

Male fertility crisis—what environmental contaminants have got to do with it

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Credit: AI-generated image ([disclaimer](#))

The World Health Organization (WHO) [recently reported](#) that around one in six couples globally are affected by infertility. For many years people tended to blame women for a couple's infertility—especially in [African countries](#).

But it's now known that male factor infertility contributes about 50% of total cases. And men worldwide—[Africa included](#)—are experiencing a [worrying trend](#) of decreased [sperm count](#) and quality.

There are multiple causes of male infertility. However, it is clear that [environmental contaminants](#) play a large part in declining fertility worldwide. Concern is rising about substances such as per- and polyfluoroalkyl substances, nanomaterials and endocrine disrupting compounds. These substances are found everywhere in modern [everyday lives](#). Most are present in personal-care products such as soaps, shampoos and hair sprays, as well as food wrap, [water bottles](#) and many other items.

Other [contaminants](#) that are [increasing](#) in prevalence and show signs of entering our food chain are pesticides and medication. Recent [research](#) in our laboratory found high traces of these in the nearshore marine environment of False Bay, as well as in rivers and air in agricultural areas of South Africa's Western Cape province.

Our study suggests that these "contaminants of emerging concern" might be contributing to the male infertility crisis in surprising ways.

In our study, we described the effects of contaminants such as pharmaceuticals and pesticides on male reproduction. We propose that these can affect men's reproductive fitness either by interacting with their brain, or by targeting the [reproductive organs](#) such as the testes directly.

The public needs to be aware of the effects of contaminants in the environment on reproductive health. Our research could assist in finding a possible cause of unexplained infertility. It may also lead to preventive treatments.

Impact on male fertility

Our research suggests that across animals, including humans, most contaminants of emerging concern interfere with hormone function. They target the hypothalamic-pituitary-gonadal axis.

The axis is the part of the [endocrine system](#) that controls reproductive functions—the ability to produce sperm in men and eggs in women. When the axis is disrupted, reproductive hormones aren't released as normal. This influences the rate and quality of sperm production.

We report that contaminants of emerging concern can also act directly on testicles by disrupting the blood-testis barrier. This [physical barrier](#) protects the developing sperm from [harmful substances](#) that may be present in the bloodstream. Once contaminants cross the barrier, these compounds move into the compartments of the testis where sperm are produced and can interact with the cells that are involved in sperm production. These cells also play important roles in regulating the production of hormones such as testosterone. Contaminants can either directly damage these cells or interfere with their function.

The contaminants can also directly damage the DNA in the sperm cells, leading to [genetic changes](#) that can affect the quality of the sperm and their ability to fertilize an egg. This can result in infertility or compromise the health of the resulting children.

The legacy of fathers

The way environmental factors affect fertility and cause effects over multiple generations may involve the [epigenome of sperm](#). The mechanisms are far from being fully understood. But these [epigenetic marks](#) can affect how the genes within sperm work without changing the

underlying [DNA sequence](#).

Yet, these changes can be passed down from a parent to their child. This can happen in two ways: when the germ cells that make sperm are exposed to contaminants of emerging concern, and when the sperm itself is affected. In both cases, epigenetic changes can be passed on to future generations who have not been directly exposed to the contaminants.

One category of compounds whose [impact](#) on epigenetic marks that has been [extensively studied](#) is nonsteroidal anti-inflammatory drugs such as paracetamol and ibuprofen. These drugs are used for managing pain and inflammation.

But our research suggests that they also have adverse effects on [reproductive health](#) in children. For example, exposure to these pharmaceuticals during pregnancy can lead to reduction in testosterone levels and changes in genes involved in neurodevelopment in boys. Further [studies](#) have also [suggested](#) that when adults were exposed to insecticides their [sperm](#) carried marks in genes involved in neurological functions including susceptibility to autism spectrum disorders, schizophrenia and bipolar disorder.

These effects may be particularly significant when exposure to contaminants of emerging concern is cumulative. And that's often the case. These contaminants can accumulate in the environment and enter our bodies in various ways, through diet, drinking water, and exposure at work or in recreation.

But there might be solutions to limit their exposure.

Taking charge

The numerous pathways in which contaminants of emerging concern

contaminate soil, water and air are apparent. But it's not easy to detect and eradicate these contaminants. So how do we reduce our exposure to them?

Current control measures include regulatory frameworks to limit the use of certain [pesticides or pharmaceuticals](#), and develop safer alternatives. There are personal protective measures to take, such as using air and water filters, and reducing the use of plastic products that may contain contaminants of emerging concern.

Public health campaigns could raise awareness about the risks of exposure, or the development of new technologies that can detect and quantify these contaminants in the environment more accurately.

Individuals, especially men, should be made aware of the rise in male infertility and how improving their own health and avoiding exposure to contaminants can increase their chances of fatherhood.

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