Lucifer Curves

Pleased to meet you
Hope you guessed my name
But what's confusing you
Is just the nature of my game

Just as every cop is a criminal
And all the sinners, saints
As heads is tails
Just call me Lucifer
'Cause I'm in need of some restraint

- *"Sympathy For The Devil" (Jagger, Mick / Richards, Keith)*

Although "Lucifer" is commonly assumed to be another name for the devil, many Bible scholars agree that this association is just an artifact of misunderstood scripture translation. The Vulgate Bible, used by the Catholic Church from 400 to 1400 A.D., translated the Hebrew word heylel as "lucifer", the Latin word for Venus when it appeared as the morning star. The Vulgate text also translated the Greek word phosphorus as "lucifer". The King James Bible retained the word Lucifer in Isaiah 14:12, but translated other references to "lucifer" and "phosphorus" as "morning star", including scripture that refers to Christ as the "morning star". The "morning star" title for Christ is used in a scriptural context that clearly conveys reverence, whereas the "morning star" title in Isaiah 14:12 was used as a sarcastic taunt to the Babylon king who compared himself to the Babylonian god Helel, the morning star - Venus.

Of course, we now know that Venus is not a god or a star, it's a planet. It shines like a bright star in part because of its proximity to Earth, but also because its "atmosphere is a toxic layer of carbon dioxide with thick clouds of sulphuric acid. The clouds reflect sunlight, which is why Venus is so bright. But the atmosphere also traps heat, so the temperature on Venus reaches almost 900 degrees Fahrenheit - hot enough to melt lead."

We also know that the mountain highlands of Venus are much more reflective than lower elevations, due to heavy metal precipitation. Lead sulfide is vaporized on the planet's surface and rises into the atmosphere as a mist. That mist condenses in the cooler temperatures of the Venus clouds "forming shiny, metallic frost on the tops of the mountains."

"Lucifer" is not the name of the devil, and does not even refer to anything innately evil. The word "Lucifer" refers to an image created by a toxic environment that produces a coating of lead contamination across planetary surfaces.

That's probably just a coincidence.

Excessive Sanctions, Brain Function, and Diminished Culpability

In *Roper v. Simmons* (2005), the U.S Supreme Court held that execution is an excessive sanction for crimes committed by youths under 18, citing the "susceptibility of juveniles to immature and irresponsible behavior" indicative of "diminished culpability". An American Psychological Association (APA) *Roper* brief also cited magnetic resonance imaging (MRI) evidence of a "biological dimension to adolescent behavioral immaturity":

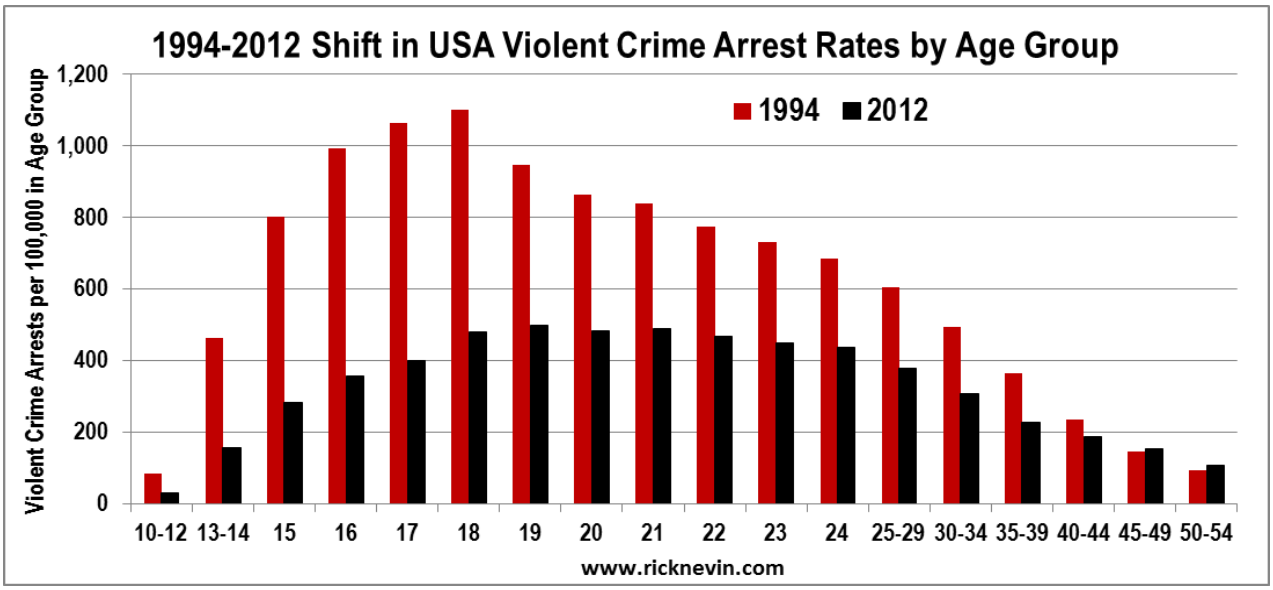
> The frontal lobes, especially the prefrontal cortex, play a critical role in the executive or "CEO" functions of the brain ... involved when an individual plans and implements goal-directed behaviors. ... Neurodevelopmental MRI studies indicate this executive area of the brain is one of the last parts of the brain to reach maturity. ...
>
> MRI research reveals that in the same regions where gray matter thins, white matter significantly increases during adolescence [as] a substance called myelin is wrapped

around brain cell axons. Myelination improves the connectivity of neural tracts by insulating the axon thereby greatly speeding up the communication between cells, allowing the brain to process information more efficiently and reliably. (APA, 2004)

In *Graham v. Florida* (2010) and *Miller v. Alabama* (2012), the Court held that life in prison without parole is also an excessive sanction for juveniles. In *Graham*, the Court found that "developments in psychology and brain science continue to show fundamental differences between juvenile and adult minds." The *Miller* decision specifically cited an APA *Miller* brief stating: "It is increasingly clear that adolescent brains are not yet fully mature in regions and systems related to higher-order executive functions such as impulse control, planning ahead, and risk avoidance".

The APA *Roper* brief highlighted research by Sowell (1999) showing a gray matter growth surge around puberty, followed by white matter growth that builds better connections between neurons, with MRI scans at ages 12-16 compared to ages 23-30 showing a large difference in frontal lobe white matter. The APA cites this as evidence of brain development affecting juvenile offending, but Bartzokis (2001) found MRI evidence of frontal lobe white matter growth to age 50, so brain growth could also affect adult offending.

Moffitt (1993) described how Adolescence-Limited offenders account for most juvenile crime, mainly involving property crimes, but some adolescents go on to become more violent Life-Course-Persistent offenders. Even among high-rate chronic violent offenders, Sampson and Laub (2003) found that offense rates rose sharply after age 10; property offending peaked in adolescence and fell almost 90% by the early-20s; and violent offending peaked in the early-20s and fell from age 30 through age 50. These patterns are entirely consistent with criminal behavior being affected by the gray matter growth surge around puberty, rapid white matter growth through the mid-20s, and ongoing white matter growth to age 50. The APA *Roper* brief also cited arrest data showing that violent offense rates "build steeply to age 18 and then fall" - but that statement is less true with every passing year.



From 1994 to 2012, violent crime arrest rates fell about 64% for ages 10-17, 50% for ages 18-20, 40% for ages 21-22, 37% for ages 23-39, and 21% for ages 40-44, but increased by 5% for ages 45-49 and 14% for ages 50-54. If brain growth is related to criminal offending, then what could explain trends in arrest rates by age suggesting better brain function for youths and young adults, resulting in lower violent offense rates, as older adults show the opposite trend with their arrest rates increasing?

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Brain Function, Lead Poisoning, and Homicide

MRI studies by University of Cincinnati researchers have shown that early childhood lead exposure impairs the same specific types of brain development linked to "diminished culpability" in *Roper*, *Graham*, and *Miller*.

> One set of scans found that lead exposure is linked to production of the brain's white matter - primarily a substance called myelin, which forms an insulating sheath around the connections between neurons. Lead exposure degrades both the formation and structure of myelin, and when this happens, says Kim Dietrich, one of the leaders of the imaging studies, "neurons are not communicating effectively." Put simply, the network connections within the brain become both slower and less coordinated.
>
> A second study found that high exposure to lead during childhood was linked to a permanent loss of gray matter in the prefrontal cortex - a part of the brain associated with aggression control (Drum, 2013)

These studies are consistent with extensive research documenting adverse neurochemical impacts associated with developmental lead exposure, and clinical literature showing that "unfortunate expectations based on ... lead's toxic effects are fulfilled by the findings from studies of neuropsychological functioning in lead-exposed children".

The impact of lead exposure on neurodevelopment provides a new perspective on earlier research by Raine (1997) comparing brain scans for 41 murderers and 41 age- and sex-matched controls. This study found that murderers had reduced glucose metabolism in the prefrontal cortex and in the corpus callosum, the largest white matter structure in the brain, facilitating communication between cerebral hemispheres. The strongest difference was in the corpus callosum, where "dysfunction and the consequent lack of inter-hemispheric integration could contribute to the abnormal asymmetries of function ... previously observed in antisocial and violent groups". A meta-analytic review of 43 imaging studies by Yang and Raine (2009) also found "significantly reduced prefrontal structure and function in antisocial individuals".

In an interview discussing his book, *The Anatomy of Violence* (2013), Raine clearly states: "Biology is not destiny ... and one factor like prefrontal dysfunction ... doesn't make you a criminal offender." He also notes that a biological basis for crime can encompass more than genetics, citing research showing that lead exposure trends since the 1940s can explain more than 90% of the variation in the U.S. violent crime rate since the 1960s. He explains that lead exposure impacts crime trends with a time lag of about 20 years, as "toddlers ... putting their fingers in their mouths and absorbing the lead ... became the next generation of violent criminal offenders because violence peaks at about 19 or 20". Raine concludes: "to me, it's the only single cause that can both explain the precipitous rise in violence from the '70s, '80s and '90s and also the drop that we've been experiencing."

USA per capita use of lead in paint increased four-fold from 1876 to 1914, then fell back to the 1876 level by 1932; per capita use of lead in gasoline increased four-fold from 1946 to 1970, and fell back to the 1946 level by 1983. The most common exposure pathway affecting young children is lead-contaminated house dust, ingested via normal hand-to-mouth activity as they crawl. That lead is absorbed into the bloodstream and carried to the developing brain.

Heavily-leaded circa-1900 paint deteriorated by "chalking", causing severe lead dust hazards. Air lead fallout from leaded gasoline also settled as lead contaminated dust. The use of lead in gasoline fell to near zero in 1987. The USA banned the use of lead paint in 1978, but lead paint in older homes affected many children throughout the leaded gasoline era, and is still affecting neurodevelopment today.

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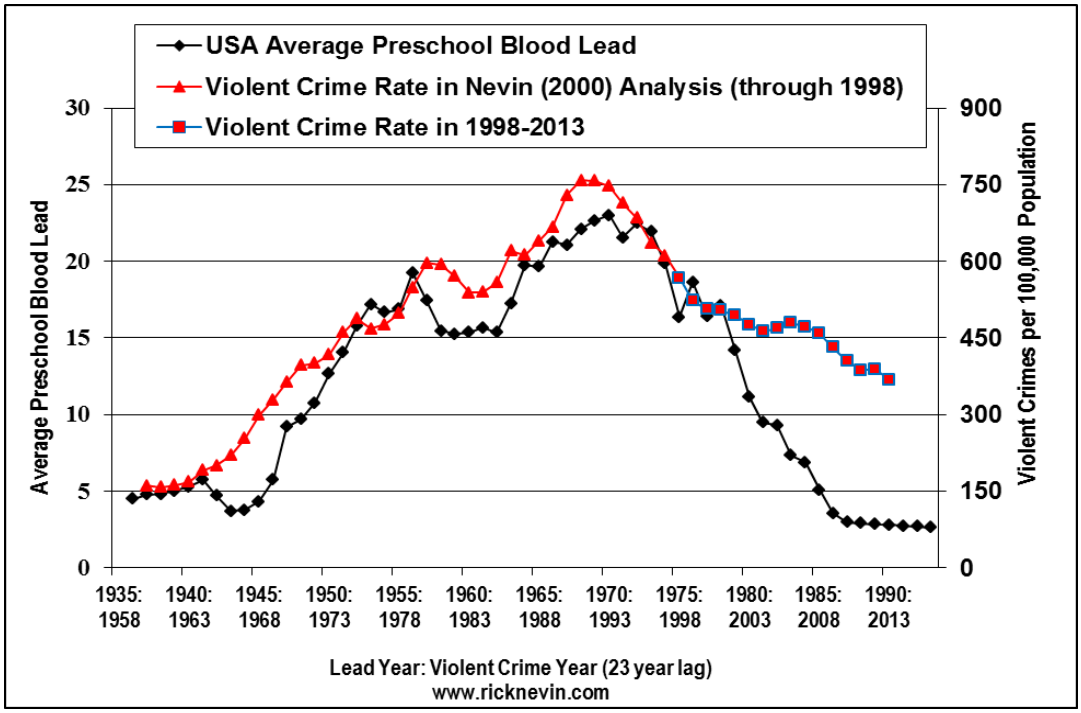
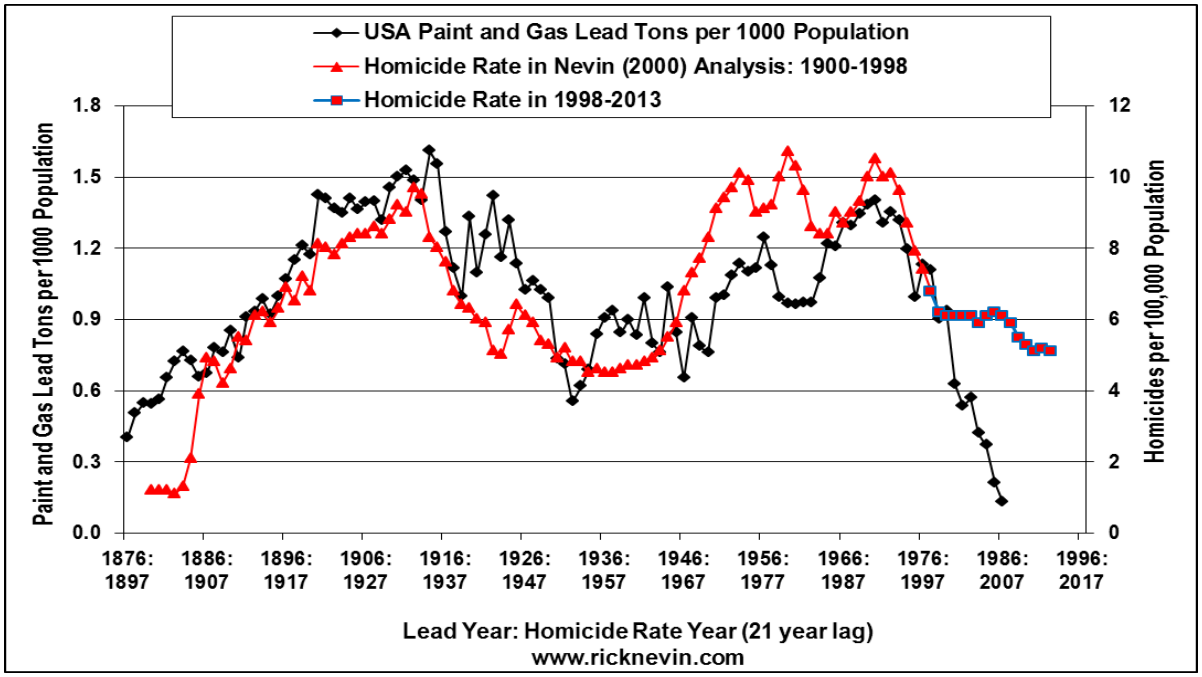


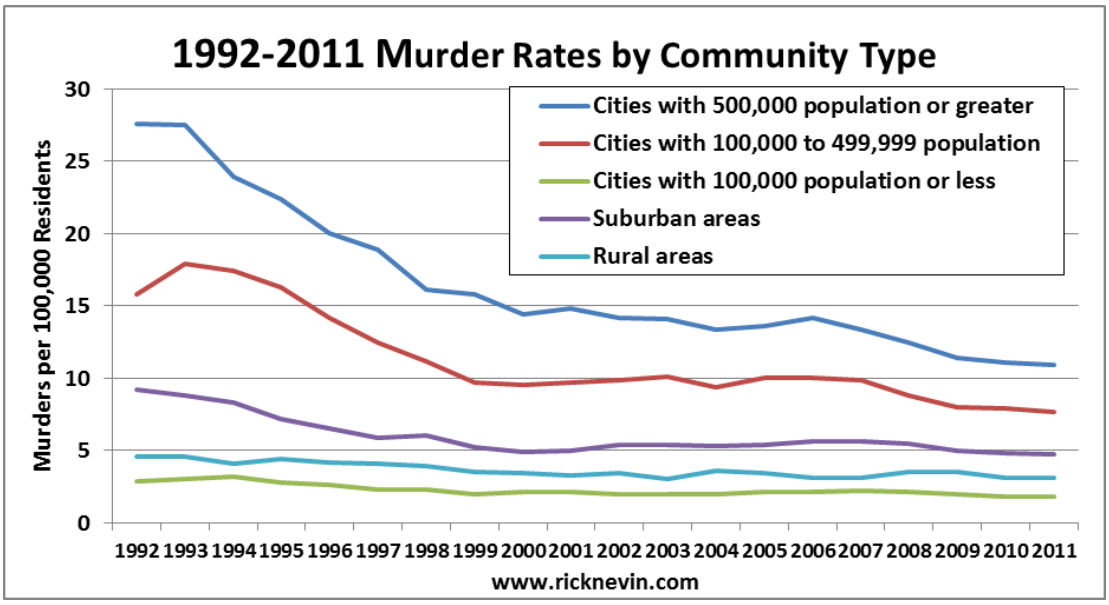
The ongoing violent crime rate decline has been slowed by an increase in arrest rates for older offenders born across years of pervasive leaded gasoline exposure, while juvenile arrest rates have fallen to record lows, due to ongoing declines in lead paint exposure over the 1990s.

Nevin (2000) also found that the USA homicide rate from 1900 to 1998 tracked the rise and fall of per capita use of lead in paint and gasoline from 1879 to 1986, with preschool lead exposure trends affecting the murder rate with a 21-year time lag.

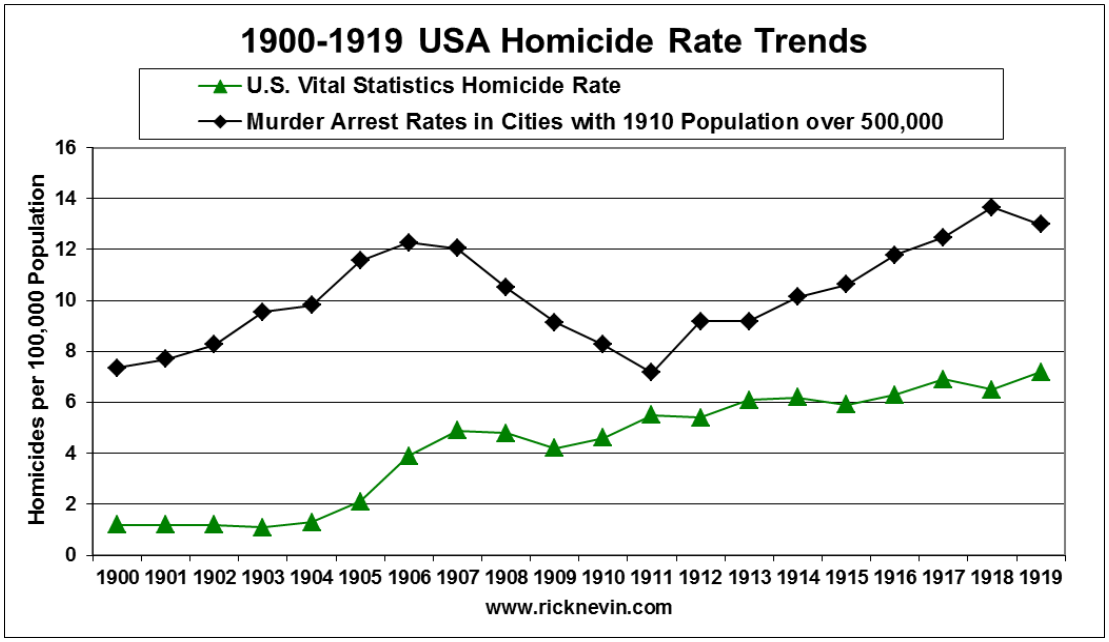


Almost all children born in the USA from 1880-1980 were exposed to lead-contaminated dust, but with widely varying degrees of lead poisoning severity. Atmospheric emissions from gas lead affected blood lead even in rural areas, but traffic caused more severe city exposure because 55% of emissions settled within 12 miles of the roadway. Cities with population

over a million had 1960s air lead that was twice as high as cities with population of 250,000 to one million, and all cities had higher air lead than rural areas. The phase-out of leaded gasoline left little difference in urban and rural air lead, and the subsequent murder rate decline has been disproportionately due to crime declines in large cities. From 1992-2011, the murder rate fell by 61% in cities with population over 500,000, 51% in cities with population of 100,000 to 500,000, and about 36% in smaller cities and rural areas.



Urban and rural murder rate trends appear to have followed a completely different pattern when the homicide rate increased six-fold from 1901 to 1911. Murder arrest data compiled by Monkkonen (1994) show no consistent trend in arrest rates from 1900-1915 in the seven cities with 1910 population over 500,000 (New York City, Chicago, Philadelphia, Baltimore, Boston, Cleveland, and Saint Louis). The population-weighted average murder arrest rate in these cities was 7.1 times the national homicide rate from 1900-1904, but just 1.6 times the national rate from 1911-1915. Only a small part of the 1901-1911 increase in the national homicide rate can be explained by urbanization, because rural areas accounted for 60% of the population in 1900, and almost 50% in 1920 (including 30% of the 1920 population that lived on farms).



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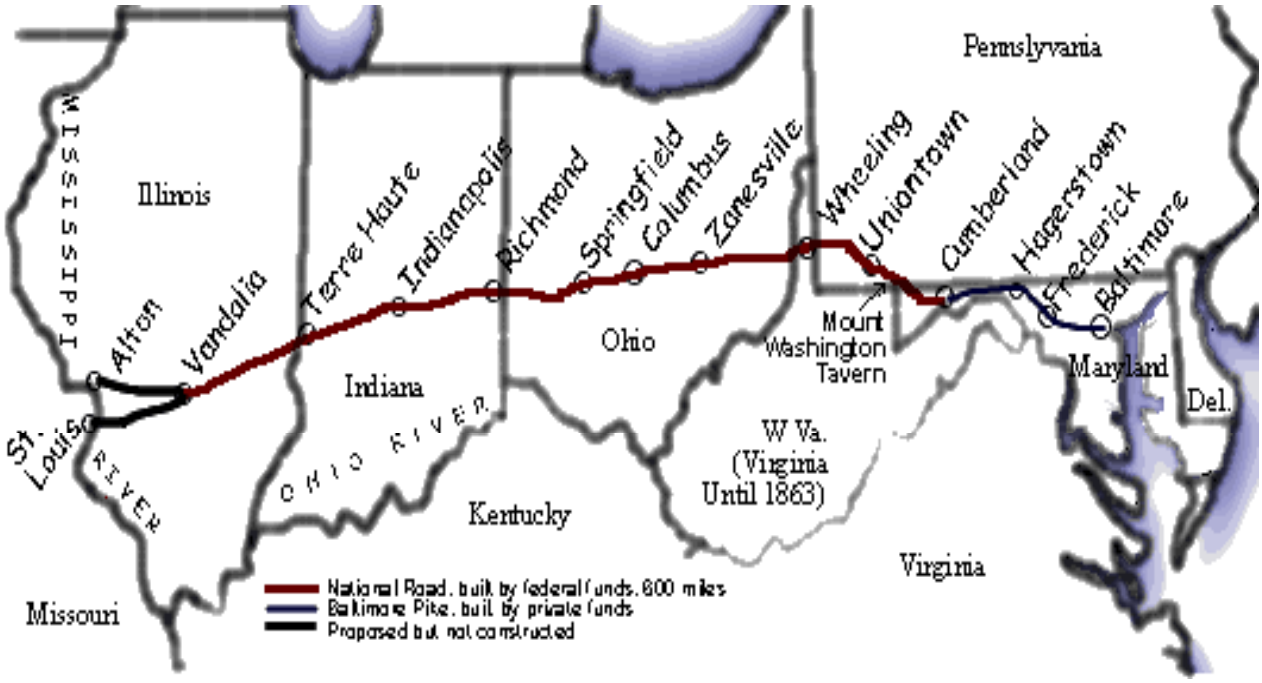
The six-fold increase in the homicide rate from 1900 to 1911 was clearly associated with a surge in rural homicides. Why? The answer to that question begins with a seemingly unrelated question: Why are barns red?

Professional painters in the 1800s prepared house paint by mixing linseed oil with white lead paste. About 90% of Americans lived in rural areas in the mid-1800s, and subsistence farmers could make linseed (flaxseed) oil, but few had access to white lead, so they mixed linseed oil with red rust to kill fungi that trapped moisture and increased wood decay. Red barns are still a tradition in most USA farming regions but white barns are the norm along the path of the old National Road. Why?

The National Road was the first federally funded highway, built from 1811 to 1834. It had heavy daily traffic that included thousands of Conestoga wagons, the "tractor-trailer" of that era. Those wagons, designed to carry heavy freight, passed through farm areas from Baltimore to Illinois, close to major lead mines in Southeast Missouri. The reason the red barn tradition never took root along that path is likely because the National Road made freight, including white lead, accessible to nearby farmers. USA lead output was a relatively stable 1000 to 2000 tons per year from 1801-1825, but lead output was 15,000 to 30,000 tons per year from the mid-1830s through the mid-1860s after the completion of the National Road.



USA refined lead output then surged from 26,000 tons in the early-1870s to almost 400,000 tons in 1904, with 30% of 1904 refined lead output being used as white lead in paint. USA per capita use of lead in paint tripled from 1876 to 1898 due to advances in transportation and lead manufacturing. The first American patent for "ready-mixed" paint was filed in 1867; railroads built almost 120,000 track miles from 1850 to 1900; and Sears Roebuck and other mail-order catalogs combined volume buying, railroad transport, and rural free parcel post delivery to provide economical rural access to a wide variety of products in the1890s.

The murder arrest rate in large cities was more than seven times the national homicide rate from 1900-1904 because lead paint in the 1870s was available in large cities but unavailable in most rural areas. The early-1900s convergence in rural and urban murder rates was presaged by a late-1800s convergence in rural and urban lead paint exposure.

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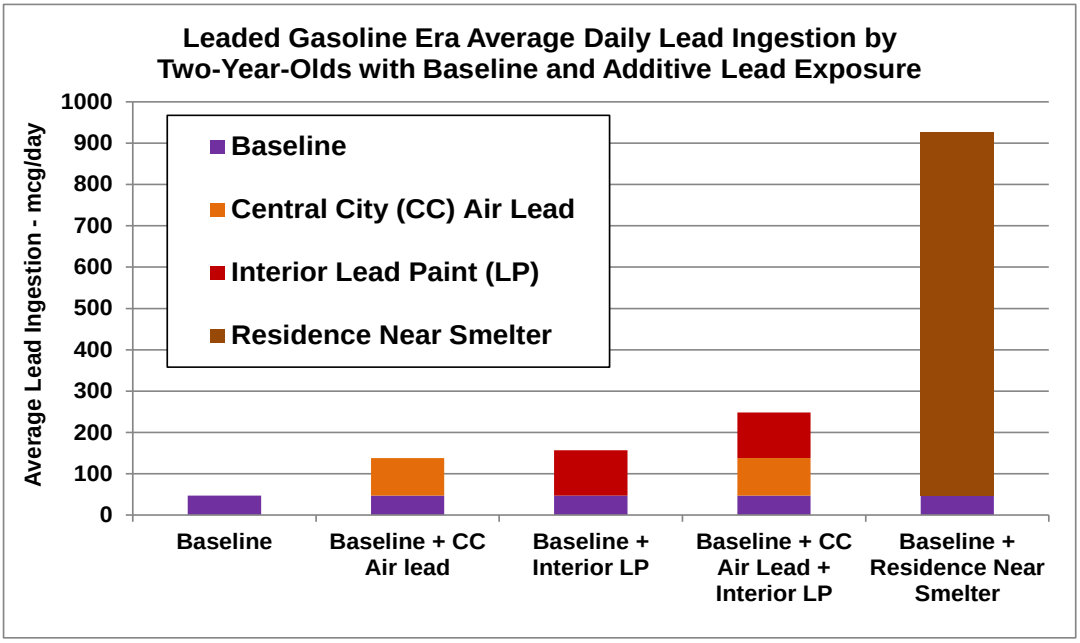
During the second half of the 20th Century, trends in average preschool blood lead tracked trends in per capita emissions of lead in gasoline, as average exposure to lead paint in older homes changed very slowly. At the same time, lead paint and other sources of exposure often contributed to severe cases of childhood lead poisoning because all lead exposure is additive.

The EPA has estimated baseline lead ingestion by two-year-olds during the leaded gasoline era, plus additive ingestion from exposure to interior lead paint, air in central cities (population over 50,000), and residence near a smelter: This analysis showed that average dust lead ingestion caused by interior lead paint exposure was actually similar to the inhaled air lead and dust lead ingestion caused by central city exposure, and lead ingestion was orders of magnitude higher for children residing near a smelter.



(EPA, 1986, Volume I of IV, Table 1-8, p. 1-49)

The homicide impact of smelters and other industrial lead emissions was demonstrated by a Stretesky and Lynch (2001) study showing that USA counties with high 1990 air lead (from industrial emissions, after the phase-out of leaded gasoline), had 1989–1991 murder rates that were four times higher than counties with low air lead, after controlling for nine air pollutants and six sociological factors. Nevin (2007) suggests this study "likely reflects 1970s additive preschool lead exposure, because if murder were much affected by contemporaneous air lead then the homicide rate would have fallen as gasoline lead and air lead fell over 70% from 1975–1984 ... Most 1990 lead-emitting facilities were in operation for decades, in areas with older housing and some traffic, so 1989–1991 murder rates likely reflected higher 1970s blood lead where children had additive exposure to lead in paint and gasoline and industrial emissions."

The local impact of smelters was also evident in the exceptional murder arrest rate trend in one large city in the early-1900s. Saint Louis was the epicenter of the "Lead Belt" in Missouri, the major source of USA lead output in the late-1800s, when the St. Joseph Lead Company became one of the largest lead producers in the world. St. Joe began operations at its first smelter in 1892, in Herculaneum, 25 miles from St. Louis. The Herculaneum smelter was still one of the largest smelters in the world in 1970, when air lead in Herculaneum was four times higher than early EPA air quality standards, in spite of pollution controls installed in 1969. USA refined lead output doubled from the early-1890s to 1904, long before there were any air quality standards, and the St. Louis murder arrest rate increased 10-fold from 1910 to 1916, about 20 years after smelting operations began in Herculaneum.

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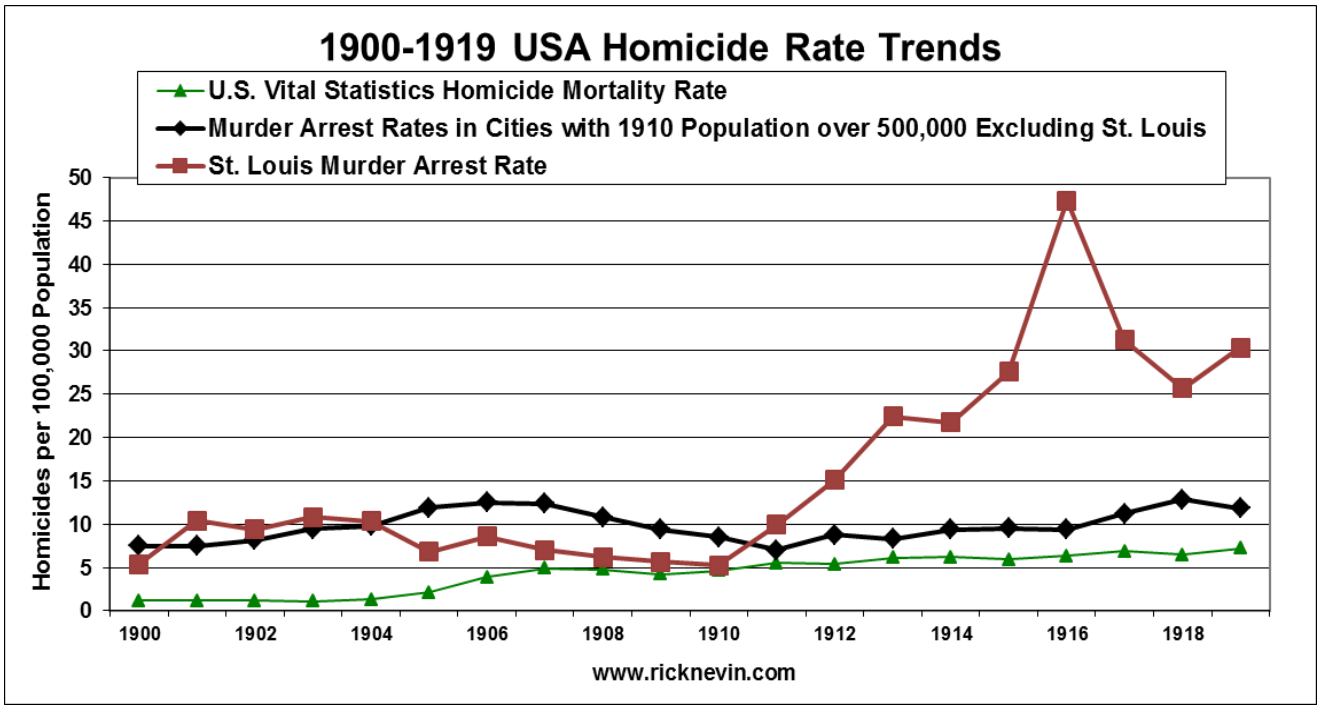

The EPA estimate for lead ingestion by two-year-olds exposed to interior lead paint is only a rough average for a range of exposure severity affected by the age and condition of housing. Jacobs (2002) presented 1998-2000 housing survey data showing that lead contaminated dust hazards are still found in one-third of homes with interior lead paint in good condition (under layers of intact lead-free paint), and in two-thirds of homes with deteriorated interior lead paint. Lead contaminated dust in homes with paint in good condition is often caused by friction and impact surfaces on windows, but lead dust hazards are twice as common in homes with old layers of lead paint exposed by interior paint deterioration.

A recent Brennan Center report acknowledged that the decline in gasoline lead exposure might have "played some role in the 1990s drop in violent crime" in the USA, but this report did not cite the evidence from Nevin (2007) showing the same consistent relationship between lead exposure trends and both violent crime and property crime trends over several decades in the USA, Britain, Canada, France, Australia, Finland, Italy, West Germany, and New Zealand. The Brennan report also notes that "prevalence of lead in gasoline has been at consistently lower levels since the early 1990s" and concludes, incorrectly, that "individuals who were around age 22 in the 2000s were exposed to consistently low rates of lead similar to previous cohorts", so lead exposure trends cannot explain the USA crime decline from 2000-2013. This conclusion ignores the fact that preschool gasoline lead exposure is still affecting the overall crime rate as arrest rates are still increasing for adults born before air lead levels peaked in the early-1970s. The Brennan report also ignores the documented decline in elevated preschool blood lead since the late-1980s, primarily due to ongoing declines in the percent of young children exposed to lead contaminated dust from interior lead paint in older homes.

A Wright (2008) analysis of blood lead data collected from pregnant women and their children since 1979, and later criminal behavior among these children, found that preschool blood lead above 5 mcg/dl (micrograms of lead per deciliter of blood) was significantly associated with violent and non-violent offending among those subjects two decades later, at ages 19-24. This study also found that arrest rates were greater for each 5 mcg/dl increase in blood lead concentration.

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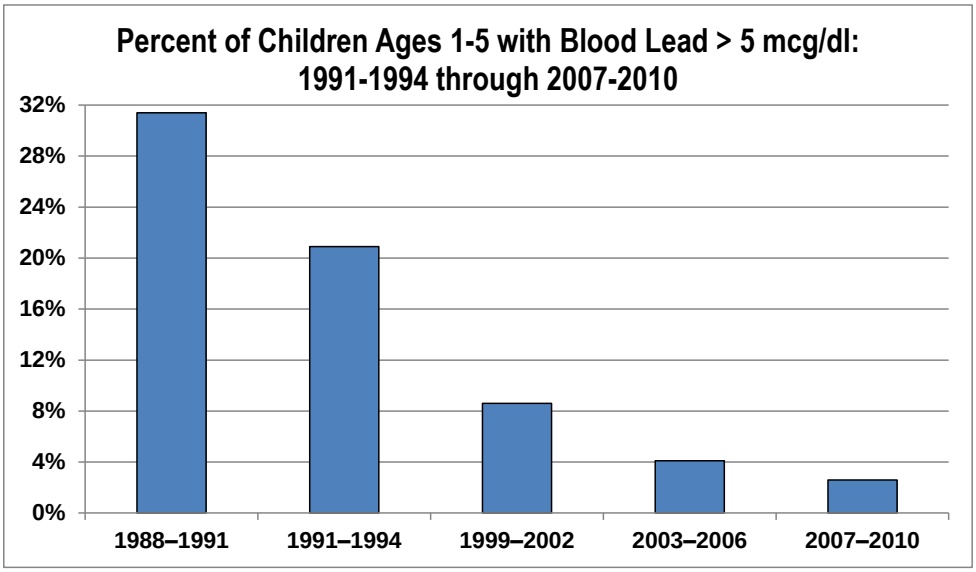
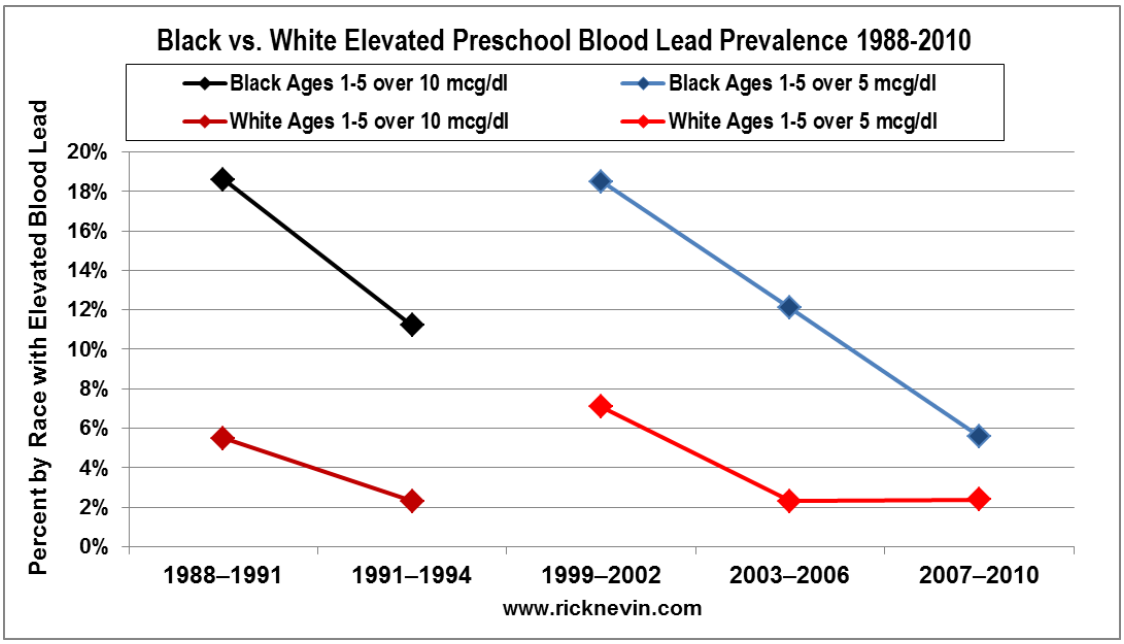
The percent of USA children ages 1-5 with blood lead above 5 mcg/dl fell from 31.4% in 1988-1991 to 20.9% in 1991-1994, and 2.6% in 2007-2010. The 2007-2010 prevalence of preschool blood lead above 5 mcg/dl was 5.3% for children living in housing built before 1950, 1.3% for children living in 1950-1977 housing, and just 0.4% for children in housing built after 1977. Lead paint was banned in 1978, and lead paint in pre-1950 housing was used on more interior surfaces and had higher lead content. Steep ongoing declines in juvenile arrest rates from 2008 through 2013 reflect the blood lead decline from 1990 through 1994. Even larger declines in under-age-15 arrest rates through 2013 reflect the ongoing impact of declines in elevated blood lead through 2002.



The decline in elevated blood lead prevalence since the late-1980s has been associated with continuing racial disparities, because black children are more likely to live in older homes with lead paint hazards. The percent of black children over 10 mcg/dl fell from 18.6% in 1988-1991 to 11.2% in 1991-1994, as the percent of white children over 10 mcg/dl fell from 5.5% to 2.3%. The percent of black children over 5 mcg/dl fell from 18.5% in 1999-2002 to 5.6% in 2007-2010, as the percent of white children over 5 mcg/dl fell from 7.1% to 2.4%.



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Lead Poisoning, Racial Disparities, and Diminished Culpability

Blood lead surveillance programs began in many large cities around 1970 when leaded gasoline use peaked, and many children had additive exposure to central city air lead and severe lead paint hazards in substandard (deteriorated and dilapidated) slum housing. A Department of Commerce analysis of that surveillance data found that 25% of city children had blood lead over 40 mcg/dl, and the prevalence of substandard housing explained 95% of 1970 Census tract variation in the percent of children over 40 mcg/dl.

Over the 1960s, urban renewal programs demolished a large number of substandard city housing units, suggesting severe lead poisoning was even more common in the early-1960s. This inference is supported by public health reports stating: "In the 1960s many inner city hospitals had large numbers of comatose and convulsing children with lead poisoning, with fatality rates of 5–28%." Convulsions, coma, and death are associated with preschool blood lead levels above 70 mcg/dl.

In the city of Cleveland, Robbins (2010) found that lead concentrations in tooth enamel formed in early childhood from 1936 to 1993 peaked in the early-1960s at five times the levels in teeth formed in 1936–1950 and 1986–1993. Tooth lead data for this predominantly (86%) black population were found to be highly correlated with national preschool blood lead data for urban African-American children, supporting an early-1960s peak preschool blood lead estimate of 48 mcg/dl for urban African-American children.

In 1960, blacks occupied 15% of central city households but occupied 56% of substandard central city housing. In the late-1970s, African-Americans accounted for 15% of all preschool children but accounted for 48% of all preschool children with blood lead over 30 mcg/dl.

The percent of black preschool children with blood lead above 30 mcg/dl fell by 90% from the late-1970s to the late-1980s, and the black juvenile murder arrest rate fell 83% from the early-1990s through 2004. The black juvenile murder arrest rate fell to another record low in 2012, 87% below its early-1990s peak. The overall juvenile murder arrest rate in 2012 was the lowest ever recorded by the FBI, 43% lower than the juvenile murder arrest rate in 1960.

In 2012, African-Americans accounted for 42% of all prisoners on death row. More than 90% of all prisoners on death row are ages 30 to 65, with birth years spanning the 1947-1982 rise and fall of leaded gasoline, when severe preschool lead poisoning was commonplace.

In 2013, African-Americans accounted for about 37% of all state and federal prison inmates, but Bureau of Justice Statistics Prisoner data show that the prison pipeline for young males is running dry due to ongoing declines in young adult arrest rates.

- In 2001, 3% of black men and 0.3% of white men ages 18-19 were serving sentences in state or federal prison: In 2013, incarceration rates for ages 18-19 fell to 1% for black males and 0.1% for white males.
- In 2001, 8% of black men and 1% of white men ages 20-24 were serving prison sentences: In 2013, incarceration rates for ages 20-24 fell to 4% for black males and 0.6% for white males.
- In 2001, 10% of black men and 1.2% of white men ages 25-29 were serving prison sentences: In 2013 incarceration rates for ages 25-29 were 5.7% for black males and 1% for white males.

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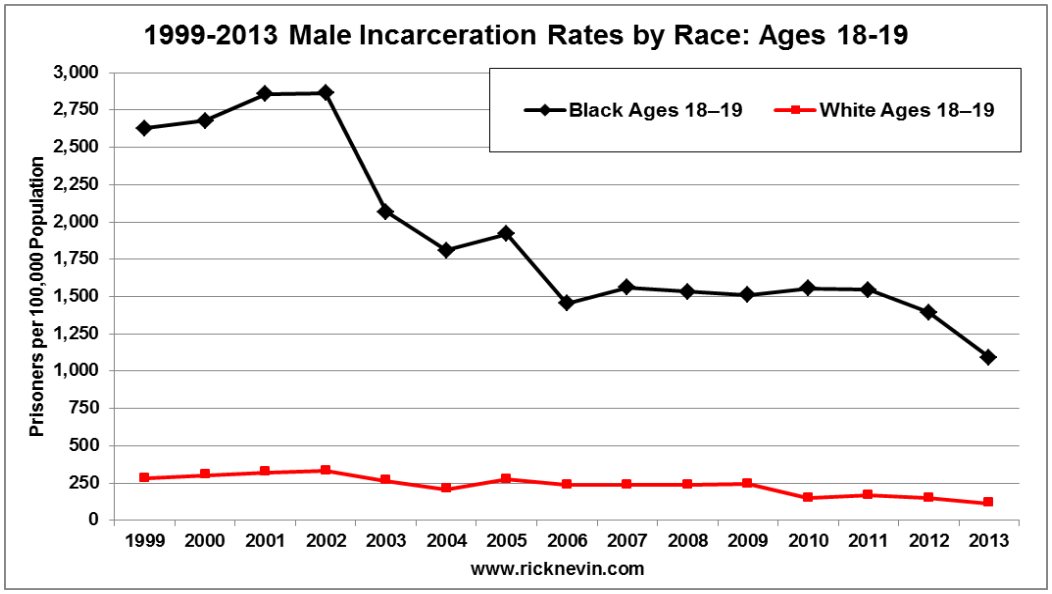

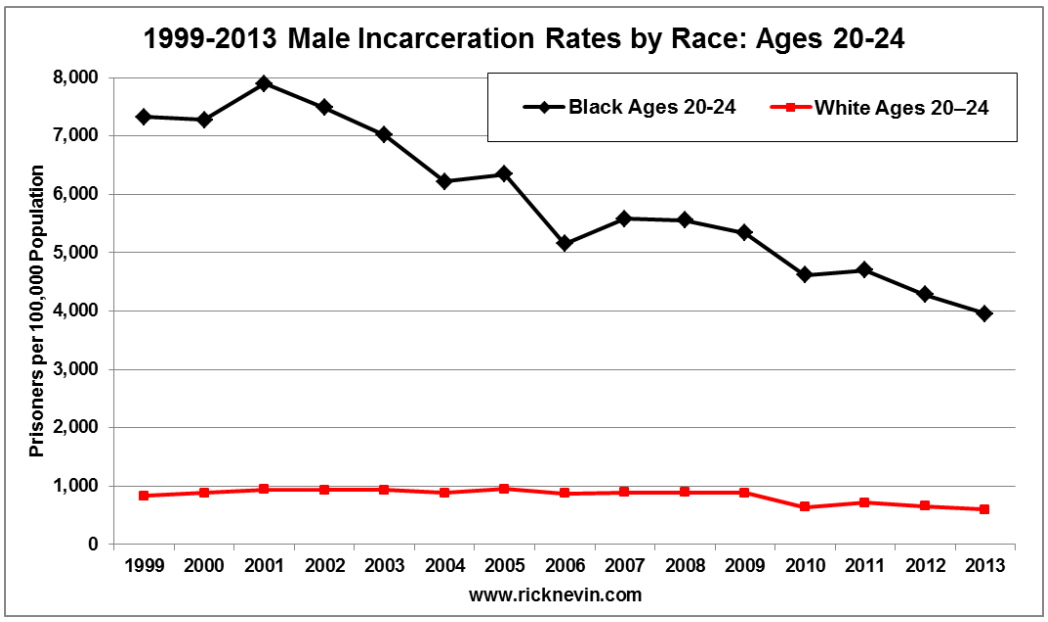

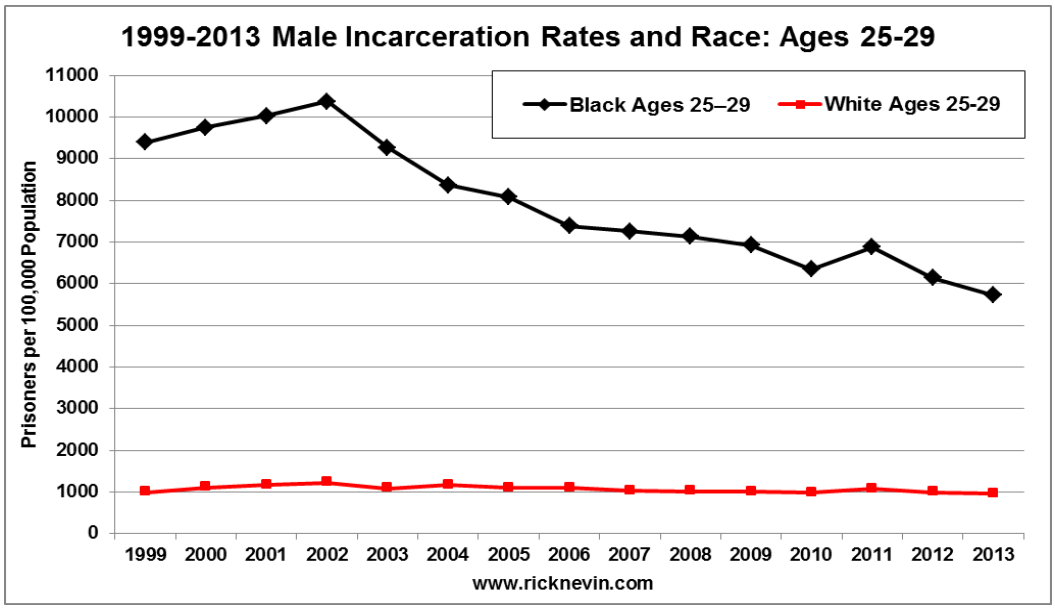

The *Roper* decision reaffirmed: "Capital punishment must be limited to those offenders who commit a narrow category of the most serious crimes and whose extreme culpability makes them the most deserving of execution." We now know that preschool lead exposure impairs the specific types of brain development linked to "culpability" in *Roper*; Raine's research links those specific types of brain impairment to homicide offending; murder rate trends by race have tracked racial disparities in lead poisoning; and the USA homicide rate and murder trends by city size have tracked lead exposure trends from 1900-2013. Legal precedent and the known history and neurodevelopmental impacts of lead exposure clearly cast doubt on our society's ability to judge the extreme culpability of any specific offender.

Dangerous people need to be incarcerated to protect law-abiding citizens, but any legal or moral justification for the death penalty is completely undermined by our inability to judge the culpability of individual offenders. The known history and impacts of preschool lead exposure should also inspire a more enlightened attitude toward incarcerated criminals, even if they must remain in prison for the sake of public safety.

So if you meet me
Have some courtesy
Have some sympathy, and some taste
Use all your well-learned politesse
Or I'll lay your soul to waste

- *"Sympathy For The Devil" (Jagger, Mick / Richards, Keith)*

Recommended Listening:

EVIL, Myoclonic Jerk podcast by Dan Kaufman, with Adrian Raine and Rick Nevin interviews

Recommended Reading:

America's Real Criminal Element: Lead, Kevin Drum, *Mother Jones*

Is Lead Exposure the Secret to the Rapid Rise and Fantastic Fall of the Juvenile Crime Rate?, Dick Mendel, Juvenile Justice Information Exchange

The Crimes Of Lead, Lauren Wolf, Chemical and Engineering News