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Joint analysis of developmental neurotoxicity in two cohorts using structural equation analysis

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Background: Two birth cohorts have been formed in the Faroe Islands to examine the long-term effects of prenatal exposure to methylmercury, while taking into account confounders, including concomitant exposure to PCBs. A joint statistical analysis was explored using structural equations.

Methodology: Cohort 1 consisted of 1022 children, recruited between 1986 and 1987, while the smaller Cohort 2 from 1994-1995 included 182 children. The cohorts were similar in exposure levels and maternal seafood diets including pilot whale. In both cohorts, the prenatal mercury exposure was assessed from mercury concentrations in cord blood and maternal hair. In Cohort 1, PCB in cord tissue was measured in half of the children, while Cohort 2 provided PCB measurements on maternal pregnancy serum and milk. At approximately 7 years, both cohorts underwent a detailed neurobehavioral examination. We allowed for imprecision both for the mercury exposure parameters and for the cord tissue PCB concentration.

Results: The mercury effects on neurobehavioral performance in the two cohorts were similar. Although adjustment for PCB tended to decrease the mercury effects, for some outcomes the mercury effect remained significant. When the information was pooled across outcomes, adverse effects were estimated for both mercury and PCB, but only the former effect was statistically significant.

Implications: Structural equation models are superior to standard regression techniques, when estimating the effects of predictors with measurement error, and this approach can be applied when merging data from different studies. The results support current evidence of adverse neurodevelopmental effects of methylmercury from seafood.