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Pennsylvania Study Links Adverse Birth Outcomes to Shale Gas Development

Buchanich, J., Talbott, E., Arena, V., Bear, T., Fabisiak, J, Wenzel, S., Youk, A., Yuan, J. (2023): Final Report for Pennsylvania Department of Health, Bureau of Epidemiology Hydraulic Fracturing Epidemiology Research Studies: Birth Outcomes.

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Terms to know:

- **Birth outcome**: Researchers analyze specific measurements taken when a baby is born to help understand the exposures to the fetus that took place during gestation and the subsequent expected health effects that the child could experience in the future. Several types of birth outcomes are studied to understand these factors, including preterm birth, small for gestational age, major congenital anomalies, and severe neonatal morbidity or mortality.

- **Retrospective cohort study**: a type of observational research study that analyzes data from past records to investigate the relationship between an exposure and an outcome. Researchers identify a study group that shares common characteristics and exposures, analyzing their data to assess how exposure may have influenced the outcome studied.

- **Buffer zone**: To understand the potential effects that proximity to oil and gas operations have on health, researchers often examine health data from people living at varied distances from those operations. Distance is analyzed as part of the overall examined health effects, and researchers can conclude what distances from operations see more health effects than others, further informing study results.

- **Low 5-minute Apgar score**: a score given after assessing the status of a newborn 5 minutes after birth. The score is based on heart rate, respiratory effort, reflex irritability, muscle tone, and color. Each criterion gets a score of 0, 1, or 2 and is then summed for an overall score between 0-10. A low 5-minute Apgar score is defined **as a score less than 7**.

- **Small for gestational age (SGA)**: birthweights less than the 10th percentile for gestation age.

- **Preterm birth**: births occurring between 22- and 36-weeks gestation. Moderate-to-late preterm births are defined as occurring between 32- and 36-weeks gestation.

- **Term birthweight**: birthweight in grams for birth occurring between 37 and 41 weeks.

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Since the early 2000s, oil and gas development in the United States has experienced extensive expansion. The United States Energy Information Agency (EIA) placed the number of active oil and gas wells in the U.S. at over 912,000 at the end of 2022, showing significant growth in industry operations. Unconventional oil and gas development, more commonly referred to as hydraulic fracturing or fracking, saw some of the most significant uptake – gas produced from hydraulic fracturing increased from 1.9 trillion cubic feet in 2007 to 32.5 trillion cubic feet in 2022. With at least 17 million people in the United States living within 1 mile of an active oil or gas well, community members and health experts have raised significant concerns regarding proximity to well sites.

Living and working close to shale gas development (SGD) can result in significant harms to public health, including adverse birth outcomes. A previous study by Stacy et al. found that live births from mothers living near SGD were both small for gestational age (SGA) and had lower birth weights. As one of the first studies on the association between birth outcomes and proximity to SGD, the Stacy et al. study demonstrated the need for additional investigations into this relationship.

To this end, The University of Pittsburgh School of Public Health, authors of the *Final Report for Pennsylvania Department of Health, Bureau of Epidemiology Hydraulic Fracturing Epidemiology Research Studies: Birth Outcomes*, sought to explore this relationship further. This new study aimed to replicate results seen in other birth outcome studies that looked at the association between proximity to shale gas operations and adverse birth effects. The team narrowed its study to an eight-county area of Southwestern Pennsylvania and observed four birth outcomes commonly associated with proximity to fracking in previous studies: low 5-minute Apgar score, SGA, preterm birth, and term birth weight.

The researchers collected live birth data from the Pennsylvania Department of Health's Bureau of Health Statistics and Research. The study included live births for the years between January 1, 2010, and December 31, 2020, to mothers residing in any of Allegheny, Armstrong, Beaver, Butler, Fayette, Greene, Washington, and Westmoreland counties.

Births that took place within 10 miles of any shale gas activity were considered exposed; however, the study also aimed to associate distance more directly with the outcome by including buffer zones of 0.5 miles, 1 mile, 2 miles, 5 miles, and 10 miles from shale gas operations to account for the effects of different distances of residence. The researchers also stratified the study data by the phase of development of each well.

The results suggest an association between adverse birth outcomes and shale gas development, with specific outcomes correlated more closely with different phases of shale gas development:

SGA: There is a moderate to strong association between SGA and the production phase of shale gas development, particularly at 2-, 5-, and 10-mile buffer distances.

Preterm birth: There was limited data to suggest a relationship between preterm birth incidence and the drilling phase of shale gas development. There was no data to support the increased risk of preterm birth with well pad preparation, hydraulic fracturing, production phases, or cumulative well count.

Term birthweight: There was limited data to suggest an increased risk of low-term birthweight with the drilling phase. Moderate data were present to suggest an increased risk of low-term birthweight when correlated with the cumulative well count. Strong data were present to suggest an increased risk with the production phase of shale gas development. All associations were elevated in the 5- and 10-mile buffer distances.

Low Apgar score: Ultimately, low Apgar score was not modeled in the study as this outcome occurred infrequently among the births in the cohort. As a result, not enough data was available to allow for analysis of the impact on Apgar score.

This study's findings corroborate the results of many other studies that have examined the effects of shale gas development on birth outcomes. The results of this study uncover evidence that the production phase of shale gas development has strong associations with negative birth outcomes. In addition, adding the findings of this study to the wider body of evidence from studies performed over multiple decades, on multiple different cohorts, and in different parts of the country would suggest that there is some health effect that can manifest in an adverse birth outcome related to the proximity at which one lives to shale gas operations. The study authors note that their research sets the stage for further investigation, and they suggest investigating the stronger correlations that their work uncovered, such as the stronger associations with the production phase and other variables that may come into play.

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To learn more about this study, explore these links:

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