

Age- and Concentration-Dependent Elimination Half-Life of 2,3,7,8-Tetrachlorodibenzo-*p*-dioxin in Seveso Children

Brent D. Kerger,¹ Hon-Wing Leung,² Paul Scott,³ Dennis J. Paustenbach,³ Larry L. Needham,⁴ Donald G. Patterson Jr.,⁴ Pier M. Gerthoux,⁵ and Paolo Mocarelli⁵

¹Health Science Resource Integration, Tallahassee, Florida, USA; ²Private Consultant, Danbury, Connecticut, USA; ³ChemRisk, San Francisco, California, USA; ⁴Centers for Disease Control and Prevention, Atlanta, Georgia, USA; ⁵Department of Laboratory Medicine, University Milano-Bicocca, Hospital of Desio, Desio-Milano, Italy

OBJECTIVE: Pharmacokinetic and statistical analyses are reported to elucidate key variables affecting 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) elimination in children and adolescents.

DESIGN: We used blood concentrations to calculate TCDD elimination half-life. Variables examined by statistical analysis include age, latency from exposure, sex, TCDD concentration and quantity in the body, severity of chloracne response, body mass index, and body fat mass.

PARTICIPANTS: Blood was collected from 1976 to 1993 from residents of Seveso, Italy, who were < 18 years of age at the time of a nearby trichlorophenol reactor explosion in July 1976.

RESULTS: TCDD half-life in persons < 18 years of age averaged 1.6 years while those ≥ 18 years of age averaged 3.2 years. Half-life is strongly associated with age, showing a cohort average increase of 0.12 year half-life per year of age or time since exposure. A significant concentration-dependency is also identified, showing shorter half-lives for TCDD concentrations > 400 ppt for children < 12 years of age and 700 ppt when including adults. Moderate correlations are also observed between half-life and body mass index, body fat mass, TCDD mass, and chloracne response.

CONCLUSIONS: Children and adolescents have shorter TCDD half-lives and a slower rate of increase in half-life than adults, and this effect is augmented at higher body burdens.

RELEVANCE: Modeling of TCDD blood concentrations or body burden in humans should take into account the markedly shorter elimination half-life observed in children and adolescents and concentration-dependent effects observed in persons > 400–700 ppt.

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