Study Examines the Risks of Oil and Gas Exposure on Childhood Leukemia

A pilot study found children with acute lymphocytic leukemia were more likely to be living in the highest density of oil and gas areas.

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A pilot study of childhood leukemia patients living near Colorado's oil and gas drilling sites recently led to an American Cancer Society (ACS) grant award for CU Cancer Center member Lisa McKenzie PhD, MPH.

For the pilot study, which was partially funded by the CU Cancer Center, McKenzie, a clinical assistant professor in the Colorado School of Public Health Department of Environmental & Occupational Health, used the Colorado Central Cancer Registry to compare children diagnosed with acute lymphocytic leukemia (ALL), a type of blood cancer, to children diagnosed with other types of cancer.

"What we found in that study was that children with ALL were four times more likely to be living in the highest density of oil and gas areas than children diagnosed with another kind of cancer," McKenzie says.

The striking findings of the pilot study led McKenzie to apply to the ACS for funding to do a larger population-based case–control study. McKenzie's funding for the four-year grant will begin on July 1.

Mapping a potential link between acute lymphocytic leukemia and oil and gas production

McKenzie chose to focus on leukemia because of its relation to the chemical benzene. Benzene is a colorless, flammable liquid and a natural part of crude oil and gasoline, so it is emitted at varying levels from oil and gas sites. It is also a known carcinogen, most closely associated with acute myeloid leukemia (AML), which occurs primarily in adults.

Unlike AML, McKenzie says not a lot is known about the environmental causes of ALL, the most common type of childhood leukemia. "Benzene hasn't necessarily been implicated in ALL, but it hasn't been ruled out, either," she says. This study will explore whether there is a potential link between the two.

The new study will draw its control group from the Colorado birth registry and its case group from the Colorado Central Cancer Registry. The control group will exclude children who have been diagnosed with any type of cancer other than ALL. As with the pilot study, McKenzie hopes to determine whether children living in close proximity to oil and gas sites — and therefore closer to areas where benzene is being emitted — are more likely than other children to develop ALL.

“The reason we chose children is because the lag time between exposure and cancer occurrence (the latency period), is much shorter in children than in adults,” McKenzie explains. The primary age range for the study is children ages two to nine years old, although McKenzie is also planning an exploratory aim to look at infants ages zero to one year.

The new study will have several advantages over the pilot study. In addition to drawing its control group from the birth registry, it will also take into account not just a child’s proximity to an oil and gas site, but also the intensity of activity at those sites.

“Different things are happening on oil and gas well sites at different times,” McKenzie says. “Some of them are under production, some of them are what we call shut in, meaning they’re not producing anything, and others are being actively drilled.” All of these can affect the levels of benzene emissions.

The new study also gives the researchers additional data reference points for each child. For all children, their date of birth and their address at birth will come from the birth registry. For the case group (children with ALL), their age of diagnosis and address at diagnosis will come from the cancer registry. And for the control group, the researchers will use a search engine to find each child’s address (based on the mother’s information) and age at the time their match case was diagnosed with ALL.

“This is important when we’re thinking about environmental exposures, because there is that lag between an exposure to something in the environment and the expression of cancer,” McKenzie says.

The second aim of the study is to explore another potential reason for the apparent increase in childhood ALL diagnoses near oil and gas sites: a social and epidemiological phenomenon called population mixing.

“When you have a large influx of a population, like when there’s a large boom of oil and gas development, that may introduce novel pathogens that could cause some sort of abnormal immune response, particularly in children with a more naïve immune system,” McKenzie explains.

Understanding risks and advancing research techniques

McKenzie says that this research is especially important in areas like Colorado where there is extensive oil and gas production. Colorado was among the top-five crude oil-producing states in the nation in 2020, according to the U.S. Energy Information Administration.

“It benefits us to understand what these risks might be, because that helps us decide what we can do to mitigate some of those risks,” she says.

Because of this, in addition to the expected academic manuscripts and peer-reviewed publications, McKenzie expects that an additional outcome of this research may be presentations of her team’s findings to interested community members and policymakers.

She also hopes the project will help herself and future researchers improve on the way they estimate environmental exposures in retrospective studies.

“For a retrospective study, you can’t go back and make measurements on people,” she says. “And a lot of information on air pollution just isn’t available — it’s not collected — so, you have to start thinking about different ways to understand what’s going on.”

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