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Place-based perceptions of the impacts of fracking along the Marcellus Shale

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ABSTRACT

We examined community perspectives and experiences with fracking in Doddridge County, West Virginia, USA as part of a larger assessment to investigate the potential health impacts associated with fracking in neighboring Maryland, USA. In November 2013, we held two focus groups with community residents who had been impacted by fracking operations and conducted field observations in the impacted areas. Employing grounded theory, we conducted qualitative analysis to explore emergent themes related to direct and indirect health impacts of fracking. Three components of experience were identified, including (a) meanings of place and identity, (b) transforming relationships, and (c) perceptions of environmental and health impacts. Our findings indicate that fracking contributes to a disruption in residents' sense of place and social identity, generating widespread social stress. Although community residents acknowledged the potential for economic growth brought about by fracking, rapid transformations in meanings of place and social identity influenced residents' perceptions of environmental and health impacts. Our findings suggest that in order to have a more complete understanding of the health impacts of fracking, future work must consider the complex linkages between social disruption, environmental impacts, and health outcomes through critical engagements with communities undergoing energy development.

1. Introduction

Discovering new sources of energy along with independence from foreign oil has become increasingly important as the demand for fossil fuels continues to rapidly increase. Recent innovations in extractive technologies have made it possible to develop previously inaccessible natural gas and oil reserves. Unconventional natural gas development and production, or fracking, the horizontal drilling of a rock layer and the injection of a pressurized mixture of water, sand, and other chemicals to release gas and oil, is one such new technique employed to extract natural gas or oil reserves dispersed within shale formations. These methods have allowed for the rapid expansion of oil and natural gas development throughout the United States, Europe, Asia, and Australia, and are predicted to make the United States a key exporter of natural gas in the near future (Boersma et al., 2015).

One of the largest shale formations in the United States, Marcellus Shale, is abundant in gas resources and is found deep beneath the surface of the Northern Appalachian regions of Pennsylvania, Ohio, West Virginia, New York, and Western Maryland (Fig. 1). Although fracking has been established in the Western United States, in states like Colorado and Texas, it has only recently been implemented in states like West Virginia and Pennsylvania. However, despite shale production beginning in 2005, Marcellus Shale is currently the largest producing shale gas basin in the United States, accounting for almost 40% of US shale gas production. Production in the Marcellus Shale has increased dramatically, from 2 billion cubic feet per day in 2010 to its current level of 16.5 billion cubic feet per day (U.S. Energy Information Administration, 2015).

The process of extracting gas from shale formations is complex and involves several phases. Negotiating mineral rights with landowners, clearing land for well pads, construction of road and infrastructure including pipelines and compressor stations,

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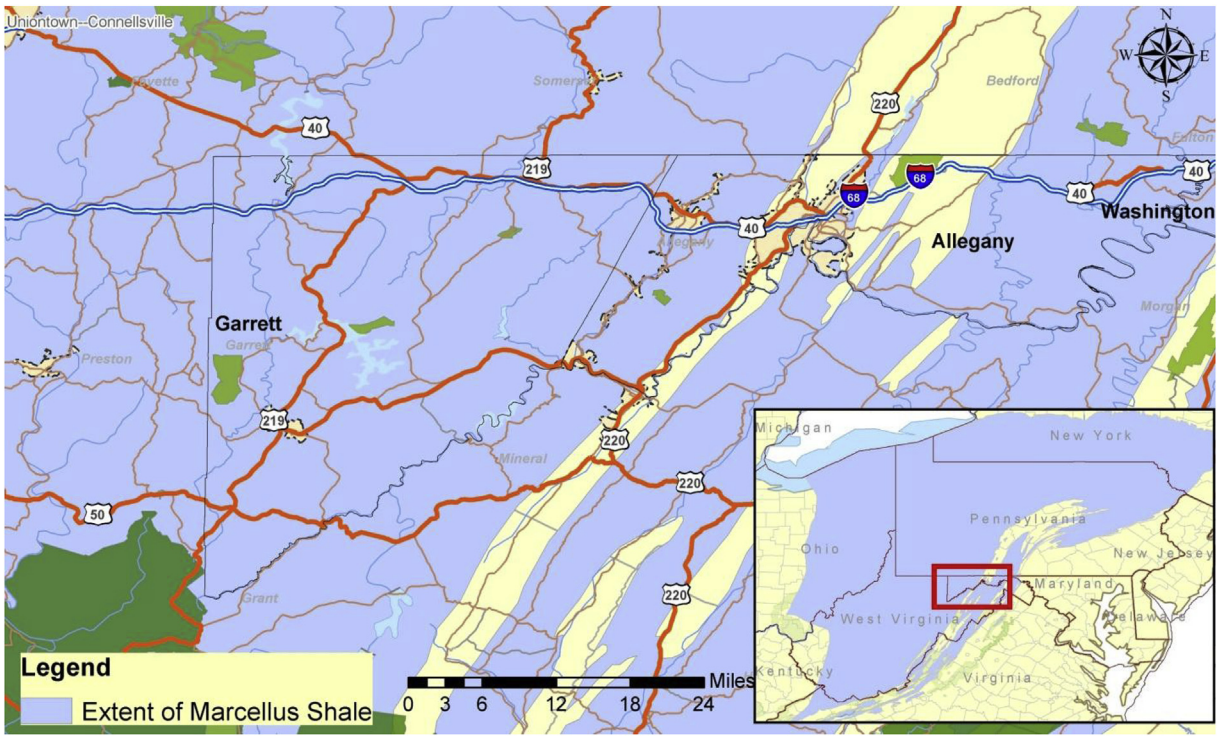

Fig. 1. Extent of the Marcellus shale in Western Maryland.

transporting and processing extracted gas as well as water and wastewater, and the influx of transient workers and populations into established communities are also important aspects of fracking. These stages of development may have significant environmental, health, and social effects for communities undergoing fracking (Ferrar et al., 2013; Jacquet, 2014).

Because fracking is relatively new and has expanded rapidly, there is a lack of substantive population-based studies of the public health effects of fracking operations. However, current research indicates that there is significant potential for adverse direct and indirect health outcomes as a result of fracking. A growing body of work has identified several key environmental, physical, and social stressors associated with fracking as well as the exposure pathways by which the health of communities may be impacted (Adgate et al., 2014; Shonkoff et al., 2014; Ziemkiewicz et al., 2014). Air pollutants, reported in various phases of fracking, have been a cause of concern since they are known respiratory, skin, and neurological toxicants; can cause drowsiness and headaches; and can lead to blood disorders, reproductive and fetal conditions, and cancer (McKenzie et al., 2012). Contamination of surface and groundwater has also been noted as a serious concern because of the large amounts of water used and generated through the fracking process (Environmental Protection Agency, 2015; Rahm and Riha, 2014). Although few studies have attempted to link chemicals used in fracking to direct health effects, these fluids are known to cause cancer and other mutations, disrupt endocrine functioning and normal immune responses, and damage neurological, cardiovascular, and kidney functioning (Colborn et al., 2011). Stressors emanating from the physical environment as a result of the fracking process such as noise and light pollution and accidents and injuries also have raised alarm among communities and researchers (Ferrar et al., 2013). Noise and light pollution can increase stress among residents living near fracking sites and may have serious impacts on workers; occupational hazards and traffic and industrial accidents can increase mortality related to fracking operations (Boudet et al., 2014).

Finally, social stressors related to rapid community change as a result of fracking—industrialization, uneven economic benefits, diminishing social cohesion, and increases in crime and substance abuse—have been noted as potentially contributing to health effects attributable to psychosocial stress (Brasier et al., 2011; Shandro et al., 2011; Stedman et al., 2012). Some of this literature has examined nonspecific health symptoms reported by residents living near fracking sites including upper respiratory tract issues, nosebleeds, eye irritation, headaches, vomiting, diarrhea, and skin rashes (Saberi et al., 2014; Werner et al., 2015). Others have focused on residential risk perceptions where fear of uncertainty around fracking and lack of trust surrounding government and industry regulations has led to increased levels of stress and anxiety (Willow, 2014). This scholarship indicates that fracking represents a significant dilemma for communities, who often welcome the potential economic growth but are also concerned about socio-environmental risks (Ladd, 2014).

In 2011, former Maryland governor Martin O'Malley issued an executive order establishing the Marcellus Shale Safe Drilling Initiative, the purpose of which was to assist state policymakers and regulators in determining whether and how gas production from the Marcellus Shale formations in Maryland can be accomplished without unacceptable risks to public health, safety, the environment, and natural resources (O'Malley and McDonough, 2011). As part of this initiative, the State of Maryland contracted us to conduct an assessment of the potential public health impacts associated with drilling in the Marcellus Shale in Western Maryland, especially those that would be concentrated in and unique to communities living and working near fracking sites. We employed a health impact assessment (HIA) methodology to conduct a study of potential public health impacts of fracking. A HIA is a process that utilizes a variety of data and analytic methods to determine a broad range of potential health impacts, including those that may result from social, economic, and environmental changes, of a proposed