

## Are sperm counts declining? What's the role of 'endocrine disruptors'?

In July, [a large study](#) was published purporting to show that sperm concentrations in the ejaculate of men in Western countries had declined by 52 percent between 1973 and 2010. The new study synthesized results from 185 studies from 50 different countries. The authors concluded that, "These findings strongly suggest a significant decline in male reproductive health, which has serious implications beyond fertility concerns."

This is not the first study to conclude that sperm counts may be in jeopardy. In 1992, a meta-analysis published in the *British Medical Journal*, which included data from 61 individual studies, reported that between 1938 and 1991 sperm counts dropped by 42%. That study attracted enormous attention both in the media and the scientific community. However, critical scrutiny revealed a number of issues — including the selection of subjects with possible fertility problems in the original studies, differences in study populations at different intervals and in different geographic regions over the 40-year time span, comparability of laboratory methods, and the statistical analysis — that called its findings into question.

Many other studies have been conducted since 1992, some of which show a decline and some of which show an increase in sperm count. Opinion in the scientific community appears evenly divided between those who think the decline is real and those who are unconvinced, based on the daunting challenges of obtaining accurate data on sperm count.

The new study is much larger and, more importantly, the authors went to great lengths to address the potential sources of error in the *BMJ* study. Specifically, they only included studies that enrolled men who were not selected based on their fertility status (referred to as "Unselected") or men who had fathered a pregnancy (referred to as "Fertile"). These two groups were analyzed separately. In addition, geographic location was divided into "Western" countries (North America, Europe, Australia, and New Zealand) and "Other" (South America, Asia, Africa). Thus, the analysis comprised four groups: Unselected Western, Fertile Western, Unselected Other, and Fertile Other.

In addition, the authors controlled for a number of potential confounding variables that could distort the results: age, fertility group, geographic group, abstinence time (which affects sperm count), semen collection methods, and laboratory methods. The new study included 42,935 men, nearly three times the number of men in the 1992 study.

The steepest decline was seen in the Unselected Western group, which showed a drop in sperm concentration from 99.0 million sperm per milliliter (million/ml) in 1973 to 47.1 million/ml in 2011, or a decline of 1.4% per year and of 52.4% over the 40-year period. The corresponding drop in sperm count was 60%. In Fertile Western men the decline in sperm concentration was weaker, and no drop in sperm count was seen. Of note was the absence of a decline in Unselected Other or Fertile Other, suggesting a different pattern in non-Western countries.

The authors wrote that, "Thus, these data provide robust indication for a decline in SC [sperm concentration] and TSC [total sperm count] in North America, Europe, Australia, and New Zealand over

the last 4 decades.” They added that there was no sign of a leveling off of the trend in the period 1996-2011.

While the results of the new study represent a substantial improvement over previous studies, they can’t be taken as the “gold standard.” For one thing, a Danish study of young men recruited into the military over a 15-year period showed no evidence of a decrease in sperm counts. However, this study does not tell us about other populations or longer time periods.

Furthermore, some specialists question the reliance on historical data. In 2013, Allan Pacey, an andrologist at the University of Sheffield [wrote](#) that, “even with today’s relatively well-standardized laboratory methods to assess semen quality, with well-established training programs for laboratory staff, increased emphasis on laboratory accreditation and comprehensive internal and external quality assurance programs in place, we are still far from generating consistent error-free data for semen analysis. As a consequence, it is very hard to look back into the archives with any sense of confidence about the precision and reliability of measurements made in the past.”

What is really needed is a prospective study – or multiple prospective studies — enrolling a random sample of the young male population and following it for several decades using standardized laboratory procedures. Until such data are available, questions will remain about the validity of the decline.

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Chemical fences: some substances in our everyday life may hamper penetration into the protective coat of the egg cell.

In the meantime, since the publication of the 1992 *BMJ* paper, and in spite of the recognized limitations of the studies, what might be responsible for declining sperm counts has become the focus of intense research and speculation.

More often than not, the first culprit to be mentioned in these discussions is “endocrine disruption,” which posits that exposure to generally very low levels of chemicals in the environment is affecting the delicate hormonal balance in humans and causing effects ranging from falling sperm counts to increased birth defects and cancer. However, in spite of sweeping claims regarding the health effects of exposure to endocrine disruptors in the environment, solid evidence is lacking.

There is strong evidence that maternal behaviors — particularly, smoking — during pregnancy can cause reduced sperm counts in adulthood. Work remains to be done to examine possible effects of medications taken by the mother during pregnancy on the testis and sperm count in the adult offspring. Among factors that could be influencing sperm count later in life are age, the increasing prevalence of obesity, lack of physical activity, trauma, exposure to occupational chemicals, and ambient temperature.

Concerning the much-discussed role of endocrine disrupting chemicals in the environment on sperm count, it is of interest that no evidence of a decline in sperm count was observed in non-Western countries in the new study. Exposure to environmental chemicals is much greater in countries like India than in advanced countries, in which the alleged decline in sperm count has been observed. Furthermore, the environmental burden of toxic chemicals has been decreasing rather than increasing in developed countries, casting doubt that the endocrine disruption hypothesis could explain decreasing sperm counts.

Given the importance of this question, with far-reaching implications for fertility, male health generally (since low sperm count is associated with increased mortality), and demographics, funding agencies and governments in developed countries should advocate for the allocation of resources to conduct proper prospective studies in different populations to determine whether there is, in fact, a decline and, if so, what its magnitude is. If the question is answered in the affirmative, this would help motivate serious research to identify causes.

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