

**EHP's Comments on the "Association Between Unconventional Natural Gas Development in the Marcellus Shale and Asthma Exacerbations"**

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In the recently published article "Association Between Unconventional Natural Gas Development in the Marcellus Shale and Asthma Exacerbations" (Rasmussen et al 2016), the authors concluded that there was an association between residential proximity to unconventional natural gas development (UNGD) and asthma attacks in individuals previously diagnosed with asthma.

Asthma is a chronic lung disease characterized by episodic acute worsening of symptoms referred to as exacerbations, or "attacks". Common symptoms of asthma include shortness of breath, cough, chest tightness and wheezing. Factors which may precipitate an asthma exacerbation include air pollution and stress, among others. Asthma exacerbations often require urgent treatment which, depending on the severity of the event, may occur with prescribing of an additional medication, treatment in an emergency department, or hospitalization. Based on these levels of treatment, the authors refer to these as mild, moderate, and severe exacerbations respectively.

In order to determine if there is a relationship between UNGD activities and asthma exacerbations, the authors studied data derived from the electronic health records of patients of the Geisinger Clinic, which provides primary care services to over 400,000 individuals in Pennsylvania. Studying the period from 2005 until 2012, they first identified a population of over 35,000 patients who had been diagnosed with asthma. Within the group of patients with asthma, they then identified those patients who had been treated for exacerbations of their asthma during each year of the study period (the cases). They compared the cases to patients within the asthma group who had not been treated for exacerbations during that year (the controls). For each treatment date for mild, moderate, or severe asthma exacerbations, the authors estimated UNGD activity on the prior day to each of four phases of well activity: pad preparation, drilling, hydraulic fracturing and production for the cases. For the assigned controls, the authors randomly selected a date of contact (eg. encounter, order, test) during the year for which the individual was serving as a control and estimated the exposure on the day prior to that contact date. When comparing the cases to the controls, they found that on the day prior to their treatment, the cases were more likely to have had greater exposure to each of the four phases of well development than the controls had experienced on the day prior to their selected contact date.

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Although other studies have raised concern regarding the association of proximity to UNGD activities and self-reported respiratory symptoms (Bamberger & Oswald, 2012) (Ferrar, et al., 2013) (Steinzor, Subra, & Sumi, 2013) (Rabinowitz, et al., 2015), this is the first study to explore the link between individual exposure to UNGD activity and *diagnosed* asthma exacerbations.

While acknowledging that their observed association of UNGD activities with asthma exacerbations is not proof of causation, the authors also indicate that an effect is biologically plausible given that both the air quality decrements and psychosocial stress associated with UNGD activities are risk factors for asthma exacerbations. Within their analysis, they also eliminated other possible explanations for the association, further strengthening their conclusions.

According to the Centers for Disease Control and Prevention (CDC), over 25 million individuals in the US are affected by asthma, representing a “significant health and economic burden to patients, their families, and society”. Any exposure which increases the severity of asthma symptoms increases this burden. As the study’s authors note “the possibility that UNGD may increase risk for asthma exacerbations requires public health attention.”

In addition to the significant public health problem that asthma exacerbations represent, there are a number of other recognized health effects of air pollution and stress that have yet to be systematically researched in the context of UNGD activity. With regards to air pollution, UNGD activity generates air emissions of carbon monoxide, nitrogen oxides, particulate matter, sulfur oxides, volatile organic compounds (including benzene), formaldehyde and methane (PADEP), contributing to the degradation of local and regional air quality. (McKenzie, Witter, Newman, & Adgate, 2012) (Litovitz, Curtwright, Abramzon, Burger, & Samaras, 2013) Recognized health effects associated with acute exposures to air pollution include not only exacerbations of asthma, but also exacerbations of COPD and cardiac failure, increased rates of myocardial infarctions and ischemia in susceptible individuals, and arrhythmias. Long term exposures to air pollution are associated with new onset asthma, increased myocardial infarctions, lung cancer, overall increased mortality and adverse birth outcomes (Abelsohn & Stieb, 2011). Individual components of air emissions may have other health impacts. Benzene exposure, for example, increases the risk for leukemia. The authors conclude “As ours is the first study to our knowledge of UNGD and objective respiratory outcomes, and several other health outcomes have not been investigated to date, there is an urgent need for more health studies.”

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