

# The Cost of Doing Nothing and the Price of Doing Something

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# Education: Difference in Test scores

## Lead and Educational Outcomes – 5-9 $\mu$ g/dL

Blood Lead Levels	Educational Impact	Size of Study	Location of Study
5 $\mu$ g/dL	30% more likely to fail third grade reading and math tests	More than 48,000 children	Chicago (Evens et al. unpublished data)
	More likely to be non-proficient in math, science, and reading	21,000 children	Detroit (Zhang et al. 2013)
5-9 $\mu$ g/dL	Scored 4.5 points lower on reading readiness tests	3,406 children	Rhode Island (McLaine et al. 2013)

# National Center for Healthy Homes

- ▶ A series of North Carolina studies of over 57,000 children found that children with a BLL as low as 4  $\mu\text{g}/\text{dL}$  at three years of age were significantly more likely to be classified as learning disabled than children with a BLL of 1  $\mu\text{g}/\text{dL}$

# National Center for Healthy Homes

- ▶ Researchers also found a dose-response relationship between end-of-grade test scores and BLL: BLLs of 3  $\mu\text{g}/\text{dL}$  and above were associated with decreases in test scores

# National Center for Healthy Housing

- ▶ Maternal education and socioeconomic status are strong predictors of lifelong health.
- ▶ Reducing the average BLL of today's children will improve educational achievement for tomorrow's parents,
- ▶ and will, in turn, set the stage for both improved health and educational outcomes for their children

# National Center for Healthy Housing

- ▶ In a study of over 48,000 school children in Chicago, BLLs as low as 5  $\mu\text{g}/\text{dL}$  were associated with lower scores on third grade reading and math tests
- ▶ A study of 3,400 kindergarten students in Providence, Rhode Island demonstrated that increased BLLs were associated with decreased scores on the Phonological Awareness Literacy Screening for Kindergarten (PALS-K), a standardized assessment of children's cognitive development and literary skills.

# The Cost of Doing Nothing - The Criminal Justice System

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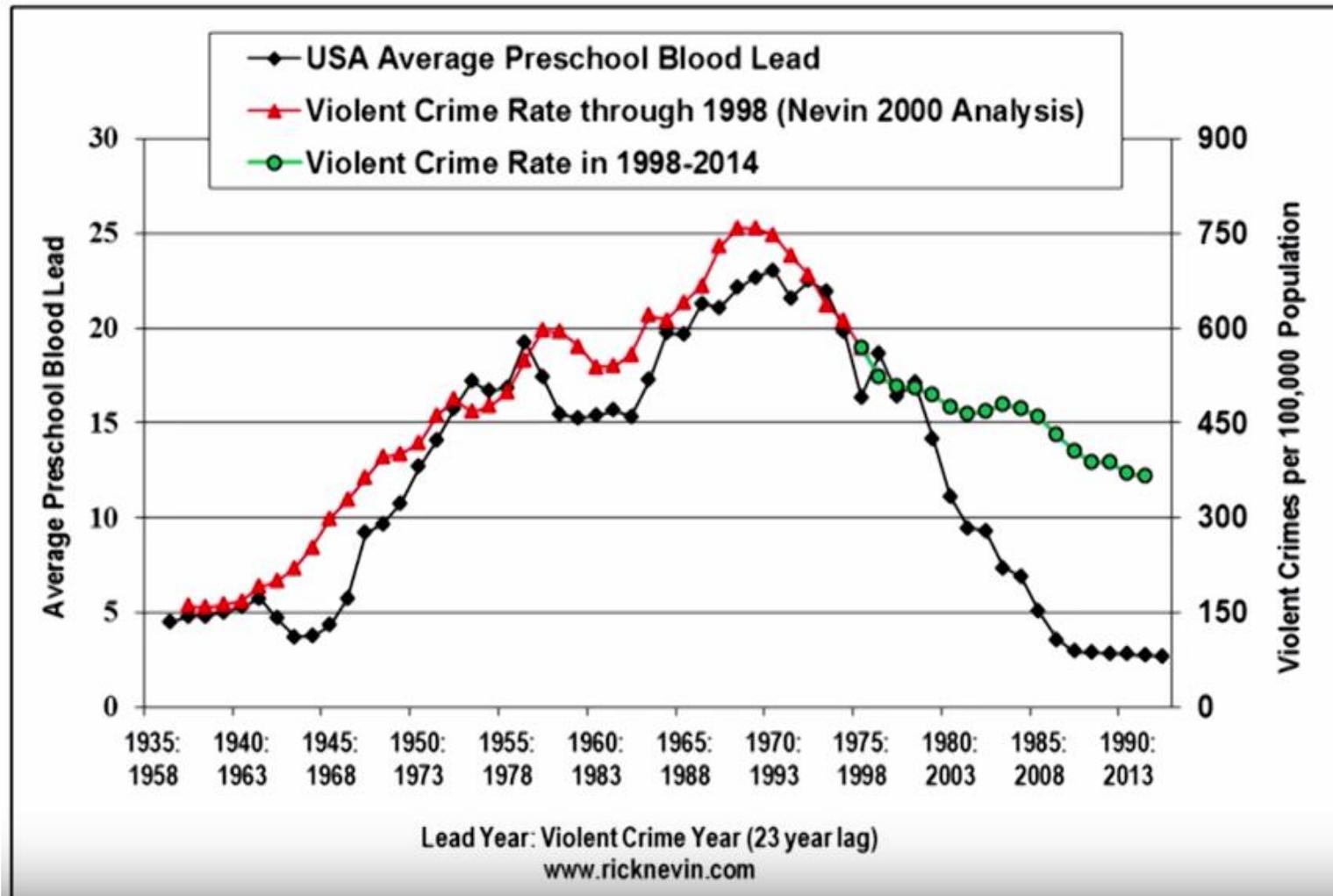
- ▶ Psychiatrists since have identified lowered IQ is as a risk factor for repeated antisocial behavior, including crime
- ▶ In light of lead's effect on IQ, it is reasonable to hypothesize that increased lead exposure, especially in childhood, may raise an individual's risk factors for committing crimes and other antisocial behavior. This hypothesis has indeed been borne out by repeated studies (Wright 2008)

# Cleveland Plain dealer article - The steep cost of lead poisoning: Toxic Neglect October 21, 2015

- ▶ The estimated crime-related costs of lead are high.
- ▶ For each reduction of 1 microgram per deciliter of lead in a preschool-age child's blood, a 2009 study computed that \$1.8 billion in direct costs to victims and the criminal justice system and \$11.8 billion in indirect costs could be saved.
- ▶ Reducing lead poisoning can prevent more than 115,000 burglaries, almost 2,500 robberies, almost 54,000 serious assaults, 4,100 rapes and more than 700 murders.

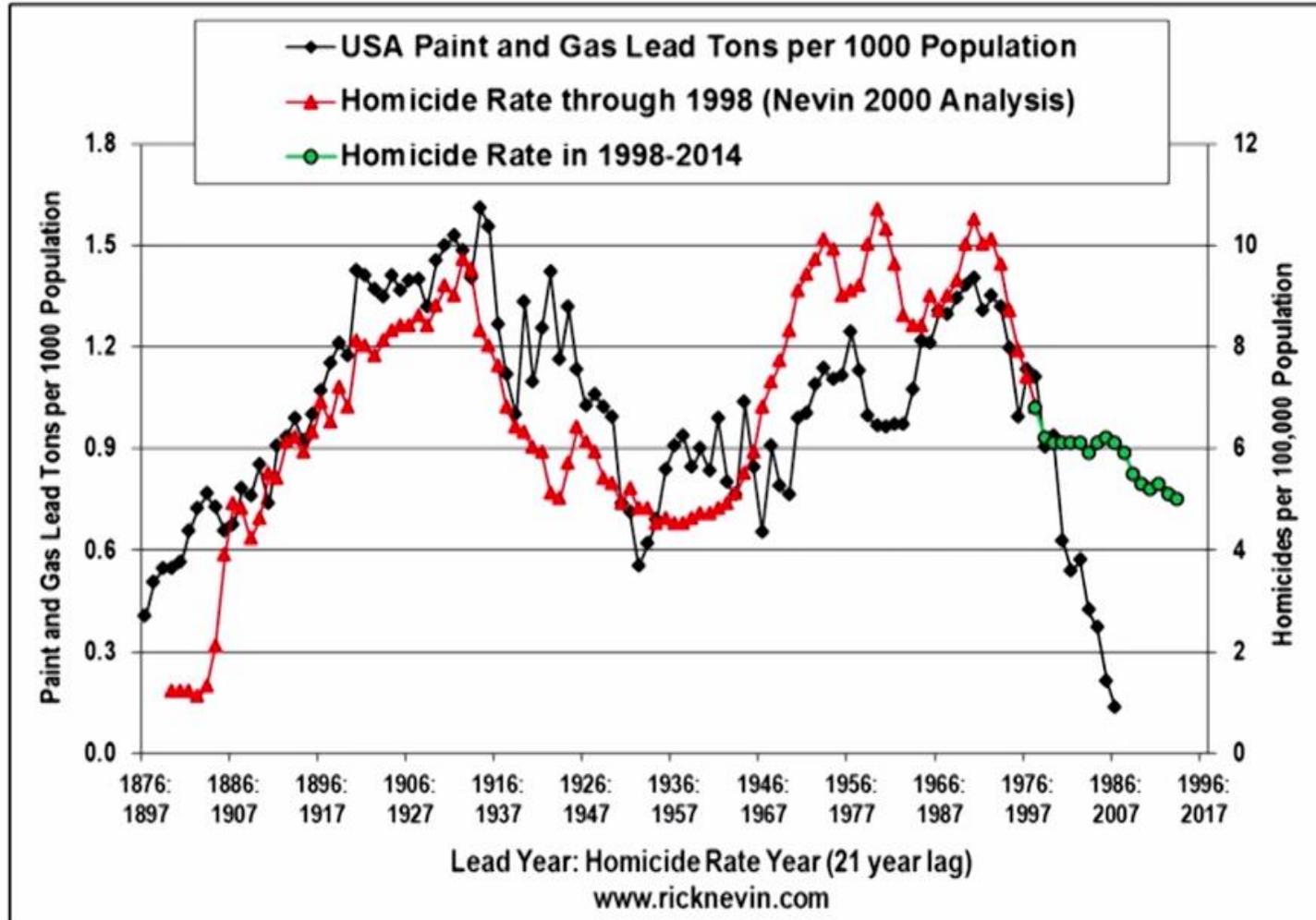
# A study by Rick Nevin

## USA Blood Lead and Violent Crime



# A study by Rick Nevin

## USA Lead Use and Homicide Trend



# University of Michigan Risk Science Center and the Michigan Network for Children's Environmental Health study

- ▶ Crime:
- ▶ An estimated 10% of juvenile crimes were associated with lead exposure
  - ▶ Estimated \$32 million in costs
- ▶ Adult crimes linked to childhood lead exposure
  - ▶ \$73 million annually

# U of M Risk Science Center and the MI Network for Children's Environmental Health study

- ▶ Special Education:
- ▶ 20% of children with BLL at or above 25  $\mu\text{g}/\text{dl}$  at age 2 receive special education for an average of 9 years
  - ▶ Costs: \$2.5 million lifetime for the cohort of 2 year olds (not including indirect costs)
  - ▶ Does not include those at lower levels that may need special attention in schools

# U of M Risk Science Center and the MI Network for Children's Environmental Health study

- ▶ Lifetime earnings:
  - ▶ As expected, lower IQ leads to reductions in lifetime earnings
  - ▶ >\$206 million for the 2010 cohorts of 2-year olds
    - ▶ Only those that were tested in that time frame
    - ▶ And not those with results  $<5 \mu\text{g}/\text{dl}$

# U of M Risk Science Center and the MI Network for Children's Environmental Health study

- ▶ Costs to taxpayers >\$475 million annually
  - ▶ With an average cost of lead abatement at \$6000 per unit, and 100,000 at risk homes are abated
  - ▶ Creates cost savings - \$230 million annually
  - ▶ Pays for itself in 3 years

# U of M Risk Science Center and the MI Network for Children's Environmental Health study

- ▶ Healthcare:
- ▶ Immediate treatment: testing assessments - \$280,000 annually
- ▶ ADHD treatment (meds and counseling)
  - ▶ >18 million annually

# The Cost of Doing Something

- ▶ A study about the monetary benefits of preventing childhood lead poisoning with lead-safe window replacement
- ▶ Authors: Rick Nevin, David Jacobs, Michael Berg, Jonathan Cohen

# NIEHS Windows study

## Window Effects on Sill Dust Lead

- When window paint is intact AND not rubbing or binding:
  - ▣ there is *no significant association* ( $p=0.95$ ) between window paint lead and sill dust lead
- When window paint is not intact AND/OR rubbing/binding
  - ▣ a 50% increase in window paint lead is associated with a 15% increase in sill dust lead
- When sills are neither smooth nor cleanable, sill dust lead is 63% higher than on smooth and cleanable sills

# NIEHS Windows study

- ▶ Window replacement (which includes paint stabilization and other measures). The benefit per resident child from improved lifetime earnings alone is \$21,195 in pre-1940 housing and \$8685 in 1940-59 housing (in 2005 dollars).
- ▶ Annual energy savings are \$130-486 per housing unit, with or without young resident children, with an associated increase in housing market value of \$5900-14,300 per housing unit, depending on home size and number of windows replaced.

# NIEHS Windows study

- ▶ Lead-safe window replacement in all pre-1960 US housing would yield net benefits of at least \$67 billion, which does not include many other benefits

# 12 year comparison of lead dust for window replacement vs non-replacement

## Summary Statistics

DUST LEAD	Floor Samples				Window Sill Samples			
	Non-Replace		All Replace		Non-Replace		All Replace	
Window Trx	N	GM (µg/ft <sup>2</sup> )	N	GM (µg/ft <sup>2</sup> )	N	GM (µg/ft <sup>2</sup> )	N	GM (µg/ft <sup>2</sup> )
Baseline	80	21.2	77	19.3	80	328	76	152
Clearance	74	10.8	77	8.2	73	30	76	14
6-Months	69	10.3	69	6.5	68	91	68	38
1-Year	70	9.1	71	5.4	69	86	70	39
2-Years*	28	11.1	13	2.8	28	64	13	43
3-Years*	23	9.5	12	1.5	23	59	12	30
6-Years*	30	3.5	17	1.8	30	47	17	24
12-Years	80	1.7	77	2.2	80	54	76	16

# What now?

## Conclusions

- Window replacement and window repair **are both successful strategies**
- **Replacement of all windows** at a dwelling is an optimal strategy based on effectiveness
- A **community lead hazard control strategy should address all sources** including exterior and neighborhood sources
- Window replacement is likely to have **greater value in high risk communities**
- **All financial benefits should be measured** when determining window replacement value
- **Public and private sector initiatives are needed** to promote window replacement

# Environmental Health Perspectives - 2009

- ▶ Each dollar invested in lead paint hazard control results in a return of \$17-\$221 or a net savings of \$181-269 billion.

## ▶ Conclusion

- ▶ There are substantial returns to investing in lead hazard control, particularly targeted at early intervention in communities most likely at risk. Given the high societal costs of inaction, lead hazard control appears to be well worth the price.