

Biomarkers of Mercury Exposure in Two Eastern Ukraine Cities

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PURPOSE

To evaluate biomarkers of mercury exposure among residents of Horlivka (area with geologic and industrial sources of environmental Hg) and Artemvisk (comparison city)

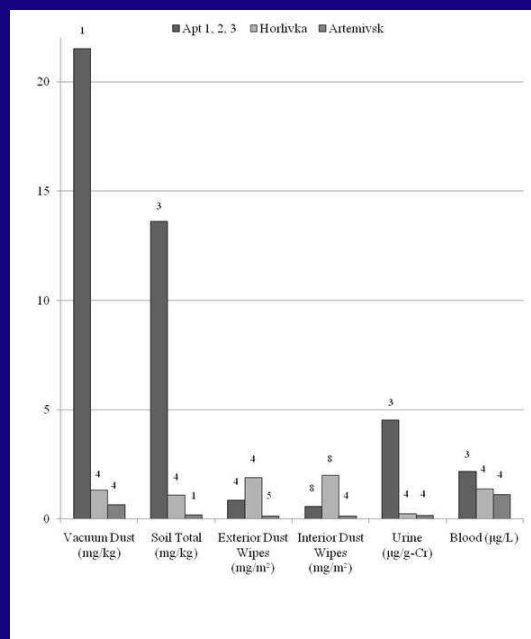
BACKGROUND

- Mercury is recognized as toxic and there is concern over risk from low levels of Hg
- The Nikitovka mines located in Horlivka, Ukraine (see right) was the largest source of Hg for the former Soviet Union until they closed in 1991
- In a previous study of workers at a Hg recycling facility in Horlivka, blood and urinary Hg (but not hair or nail Hg), were found to be strongly correlated with occupational exposure. Mercury exposure in Horlivka is expected to be primarily inorganic and elemental mercury, which should be reflected in urinary and blood mercury levels.



RESULTS

- In Artemvisk (but not Horlivka), median urinary Hg was significantly higher in females, nonsmokers, those consuming tap water and those not consuming alcohol
- Individuals in Horlivka had significantly higher fingernail and toenail Hg measurements compared to individuals in Artemvisk
- Residents of Artemvisk had significantly higher levels of Hg in hair and urine
- Individuals consuming tap water in Artemvisk had higher urinary Hg than those consuming well water and higher urinary Hg than those in Horlivka consuming either tap or well water
- The 3 residents of Apts. 1, 2 and 3 in Horlivka (see right) had the highest average urinary Hg (all 3 worked at the plant but were not directly involved in the recycling operation)
- Hg concentration in vacuum dust associated with urinary Hg ($R^2 = 0.99$, $p < 0.001$)
- Soil Hg concentration associated with urinary Hg ($R^2 = 0.55$, $p < 0.05$)
- Hg concentration in vacuum dust was borderline significantly associated with blood Hg ($R^2 = 0.44$, $p = 0.07$)



Average Hg Concentrations in Environmental and Biological Samples

METHODS

- Urine, blood, hair and nails (toenails and fingernails) were collected from residents of Horlivka and the comparison city of Artemvisk and analyzed for total Hg
- Questionnaire administered to study participants to obtain information regarding age, gender, occupational history, smoking, alcohol and fish consumption, tattoos, dental amalgams, home heating system, education, source of drinking water and family employment in mines
- For a limited number of residents from Horlivka [N=7, including 3 residents living close to the mine (Apts. 1, 2 and 3)] and Artemvisk (N=4), environmental samples including vacuum cleaner dust, dust wipes, and soil, were collected from their residences
- Convenience sample – exact location of residents other than those living in Apts. 1, 2 and 3 is unknown



DISCUSSION

- Surprisingly, biological markers did not indicate that Hg exposure in Horlivka was an environment with Hg contamination greater than Artemvisk
- Higher urinary Hg concentrations in Artemvisk could be related to Hg contamination of tap water supply or be a reflection of the convenience sampling
- Environmental samples are helpful predictors of exposure
- Vacuum cleaner dust and soil Hg were good predictors of urinary Hg concentrations; dust was also a predictor of blood Hg



Biologic (blood and urine) and Environmental (soil, dust) Hg Concentrations for Seven Residents of Horlivka and Four Residents of Artemvisk for Whom Environmental Samples Were Collected

Group	ID	Vacuum Dust Hg (mg/kg)	Total Soil Hg (mg/kg)	Average Hg Exterior Dust Wipes (mg/m²)	# Exterior Dust Wipe Samples	Average Hg Interior Dust Wipes (mg/m²)	# Interior Dust Wipe Samples	Blood Hg (µg/L)	Urinary Hg (µg/g-Cr)
Apts. 1,2,3 (near the mine in Horlivka)	1	21.50	29.00	1.80	1	0.26	2	2.63	5.59
	2	-	7.44	0.16	1	0.50	3	1.37	2.52
	3	-	4.42	0.61	2	0.96	3	2.58	5.48
Artemvisk	22	0.37	0.20	0.13	1	0.02	1	1.54	0.24
	24	0.70	-	0.18	1	0.07	1	0.96	0.10
	25	0.67	-	0.16	1	0.12	1	1.10	0.22
	29	0.86	-	0.12	2	0.05	1	0.94	0.15
Horlivka	31	1.42	0.77	0.99	1	0.98	2	0.68	0.12
	32	0.82	0.97	0.75	1	0.53	3	2.41	0.39
	33	2.18	0.69	-	-	6.20	2	-	0.18
	35	0.88	2.00	3.94	2	0.25	1	1.01	0.27

