 months if the child is at high risk or risk changes during the timeframe.** Ensure levels are done at 1 and 2 years of age.
  - **For children screened at age < 12 months, consider retesting in 3-6 months as lead exposure may increase as mobility increases.**
  - **Perform routine health maintenance** including assessment of nutrition, physical and mental development, as well as iron deficiency risk factors.
  - **Provide anticipatory guidance on common sources of environmental lead exposure:** paint in homes built prior to 1978, soil near roadways or other sources of lead, take-home exposures related to adult occupations, imported spices, cosmetics, folk remedies, and cookware.



# PEHSUs' Recommendations for Operationalizing the New CDC Recommendations

- **BLL 5-14 mcg/dL**
  - Perform steps as described above for levels < 5 mcg/dL.
  - **Re-test venous blood lead level within 1-3 months** and then if stable or decreasing, in 3 months. Refer patient to local health authorities if such resources are available. Contact the CDC at 800-CDC-INFO (800-232-4636) or the National Lead Information Center at 800-424-LEAD (5323) for resources.
  - **Take a careful environmental history.** Take care to consider other children who may be exposed.
  - **Provide nutritional counseling related to calcium and iron.**
  - **Ensure iron sufficiency with adequate laboratory testing (CBC, Ferritin, CRP) and treatment per AAP guidelines.** Consider starting a multivitamin with iron.
  - **Perform structured developmental screening evaluations at child health maintenance visits,** as lead's effect on development may manifest over years.



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# MACCHE

- Region 3
- Pennsylvania, Delaware, Maryland, Virginia, West Virginia, & the District of Columbia
- **1-866-622-2431**
- **202-476-4829**
- **macche@childrensnational.org**
- **www.childrensnational.org/MACCHE**

