Webinars
- Series of scientific webinars that provide a forum for discourse on scientific issues.
- Live and On-Demand
- Case Conferences
- Journal Clubs
- Grand Rounds
- CE Available

Online Courses
- Evidence-based online courses on a variety of children's environmental health topics.
- Interactive and Self-Paced
- CE Available

Resource Catalog
- Fact sheets, journal publications, reports, and other resources for parents, community members, patients and healthcare professionals
- Topics included: Air Quality, Pesticides, Natural Disasters, BPA, Mold, Lead, Mercury
An Approach to Elemental Mercury Exposure Clusters

Elizabeth Silver, PharmD; Clinical Toxicology Fellow, Georgia Poison Center
&
Paul Wax, MD; PEHSU West Program Director, Executive Director, American College of Medical Toxicology
Disclaimer & Acknowledgement

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Acknowledgements

- All those who assisted and participated in the care of these patients
- Dr. Ziad Kazzi, MD
- Dr. Robert Geller, MD
- Dr. Sukhi Atti, MD

- Elizabeth Silver, PharmD has nothing to disclose
Objectives

- Identify common sources of elemental mercury
- Recognize signs and symptoms associated with inhalational mercury exposure
- Describe environmental cleanup procedures for large exposures
<table>
<thead>
<tr>
<th>Patient 1</th>
<th>Patient 2</th>
<th>Patient 3</th>
<th>Patient 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 y.o F</td>
<td>13 y.o F</td>
<td>11 y.o M</td>
<td>32 y.o F</td>
</tr>
<tr>
<td>CC: Fever, rash, body aches x 2-3days</td>
<td>CC: Fever, Rash, Body Aches x 2-3days</td>
<td>CC: Fever, Rash, Body Aches x 2-3days</td>
<td>No hospital visit</td>
</tr>
<tr>
<td>VS: 102.5F, HR 125</td>
<td>VS: WNL</td>
<td>VS: WNL</td>
<td></td>
</tr>
</tbody>
</table>

- Presented to their local emergency department (ED)
- Diagnosed with viral syndrome
Second Hospital Visit (2 Days After)

<table>
<thead>
<tr>
<th>Patient 1</th>
<th>Patient 2</th>
<th>Patient 3</th>
<th>Patient 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 y.o F</td>
<td>13 y.o F</td>
<td>11 y.o M</td>
<td>32 y.o F</td>
</tr>
<tr>
<td>CC: Fever, Rash, headache, body aches, sore throat</td>
<td>Fever, Rash, Body Aches, sore throat</td>
<td>Fever, Rash, Body Aches, sore throat</td>
<td>Fever, Rash, Body Aches, sore throat</td>
</tr>
<tr>
<td>VS: 103.8F, HR 143</td>
<td>100.4F, HR 110</td>
<td>98.4F, HR 104</td>
<td>101.7F, HR 120 bpm</td>
</tr>
</tbody>
</table>

- Presented to their local ED for a second time
- Sent home with azithromycin for a presumptive streptococcus infection
### Third Hospital Visit (Another 2 Days)

<table>
<thead>
<tr>
<th>Patient 1</th>
<th>Patient 2</th>
<th>Patient 3</th>
<th>Patient 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 y.o F</td>
<td>13 y.o F</td>
<td>11 y.o M</td>
<td>32 y.o F</td>
</tr>
<tr>
<td><strong>CC:</strong> Numbness in legs, difficulty walking</td>
<td><strong>CC:</strong> Fever, Rash, Body Aches</td>
<td><strong>CC:</strong> Fever, Rash, Body Aches</td>
<td><strong>CC:</strong> Fever, Rash, Body Aches, SOB, numbness of mouth, lips</td>
</tr>
<tr>
<td><strong>VS:</strong> 101.4F, HR 114, 123/71, RR: 31, SpO2 98%</td>
<td><strong>VS:</strong> 102.2F, HR 118</td>
<td><strong>VS:</strong> 102.2F, HR 122</td>
<td><strong>VS:</strong> 101.3F, HR 131</td>
</tr>
</tbody>
</table>

- Presented to a tertiary care hospital ➔ Family was getting worse
- Admitted for further work-up
Patient 1: 15 y.o Female
Patient 2: 13 y.o Female
Patient 3: 11 y.o Male
<table>
<thead>
<tr>
<th>Lab and Imaging Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patient 1</strong> 15 y.o F</td>
</tr>
<tr>
<td>Labs: WBC: 27 x $10^3$/uL, +17% bands</td>
</tr>
<tr>
<td>H/H: 7.6/23.6</td>
</tr>
<tr>
<td>Platelets: 113 x $10^3$/uL</td>
</tr>
<tr>
<td>CXR: Patchy Infiltrates vs pneumonitis</td>
</tr>
</tbody>
</table>
Did Someone Mention Mercury?

- Extensive history-taking at tertiary care center
- Family mentioned they had mercury in the house from a friend

Call to GPC to discuss what these symptoms could be...

13 days earlier
Elemental mercury brought to house

12 days earlier
Mercury is vacuumed
Switch to Dr. Paul Wax

To Be Continued…
Mercury Incident in a Dallas School

Paul M. Wax, MD, FACMT
Clinical Professor of Emergency Medicine (Medical Toxicology)
UT Southwestern Medical School
Executive Director, American College of Medical Toxicology
Program Director, PEHSU West
DALLAS, Oct. 29 (UPI) -- A Dallas elementary school informed its students' parents of a mercury spill at the school, noting the mercury was contained and the school safe to attend.

A statement Sunday evening from the Dallas Independent School District said the mercury "was brought to school by a student who found a container of it near his/her home."
Mercury Cleanup Continues At North Texas Elementary School

October 29, 2012 at 1:22 pm  Filed Under:  Dallas Independent School District, DISD, hospitalized, Mercury, Poison, Students, Urban Park Elementary

DALLAS (CBSDFW.COM) – Clean up continues at one North Texas elementary school following a mercury spill. The Environmental Protection Agency (EPA), Texas Commission of Environmental Quality (TCEQ), and the North Texas Poison Center have been at Urban Park Elementary School for several days.

Apparently the mercury was spilled almost two weeks ago, but no one became aware of the incident until several DISD students were hospitalized.

“It was through the hospitalization that we learned about this,” explained DISD spokesperson Jon Dahlander. “The student started exhibiting some mercury-poisoning symptoms on Thursday. And then on Friday as they began to talk with the students about where the mercury may have been that’s when the issue arose on our end.”

In all three students, only one of them enrolled at Urban Park, have been hospitalized. Dahlander said the highly toxic metallic was brought onto the campus by one of them. “The mercury was brought to school by a student who found a container of it near his or her home. They brought it to school during a parent/teacher conference that was taking place on October 17.”
Case 1 – 14 year old male

- Presents to the ED with fever for one day and a rash for a few hours.
- PMH - asthma
- Patient was given ibuprofen and sent home from the ED with a diagnosis of viral syndrome.
- The following day, he returned to the same ED with persistent fever to 105 degrees F at home and rash.
- Additional symptoms - dry cough, malaise, sore throat, and generalized headache.
Case 1 – Physical Exam

- VS: BP 125/74 mm Hg
- HEENT: bilateral injected conjunctiva, erythematous oropharynx without exudate
- Neck: supple
- Chest: coarse breath sounds diffusely
- Neuro: normal, no evidence of tremor
- Skin: diffuse confluent erythematous maculopapular pruritic rash (excluding the palms and soles) without desquamation and petechiae localized to bilateral lower extremities,
Conjunctivitis

Petechiae to bilateral lower extremities
Case 2 – 9 year old female

- Sister of case 1 presented to the ED with her older brother c/o fever, rash, headache, bilateral foot pain for one day.
- PMH - asthma
- She was also sent home from the ED with a diagnosis of viral syndrome.
- The following day, the patient returned with her brother complaining of similar symptoms including fever, diffuse headache, persistent dry cough, sore throat, nonbloody diarrhea, vomiting, abdominal cramps, and anorexia.
Case 2 – Physical Exam

- VS: BP was 117/62 mm Hg
- HEENT: bilateral injected conjunctiva, erythematous oropharynx without exudate,
- Neck: supple
- Chest: coarse breath sounds bilateral
- Abd: nontender
- Neuro: intact without tremor
- Skin: pruritic confluent rash without petechiae
Confluent blanching erythematous maculopapular rash to abdomen

Hand – no rash
Case 3 – 11 year old female

- Sibling of cases 1 & 2 presents to the ED 2 days after her siblings initial ED visit also complaining of a rash and fever.
- No cough
- No petechiae, fever, diffuse headache, sore throat, abdominal pain, and neck pain
- PMH: negative
Case 3 – Physical Exam

- VS: BP was 116/73 mm Hg
- HEENT: injected bilateral conjunctiva, erythematous oropharynx without exudate
- Neck: supple
- Chest: clear
- Abd: nontender
- Neuro: normal without tremor
- Skin: diffuse pruritic confluent blanching erythematous maculopapular rash without petechiae
What Diagnoses Should be Considered in Children Who Present with a Rash and Fever?
Rash and fever is a common childhood presentation to an ED. Infectious etiology is generally thought to be the most likely etiology.

Viruses
- Adenovirus
- Epstein-Barr virus

Bacterial
- Streptococcal

Other
- Kawasaki Disease
At the time of the second ED visit, the 14 year old boy brought to the ER a 300 gram container of 99.9% elemental mercury which he had found “on the street” 10 days prior to the ED visit.

After his initial ED visit he read about mercury on the internet and brought the mercury bottle to the hospital because he wondered whether the mercury might have any connection with his acute illness.

This discovery prompted the medical toxicology consultation.
What are Some of the Key Components of A Exposure History?
Although 3 siblings presenting with rash and fever certainly suggested an infectious etiology, the additional history that the children had been playing with mercury raised the possibility of a toxic etiology. Establishing who might have been exposed to the mercury is critically important as part of obtaining the exposure history. Moreover, inquiring where and how the mercury has been stored, whether any of the mercury might have been spilled, and where it might have been spilled is an essential part of the exposure history. In addition, inquiring whether there had been any attempt to clean up the mercury, whether a vacuum has been used, and how the mercury may have been disposed of are also important questions to ask. Carefully ascertaining whether the mercury may have been taken out of the house and where it might have been taken should also be investigated.
According to the 14 year old boy, and confirmed by his two sisters, during the 10 day period between when the mercury was first brought home and the children’s presentation to the hospital, all three children took the elemental mercury out of its container while at home and played with it in their hands for approximately 15 minutes per day for at least 8 of the 10 days.

During this period they poured the mercury into other containers which were then stored without lids in the kitchen and in the girls’ shared bedroom.

Shortly after bringing the mercury home, the 14-year old boy also tried to heat the mercury with a cigarette lighter.

All patients denied ingesting the mercury.

The family denied vacuuming the mercury.

Further questioning revealed that two of the children had brought the mercury to their respective schools to show their friends.
What Public Health Resources are Available to Aid in the Investigation?
- Federal, state and local public health assets are ready to assist environmental health investigations.
- ATSDR and EPA are resourced to conduct investigations and ensure that proper environmental assessments are performed.
- Regional and local partners such as the state, county or city health department are also able to aid in performing the proper investigations and help initiate critical risk communication outreach to all parties involved.
Public Health Response

- Once it became apparent that a environmental toxic exposure may have been responsible for these children’s illnesses the regional ATSDR office and the county health department was contacted by the medical toxicologists at the conclusion of the initial consultation to help with the environmental and public health assessment.
- The ATSDR regional office contacted their Environmental Protection Agency (EPA) partners.
- The ATSDR regional office, EPA, state and local health departments and school officials as well as the regional poison control center all became active in investigating and responding to these cases.
- Communication was facilitated with daily phone calls between the medical toxicologists and these various public agencies.
Where and what environmental sampling should be measured? What are the recommended actions levels for mercury in residential settings?
- Portable mercury vapor analyzers (e.g., Lumex or Jerome) can be utilized to rapidly analyze for mercury in air.
- Testing should be performed wherever there is a suspicion of a mercury spill or contamination.
- Based on the ATSDR Chronic Minimal Risk Level and EPA Reference Concentration, the recommended action levels for mercury in residential settings is 1 ug/m³ for normal occupancy.
Mercury vapor measurements performed by the Lumex analyzer were elevated throughout the children’s house. Entry and living room levels were 42 $\text{ug/m}^3$ and back bedrooms and bathroom had levels greater than 50 $\text{ug/m}^3$. The EPA cleaned up the home until all measurements were below 1 $\text{ug/m}^3$. 

Environmental Sampling Results
What are the recommended actions levels for mercury in the school setting?
The exposure scenario at most schools is typically much closer to a workday type of exposure (i.e., 7–10 hours) than a residential setting.

ATSDR recommends a mercury air concentration of \( \leq 3 \) ug/m\(^3\) before resuming normal operations of the school.
Based on the history that the children not only played with the mercury in their home but also may have also tracked some of the mercury to their schools, it was essential that the EPA visit the schools to perform environmental testing for mercury.

Mercury levels at youngest siblings school ranged from 2 ug/m$^3$ - > 50 ug/m$^3$ in the janitor’s closet.

EPA cleaned up the school, home and hospital until all measurements were below 3 ug/m$^3$. 
• What additional procedures need to be followed when the environmental mercury testing at the school came back elevated?
• Elevated mercury levels at the school provides a real concern and requires a carefully orchestrated public health response.

• Because of the concern that some children may have tracked their shoes through areas of Hg contamination prior to clean-up, the shoes that the children had worn to school prior to the clean-up were analyzed for mercury contamination.

• To assess the amount of contamination the shoes were placed in a bag and the bag was heated by direct sunlight to what might be reasonably anticipated to be maximum temperatures of normal use.

• Headspace readings for mercury vapor were then taken within each bag.

• For belongings that may have been contaminated by mercury vapors ATSDR recommends headspace readings that are in the range of 3-6 ug/m³ be considered protective of human health.
The school children brought in their shoes to be tested by the EPA for mercury.

Only 2 of the school children had worn shoes where mercury headspace measurements were above 6 ug/m³.

In these 2 cases the EPA visited their home to measure the ambient air for mercury.

Neither of these school children had elevated mercury levels at home.
What is the role for a public meeting? Should the media be invited?
Dear Parents and Teachers,

At the end of the day on October 26, 2012, we were informed by health agencies of a possible mercury spill that happened on October 17, 2012 near Room 207 at Urban Park Elementary School.

The University of Texas Southwestern Medical Toxicology Service learned of this incident after the hospitalization of an Urban Park student, along with his/her siblings, with symptoms related to mercury exposure. The child and siblings had been playing with a large amount of liquid mercury in their home and they stated that a small amount of the substance had been brought to the school after-hours on October 17th and spilled near Room 207.

The U.S. Environmental Protection Agency (EPA) was immediately involved and a team from the EPA and the Texas Commission on Environmental Quality (TCEQ) tested the school on the evening of October 26th. They found low-level mercury contamination in limited locations of the school. The school was closed and thoroughly cleaned by professional environmental contractors over the weekend. The officials of the EPA have advised the school that the indoor air levels of mercury are now safe. The classrooms on the second floor of the school will remain closed as a precaution during further cleaning activities, until the EPA staff has determined they can be used.

The mercury is not currently a health hazard to students or staff who attend Urban Park, as per the health-related recommendations of the Texas Department of State Health Services (TDSHS).

Health experts at the UT Southwestern Medical Toxicology service, the North Texas Poison Center, and the ATSDR have advised that no health effects for students, family members, or teachers are expected from the October 17th incident at the school, based on the indoor air testing results, short duration of exposure, and limited number of locations where the mercury was detected.

You are welcome to attend a meeting with health and environmental experts which will be held tomorrow, Tuesday, October 30th at 6pm in the auditorium of Urban Park to help answer your questions and keep you informed. If you cannot attend the meeting, or have questions before the meeting, the Texas Poison Center Network is available 24/7 with bilingual staff to provide consultation to any concerned parents, and can be contacted at: 1-800-222-1222.
This letter is to give you additional information about the mercury cleanup that is going on at our school.

As a safety measure, the shoes you child wore to school today were tested by health officials and were not found to have any mercury. If your child may have worn a different pair of shoes to school on or after October 17th, please follow the below instructions and have your child bring those shoes to school tomorrow in a plastic bag, so that they can be tested.

We are asking that students and family members who may have been in or near Room 207 on or after October 17th to bring their shoes back to the school for mercury testing.

What to do:
- Put each pair of shoes in its own plastic garbage bag. Seal it by tying it in a knot.
- Label the bag with your child’s name, their teacher’s name and your phone number.
- Bring it to the front office at Urban Park Elementary School on Monday October 28th or Tuesday October 29th. We will be disinfecting and testing these shoes.
- After testing, we will call you to let you know if your shoes have any mercury left on them. Shoes without any mercury will be returned to you. Shoes that have mercury on them will be safely thrown away.

Professional environmental contractors have been conducting ongoing cleaning and airing out of the school. Tests that were done after the weekend cleanup show that indoor air levels at the school are now safe. As a precaution, all the students in fourth and fifth grade on the second floor of the new wing have been relocated for a couple of days to allow time for the cleanup efforts to continue.

If you would like more information, the Texas Poison Center Network is available to provide consultation to any concerned parents, and can be contacted at: 1-800-222-1222.
All three children were hospitalized once it became apparent that their presentation may not have been a routine viral exanthema, and that mercury poisoning was suspected based on the exposure history.

None of the siblings exhibited the typical pneumonitis associated with high dose acute elemental mercury toxicity.

They did not develop hypoxemia or respiratory distress.

Chest radiographs of all three children were normal.

Blood cultures and viral respiratory testing were negative in all the cases.

All three cases were febrile with their maximum temperatures (40.8-41.8 degrees Celsius) occurring by hospital day 2 or 3.

All cases remained tachycardic during their hospital stay.
What other etiologies were considered in this case as the basis for their presentation?
- Pheochromocytoma may present with tachycardia, mild hypertension, and high fevers.
- Many previously published papers of mercury poisoning describe cases where the patients were initially thought to have a pheochromocytoma and only later found to have mercury poisoning.
- This is because of the mercury inhibition of the SAM and COMT enzymes that will eventually inhibit the catabolism of catecholamines.
- Idiopathic thrombocytopenic purpura was also considered given the 14 year old brothers significant thrombocytopenia and petechiae.
- Thrombocytopenia has been described as a toxic effect of mercury.
What are some of the typical clinical features of elemental mercury poisoning?
Acute inhalational elemental mercury poisoning is typically manifested by pulmonary symptoms that may progress to respiratory distress.

The rash associated with classic acrodynia typically features painful erythema of the palms and soles with desquamation.

Although the children never developed pulmonary symptoms and their rashes spared the palms and soles and was not desquamating, the temporal association of these clinical presentations with the children’s handling of the mercury suggested that mercury exposure was likely the cause of their illnesses.
What biomarkers should be ordered to establish the diagnosis of mercury poisoning and to assess the severity of the mercury exposure?
Blood and urine mercury analysis is indicated to confirm the elemental mercury exposure.

Blood testing may be particularly useful to establish the time course of the exposure.
To confirm such an exposure blood mercury and spot urine mercury tests were ordered on all three children at the time of hospital admission.

Initial blood and spot urine levels were as follows:

- 14 year old boy - blood mercury 160 μg/L, urine mercury 141 μg/L
- 11 year old girl - blood mercury 79 μg/L, urine mercury 78 μg/L
- 9 year old girl - blood mercury 137 μg/L, urine mercury 215 μg/L
<table>
<thead>
<tr>
<th>Categories</th>
<th>Survey years</th>
<th>Geometric mean (95% conf. interval)</th>
<th>50th Percentile (95% conf. interval)</th>
<th>75th Percentile (95% conf. interval)</th>
<th>90th Percentile (95% conf. interval)</th>
<th>95th Percentile (95% conf. interval)</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>11-12</td>
<td><strong>.703 (.617-.801)</strong></td>
<td><strong>.640 (.580-.730)</strong></td>
<td><strong>1.38 (1.14-1.72)</strong></td>
<td><strong>2.87 (2.39-3.62)</strong></td>
<td><strong>4.40 (3.50-5.71)</strong></td>
<td>7920</td>
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<tr>
<td></td>
<td>13-14</td>
<td><strong>.683 (.621-.751)</strong></td>
<td><strong>.620 (.540-.690)</strong></td>
<td><strong>1.29 (1.14-1.46)</strong></td>
<td><strong>2.65 (2.32-3.08)</strong></td>
<td><strong>4.36 (3.65-4.97)</strong></td>
<td>5215</td>
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<tr>
<td></td>
<td>15-16</td>
<td><strong>.678 (.619-.743)</strong></td>
<td><strong>.600 (.540-.690)</strong></td>
<td><strong>1.26 (1.07-1.47)</strong></td>
<td><strong>2.55 (2.17-3.10)</strong></td>
<td><strong>4.25 (3.44-4.94)</strong></td>
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<td>Age group</td>
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<tr>
<td>1-5 years</td>
<td>11-12</td>
<td><strong>.262 (.237-.291)</strong></td>
<td>&lt; LOD</td>
<td><strong>.390 (.340-.450)</strong></td>
<td><strong>.680 (.540-.880)</strong></td>
<td><strong>.990 (.790-1.21)</strong></td>
<td>713</td>
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<tr>
<td></td>
<td>13-14</td>
<td>*</td>
<td>&lt; LOD</td>
<td><strong>.410 (.370-.450)</strong></td>
<td><strong>.810 (.710-.990)</strong></td>
<td><strong>1.21 (1.05-1.48)</strong></td>
<td>818</td>
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<tr>
<td></td>
<td>15-16</td>
<td>*</td>
<td>&lt; LOD</td>
<td><strong>.380 (.340-.430)</strong></td>
<td><strong>.690 (.540-.830)</strong></td>
<td><strong>1.06 (.840-1.36)</strong></td>
<td>790</td>
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<td>6-11 years</td>
<td>11-12</td>
<td><strong>.330 (.287-.379)</strong></td>
<td><strong>.320 (.280-.360)</strong></td>
<td><strong>.530 (.480-.600)</strong></td>
<td><strong>.930 (.780-1.20)</strong></td>
<td><strong>1.40 (1.02-2.17)</strong></td>
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<tr>
<td></td>
<td>13-14</td>
<td>*</td>
<td><strong>.300 (.260-.360)</strong></td>
<td><strong>.570 (.470-.680)</strong></td>
<td><strong>1.12 (.980-1.36)</strong></td>
<td><strong>1.62 (1.38-2.19)</strong></td>
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<td>15-16</td>
<td>*</td>
<td><strong>.310 (.290-.340)</strong></td>
<td><strong>.480 (.430-.570)</strong></td>
<td><strong>.920 (.750-1.13)</strong></td>
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<td>12-19 years</td>
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<td><strong>.411 (.355-.476)</strong></td>
<td><strong>.370 (.320-.450)</strong></td>
<td><strong>.680 (.590-.800)</strong></td>
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<td><strong>.340 (.300-.370)</strong></td>
<td><strong>.590 (.470-.750)</strong></td>
<td><strong>1.00 (.850-1.35)</strong></td>
<td><strong>1.89 (1.02-3.34)</strong></td>
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<td>20 years and older</td>
<td>11-12</td>
<td><strong>.863 (.753-.990)</strong></td>
<td><strong>.790 (.690-.940)</strong></td>
<td><strong>1.68 (1.36-2.12)</strong></td>
<td><strong>3.35 (2.71-4.31)</strong></td>
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<td><strong>.740 (.650-.850)</strong></td>
<td><strong>1.54 (1.36-1.71)</strong></td>
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<td><strong>4.88 (4.36-5.21)</strong></td>
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<td></td>
<td>15-16</td>
<td><strong>.810 (.740-.886)</strong></td>
<td><strong>.740 (.660-.830)</strong></td>
<td><strong>1.47 (1.28-1.75)</strong></td>
<td><strong>2.86 (2.50-3.44)</strong></td>
<td><strong>4.66 (3.91-5.96)</strong></td>
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<td>Gender</td>
<td></td>
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<tr>
<td>Males</td>
<td>11-12</td>
<td><strong>.712 (.623-.815)</strong></td>
<td><strong>.650 (.570-.730)</strong></td>
<td><strong>1.40 (1.17-1.72)</strong></td>
<td><strong>3.00 (2.44-3.91)</strong></td>
<td><strong>4.94 (3.50-6.79)</strong></td>
<td>3968</td>
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<td></td>
<td>13-14</td>
<td><strong>.688 (.617-.767)</strong></td>
<td><strong>.620 (.530-.720)</strong></td>
<td><strong>1.30 (1.12-1.54)</strong></td>
<td><strong>2.76 (2.36-3.34)</strong></td>
<td><strong>4.52 (3.65-5.23)</strong></td>
<td>2587</td>
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<tr>
<td></td>
<td>15-16</td>
<td><strong>.679 (.621-.743)</strong></td>
<td><strong>.610 (.530-.700)</strong></td>
<td><strong>1.29 (1.06-1.60)</strong></td>
<td><strong>2.45 (2.06-3.31)</strong></td>
<td><strong>4.67 (3.77-5.39)</strong></td>
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<tr>
<td>Females</td>
<td>11-12</td>
<td><strong>.694 (.609-.791)</strong></td>
<td><strong>.640 (.580-.740)</strong></td>
<td><strong>1.36 (1.09-1.75)</strong></td>
<td><strong>2.81 (2.28-3.50)</strong></td>
<td><strong>4.03 (3.29-5.08)</strong></td>
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<td><strong>.678 (.617-.745)</strong></td>
<td><strong>.610 (.530-.700)</strong></td>
<td><strong>1.27 (1.14-1.42)</strong></td>
<td><strong>2.56 (2.17-3.08)</strong></td>
<td><strong>4.15 (3.37-4.93)</strong></td>
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<td>15-16</td>
<td><strong>.677 (.608-.754)</strong></td>
<td><strong>.600 (.530-.700)</strong></td>
<td><strong>1.23 (1.02-1.42)</strong></td>
<td><strong>2.57 (2.20-3.10)</strong></td>
<td><strong>3.95 (3.10-4.55)</strong></td>
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</table>
## Urinary Mercury (2011 – 2014)

Geometric mean and selected percentiles of urine concentrations (in µg/L) for the U.S. population from the National Health and Nutrition Examination Survey.

<table>
<thead>
<tr>
<th>Categories</th>
<th>Survey years</th>
<th>Geometric mean (95% conf. interval)</th>
<th>50th Percentile (95% conf. interval)</th>
<th>75th Percentile (95% conf. interval)</th>
<th>90th Percentile (95% conf. interval)</th>
<th>95th Percentile (95% conf. interval)</th>
<th>Sample size</th>
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</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td>11-12</td>
<td>.324 (.285-.368)</td>
<td>.320 (.280-.370)</td>
<td>.660 (.580-.770)</td>
<td>1.37 (1.15-1.59)</td>
<td>1.83 (1.62-2.14)</td>
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<td>13-14</td>
<td>.246 (.221-.273)</td>
<td>.200 (.170-.240)</td>
<td>.470 (.400-.570)</td>
<td>1.07 (.900-1.22)</td>
<td>1.64 (1.35-1.96)</td>
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<td><strong>Age group</strong></td>
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<td>6-11 years</td>
<td>11-12</td>
<td>.241 (.206-.283)</td>
<td>.220 (.190-.270)</td>
<td>.450 (.390-.530)</td>
<td>.930 (.680-.1.36)</td>
<td>1.37 (.990-2.03)</td>
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<td>13-14</td>
<td>*</td>
<td>&lt; LOD</td>
<td>.220 (.150-.310)</td>
<td>.560 (.340-.840)</td>
<td>.890 (.640-1.10)</td>
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<td>12-19 years</td>
<td>11-12</td>
<td>.257 (.212-.312)</td>
<td>.270 (.220-.340)</td>
<td>.490 (.390-.600)</td>
<td>.840 (.650-1.24)</td>
<td>1.31 (.920-1.75)</td>
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<td>.240 (.190-.310)</td>
<td>.560 (.400-.860)</td>
<td>1.02 (.610-1.81)</td>
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<td>20 years and older</td>
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<td>.346 (.303-.396)</td>
<td>.340 (.290-.400)</td>
<td>.720 (.620-.850)</td>
<td>1.49 (1.20-1.67)</td>
<td>1.93 (1.67-2.17)</td>
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<td>13-14</td>
<td>.274 (.246-.305)</td>
<td>.240 (.200-.280)</td>
<td>.540 (.450-.630)</td>
<td>1.16 (1.00-1.33)</td>
<td>1.76 (1.44-2.04)</td>
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<td><strong>Gender</strong></td>
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<tr>
<td>Males</td>
<td>11-12</td>
<td>.342 (.293-.399)</td>
<td>.330 (.290-.380)</td>
<td>.670 (.580-.810)</td>
<td>1.34 (1.03-1.67)</td>
<td>1.91 (1.54-2.51)</td>
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<td>13-14</td>
<td>.243 (.219-.268)</td>
<td>.200 (.170-.220)</td>
<td>.480 (.390-.600)</td>
<td>1.07 (.840-1.33)</td>
<td>1.55 (.128-1.96)</td>
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<tr>
<td>Females</td>
<td>11-12</td>
<td>.307 (.262-.360)</td>
<td>.300 (.250-.360)</td>
<td>.660 (.540-.770)</td>
<td>1.37 (1.17-1.54)</td>
<td>1.82 (1.54-2.14)</td>
<td>1247</td>
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<tr>
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<td>13-14</td>
<td>.249 (.218-.284)</td>
<td>.210 (.170-.260)</td>
<td>.470 (.390-.570)</td>
<td>1.07 (.820-.1.27)</td>
<td>1.75 (1.25-2.26)</td>
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<tr>
<td><strong>Race/ethnicity</strong></td>
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<tr>
<td>Mexican Americans</td>
<td>11-12</td>
<td>.301 (.261-.348)</td>
<td>.300 (.200-.400)</td>
<td>.620 (.510-.680)</td>
<td>1.25 (1.01-1.53)</td>
<td>1.75 (1.32-2.25)</td>
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<tr>
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<td>13-14</td>
<td>.229 (.198-.265)</td>
<td>.160 (.150-.210)</td>
<td>.450 (.300-.620)</td>
<td>1.12 (.780-.1.35)</td>
<td>1.47 (.970-.2.38)</td>
<td>454</td>
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<tr>
<td>Non-Hispanic blacks</td>
<td>11-12</td>
<td>.360 (.316-.410)</td>
<td>.360 (.320-.400)</td>
<td>.670 (.570-.800)</td>
<td>1.33 (1.06-1.60)</td>
<td>1.99 (1.48-3.06)</td>
<td>671</td>
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<tr>
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<td>13-14</td>
<td>.279 (.228-.340)</td>
<td>.250 (.190-.320)</td>
<td>.530 (.400-.690)</td>
<td>1.10 (.900-1.49)</td>
<td>1.82 (1.11-2.48)</td>
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<td>Non-Hispanic whites</td>
<td>11-12</td>
<td>.308 (.260-.365)</td>
<td>.290 (.260-.360)</td>
<td>.630 (.510-.810)</td>
<td>1.37 (1.09-1.64)</td>
<td>1.77 (1.49-2.14)</td>
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<tr>
<td></td>
<td>13-14</td>
<td>.240 (.211-.271)</td>
<td>.200 (.160-.230)</td>
<td>.460 (.370-.580)</td>
<td>1.06 (.840-1.24)</td>
<td>1.64 (1.12-2.04)</td>
<td>988</td>
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<tr>
<td>All Hispanics</td>
<td>11-12</td>
<td>.330 (.299-.364)</td>
<td>.330 (.270-.390)</td>
<td>.680 (.610-.760)</td>
<td>1.30 (1.15-1.53)</td>
<td>1.98 (1.61-2.42)</td>
<td>574</td>
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<tr>
<td></td>
<td>13-14</td>
<td>.239 (.207-.276)</td>
<td>.180 (.150-.240)</td>
<td>.460 (.360-.620)</td>
<td>1.14 (.800-.1.35)</td>
<td>1.57 (1.24-1.15)</td>
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<tr>
<td>Asians</td>
<td>11-12</td>
<td>.430 (.351-.527)</td>
<td>.450 (.330-.580)</td>
<td>.910 (.750-.1.12)</td>
<td>1.69 (1.31-2.06)</td>
<td>2.41 (1.77-3.53)</td>
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<tr>
<td></td>
<td>13-14</td>
<td>.313 (.269-.363)</td>
<td>.270 (.220-.340)</td>
<td>.620 (.520-.710)</td>
<td>1.18 (.890-.1.66)</td>
<td>1.78 (.20-1.30)</td>
<td>291</td>
</tr>
</tbody>
</table>
• All family members who lived in, or frequently visited, the mercury contaminated dwelling needed to be assessed for toxic mercury exposure by obtaining blood and urine mercury testing.

• Anyone at the school who may have been at risk for excessive mercury exposure should have such testing performed.
### Laboratory Testing

<table>
<thead>
<tr>
<th></th>
<th>Blood Hg</th>
<th>Urine Hg</th>
<th>AST</th>
<th>ALT</th>
</tr>
</thead>
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<tr>
<td>14 year old male</td>
<td>160</td>
<td>141</td>
<td>72, 224, 16</td>
<td>105, 224, 85</td>
</tr>
<tr>
<td>11 year old female</td>
<td>137</td>
<td>215</td>
<td>50, 97, 40</td>
<td>54, 110, 93</td>
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<tr>
<td>9 year old female</td>
<td>79</td>
<td>78</td>
<td>41, 27</td>
<td>21, 28</td>
</tr>
<tr>
<td>Mother</td>
<td>60</td>
<td>34</td>
<td>66, 104</td>
<td>54, 88</td>
</tr>
<tr>
<td>Older brother</td>
<td>23</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aunt</td>
<td>1</td>
<td>&lt;1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aunt</td>
<td>3</td>
<td>2</td>
<td>23</td>
<td>33</td>
</tr>
<tr>
<td>Grandmother</td>
<td>1</td>
<td>&lt;1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uncle</td>
<td>No Labs</td>
<td></td>
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<tr>
<td>Custodian</td>
<td>&lt;1</td>
<td>&lt;1</td>
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</tbody>
</table>

14 year old boy and the 11 year old girl had thrombocytopenia with a nadir of 86 and 68 thousand/mm³ respectively.
Treatment

- Once the elevated blood and urine mercury levels were reported from the outside laboratory, chelation therapy with DMSA (succimer) was started on all three symptomatic children on hospital day 4 in an attempt to enhance the elimination of mercury.
- This treatment was given for 4 days while they were still hospitalized, and continued after they were discharged from the hospital for a total of 38 days.
- Intravenous N-acetylcysteine, which may provide some mercury detoxifying effect, was also administered during their hospitalization.
Blood mercury levels over three months in each child
Urine mercury levels over three months in each child

<table>
<thead>
<tr>
<th>Day</th>
<th>Oct. 25th</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
<th>Day 5</th>
<th>Day 6</th>
<th>Day 7</th>
<th>Day 8</th>
<th>Day 9</th>
<th>Day 10</th>
<th>Nov. 1st</th>
<th>Nov. 2nd</th>
<th>Nov. 6th</th>
<th>Nov. 7th</th>
<th>Nov. 8th</th>
<th>Nov. 9th</th>
<th>Nov. 10th</th>
<th>Dec. 4th</th>
<th>Dec. 5th</th>
<th>Jan. 9th</th>
<th>Jan. 10th</th>
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</thead>
<tbody>
<tr>
<td>1yo Male</td>
<td>141</td>
<td>66</td>
<td>107</td>
<td>130</td>
<td>2</td>
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<td></td>
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<td></td>
<td>249</td>
<td>80</td>
<td>195</td>
<td>10</td>
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<tr>
<td>1.5yo Male</td>
<td>78</td>
<td>214</td>
<td>157</td>
<td>210</td>
<td>169</td>
<td>231</td>
<td>427</td>
<td>239</td>
<td>43</td>
<td>23</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2yo Female</td>
<td>215</td>
<td>148</td>
<td>204</td>
<td>202</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>272</td>
<td>87</td>
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</tbody>
</table>

Legend:
- Acetadote
- DMSA
- *Hg 24 hr Urine (ug/L)
Follow-Up

- Over the next 6 months the children were followed in the medical toxicology clinic.
- At 3 months, the spot urine mercury were as follows: 14 year old male, 10 μg/L, 11 year old female, 18 μg/L, and 9 year old female, 23 μg/L.
- During these follow-up visits the 14 year old male demonstrated mild hypertension with systolic BP in 120-130’s mm Hg.
- Otherwise, all patients remain asymptomatic.
- The rashes and fever all resolved.
- None demonstrated any desquamation or neurotoxicity.
- After the residence was thoroughly cleaned up by the EPA the family moved back into their residence.
Back to Dr. Silver
Timeline Continued

7 people, 3 animals, 2 homes. EPA contacted

Home 1 is evacuated and quarantined

Patients admitted

EPA Deployed: Level in home: 100,000 mg/m³

Treatment started

Serial labs and levels

Clearance from EPA ~1 week later

Procurement of outpatient medication + Discharge
<table>
<thead>
<tr>
<th>Levels and Treatment</th>
<th>Patient 1 15 y.o F</th>
<th>Patient 2 13 y.o F</th>
<th>Patient 3 11 y.o M</th>
<th>Patient 4 32 y.o F</th>
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</thead>
<tbody>
<tr>
<td>Hg Levels</td>
<td>1&lt;sup&gt;st&lt;/sup&gt;: &gt;200ug/L</td>
<td>1&lt;sup&gt;st&lt;/sup&gt;: 154ug/L</td>
<td>1&lt;sup&gt;st&lt;/sup&gt;: 130ug/L</td>
<td>1&lt;sup&gt;st&lt;/sup&gt;: 171ug/L</td>
</tr>
<tr>
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<td>2&lt;sup&gt;nd&lt;/sup&gt;: 130ug/L</td>
<td>2&lt;sup&gt;nd&lt;/sup&gt;: 57ug/L</td>
<td>2&lt;sup&gt;nd&lt;/sup&gt;: 53 ug/L</td>
<td>2&lt;sup&gt;nd&lt;/sup&gt;: 129ug/L</td>
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<tr>
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<td>3&lt;sup&gt;rd&lt;/sup&gt;: 155ug/L</td>
<td>3&lt;sup&gt;rd&lt;/sup&gt;: 29ug/L</td>
<td>3&lt;sup&gt;rd&lt;/sup&gt;: 23ug/L</td>
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<td>4&lt;sup&gt;th&lt;/sup&gt;: 63ug/L</td>
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<tr>
<td>Treatment</td>
<td>Succimer: 10mg/kg x 14 days Re-Prescribed another 14 days</td>
<td>Succimer: 10mg/kg x 19 days</td>
<td>Succimer: 10mg/kg x 19 days</td>
<td>Succimer: 10mg/kg x 1.5 doses BAL 5mg/kg BID IM injection x 10 days</td>
</tr>
</tbody>
</table>
Challenges Encountered

- Diagnosis
- Obtaining analytical laboratory measurements
- Access and adherence to chelating agents for the duration of the course of therapy
- Follow up with family
- Environmental clean up
References

**Mercury Incident in a Dallas School**

Thank You

- Dr. Kurt Kleinschmidt – UT Southwestern Medical School
- Dr. Amy Young - UT Southwestern Medical School
- Dr. Sing-Yi Feng - UT Southwestern Medical School
- Patrick Young at ATSDR Region VI
- EPA
- Dallas Schools
- Dallas County Health and Human Services
- Texas Department of State Health Services
- Texas Commission on Environmental Quality
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Grand Rounds
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Interactive and Self-Paced
CE Available

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