

Reproductive Health and Your Environment

Reproductive health refers to the condition of female and male reproductive systems during all stages of life. Reproductive systems include organs like the ovaries in females and the testicles in males. These organs and glands, such as the pituitary or hypothalamus, also produce and release hormones that influence reproductive success.

Research on reproductive health often focuses on females and barriers to pregnancy, such as:

- Early or delayed puberty
- Menstrual problems
- Infertility or reduced fertility
- Pregnancy issues and complications
- Polycystic ovary syndrome
- Uterine fibroids
- Endometriosis
- Menopause

A growing body of research has revealed a decline in male reproductive health and fertility and spurred additional studies to determine causes.¹ Issues include:

- Impotence or erectile dysfunction
- Low sperm count
- Prostate and testicular cancer
- Testosterone deficiency

Reproductive health research also addresses how environmental exposures during pregnancy affect the health of a child at birth and throughout life. Areas of attention include:

- Infant mortality
- Premature birth
- Fetal growth
- Fetal neurodevelopment



Environmental influences on reproductive health

A broad array of factors influence reproductive health. These range from exercise habits and food consumption to the presence of chemicals in the environment that affect the body's endocrine system and disrupt reproductive hormones. Although there is concern about negative impacts, environmental influences can be positive as well. Some may also produce differing effects on males and females. Areas of research include:

Diet — Diets high in fruits, vegetables, whole grains, and seafood, and low in red meat, sweets, and sugar-sweetened beverages, have been associated with greater fertility in women and better sperm quality in males.² Higher levels of vitamin D have been associated with an increased probability of conception and a lower probability of delayed ovulation in women over the age of 30.³

Heavy metals — Metals like lead, arsenic, and cadmium affect the human endocrine system and have been linked to reduced fertility in both males⁴ and females.⁵ Exposure to arsenic and cadmium during pregnancy has been linked to abnormal fetal development, especially lung development.⁶



Microplastics — Microplastics have been found in food, drinking water, and air. In males, ingestion and absorption of these particles has been associated with lower testes weight, reduced sperm production, and higher rates of sperm death.⁷ In females, microplastics may influence sex hormone levels and the production, development, and viability of ova.⁸

Musk ambrette — A study suggests that this synthetic compound used in fragrances and perfumes may activate reproductive hormone receptors in the hypothalamus and trigger early puberty.⁹

Personal care products — Personal care products, like talcum powder, douches, hair care, skin care, and nail products, often contain parabens, phthalates, and phenols. These chemicals may disrupt the endocrine system and have been associated with the development of uterine fibroids,¹⁰ ovarian cancer,¹¹ and hypertension during pregnancy.¹² Studies also suggest that the concerns are greater for Black women who use hair straighteners and other personal care products more frequently.¹³

PFAS — Per- and polyfluoroalkyl substances (PFAS), synthetic chemicals used in many household and industrial products, are widespread in the environment. People may be exposed through food, drinking water, and direct use of consumer goods. The substances have been linked to lower testosterone levels and reduced semen quality in males¹⁴ and decreased fertility in women.¹⁵ PFAS chemicals also have been associated with increased risks of prostate¹⁶ and endometrial¹⁷ cancer.

Pesticides — Studies indicate that females who consume food with high levels of pesticide residues or who are involved in pesticide application over an extended period may experience an increased risk of infertility, reduced ovarian reserves, higher incidences of miscarriage and fetal development concerns, and delayed puberty.¹⁸ Research on males has associated pesticides exposure with lower testosterone levels, reduced semen quality, and decreased sperm counts.¹⁹

Phthalates — These chemicals, frequently used to increase the flexibility and durability of plastics, have been associated with preterm births, low birth weights, and other negative effects on pregnancy,²⁰ as well as with decreased fertility among males.²¹

Temperature — High temperatures may affect reproduction rates. Studies have found that hotter climates and heat waves may result in reduced sperm motility for males²² and may accelerate reproductive aging and pregnancy loss in females.²³

Workplace activity — Women who lift heavy loads on the job or who work outside a standard day shift may produce fewer eggs.²⁴ By contrast, strenuous jobs and rotating or evening shifts have been associated with greater testicular function and higher sperm counts in men.²⁵

What is NIEHS doing?

Research

National Institute of Environmental Health Sciences (NIEHS) grants, awarded annually, fund reproductive health research at universities and institutions across the nation. Additional studies are underway at the NIEHS Research Triangle Park, North Carolina, campus.

The **Reproductive and Developmental Biology Group** examines how environmental agents produce harmful effects at the molecular level and pursues ways to prevent, diagnose, and treat disorders. The group also assesses development of reproductive organs in utero, studies how fetal abnormalities contribute to fertility issues in adults, and seeks ways to reduce birth defects.²⁶

The **Epidemiology Branch** studies how environmental factors, like phthalates, phenols, PFAS, air pollution, and climate, affect human puberty, menstrual cycles, fertility, fetal growth, pregnancy health, and reproductive cancers. Recent studies include an assessment of the menstrual cycle as a key indicator of reproductive and general health.²⁷

NIEHS also runs multiple long-term, multicomponent studies of the reproductive health of women and children, including:

Body Weight and Puberty — Assesses possible connections between obesity and early puberty in girls.

Calorie Restriction, Environment, and Fitness: Reproductive Effects Evaluation (CaREFREE) — Analyzes how nutrition, fitness, and the environment affect menstrual cycles.

Demystifying a Girl's First Period — Focuses on how reproductive hormones and the ovaries change as girls transition to reproductive maturity and how environmental factors, like sleep, physical activity, microbiome, and PFAS exposure, influence the process. The project includes the Teenage Menstrual Health Study that assesses what constitutes a normal period and the Women's Reproductive Health Study to better understand polycystic ovary syndrome.

Environmental Causes of Infertility — Seeks to identify environmental exposures and understand how they alter uterine function in women and may result in infertility and disease.

Inherited Reproductive Disorders — Investigates how abnormal hormone levels may be passed down in families and the body's regulation of puberty and reproduction.

Observation of Environment and Reproductive Endocrine Effects (Observe) — Analyzes the influence of the environment on reproductive endocrine disorders. The long-term project includes the studies Environmental Impact on Adult Hormones and Reproductive Health and Environmental Impact on Children's Hormones and Reproductive Health.



Ovarian Health — Investigates the development of a procedure to measure Anti-Müllerian hormone in urine as a tool for assessment of reproductive development and function.

Polycystic Ovary Syndrome in Twin Sisters — Investigates whether polycystic ovary syndrome in twins is caused by genetics, environmental triggers, or a combination.

In addition to their efforts to improve understanding of the causes of reproductive health issues, NIEHS staff and grant recipients actively seek solutions by:

- Developing yeast-based tests that support rapid screening of large numbers of chemicals to identify those that may harm reproductive health.²⁸
- Researching the effectiveness of folate supplements as a way to reduce PFAS accumulation in blood serum during pregnancy and lessen the potential for adverse outcomes.²⁹
- Identifying distinct cell populations in developing fetuses — a process that will advance research on birth defect prevention.³⁰
- Examining how reduced male exposure to chemicals, drugs, stress, and other factors prior to conception may improve reproductive success and the health and development of children.³¹

For more information on the National Institute of Environmental Health Sciences, go to <https://www.niehs.nih.gov>.

Research programs supported by NIEHS work to improve reproductive health. For example:

- Harvard University's Scientific Early Life Environmental Health & Development (SEED) Program emphasizes understanding of environmental influences on reproduction. <https://seed-program.org>
- The University of California, San Francisco Program on Reproductive Health and the Environment provides resources to promote a healthy environment for reproduction. <https://prhe.ucsf.edu>
- The Wayne State University Pilsner Lab concentrates on the paternal aspect of reproductive health research. <https://www.pilsnerlab.com>

Additionally, the Endocrine Society, <https://www.endocrine.org/topics>, is a professional organization that supports awareness and research on both [male](#) and [female](#) reproductive endocrinology.

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