The Ten Most Violent Cities in the U.S

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Abstract

Although few Americans view high rates of violent crime or learning disabilities as desirable features of the community where they live, most studies of differences between our cities focus on socio-economic and ethnic factors. What hasn’t received enough attention are environmental features that change brain chemistry in ways that contribute to dysfunctional behavior. Many scientific publications over the last 20 years have identified four neurotoxic chemicals in American water supplies that are linked to violent crime and learning disabilities. These toxins include not only lead and manganese (long known to inhibit the function of essential neurotransmitters), but also two untested chemical compounds - fluorosilicic acid (H$_2$SiF$_6$) or sodium silicofluoride (Na$_2$SiF$_6$) - now used for over 90% of our water fluoridation. To confirm findings based on data for all counties in 1985 and in 1991, this study tests the hypothesis with statistics from the ten most violent cities in the U.S. The results strongly confirm the harmful effects of silicofluorides. This evidence greatly strengthens the need to end their addition to American public water supplies and thereby lower rates of violent crime and learning disabilities at virtually no cost.

Keywords: Violent Crime; Learning Disabilities; Silicofluorides

In 2007, the Associated Press reported the results of a survey of violent cities by the American Society of Criminology [1]. Papers and radio newscasts reported that Detroit came out on top of the list, but quoted citizens of the city who couldn’t believe it. Using complex statistical methods, however, it’s possible to check whether the higher rates of violent crime are due to an environmental factor rather than human failure. When such an analysis confirms there’s problem, it can sometimes also point to unsuspected reasons for high crime that may be easier to remove than racial poverty or high divorce rates.

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Over the last 20 years, I collaborated with the late Myron J. Coplan (former Vice President of Albany Chemical Corporation in publishing fourteen peer-reviewed scientific articles showing that toxic chemicals are significantly associated with geographical differences in rates of violent crime within the U.S. While it's generally known that lead is a poison, few Americans are aware that lead's effects on the brain include blocking the activity of a key neurotransmitter (dopamine) that is basic to cognition and self-control; as a result, lead pollution in a community is significantly linked to higher rates of violent crime taking other factors (such as race, income, population density, and education) into account [2,3]. Manganese is another heavy metal which has similar effects on brain chemistry and behavior [4,5].

Table 1 presents data on these effects by comparing murder rates in the ten most violent cities in the U.S. The EPA’s Toxic Release Inventory reports pollution with either lead or manganese. Based on these EPA reports, the murder rate in cities with either lead pollution (8.7 per 100,000 population) or manganese pollution (5.0 per 100,000 population) are at least double the murder rate in cities exposed to neither of these toxins (2.5 per 100,000 population). Even more striking, and more important scientifically, the murder rate is 50.1 per 100,000 in cities with pollution from both lead and manganese — a rate that's twenty times higher than the rate in cities that are not polluted with either neurotoxin. While these data on violence levels, provided to me by Everett “Red” Hodges (President of the Violence Research Foundation), are only one sample from recent findings, shows there’s a need to study further whether lead and/or manganese pollution increases rates of murder or other violent crimes. Perhaps more important, these statistics show that a combination of these two toxins seems to have explosive consequences that dwarf a merely additive effect. Instead of looking for the cause of these harmful behaviors, it’s probably important to consider how connections between different “risk factors” contribute outcomes like murder.

<table>
<thead>
<tr>
<th></th>
<th>No Manganese Pollution</th>
<th>Manganese Pollution</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Lead Pollution</td>
<td>2.5</td>
<td>5.0</td>
<td>2.8</td>
</tr>
<tr>
<td>Lead Pollution</td>
<td>8.7</td>
<td>50.1</td>
<td>31.3</td>
</tr>
<tr>
<td>Total AVE.</td>
<td>3.0</td>
<td>26.2</td>
<td></td>
</tr>
</tbody>
</table>

**Table 1:** Lead and manganese pollution contribute to violent crime.

**U.S. murder rates and heavy metal pollution — 1991.**

**Numbers in Table:** (average number of murders per 100,000 population)

**Pollution:** EPA Toxic Release Inventory (all 3141 U.S. counties).

**Statistical significance of increase in murder rate by toxin:**

Manganese: *p = .0001*

Lead: *p = .0001*

Interaction: *p = .0001* (the combination of both lead and manganese).

Statistical analysis shows that the “statistical significance” of each of the three measures of murder rates in table 1 is at the level of *p = .0001* — which means in everyday language that each result would be expected to occur by accident (and hence be of no scientific value) only once in 10,000 observations. In scientific terms, this is a very high level of “statistical significance” since at present the usual criterion for scientific value is *p = .05* (five chances in 100 of error). This result should not be surprising, however, because there are known neuro-scientific mechanisms that explain the pattern just described.

Activity in the brain occurs when chemicals called “neurotransmitters” either increase or inhibit the firing of neurons (brain cells) along specific pathways. Manganese is a neurotoxin that inhibits the normal functions of the neurotransmitter norepinephrine (which links pathways in the brain underlying self-control). Lead blocks the normal functions of the neurotransmitter dopamine, which is essential for learning as well as self-control. To fulfill this role, dopamine is an unusual neurotoxin because, depending on the pathway, it can either activate or inhibit a response. For example, a child is taught how to add 2 + 2. What’s required is that the answer “2 + 2 = 4” needs to be activated, but the answer “2 + 2 = 5” needs to be inhibited!
Not only can either neurotoxin interfere with patterns of brain activity needed for education and obedience to rules, but the effect of lead alone is slightly greater than the effect of manganese alone. Even more important, however, in communities with both lead and manganese pollution, there is an interaction between the different neural pathways affected by each neurotoxin. In short, the mechanisms of neurotoxicity and brain function explain the pattern illustrated by the four numbers in the center of table 1.

The example in table 1 is striking because it indicates how combinations of toxins often have more important effects than a single toxin alone. This point is relevant because the late Myron J. Coplan (a chemist and former Vice President of Albany Chemical Corp.) collaborated with the present author in research on another kind of chemical that’s involved in findings concerning lead and manganese neurotoxicity. In studying other factors associated with higher rates of violent crime, we found that - taking into consideration as many as a dozen other environmental characteristics like old housing (where lead paint as used), population size and density, ethnic differences, college education, average income, etc.) -- there are two other toxic chemicals that interact with lead and manganese to increase rates of violent crime.

Although the policy of water fluoridation has long been assumed to be safe as well as beneficial, there is a technical issue of chemistry in the choice of a toxic fluoride compound for over 90% of the population drinking water to which fluorine has been added. The difference in spelling between “fluoride” and “fluorine” in that last sentence is intentional and important. Because the element fluorine is not stable unless it’s in a compound, when chemists refer to that element in a compound they spell the word “fluoride” with a “D” (whereas as an element it’s spelled with an “N”). In short, the practice of water fluoridation requires adding a fluoride compound to water, and the combination triggers a chemical reaction (called hydrolysis) that separates the atoms of fluorine from other elements in the original compound. This matters, because all the tests of the safety of water fluoridation were conducted using sodium fluoride -- familiar in toothpaste -- as the compound to deliver fluorine to the public as a means of reducing tooth decay.

Since the practice of water fluoridation officially began in 1942, public water — especially in large cities — has usually been treated with either hydrofluorosilicic acid (H$_2$SiF$_6$) or sodium silicofluoride (Na$_2$SiF$_6$) instead of sodium fluoride (NaF). The difference is very important. When sodium fluoride is added to water, the sodium atoms split from fluorine atoms. Sodium (normally in salt) is not toxic, and since fluorine is widely used in toothpaste, it was assumed to be safe. Officially, when the use of either silicofluoride was formally approved as safe in 1950, it was simply “assumed” that, on being added to water, both H$_2$SiF$_6$ and Na$_2$SiF$_6$ would separate into their three component elements so that the logic of sodium fluoride safety would also apply to these silicofluorides.

There was a potential problem that neither doctors nor dentists realized with this assumption. Fluorosilicic acid is an unusually strong corrosive acid that was used in industries as means of etching steel. But generally unknown to the medical professions, government regulators, or the public, the original idea of water fluoridation came from the Manhattan Project as a necessary step in the top-secret project to build an Atomic bomb, which began immediately after Pearl Harbor. This project was urgently needed because Hitler, whose conquest of Czechoslovakia had given Germany control of a mine with high quality uranium, had ordered his scientists to design an atomic bomb. Once the U.S. was at war, building an atomic bomb was therefore a top priority, but we confronted the obstacle that no such uranium mine existed within America’s borders. It turned out that the only possible source of weapons-grade uranium seemed to be its presence in phosphate rock.

The Manhattan Project settled on the following process. To separate the weapons-grade uranium from phosphate rock, the rocks were to be ground and put into fluorosilicic acid, whose strong corrosive activity would split the bonds between the elements in the rocks. Then putting the mix of the acid and the rock particles in a centrifuge which could spin the mixture rapidly, centrifugal force would send the particles of uranium (the heaviest element) to the outside of the mixture from which they could easily be collected. At that point, however, it would necessary to maintain top secrecy when disposing of the remaining mixture of other elements and fluorosilicic water.

The solution was to use a filter so that the liquid fluorosilicic acid would pass out of the mixture and could be separated from the left-over solid elements of the ground-up phosphate rock. Then the solid particles could be dumped on any slag heap without attracting attention, and an equivalent way to dispose of the fluorosilicic acid would be dumping it in water. The problem was to create filter for separating the solid elements from the liquid that would not be corroded or otherwise destroyed by the highly corrosive fluorosilicic acid. In February 1942, that chemical task was given to the Albany Chemical Corp. in Boston, and the chemist responsible for carrying it out was Myron J. Coplan.

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This story not only explains why water fluoridation was initiated in 1942, using fluorosilicic acid in many communities, but also why Myron ("Mike") Coplan called this author out of the blue, asking if I knew anything about "silicofluorides" (which of course I didn’t). It had happened, however, that as a political scientist I had been at a conference in California where I met Everett "Red" Hodges, who had created the "Violence Research Foundation" and gave a presentation on the role of lead and manganese toxicity in violent behavior. After this, he gave me the numbers in table 1, which had been part of his talk to the conference.

On the plane flying back to Dartmouth, it struck me that the studies of individuals that Red Hodges was doing were not the only way to study whether lead or manganese could be responsible for violent crime. Although my background was in political philosophy, I’d taught a "scope and methods" course that surveyed the various approaches to data analysis in political science with a professor (Denis Sullivan) who did statistical research. Having learned about multiple regression models from those classes, it occurred to me that the link between pollution with either lead or manganese and murder rates might be tested with these statistical methods.

The result has been fifteen years of research, using complex statistical analysis that take multiple facts into consideration as possibly responsible for high rates of murder. Working on that hunch in the airplane on the way home from California, it was evident that to determine whether lead and manganese were factors in violent human behavior, it was necessary to use what’s called "multivariate statistical analysis" (and in particular, "multiple regression"). The numbers in table 1 don’t really show anything for a certainty about rates of murder unless it can be shown that lead and/or manganese had added effects on violence after taking into account the possible effects of poverty, unemployment, lack of education, population density as well as urban decay and other sources used in conventional explanations for crime. In statistical analyses, such research is the equivalent of seeing whether putting all the likely factors linked to murder in an equation, and finding in that calculation that the presence of lead or manganese pollution contributed to more murders than could be explained by the conventional social and environmental statistics.

Having learned how to do such analyses, I began to publish statistical studies of crime rates -- and found that lead and manganese were indeed what statisticians call "significant variables" related to violent crime. After I had published this work for several years [6-9], Myron. J. ("Mike") Coplan read some of my articles and called me to ask if I’d be interested in adding silicofluorides to the multivariate statistical tests. Using this statistical approach with Mike, we found that along with the effects attributed to lead or manganese, chemicals called “silicofluorides” made an additional contribution to higher rates of learning disabilities, substance abuse, and violent crime. Indeed, we also found that where there is lead in the environment (from lead paint in old housing, corrosion of water pipes, and other sources in addition to industrial pollution), the absorption of lead in children’s blood is greatly increased where silicofluorides are in public water supply [2,3,10,11].

This effect of water fluoridation chemistry on children’s blood lead levels is most obvious when the statistics for all U.S. counties are broken down by ethnicity (comparing Blacks with Whites) and exposure to a county where over 80% of the population is or is not exposed to silicofluoride treated water (Table 2). Several factors in these eight measures of children’s blood lead deserve emphasis:

1) Younger children always absorb more lead than those who are older; this is important because neurotoxins have greater lasting effects on the developing brain in very young children.

2) Black children always absorb more lead than White children in the same environment; one probable explanation is that Blacks in the U.S. tend to have higher frequency of lactose intolerance, which results in lower calcium levels due to avoidance of milk.

3) "Controlling" for these two factors, water treatment with silicofluorides has a consistent, highly significant association with higher blood lead levels (p = .0001). Since high blood lead is linked to lower educational success and weaker behavioral self-control, this evidence indicates not only how neurotoxic effects could play a major role in murder rates, but also provide a hypothesis for further research on the tendency of these toxins to increase rates of educational dysfunctions and substance abuse.
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While data comparable to table 2 were not available for manganese levels by ethnicity and age, it’s quite possible that both heavy metals have similar effects. Nonetheless, even if our attention is limited to lead neurotoxicity and its greater effect when silicofluorides are added to water, these statistics make it clear that multiple neurotoxic chemicals very probably combine to be a significant factor in all violent crimes including murders. The results in table 2 therefore are strongly consistent with the hypothesis that the harmful effects of lead and manganese are greatly increased in communities where either hydrofluorosilicic acid (H$_2$SiF$_6$) or sodium silicofluoride (Na$_2$SiF$_6$) have been substituted for sodium fluoride (NaF) as the chemicals used for water fluoridation.

<table>
<thead>
<tr>
<th>Factors Associated with Higher Children’ Blood Lead Levels (Race and Silicofluoride Exposure)</th>
<th>Age of Children</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Black and more than 80% of county Exposed to a Silicofluoride</td>
<td>8.0</td>
</tr>
<tr>
<td>*Black and less than 80% of county Exposed to a Silicofluoride</td>
<td>5.5</td>
</tr>
<tr>
<td>*White and more than 80% of county Exposed to a Silicofluoride</td>
<td>3.5</td>
</tr>
<tr>
<td>**White and less than 80% of county Exposed to a Silicofluoride</td>
<td>2.25</td>
</tr>
</tbody>
</table>

Table 2: Toxins ethnicity and children’s blood lead levels (in µg/dL).

Effects of Ethnicity (Blacks vs. Whites) and Exposure to Silicofluoride Treated Water on Children’s Blood Lead Levels (all reporting US. Counties).

* Statistical significance of this combination of race and exposure to a silicofluoride as an influence of children’s blood lead levels: p = .0001 (1 chance in 10,000 of error).

** Statistical significance of this combination of race and exposure to a silicofluoride as an influence of children’s blood lead levels: p = .0029 (29 chances in 10,000 of error).

While this research began with an assessment of the effects of lead and manganese on violent behavior, the statistical evidence shifted our primary focus to these silicofluorides. In addition to contributing to increased levels of lead and manganese absorbed from environmental exposures, moreover, silicofluorides have a direct effect on a key enzyme in the brain. The German researcher Johannes Westendorf had documented reduced functioning of the enzyme acetylcholinesterase, which regulates the neurotransmitter acetylcholine [12,13]. Since acetylcholine is a main neurotransmitter that activates bodily movement, this effect of silicofluoride is probably related to the increased frequency of hyperactivity, a condition that is far more frequent today than it was 50 years ago. Once again, however, there are multiple influences: other researchers have isolated a genetic mutation that’s probably related to ADHD. The lesson here is that biologists now often find that behaviors reflect what is called “gene-environment interaction” or other combined effects of different influences.

Since over 90% of water fluoridation uses “silicofluorides” (toxic compounds never tested for safety), ending silicofluoride use will have the effect of greatly reducing levels of lead and manganese in the brains of American children (thereby improving educational results) as well as cutting rates of violent crime. Using county-level statistics, these findings have been replicated for several different years and checked using different statistical techniques. While more research is needed to confirm the mechanisms for these findings, studies by Johannes Westendorf in Germany indicated at least one key biochemical factor. Silicofluorides are acetylcholinesterase inhibitors - a class of enzymes that can increase aggressive behavior in young males [14]. Besides, since our first publication in 1999, no research has challenged the link between silicofluoride use and violent crime. Moreover, the one study claiming to challenge a link between silicofluoride use and higher blood lead in children actually confirmed our findings - and ignored the other harmful effects we find are increased where silicofluorides are in use.

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Silicofluorides, originally highly toxic waste products from producing weapons grade uranium, are now added to water supplies delivered to over 120 million Americans. Although these compounds were approved for use in 1950 by the Public Health Service, to this day they have never been tested for safety. Although the National Toxicology Program nominated them for study in 2002, no such research has been conducted. How could this be? If silicofluorides really increase murder rates and other violent crimes, their use to treat public water supplies is apparently a billion dollar mistake.

The new statistics provide other support for this conclusion. Do communities high on the current list of violent cities use silicofluorides in their water treatment whereas the safe ones don’t? The results in table 3 are clear. In the American Society of Criminology study of urban violent crimes, of the ten most violent cities in the U.S., nine treat their water with silicofluorides. In contrast, of the five least violent cities in the U.S., none use silicofluorides. We’ve never claimed that silicofluorides are the only cause of crime, but table 3A and 3B, showing the effect of these chemicals in 14 of 15 cities with extreme rates of violent crime (93% accuracy), along with table 2 showing the association of silicofluoride treated water and higher lead uptake seems to show the value seeking multiple tests to confirm a research hypothesis.

### Table 3A: Silicofluoride use in cities with extreme rates of violent crime.

<table>
<thead>
<tr>
<th>Metropolitan Area</th>
<th>Fluoridation Chemical</th>
<th>Violent Crime Rate per 10,000</th>
<th>Property Crime Rate per 10,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York, Northern New Jersey, Long Island, NY-NJ-PA MSA</td>
<td>Na2SiF6</td>
<td>406.0</td>
<td>1744.1</td>
</tr>
<tr>
<td>Los Angeles, Long Beach, Santa Ana, CA MSA</td>
<td>Natural</td>
<td>405.4</td>
<td>2232.7</td>
</tr>
<tr>
<td>Chicago-Joliet-Naperville, IL-IN-WI MSA</td>
<td>H2SiF6</td>
<td>304.8**</td>
<td>2791.5</td>
</tr>
<tr>
<td>Dallas-Fort Worth-Arlington, TX MSA</td>
<td>Na2SiF6</td>
<td>358.4</td>
<td>2791.5</td>
</tr>
<tr>
<td>Huston-Sugar Land-Baytown, TX MSA</td>
<td>H2SiF6</td>
<td>550.8</td>
<td>3576.9</td>
</tr>
<tr>
<td>Philadelphia-Camden-Wilmington, PA-NJ-DE MD MSA</td>
<td>H2SiF6</td>
<td>532.3</td>
<td>2747.3</td>
</tr>
<tr>
<td>Washington-Arlington-Alexandria DC-VA-MD-WV MSA</td>
<td>H2SiF6</td>
<td>334.6</td>
<td>2386.0</td>
</tr>
<tr>
<td>Miami-Fort Lauderdale-Pompano Beach, FL MSA</td>
<td>H2SiF6</td>
<td>596.7</td>
<td>2747.3</td>
</tr>
<tr>
<td>Atlanta-Sandy Springs-Marietta, GA MSA</td>
<td>H2SiF6</td>
<td>400.9</td>
<td>3552.0</td>
</tr>
<tr>
<td>Boston-Quincy, Cambridge-MA-NH MSA</td>
<td>No fluoride</td>
<td>374.4</td>
<td>2109.0</td>
</tr>
</tbody>
</table>

**Totals for all 10 Metropolitan Areas**

<table>
<thead>
<tr>
<th>Chemical Used</th>
<th>Number of Areas</th>
<th>Total Number of Crimes</th>
<th>Total Number of Crimes</th>
</tr>
</thead>
<tbody>
<tr>
<td>H2SiF6</td>
<td>7</td>
<td>3085.9</td>
<td>440.8</td>
</tr>
<tr>
<td>Na2SiF6</td>
<td>2</td>
<td>769.4</td>
<td>382.7</td>
</tr>
<tr>
<td>Natural (None = Boston-Quincy)</td>
<td>1</td>
<td>405.4</td>
<td>2232.7</td>
</tr>
<tr>
<td>(H2SiF6 = Cambridge)</td>
<td>1</td>
<td>374.7</td>
<td>2109.0</td>
</tr>
</tbody>
</table>

### Table 3B: Fluoridation chemical and violent crime rates in 10 largest U.S. metropolitan areas (2011).
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Where there’s lots of smoke, there may well be fire, so why not call the fire department to be sure? If we can ban Chinese made toys with lead paint, we can - and should - stop putting the two toxic silicofluoride compounds in public water supplies until they are proven to be safe. Not every child in Detroit or other crime-ridden cities buys Chinese toys. All children need to drink water, and boiling water for infant formula increases the concentration of toxic chemicals in the resulting drink. Only the wealthy can shift entirely from the faucet to bottled water. Besides, our data show the harmful effects are worse for Blacks and Hispanics than for Whites (probably due to ethnic differences in lactose intolerance). Until silicofluorides are solidly PROVEN to be safe, let’s have a moratorium on their use.

Bibliography