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\textsuperscript{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.\textsuperscript{15}
Background: The Marcellus Shale Region

Marcellus Shale Area: New research shows an estimated 500 trillion cubic feet of natural gas lies within the rock.

Devonian Black Shale Succession: The Marcellus Shale comprises part of this large formation.
Background: Drilling Activity
Background: A Changing Community
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

<table>
<thead>
<tr>
<th>Reason for Visit</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dental Clinic</td>
<td>43</td>
<td>18</td>
</tr>
<tr>
<td>Medical Clinic—Routine Visit</td>
<td>56</td>
<td>23</td>
</tr>
<tr>
<td>Friend/Family of Client</td>
<td>78</td>
<td>33</td>
</tr>
<tr>
<td>Medical Clinic—Sick Visit</td>
<td>54</td>
<td>23</td>
</tr>
<tr>
<td>Unknown</td>
<td>8</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Self-Reported Health (n=237)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent/Very Good</td>
<td>74</td>
<td>31</td>
</tr>
<tr>
<td>Good</td>
<td>109</td>
<td>46</td>
</tr>
<tr>
<td>Fair/Poor</td>
<td>54</td>
<td>23</td>
</tr>
</tbody>
</table>
What We Learned from the Descriptive Study: Mental Health

<table>
<thead>
<tr>
<th>SF-36 SUBSCALES</th>
<th>Range</th>
<th>Mean (SD)</th>
<th>% Low Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Vitality</td>
<td>22.89-70.42</td>
<td>47.9 (10.7)</td>
<td>22</td>
</tr>
<tr>
<td>• Social Function</td>
<td>17.23-57.34</td>
<td>46.7 (11.4)</td>
<td>27</td>
</tr>
<tr>
<td>• Mental Health</td>
<td>16.86-63.95</td>
<td>47.2 (11.2)</td>
<td>24</td>
</tr>
<tr>
<td>• Role-Emotional</td>
<td>14.39-56.17</td>
<td>46.7 (11.9)</td>
<td>29</td>
</tr>
<tr>
<td>• MCS</td>
<td>10.84-69.13</td>
<td>47.4 (12.2)</td>
<td>27</td>
</tr>
</tbody>
</table>
What We Learned from the Descriptive Study: Sense of Control

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>SF-36 MENTAL HEALTH SUBSCALES *</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vitality</td>
</tr>
<tr>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Clinic Client</td>
<td></td>
</tr>
<tr>
<td>Medical-Well</td>
<td></td>
</tr>
<tr>
<td>Family/Friend</td>
<td></td>
</tr>
<tr>
<td>Medical-Sick</td>
<td>-0.170</td>
</tr>
<tr>
<td>Unknown</td>
<td></td>
</tr>
<tr>
<td>Employed</td>
<td></td>
</tr>
<tr>
<td>Social Control</td>
<td>0.216</td>
</tr>
</tbody>
</table>

*Regression coefficients significance <0.05
What We Learned from the Descriptive Study: Proximity to UGD
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
- 128 unique statements
- 17 categories
- 26 statements

Health Effects Associated with Oil
- 53 unique statements
- 10 categories
- 13 statements
Panelists’ Responses: Round Three Consensus

Health Effects Associated with Gas
- 128 unique statements
- 17 categories
- 26 statements
- 15 statements

Health Effects Associated with Oil
- 53 unique statements
- 10 categories
- 13 statements
- 7 statements
Results:
Round Three Consensus UNGD

% Panelists Agree These 14 Effects are Associated with UNGD

- Shale Gas Syndrome
- Nose and Throat
- Skin Rashes
- Birth Outcomes
- Cardiovascular Disease
- Headaches
- Health Care Utilization
- Sleep Problems
- Accidents and Injuries
- Respiratory Diseases
- Boomtown Effects
- Occupational Exposures
- Psychological
- Stress

Bar graph showing the percentage of panelists who agree that these 14 effects are associated with UNGD.
Results:
Round Three Consensus Oil Development

% Panelists Agree These 7 Effects are Associated with Oil Development

- Occupational exposures
- Accidents and Injuries
- Same as gas
- Breathing
- Boomtown Effects
- Headaches
- Eye, Nose, Throat

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
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\textsuperscript{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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References


