SOUTHWEST PENNSYLVANIA ENVIRONMENTAL HEALTH PROJECT

Mental Health and Unconventional Oil and Gas Development

A Review and Discussion of the Science

Health and Shale Gas Development: State of the Science
SWPA-EHP • June 10, 2016

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What are your goals for today?

- Review what we know
  - Published research from communities exposed to industrial accidents
  - Published research from communities exposed to UOGD
  - SWPA-EHP clinical data
  - SWPA-EHP research
    - Community study
    - Delphi study
- Share what we know
  - Experiences
  - Resources
  - Questions

Mental Health and Exposure to Industrial Accidents

- Releases of fossil fuel
  - In comparison studies of exposed and unexposed communities, multiple studies have demonstrated
  - anxiety[1,2,3,5,7,8,9]
  - depression[2,3,4,6,7,8]
  - post-traumatic stress disorder (PTSD)[1,2,3]
  - increased substance use[1]
  - increased violence[1]
  - insomnia[5]
  - somatic complaints[5]
  - Duration of symptoms ranges from immediate[1,4,6,9] to one year later[2,5,7,8] and up to six years later in subsets of one study[3]

Mental Health and Exposure to Unconventional Natural Gas Development

- Qualitative Studies
  - Effects similar to those seen in victims of bullying and other abuse[10]
  - Impact similar to communities that have experienced natural and human-caused disasters[10]
  - Sense of powerlessness over health of self and family[11]
- Community Studies
  - Psychological symptoms reported by 79% in one Pennsylvania study[12]
    - Stress the most frequently reported symptom

Mental Health and Exposure to Unconventional Oil & Gas Development

- Community Studies
  - In one Pennsylvania study more than 1/3 of participants reported mental health symptoms[13,14]
    - Symptoms included depression and severe anxiety
    - % reporting symptoms increased with proximity
  - More than ½ of participants in a community study in California reported mental health symptoms such as depression and anxiety.[15]

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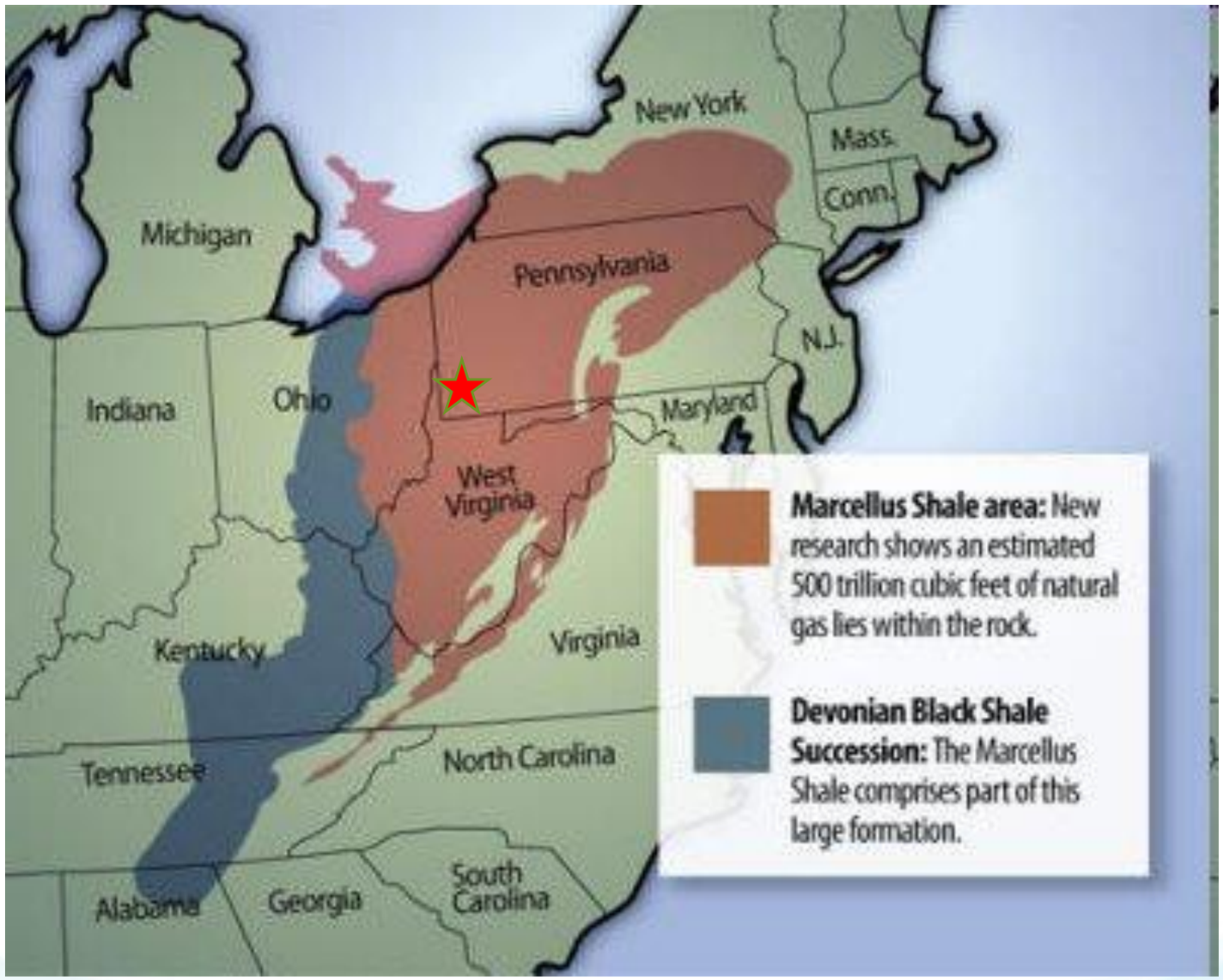
Background: The Marcellus Shale Region



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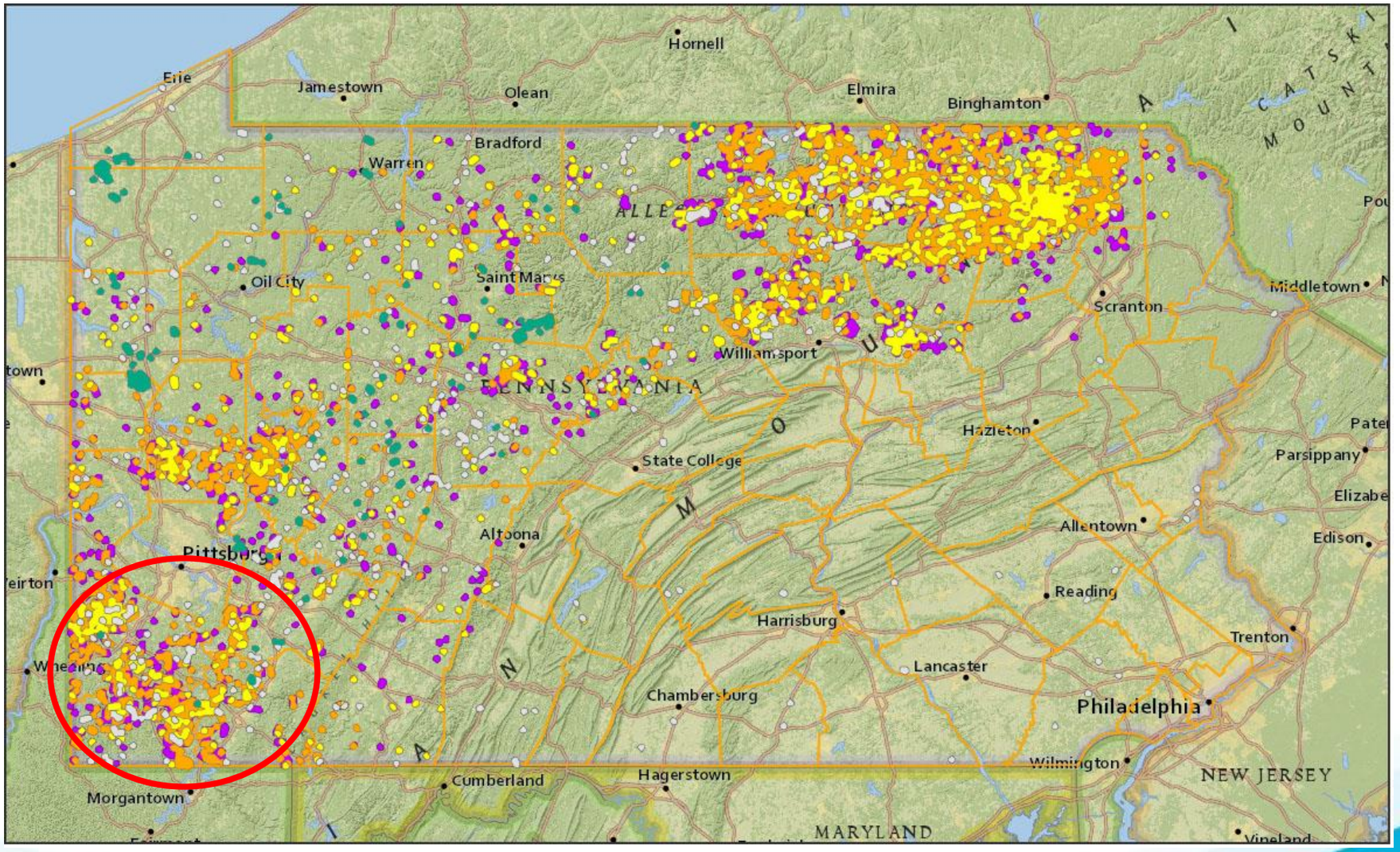
Background: Drilling Activity



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Background: A Changing Community

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Background: A Changing Community

Source: http://www.marcellus-shale.us/Chappel-Unit.htm

What We Learned from EHP Health Intakes

- EHP nurse practitioner provides comprehensive review of physical and mental health to residents who express concern about potential health impacts of exposure
- Preliminary analysis of data from health intakes demonstrates that community residents who live within 1 km. of a well or compressor station report mental health concerns in two domains:
  - Stress and worry 28/88 (35%)
  - Irritability and mood 16/88 (19%)

What We Learned from A Descriptive Study of Mental Health

- EHP conducted a pilot study to describe the mental health and function of residents living in one county with high levels of unconventional natural gas extraction
  - Convenience sample from clinic population
  - Cross sectional design
  - SF-36 measured 8 dimensions of health
  - Determined proximity to unconventional gas development

What We Learned from the Descriptive Study: The Sample

	n	%
Reason for Visit		
• **Dental Clinic**	43	18
• **Medical Clinic—Routine Visit**	56	23
• **Friend/Family of Client**	78	33
• **Medical Clinic—Sick Visit**	54	23
• **Unknown**	8	3
Self-Reported Health (n=237)		
• **Excellent/Very Good**	74	31
• **Good**	109	46
• **Fair/Poor**	54	23

What We Learned from the Descriptive Study: Mental Health

SF-36 SUBSCALES	Range	Mean (SD)	% Low Score
• Vitality	22.89-70.42	47.9 (10.7)	22
• Social Function	17.23-57.34	46.7 (11.4)	27
• Mental Health	16.86-63.95	47.2 (11.2)	24
• Role-Emotional	14.39-56.17	46.7 (11.9)	29
• MCS	10.84-69.13	47.4 (12.2)	27

What We Learned from the Descriptive Study: Sense of Control

	SF-36 MENTAL HEALTH SUBSCALES *				
Characteristics	**Vitality**	**Social Function**	**Mental Health**	**Role Emotional**	**MCS**
Age					
Gender					
Clinic Client					
Medical-Well					
Family/Friend					
Medical-Sick	-0.170	-0.180			
Unknown					
Employed		0.197		0.151	
Social Control	0.216	0.274	0.207	0.237	0.205

*Regression coefficients significance <0.05

What We Learned from the Descriptive Study: Proximity to UGD

SF-36 Subscales and Composite Scores

What We Learned from the Experts

- EHP used the Delphi Technique to elicit expert opinion about the health effects related to unconventional oil and gas development
- Results of the Delphi related to set-back distances has been described elsewhere and is currently undergoing peer review.
- Present today preliminary results related to health effects.

What is a Delphi?

- Method for reaching expert consensus on an issue when data are inconclusive
- Can be viewed as a series of rounds. In each round, panelists respond anonymously to a set of questions/statements and receive information about the responses of all other participants
- Panelists re-assess their own responses on subsequent rounds with a goal of reaching consensus.
- Consensus set at 70% for this study.

Who was on the panel?

- Selection criteria
  - Researchers whose work has been published in peer-reviewed journals and/or presented at national scientific meetings
  - Scientists employed in regulatory agencies
  - Leaders in public policy and environmental advocacy who have been published in the grey literature.
- 18 panelists with expertise in these areas:
  - Medicine/health care, air quality, water quality, toxicology, environmental science, environmental health, public health, epidemiology, social science, policy, and risk analysis

What were our questions?

- What health outcomes do you believe are attributable to hydraulic fracturing and related activities associated with natural gas production?
- What health outcomes do you believe are attributable to hydraulic fracturing and related activities associated with oil production?

Panelists' Responses: Round One

Health Effects Associated with Gas

128 unique statements

17 categories

Health Effects Associated with Oil

53 unique statements

10 categories

Stress: Examples of Statements

- “Psychological stress”
- “Increased stress”
- “Higher levels of stress in rural areas”
- “Stress-mediated problems”
- “Drilling activities and noise are known to cause stress”
- “…health outcomes related to stress are also occurring”

Psychological Wellbeing: Examples of Statements

- “Mental health”
- “Irritability…”
- “Anger”
- “Depression related to loss of trust and confidence in health”; “Depression”
- “Fear related to intimidation and harassment”
- “Anxiety related to disruption in daily life”; “Anxiety”

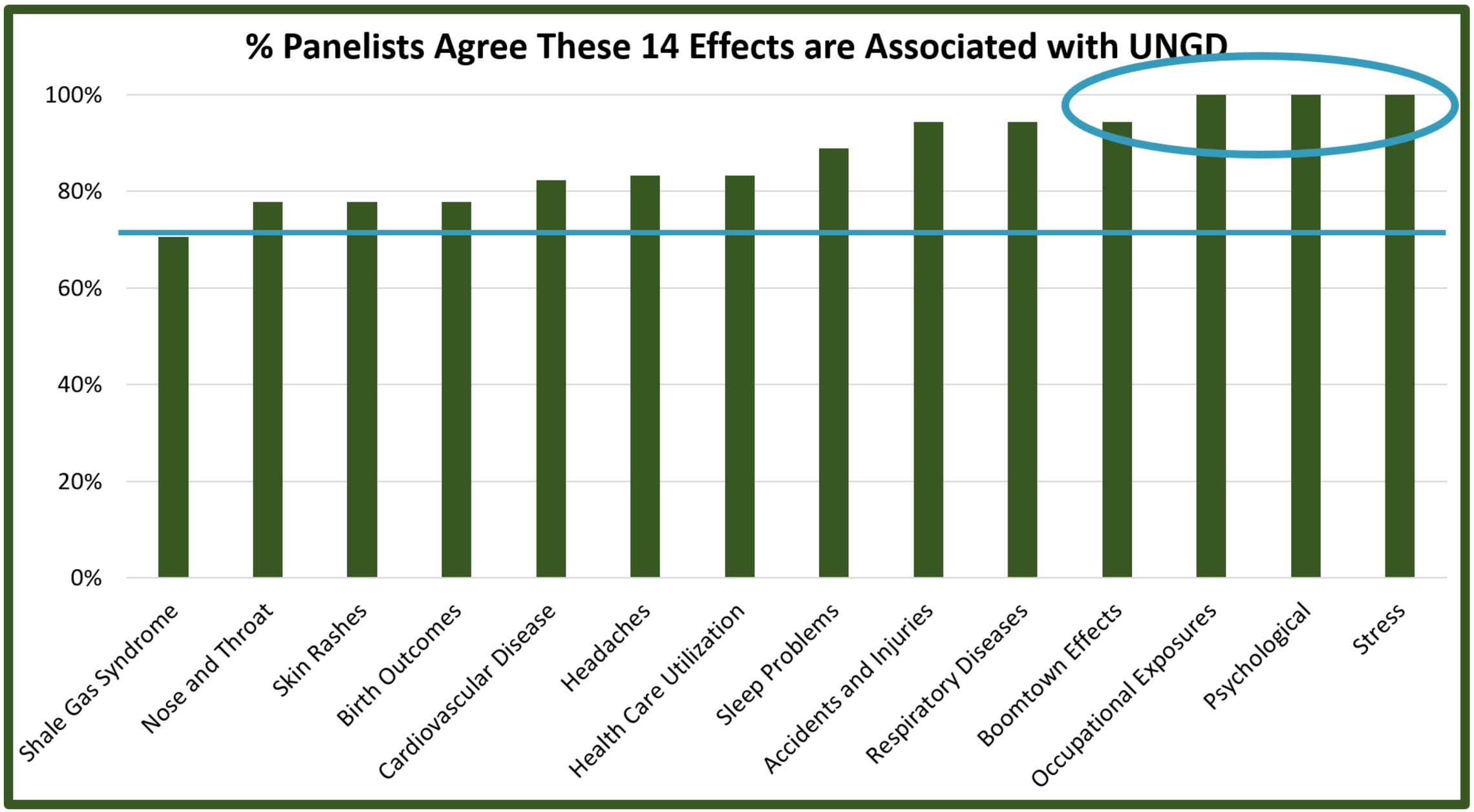
Panelists' Responses: Round Two Emerging Consensus

Health Effects Associated with Gas	Health Effects Associated with Oil
128 unique statements	53 unique statements
17 categories	10 categories
26 statements	13 statements

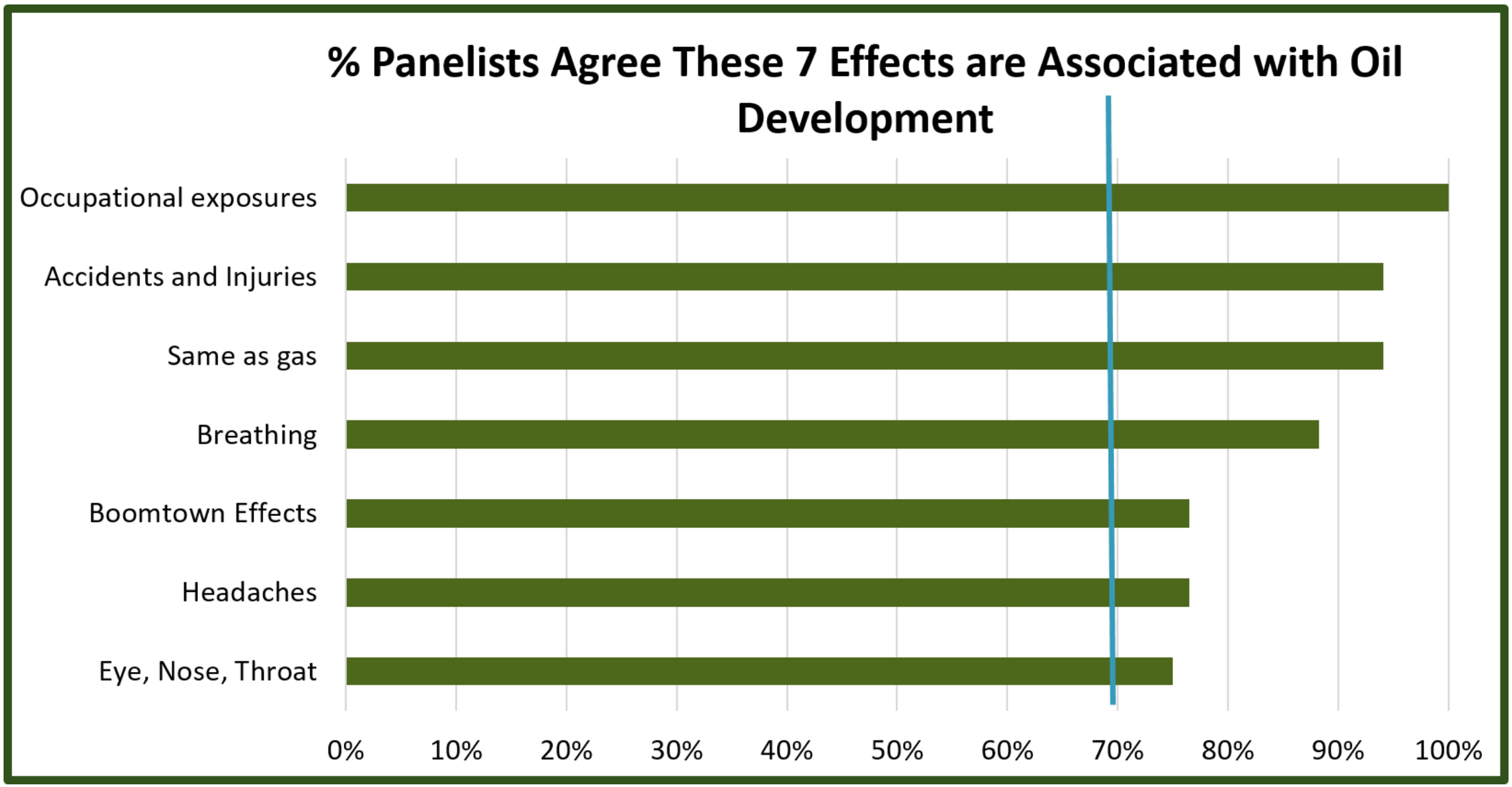
Panelists' Responses: Round Three Consensus

Health Effects Associated with Gas	Health Effects Associated with Oil
128 unique statements	53 unique statements
17 categories	10 categories
26 statements	13 statements
15 statements	**7 statements**

Results:
Round Three Consensus UNGD



Results:
Round Three Consensus Oil Development



Round Three: Lack of Consensus

- Health effects and unconventional gas (n=11)
  - Nausea
  - Specific cancers
  - Cardiac arrhythmias
  - Cognition
  - Mental “spaciness”
  - Decreased sperm count
  - Respiratory infections
  - Neurological problems
  - Gastro-intestinal problems
  - Kidney and liver diseases

Round Three: Lack of Consensus

- Health effects and oil (n=6)
  - Cancer
  - Reproductive health
  - Neurological problems
  - Skin
  - Nausea and vomiting
  - Insufficient data

Summary

- Multiple sources of data suggest mental health effects associated with UOGD.
- Delphi study consensus confirms what is found in multiple sources
- Available data suggests proximity to UOGD activity is an important factor in health outcomes
- Stress a is consistent finding across multiple data sources
  - Specific mental health symptoms are more variable

Stress and the Brain

- Inflammation is good for fighting infections, but bad in the long term.
  - Affects multiple systems directly, including the brain
- Immune system-brain interactions can result in symptoms that look like depression
- Safe anti-inflammation strategies include
  - Exercise
  - Mindfulness
  - Sleep
  - Social connections
  - Healthy diet

Putting It into Practice

- WILD 5 Wellness[16]
  - Available at no cost
  - Evidence-based
    - Reduction in symptoms of depressive symptoms
    - Reduction in symptoms of anxiety
    - Reduction in emotional eating
    - Improved sleep
    - Increased sense of well-being
- Materials available on SWPA-EHP website

For More Information

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