



# Neonatal exposure to Thimerosal from vaccines and child development in the first 3 years of life

Dorota Mrozek-Budzyn\*, Renata Majewska, Agnieszka Kieltyka, Malgorzata Augustyniak

Epidemiology and Preventive Medicine, Jagiellonian University Medical College, Krakow, Poland

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## ABSTRACT

**Background:** Despite the common use of Thimerosal as a preservative in childhood vaccines since the 1930s, there are not many studies on ethylmercury toxicokinetics and toxicodynamics in infants. The knowledge of ethylmercury's potential adverse effects is derived mostly from parallel methylmercury research or from animal and theoretical models.

**Aim of the study:** This study was designed to examine the relationship between neonatal exposure to Thimerosal-containing vaccine (TCV) and child development.

**Material and methods:** The study sample consisted of 196 infants born between January 2001 and March 2003 to mothers attending ambulatory prenatal clinics in the first and second trimesters of pregnancy in Krakow. Vaccination history (date and the type of the vaccine) was extracted from physicians' records. Child development was assessed using the Bayley Scales of Infant Development (BSID-II) measured in one-year intervals over 3 years. General Linear Model (GLM) and Generalized Estimating Equation (GEE) models adjusted for potential confounders were used to assess the association.

**Results:** An adverse effect of neonatal TCV exposure was observed for the psychomotor development index (PDI) only in the 12th and 24th months of life ( $\beta = -6.44$ ,  $p < 0.001$  and  $\beta = -5.89$ ,  $p < 0.001$ ). No significant effect of neonatal TCV exposure was found in the 36th month. The overall deficit in the PDI attributable to neonatal TCV exposure measured over the course of the three-year follow-up (GEE) was significantly higher in TCV group ( $\beta = -4.42$ ,  $p = 0.001$ ). MDI scores did not show the adverse association with neonatal TCV exposure.

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## 1. Introduction

The discussion on the safety of Thimerosal-containing vaccines (TCVs) started in 1999 (Joint Statement issued by the American Academy of Pediatrics and the U.S. Public Health Service in July 1999). It was suspected that ethylmercury contained in the vaccines had a harmful effect on children's neurodevelopment. In fact, the toxicity of low dose human exposure to ethylmercury has not been assessed sufficiently, although it is assumed to have a similar effect as exposure to methylmercury (Pichichero et al., 2000, 2002), an organic compound with demonstrated harmful consequences (Grandjean et al., 1997, 2010; Jedrychowski et al., 2006; Lederman et al., 2008; Oken et al., 2008). A joint statement issued by the American Academy of Pediatrics and the U.S. Public Health Service in July 1999 called for measures to remove Thimerosal from vaccines for infants. Since 2004, no vaccines recommended and routinely used in the United States and the European Union (EU) to protect preschool children have contained Thimerosal

(CDC, 2004; EMEA, 2001). Nevertheless, most countries continue to use TCVs in their childhood immunization schedules. The World Health Organization's (WHO) position is based on the high effectiveness of vaccines in protecting children against infectious diseases and not on specific studies addressing ethylmercury in population studies (WHO, 2000, 2006). It is difficult to argue with the WHO's strategy, since there is a scarcity of evidence for the harmful influence of ethylmercury in population studies. Reports on the adverse health effects of ethylmercury derive mainly from animal experiments (Hornig et al., 2004; Hewitson et al., 2010) and in vitro tests in human cell-cultures (Mukus et al., 2005; Yel et al., 2005; Herdman et al., 2006). These experimental studies have shown consistent toxicity in neural cells caused by Thimerosal at concentrations relevant to vaccines. Furthermore, in animal studies, behavior changes in groups exposed to ethylmercury were observed (Hornig et al., 2004; Hewitson et al., 2010). The applicability of these studies to humans is unknown, but the consistency of their results suggests biological consequences in the neurodevelopment of susceptible infants.

The controversies as to the harmful effects of childhood TCVs and the strategies to abandon TCV vaccinations in developed countries create confusion among parents and health workers in some regions where TCVs are still administered to children. In Poland, newborns and infants

\* Corresponding author at: Epidemiology and Preventive Medicine, Jagiellonian University Medical College, Kopernika 7A, 31-034 Kraków, Poland. Tel.: +48 12 423 10 03; fax: +48 12 422 87 95.

E-mail address: [dorota.mrozek-budzyn@uj.edu.pl](mailto:dorota.mrozek-budzyn@uj.edu.pl) (D. Mrozek-Budzyn).