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### SLIDES: Public Health Research on Near O&G Development: Challenges and Needs

John L. Adgate

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# Public Health Research on Near O&G Development: Challenges and Needs

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June 6, 2014

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# Questions

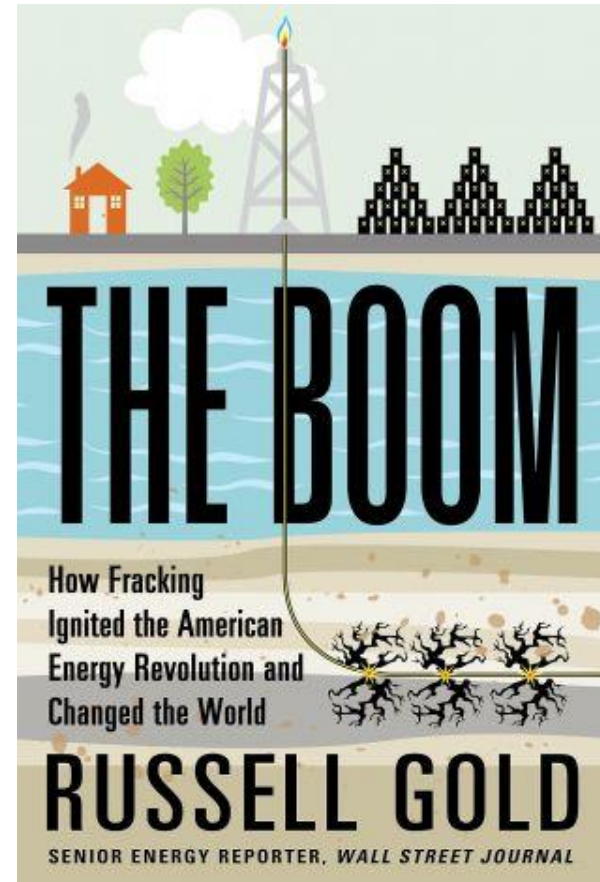
- What is Public Health?
- What Research is Needed to Advance Public Health Around O&G Development Sites?
- What Challenges and Needs Exist for Research Design & Implementation?

# What is Public Health? (in this context)

- Seeks to “**Optimize the health of populations over time**”
  - Workers and Communities
  - Highly dependent on activities, hazards and exposure mitigations, spatial and temporal scale
  - Tracking Health Effects and Exposures as well as ancillary studies (toxicology, modeling, others)
- **Not just about standards for what is “safe”**
  - Both **Technology-based standards AND**
  - **Health-based standards** are context dependent

# The Unconventional O&G Boom in the US

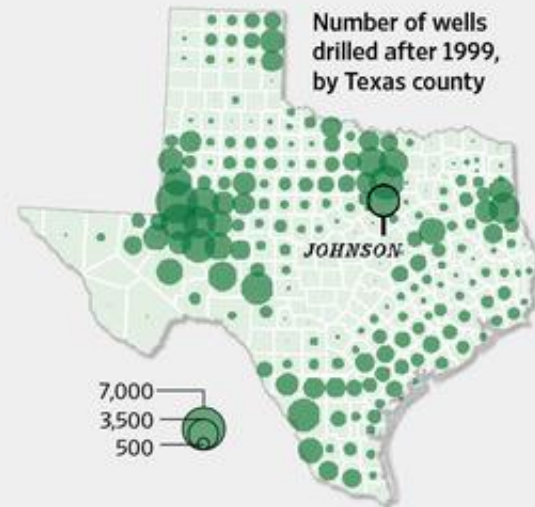
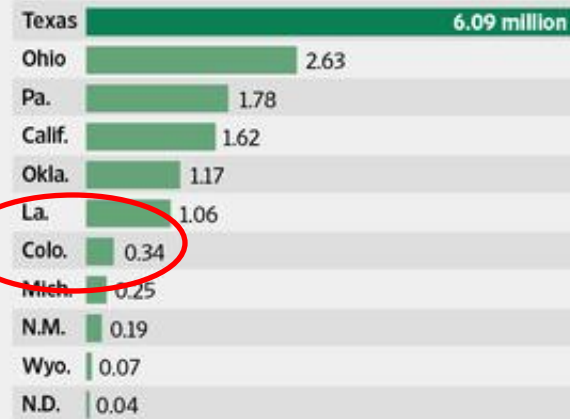
- Wall Street Journal, October 25, 2013
  - “More than 15 million Americans live within a mile of a well that has been drilled and fracked since 2000.”



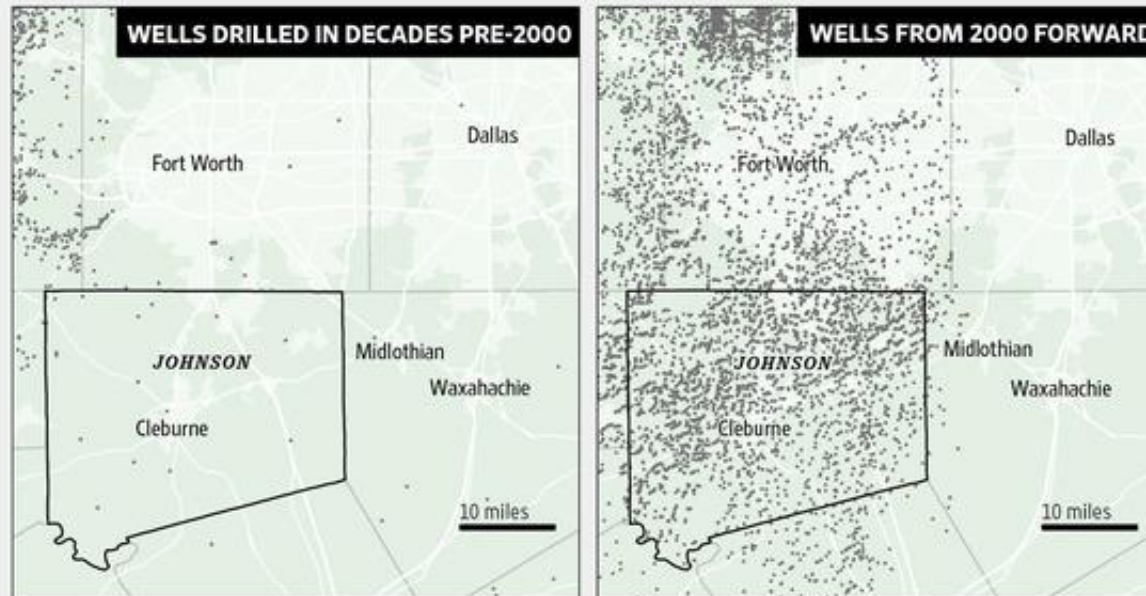
# Neighborhood Wells

A Wall Street Journal analysis looked at oil- and gas-well locations and population data in 11 major energy-producing states. Some of the findings:

Population in census blocks within one mile of a well drilled after 1999



Johnson County, Texas, near Fort Worth, saw one of the largest drilling booms in the nation. Prior to 2000, there were only a handful of wells in the county. Now there are more than 3,900.

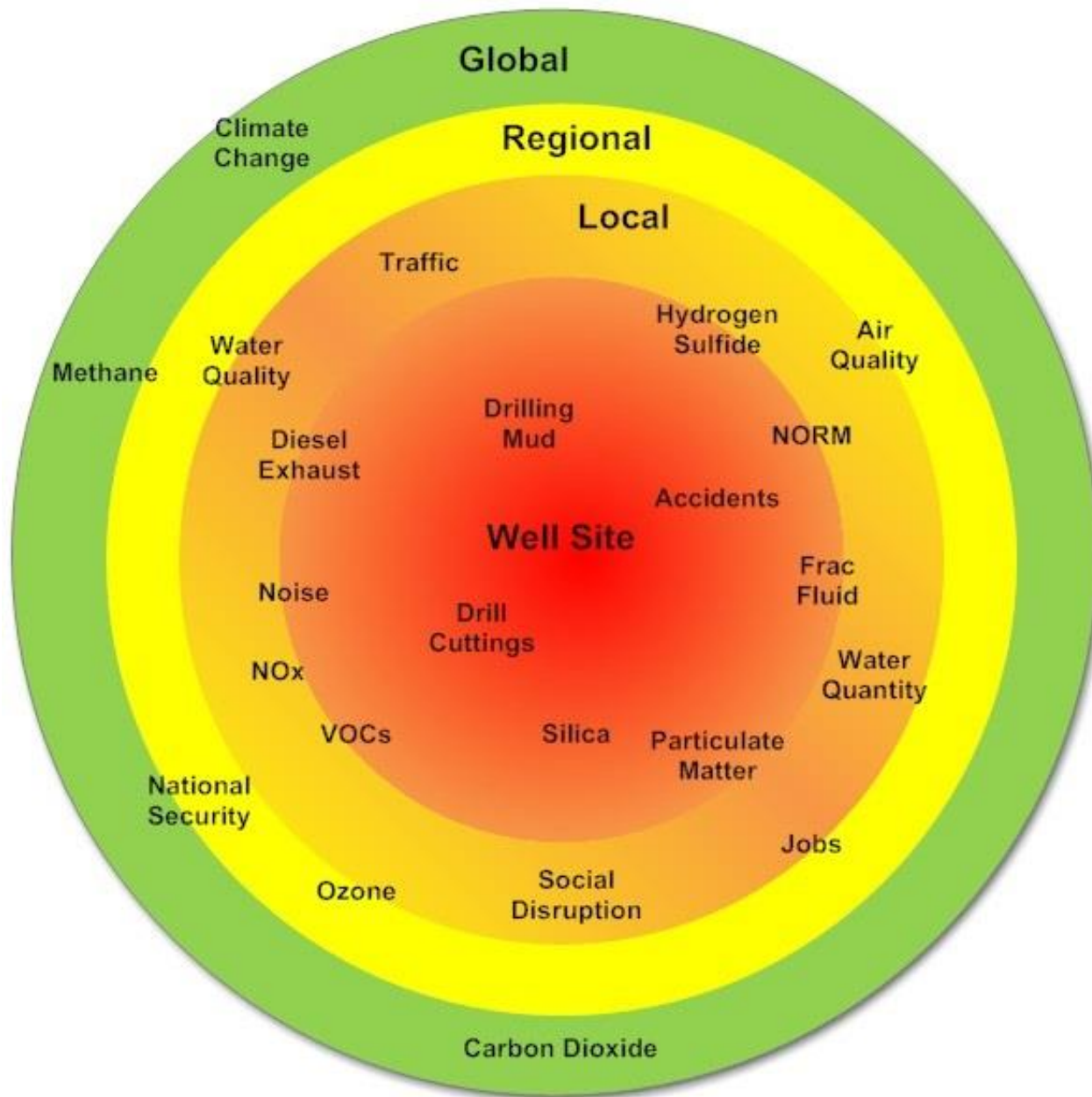


# Public Health and Study Design Questions

- Populations:
  - Who's exposed and are they vulnerable?
- Health Effects:
  - What health effects/concerns are potentially associated with extraction?
- Exposures:
  - What stressors can be measured, and over what temporal and spatial scale?
- Approaches:
  - What study designs can be used to look at links between exposures and health?
  - What interventions can be used to minimize population health impacts?
- Limitations:
  - What are the key knowledge gaps?

# What Research is Needed to Advance Public Health Around O&G Development Sites?





# Potential Public Health Hazards, Exposures and Health Effects from Unconventional Natural Gas Development

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**ABSTRACT:** The rapid increase in unconventional natural gas (UNG) development in the United States during the past decade has brought wells and related infrastructure closer to population centers. This review evaluates risks to public health from chemical and nonchemical stressors associated with UNG, describes likely exposure pathways and potential health effects, and identifies major uncertainties to address with future research. The most important occupational stressors include mortality, exposure to hazardous materials and increased risk of industrial accidents. For communities near development and production sites the major stressors are air pollutants, ground and surface water contamination, truck traffic and noise pollution, accidents and malfunctions, and psychosocial stress associated with community change. Despite broad public concern, no comprehensive population-based studies of the public health effects of UNG operations exist. Major uncertainties are the unknown frequency and duration of human exposure, future extent of development, potential emission control and mitigation strategies, and a paucity of baseline data to enable substantive before and after comparisons for affected populations and environmental media. Overall, the current literature suggests that research needs to address these uncertainties before we can reasonably quantify the likelihood of occurrence or magnitude of adverse health effects associated with UNG production in workers and communities.







# Measurements of methane emissions at natural gas production sites in the United States

David T. Allen<sup>a,1</sup>, Vincent M. Torres<sup>a</sup>, James Thomas<sup>a</sup>, David W. Sullivan<sup>a</sup>, Matthew Harrison<sup>b</sup>, Al Hendler<sup>b</sup>, Scott C. Herndon<sup>c</sup>, Charles E. Kolb<sup>c</sup>, Matthew P. Fraser<sup>d</sup>, A. Daniel Hill<sup>e</sup>, Brian K. Lamb<sup>f</sup>, Jennifer Miskimins<sup>g</sup>, Robert F. Sawyer<sup>h</sup>, and John H. Seinfeld<sup>i</sup>

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- Wide range of methane emissions across processes, companies
- Part of emerging consensus that methane emissions may be at the the lower end of the projected range
  - But a lot depends on how representative the results are for the industry as a whole
- Suggests a wide range of hazardous air pollution exposures exist, including localized hot spots

Stressors Volunteered by Subjects Who Believe Their Health has been Affected by Marcellus Shale Activities  
(n=33) (Ferrar et al 2013)

Top 6 Stressors	% of group
Denied or provided false information	79%
Corruption	61%
Concerns/complaints ignored	58%
Being taken advantage of	52%
Financial damages	45%
Noise pollution	45%

# What Do We Not Know?

- Frequency and duration of human exposure to a range of air pollutants
- The extent of future development
- Future emission controls/mitigations
- Baseline data on health outcomes:
  - Many are not tracked in useful ways
  - Some health effects have long latency, i.e., we won't know for sure for 20-30 years
- How to combine assessments of chemical and nonchemical hazards (i.e., psychosocial stress)

# What Challenges and Needs Exist for Research Design & Implementation?

# Research Needs

- Trust, Resources, and Access to a Population at Risk
  - “Large enough” for statistical power
- Public and/or private data on exposures and health effects and/or the ability to collect this data
- A plausible hypothesis worth testing, spatial and temporal specificity and time to observe a change, OR
- An intervention to test and evaluate



# Research Challenges

- Resources:
  - Infrastructure to conduct research and address Privacy and Human Subjects Issues
- Bias and Applicability
  - Humans: The Hawthorne Effect
  - Animals: Are results applicable to human exposures or health effects?
  - Existence of health-based standards or research to develop them
- Communication of Results

# Perception of Impacts in PA

(Source: Jacquet, 2014)

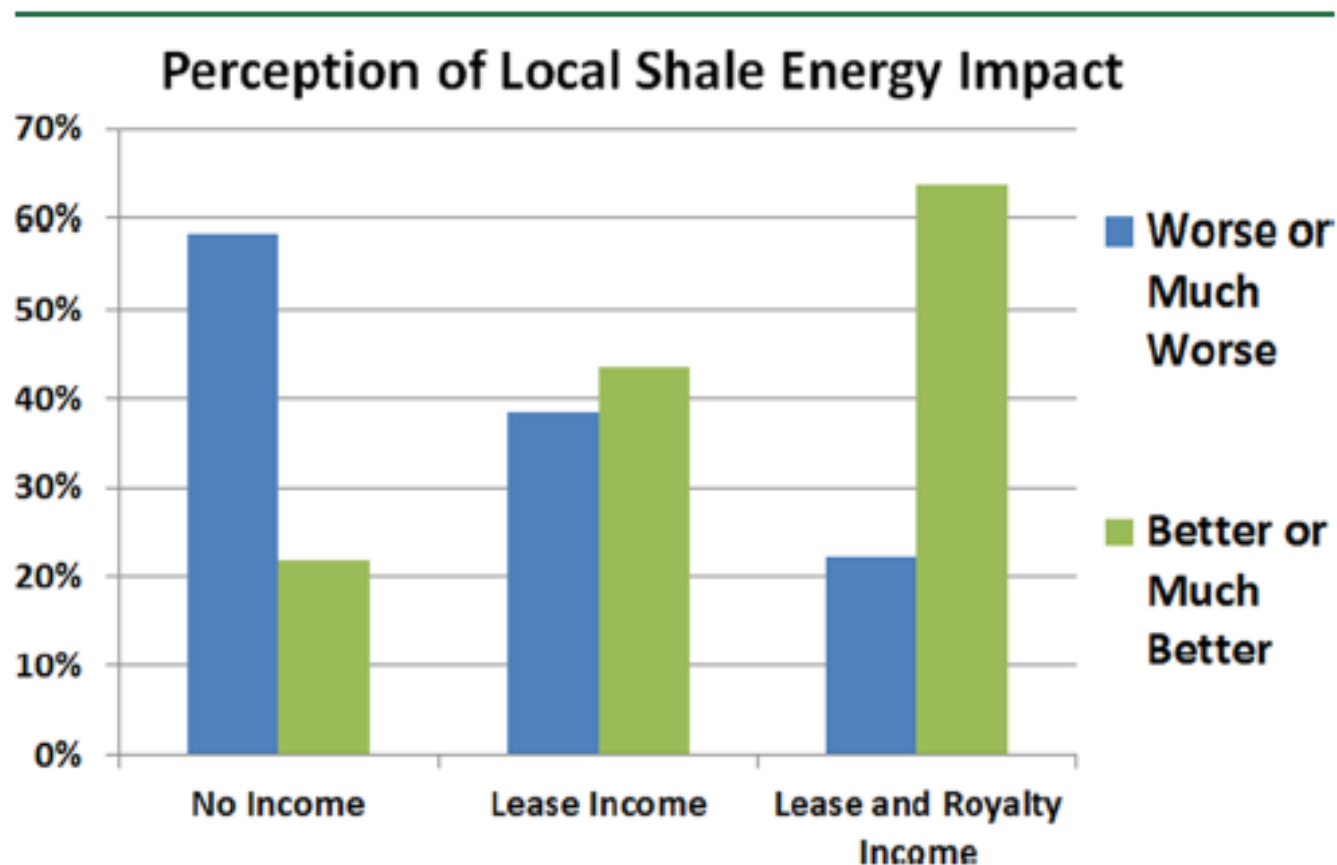
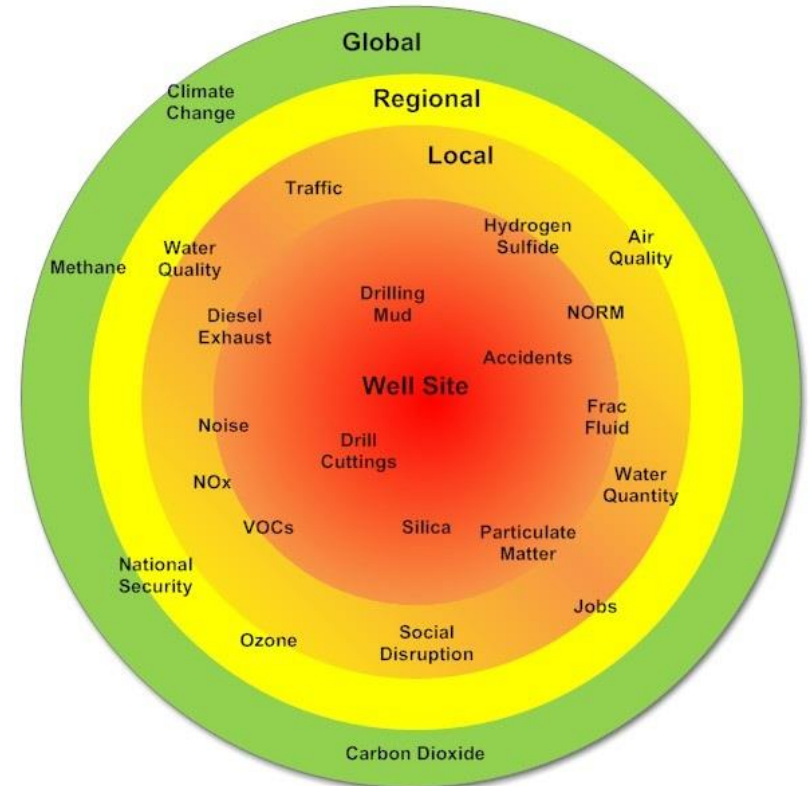


Figure 1. 2011 Survey ( $N = 1052$ ) of landowner's attitudes toward shale gas drilling in Northern Pennsylvania, based on the amount of development and associated income received.<sup>64,73</sup>

# In Closing

- While there is substantial public concern, it is likely many more people will live near gas and oil development sites in the future
- Research on control and mitigation strategies should focus on knowledge gaps and uncertainties



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