

Fifth Disease (erythema infectiosum)

Selected References:

- American College of Obstetricians and Gynecologists. 2015. Practice Bulletin. Cytomegalovirus, parvovirus B19, varicella zoster, and toxoplasmosis in pregnancy. *Ob Gyn* 125(6): 1510-1525. Anderson LG. 1990. Human parvovirus B19. *Pediatric Annuals* 1990 19(9):509-513.
- Bascietto F, et al. 2018. Outcomes associated with fetal parvovirus B19 infection: A systematic review and meta-analysis. *Ultrasound Obstet Gynecol*. 2018 Nov;52(5):569-576.
- Bizjak G, et. al. 2009, Acute infection with parvovirus B19 in early pregnancy. *Ultrasound Obstet Gynecol*, 34: 234-235.
- Centers for Disease Control and Prevention. 2023. Parvovirus B19 and Pregnancy <https://www.cdc.gov/parvovirusb19/pregnancy.html>. Accessed 3/2024.
- Chisaka H, et al 2006. Clinical manifestations and outcomes of parvovirus B19 infection during pregnancy in Japan. *Tohoku J Exp Med*. 209(4):277-283. PMID: 16864949 DOI: 10.1620/tjem.209.277
- Committee on Infectious Disease. American Academy of Pediatrics: Parvovirus B 19, in 2003 Red Book: Report of the Committee on Infectious Disease, 26th edition, pp 459-461.
- Crane J, et al. 2014. Parvovirus B19 infection in pregnancy. *J Obstet Gynaecol Can*. 36(12):1107-16.
- Daniilidis A, et al. 2014. Association of fetal loss with recent parvovirus infection and other demographic prognostic risk factors. *J Obstet Gynaecol* 34(1): 40-44.
- DeJong EP, et. al. 2012. Intrauterine transfusion for parvovirus B19 infection: long-term neurodevelopmental outcome. *Am J Obstet Gynecol* 206(3):204.
- De Jong EP, et. al. 2011, Parvovirus B19 infection in pregnancy: new insights and management. *Prenat. Diagn.*, 31: 419-425.
- Dittmer FP, et al. 2024. Parvovirus B19 infection and pregnancy: review of the current knowledge. *Journal of Personalized Medicine* 14(2): 139.
- Fairley CK, et al. 1995. Observational study of effect of intrauterine transfusions on outcome of fetal hydrops after parvovirus B19 infection. *Lancet* 346(8986):1335-1337.
- Gilbert GL. 2000. Parvovirus B19 infection and its significance in pregnancy. *Commun Dis Intell*. 24 Suppl:69-71. PMID: 10846815
- Gillespie SM, et al. 1990. Occupational risk of human parvovirus B19 infection for school and daycare personnel during an outbreak of erythema infectiosum. *JAMA* 263:2061-2065.
- Iaccarino DA, et al. 2025. Successful management of parvovirus B19-associated maternal mirror syndrome: a case report and review of the literature. *Taiwanese Journal of Obstetrics and Gynecology* 64(6): 1076-1079.
- Jordan JA. 2001. Placental cellular immune response in women infected with human parvovirus B19 during pregnancy. *Clin Diagn. Lab Immunol* 8(2):288-292.
- Kailasam C. 2001. Congenital parvovirus B19 infection; experience of a recent epidemic. *Fetal Diagn Ther*. 16(1):18-22.
- Kawabe A, et al. 2016. Placental abruption possibly due to parvovirus B19 infection. *Springerplus* 5(1): 1280.
- Koga M. 2001. Human parvovirus B19 in cord blood of premature infants. *Am J Perinatol*. 18 (5):237-240.
- Kostolansky S, et al 2021. Erythema Infectiosum. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing. <https://www.ncbi.nlm.nih.gov/books/NBK513309/>. Accessed 01/2022.
- Lassen J et. al. 2013. Parvovirus B19 infection in pregnancy and subsequent morbidity and mortality in offspring. *Int. J. Epidemiol* 42 (4): 1070-1076.
- McCarter-Spaulding D. 2002. Parvovirus B19 in pregnancy. *JOGNN*. 31:107-112.
- Nagel H, et al. 2007. Long-term outcome after fetal transfusion for hydrops associated with parvovirus B19 infection, *Obstet Gynecol* 109(1):42-7.

- Ornoy A, et al. 2017. Parvovirus B19 infection during pregnancy and risks to the fetus. Birth Defects Res. 109(5):311-323. doi: 10.1002/bdra.23588.
- Sailer DN, et al. 1993. Maternal serum biochemical markers in pregnancies with fetal parvovirus B19 infection. Prenat Diagn 12(6):467-741. Soulie JC. 1995. Cardiac involvement in fetal parvovirus B19 infection. Pathol Biol Paris 43(5):416-419.
- Staroselsky A, et al. 2009. Exposure to fifth disease in pregnancy. Can Fam Physician;55(12):1195-8.
- Tolfvenstam T and Broliden K. 2009. Parvovirus B19 infection, Semin Fetal Neonatal Med 14(4):218-21.
- Williams EJ, et al. 2013. Viral infections: contributions to late fetal death, stillbirth, and infant death. J Pediatr. 2013 Aug;163(2):424-8.

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, January 1, 2026.

Fifth Disease (erythema infectiosum)

Selected References:

- Attarchi MS, et al. 2012. Assessment of time to pregnancy and spontaneous abortion status following occupational exposure to organic solvents mixture. Int Arch Occup Environ Health, 85(3):295-303.
- Arora H & Tosti A. 2017. Safety and efficacy of nail products. Cosmetics, 4(3):24.
- Centers for Disease Control and Prevention (CDC). 2008. Update on Overall Prevalence of Major Birth Defects, 1978-2005. MMWR Morb Mortal Wkly Rep. 57(1):1-5.
- Ferguson KK, et al. 2014. Environmental phthalate exposure and preterm birth. JAMA Pediatr, 168(1):61-67.
- Freeland C, et al. 2021. Understanding knowledge and barriers related to hepatitis B for Vietnamese nail salon workers in the city of Philadelphia and some of its environs. J Community Health, 46(3):502-508.
- Gallicchio L, et al. 2009. Cosmetologists and reproductive outcomes. Obstet Gynecol, 113(5):1018-1026.
- Gallicchio L, et al. 2010. Health outcomes of children born to cosmetologists compared to children of women in other occupations. Reprod Toxicol, 29(3):361-365.

- Gallicchio L, et al. 2010. Menstrual cycle abnormalities among cosmetologists: the Reproductive Outcomes in Salon Employees (ROSE) study. *Reprod Sci*, 17(1):20-28.
- Garcia E, et al. 2015. Evaluating a county-based healthy nail salon recognition program. *Am J Ind Med*, 58(2):193-202.
- Halliday-Bell JA, et al. 2009. Work as a hairdresser and cosmetologist and adverse pregnancy outcomes. *Occup Med (Lond)*, 59(3):180-184.
- Herdt-Losavio ML et al. 2009. The risk of congenital malformations and other neonatal and maternal health outcomes among licensed cosmetologists. *Am J Perinatol*, 26(9):625-631.
- Herdt-Losavio ML, et al. 2009. The risk of having a low birth weight or preterm infant among cosmetologists in New York State. *Matern Child Health J*, 13(1):90-97.
- Hines CJ, et al. 2009. Urinary phthalate metabolite concentrations among workers in selected industries: a pilot biomonitoring study. *Ann Occup Hyg*, 53(1):1-17.
- Kwapniewski R, et al. 2008. Occupational exposure to dibutyl phthalate among manicurists. *J Occup Environ Med*, 50(6):705-711.
- Lamplugh A, et al. 2019. Occupational exposure to volatile organic compounds and health risks in Colorado nail salons. *Environ Pollut*, 249:518-526.
- Reinecke JK, et al. 2020. Nail health in women. *Int J Womens Dermatol*, 6(2):73-79..
- OSHA publication OSHA 3542-05 2012. Stay Healthy and Safe While Giving Manicures and Pedicures: A Guide for Nail Salon Workers. <https://www.osha.gov/sites/default/files/publications/3542nail-salon-workers-guide.pdf> available in other languages at <https://www.osha.gov/nail-salons>.
- Pak VM, et al. 2013. Occupational chemical exposures among cosmetologists: risk of reproductive disorders. *Workplace Health Saf*, 61(12):522-529.
- Pavilonis B, et al. 2018. Assessing indoor air quality in New York City nail salons. *J Occup Environ Hyg*, 1:1-23.
- Quach T, et al. 2015. Adverse birth outcomes and maternal complications in licensed cosmetologists and manicurists in California. *Int Arch Occup Environ Health*, 88(7):823-833.
- Siegel, M. R., et al. 2022. Maternal occupation as a nail technician or hairdresser during pregnancy and birth defects, National Birth Defects Prevention Study, 1997–2011. *Occup Environ Med*, 79(1):17-23
- Tomar S, et al. 2020. Occupational respiratory morbidity among hair and beauty salon workers in Udipi taluk, Karnataka, India. *Am J Ind Med*, 63(10):902-906.
- Varshavsky JR, et al. 2020. A pilot biomonitoring study of cumulative phthalates exposure among Vietnamese American nail salon workers. *Int J Environ Res Public Health*, 17(1):325.

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, January 1, 2026.

Fifth Disease (erythema infectiosum)

Selected References:

- Dalkilic E, et al. 2019. A successful pregnancy in a patient with Takayasu's arteritis under tocilizumab treatment: A longitudinal case study. *Int J Rheum Dis*; 22(10):L 1941-1944.
- Dernoncourt A, et al. 2023. Fetal and neonatal adverse drug reactions associated with biologics taken during pregnancy by women with autoimmune diseases: Insights from an analysis of the World Health Organization Pharmacovigilance Database (VigiBase®). *BioDrugs*; 37(1):73-87.
- Förger F & Villiger PM. 2016. Treatment of rheumatoid arthritis during pregnancy: present and future. *Expert Rev of Clin Immun*; 12(9):937-944. Genentech, Inc. Actemra Prescribing Information. 2025. Available online at: https://www.gene.com/download/pdf/actemra_prescribing.pdf Accessed 27 Jan 2026.
- Götestam Skorpen C, et al. 2016. The EULAR points to consider for use of antirheumatic drugs before pregnancy, and during pregnancy and lactation. *Annals of the Rheum Dis*; 75:795-810.
- Hoeltzenbein M, et al. 2016. Tocilizumab use in pregnancy: analysis of a global safety database including data from clinical trials and post-marketing data. *Sem Arthr Rheum*; 46(2):238-245.
- Hyrich KL and Verstappen SM. 2014. Biologic therapies and pregnancy: the story so far. *Rheumatology (Oxford)*; 53(8):1377-85.
- Isaac B, et al. 2023. Maternal and fetal outcome in pregnant women with critical COVID-19 treated with tocilizumab in a tertiary care hospital in Dubai. *Cureus*; 30;15(1):e34395.
- Jimenez-Lozano I, et al. 2021. Safety of tocilizumab in COVID-19 pregnant women and their newborn: A retrospective study. *J Clin Pharm Ther*; 46:1062-1070.
- Jorgensen S & Lapinsky SE. 2022. Tocilizumab for coronavirus disease 2019 in pregnancy and lactation: a narrative review. *Clin Microbiol Infect*; 28(1):51-57.
- Konagai N, et al. 2023. Safe use of tocilizumab in pregnant women with Takayasu arteritis: three case studies. *RMD Open* 9:e002996.
- Kaneko K, et al. 2016. Tocilizumab and pregnancy: Four cases of pregnancy in young women with rheumatoid arthritis refractory to anti-TNF biologics with exposure to tocilizumab. *Mod Rheumtol*; 26(5):672-675.
- Levy RA, et al. 2016. Critical review of the current recommendations for the treatment of systemic inflammatory rheumatic diseases during pregnancy and lactation. *Autoimmun Rev*; 15(10):955-963.
- Moriyama M, et al. 2020. Unexpectedly lower proportion of placental transferred tocilizumab relative to whole immunoglobulin G: a case report. *Scand J Rheumatol*; 49(2):165-166.
- Nakajima K, et al. 2016. Pregnancy outcomes after exposure to tocilizumab: A retrospective analysis of 61 patients in Japan. *Mod Rheumtol*; 26(5):667-671.
- Nana M, et al. 2024. Use of interleukin-6 receptor antibodies in the second and third trimester of pregnancy: a retrospective cohort study. *Lancet Rheumatol*; 6(9): e625-e635.
- Ostensen M and Förger F. 2011. Treatment with biologics of pregnant patients with rheumatic diseases. *Curr Opin Rheumatol*; 23(3):293-8.

- Pham T, et al. 2010. Tocilizumab: therapy and safety management. Joint Bone Spine; 77 Suppl 1:S3-100.
- Rubbert-Roth A, et al. 2010. First experiences with pregnancies in RA patients receiving tocilizumab therapy. [abstract]. Arthritis Rheum; 62 Suppl 10:384.
- Saito J et. al. 2019. Tocilizumab during pregnancy and lactation: drug levels in maternal serum, cord blood, breast milk and infant serum. Rheumatology (Oxford); 58(8):1505-1507.
- Weber-Schoendorfer C and Schaefer C. 2016. Pregnancy outcome after tocilizumab therapy in early pregnancy- a case series from the German Embryotox Pharmacovigilance Center. Reprod Toxicology; 60:29-32.

Câu hỏi? Gọi 866.626.6847 | Gửi tin nhắn đến 855.999.3525 | Gửi email hoặc trò chuyện tại 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, January 1, 2026.

Fifth Disease (erythema infectiosum)

Selected References:

- Abe K, et al. 2014. Impact of planning of pregnancy in women with epilepsy on seizure control during pregnancy and on maternal and neonatal outcomes. Seizure 23(2):112-6.
- Andrade, C., et al. 2025. Gestational Exposure to Valproate and Autism Spectrum Disorder or Attention-Deficit/Hyperactivity Disorder in Offspring: Systematic Review and Meta-Analysis. Acta Psychiatrica Scandinavica, 151(6), 668-679.
- Aydin B, et al. 2015. Olanzapine and quetiapine use during breastfeeding: excretion into breast milk and safe breastfeeding strategy. J Clin Psychopharmacol 35(2):206-8.
- Barton S, et al. 2018. Memory dysfunction in school-aged children exposed prenatally to antiepileptic drugs. Neuropsychology 32:784-796. doi:10.1037/neu0000465.
- Blotière PO, et al. Risk of early neurodevelopmental outcomes associated with prenatal exposure to the antiepileptic drugs most commonly used during pregnancy: a French nationwide population-based cohort study. BMJ Open. 2020 Jun 7;10(6):e034829. doi: 10.1136/bmjopen-2019-034829. PMID: 32513880; PMCID: PMC7282331.
- Christensen J, et al. 2013. Prenatal valproate exposure and risk of autism spectrum disorders and childhood

autism. JAMA. 24;309(16)

- Christensen J, et al. 2024. Valproate use during spermatogenesis and risk to offspring. JAMA Netw Open. 2024;7(6):e2414709
- Christensen, J. et al. 2025. Risk of Neurodevelopmental Disorders and Paternal Use of Valproate During Spermatogenesis. JAMA network open, 8(5), e2512139-e2512139.
- Coban D, et al. 2010. Neonatal episodic hypoglycemia: a finding of valproic acid withdrawal. J Clin Res Pediatr Endocrinol 2(2):92-4.
- Colas, S., et al. 2025. Paternal valproate use and neurodevelopmental disorder and congenital malformation risk in offspring. JAMA Network Open, 8(11), e2542581.
- Coste J, et al. Risk of early neurodevelopmental disorders associated with in utero exposure to valproate and other antiepileptic drugs: a nationwide cohort study in France. Sci Rep. 2020 Oct 22;10(1):17362. doi: 10.1038/s41598-020-74409-x. PMID: 33093466; PMCID: PMC7581762.
- Daugaard CA, et al. Association of Prenatal Exposure to Valproate and Other Antiepileptic Drugs With Intellectual Disability and Delayed Childhood Milestones. JAMA Netw Open. 2020 Nov 2;3(11):e2025570. doi: 10.1001/jamanetworkopen.2020.25570. PMID: 33170264; PMCID: PMC7656282.
- Daugaard CA, et al. Association of Prenatal Exposure to Valproate and Other Antiepileptic Drugs With Intellectual Disability and Delayed Childhood Milestones. JAMA Netw Open. 2020 Nov 2;3(11):e2025570. doi: 10.1001/jamanetworkopen.2020.25570. PMID: 33170264; PMCID: PMC7656282.
- Deshmukh U, et al. 2016. Behavioral outcomes in children exposed prenatally to lamotrigine, valproate, or carbamazepine. Neurotoxicol Teratol 54:5-14.
- Di Y, et al. Maternal folic acid supplementation prevents autistic behaviors in a rat model induced by prenatal exposure to valproic acid. Food Funct. 2021 May 21;12(10):4544-4555. doi: 10.1039/d0fo02926b. Epub 2021 Apr 27. PMID: 33903876.
- Diav-Citrin O, et al. 2009. Pregnancy outcome after in utero exposure to valproate: evidence of dose relationship in teratogenic effect. CNS Drugs 22(4):325-34.
- Dreier JW, Bjork MH, et al. 2023. Prenatal exposure to antiseizure medication and incidence of childhood- and adolescence-onset psychiatric disorders. JAMA neurology;80(6):568-577.
- Einarson A, et al. 2009. Use and safety of antipsychotic drugs during pregnancy. J Psychiatr Pract 15: 183-92.
- Harden CL, et al. 2009. Management issues for women with epilepsy – Focus on pregnancy (an evidence-based review): II. Teratogenesis and perinatal outcomes: Report of the Quality Standards Subcommittee and Therapeutics and Technology Subcommittee of the American Academy of Neurology and the American Epilepsy Society. Epilepsia 50: 1237-46.
- Garey, J. D., et al. 2024. Paternal valproate treatment and risk of childhood neurodevelopmental disorders: precautionary regulatory measures are insufficiently substantiated. Birth defects research, 116(8), e2392.
- Huber-Mollema Y, et al. Neurocognition after prenatal levetiracetam, lamotrigine, carbamazepine or valproate exposure. J Neurol. 2020 Jun;267(6):1724-1736. doi: 10.1007/s00415-020-09764-w. Epub 2020 Feb 28. PMID: 32112258; PMCID: PMC7293688.
- IQVIA. A post-authorisation safety study (PASS) to evaluate the paternal exposure to valproate and the risk of neurodevelopmental disorders including autism spectrum disorder as well as congenital abnormalities in offspring—a population-based retrospective study. Published March 20, 2023.
- Jentink J, et al. 2010. Valproic Acid Monotherapy in Pregnancy and Major Congenital Malformations. N Engl J Med 362:2185-93.
- Joffe H, et al. 2006 Longitudinal follow-up of reproductive and metabolic features of valproate-associated polycystic ovarian syndrome features: A preliminary report. Biol Psychiatry. Dec 15;60(12):1378-81.
- Kacirova I, Grundmann M, Brozmanova H. Valproic acid concentrations in nursing mothers, mature milk, and breastfed infants in monotherapy and combination therapy. Epilepsy Behav. 2019 Jun;95:112-116. doi: 10.1016/j.yebeh.2019.04.002. Epub 2019 Apr 28. PMID: 31035102.
- Keni et al. Anti-epileptic drug and folic acid usage during pregnancy, seizure and malformation outcomes: Changes over two decades in the Kerala Registry of Epilepsy and Pregnancy. Epilepsy Res.

2020 Jan;159:106250. doi: 10.1016/j.eplepsyres.2019.106250. Epub 2019 Dec 9. PMID: 31855827.

- Madley-Dowd, P., et al. 2024. Antiseizure medication use during pregnancy and children's neurodevelopmental outcomes. *Nature communications*, 15(1), 9640.
- Markoula S, et al. 2020. Reproductive health in patients with epilepsy. *Epilepsy & Behavior*, 113, 107563.
- Mawhinney E, et al. 2012. Valproate and the risk for congenital malformations: Is formulation and dosage regime important? *Seizure* 21(3):215-218.
- Mbizvo, G. K., et al. 2025. A retrospective cohort study of valproate and infertility in men with epilepsy or bipolar disorder using international health data. *Nature Communications*, 16(1), 8221.
- Meador KJ, et al. 2012. Effects of fetal antiepileptic drug exposure: outcomes at age 4.5 years. *Neurology* 78(16):1207-14.
- Meador KJ, et al. 2014. Breastfeeding in children of women taking antiepileptic drugs: Cognitive outcomes at age 6 years. *JAMA Pediatr*. 168:729-36.
- Ornoy A. 2009. Valproic acid in pregnancy: how much are we endangering the embryo and fetus? *ReprodToxicol* 28: 1-10.
- Ornoy A, et al. 2023. Valproic Acid in Pregnancy Revisited: Neurobehavioral, Biochemical and Molecular Changes Affecting the Embryo and Fetus in Humans and in Animals: A Narrative Review. *International journal of molecular sciences*, 25(1), 390.
- Mazzone, P., et al. 2023. Comparison of Perinatal Outcomes for Women With and Without Epilepsy: A Systematic Review and Meta-Analysis. *JAMA Neurology* 80, no. 5 (2023): 484-494.
- Shallcross R, et al. 2014. In utero exposure to levetiracetam vs valproate: development and language at 3 years of age. *Neurology* 82(3):213-21.
- Smith J et al. 2009. Sodium valproate and the fetus: a case study and review of the literature. *Neonatal Netw* 28: 363-7.
- Stjerna, S., et al. 2024. Cognitive outcomes after fetal exposure to carbamazepine, lamotrigine, valproate or levetiracetam monotherapy: Data from the EURAP neurocognitive extension protocol. *Epilepsy & Behavior*, 159, 110024.
- Sveberg L, et al. 2015. The impact of seizures on pregnancy and delivery. *Seizure*. 28:35-8.
- Tomson T, et al. 2015. Valproate in the treatment of epilepsy in girls and women of childbearing potential. *Epilepsia* 56(7):1006-19.
- United States Food and Drug Administration. 2013. FDA Drug Safety Communication: Valproate Anti-seizure Products Contraindicated for Migraine Prevention in Pregnant Women due to Decreased IQ Scores in Exposed Children. Accessed on 3/2026 from <https://web.archive.org/web/20251214091635/https://www.fda.gov/drugs/drug-safety-and-availability/fda-drug-safety-communication-valproate-anti-seizure-products-contraindicated-migraine-prevention>
- Vajda FJ, et al. 2013. Dose dependence of fetal malformations associated with valproate. *Neurology*; 81(11):999-1003.
- Vajda FJE, et al. 2019. Valproate-associated foetal malformations-Rates of occurrence, risks in attempted avoidance. *Acta Neurol Scand* 139(1):42-48.
- Vajda FJE et al. Folic acid dose, valproate, and fetal malformations. *Epilepsy Behav*. 2021 Jan;114(Pt A):107569. doi: 10.1016/j.yebeh.2020.107569. Epub 2020 Dec 1. PMID: 33272896.
- Veiby G, et al. 2014. Fetal growth restriction and birth defects with newer and older antiepileptic drugs during pregnancy. *J Neurol* 261: 579-588.
- Veroniki AA, et al. 2017. Comparative safety of anti-epileptic drugs during pregnancy: a systematic review and network meta-analysis of congenital malformations and prenatal outcomes. *BMC medicine* 15(1):95.
- Wang, Q., et al. 2024. Investigation of spontaneous abortion and stillbirth adverse events in epilepsy patients treated with levetiracetam: A pharmacovigilance study. *Epilepsy & Behavior*, 160, 110077.
- Weston J, et al. 2016. Monotherapy treatment of epilepsy in pregnancy: congenital malformation outcomes in the child. *Cochrane Database Syst Rev* 11:Cd010224.
- Wiggs KK et al. Antiseizure medication use during pregnancy and risk of ASD and ADHD in children. *Neurology*.

2020 Dec 15;95(24):e3232-e3240. doi: 10.1212/WNL.00000000000010993. Epub 2020 Oct 28. PMID: 33115775; PMCID: PMC7836668.

- Yerby MS, McCoy GB. 1999. Male infertility: possible association with valproate exposure. *Epilepsia* 40:520-1.
- Yonkers KA et al. 2004. Management of bipolar disorders during pregnancy and the postpartum period. *Am J Psych* 161:608-20.

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, January 1, 2026.

Fifth Disease (erythema infectiosum)

Selected References:

- ACOG (American College of Obstetricians and Gynecologists). 2017. Opioid Use and Opioid Use Disorder in Pregnancy. Available at: <https://www.acog.org/clinical/clinical-guidance/committee-opinion/articles/2017/08/opioid-use-and-opioid-use-disorder-in-pregnancy>. [Accessed 7/2023].
- Badhad RKS & Gittins R. 2021. Precision dosing of methadone during pregnancy: a pharmacokinetics virtual clinical trials study. *J Subst Abuse Treat*, 130:108521.
- Bakhireva LN, et al. 2019. Association between prenatal opioid exposure, neonatal opioid withdrawal syndrome, and neurodevelopmental and behavioral outcomes at 5-8 months of age. *Early Hum Dev*, 128:69-76.
- Ballard JL. 2002. Treatment of neonatal abstinence syndrome with breast milk containing methadone. *J Perinat Neonatal Nurs*, 15:76-85.
- Beckwith AM, Burke SA. 2015. Identification of early developmental deficits in infants with prenatal heroin, methadone, and other opioid exposure. *Clin Pediatr (Phila)*, 54(4):328-335.
- Bello JK, Xu KY, Salas J, Bedrick BS, Grucza RA. 2024. Pregnancy rates among women treated with medication for opioid use disorder. *J Gen Intern Med*. 39(8):1342-1348.
- Berghella V, et al. 2003. Maternal methadone dose and neonatal withdrawal. *Am J Obstet Gynecol*, 189:312-317.

- Blinick G, et al. 1973. Methadone maintenance, pregnancy and progeny. *J Am Med Assoc*, 225:477-479.
- CDC (Centers for Disease Control and Prevention). 2022. Opioid Use During Pregnancy. <https://www.cdc.gov/pregnancy/opioids/index.html>. [Accessed 7/2023].
- Cleary B, et al. 2019. Methadone, Pierre Robin sequence and other congenital anomalies: a case-control study. *Arch Dis Child Fetal Neonatal Ed*, 105(2):151-157.
- Cleary BJ, et al. 2011. Methadone and perinatal outcomes: a retrospective cohort study. *Am J Obstet Gynecol*, 204(2):139.e1-9.
- Coulson CC, et al. 2021. Association of maternal buprenorphine or methadone dose with fetal growth indices and neonatal abstinence syndrome. *Am J Perinatol*, 38(1):28-36.
- Dashe JS, et al. 2001. Relationship between maternal methadone dose and neonatal withdrawal. *Am J Obstet Gynecol*, 185(6 Pt 2):S106.
- Goshgarian G, et al. 2022. Buprenorphine/Naloxone or methadone use on neonatal outcomes in Michigan. *Cureus*, 14(8):e27790.
- Hall RW, Babineau DC, Bangdiwala AS, et al. 2025. Association between medication for opioid use disorder during pregnancy and neonatal outcomes. *J Perinatol*. doi:10.1038/s41372-025-02442-7
- Harris M, Schiff DM, Saia K, et al. 2023. Academy of breastfeeding medicine clinical protocol #21: Breastfeeding in the setting of substance use and substance use disorder *Breastfeed Med* 18:715-33.
- Hoegerman G, Schnoll S. 1991. Narcotic use in pregnancy. *Clin Perinatol*; 18(1):51-76.
- Jones HE, et al. 2008. Methadone maintenance vs. methadone taper during pregnancy: maternal and neonatal outcomes. *Am J Addict*, 17(5):372-386.
- Jones HE, et al. 2017. Medically assisted withdrawal (detoxification): considering the mother-infant dyad. *J Addict Med*; 11:90-2.
- Kaltenbach K, et al. 1998. Opioid dependence during pregnancy. Effects and management. *Obstet Gynecol Clin North Am*. 25(1):139-51.
- Kaltenbach K, et al. 2018. Prenatal exposure to methadone or buprenorphine: early childhood developmental outcomes. *Drug Alcohol Depend*, 185:40-49.
- Kanervo MM, et al. 2022. Buprenorphine-naloxone, buprenorphine, and methadone throughout pregnancy in maternal opioid use disorder. *Acta Obstet Gynecol Scand*, 102(3):313-322.
- Kanervo MM, Tupola SJ, Nikkola EM, Gissler M, Kahila HK, Rantakari KM. 2025. Neurodevelopmental challenges at age four following fetal exposure to maternal opioid maintenance treatment. *Pediatr Res*. 98(5):1737-1745. doi:10.1038/s41390-025-04029-6
- Konijnenberg C, et al. 2022. Verbal and nonverbal memory in school-aged children born to opioid-dependent mothers. *Early Hum Dev*, 171:105614.
- Levine TA et al. 2021. Prenatal methadone exposure and child developmental outcomes in 2-year-old children. *Dev Med Child Neurol*, 63(9):1114-1122
- Levine TA, Woodward LJ. 2018. Early inhibitory control and working memory abilities of children prenatally exposed to methadone. *Early Hum Dev*, 116:68-75.
- Lim S, et al. 2009. High-dose methadone in pregnant women and its effect on duration of neonatal abstinence syndrome. *Am J Obstet Gynecol*, 200(1):70.e1-5.
- McCarthy JJ, Posey BL. 2000. Methadone levels in human milk. *J Hum Lact*, 16(2):115-120.
- Mirzai N, Saboory E, Faridi A. 2025. Evaluating the effect of oxytocin and zinc sulphate on reproductive indices in opiate-addicted men receiving methadone maintenance therapy: A randomized, double-masked clinical trial. *Addict Health*. 17:1552.
- Newman RG, et al. 1975. Results of 313 consecutive live births delivered to patients in the New York City methadone maintenance program. *Am J Obstet Gynecol*, 121:233-237.
- NIH (National Institutes of Health). 2017. Treating Opioid Use Disorder During Pregnancy Policy Brief. <https://nida.nih.gov/publications/treating-opioid-use-disorder-during-pregnancy>. [Accessed 7/2023].
- Petrich M, et al. 2022. Comparison of neonatal outcomes in pregnant women undergoing medication-assisted treatment of opioid use disorder with methadone or buprenorphine/naloxone. *J Matern Fetal Neonatal Med*,

35(26):10481-10486

- Pond SM, et al. 1985. Altered methadone pharmacokinetics in methadone-maintained pregnant women. *J Pharmacol Exp Ther*; 233:1-6.
- Reddy UM, et al. 2017. Opioid use in pregnancy, neonatal abstinence syndrome, and childhood outcomes: executive summary of a joint workshop by the Eunice Kennedy Shriver National Institute of Child Health and Human Development, American College of Obstetricians and Gynecologists, American Academy of Pediatrics, Society for Maternal-Fetal Medicine, Centers for Disease Control and Prevention, and the March of Dimes. Opioid Use in Pregnancy, Neonatal Abstinence Syndrome, and Childhood Outcomes Workshop. *Obstet Gynecol* 2017;130:10-28.
- Reece-Stremtan S, Marinelli KA. 2015. ABM clinical protocol #21: guidelines for breastfeeding and substance use or substance use disorder, revised 2015. *Breastfeed Med*, 10(3):135-141.
- Rementeria JL, Nunag NN. 1973. Narcotic withdrawal in pregnancy: stillbirth incidence with a case report. *Am J Obstet Gynecol*, 116(8):1152-1156.
- SAMHSA (Substance Abuse and Mental Health Services Administration). Clinical Guidance for Treating Pregnant and Parenting Women with Opioid Use Disorder and Their Infants. <https://www.samhsa.gov/resource/ebp/clinical-guidance-treating-pregnant-parenting-women-opioid-use-disorder-their-infants>. [Accessed 7/2023].
- Schuckit MA. 2016. Treatment of opioid-use disorders. *N Engl J Med*, 375:357-368.
- Sharpe C, Kuschel C. 2004. Outcomes of infants born to mothers receiving methadone for pain management in pregnancy. *Arch Dis Child Fetal Neonatal Ed*, 89(1):F33-F36.
- Stover MW, Davis JM. 2015. Opioids in pregnancy and neonatal abstinence syndrome. *Semin Perinatol*. 39(7):561-5.
- Suarez EA, et al. 2022. Buprenorphine versus methadone for opioid use disorder in pregnancy. *N Engl J Med*, 387(22):2033-2044.
- Wang S, et al. 2023. Comparative safety analysis of opioid agonist treatment in pregnant women with opioid use disorder: a population based study. *Drug Saf*, 46(3):257-271
- Weaver K, et al 2022. Robin sequence without cleft palate: genetic diagnoses and management implications. *Am J Med Genet A*, 188(1):160-177.
- Welle-Strand GK, et al. 2013. Neonatal outcomes following in utero exposure to methadone or buprenorphine: a national cohort study of opioid-agonist treatment of pregnant women in Norway from 1996 to 2009. *Drug Alcohol Depend*, 127(1-3):200-206.
- Woodward LJ, et al. 2006. Early neurobehavioral development of the infant exposed to methadone during pregnancy. *Pediatr Res*, (2006 PAS Annual Meeting):3571.318.
- Woudes TA, et al. 2020. Neurobehavior of newborn infants exposed prenatally to methadone and identification of a neurobehavioral profile linked to poorer neurodevelopmental outcomes at age 24 months. *PLoS One*, 15(10):e024095.

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, January 1, 2026.