



**National Center for
Healthy Housing**

Creating healthy and safe homes for children through practical and proven steps.

CDC Blood Lead Reference Value, Lead Exposure, and Primary Prevention

David E. Jacobs, PhD, CIH
Research Director
June 2012



Outline

- New National Toxicology Program and other reviews of lead
- State of Childhood Lead Exposure – 2012
- Blood Lead, Lead Toxicity, and Lead Exposure
- Responsibilities and Collaboration – clinical, exposure assessment, hazard control
- Resources and Cost/Benefit
- 2012 Declaration and CHPAC Letter
- Conclusions – *Making primary prevention real*



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National Toxicology Program

U.S. Department of Health and Human Services

NTP MONOGRAPH ON HEALTH EFFECTS OF LOW-LEVEL LEAD

June 13, 2012

Office of Health Assessment and Translation
Division of the National Toxicology Program
National Institute of Environmental Health Sciences
National Institutes of Health
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES



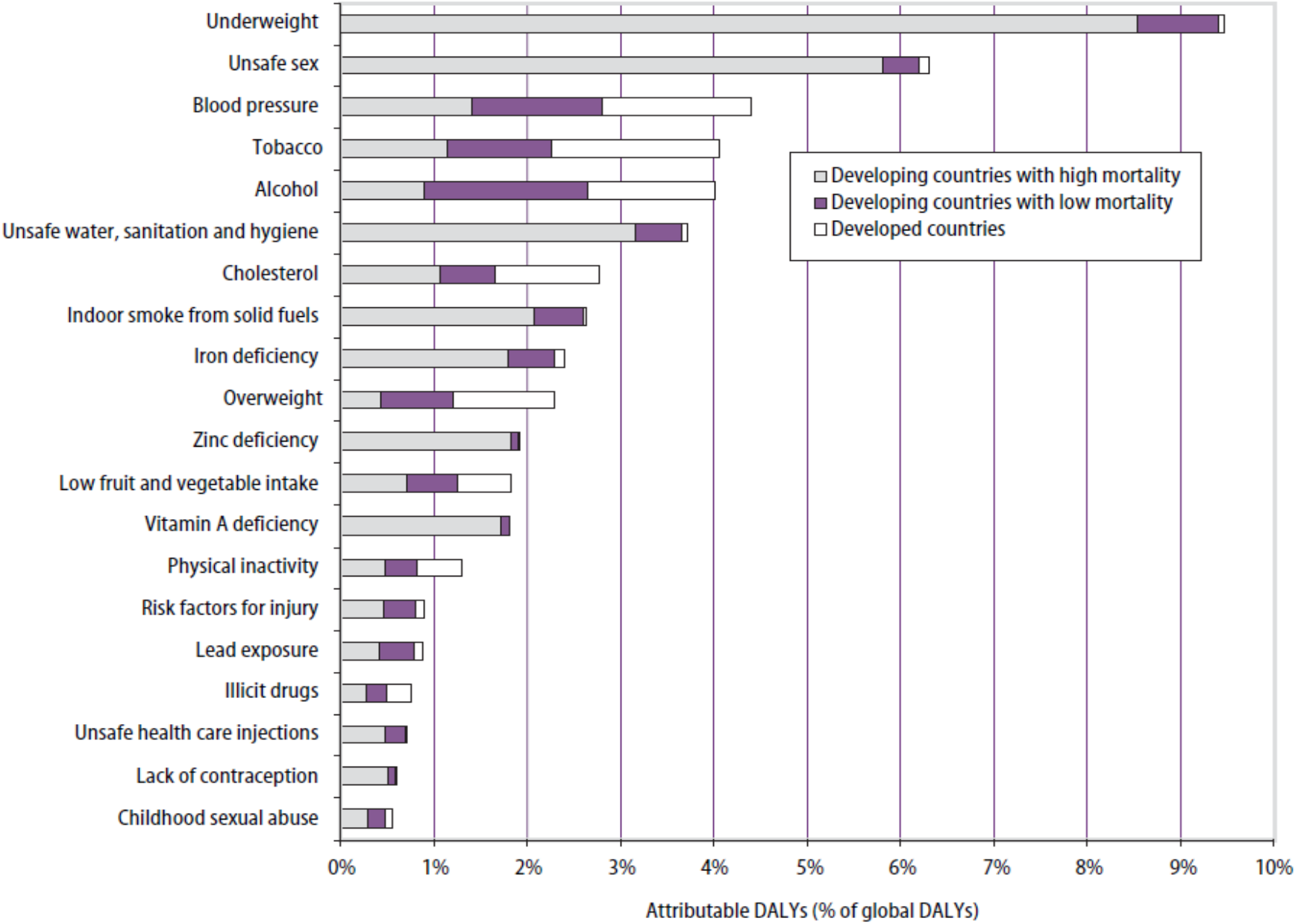
NTP concludes sufficient evidence for academic achievement, cognition, ADHD, behavior at $<5 \mu\text{g/dL}$

http://ntp.niehs.nih.gov/NTP/ohat/Lead/Final/MonographHealthEffectsLowLevelLead_prepublication_508.pdf

Table 1.1: NTP conclusions on health effects of low-level Pb by life stage

| Life Stage | Blood Pb Level | NTP Conclusion | Principal Health Effects |
|------------|----------------------|-------------------|---|
| Children | $<5 \mu\text{g/dL}$ | <i>Sufficient</i> | Decreased academic achievement, IQ, and specific cognitive measures; increased incidence of attention-related behaviors and problem behaviors |
| | | <i>Limited</i> | Delayed puberty and decreased kidney function in children ≥ 12 years of age |
| | $<10 \mu\text{g/dL}$ | <i>Sufficient</i> | Delayed puberty, reduced postnatal growth, decreased IQ, and decreased hearing |
| | | <i>Limited</i> | Increased hypersensitivity/allergy by skin prick test to allergens and increased IgE* (not a health outcome) |
| | | <i>Inadequate</i> | Any age - asthma, eczema, nonallergy immune function, cardiovascular effects; <12 years of age - renal function |

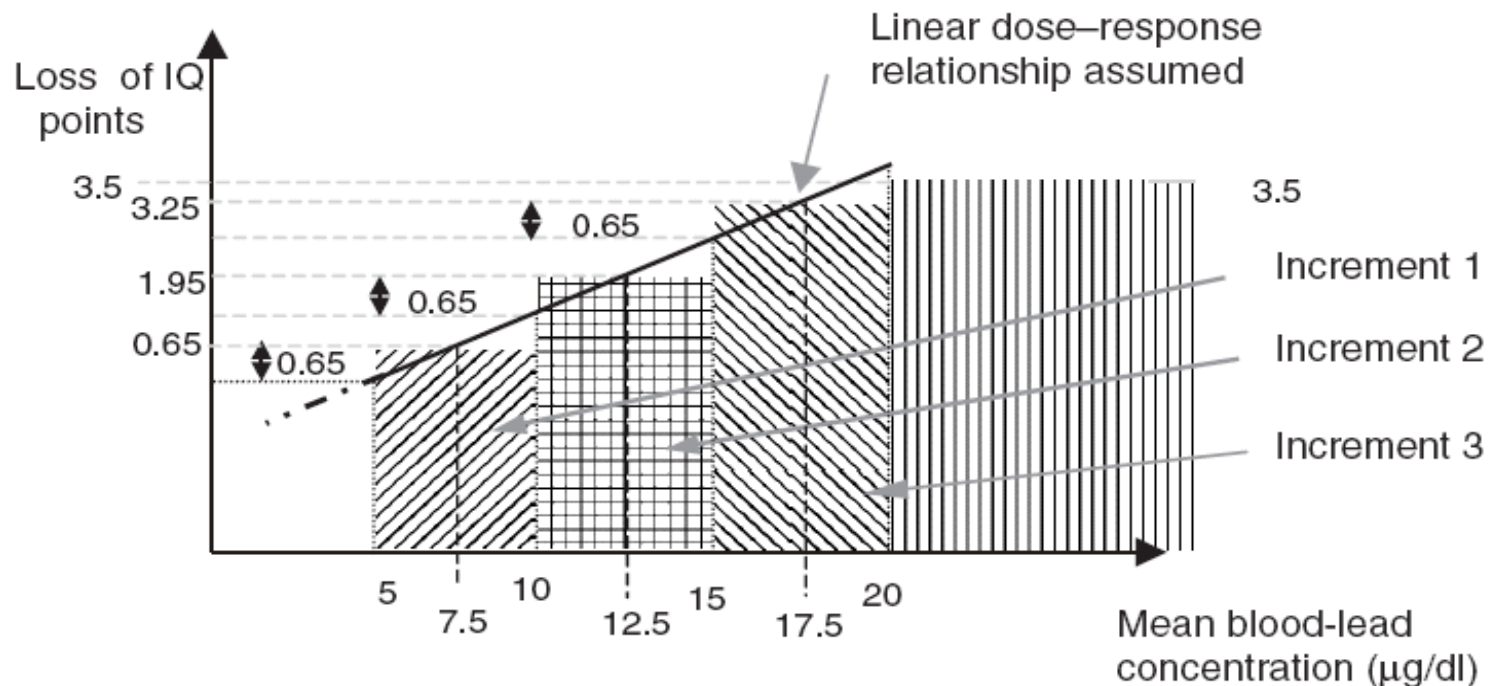
Figure 4.9 Global distribution of burden of disease attributable to 20 leading selected risk factors





2003 WHO Analysis

Figure 19.3 Decrease in IQ points per increment increase in blood-lead concentration (“best estimate”)





More Recent Data on $\text{PbB} < 10 \mu\text{g/dL}$

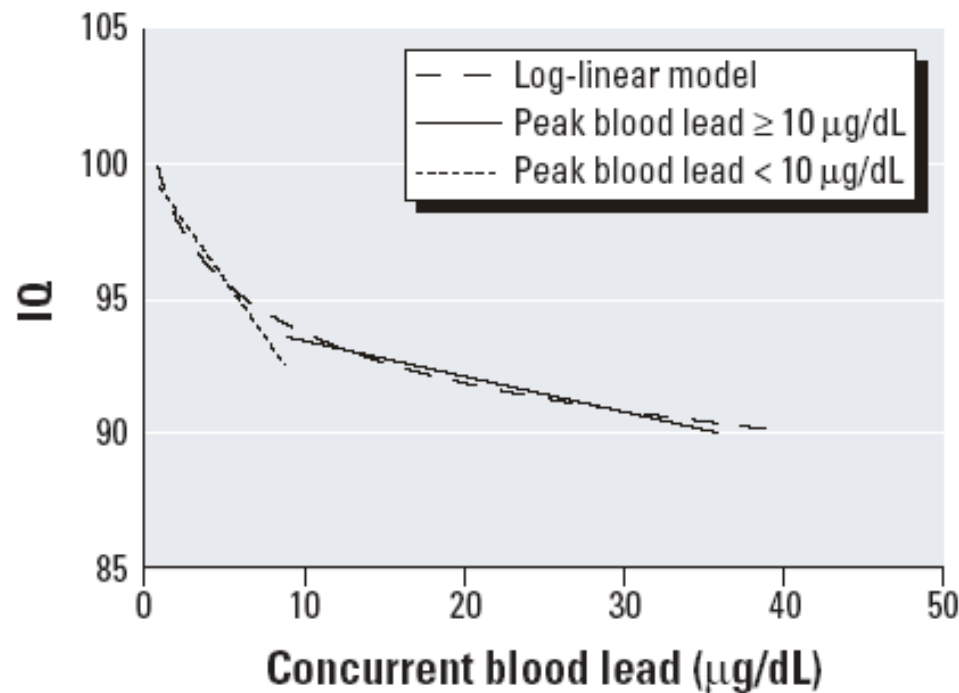


Figure 4. Log-linear model for concurrent blood lead concentration along with linear models for concurrent blood lead levels among children with peak blood lead levels above and below $10 \mu\text{g/dL}$.



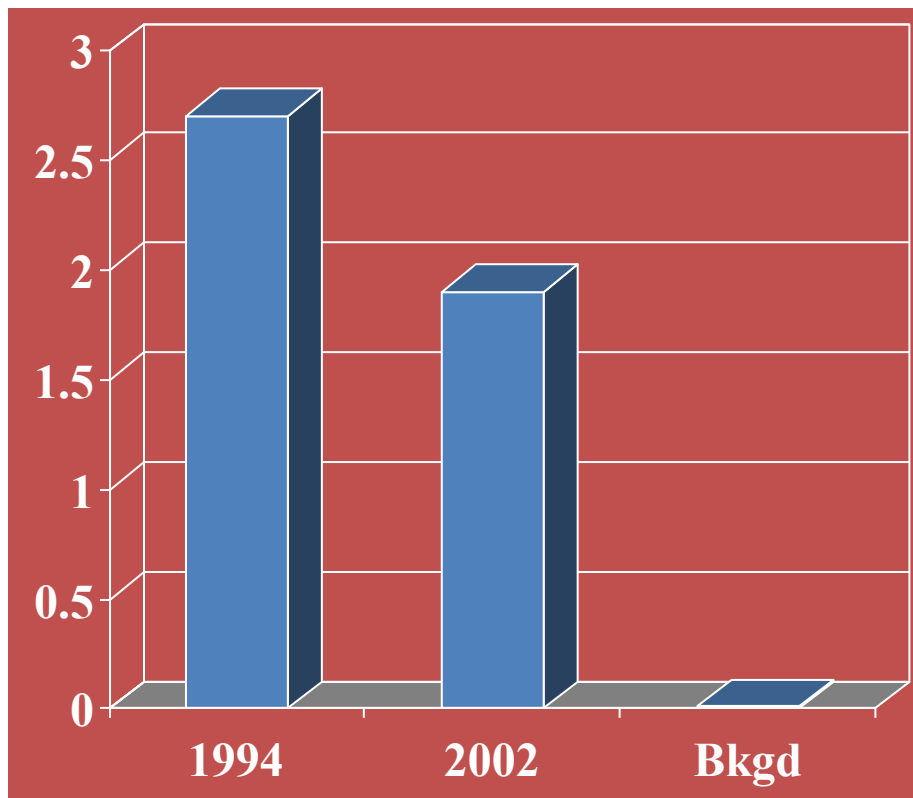
Reference Value vs. Reference Dose

- The CDC lead reference value is the 97.5th percentile of the blood lead distribution
- The EPA reference dose is an estimate (including uncertainty) of a daily oral intake that is likely to not result in adverse health effects during a lifetime.
- Why did EPA never establish a reference dose for lead?



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“Natural” Background Blood Lead Levels Were 100 Time Lower Than Now Despite Progress, Exposures Are Still Large



NHANES 1999-2004 Mean
Blood Lead = 1.9 µg/dL
(Jones et al. 2009. Pediatrics)

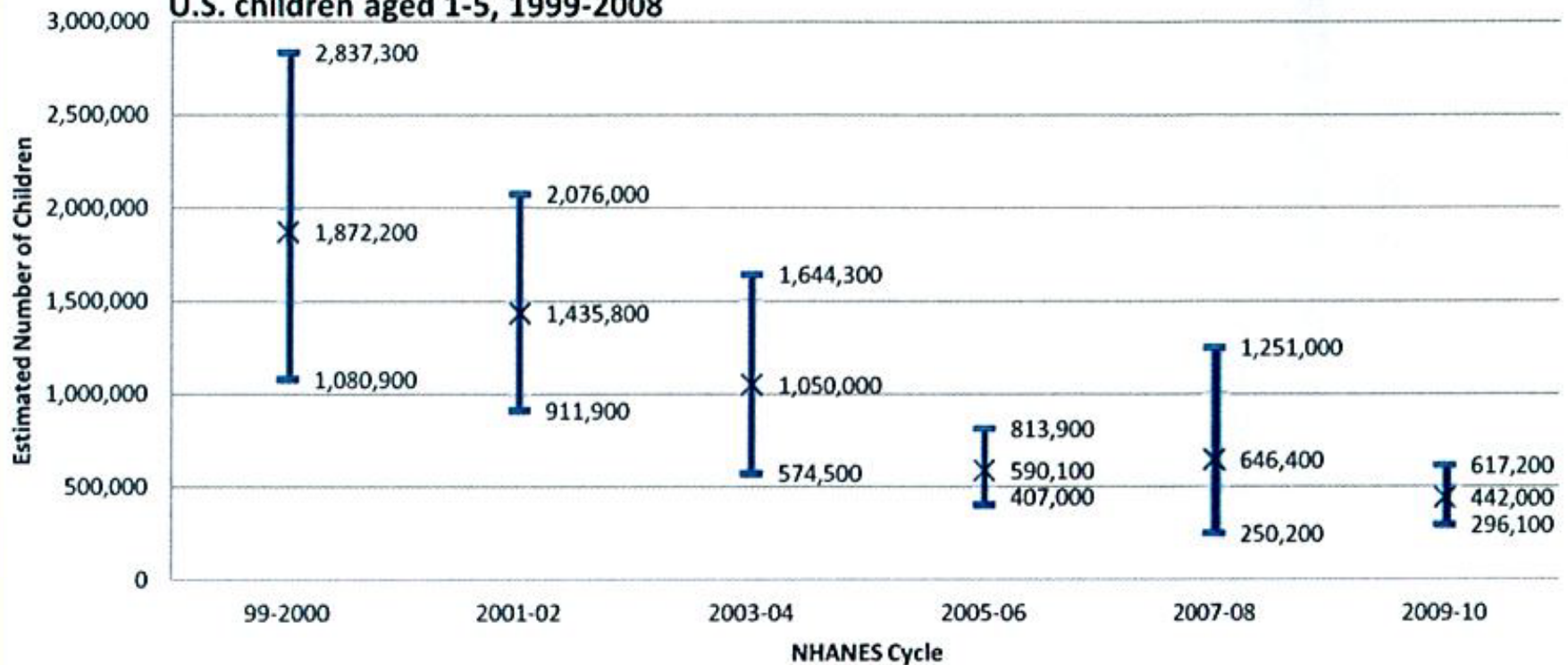
■ Mean Blood Lead

**Bkgd = 0.016 ug/dL
(Flegal 1986)**



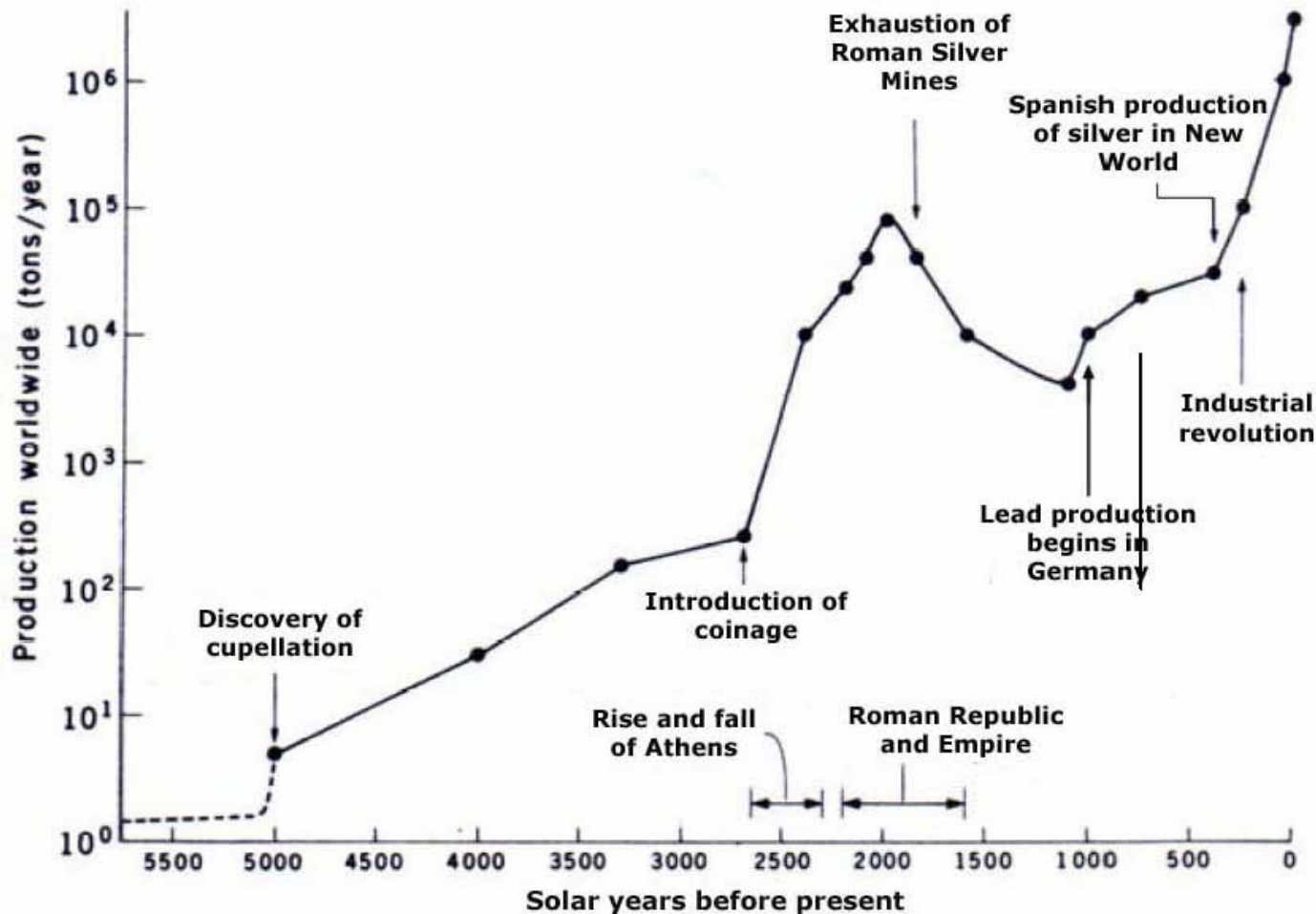
Recent NHANES Data

NHANES estimates and 95% confidence intervals of prevalence of blood lead ≥ 5 among U.S. children aged 1-5, 1999-2008



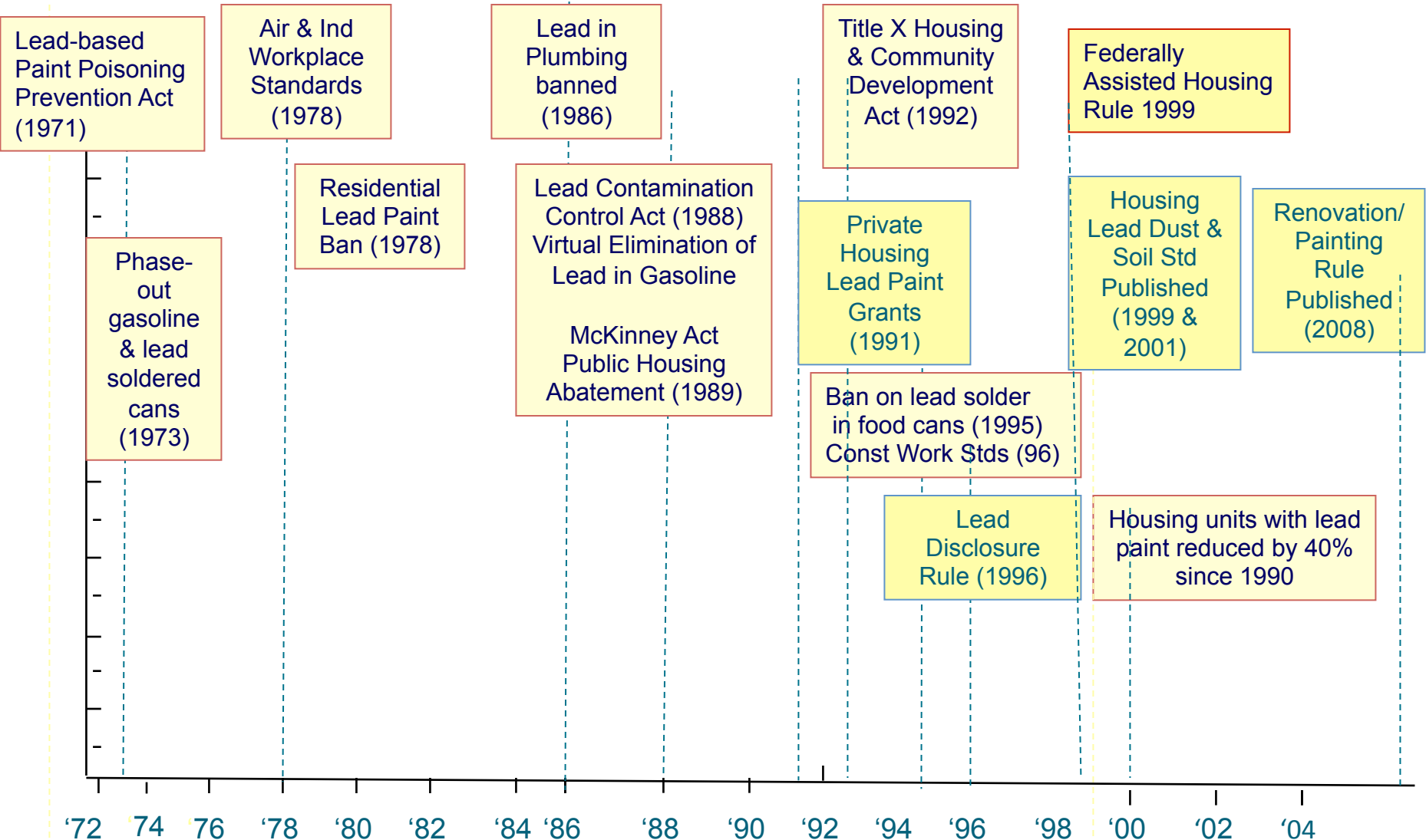


Long-Term Lead Production Increase





U.S. Selected Lead Poisoning Prevention Policies





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Lead is a Multi-Media Pollutant

Lead Exposures in U.S. Children, 2008: Implications for Prevention

Ronnie Levin,¹ Mary Jean Brown,² Michael E. Kashtock,³ David E. Jacobs,^{4} Elizabeth A. Whelan,⁵ Joanne Rodman,⁶ Michael R. Schock,⁷ Alma Padilla,¹ and Thomas Sinks²*

¹U.S. Environmental Protection Agency, Boston, Massachusetts, USA; ²Centers for Disease Control and Prevention, Atlanta, Georgia, USA; ³Food and Drug Administration, Washington, DC, USA; ⁴Department of Housing and Urban Development, Washington, DC, USA; ⁵National Institute for Occupational Safety and Health, Cincinnati, Ohio, USA; ⁶U.S. Environmental Protection Agency, Washington, DC, USA; ⁷U.S. Environmental Protection Agency, Cincinnati, Ohio, USA



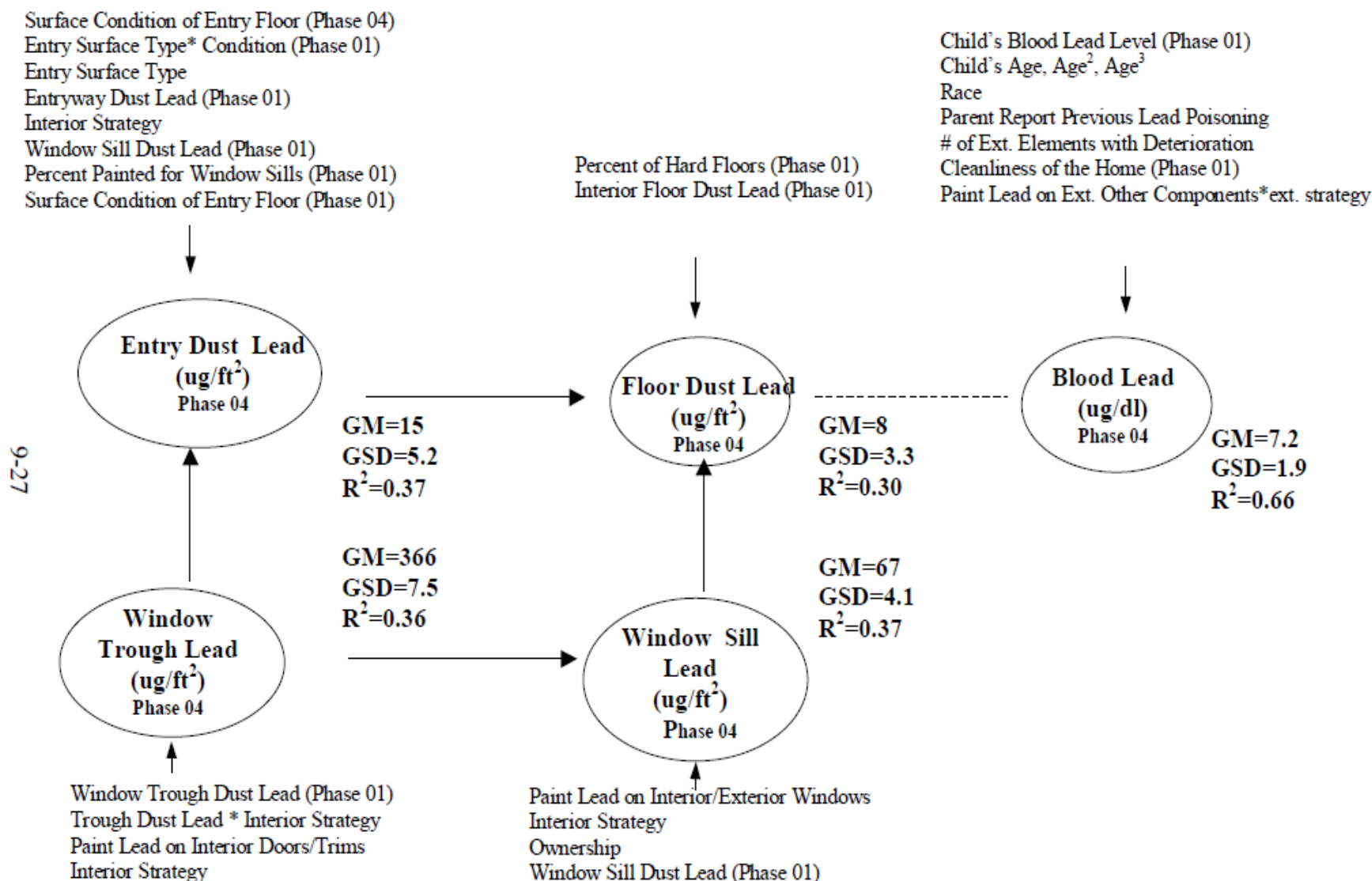
Primary Prevention

- Primary prevention is a strategy that *emphasizes the prevention* of lead exposure, rather than a response to exposure after it has take place.
- Primary prevention is necessary because the effects of lead appear to be irreversible.
- In the U.S., this will largely require that children not live in older housing with lead-based paint hazards.
- Screening children for elevated BLLs and dealing with their housing only when their BLL is already elevated should no longer be acceptable practice.

Twelve-Month Post-Intervention Lead Exposure Pathways Including Blood Lead

(Data as of: June 1, 2000)

(N = 155)



Note: Solid line indicates that a statistically significant coefficient was found.
 Dash line indicates that no statistically significant coefficient was found.
 All coefficients are significant at P<0.05



New Roles and Responsibilities

- Clinicians should monitor blood lead
- Environmental & housing professionals and allied fields should monitor lead exposures to protect all children before they are exposed
- If a child is above the reference value, it means there is an exposure(s) that must be controlled
- Risk assessors (not clinicians) should identify exposure sources and pathways and recommend needed interventions based on environmental levels



Lead Sources and Pathways

- Housing lead-based paint hazards includes settled contaminated house-dust, bare contaminated soil, and deteriorated paint
- Dust is the main pathway for most children
- Water
- Diet
- Air
- Dinnerware
- Consumer goods, folk remedies
- Nearby demolition activity
- Many others



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Number of Houses with Lead Paint

1990 – 64 Million

2000 – 38 Million

2006 – 37 Million



Source: Jacobs, et al. "Prevalence of Lead-Based Paint Hazards in Housing," *Env Health Persp.*, 110: A599-606 (2002) & HUD (2011)



How Much Lead Paint is Left?

- 7.5 billion square feet interior
- 29.2 billion square feet exterior
- Total = **36.7 billion square feet**

Source: HUD National Survey of Lead and Allergens, 2000



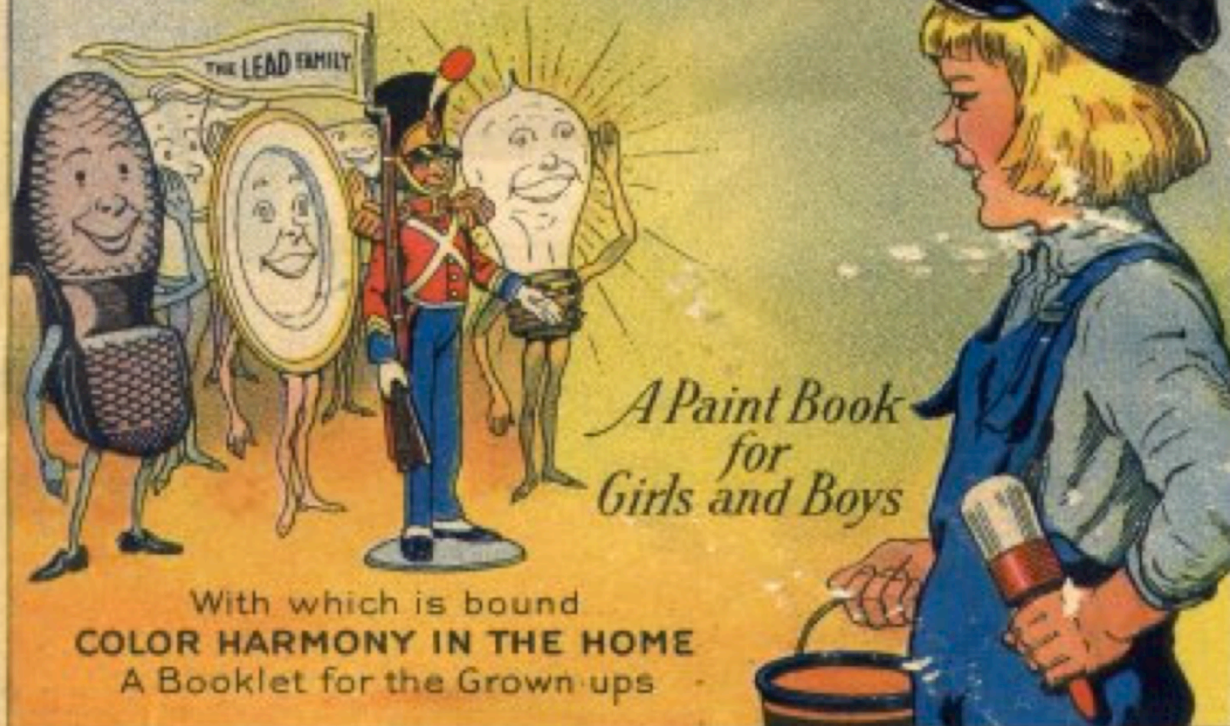
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THE DUTCH BOY'S LEAD PARTY



*A Paint Book
for
Girls and Boys*

With which is bound
COLOR HARMONY IN THE HOME
A Booklet for the Grown ups





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U.S. Dust Lead Standard (1999 & 2001)

- Floors = 40 $\mu\text{g}/\text{ft}^2$
- Interior Window Sills = 250 $\mu\text{g}/\text{ft}^2$
- Set in 1999 – 2001 based on data from mid-1990's



History of Floor PbD Standard

- Bioavailable PbD fraction
 - 200 $\mu\text{g}/\text{ft}^2$ (Farfel et al. – Baltimore Late 1980's), based on PbB of 25 $\mu\text{g}/\text{dL}$
- Total Pb PbD
 - 100 $\mu\text{g}/\text{ft}^2$ (EPA Guidance, 1995)
 - 40 $\mu\text{g}/\text{ft}^2$ (HUD Standard, 1999)
 - 40 $\mu\text{g}/\text{ft}^2$ (EPA Standard, 2001)



New Data (Cross-Sectional)

- HUD National Survey (2000)
 - Floor GM = $1 \mu\text{g}/\text{ft}^2$
 - 90th percentile (floor) $< 10 \mu\text{g}/\text{ft}^2$
- NHANES/PbD Analysis (2008)
 - 98% of homes have
 - Floor PbD $< 10 \mu\text{g}/\text{ft}^2$



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NHANES Dust Data

Research | Children's Health

Exposure of U.S. Children to Residential Dust Lead, 1999–2004: II. The Contribution of Lead-Contaminated Dust to Children's Blood Lead Levels

Sherry L. Dixon,¹ Joanna M. Gaitens,² David E. Jacobs,¹ Warren Strauss,³ Jyothi Nagaraja,³ Tim Pivetz,³ Jonathan W. Wilson,¹ and Peter J. Ashley⁴

¹National Center for Healthy Housing, Columbia, Maryland, USA; ²Healthy Housing Solutions, Inc., Columbia, Maryland, USA; ³Battelle Memorial Institute, Columbus, Ohio, USA; ⁴U.S. Department of Housing and Urban Development, Washington, DC, USA



Dust Lead Recommendations

- EPA should act on the EPA Science Advisory Board Report on residential lead dust standards (Found at: <http://tinyurl.com/7ptzrnt>)
- Parents, contractors, risk assessors and others should keep Floor PbD $< 10 \mu\text{g}/\text{ft}^2$ and Sill PbD $< 100 \mu\text{g}/\text{ft}^2$
- Local jurisdictions should consider adopting these levels



12 Year Study of Floor Dust Lead Levels with Lead-Safe Window Replacement

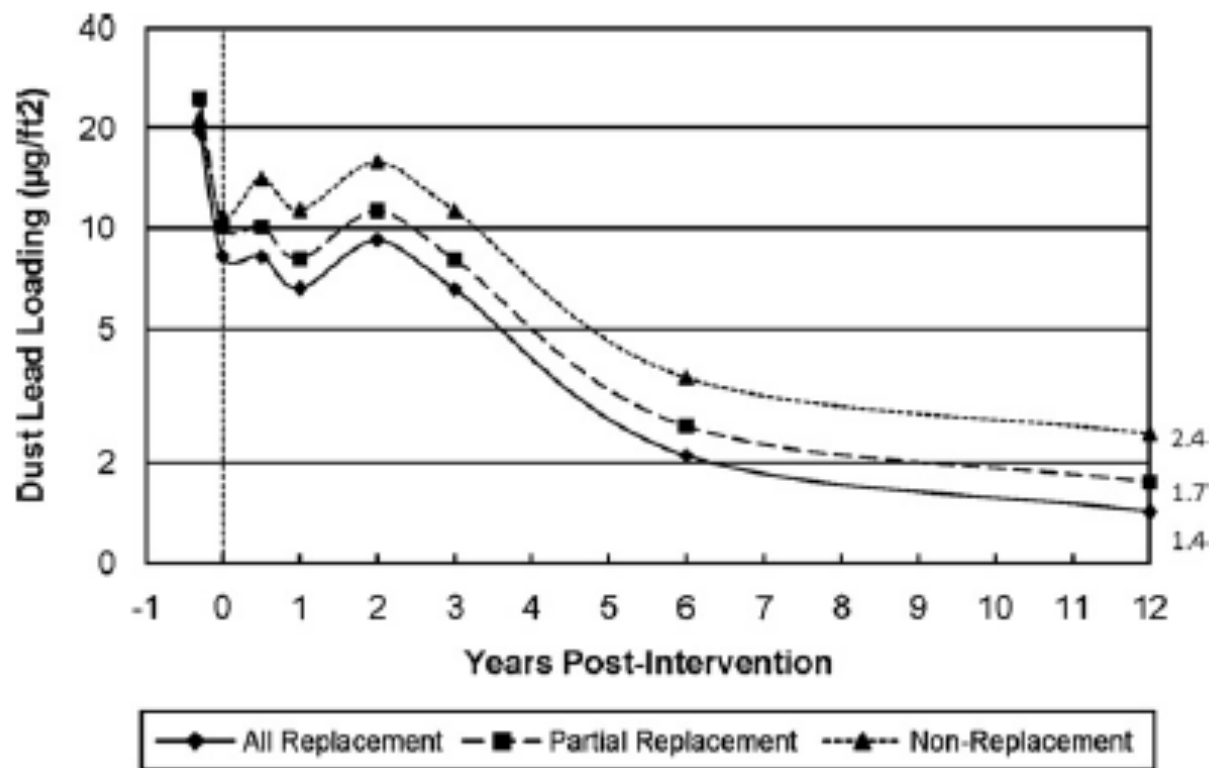


Fig. 1. Adjusted geometric mean floor dust lead loading by window replacement group from pre-intervention to 12-years post-intervention.



Economic Benefits of Lead-Safe Window Replacement

Table 3

Incremental costs and benefits of lead-safe window replacement.

| | Size of housing unit | | |
|--|---|---|--|
| | 800 ft ² Attached 7 Windows | 1200 ft ² Detached 10 Windows | 1800 ft ² Detached 16 Windows |
| Net window replacement cost | \$1953 | \$2790 | \$4464 |
| Lifetime earnings benefits per unit ^a | \$1671 | \$1671 | \$1671 |
| Appearance value | \$700 | \$1000 | \$1600 |
| Energy efficiency value | \$1301 | \$1951 | \$3250 |
| Net economic benefit | \$1719 | \$1832 | \$2057 |

^a Lifetime earnings benefit is calculated from avoided IQ loss due to lower DPb exposure (see www.nchh.org for details).



New Cost/Benefit Estimate (Gould, Env Health Persp 2009)

Each dollar invested in lead paint hazard control results in a return of \$17-\$221 or a net savings of \$181-\$269 billion (for each cohort of children < 6)

Includes: cost of lead hazard control, health care, lost lifetime earnings, tax revenue, special education, crime, and attention deficit hyperactivity disorder

Research | Children's Health

Childhood Lead Poisoning: Conservative Estimates of the Social and Economic Benefits of Lead Hazard Control

Elise Gould

Economic Policy Institute, Washington, DC, USA

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Jennifer Lowry, MD
Leyla McCurdy, MPhil

March 29, 2012

Lisa P. Jackson, Administrator
United States Environmental Protection Agency
1200 Pennsylvania Ave, NW
Washington, DC 20460

RE: Childhood Lead Poisoning Prevention

Dear Administrator Jackson:

The Children's Health Protection Advisory Committee (CHPAC) has been asked by the Office of Children's Health Protection (OCHP) to provide input on upcoming lead regulations being considered by the US Environmental Protection Agency (EPA) as well as childhood lead poisoning prevention activities across EPA and in partnership with stakeholders and other agencies. In the past, EPA has played a leadership role in reducing exposures to lead and CHPAC encourages EPA to continue. Despite this, childhood lead poisoning remains a persistent public health problem especially among children living in older, poorly maintained housing, children under the age of six years, children of color, and among high risk women who are exposed before and during pregnancy. No "safe" threshold of exposure has ever been identified. This demonstrates the need for EPA to examine its current and pending policies and programs aimed at preventing childhood lead exposure and to take action.

CHPAC is concerned that both Congress and this Administration must continue—not abandon—the battle to protect children from lead poisoning.¹ As a leader in children's health protection, your immediate and urgent attention to CHPAC's recommendations is needed. The US Centers for Disease Control and Prevention (CDC) lead poisoning prevention program for 2012 has been largely eliminated and CHPAC believes EPA and US Housing and Urban Development (HUD) programs have inadequate and increasingly fewer resources.



EPA Children's Health Protection Advisory Committee Letter (March 2012)

http://yosemite.epa.gov/ochp/ochpweb.nsf/content/chpac_childhood_lead_poison_letter.htm

- “CHPAC is concerned that both Congress and this Administration must continue—not abandon—the battle to protect children from lead poisoning. The CDC lead poisoning prevention program for 2012 has been largely eliminated and CHPAC believes EPA and HUD programs have inadequate and increasingly fewer resources.”
- The President's budget for 2012 proposed to cut in half the lead poisoning prevention program at CDC. Congress in the final budget appropriation reduced the CDC lead poisoning prevention program from \$30 million to only \$2 million. As a result, health departments' lead programs across the country may be forced to shut down as early as the summer of 2012, severely limiting the nation's ability to properly identify children who are at risk and take action before harm is done.
- Emergency Meeting of the President's Cabinet Level Task Force on Children's Environmental Health and Safety Risks



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2012 Lead Poisoning Declaration

LEHA Lead and Environmental Hazards Association

P.O. Box 535 . Olney, MD 20830 . Phone: 301.924.0804 . Fax: 301.924.0265

2012 DECLARATION OF NATIONAL LEAD POISONING PREVENTION DELEGATES

We are hundreds of delegates to the Lead and Environmental Hazards Association and the National Association of Lead and Healthy Homes Grantees representing thousands from all walks of life to assess the state of the nation's childhood lead poisoning prevention campaign. We are doctors, nurses, advocates, scientists, parents, business executives, local and state government officials, environmental professionals, inspectors, risk assessors, abatement contractors, artists and teachers, as well as citizens, taxpayers and concerned parents.

We find that the nation failed to meet the 2010 goal to eliminate childhood lead poisoning,¹ and that the disease is entirely preventable.

We find that unless we take action, millions of children will be poisoned in the coming years and that at least half a million children have excessive exposures above 5 µg/dL today², which causes long term adverse health effects.³

We find that the Centers for Disease Control and Prevention (CDC) should adopt the recommendation of its Advisory Committee on Childhood Lead Poisoning Prevention.⁴

We find that hundreds of local lead poisoning prevention activities across the nation will be forced to close this summer due to loss of CDC funding.⁵

We find that for every \$1 dollar invested in lead poisoning prevention, the nation gains up to \$221⁶, that the CDC program has a proven track record and works by enabling parents to find help for their children and by conducting many other core functions essential to the health of the nation and the world. It costs at least \$38,000 over 3 years to provide special education to a lead poisoned child,⁷ but it makes no sense to pay this cost when we could prevent it.

THEREFORE, Congress must restore the CDC program to its previous level of at least \$29 million as a separate protected line item and restore its staff capacity.

THEREFORE, the Administration must immediately provide discretionary funding to enable local lead poisoning prevention programs across the country to continue their work this year, not shut down.

THEREFORE, the Secretary of Health and Human Services and the Administrator of the U.S. Environmental Protection Agency, as co-chairs, should convene an emergency cabinet-level meeting of the President's Task Force on Environmental Health and Safety Risks to Children to find a way to prevent the shutdown of local programs this summer.

THEREFORE, we demand that the nation's budget not be balanced on the backs of our most vulnerable children. We demand that our children be protected and that our country's resources be properly allocated to restore the nation's capacity to prevent childhood lead poisoning.

LEHA Lead and Environmental Hazards Association

P.O. Box 535 . Olney, MD 20830 . Phone: 301.924.0804 . Fax: 301.924.0265

May 25, 2012

Thomas Friedan, MD, MPH
Director
Centers for Disease Control and Prevention
1600 Clifton Road
Atlanta, GA 30333

Subject: CDC Lead Poisoning Prevention Program

Dear Dr. Friedan:

Enclosed is a Declaration that was recently adopted at the national conference of the Lead and Environmental Hazards Association urging a restoration of the CDC's lead poisoning prevention program. We hope that you will take action to enable this program to carry out its important mission.

Sincerely,

/s/ Stephen Weil

Stephen Weil
Executive Director
Lead and Environmental Hazards Association

Cc: Secretary Shaun Donovan, U.S. Department of Health and Urban Development
Secretary Kathleen Sebelius, U.S. Department of Health & Human Services
Administrator Lisa Jackson, U.S. Environmental Protection Agency

Senator Tom Harkin
Senator Daniel K. Inouye
Senator Herbert Kohl
Senator Patty Murray
Senator Mary L. Landrieu
Senator Richard J. Durbin
Senator Jack Reed
Senator Mark L. Pryor
Senator Barbara A. Mikulski
Senator Sherrod Brown

Senator Richard C. Shelby
Senator Thad Cochran
Senator Kay Bailey Hutchison
Senator Lamar Alexander
Senator Ronald Johnson
Senator Mark Kirk, USNR
Senator Lindsey O. Graham, USAFR
Senator Jerry Moran

Congressman Denny Rehberg
Congressman Jerry Lewis
Congressman Rodney M. Alexander
Congressman Jack Kingston
Congresswoman Kay Granger
Congressman Michael K. Simpson
Congressman Jeff Flake
Congresswoman Cynthia Marie Lummis
Congressman Harold Rogers

Congresswoman Rosa L. DeLauro
Congresswoman Nita M. Lowey
Congressman Jesse L. Jackson, Jr.
Congresswoman Lucille Roybal-Allard
Congresswoman Barbara Lee
Congressman Norman Dicks



Resources

- See “Campaign to Eliminate Childhood Lead Poisoning”
- www.nchh.org



Conclusions

- The move to the new reference value brings new focus to exposure prevention, because it is a function of the population distribution, not an arbitrary “level of concern.”
- More resources will be needed to provide lead poisoning services to more children.
- The goal of eliminating excessive exposures to lead was not met in 2010, mainly due to inadequate resources. But the goal is achievable.
- Continued delays in meeting that goal will cost the nation billions of dollars in avoidable medical care, lost lifetime earnings, adverse educational outcomes, needless suffering, and others.



Conclusions

- Clinicians should refer those with exposures above the reference value to risk assessors and others who are trained to locate and eliminate sources and pathways.
- Exposure control is assessed by comparison to environmental exposure limits, not blood lead level. Lead exposure limits for air, water, dust, and others should be updated.
- Public health, environmental, and allied fields should advocate for the resources needed to protect children.
- We should act on what the science tells us!



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Contact Info

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