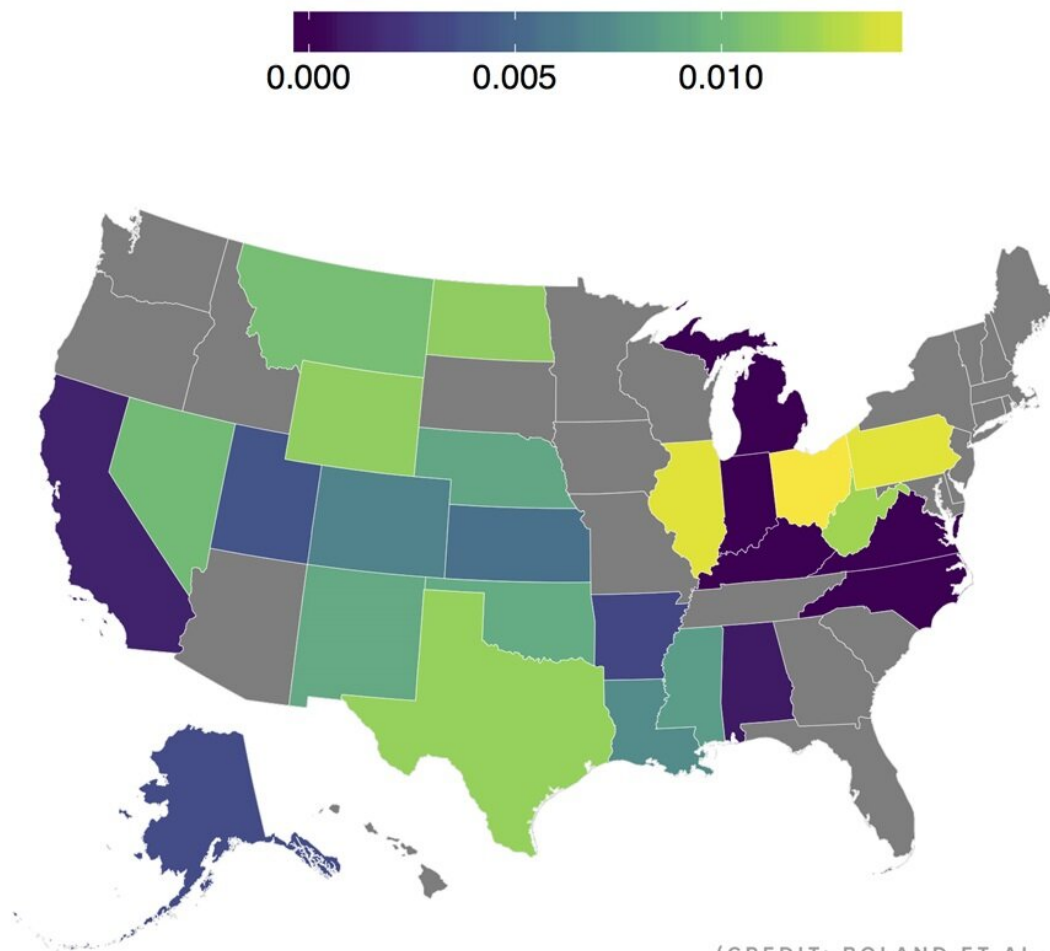


Is your drinking water toxic? This app may help you find out.

September 23 2020, by Lauren Ingeno

PROPORTION OF WELLS WITH CHEMICALS THAT TARGET TESTOSTERONE PATHWAYS



Past studies have shown that fracking chemicals could cause infertility, cancer, and birth defects. According to data compiled from a new tool developed at

Penn Medicine, a disproportionately high number of wells in Pennsylvania, Illinois, and Ohio contain chemicals that target testosterone-pathways in the human body. Credit: Perelman School of Medicine at the University of Pennsylvania

Exposure to hydraulic fracturing fluid in drinking water has been shown to increase the risk of respiratory problems, premature births, congenital heart defects, and other negative health consequences. But not all wells are created equal. Since different hydraulic fracturing—or fracking—sites use a diverse mix of chemical ingredients, often individuals and researchers are in the dark about the exact health consequences of living near a particular well.

Now, a new, [interactive tool](#) created by Penn Medicine researchers allows community members and scientists to find out which toxins may be lurking in their drinking water as a result of [fracking](#). By typing your ZIP code into the website or [accompanying app](#)—called [WellExplorer](#)—you can view the closest fracking sites in your state, learn which chemicals are used at those sites, and view their levels of toxicity.

In a recent study, published in the journal *Database*, the WellExplorer app's creators found, for example, that wells in Alabama use a disproportionately high number of ingredients targeting estrogen pathways, while Illinois, Ohio, and Pennsylvania use a high number of ingredients targeting testosterone pathways. The information found through WellExplorer might be particularly relevant for individuals who use private water wells, which are common in rural Pennsylvania, since homeowners may not be performing rigorous testing for these fracking chemicals, according to the study's principal investigator Mary Regina Boland, PhD, an assistant professor of Informatics in the Perelman School of Medicine at the University of Pennsylvania.

"The [chemical](#) mixtures used in fracking are known to regulate hormonal pathways, including testosterone and estrogen, and can therefore affect [human development](#) and reproduction," Boland said. "Knowing about these chemicals is important, not only for researchers who may be studying health outcomes in a community, but also for individuals who may want to learn more about possible health implications based on their proximity to a well. They can then potentially have their water tested."

While [FracFocus.org](#) serves as a central registry for fracking chemical disclosures in the United States, the database is not user-friendly for the general public, and it does not contain information about the biological action of the fracking chemicals that it lists. In order to create a tool that could provide more in-depth, functional information for researchers and individuals alike, the Penn researchers first cleaned, shortened, and subsetting the data from FracFocus.org to create two newly usable files that could be used in WellExplorer website and app.

Because the research team also wanted to provide toxic and biological properties of the ingredients found at these well sites, they integrated data from the [Toxin and Toxin Target Database \(T3DB\)](#). From that database, they compiled information on fracking chemicals' protein targets (and the genes that encode those proteins), toxin mechanisms of actions, and specific protein functions. Moreover, they extracted the toxicity rankings of the top 275 most toxic ingredients from the [Agency for Toxic Substances and Disease Registry](#), as well as a list of ingredients that were food additives as described by Substances Added to Food Inventory. The team then linked all of that information together and created a ZIP Searcher function into their web tool, so that people could easily find their exposure risks to specific chemicals.

"The information had been out there, but it was not all linked together in a way that's easy for regular people to use," Boland said.

However, Boland added that the use of chemicals at a fracking site may not necessarily mean that those chemicals would be present in the water supply, which would be dependent on other factors, such as what type of soil or bedrock is being drilled into, and the depth of both the hydraulic fracturing well and an individual's private well depth. Nonetheless, WellExplorer provides a starting point for residents who may be experiencing symptoms and want to have their water tested.

Beyond information-gathering for individuals, WellExplorer can also be used as an important tool for environmental scientists, epidemiologists, and other researchers to make connections between specific health outcomes and proximity to a specific fracturing well. From a development standpoint, this means that the research team had to be conscious of the two audiences when designing the website and app, said Owen Wetherbee, who aided in the development of WellExplorer while interning in the Boland Lab.

"Nationally, researchers are trying to link fracking to health outcomes, and I believe that a large reason why answering that question is challenging, is because different wells are using different ingredients, and so, the side effects of exposure would be different from place to place," Boland added. "What this app gives you is some information about where to start looking for these answers."

WellExplorer can be accessed for free at wellexplorer.org or downloaded through the Apple App Store.

More information: Owen Wetherbee et al. WellExplorer: an integrative resource linking hydraulic fracturing chemicals with hormonal pathways and geographic location, *Database* (2020). [DOI: 10.1093/database/baaa053](https://doi.org/10.1093/database/baaa053)

Provided by Perelman School of Medicine at the University of Pennsylvania

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