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Role of environmental toxicants in the developmental origin of learning and behavioural problems

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Background: There is increasing evidence indicating that exposures to environmental toxicants during prenatal development and early childhood are associated with learning and behavioural problems.

Objective: To summarize the evidence linking prenatal and childhood exposures to environmental toxicants, including tobacco, lead and pesticides, with cognitive functioning, attention deficit hyperactivity disorder (ADHD), and antisocial behaviour.

Methods: We reviewed findings from prospective cohort studies and national surveys of the association of prenatal and postnatal environmental toxicant exposures with learning and behavioural problems in children and young adults, emphasizing the role of biomarkers to reduce exposure misclassification and examine low-level effects.

Results: Prenatal and childhood lead exposure have been associated with antisocial behaviours and ADHD. In the Cincinnati Lead Study, blood lead levels were predictors of criminal arrests using official criminal records. Prenatal tobacco exposure is a risk factor for conduct disorder and ADHD in cohort studies and case-control studies. In NHANES, children in the highest quintile of lead exposure were at 4-fold higher risk for doctor-diagnosed ADHD; prenatal tobacco exposure was associated with a 2.5-fold greater risk for ADHD. Prenatal exposure to organophosphate pesticides has also been linked with features consistent with ADHD. Numerous studies have linked low-level exposure to environmental toxicants with deficits in reading ability and cognitive functioning. We conclude that exposures to low-level environmental toxicants during fetal development or early childhood are risk factors for cognitive deficits, ADHD and antisocial behaviour.

Implications: These studies argue for strengthening existing environmental regulations to reduce human exposures to proven or suspected environmental toxicants.