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A Global Look at Mercury Exposures: Supporting the Goals of the Minamata Convention

Carol Potera

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The Minamata Convention on Mercury sets guidelines for limiting human exposure to this environmental toxicant. Article 22 of the Minamata Convention, which entered into force in August 2017, calls for parties to monitor mercury in the environment as well as in people as a way of assessing the effectiveness of the convention.[1] Investigators have now conducted the first state-of-the-science systematic review of mercury biomonitoring data, which was published in *Environmental Health Perspectives*.[2]

The new review was conducted to support the 2018 Global Mercury Assessment, published by the United Nations Environment Programme.[3] But it goes hand in hand with the Minamata Convention to help identify background exposures, explains study leader Niladri Basu, who holds a Canada Research Chair in environmental health sciences at McGill University in Montreal, Quebec. "It is still unclear how the Minamata Convention will affect people, but we hope it has a positive effect in the future," Basu says.

After screening more 9,000 articles, the review team selected 312 papers that reported relevant mercury biomarker measurements in human hair, blood, urine, or cord blood. The selected papers comprised three study types: 15 national biomonitoring studies, 32 longitudinal birth cohort studies, and 265 cross-sectional studies. In choosing cross-sectional studies, the researchers focused on four groups: general populations, people exposed to point sources of mercury (such as artisanal gold mining operations), people who have high dietary exposures to mercury, and populations that are especially vulnerable to fetal exposures.

The studies included in the review provided a wealth of mercury biomarker data points—424,858 measurements from 335,991 people living in 75 countries. Using a modified version of an approach described in 2014,[4] the authors pooled data across relevant studies to obtain two summary distributions (central and upper) for each biomarker.

The authors estimated average mercury levels for general populations to be less than 5 μg/L in blood, less than 2 μg/g in hair, and less than 3 μg/L in urine. In countries where data were available, adults had higher blood mercury levels, on average, than children, and levels increased with age in adulthood. After

Artisanal and small-scale gold miners use elemental mercury to extract gold from sediment. In 2015, these informal mining operations released an estimated 1,220 metric tons of mercury into soil and water—more than twice that of all other sectors combined—and accounted for almost 38% of total air releases worldwide.[3] Image: © Julio Etchart/Alamy Stock Photo.

pooling cross-sectional data, the team estimated central and upper medians of 2.2 μg/L and 9 μg/L, respectively, for blood mercury; 1 μg/g and 6.2 μg/g, respectively, for hair mercury; and 1 μg/L and 6.1 μg/L, respectively, for urinary mercury.

The individuals with the highest reported mercury levels were those living in the Arctic, Pacific, Mediterranean, and Atlantic coast regions who consume the highest amounts of fish, seafood, and marine mammals. In one study,[5] coastal indigenous people were estimated to eat 15 times more seafood than nonindigenous groups. The review authors estimated that populations living close to rivers and lakes have 6.7 times higher blood mercury levels, on average, than people living inland. Although Arctic traditional foods can be high in mercury, human exposures have dropped over the past 20 years, due in part to local dietary warnings.[6]

Indigenous peoples who live in the Amazon rely heavily on freshwater fish as food sources and are also exposed to mercury from artisanal and small-scale gold mining. The authors estimated that mercury exposures among these populations are approximately 7.5 times higher, as determined by both urine and blood levels, than those of general background populations in other studies.

"Gold mining has become a problem in developing countries on a global scale in the last decade," Basu says. "Mercury strongly binds gold, then the mercury is burned off, exposing 15 million miners and 100 million women and children to the toxicant."

In Brazil, the Seychelles, and the Faroe Islands, the authors reported, pregnant women have cord blood mercury levels that may exceed 10 μg/L. However, in the last 20 years, mercury levels in cord blood fell dramatically in the Faroe Islands and the Seychelles, again due to health and seafood consumption advisories.[7]

Despite the large number of studies included in the review, only 9 of the world's 194 countries have national biomonitoring programs, and 69% of the data came from the United States, China, Japan, South Korea, Brazil, Saudi Arabia, Canada, and Russia. Very few countries have data based on mercury biomonitoring programs. Data are especially lacking for people who live in Asia, Africa, and Small Island Developing States, who may be highly exposed to mercury.

The new review is a substantial contribution to our knowledge of mercury-exposed populations worldwide, says Elsie Sunderland, a professor of environmental chemistry at Harvard's John A. Paulson School of Engineering and Applied Sciences, who was not involved in the review. "It clearly illustrates the vulnerability of sensitive populations to global mercury pollution, such as indigenous people who consume large amounts of fish and marine mammals," she says. "The study also suggests that efforts to harmonize mercury biomonitoring efforts are particularly effective for gaining a population-level understanding of exposures to this neurotoxicant."

Carol Potera, based in Montana, also writes for *Microbe* and the *American Journal of Nursing*.

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