

TITLE

The Navigation Guide — Evidence-Based Medicine Meets Environmental Health: Integration of Animal and Human Evidence for PFOA Effects on Fetal Growth

AUTHOR(S)

Juleen Lam, Erica Koustas, Patrice Sutton, Paula I. Johnson, Dylan S. Atchley, Saunak Sen, Karen A. Robinson, Daniel A. Axelrad, and Tracey J. Woodruff

ABSTRACT

Background:

Perfluorooctanoic acid (PFOA) or “C8” is a synthetic (man-made) chemical that does not occur naturally and persists in the environment indefinitely. Companies use PFOA to make fluoropolymers, substances that impart properties such as fire resistance and oil and water repellence to materials such as non-stick coatings for cookware and waterproof membranes for clothing. PFOA can also be released by the breakdown of fluorinated telomers which are used as surface treatment chemicals in many products including carpets, textiles and leather, to impart soil, stain, grease, and water resistance. Telomers are also used as surfactants in cleaning products, non-stick coatings, fire-fighting foams, and paint. Previous studies have found associations between exposure to PFOA and adverse impacts on prenatal development, specifically with regard to decreased fetal growth.

The Navigation Guide is a systematic and transparent review methodology, developed by UCSF’s Program on Reproductive Health and the Environment, and used to synthesize scientific evidence and reach strength of evidence conclusions for environmental health decision making. It was designed to evaluate the quality of evidence and the strength of the recommendations made about the relationship between the environment and reproductive health. Results from this methodology are used to inform effective clinical practice/healthcare and policy.

Objective:

To integrate, using the Navigation Guide, scientific findings from human and nonhuman studies to determine the overall strength of evidence for the question, “Does developmental exposure to PFOA affect fetal growth in humans?”

Methods:

The Navigation Guide outlines four steps, three of which were completed in this case study. The authors assembled a review team of experts in various relevant fields to develop a protocol for each step. First, they specified the study question, and second, they selected evidence. The third step was to rate the quality and strength of the evidence found. Prespecified criteria were developed and applied in order to systematically and transparently (a) rate the quality of the scientific evidence as “high,” “moderate,” or “low”; (b) rate the strength of the human and nonhuman evidence separately as “sufficient,” “limited,” “moderate,” or “evidence of lack of toxicity”; and (c) integrate the strength of the human and nonhuman evidence ratings into a strength of evidence conclusion. This evaluation step involved examining the quality of previous study designs, the direction of the observed effects, the likelihood that a new study could change the conclusion, and other compelling attributes of the data that could influence certainty. However, the fourth step of the Navigation Guide, developing a public health recommendation and rating the recommendation’s strength, was not completed due to limited resources.

Results:

The review team identified 18 epidemiology studies and 21 animal toxicology studies relevant to the research question. The overall quality of both human and nonhuman mammalian evidence was rated as “moderate” and of “sufficient” strength. Integration of these evidence ratings produced a final strength of evidence rating in which review authors concluded that PFOA is “known to be toxic” to human reproduction and development based on sufficient evidence of decreased fetal growth in both human and nonhuman mammalian species. One limitation they found of using the Navigation Guide is its limited scope that has no method of incorporating the results of *in vitro* studies and other modern toxicology testing into the re-

Conclusion:

Based on using the Navigation Guide, the authors concluded that developmental exposure to PFOA adversely affects human health based on sufficient evidence of decreased fetal growth in both human and nonhuman mammalian species.

POLICY IMPLICATIONS

The Navigation Guide is a useful tool that synthesizes findings from multiple, varied research studies to inform environmental health policy. The application of the steps outlined in the Navigation Guide could be used to determine science-based policy recommendations for a number of different environmental toxicants. In this case, the results indicated that PFOA is “known to be toxic” to human reproduction and development, which has implications on how PFOA should be regulated.

In 2008, the U.S. Environmental Protection Agency (EPA), invited the eight major fluoropolymer and telomer manufacturers to join in a global stewardship program to reduce all long-chain perfluoroalkyl carboxylate (LCPFAC) emissions, including PFOA, 95% from 2000 levels by 2010 and commit to work toward the elimination of these chemicals from emissions and products by 2015. All of the eight companies agreed to work towards these goals as part of this 2010/2015 PFOA Stewardship Program. According to 2012 progress reports, four of the eight companies had met the interim goal of a 95% reduction in LCPFAC emissions, and all participating companies announced that they were on track to eliminate the use of these chemicals by 2015.

While the PFOA Stewardship Program has been very successful, only eight companies are participating in it, and other foreign companies, or smaller domestic producers have made no pledge to reduce the use of LCPFAC or PFOA. In response, on September 30, 2013, EPA published a final Significant New Use Rule (SNUR) to ensure that the Agency is notified prior 90 days prior to any new use of a LCPFAC chemical substance as part of carpets or carpet treatment products, whether produced domestically or imported. Upon notification, EPA can review the use and, if necessary, take action to restrict it. (continued on page 2)

TITLE**The Navigation Guide — Evidence-Based Medicine Meets Environmental Health:
Integration of Animal and Human Evidence for PFOA Effects on Fetal Growth****AUTHOR(S)**

Juleen Lam, Erica Koustas, Patrice Sutton, Paula I. Johnson, Dylan S. Atchley, Saunak Sen, Karen A. Robinson, Daniel A. Axelrad, and Tracey J. Woodruff

POLICY IMPLICATIONS, continued

Despite these actions, the Agency for Toxic Substances and Disease Registry has not yet established a minimal risk level for PFOA, citing a need for more research on human health effects of exposure. However, in 2009, EPA's Office of Water established a provisional health advisory of 0.4 micrograms per liter ($\mu\text{g/L}$) for PFOA and EPA Region 4 in the Southeast recommended a residential soil screening level of 16 milligrams per kilogram (mg/kg) for PFOA. At the state level, Minnesota, New Jersey, and North Carolina have established guidelines and limits for the compounds' concentration in drinking water.

Since 2000 EPA has been reviewing alternatives for PFOA as encouraged under the 2010/2015 Stewardship Program. Potential alternatives should be thoroughly tested for human health effects, especially for effects on the most vulnerable populations.

References

[2010/2015 PFOA Stewardship Program](#)

[EPA Significant New Use Rule on LCPFAC](#)

[Strategic Approach to International Chemicals Management](#)

[EPA Factsheet on PFOA and PFOS](#)

[New Chemical Review of Alternatives for PFOA and Related Chemicals](#)

REFERENCE

Article available in [Environmental Health Perspectives](#).

KEY WORD(S)

Perfluorooctanoic acid (PFOA), [The Navigation Guide](#), [Fetal Growth Restriction](#)