

Question: Does arsenic cause developmental problems in children?

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From Dr. Mellard:

“10 ppm arsenic in soil is not a health hazard to anyone. Maybe she (Royalton Hartland School Board member) was talking about another medium (other than soil)?”

“As for arsenic's ability to contribute to learning disabilities, we have insufficient information to draw that conclusion. I can see why someone might reach that conclusion because arsenic is a neurotoxin but we would need more epi studies to tease out whether arsenic (like lead) is affecting children's learning.”

From the CDC web site: www.cdc.gov

FAQ'S About Arsenic: www.cdc.gov/nceh/clusters/Fallon/arsenicfaq.htm

Can arsenic cause developmental effects?

Several studies have linked exposure to inorganic arsenic with a higher risk for birth defects, low birth weight, or spontaneous abortion. However, in all these studies, the people were exposed to other chemicals and had other risks that might have caused these problems.

(There was no mention of mental or learning disabilities.)

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A Few of the Studies Found on the Internet

On PubMed Central, a Government Web site

under the National Institutes of Health at www.pubmedcentral.nih.gov

Arsenic Exposure and Cognitive Performance in Mexican Schoolchildren

The study sample consisted of 602 children, 6–8 years of age who attended first grade in nine public elementary schools located within 3.5 km of a metallurgic smelter complex in the city of Torreón, Mexico.

Source of arsenic: drinking water from contaminated ground water

Conclusions: Children living in an area contaminated with both arsenic and lead showed arsenic contamination can affect children's cognitive development, independent of any effect of lead.

Data:

The mean for **UAs** was 58.1 ± 33.2 µg/L; 52% of the children had UAs concentrations > 50 µg/L, and 50.7% of children had PbB > 10 µg/dL.

(UAs - Urinary arsenic)

- UAs concentration was associated with low socioeconomic status.
- Nutritional status indicators were not related to UAs concentrations.
- Adjustments for hemoglobin concentration of PbB, and socioeconomic conditions showed an inverse association between UAs and test scores.

Source page: www.pubmedcentral.nih.gov/articlerender.fcgi?artid=1964916

Cognitive scores of children stratified by UAs concentration

[mean \pm SD (minimum–maximum)].

Cognitive tests	Overall	Children with UAs < 50 μ g/L	Children with UAs > 50 μ g/L
Math Achievement Test	31.35 \pm 7.50 (3–52)	32.27 \pm 7.69 (8–52)	30.57 \pm 7.20 (3–49)*
Visual–Spatial Abilities with Figure Design	18.31 \pm 5.15 (2–34)	18.88 \pm 5.16 (3–34)	17.84 \pm 5.08 (2–31)*
WISC-RM Arithmetic Subscale	7.41 \pm 3.62 (1–17)	7.26 \pm 3.66 (1–17)	7.59 \pm 3.57 (1–17)
Peabody Picture Vocabulary Test	103.19 \pm 15.65 (55–145)	105.20 \pm 16.11 (55–145)	101.67 \pm 14.92 * (55–140)
WISC-RM Digit Span Subscale	9.10 \pm 3.63 (1–19)	9.46 \pm 3.73 (1–19)	8.80 \pm 3.55 * (2–18)
Sternberg Memory (correct trials)	12.14 \pm 2.94 (4–20)	12.30 \pm 3.01 (4–20)	11.98 \pm 2.86 (5–20)
Visual Memory Span (correct trials)	2 \pm 0.52 (0.69–3.37)	2.03 \pm 0.51 (0.69–3.37)	1.97 \pm 0.53 (0.69–3.26)
Stimulus Discrimination (correct trials < 19 vs. \geq 19)	0.57 \pm 0.50 (0–1)	0.63 \pm 0.48 (0–1)	0.52 \pm 0.50 * (0–1)
WISC-RM Coding Subscale	2.26 \pm 0.59 (1–3.71)	2.29 \pm 0.58 (1.07–3.71)	2.23 \pm 0.61 (1–3.71)
Visual Search (correct minus incorrect minus omitted trials)	5.03 \pm 1.51 (1–10.82)	5.23 \pm 1.47 (1.14–10.82)	4.84 \pm 1.50* (1–8.99)
Letter Sequencing (correct trials 0 vs. \geq 1)	0.48 \pm 0.50 (0–1)	0.55 \pm 0.50 (0–1)	0.41 \pm 0.49 (0–1)*

*Difference between children with UAs < 50 and children UAs > 50 μ g/L is significant at $p < 0.05$.

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From internet site: www.ehponline.org

Environmental Health Perspectives (EHP), the peer-reviewed journal of the United States' National Institute of Environmental Health Sciences

Water Arsenic Exposure and Children's Intellectual Function in Arahazar, Bangladesh

- Study consisted of a cross-sectional investigation of intellectual function in 201 children 10 years of age.
- Children's intellectual function on tests were obtained from the Wechsler Intelligence Scale for Children, version III.
- Verbal, Performance, and Full-Scale raw scores were calculated.
- Exposure to arsenic from **drinking water** was associated with reduced intellectual function in a dose–response manner, such that children with **water arsenic levels $> 50 \mu\text{g/L}$** achieved lower performance than did children with water arsenic levels $< 5.5 \mu\text{g/L}$.
- Manganese was also indicated as a possible factor.

Source page: www.ehponline.org/realfiles/docs/2004/6964/abstract.html

Cognitive Effects

Water Arsenic Exposure and Children's Intellectual Function in Arahazar, Bangladesh

Gail A. Wasserman et al., Environmental Health Perspectives 112, Sept 2004

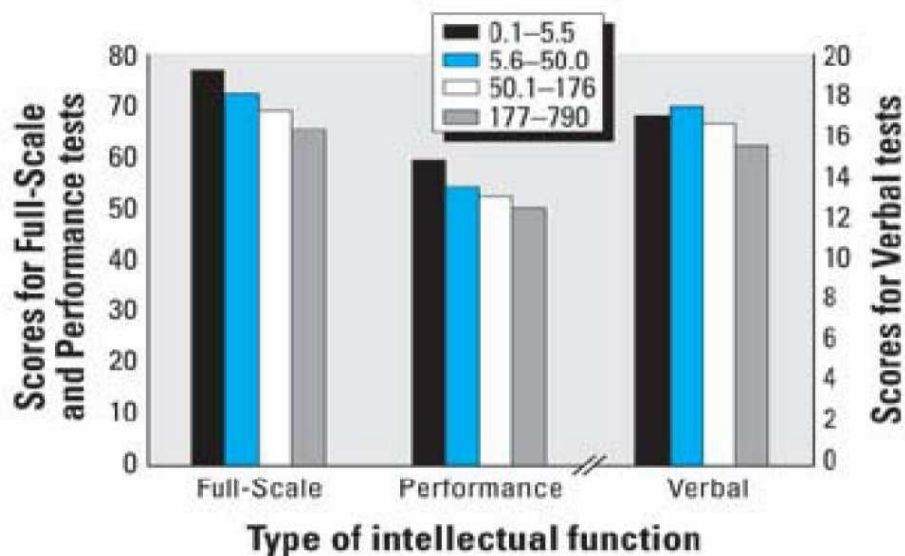


Figure 1. Adjusted scores by quartiles of water As for Full-Scale, Performance, and Verbal raw scores. In each case, adjustments were made for maternal education and intelligence, type of housing, child height and head circumference, and access to television.

From internet site: www.sciencedirect.com

ScienceDirect offers more than a quarter of the world's scientific, medical and technical information online.

Hair arsenic, manganese, and cadmium levels in school-age children residing near a hazardous waste site

- Thirty-two children, 11–13 years old, were given a battery of tests which assessed:
 - general intelligence
 - visual-motor skills
 - receptive language
 - verbal memory
 - nonverbal problem-solving
 - behavior problems
- Parents and teachers rated the children's:
 - attention
 - executive functions
 - behavior problems
- Concentrations of manganese (Mn), arsenic (As), and cadmium (Cd) were measured in hair samples provided by 31 of the children.
- The mean hair metal levels were:
 - Mn 471.5 parts per billion (ppb)
 - As 17.8 ppb
 - Cd 57.7 ppb
- Children's general intelligence scores, particularly verbal IQ scores, were related, inversely, to hair Mn and As levels, as were scores on tests of memory for stories and a word list.
- In some cases, **a significant Mn-by-As interaction was found.**
- It appeared the low scores of children for whom both Mn and As levels were above the median values in the sample were responsible for the main effects observed for each metal.

(No source for the toxic metals was given)

SourcePage: www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6W81-4HNS64R-1&_user=5041245&_coverDate=03%2F31%2F2006&_rdoc=1&_fmt=&_orig=search&_sort=d&view=c&_acct=C00052291&_version=1&_urlVersion=0&_userid=5041245&md5=7af0149ae119c159c3e770f675cc5b17

Student Proficiency on State Tests - 2006

Local Schools

District

	<u>Barker</u>	<u>Lyndonville</u>	<u>Medina</u>	<u>Newfane</u>	<u>Roy-Hart</u>
English Language Arts Proficiency (%)	72.3	65.3	58.7	70.0	70.5
Math Proficiency (%)	75.9	77.3	62.6	77.7	74.6
English Language Arts and Math Proficiency (RaMP) (%)	74.1	71.3	60.6	73.8	72.6

High Schools

	<u>Barker</u>	<u>Medina</u>	<u>Newfane</u>	<u>Roy-Hart</u>
English Language Arts Proficiency (%)	92.6	74.1	79.0	84.6
Math Proficiency (%)	92.6	85.3	80.9	85.2
English Language Arts and Math Proficiency (RaMP) (%)	92.6	79.7	79.9	84.9

Middle Schools

	<u>Barker</u>	<u>Lyndonville</u>	<u>Newfane</u>	<u>Roy-Hart</u>
English Language Arts Proficiency (%)	65.9	53.5	66.0	64.5
Math Proficiency (%)	65.5	64.5	71.0	65.8
English Language Arts and Math Proficiency (RaMP) (%)	65.7	59.1	68.5	65.2

From the Bill and Melinda Gates Foundation web site (schoolmatters.com)

Other New York State Schools

	<u>Afton</u>	<u>All-Lime</u>	<u>Attica</u>	<u>Cincinnatus</u>	<u>Roy-Hart</u>
English Language Arts Proficiency (%)	51.6	70.8	68.6	51.3	70.5
Math Proficiency (%)	67.8	72.3	70.0	57.7	74.6
English Language Arts and Math Proficiency (RaMP) (%)	59.7	71.6	69.3	54.5	72.6
Enrollment	686	1,416	1,692	697	1,592
Graduation Rate Index	65.6	77.5	85.3	68.7	75.1
Students Per Teacher	10.7	12.1	12.1	9.6	13.8
Students with Special Needs Inde	37.5	15.9	19.5	38.7	14.7
Community Profile: Adults with at Least a Bachelor's Degree (%)	12.3	21.7	11.3	10.3	12.8
County	Chenango	Cattaraugus	Wyoming	Cortland	Niagara

All Schools: Urban Status: Rural, Outside CBSA

From the Bill and Melinda Gates Foundation web site (schoolmatters.com)

Conclusion

- Some preliminary studies have shown arsenic, in certain circumstances, may cause developmental problems in children.
- These circumstances may not apply to Middleport:
 - These studies, where it was given, indicated the source of the arsenic was drinking water.
 - More quantities of arsenic is consumed in water because of the volume of drinking water ingested over soil.
 - Arsenic in drinking water is more readily available to be absorbed by the body than arsenic in soil because of its state.
 - Most all residents in Middleport get their water from a municipal water system with water supplied from outside the area.
 - Where given, urinary arsenic levels were above 50 ug/l for children with developmental problems.
 - Urinary arsenic levels in Middleport residents who were tested by Exponent had speciated levels below 20 ug/l with a mean of 4.7.
- Arsenic may have to be combined with Manganese to cause developmental problems.
- Socioeconomic status may play a part.
- Royalton-Hartland School test scores do not appear to be out of line from other schools within the area and across the state.