

# Prenatal and Postnatal Mercury Exposure, Breastfeeding and Neurodevelopment During the First 5 Years

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**Objective:** We evaluated the association between infant hair-Hg and Gesell schedules (GS).

**Background:** Longitudinal assessment of prenatal and postnatal Hg exposure during the first 60 months.

**Methods:** We used hair-Hg as a marker of postnatal Hg exposure (inorganic and methyl-Hg from breast milk, and ethyl-Hg from thimerosal) and GS measured at 6, 36, and 60 months.

**Results:** Hair-Hg at 6 months responded to events related to Hg exposure and breastfeeding. However, most neurodevelopment delays observed at 6 months were overcome with infant growth; at 60 months 87% of children showed adequate GS (> 85). Length of lactation and hair-Hg were each significantly correlated with GS, but in opposite ways: length of lactation was positive and significantly correlated with all GS at 60 months; hair-Hg concentrations were negative and significantly correlated with GS at 6 months ( $r = -0.333$ ;  $P = 0.002$ ) and 60 months ( $r = -0.803$ ;  $P = 0.010$ ), but not at 36 months. Multiple regression models showed that the GS outcome at 60 months depended on GS at 36 months that in turn was influenced by infants' developmental and Hg exposure variables. GS at 6 months was significantly influenced by prenatal (maternal and infant hair-Hg at birth) and postnatal Hg exposure at 6 months.

**Conclusions:** Until there is more refined approach to recognize children sensitive to Hg exposure, and in situations of uncertainty (EtHg exposure), the neurodevelopment benefit of breastfeeding should be recommended.

**Key Words:** thimerosal, ethylmercury, breastfeeding, neurodevelopment, Gesell scores, vaccines

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Mercury is neurotoxic and has been widely recognized as harmful to the developing brain; therefore, preventing exposure during prenatal and postnatal critical periods of central nervous system (CNS) development has been the object of public health policies. Fish advisories aim to restrict its consumption during pregnancy<sup>1</sup> whereas thimerosal-containing vaccines (TCVs) have been banned in rich countries<sup>2</sup> despite the WHO recognition that TCVs are safe to use in infants and children. Collectively, the skewed rationale and perceived double standards that underlie thinking of infant Hg exposure (from maternal sources) and safety of thimerosal in vaccines has spawned skepticism among stakeholders and uncertainties among health professionals.<sup>3</sup>

Despite epidemiologic studies showing no association between TCVs and autism, there are grounds for concerns about other neurodevelopment (ND) disorders. The ability of the newborn to handle Hg is modulated by the degree of immaturity that is, limited bile production and renal function, and underdeveloped metabolic pathways<sup>3</sup>; these impairments are further exacerbated by the various factors associated with Hg exposure: source (Hg chemical forms—inorganic and organic Hg), route (enteral breast milk vs parenteral TCVs) and pathway (intrinsic in breast-milk protein matrix vs extrinsic in pure chemical form—EtHg). Additionally, genotypes with decreased glutathione availability for Hg conjugation have been found to affect Hg metabolism.<sup>3</sup>

Newborn babies and infants (especially those from less developed countries) represent populations of greatest concern to ND adversities: those most sensitive (because of anatomical, physiologic, and biochemical immaturity) and those most exposed (when immunized with TCVs and after maternal fish consumption) to Hg.<sup>4</sup> Owing to great variation in infants' susceptibility and modifiable circumstances (anatomical and functional development), there is a recognizable risk that mild and transient ND disorders can occur as a result of TCVs. However, because subtle effects of Hg on the CNS may manifest themselves long after TCVs exposure, and as this drawback is coupled with lack of proper markers (of exposure and effects), there are serious difficulties in establishing cause and effects (or even association), especially at early stages of development. Therefore, ND associated with time differences of perinatal TCVs inoculation schemes has not been detected in exclusively breastfed infants<sup>5</sup>; as a result, it is important to differentiate low-risk from high-risk situations.