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Featured Research Review:

Xu, Y., Sajja, M., Kumar, A. (2019). Impact of the Hydraulic Fracturing on Indoor Radon Concentrations in Ohio: A Multilevel Modeling Approach

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Terms to know:

- pCi/l (pico-curies per liter of air) – The unit of measurement for the concentration of radon gas present in the air.
- Urban area – This study defines an urban area as a continuously built-up area with a population of 50,000 or more.
- Rural area – This study defines rural areas of open countryside with population densities of less than 500 people per square mile and places with fewer than 2,500 people.
- Urban clusters – This study defines urban clusters as areas with at least 2,500 people and less than 50,000 population.
- Multilevel modeling (MLM) – This is also sometimes referred to as a hierarchical linear model, random-effect model, variance-components model, or mixed model. This model is used to predict the values of dependent variables at multiple levels.
- Hydraulic fracturing – Sometimes shortened to "fracking," this is a technology used to extract naturally occurring shale gas by drilling into deep formations and breaking open the rock to release gas to the surface.

Radon is a colorless and odorless gas found naturally in our environment in soil, water, or rocks.[1] Radon is highly radioactive, and the United States Environmental Protection Agency (U.S. EPA) considers it to be a human carcinogen, indicating that the more one is exposed, the higher the chance they could develop cancer. Specifically, radon is the second leading cause of lung cancer in the United States, and it is estimated that it is responsible for 20,000 lung cancer deaths every year.[2] A 2015 study showed higher levels of radon on the first floor of homes for those in proximity to shale gas activities in Pennsylvania.[3]

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Main Office: 2001 Waterdam Plaza Drive, Suite 201, McMurray, PA 15317
Northeast Office: 470 James Street, Suite 29, New Haven, CT 06513
info@environmentalhealthproject.org | 724.260.5504

The authors of a more recent study—"Impact of The Hydraulic Fracturing on Indoor Radon Concentrations in Ohio: A Multilevel Modeling Approach" (Xu, Y., Sajja, M., Kumar, A., 2019)—used statistical modeling to expand on previous research and to determine whether there is an association between shale gas development (SGD) activity and radon levels. The researchers used data from the Ohio Radon Information System (ORIS) from 2007 to 2014 and additionally collected over 100,000 individual household records. They then took SGD well data from the Ohio Department of Natural Resources to determine proximity. Only active wells drilled after 1999 were included in this study. With this data, the researchers identified fifty-seven (57) counties in Ohio that obtained shale gas wells. The researchers also referenced the EPA recommended indoor limit for radon gas of 4 pCi/l (pico-curies per liter of air), as well as the World Health Organization (WHO) recommended indoor level of 2.7 pCi/l.[4]

The modeling in this study showed a significant relationship between indoor radon concentrations and proximity to shale gas development.

- The average radon concentration among the homes tested was 5.76 pCi/l, which is higher than both EPA and WHO standards.
- The closer a home is to shale gas wells, the higher the radon concentrations were.
- Population density is negatively associated with radon concentration, meaning that rural areas and urban clusters tend to have higher radon concentrations when compared with the urban areas (which are more population dense). The larger the population, the smaller the radon concentration.

To learn more about this study, explore these links:

1. Radon in the Home. (2022, January 3). Centers for Disease Control and Prevention. https://www.cdc.gov/nceh/features/protect-home-radon/index.html
2. Agency for Toxic Substances and Disease Registry. (2012, October). Radon – Tox FAQs. https://www.atsdr.cdc.gov/toxfaqs/tfacts145.pdf
3. Casey, J. A., Ogburn, E. L., Rasmussen, S. G., Irving, J. K., Pollak, J., Locke, P. A., & Schwartz, B. S. (2015). Predictors of Indoor Radon Concentrations in Pennsylvania, 1989–2013. *Environmental Health Perspectives*, *123*(11), 1130–1137. https://doi.org/10.1289/ehp.1409014
4. Xu, Y., Sajja, M., & Kumar, A. (2019). Impact of the Hydraulic Fracturing on Indoor Radon Concentrations in Ohio: A Multilevel Modeling Approach. *Frontiers in Public Health*, *7*. https://doi.org/10.3389/fpubh.2019.00076
5. Environmental Health Project. (2023, January 12). *Protect Your Health from Radon*. EHP. https://www.environmentalhealthproject.org/post/protect-your-health-from-radon