

## INCREASED RISK OF CHILDHOOD LEUKEMIA IN COMMUNITIES IMPACTED BY HYDRAULIC FRACTURING IN THE MARCELLUS SHALE

Stephanie Moller Hikel, *Epidemiology International, USA*

Katherine Moon, *Epidemiology International, USA*

April Zambelli-Weiner, *Epidemiology International, USA*

**Background and Aims:** Hydraulic fracturing (HF) is a process by which water, chemical additives, and proppants are injected into geologic formations to facilitate oil and natural gas production from unconventional reservoirs such as shales and coalbeds. The US EPA recently issued a draft plan to examine the potential impacts of HF on drinking water resources, which includes the identification of areas with a high density of existing wells, evidence of impaired water quality, and human populations located in proximity to contaminated water. While the chemical composition of fracturing fluid is proprietary, and is currently unknown to the scientific community, typical fracturing solutions contain known leukemogens such as benzene. Our aim was to perform an exploratory analysis of potential health impacts in areas affected by HF, with a particular focus on risk of childhood leukemia.

**Methods:** We performed a standardized incidence ratio (SIR) analysis examining the incidence of childhood leukemia in four Pennsylvania counties overlying the Marcellus Shale and meeting the EPA criteria for HF-impacted areas. Expected rates were calculated based on age- and sex-adjusted data from the Surveillance, Epidemiology, and End Results (SEER) Program.

**Results:** From 1998-2007, a total of 40 leukemia cases were diagnosed in children aged 19 years or younger, which was more than four times higher than expected compared to national rates (SIR=4.08, 95% CI: 2.91-5.55). Individual county SIRs ranged from 2.64-4.91, with all CIs exclusive of 1.0. Subtype analyses revealed the majority of leukemias to be of lymphocytic origin.

**Conclusions:** Our analysis demonstrates highly increased risks of childhood leukemia in counties with a high density of HF wells and evidence of water contamination due to HF. These data suggest that EPA's recent concerns regarding HF are well-founded, and that children may be particularly susceptible to the adverse effects of HF on water quality.