



# How do landowners learn about high-volume hydraulic fracturing? A survey of Eastern Ohio landowners in active or proposed drilling units



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## ABSTRACT

We examine how different sources and types of information affect the knowledge of landowners confronting a controversial emergent technology, high-volume hydraulic fracturing (HVHF). HVHF may substantially affect the environmental, health, and economic and social realities faced by communities where drilling occurs. Yet how landowners in these areas learn about HVHF is largely unknown. Understanding landowner knowledge is important because HVHF development depends on voluntary choices of landowners, less knowledgeable landowners may be vulnerable to industry malfeasance, and support for HVHF is linked to familiarity with the industry. Using an original survey of Eastern Ohio landowners affected by HVHF, we find that they most frequently get information about HVHF from the news, oil/gas companies, social connections, and the internet. Information sourcing varies with demographics, socioeconomic, and political partisanship. Although landowners are exposed to many sources of information, most do not help them feel more informed about HVHF. Self-perceived familiarity with HVHF varies positively with the number of sources consulted, internet research, and receipt of information from the oil/gas industry and industry advocacy groups. Landowners often receive unsolicited information about HVHF, but this information rarely helps them feel more informed.

## 1. Introduction

We examine how different sources and types of information affect the knowledge of individuals confronting a controversial emergent technology, high-volume hydraulic fracturing (HVHF). HVHF is a technology that extracts oil and gas from previously inaccessible underground shales. HVHF's rapid spread has raised questions about landowners' familiarity with the technology and its impacts, particularly since HVHF varies in key ways from traditional oil and gas production (Holahan and Arnold, 2013). Research has examined HVHF's significant consequences for economies (Kinnaman, 2011; Kelsey et al., 2011), the environment (Clarke et al., 2012; Howarth et al., 2011; Osborn et al., 2011; Rahm, 2011; Warner et al., 2012), and public policy (Farrer et al., 2017; Holahan and Arnold, 2013; Warner and Shapiro, 2013). How landowners learn about these impacts is largely unknown. Yet this issue is critical given that the U.S. HVHF industry strongly depends on the voluntary choices of landowners to lease their land for production (Bugden et al., 2016). How do landowners faced with a leasing decision learn about HVHF, and what factors affect their familiarity with the industry?

A few scholars have investigated the latter question, focusing on how citizen attributes (e.g., gender) and contextual variables (e.g., proximity to drilling) affect familiarity (Stedman et al., 2016; Willits et al., 2016). Another handful of studies investigate sources of information about HVHF and public perceptions of these sources (e.g., Brown et al., 2013; Rabe and Borick, 2011; Theodori et al., 2014; Theodori and Ellis, 2017). However, little research explores factors affecting choices about HVHF information sources, and the potential relationship between level of familiarity with HVHF and types of sources consulted. These issues are important for at least three reasons.

First, HVHF is poorly understood, even where the industry is highly active (e.g., Borick and Clarke, 2016; Whitworth et al., 2017). Since good governance relies on an informed citizenry, it is worth exploring why HVHF is characterized by so much confusion and uncertainty. HVHF's newness and complexity may be part of the puzzle, but it is likely that the information environment itself—encompassing information sources, characteristics of information receivers, attributes of information, and contextual factors (see Whitmarsh et al. (2016))—also is important. By analyzing the information environment, we can identify ways of encouraging greater understanding of HVHF. We can also

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contribute to more general theories about how to measure and understand policy knowledge regarding emergent, controversial technologies.

Second, while familiarity with HVHF and support for it appear linked, the nature of this relationship is contested. Some scholars find that greater knowledge about HVHF leads to greater industry support (Alcorn et al., 2017; Stedman et al., 2016, focusing on the UK; Theodori et al., 2014; Whitmarsh et al., 2016), others find no relationship (Stedman et al., 2016, focusing on the United States; Willits et al., 2016), and still others find that more information about HVHF is associated with less support (Boudet et al., 2016; Choma et al., 2016). Level of public support for HVHF has important policy implications, helping explain why some jurisdictions adopt bans and moratoriums (e.g., Massachusetts, Germany) and others embrace the industry (e.g., Texas, Poland). To understand these phenomena, it is important to understand drivers of public support for HVHF, such as familiarity.

Finally, understanding the knowledge landowners have about HVHF, and how they form this knowledge, may be important for helping ensure that landowners are treated fairly by the industry. Stories abound of HVHF operators and landmen downplaying HVHF's risks and hyping its benefits (Simonelli, 2014), convincing landowners to sign leases with unfavorable terms they poorly understand (Cusick, 2013), and pressuring landowners by making deceptive claims about neighbors' or peers' leasing decisions and the HVHF process (Malin and DeMaster, 2015; Willow and Wylie, 2014). Some landowners may be more vulnerable to these dynamics than others due to limited information or heavy reliance on particular information sources. Our study moves toward understanding this potential vulnerability.

We explore how variation in the source and "wantedness" of HVHF information, as well as a range of landowner attributes and contextual factors, affect landowners' knowledge about and familiarity with HVHF. By surveying Eastern Ohio landowners whose land is or is likely to be used for HVHF, we explore the information environment of an important population. We find that these landowners most commonly get information about HVHF from news media, oil/gas companies, social connections, and the internet. Landowner information sourcing varies with demographics, socioeconomic, and political partisanship. Although landowners are exposed to many sources of information about HVHF, most do not help landowners feel more informed. Self-perceived familiarity with HVHF varies positively with the number of sources consulted, internet research, and receipt of information from the oil/gas industry and industry advocacy groups. Landowners often receive unsolicited information about HVHF, but this information generally does not help them feel more informed. This result suggests that an individual's degree of agency may mediate the effects of information.

## 2. Literature

HVHF remains poorly understood in the United States. Consider a series of recent surveys, each of which used a nationally-representative sample: In 2012, 51% of respondents said that they did not know whether they supported HVHF, and respondents' mean self-reported familiarity was 2.1 on a 1–4 scale where 2 is "a little" (Boudet et al., 2014). When asked about coverage of HVHF, fifty-five percent reported hearing nothing at all or only "a little" about HVHF (Boudet et al., 2014). In 2013, 49% of respondents could not identify, or identified incorrectly, the resource extracted by HVHF (Pew Research Center, 2013). In another 2013 survey, the mean level of HVHF familiarity was 1.44 on a 0–3 scale (Clarke et al., 2015). In 2014, a survey asked respondents three true/false factual questions about HVHF; the average number of correct responses was 1.06 (Howell et al., 2017). Forty percent of respondents to another survey did not know the resource extracted by HVHF, and 27% identified the resource incorrectly (Stedman et al., 2016). In 2015, 54% of U.S. respondents reported knowing little or nothing about HVHF (Borick and Clarke, 2016).

Although more people are familiar with HVHF in areas where the

industry is active, knowledge is not pervasive there either. In a 2011 survey of Pennsylvania residents, 51% reported following debate over HVHF "not too closely" or "not at all" (Rabe and Borick, 2012). In a 2012 survey in 21 Pennsylvania counties above the Marcellus Shale, 43% of respondents reported unfamiliarity with HVHF. Put differently, on a 1–7 single-item familiarity scale, where scores of 5 and above suggest any familiarity, the mean score was 3.73 (Theodori et al., 2014). Willits et al. (2016) use the same 21-county Pennsylvania sample and scaling but construct a familiarity measure using three HVHF knowledge questions; that mean familiarity score is 3.2. Another 2012 survey found that 52% of Michigan residents followed debate around HVHF "not too closely" or "not at all," while the comparable figure in Pennsylvania was 42% (Brown et al., 2013). In 2015, a survey of residents in two counties over Texas's Eagle Ford Shale found that 39% of respondents had limited HVHF familiarity (scoring between 1 and 4 on the 1–7 familiarity scale); the mean familiarity score was 4.65 (Theodori and Ellis, 2017). Another Eagle Ford Shale survey, conducted between 2013 and 2015, found that 46% of respondents did not understand the HVHF process and 40% were not aware of HVHF's potential environmental effects (Whitworth et al., 2017).

There are many potential reasons why unfamiliarity with HVHF is pervasive. Information about HVHF's environmental and health consequences are still emerging and frequently contested (Sovacool, 2014). The narratives about HVHF deployed by oil and gas companies, pro- and anti-HVHF advocates, government officials, and stakeholders are diverse, casting HVHF as an economic development opportunity, environmental disaster, threat to public health, lifeline for struggling rural communities, bridge to clean energy, myopic investment in fossil fuels, risky endeavor, and safe endeavor (see Bomberg (2017), Dodge and Lee (2015), Hudgins and Poole (2014), Williams et al. (2017)). Different terms are regularly used to describe HVHF, including "fracking," "hydraulic fracturing," "hydrofracturing," and "shale oil/gas development," potentially adding to confusion (Clark et al., 2015; Evensen et al., 2014).

Just as practitioners use many different terms and frames when discussing HVHF, academics use many different variables to measure the impact of those discussions. Most scholars use self-reported measures of HVHF knowledge and factual questions when assessing whether an individual has learned from this public discourse (Brown et al., 2013; Rabe and Borick, 2012; Theodori et al., 2014; Willits et al., 2016). But being able to answer questions about the technical process of HVHF does not necessarily imply that a person is well-informed about all parts of the process, or even the parts most relevant for them. Conversely, self-reports of knowledge not reliant on technical questions may suffer from social desirability bias. Although progress has been made in refining measures of HVHF knowledge, there is room for improvement (Willits et al., 2016). We contribute to that effort. Although we use self-reports, we go beyond prior literature by measuring how the effect of information changes depending on its status as solicited or unsolicited.

Studies of HVHF information sourcing have asked respondents about as many as 20 different sources (Brown et al., 2013; Rabe and Borick, 2011; Theodori et al., 2014; Theodori and Ellis, 2017),<sup>1</sup> and have found that trust plays an important role in how people learn from different sources. Theodori et al. (2014) asked Pennsylvania residents overtop the Marcellus Shale to rate their trust in eight HVHF information sources. On a 0–3 scale, the highest-ranked source, professors, scored only a 1.57, between "very little" and "some" trust. The lowest-ranked source, the film *Gasland*, averaged 0.80. Rabe and Borick (2011) asked Pennsylvania residents whether various HVHF information sources overstated the industry's environmental impacts, potentially indicating mistrust. Forty-eight percent reported that

<sup>1</sup> This is a range because language differences across surveys create ambiguity about whether some categories can be combined.

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