

Methylmercury in Fish

Selected References:

- Al-Saleh I, et al. 2020. Effects of early and recent mercury and lead exposure on the neurodevelopment of children with elevated mercury and/or developmental delays during lactation: A follow-up study. *Int J Hyg Environ Health* 230:113629.
- Ashrap P, et al. 2020. Maternal blood and metalloid concentrations in association with birth outcomes in Northern Puerto Rico. *Environ Int* 138:105606.
- Buck Louis GM, et al. 2017. Low-level environmental metals and metalloids and incident pregnancy loss. *Reprod Toxicol* 69:68-74.
- Byeong-Jin Y, et al. 2016. Evaluation of mercury exposure level, clinical diagnosis and treatment for mercury intoxication. *Ann Occup Environ Med* 28:5.
- Choy CMY, et al. 2002. Relationship between semen parameters and mercury concentration in blood and in seminal fluid from subfertile males in Hong Kong. *Fertil Steril* 78(2):426-428.
- Choy CM, et al. 2002. Infertility, blood mercury concentrations and dietary seafood consumption: a case-control study. *BJOG: an international journal of obstetrics and gynaecology*; 109(10), 1121-1125.
- Cox C, et al. 199. Prenatal and postnatal methyl mercury exposure and neurodevelopmental outcomes. *JAMA* 282:1333-1334.
- Crump KS, et al. 1998. Influence of prenatal mercury exposure upon scholastic and psychological test performance: Benchmark analysis of a New Zealand cohort. *Risk Anal* 18:701-713.
- Davidson PW, et al. 1998. Effects of prenatal and postnatal methyl mercury exposure from fish consumption on neurodevelopment. *JAMA* 280:701-707.
- Davidson PW, et al. 2006. Prenatal methylmercury exposure from fish consumption and child development: A review of evidence and perspectives from the Seychelles Child Development Study. *Neurotoxicology* 27:1106-1109.
- Debes F, et al. 2016. Cognitive deficits at age 22 years associated with prenatal exposure to methylmercury. *Cortex* 74:358-69.
- Dorea JG, 2004. Mercury and Lead during breast-feeding. *British J of Nutr* 92(1):21-40.
- Dorea JG. 2021. Exposure to environmental neurotoxic substances and neurodevelopment in children from Latin America and the Caribbean. *Environ Res* 192:110199.
- Food and Drug Administration (FDA). 2017. Mercury levels in commercial fish and shellfish (1990-2012). Available at: <https://www.fda.gov/food/foodborneillnesscontaminants/metals/ucm115644.htm>
- Golding J, et al. 2017. Maternal prenatal blood mercury is not adversely associated with offspring IQ at 8 years provided the mother eats fish: A British prebirth cohort study. *Int J Hyg Environ Health* 220(7): 1161-1167.
- Golding J, et al. 2022. The benefits of fish intake: Results concerning prenatal mercury exposure and child outcomes from the ALSPAC prebirth cohort. *Neurotoxicology* 91:22-30.
- Gokoel AR, et al. 2020. Influence of prenatal exposure to mercury, perceived stress and depression on birth outcomes in Suriname: Results from the MeKiTamara Study. *Int J Environ Res Public Health* 17(12):4444.
- Grandjean P, et al. 1997. Cognitive deficit in 7-year-old children with prenatal exposure to methyl mercury. *Neurotoxicol Teratol* 19:417-428.
- Grandjean P, et al. 1999. Methylmercury exposure biomarkers as indicators of neurotoxicity in children aged 7 years. *Am J Epidemiol* 149:301-305.
- Grandjean P, et al. 2003. Attenuated growth of breast-fed children exposed to increased concentrations of methylmercury and polychlorinated biphenyls. *FASEB J* 17(6):699-701.
- Henriques MC, et al. 2019. Exposure to mercury and human reproductive health: a systematic review. *Reprod Toxicol*; 85:93-103.

- Hibbeln J, et al. 2018. Total mercury exposure in early pregnancy has no adverse association with scholastic ability of the offspring particularly if the mother eats fish. *Environ Int* 116:108-115.
- Hibbeln JR, et al. 2019. Relationship between seafood consumption during pregnancy and childhood neurocognitive development: Two systematic reviews. *Prostaglandins Leuko Essent Fatty Acids* 151:14-36.
- Howe CG, et al. 2021. Prenatal metal mixtures and birth weight for gestational age in a predominately lower-income Hispanic pregnancy cohort in Los Angeles. *Environ Health Perspect* 128(11):117001.
- Hsi HC, et al. 2014. The neurological effects of prenatal and postnatal mercury/methylmercury exposure on three-year-old children in Taiwan. *Chemosphere*; 100:71-76.
- Hu Y, et al. 2016. Prenatal low-level mercury exposure and infant neurodevelopment at 12 months in rural northern China. *Environ Sci Pollut Res Int* 23(12): 12050-12059.
- Iwai-Shimada M, et al. 2015. Methylmercury in the breast milk of Japanese mothers and lactational exposure of their infants. *Chemosphere*; 126:67-72.
- Jensen TK, et al. 2005. Effects of breast feeding on neuropsychological development in a community with methylmercury exposure from seafood. *J Expo Anal Environ Epidemiol*; 15(5):423-430.
- Jin L, et al. 2016. Exposure of methyl mercury in utero and the risk of neural tube defects in a Chinese population. *Reprod Toxicol*; 61:131-135
- Jin L, et al. 2013. Placental concentrations of mercury, lead, cadmium, and arsenic and the risk of neural tube defects in a Chinese population. *Reprod Toxicol*; 35:25-31.
- Kim B, et al. 2020. Adverse effects of prenatal mercury exposure on neurodevelopment during first 3 years of life modified by early growth velocity and prenatal maternal folate level. *Environ Res* 191:109909.
- Klus JK, et al. 2023. Postnatal methylmercury exposure and neurodevelopmental outcomes at 7 years of age in the Seychelles Child Development Study Nutrition Cohort 2, *NeuroToxicology*; 99: 115-119,
- Koos BJ & Longo LD. 1976. Mercury toxicity in the pregnant woman, fetus, and newborn infant. *Am J Obstet Gynecol*; 390(5):390-409.
- Kopylev L, & Segal D. 2025. Relationship of prenatal methylmercury exposure and language/verbal function: a meta-analysis. *Environmental health : a global access science source*; 24(1), 68.
- Kushawaha B, et al. 2025. The impact of mercury exposure on male reproduction: mechanistic insights. *J Trace Elem Med Biol*; 87:127598.
- Lamoureux-Tremblay V, et al. 2021. Altered functional activations of prefrontal brain areas during emotional processing of fear in Inuit adolescents exposed to environmental contaminants. *Nurotoxicol Teratol*; 85:106973.
- Li S, et al. 2022. Relationship between maternal heavy metal exposure and congenital heart defects: a systematic review and meta-analysis. *Environ Sci Pollut Res Int*; 29(37):55348-55366.
- Maeda E, et al. 2019. Associations of environmental exposures to methylmercury and selenium with female infertility: A case-control study. *Environmental research*; 168,357-363.
- Minguez-Alarcon L et al; Earth Study Team. 2017. Hair mercury (Hg) levels, fish consumption and semen parameters among men attending a fertility center. *Int J Hyg Environ Health*; pii:S1438-4639(17)30315-2.
- Myers GJ, et al. 2003. Prenatal methyl mercury exposure from ocean fish consumption in the Seychelles child development study. *Lancet* 361:1686-1692.
- Myers, et al. 2009. Postnatal exposure to methyl mercury from fish consumption: a review and new data from the Seychelles Child Development Study. *Neurotoxicology*; 30(3):338-349
- Myers GJ, et al. 2007. Nutrient and methyl mercury exposure from consuming fish. *J Nutr*; 137(12):2805-2808.
- Nišević RJ, et al. 2019. Combined prenatal exposure to mercury and LCUPUFA on newborn's brain measures and neurodevelopment at the age of 18 months. *Environ Res*; 178:108682.
- O'Connor LE, et al. 2025. Mercury exposure and childhood outcomes: an overview of systematic reviews. *Environ Res*; 274:121196.
- Oken E and Bellinger DC. 2008. Fish consumption, methylmercury and child neurodevelopment. *Curr Opin Pediatr* 20(2):178-183.
- Papadopoulou E, et al. 2021. Maternal seafood intake during pregnancy, prenatal mercury exposure and child

body mass index trajectories up to 8 years. *Int J Epidemiol*; 50(4):1134-1146.

- Polevoy C, et al. 2020. Prenatal exposure to legacy contaminants and visual acuity in Canadian infants: a maternal-infant research on environmental chemicals study. *Environ Health*; 19(1):14.
- Rignell-Hydbom A, et al. 2007. Dietary exposure to methyl mercury and PCB and the associations with semen parameters among Swedish fishermen. *Environmental health : a global access science source*; 6,14.
- Rothenberg SE, et al. 2021. Maternal methylmercury exposure through rice ingestion and child neurodevelopment in the first three years; a prospective cohort study in rural China. *Environ Health*; 20(1):50.
- Saavedra S, et al. 2021. Impact of dietary mercury intake during pregnancy on the health of neonates and children: a systematic review. *Nut Rev*; 80(2):317-328.
- Saito, H. 2020 (Reproduction from 2004). Congenital Minamata disease: a description of two cases in Niigata. *Neurotoxicology*; 81:360-363.
- Sarzo B, et al. 2024. The impact of prenatal mercury on neurobehavioral functioning longitudinally assessed from a young age to pre-adolescence in a Spanish birth cohort. *Environmental research*; 252(Pt 2):118954.
- Schaefer C, et al 2007. Industrial Chemicals and environmental contaminants: Mercury In Drugs During Pregnancy and Lactation, pgs 816-817. Amsterdam.
- Shamlaye C, et al. 2020. The Seychelles Child Development Study: Two decades of collaboration. *Reproduction in Neurotoxicology*. 81:315-322.
- Skerfving & Copplestone. 1976. Poisoning caused by the consumption of organomercury-dressed seed in Iraq. *Bull World Health Organ*; 1976;54(1):101-112.
- Sloane-Reeves J, et al. 2020. Scholastic achievement among children enrolled in the Seychelles Child Development Study. *Neurotoxicology*; 81:347-352.
- Small V, et al. 2025. Through the Eye: Retinal Changes of Prenatal Mercury Exposure in Grassy Narrows First Nation, Canada. *International journal of environmental research and public health*; 23(1)1.
- Smith JC, et al. 1997. Hair methylmercury levels in U.S. women. *Arch Environ Health*. 52(6):476-80.
- Spiller P, et al. 2019. An abundance of seafood consumption studies presents new opportunities to evaluate effects on neurocognitive development. *Prostaglandins Leukot Essent Fatty Acids*; 151:8-13.
- Strain J. 2014. Eating fish for two. *Nutr Bull*; 39(2):181-186.
- Strain JJ, et al. 2015. Prenatal exposure to methyl mercury from fish consumption and polyunsaturated fatty acids: associations with child development at 20 mo of age in an observational study in the Republic of Seychelles. *Am J Clin Nutr*; 101(3):530-537.
- Strain JJ, et al. 2021. Associations of prenatal methylmercury exposure and maternal polyunsaturated fatty acid status with neurodevelopmental outcomes at 7 years of age: results from the Seychelles Child Development Study Nutrition Cohort 2. *Am J Clin Nutr*; 113(2):304-313.
- Tian T, et al. 2021. Single and mixed effects of metallic elements in maternal serum during pregnancy on risk for fetal neural tube defects: A Bayesian kernel regression approach. *Environ Pollut*; 285:117203.
- Tong M, et al. 2021. Total mercury concentration in placental tissue, a good biomarker of prenatal mercury exposure, is associated with risk for neural tube defects in offspring. *Environ Int*; 150:106425.
- Ulloa AC, et al. 2021. Prenatal methylmercury exposure and DNA methylation in seven-year-old children in the Seychelles Child Development Study. *Environ Int*; 147:106321.
- US DHHS: Mercury Toxicity, Monograph 17. ATSDR Case Studies in Environmental Medicine, 1992.
- United States Environmental Protection Agency (EPA). 2026. Choose Fish and Shellfish Wisely. <https://www.epa.gov/choose-fish-and-shellfish-wisely>.
- United States Environmental Protection Agency (EPA). 2014. Estimated Fish Consumption Rates for the U.S. Population and Selected Subpopulations (NHANES 2003-2010). Final report. EPA-820-R-14-002. <https://www.epa.gov/sites/production/files/2015-01/documents/fish-consumption-rates-2014.pdf>.
- United States Environmental Protection Agency (EPA). 2013. Trends in Blood Mercury Concentrations and Fish Consumption Among U.S. Women of Reproductive Age (EPA NHANES, July 2013).
- United States Environmental Protection Agency (EPA) 2026. National Biomonitoring Program. Mercury Factsheet. <https://www.epa.gov/americaschildrenenvironment/biomonitoring-mercury>

- United States Food and Drug Administration (FDA). 2022. Eating Fish for Those Who Might Become or Are Pregnant or Breastfeeding and Children Ages 1 to 11 Years. <https://www.fda.gov/food/consumers/questions-answers-fdaepa-advice-about-eating-fish-those-who-might-become-or-are-pregnant-or>.
- United States Food and Drug Administration (FDA) & United States Environmental Protection Agency (EPA). 2024. Advice About Eating Fish. <https://www.fda.gov/food/consumers/advice-about-eating-fish>
- van Wijngaarden E, et al. 2017. Methyl mercury exposure and neurodevelopmental outcomes in the Seychelles Child Development study main cohort at age 22 and 24 years. *Neurotoxicol Teratol*; 59:35-42.
- Vigeh M, et al. 2018. Prenatal mercury exposure and birth weight. *Reprod Toxicol*; 76:78-83.
- Weichselbaum E, et al. 2013. Fish in the diet: a review. *Nutrition Bulletin*; 38: 128-177.
- Xiang H, et al. 2019. Protective effect of high zinc levels on preterm birth induced by mercury exposure during pregnancy: A birth cohort study in China. *J Trace Elem Med Biol*; 55:71-77.
- Yorifuji T, et al. 2025. Prenatal methylmercury poisoning and neurocognitive impairment in Minamata. *The Science of the total environment*, 985, 179743.
- Yorifuji T, et al. 2026. Long-term neurological and neurocognitive deficits in adults prenatally exposed to methylmercury: Minamata disease. *Neurotoxicology and teratology*; 115,107590.
- Young EC, et al. 2020 (Reproduction from 2004). Association between prenatal dietary methyl mercury and developmental outcomes on acquisition of articulatory-phonologic skills in children in the Republic of Seychelles. *Neurotoxicology*; 81:353-357.

Câu hỏi? Gọi 866.626.6847 | Gửi tin nhắn đến 855.999.3525 | Gửi email hoặc trò chuyện tại [MotherToBaby.org](https://www.MotherToBaby.org).

Disclaimer: MotherToBaby Fact Sheets are meant for general information purposes and should not replace the advice of your health care provider. MotherToBaby is a service of the non-profit Organization of Teratology Information Specialists (OTIS). Copyright by OTIS, May 1, 2026.

Methylmercury in Fish

Selected References:

- Agency for Toxic Substances and Disease Registry (ATSDR). 2020. Toxicological Profile for Tetrachloroethylene. <https://wwwn.cdc.gov/TSP/ToxFAQs/ToxFAQsDetails.aspx?faqid=264&toxid=48>.

Accessed 29 July 2025.

- Aschengrau A, et al. 2020. Reproductive and developmental health effects of prenatal exposure to tetrachloroethylene-contaminated drinking water. *Environ Sci Process Impacts*; 22(3):555-566.
- Aschengrau A, et al. 2018. Modeled exposure to tetrachloroethylene-contaminated drinking water and the occurrence of birth defects: a case-control study from Massachusetts and Rhode Island. *Environ Health*; 17(1):75.
- Aschengrau A, et al. 2015. Long-term health effects of early life exposure to tetrachloroethylene (PCE)-contaminated drinking water: a retrospective cohort. *Environ Health*; 14:36.
- Aschengrau A, et al. 2009. Prenatal exposure to tetrachloroethylene-contaminated drinking water and the risk of congenital anomalies: a retrospective cohort study. *Environ Health*; 8:44.
- Bagnell PC and Ellenberger HA. 1977. Obstructive jaundice due to a chlorinated hydrocarbon in breast milk. *Can Med Assoc J*; 117:1047-1104.
- Bosco MG, et al. 1987. Health and reproductive status of female workers in dry cleaning shops. *Int Arch Occup Environ Health*; 59:295-301.
- Brown Dzubow R, et al. 2010. Early life stage exposure and potential developmental susceptibility to tetrachloroethylene. *Birth Defects Res B Dev Reprod Toxicol*; 89(1):50-65.
- Bukowski JA. 2011. Review of the epidemiologic literature on residential exposure to perchloroethylene. *Crit Rev Toxicol*; 41(9):771-82.
- Ceballos DM, et al. 2021. Perchloroethylene and Dry Cleaning: It's Time to Move the Industry to Safer Alternatives. *Front Public Health*; 9:638082.
- Centers for Disease Control and Prevention (CDC). 2025. Breastfeeding and special circumstances- occupational exposures. Available at URL: <https://www.cdc.gov/breastfeeding-special-circumstances/hcp/exposures/occupational.html>. Accessed May 2026.
- Centers for Disease Control and Prevention. (CDC). 2019. NIOSH Pocket Guide to Chemical Hazards: Tetrachloroethylene. <https://www.cdc.gov/niosh/npg/npgd0599.html> Accessed May 2026.
- Doyle P, et al. 1997. Spontaneous abortion in dry cleaning workers potentially exposed to perchloroethylene. *Occup Environ Med*; 54(12):848-853. Eskenazi B, et al.
- 1991. A study of the effect of perchloroethylene exposure on semen quality in dry cleaning workers. *Am J Ind Med*; 20:575-591.
- Fisher J, et al. 1997. Lactational transfer of volatile chemicals in breast milk. *Am Ind Hyg Ass J*; 58:425-431.
- Forand SP, et al. 2012. Adverse birth outcomes & maternal exposure to trichloroethylene & tetrachloroethylene through soil vapor intrusion in New York State. *Env Health Persp*; 120(4):616-621.
- Ghahri A, et al. 2022. The perchloroethylene-induced toxicity in dry cleaning workers lymphocytes through induction of oxidative stress. *J Biochem Mol Toxicol*; 36(4):e23000.
- Getz KD, et al. 2012. Prenatal and early childhood exposure to tetrachloroethylene and adult vision. *Environ Health Perspect*; 120:1327-1332.
- Janulewicz PA, et al. 2008. Risk of learning and behavioral disorders following prenatal and early postnatal exposure to tetrachloroethylene (PCE)-contaminated drinking water. *Neurotoxicol Teratol*; 30(3):175-185.
- Janulewicz PA, et al. 2012. Adult neuropsychological performance following prenatal and early postnatal exposure to tetrachloroethylene (PCE)-contaminated drinking water. *Neurotoxicol Teratol*; 34(3):350-359.
- Kyörönen P, et al. 1989. Spontaneous abortions and congenital malformations among women exposed to tetrachloroethylene in dry cleaning. *J Epidemiol Community Health*; 43(4):346-351.
- Laumon B, et al. 1996. Exposure to organic solvents during pregnancy and oral clefts: a case-control study. *Reprod Toxicol*; 10:15-19.
- Mirazi N, et al. 2023. Maternal long-term inhalation exposure to perchloroethylene and prenatal teratogenicity: morphometric, hormonal, and histological study. *Toxicol Mech Methods*; 33(3):206-214.
- Modenese A, et al 2019. Evaluation of occupational exposure to perchlorethylene in a group of

Italian dry cleaners using noninvasive exposure indices. *Int J Environ Res Public Health*; 16(16):2832.

- Nijhuis N, et al. 2010. Tetrachloroethylene. In: WHO Guidelines for Indoor Air Quality: Selected Pollutants. Geneva: World Health Organization; <https://www.who.int/publications/i/item/9789289002134>. [Last Accessed May 2026]
- Nickerson K. 2006. Environmental contaminants in breast milk. *J Midwifery Womens Health*, 51(1):26-34.
- Occupational Safety and Health Administration (OSHA). 2005. Reducing Worker Exposure to Perchloroethylene in Dry Cleaning. <https://www.osha.gov/sites/default/files/publications/OSHA3253.pdf> Accessed May 2026.
- Ruckart PZ, et al. 2013. Evaluation of exposure to contaminated drinking water and specific birth defects and childhood cancers at Marine Corps Base Camp Lejeune, North Carolina: a case-control study. *Environ Health*; 12:104.
- Sallmen M, et al. 1995. Reduced fertility among women exposed to organic solvents. *Am J Ind Med*; 27:699-713.
- United States Environmental Protection Agency (EPA). 2023. Final Risk Evaluation for Perchloroethylene (PCE). <https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/final-risk-evaluation-perchloroethylene-pce>. [Last accessed May 2026].
- United States Environmental Protection Agency (EPA). 2012. Toxicological review of tetrachloroethylene (perchloroethylene). [EPA/6363/R-08/011F Feb 2012]. https://cfpub.epa.gov/ncea/iris/iris_documents/documents/toxreviews/0106tr.pdf [Last accessed May 2026].
- Zielhuis GA, et al. 1989. Menstrual disorders among dry-cleaning workers. *Scand J Work Environ Health*; 15:238.

Câu hỏi? Gọi 866.626.6847 | Gửi tin nhắn đến 855.999.3525 | Gửi email hoặc trò chuyện tại [MotherToBaby.org](https://www.MotherToBaby.org).

Disclaimer: MotherToBaby Fact Sheets are meant for general information purposes and should not replace the advice of your health care provider. MotherToBaby is a service of the non-profit Organization of Teratology Information Specialists (OTIS). Copyright by OTIS, May 1, 2026.

Methylmercury in Fish

Selected References:

- Carmichael SL, et al. 2007. Maternal corticosteroid use & orofacial clefts. *Am J Obstet Gynecol*; 197(6):585.e1-585.e7.

- Constantinescu S, et al. 2014. Breast-feeding after transplantation. *Best Pract Res Clin Obstet Gynaecol*; 28(8):1163-1173.
- Fitzsimons R, et al. 1986. Outcome of pregnancy in women requiring corticosteroids for severe asthma. *J Allergy Clin Immunol*; 78(2):349-353.
- Florentien D, et al. 2023. Does prednisone use in pregnant women with rheumatoid arthritis induce insulin resistance in the offspring? *Clin Rheumatol*; 42(1):47-54.
- Gomaa MF, et al. 2014. Combined oral prednisolone and heparin versus heparin: the effect on peripheral NK cells and clinical outcome in patients with unexplained recurrent miscarriage. A double-blind placebo randomized controlled trial. *Arch Gynecol Obstet*; 290:757-762.
- Gur C, et al. 2004. Pregnancy outcome after first trimester exposure to corticosteroids: a prospective controlled study. *Reprod Toxicol*; 18(1):93-101.
- Hendry WF, et al. 1990. Comparison of prednisolone and placebo in subfertile men with antibodies to spermatozoa. *Lancet*; 335:85-88.
- Ito S, et al. 1993. Prospective follow-up of adverse reactions in breast-fed infants exposed to maternal medication. *Am J Obstet Gynecol*; 168:1393-1399.
- Liauw J, 2025. Antenatal Corticosteroids and Child Neurodevelopment: A Systematic Review and Meta-analysis. *Obstetrics and gynecology*; 146(3), 360-376.
- Ma N, et al. 2022. Oral immunosuppressants improve pregnancy outcomes in women with idiopathic recurrent miscarriage: A meta-analysis. *J Clin Pharm Ther*; 47:870-878.
- Man YA, et al. 2009. Association of higher rheumatoid arthritis disease activity during pregnancy with lower birth weight: results of a national prospective study. *Arthritis Rheum*; 60(11):3196-3206.
- Marzec I, et al. 2021. Pregnancy after liver transplant: maternal and perinatal outcomes. *BMC Pregnancy Childbirth*; 21: 627.
- McGuire E. 2012. Sudden loss of milk supply following high-dose triamcinolone (Kenacort) injection. *Breastfeed Rev*; 20:32-34.
- National Institute of Child Health and Human Development. 2024. Prednisolone. *Drugs and Lactation Database (LactMed)*.
- Nørgård B, et al. 2007. Therapeutic drug use in women with Crohn's disease and birth outcomes: a Danish nationwide cohort study. *Am J Gastroenterol*; 102:1406-1413. Nyberg
- G, et al. 1998. Breast-feeding during treatment with cyclosporine. *Transplantation*; 65:253-255.
- Ost L, et al. 1985. Prednisolone excretion in human milk. *J Pediatr*; 106:1008-1011.
- Palmsten K, et al. 2020. Oral corticosteroid use during pregnancy and risk of preterm birth. *Rheumatology (Oxford)*; 59(6):1262-1271.
- Park-Wyllie L, et al. 2000. Birth defects after maternal exposure to corticosteroids: prospective cohort study and meta-analysis of epidemiological studies. *Teratology*; 62(6):385-392.
- Petri M, et al. 1992. The Hopkins Lupus Pregnancy Center: 1987-1991 update. *Am J Reprod Immunol*; 28(3-4):188-191.
- Pradat P, et al. 2003. First trimester exposure to corticosteroids & oral clefts. *Birth Defects Res A Clin Mol Teratol*; 67(12):968-970.
- Rodríguez-Pinilla E & Martínez-Frías ML. 1998. Corticosteroids during pregnancy & oral clefts: a case-control study. *Teratology*; 58(1):2-5.
- Ryu RJ, et al. 2018. Prednisone pharmacokinetics during pregnancy & lactation. *J Clin Pharmacol*; 58(9):1223-1232.
- Silver RK, et al. 1993. Comparative trial of prednisone plus aspirin versus aspirin alone in the treatment of anticardiolipin antibody – positive obstetrics patients. *Am J Obstet Gynecol*; 169(6):1411-1417.
- Skuladottir H, et al. 2014. Corticosteroid use and risk of orofacial clefts. *Birth Defects Res (Part A)*; 100: 499-506.
- Slob E, et al. 2023. Safety of antenatal prednisolone and dexamethasone on fetal, neonatal and childhood outcomes: a systematic review. *The J of Clin Endocr & Metab*; 109(4):e1328-e1335.

- Tata LJ, et al. 2008. Effects of maternal asthma, exacerbations and asthma medication use on congenital malformations in offspring: a UK population-based study. *Thorax*; 63(11):981-987.
- Van Zutphen AR, et al, National Birth Defects Prevention Study. 2015. Maternal asthma medication use during pregnancy and risk of congenital heart defects. *Birth Defects Res A Clin Mol Teratol*; 103(11):951-961.
- Viktil KK, et al. 2012. Outcomes after anti-rheumatic drug use before and during pregnancy: a cohort study among 150,000 pregnant women and expectant fathers. *Scand J Rheumatol*; 41(3):196-2012.
- Xu L, et al. 2009. The influence of immunosuppressants on the fertility of males who undergo renal transplantation and on the immune function of their offspring. *Transpl Immunol*; 22(1-2):28-31

Câu hỏi? Gọi 866.626.6847 | Gửi tin nhắn đến 855.999.3525 | Gửi email hoặc trò chuyện tại [MotherToBaby.org](https://www.MotherToBaby.org).

Disclaimer: MotherToBaby Fact Sheets are meant for general information purposes and should not replace the advice of your health care provider. MotherToBaby is a service of the non-profit Organization of Teratology Information Specialists (OTIS). Copyright by OTIS, May 1, 2026.

Methylmercury in Fish

Selected References:

- Alano MA, et al. 2001. Analysis of nonsteroidal anti-inflammatory drugs in meconium and its relation to persistent pulmonary hypertension of the newborn. *Pediatrics*; 107:519-523.
- Center for Drug Evaluation and Research. (n.d.). NSAIDs may cause rare kidney problems in unborn babies. Retrieved October 16, 2020, from <https://www.fda.gov/drugs/drug-safety-and-availability/fda-recommends-avoiding-use-nsaids-pregnancy-20-weeks-or-later-because-they-can-result-low-amniotic>
- Chen X, et al. 2024. Pregnancy outcomes and birth defects in offspring following non-steroidal anti-inflammatory drugs exposure during pregnancy: A systematic review and meta-analysis. *Reproductive Toxicology*; 125, 108561.
- Choi EY, et al. 2023. Neonatal and maternal adverse outcomes and exposure to nonsteroidal anti-inflammatory drugs during early pregnancy in South Korea: A nationwide cohort study, *PLoS Med*; 20(2):1-19.
- Delker E, et al. 2023. Associations of prenatal exposure to non-steroidal anti-inflammatory drugs with preterm birth and small for gestational age infants among women with autoimmune disorders, *Pharmacoepidemiol Drug Saf*; 32:225-237.

- Ericson A & Kallen BA. 2001. Nonsteroidal anti-inflammatory drugs in early pregnancy. *Reproductive Toxicology*; 15:371-375.
- Esposito DB, et al. 2021. Periconceptional nonsteroidal anti-inflammatory drug use, folic acid intake, and the risk of spina bifida. *Birth Defects Res*; 113(17):1257-1266.
- Hernandez RK, et al. 2012. Nonsteroidal antiinflammatory drug use among women and the risk of birth defects. *Am J Obstet Gynecol*; 206(3):228.e1-8.
- Hultzs S, et al. 2021. First trimester naproxen exposure and outcome of pregnancy – a German case series. *Reprod Toxicol*; 103:51-57.
- Ito S, et al. 1993. Prospective follow-up of adverse reactions in breast-fed infants exposed to maternal medication. *Am J Obstet Gynecol*; 168(5):1393-1399.
- Janssen NM & Genta MS. 2000. The effects of immunosuppressive and anti-inflammatory medications on fertility, pregnancy, and lactation. *Arch Intern Med*; 160(5):610-619.
- Kabir Chowdhury MA, et al. 2023. Relationship of nonsteroidal anti-inflammatory drug use during pregnancy with autism spectrum disorder and intellectual disability among offspring. *Journal of Women's Health*; 32(3):356-365.
- Kallen BA. 2003. Maternal drug use and infant cleft lip/palate with special reference to corticoids. *Cleft Palate Craniofac J*; 40(6):624-628.
- Kallen BA & Olausson PO. 2003. Maternal drug use in early pregnancy and infant cardiovascular defect. *Reprod Toxicol*; 17(3):255-261.
- Koren G et al. 2006. Nonsteroidal antiinflammatory drugs during third trimester and the risk of premature closure of the ductus arteriosus: a meta-analysis. *The Annals of Pharmacotherapy*; 40:824-829.
- Malm H & Borish C. 2015. Non-steroidal anti-inflammatory drugs and antirheumatic drugs. In C Schaefer, P Peters, R Miller (Eds.), *Drugs During Pregnancy and Lactation: Treatment Options and Risk Assessment*, 3rd ed. P. 41-45. London: Elsevier.
- Markovic M, et al. 2019. Prenatal exposure to non-steroidal anti-inflammatory drugs (NSAIDs) and neurodevelopmental outcomes in children. *Pharmacoepidemiology and Drug Safety*; 28(4):452-459.
- McInerney KA, et al. 2017. Preconception use of pain-relievers and time-to-pregnancy: a prospective cohort study. *Hum Reprod*; 32(1):103-111.
- Nakhai-Pour HR, et al. 2011. Use of nonaspirin nonsteroidal anti-inflammatory drugs during pregnancy and the risk of spontaneous abortion. *CMAJ*; 183(15):1713-1720.
- Nielsen GL, et al. 2001. Risk of adverse birth outcome and miscarriage in pregnant users of non-steroidal anti-inflammatory drugs: population based observational study and case control study. *BMJ*; 322(7281):266-270.
- Li D, et al. 2003. Exposure to non-steroidal anti-inflammatory drugs during pregnancy and risk of miscarriage: population based cohort study. *BMJ*; 327:1-5.
- Li DK, et al. 2018. Use of non-steroidal anti-inflammatory drugs during pregnancy and the risk of miscarriage. *Am J Obstet Gynecol*; 219(3):275.e1-275.e8.
- Ofori B, et al. 2006. Risk of congenital anomalies in pregnant users of non-steroidal anti-inflammatory drugs: a nested case-control study. *Birth Defects Res B Dev Reprod Toxicol*; 77(4):268-279.
- Ostensen M & Ostensen H. 1996. Safety of nonsteroidal antiinflammatory drugs in pregnant patients with rheumatic disease. *J Rheumatol*; 23(6):1045-1049.
- Spencer JP, et al. 2001. Medications in the breast-feeding mother. *Am Fam Physician*; 64(1):119-127.
- Tanaka S, et al. 2016. Prediction of fetal ductus arteriosus constriction by systemic and local dermatological formulations of NSAIDs based on PK/PD analysis. In *J Clin Pharmacol Ther*; 54(10):782-794.

Câu hỏi? Gọi 866.626.6847 | Gửi tin nhắn đến 855.999.3525 | Gửi email hoặc trò chuyện tại [MotherToBaby.org](https://www.MotherToBaby.org).

Disclaimer: MotherToBaby Fact Sheets are meant for general information purposes and should not replace the advice of your health care provider. MotherToBaby is a service of the non-profit Organization of Teratology Information Specialists (OTIS). Copyright by OTIS, May 1, 2026.

Methylmercury in Fish

Selected References:

- Ahlqvist VH, et al. 2024. Acetaminophen Use During Pregnancy and Children's Risk of Autism, ADHD, and Intellectual Disability. *JAMA*, 331(14):1205–1214.
- Alwan S, et al. 2022. Paracetamol use in pregnancy – caution over causal inference from available data. *Nat Rev Endocrinol*, 18(3):190.
- American College of Obstetricians and Gynecologists (ACOG). 2025. Acetaminophen Use in Pregnancy and Neurodevelopmental Outcomes. Practice Advisory, ACOG. <https://www.acog.org/clinical/clinical-guidance/practice-advisory/articles/2025/09/acetaminophen-use-in-pregnancy-and-neurodevelopmental-outcomes>
- Andrade C. 2016. Use of acetaminophen (paracetamol) during pregnancy and the risk of autism spectrum disorder in the offspring. *J Clin Psychiatry*; 77(2):e152-4. Arneja J, et al. 2020. Association between maternal acetaminophen use and adverse birth outcomes in a pregnancy and birth cohort. *Pediatr Res*; 87(7):1263-1269.
- Aselton P, et al. 1985. First-trimester drug use and congenital disorders. *Obstet Gynecol* 65:451-5.
- Aw M, et al. 1999. Neonatal paracetamol poisoning. *Arch Dis Child Fetal Neonatal Ed*; 81(1):F78.
- Baker BH, et al. 2020. Association of Prenatal Acetaminophen Exposure Measured in Meconium With Risk of Attention-Deficit/Hyperactivity Disorder Mediated by Frontoparietal Network Brain Connectivity. *JAMA pediatrics*, 174(11):1073-1081.
- Bauer AZ, et al. 2018. Prenatal paracetamol exposure and child neurodevelopment: A review. *Hormones Behav* 101:125-147.
- Baur AZ, et al. 2021. Paracetamol use during pregnancy – a call for precautionary action. *Nat Rev Endocrinol*, 17(12):757-766.
- Bornehag CG, et al. 2018. Prenatal exposure to acetaminophen and children's language development at 30 months. *Eur Psychiatry*, in press.
- Bornehag CG, et al. 2018. Reply to: Shukla et al., Commentary on: Prenatal exposure to acetaminophen and children's language development at 30 months. *Eur Psychiatry* 51:86.
- Brandlistuen RE, et al. 2013. Prenatal paracetamol exposure and child neurodevelopment: a sibling-controlled cohort study. *Int J Epidemiol*; 42(6):1702-13.
- Castro CT, et al. 2022. Effect of Acetaminophen use during pregnancy on adverse pregnancy outcomes: a systematic review and meta-analysis. *Expert Opin Drug Saf*, 21(2):241-251.
- D'Antonio F, et al. 2026. Prenatal paracetamol exposure and child neurodevelopment: a systematic review and meta-analysis. *The Lancet Obstetrics, Gynaecology, & Women's Health*; 2, e190-e198.
- Damker P, et al. 2022. Handle with care – interpretation, synthesis and dissemination of data on paracetamol in pregnancy. *Nat Rev Endocrinol*, 18:191.
- Damkier P, et al. 2025. Acetaminophen in Pregnancy and Attention-Deficit and Hyperactivity Disorder and Autism Spectrum Disorder. *Obstetrics and Gynecology*, 145(2):168–176.

- Feldkamp ML, et al. 2010. Acetaminophen use in pregnancy and risk of birth defects. *Obstet Gynecol*;
- Golding J, et al. 2020. Associations between paracetamol (acetaminophen) intake between 18 and 32 weeks gestation and neurocognitive outcomes in the child: A longitudinal cohort study. *Paediatr Perinat Epidemiol*; 34(3):257-266.
- Harvard Health Publishing. 2017. Acetaminophen safety: Be cautious but not afraid. <https://www.health.harvard.edu/pain/acetaminophen-safety-be-cautious-but-not-afraid> [Accessed 5/18]115(1):109-15.
- Jick H, et al. 1981. First-trimester drug use and congenital disorders. *JAMA*; 246(4):343-6.
- Li DK, et al. 2003. Exposure to non-steroidal anti-inflammatory drugs during pregnancy and risk of miscarriage: population-based cohort study. *BMJ*, 327(7411):368. doi: 10.1136/bmj.327.7411.368.
- Li D, et al. 2018. Use of nonsteroidal anti-inflammatory drugs during pregnancy and risk of miscarriage. *Am J Obstet Gynecol*; 219(3):275.e1-275.e8.
- Kang EM, et al. 2009. Prenatal exposure to acetaminophen and asthma in children. *Obstet Gynecol*; 114(6):1295-1306.
- Liew Z, et al. 2019. Use of negative control exposure analysis to evaluate confounding: An example of acetaminophen exposure and attention-deficit/hyperactivity disorder in Nurses' Health Study II. *Am J Epidemiol* 188(4): 768-775.
- Liew Z, et al. 2014. Acetaminophen use during pregnancy, behavioral problems, and hyperkinetic disorders. *JAMA Pediatr*;168(4):313-20.
- Marsh CA, et al. 2014. Case-control analysis of maternal prenatal analgesic use and cardiovascular malformations: Baltimore-Washington Infant Study. *Am J Obstet Gynecol*; 211(4):404.e1-9.
- McElhatton PR, et al. 1997. Paracetamol overdose in pregnancy analysis of the outcomes of 300 cases referred to the Teratology Information Service. *Reprod Toxicol*; 11(1):85-94.
- Niederhoff H and Zahradnik HP 1983. Analgesics during pregnancy. *Am J Med*; 75:117-120.
- Ricci C et al. 2023. In utero acetaminophen exposure and child neurodevelopmental outcomes: Systematic review and meta-analysis. *Paediatric and perinatal epidemiology*, 37(5):473-484.
- Riggs BS, et al. 1989. Acute acetaminophen overdose during pregnancy. *Obstet Gynecol*; 74(2):247-53.
- Rosevear SK and Hope PL. 1989. Favourable neonatal outcome following maternal paracetamol overdose and severe fetal distress. Case report. *Br J Obstet Gynaecol*; 96(4):491-3.
- Smarr MM, et al. 2016. Urinary paracetamol and time-to-pregnancy. *Hum Reprod*, 31(9):2119-2127.
- Wesselink AK, et al. 2020. Association Between Male Use of Pain Medication and Fecundability. *Am J Epidemiol*, 189(11):1348-1359.
- Zafeiri A, et al. 2022. Maternal over-the-counter analgesics use during pregnancy and adverse perinatal outcomes: cohort study of 151,141 singleton pregnancies. *BMJ Open*, 12:e048092.

Câu hỏi? Gọi 866.626.6847 | Gửi tin nhắn đến 855.999.3525 | Gửi email hoặc trò chuyện tại [MotherToBaby.org](https://www.MotherToBaby.org).

Disclaimer: MotherToBaby Fact Sheets are meant for general information purposes and should not replace the advice of your health care provider. MotherToBaby is a service of the non-profit Organization of Teratology Information Specialists (OTIS). Copyright by OTIS, May 1, 2026.