

Childhood Ingestion of Lead-Contaminated Paint, Dust, Soil, & Air (ages 0-5)

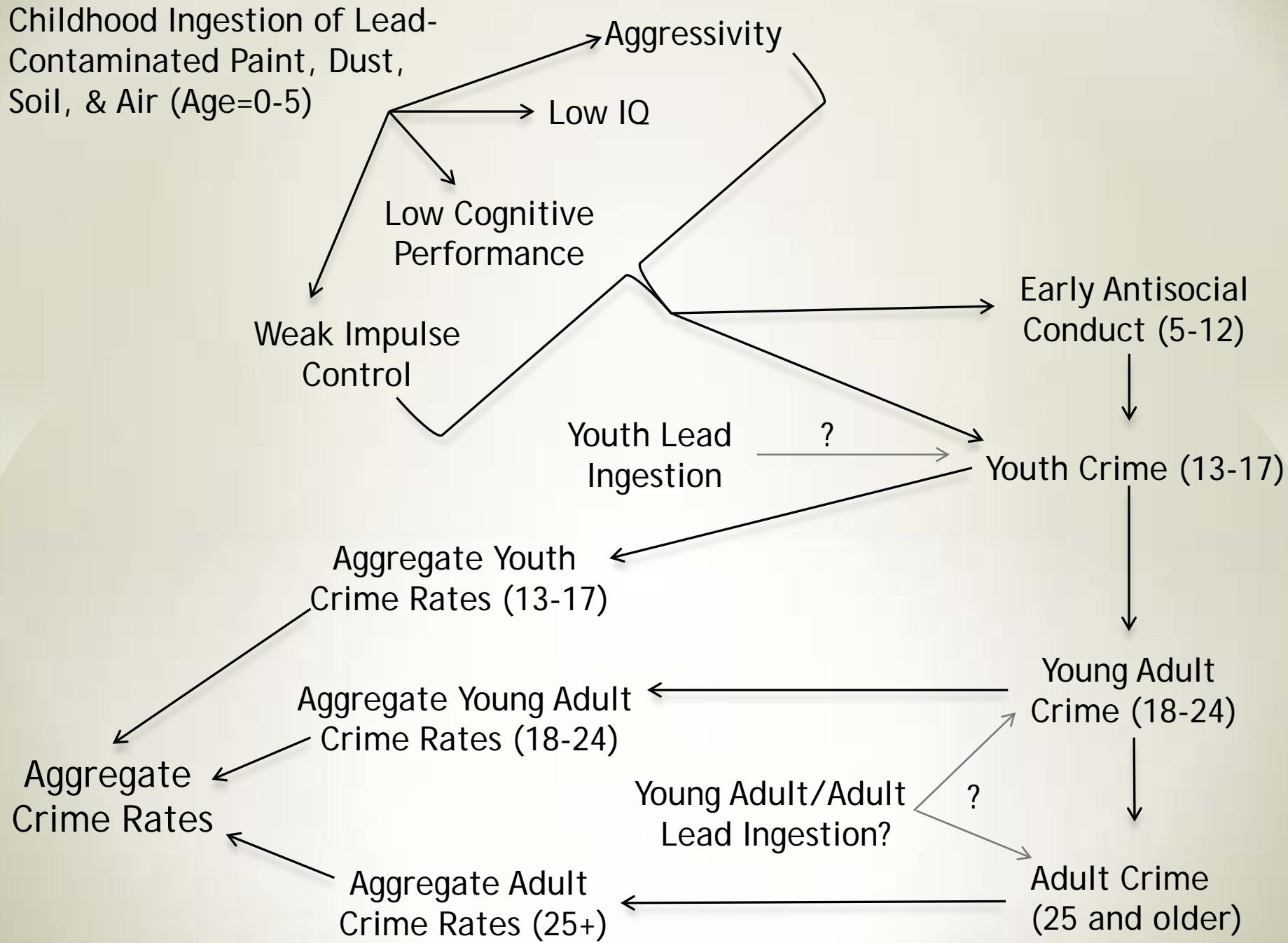
Evidence yields persuasive case for a significant association.

But...

+ Is it spurious, or causal via several hypothesized indirect pathways on prevalence and/or incidence of criminal behavior?

If causal, what is the magnitude of the total effect? Is it sufficient to yield relatively large aggregate reductions in crime rates?

Aggregate
Crime Rates
(many years later)



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Three basic approaches....



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Aggregate
Crime Rates
(many years later)

(1) Aggregate temporal analyses, with varying degrees of attention to time series properties of the data:
Nevin (2000), Mielke and Zahran (2012), & Reyes (2007).

Provocative and plausible, but open to notable questions and reasonable claims of spuriousness.

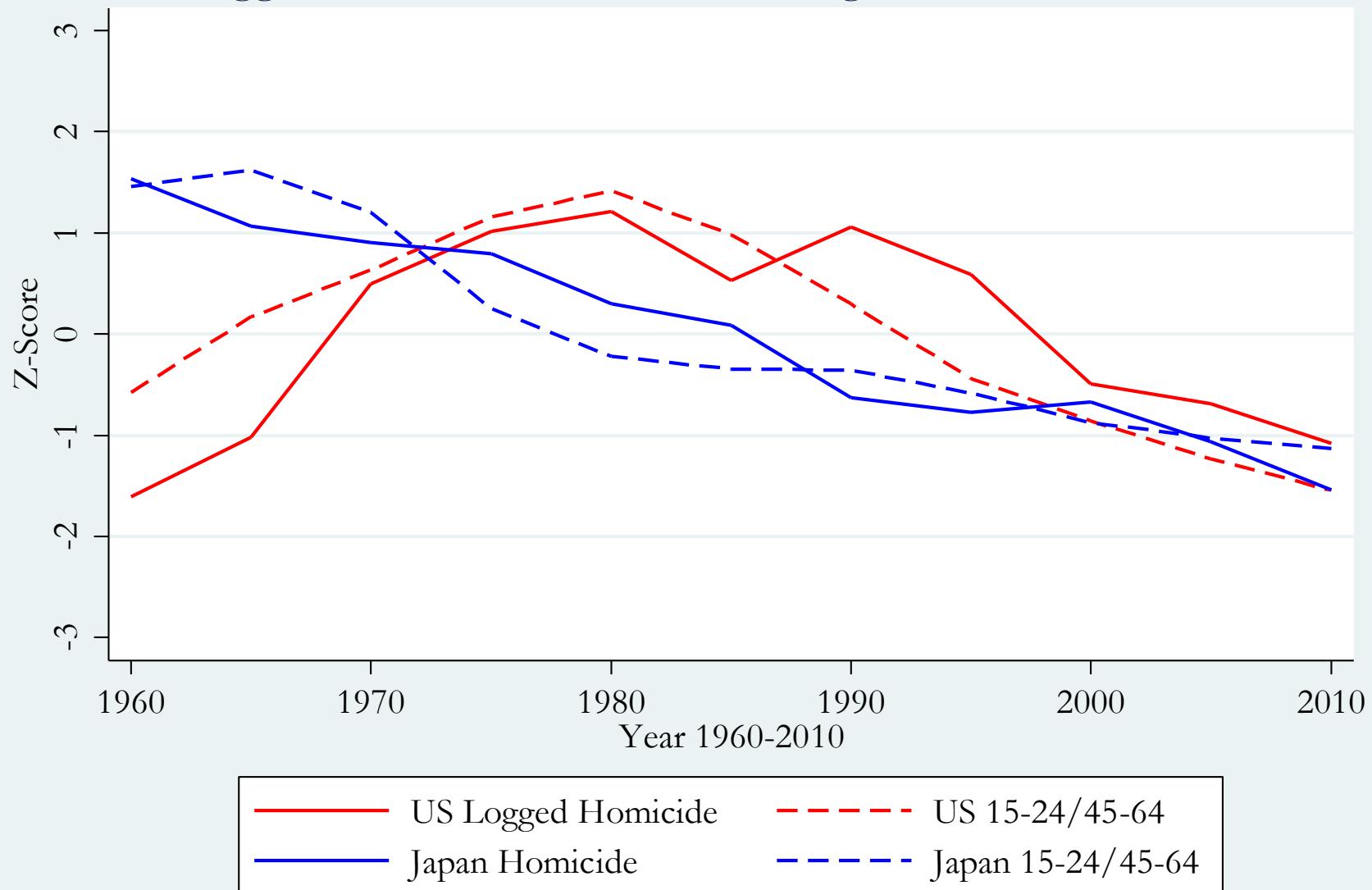
Crime-specific findings open to questions about validity and reliability (e.g., aggravated assault and rape).

Period effects appear to be underappreciated (see, e.g., Cook and Laub, 2002). Both lead-free and fully-leaded cohorts exhibit major drops in the 1990s (and some lead-infested cohorts exhibit steep drops prior to the 1990s).

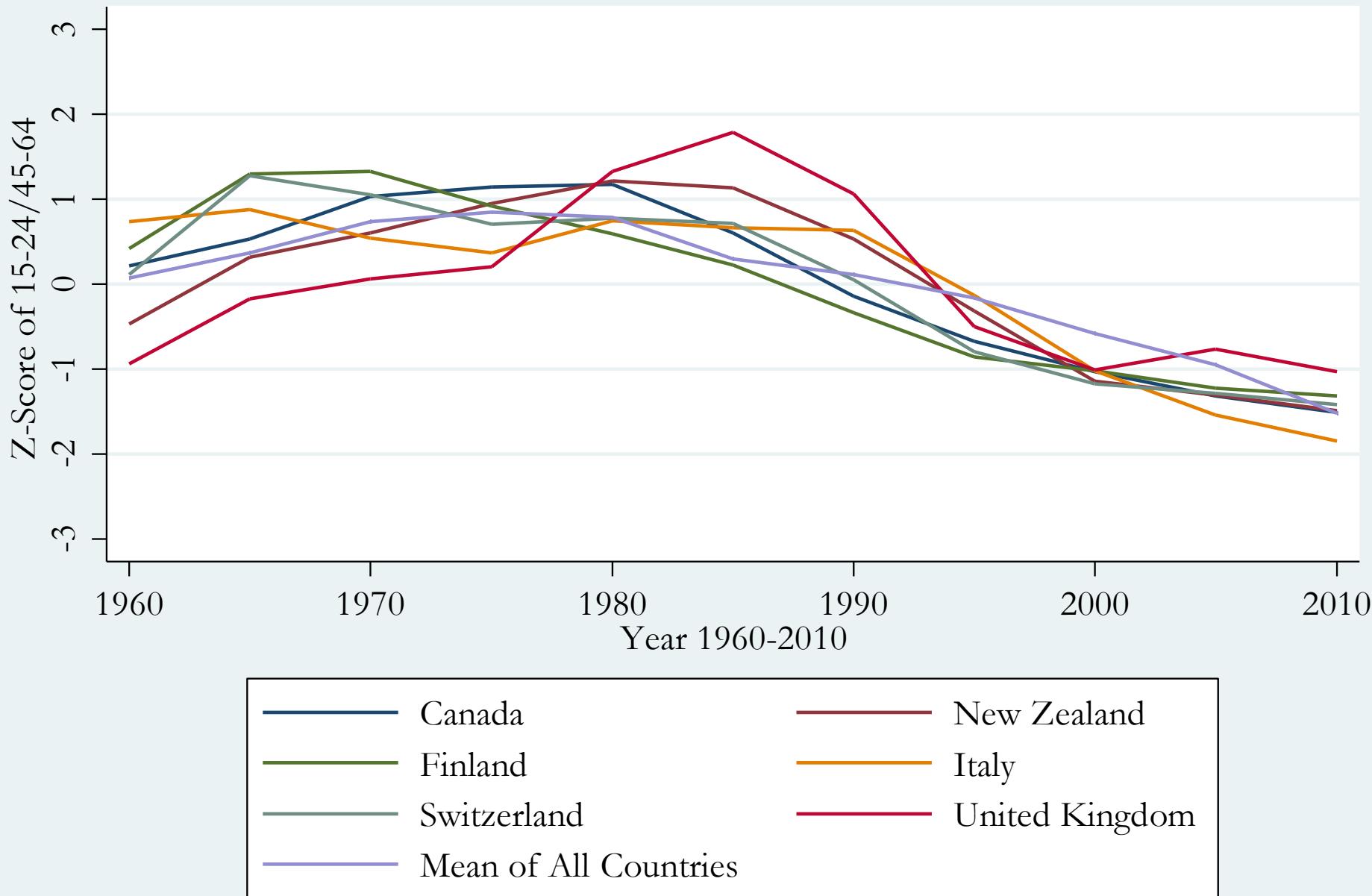
Other things changed (lagged and contemporaneously) with post WWII crime in the US and elsewhere as well. One example: shifting relative age structure (e.g., the ratio of 15-29/45+).

Geographic breadth of lead-crime relationship less expansive than implied (e.g., Japan?).

Logged Total Homicide Rate & Age Structure 1960-2010



Shifting Age Structure in Selected Nations 1960-2010



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(2) National-level Age-Period-Cohort-Characteristic (APCC) models.

(a) Indirect—O'Brien (2014) & 2000; O'Brien and Stockard (2002, 1999)

Provides clear assessment of shifts in homicide over time for cohorts exposed to differential conditions (**but not lead toxins**).

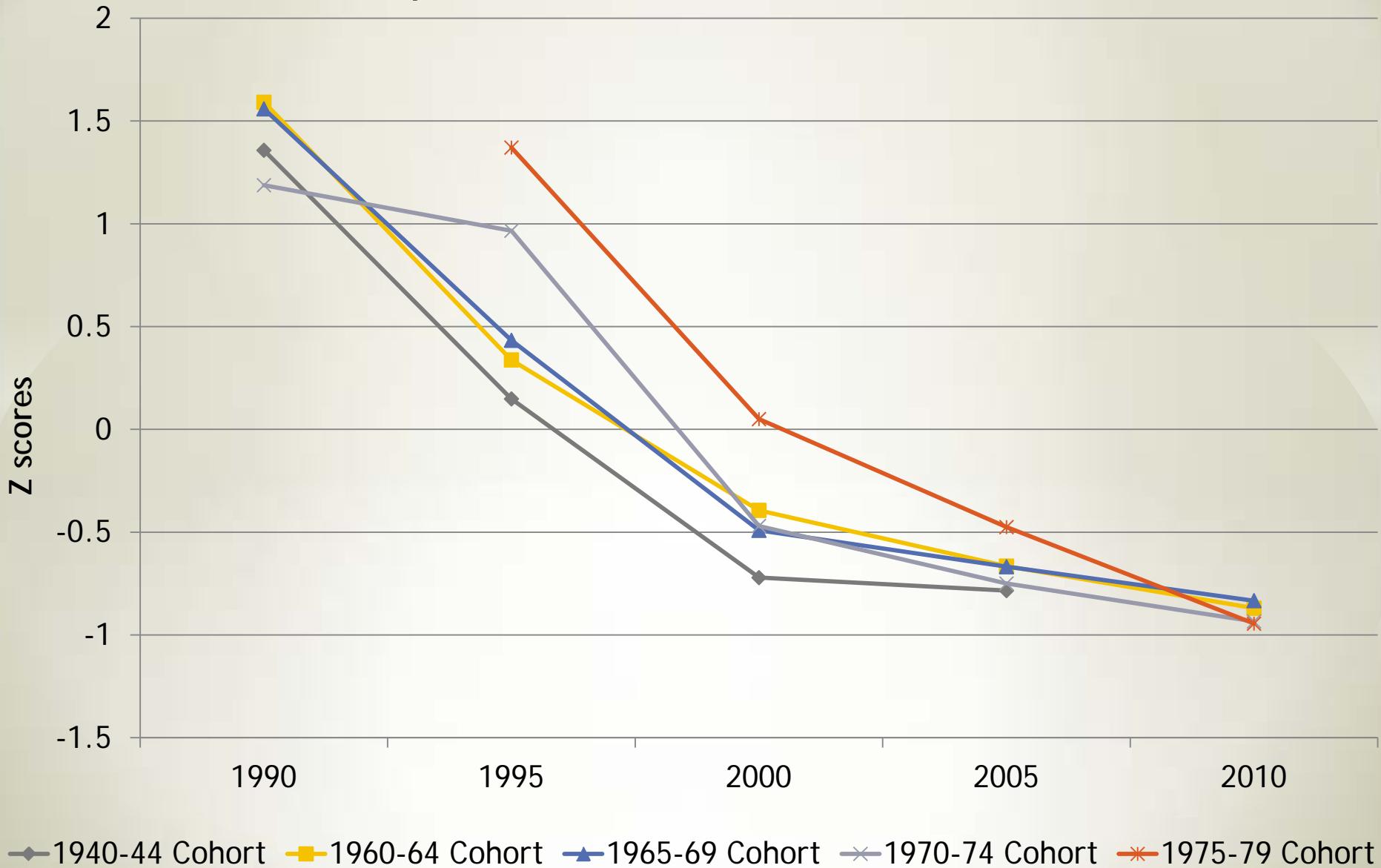
Show that many cohorts and age groups experienced 1990s crime decline.

Suggest that cohort attributes (relative cohort size and % born to unmarried mothers) *and* period conditions are important.

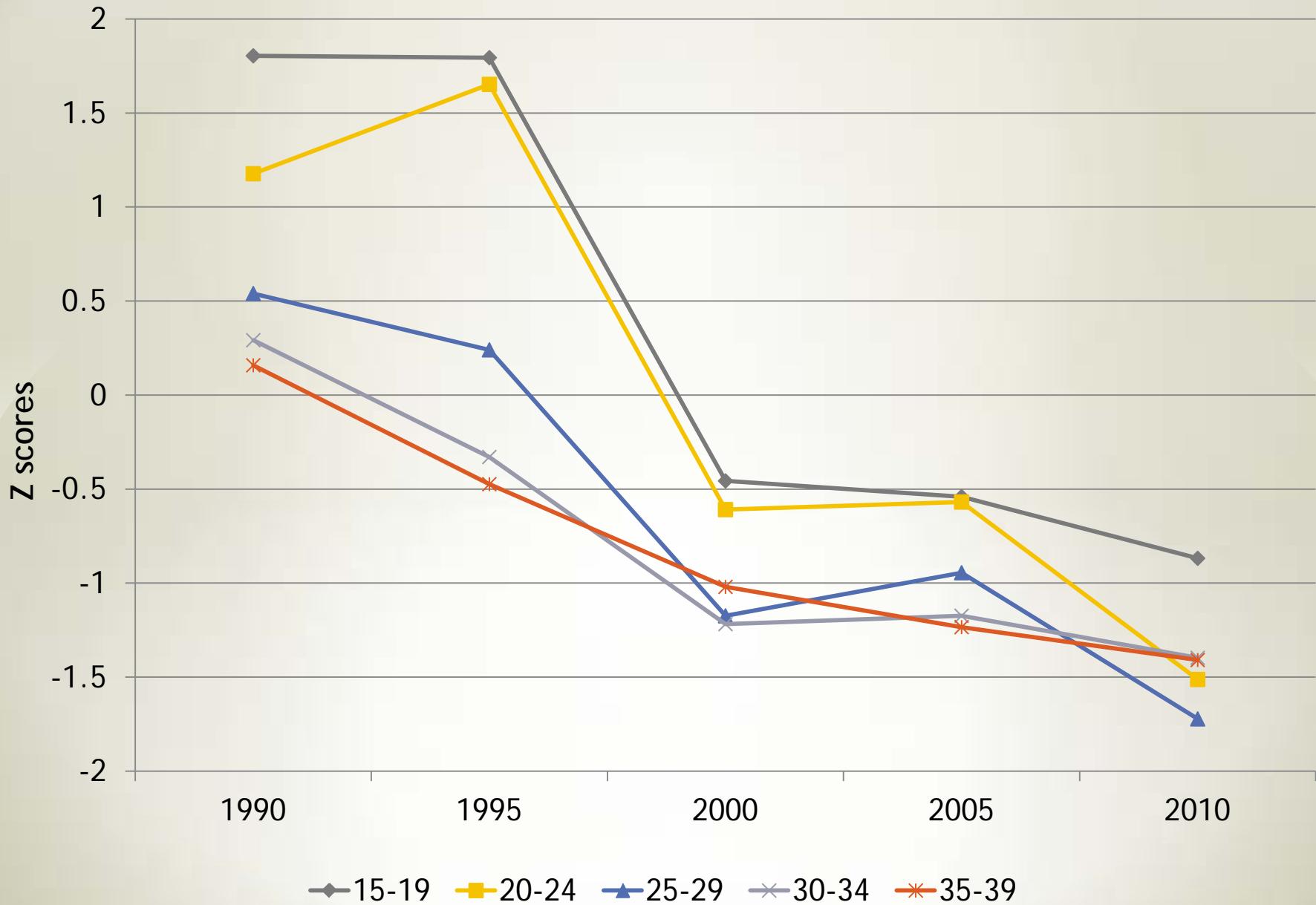
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Aggregate
Crime Rates
(many years later)

U.S. Cohort-Specific Homicide Victimization Rates, 1990-2010



U.S. Age-Specific Homicide Victimization Rates, 1990-2010



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(b) Direct—McCall and Land (2004)

Document shifts in homicide rates over time for different cohorts exposed to varying levels of lead toxins, controlling for other cohort and period conditions.

Conclude that differential lagged exposure to lead not significantly associated with homicide rates.

But national level in scope. Would be useful to replicate with state-level data (paralleling Reyes, 2007; 2013), without funding from Ethyl.

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Aggregate Crime Rates
(many years later)

Childhood Ingestion of Lead-Contaminated Paint, Dust, Soil, & Air (ages 0-5)

Three basic approaches....

(3) Individual/multi-level models of exposure to lead and involvement in crime.

*Small body of research on individuals over time that vary in the amount of lead detected in blood, bones, teeth, etc. Shows persuasive evidence that kids who have greater lead concentration in blood are more likely to engage in antisocial behavior and delinquency in adolescence and young adulthood.

*Reyes (2013) study of individuals who reside in states that have variable levels of estimated lead to which subjects may have been exposed.

Indirect (but plausible) estimation of state levels of lead exposure. Creative, exhaustive, and impressive.

Reveals significant effects of state levels of lead exposure on early child psychological and behavioral problems.

Reveals significant effects of state levels of lead exposure during childhood on ever hitting and attacking somebody by age 13, 15, and 17.

Aggregate Crime Rates

(many years later)

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Three basic approaches....

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*Reyes (2013) study...

Comments and Questions:

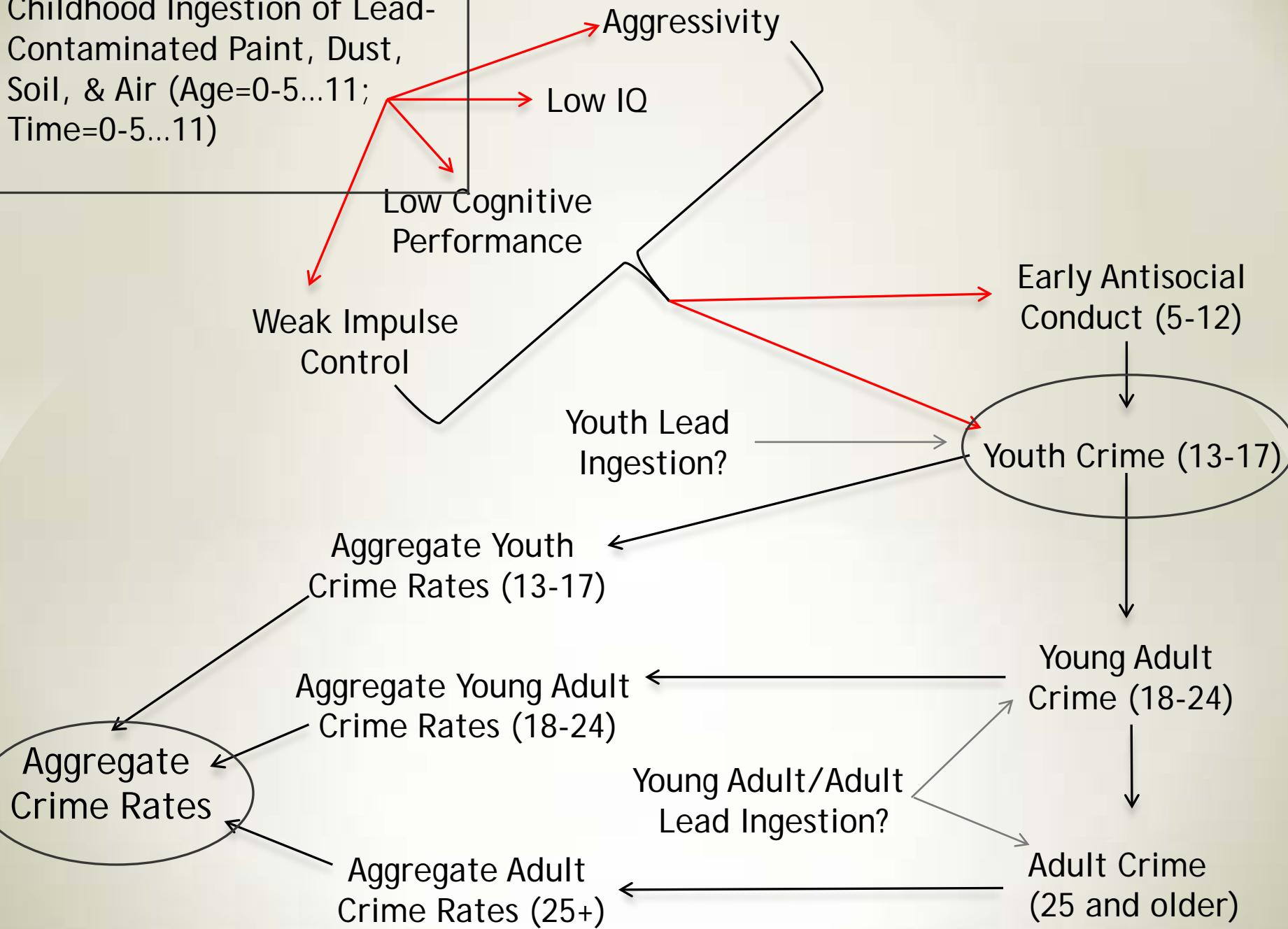
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- ✓ Assumes homogeneity in exposure to lead within states (probably not plausible).
- ✓ Appears to lack controls for residence in urban areas, which could be an important confounder. Some may find individual-level model underspecified.
- ✓ The mechanisms of the claimed causal effect remain unclear. Are state lead effects on delinquency and criminal behavior explained by early antisocial conduct, impulsivity, cognitive impairment?
- ✓ Implications of Reyes' multilevel analysis of youth within states for aggregate crime trends unspecified and unclear.

Aggregate
Crime Rates

(many years later)

Childhood Ingestion of Lead-Contaminated Paint, Dust, Soil, & Air (Age=0-5...11; Time=0-5...11)



Further Comments and Questions:

There is uncertainty regarding the contribution of lead to recent aggregate crime trends, based in large measure on Reyes' (2007) state-level panel analysis of violent (aggravated assault, robbery, rape, murder), property (burglary, larceny, and auto theft), and murder from 1985-2002.

Reveals significant effects of lagged state-levels of lead exposure on state trends in violent crime, but not property crime and murder.

- ✓ Robust to many specifications, but sensitive to cross-state migration adjustment (lead exposure not significant when this adjustment excluded). This seems like an arbitrary adjustment based on uncertain assumptions about state mobility patterns. Which results are most valid?
- ✓ Lead effects not significant when state-specific trend parameters are included. Raises possibility of omitted variable bias - lagged levels of lead exposure appear to be significantly associated with unmeasured contemporaneous state-specific factors that changed over time and are related to violent crime trends.

Further Comments and Questions (Continued):

If we accept the specification and point estimates in Reyes (2007), the elasticity for lead on violent crime is approximately .8 (10% change in lead ~ 8% change in violent crime).

Difficult to trace estimation of lead contribution from the paper, but Reyes suggests that 28-91% of observed increase in crime between 1972-1992 and 56% of the decline observed during 1990s can be attributed to changes in lead ingestion.

- Does this make sense given that there still would have been many lead-laden relatively young persons in the population during the 1990s? Given the lead abatement patterns that have been highlighted, wouldn't the crime decline have started later?
- Does it make sense given that all cohorts exhibited significant declines in crime (at least homicide) during the 1990s, including those born in the heavy-lead era (early 1970s) who would have been in the high crime ages of the 20s during the 1990s?
- Does it make sense given the relatively modest effects of lead ingestion on proposed mediators and criminal behavior in individual-level research?