

Determination of Total Mercury in Residual Dried Bloodspots of Newborns from the Lake Superior Basin Region of Minnesota, Wisconsin, and Michigan

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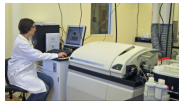
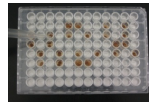
Introduction

A method was developed to determine the concentration of total mercury in residual dried bloodspots (RDBS). This method was used for the analysis of total mercury in RDBS from 1465 infants born 2008 through 2010 to mothers residing in the US portion of the Lake Superior Basin. This study was conducted to determine the range of mercury concentrations in these infants and to assess the feasibility of using RDBS from infants as an indicator of mercury exposure. The level of mercury found in the newborns' blood is indicative of the mothers' exposure to mercury during pregnancy.

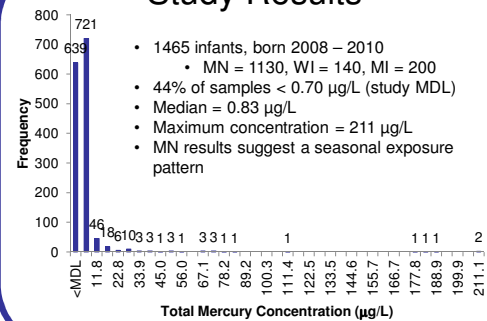


Mercury Analysis

- Two 3-mm punches placed in a 96-well filter plate
- Added 0.15 mL 0.05% 2-mercaptoethanol, 0.001% L-cysteine, 0.005% EDTA, 0.01% Triton X-100, and 10 µg/L Iridium
- Followed by 0.15 mL 2% Hydrochloric acid
- 30 minutes of agitation and stored overnight
- 20 minutes of re-agitation followed by vacuum filtration
- Analyzed by ELAN DRC-II ICP-MS equipped with a ESI SC-FAST autosampler
- 5-point aqueous calibration curve containing a mixture of inorganic and methylmercury



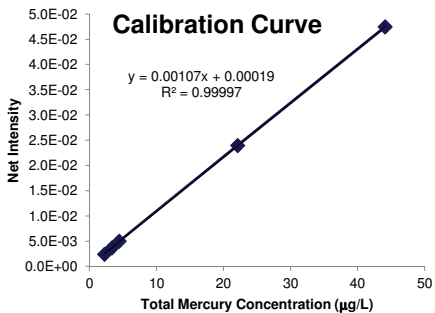
Study Results



Conclusions

- Method Performance
 - Reproducible, linear calibration curves
 - ≥ 80% recoveries for a variety of control samples
 - Very consistent percent recoveries over time
- Compares well to mercury in RDBS study conducted in UT¹
 - Similar MDLs (0.65 µg/L vs. 0.70 µg/L)
 - Smaller RDBS punches and lower volumes than UT
- 8% of infants tested had mercury levels above the U.S. EPA reference dose for methylmercury of 5.8 µg/L
 - Supports the need for education on mercury exposure and fish consumption to women of child-bearing age
- Due to limited availability of blood spots leftover after newborn screening, only 2-3mm discs were used for mercury analysis
 - Increased the MDL; limited characterization of low end of exposure distribution
 - Limits ability to re-analyze if QC issues
- Speciation- unlikely to consistently have enough residual sample to speciate mercury
- Useful for characterizing high end of exposure distribution and as a screen for follow-up
 - However preference would be to screen mothers to prevent exposure
- Uncertainty regarding future restrictions on use of RDBS for public health research
- Correlation of bloodspot mercury with cord blood and maternal blood would be an interesting follow-up study

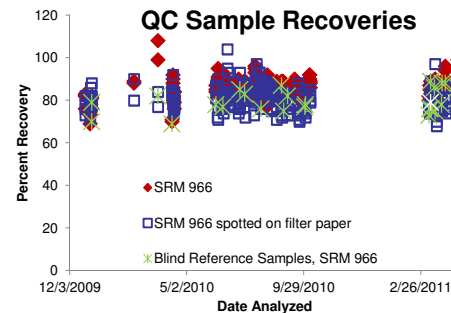
¹Chaudhuri SN, Butala S, Ball RW, Braniff CT, 2009. Pilot study for utilization of dried blood spots for screen. doi:10.1038/jes.2008.19



Method Performance

MDL	0.70 µg/L		
Report Level	2.13 µg/L		
Report Level Verification	2.13 µg/L spotted on cards; n = 78	91%	
Precision	Average of SRM 966 spotted on cards duplicates		RPD = 6.4%
Accuracy	SRM 966; 31.4 µg/L; n = 214	86%	
	SRM 966 on cards; n = 219	82%	
	Blind Reference Samples, SRM 966 on cards; n = 26	80%	
	Old PT sample on cards; 15.9 µg/L Hg; n = 92	92%	RSD = 6.8%
	Old PT sample on cards; 5.36 µg/L; n = 93	84%	RSD = 8.8%

QC Sample Recoveries



Acknowledgments

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 Information on any of the MN EHTB pilot projects can be found at:
<http://www.health.state.mn.us/divs/eh/tracking/biomonitoringpilot.htm>

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