ENVIRONMENTAL HEALTH PROJECT
DEFENDING PUBLIC HEALTH SINCE 2012

Featured Research Review:

Deziel, N. C., Clark, C. J., Casey, J. A., Bell, M. L. (2022). Strengths, Challenges, and Implications of Assessing Exposure to Unconventional Oil and Gas Development in Epidemiologic Research

June 1, 2023

Terms to know:

- Epidemiologic studies help us to understand how many people have a disease or disorder, if those numbers are changing, and how the disorder affects our society and our economy.
- Epidemiology is the branch of medical science that investigates all the factors that determine the presence or absence of diseases and disorders.

Shale gas development (SGD) is the process of drilling first vertically deep in the earth then horizontally for a mile or more to extract methane gas via hydraulic fracturing (fracking). During this process, operators inject large volumes of water, chemicals, and sand at high pressures to fracture rock formations to release fossil fuels.

According to the U.S. Energy Information Administration, there were about 150,000 active shale gas wells in the U.S. in 2019, and the country saw an estimated eightfold increase in shale gas production over the decade from 2009 to 2019. With an estimated 1.5 to 4 million people living within 1.6 km (one mile) of a shale gas well, this rapid growth in the industry has led to increasing public health concerns. These health concerns have been identified in several epidemiological studies relating adverse human health effects to various environmental factors created by SGD activity, including air pollution, noise, odors, water contamination, radioactive releases, seismic activity, traffic, and psychosocial stress.

Limitations and variations in how studies are designed can add to uncertainty about associations and lead to different conclusions, and some study results have been inconsistent. Nevertheless, many of the epidemiological studies looking at SGD and public health found increased risk of poor health outcomes in children, such as low birth weight, preterm births, congenital anomalies, childhood asthma hospitalizations, and childhood cancer.

In a recent literature review, *Assessing Exposure to Unconventional Oil and Gas Development: Strengths, Challenges, and Implications for Epidemiologic Research* (Deziel N. C., Clark C. J., Casey J. A., Bell M. L., 2022), the authors discussed the strengths and limitations of shale gas exposure assessment methods used in epidemiologic studies, particularly those considering children's health outcomes.

Researchers reviewed 42 published epidemiologic studies, including 29 pediatric-focused populations, that were designed to examine associations between SGD and human health conducted in the U.S. and Canada, identified through searches in PubMed and Google Scholar.

The researchers first identified SGD-related stressors such as chemical contaminants in water, air pollutants, sensory stressors, greenhouse gases, socio-environmental disturbances and radiation, radioactivity, and radon. They then proceeded to examine the effectiveness of five exposure assessment methods in gauging the previously identified SGD stressors. The five methods for assessing exposure to SGD-related stressors were surveys, environmental measurements (e.g., direct measurement using

View more of EHP's Featured Research Reviews here.

instruments), aggregate proximity-based models, pathway-specific models, and biological monitoring (e.g., urine and blood serum testing).

Researchers identified several challenges facing SGD exposure assessments, including:

- There is sparsely available monitoring data in areas with SGD, so researchers find it difficult to collect new exposure measurements for both environmental and body burden measures.
- There is limited information on the identity of chemical and non-chemical pollutants and the concentrations present.
- Because shale gas activity happens in stages, emissions are episodic, and chemicals or other hazards are infrequently released.
- Emissions and dispersion patterns are complex due to pollutant mixing, tree cover, and weather influences.

Given the above challenges, researchers found that:

- All of the studies they reviewed used simple, proximity-based models (or distance from the facility) to assess exposure rather than surveys, biomonitoring, or environmental measurements.
- Rather than using pathway-specific models, most studies used mixtures of models, aggregating data, as a substitute to help understand the complex mix of potential pollutants and polluters.

The authors concluded that despite the limitations in exposure assessment, studies have consistently identified increased risk of health problems associated with SGD exposure, particularly in children.

To learn more about this study, explore these links:

- Deziel, N. C., Clark, C. R., Casey, J. A., Bell, M. L., Plata, D. L., & Saiers, J. E. (2022). Assessing Exposure to Unconventional Oil and Gas Development: Strengths, Challenges, and Implications for Epidemiologic Research. *Current Environmental Health Reports*, *9*(3), 436–450. https://doi.org/10.1007/s40572-022-00358-4

- Czolowski, E. D., Santoro, R., Srebotnjak, T., & Shonkoff, S. B. (2017). Toward Consistent Methodology to Quantify Populations in Proximity to Oil and Gas Development: A National Spatial Analysis and Review. *Environmental Health Perspectives, 125*(8). https://doi.org/10.1289/ehp1535

- Hays, J., & Shonkoff, S. B. (2016). Toward an Understanding of the Environmental and Public Health Impacts of Unconventional Natural Gas Development: A Categorical Assessment of the Peer-Reviewed Scientific Literature, 2009-2015. *PLOS ONE*, *11*(4), e0154164. https://doi.org/10.1371/journal.pone.0154164

- Adgate, J. L., Goldstein, B. R., & McKenzie, L. M. (2014). Potential Public Health Hazards, Exposures and Health Effects from Unconventional Natural Gas Development. *Environmental Science & Technology*, *48*(15), 8307–8320. https://doi.org/10.1021/es404621d

- Deziel, N. C., Brokovich, E., Grotto, I., Clark, C. J., Barnett-Itzhaki, Z., Broday, D. M., & Agay-Shay, K. (2020). Unconventional oil and gas development and health outcomes: A scoping review of the epidemiological research. *Environmental Research*, *182*, 109124. https://doi.org/10.1016/j.envres.2020.109124

View more of EHP's Featured Research Reviews here.