Community Health Risk Assessment
An Assessment of Risk Related to the Natural Gas Industry in Garfield County
Part II: Health Study
Tonight’s presentation

- Overview of report content, conclusions, and recommendations
- Technical review process
- Citizen access and comment
Acknowledgements

- Saccomanno Research Institute
  - Kathy Petefish
  - Susan Keizer
  - Mary Nichols
  - Teara Carr

- Garfield County
  - Garfield County Public Health
  - Grand River Hospital District
  - Citizens and organizations

- Colorado Department of Public Health and Environment
At the present time – based on our data sources – there is not a health crisis in Garfield County.

That is not to say that some people don’t have health problems (unusually susceptible individuals) and there are trends that should be monitored.

Data are largely population-based (limitations for identifying rare and individual health events)

Can make recommendations for protection of public health into the future
The Question: Our Dilemma

Was “Mr. Jones’ health condition caused by exposure to a toxic material introduced into the environment by natural gas industry operations?"
Study Methodology

Questions

◦ Is the health of residents of Garfield County different than the health of residents of Delta, Mesa or Montrose counties?
◦ Is the health of residents of areas of Garfield County that are heavily impacted by the natural gas industry different from the health of residents of less impacted areas of Garfield County?

“Snapshot in time”/Baseline

◦ Descriptive study (correlation study)
◦ Not possible to make definitive causal conclusions
Study Limitations

- Funding: Issues or areas that need more in-depth research than can be performed with existing funding.
- Lack of baseline health data with which to determine trends or changes.
- Relatively new presence of the industry in the region: health outcomes may not yet be apparent.
- Both risk and causation involve probability statements: may never be able to say with certainty that a particular health condition is caused by an exposure to a potentially toxic material.
Data Collection: Four Ways to Answer the Questions

- Public Experience (Perceptions and Concerns)
  - Focus groups, public meetings, interviews, complaint logs
  - Sample size of ~500 individuals and comments

- State Health Measures
  - Colorado Department of Public Health and Environment
  - County–based data for Delta, Garfield, Mesa and Montrose counties
  - Sample size – entire population of each county
Data Collection (continued)

- Hospital and Medical Insurance data
  - Colorado Hospital Association discharge data
  - Grand River Medical Center and St. Mary’s Hospital ER data
  - “Careflight” data
  - Rocky Mountain Health Plans member data (In-patient, out-patient, and ER)
  - Four-county comparison
  - Sample size dependent on data source – user population

- Self-reported Health Status
  - Household survey
  - Randomly selected households from all zip code areas within Garfield County
  - Sample size: Comprehensive health and risk factor information for 1048 individuals
Comparison counties were selected for the following reasons:

- All four counties are located on the Western Slope of Colorado, and thus, share similar social and political cultures.
- All four counties have experienced energy and mining activities, although to different degrees
  - Have experienced similar economic cycles of growth and recession (“boom and bust”)
  - Have experienced accompanying environmental and social impacts.
- Somewhat overlapping healthcare networks and service areas allowed us to acquire comparative health data for residents of the four counties.

Demographic data: http://dola.colorado.gov
Why look at disease presumably not related to exposures from natural gas industry operations?

• Many health conditions have symptoms that are similar and/or have multiple causes.

• A person’s general health can influence susceptibility to toxins or disease agents.
“Perceptions and Concerns”

Garfield County Health Risk Study - Community Interviews / Focus Groups

Total Comments

- Environment
- Health
- Societal / Health
- Societal
- Wildlife / Lifestock

Comment Categories
Physical Health Issues/Concerns

- Increase in or exacerbations of allergies and asthma
  - Related concerns: coughing, wheezing, other respiratory complaints

- Mental health issues such as stress, depression, anger, inability to sleep

- Burning/itching skin

- Headaches, dizziness, burning/itching eyes, nausea/vomiting, sinus problems - most often attributed to odors

- Generalized chemical sensitivities

- Fibromyalgia/chronic pain
  - Related concern: chronic fatigue, lethargy

- Chronic colds
  - Related concerns: concern about compromised immune systems
Physical Health Issues/Concerns

- Cancer (adrenal cancer, brain tumors, unknown/presumed cancers or “fear of developing cancer”)
- Obesity
- Pre-existing health conditions have been exacerbated; “feeling worse” than in the past
- Diabetes
- Loss of voice or speech problems
- Trauma/work-related injuries
- Age-related illnesses
Social/Community Issues and Concerns

- Increase in child and spousal abuse; child neglect; stressed family relationships
- Increase in sexually transmitted diseases related to increase in temporary workers
- High suicide rate
- Alcohol abuse (especially among high school students)
- Drug abuse (especially methamphetamine use)
Social/Community Issues and Concerns

Lack of health insurance
- Related concerns: lack of dental care for children and preventive care

Traffic, public safety

Cultural clash (long-time residents, industry workers)

Access to healthcare and mental health services

Availability of housing and community services

Increase in low-income families
Environmental Concerns

- Noise
- Odors
- Dust
- "Toxic" chemicals in water and air
- Spills
- Visual Appearance
- Road Conditions
Wildlife/Domestic Animals

- Reported changes in herd animal reproductive patterns/illnesses
- Decreases in bird, insect, and deer populations
Qualitative Data: Four-county comparison

- Adolescent health measures (2007)
- West Nile virus (2002–2007)

www.cdphe.state.co.us
Sexually Transmitted Diseases

Rate per 100,000 population of reported Chlamydia cases in Delta, Garfield, Mesa and Montrose counties compared to Colorado Chlamydia case rate per 100,000 (2000–2007)
Sexually Transmitted Diseases

Rate per 100,000 of reported Gonorrhea cases in Delta, Garfield, Mesa and Montrose counties compared to Colorado Gonorrhea case rate per 100,000 and Healthy People 2010 Goal (2000–2007)
Sexually Transmitted Diseases

Rate per 100,000 population of reported HIV cases for Delta, Garfield, Mesa and Montrose counties compared to Colorado HIV case rate (2000–2007)
Sexually Transmitted Diseases

Rate per 100,000 population of reported AIDS cases for Delta, Garfield, Mesa and Montrose counties compared to Colorado AIDS case rate (2000–2007)

Year of Diagnosis

Rate per 100,000

2000 2001 2002 2003 2004 2005 2006 2007

Delta County
Garfield County
Mesa County
Montrose County
Colorado
Qualitative Data (Continued): Four-county comparison

  - General health status (physical & mental)
  - Diabetes, asthma
  - Smoking, weight
  - Health insurance

Injury Hospitalizations & Deaths

Injury Hospitalizations by Injury Type

- Motor Vehicle Traffic
- Fall
- Poisoning
- Suicide/ Attempt
- Assault/Legal Intervention

Y-axis: 0 to 350

Locations:
- Delta
- Garfield
- Mesa
- Montrose
- Colorado
Injury Hospitalizations & Deaths

Injury Deaths by Injury Type

- Delta
- Garfield
- Mesa
- Montrose
- Colorado

Categories:
- Motor Vehicle Traffic
- Fall
- Poisoning
- Suicide
- Homicide
- Firearm Related
Cancer

All Cancers Incidence Trend
Average Annual Rate - Males

All Cancers Incidence Trend
Average Annual Rate - Females
Leukemia Incidence by County for 2003-2005
Average Annual Rates

<table>
<thead>
<tr>
<th>County</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colorado</td>
<td>16</td>
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<td>25</td>
<td>12</td>
</tr>
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<td>Mesa</td>
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<td>10</td>
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<tr>
<td>Garfield</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>Delta</td>
<td>15</td>
<td>5</td>
</tr>
</tbody>
</table>

Age-adjusted Rate per 100,000
Hospital and Medical Insurance Data

- Diagnosis Related Group (DRG)-based hospital discharge data (2000 through 1st quarter 2006)
- Emergency room data
  - Grand River Medical Center
  - RMHP – member data for 4 counties
  - St. Mary’s Hospital CareFlight data
- Rocky Mountain Health Plans (RMHP) member data – 4 county comparison
  - By DRG category
  - Focus on respiratory conditions
During six-year period -- with exception of 2003 -- circulation and bone and joint disorders were either the first or second most common reasons for hospitalization.

- In 2003, birthing and pregnancy disorders was number one, and circulation disorders was third.

- Digestive disorders ranked third in four out of the six year.

- Respiratory disorders were either the fourth or fifth most common reason for hospitalization in all years.

- Neonatal disorders were sixth in frequency during the entire six-year period.

- Nervous system disorders were either seventh or eighth each year.
Nervous System Disorders
Seizure & Headache Age >17

admits per 1,000

2000 2001 2002 2003 2004 2005 2006

Delta, CO Garfield, CO Mesa, CO Montrose, CO
## RMHP Member Data: Ambulatory Visits 2000–2007

<table>
<thead>
<tr>
<th>DRG Category</th>
<th>Adults (≥18)</th>
<th>Children (&lt;18)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accident, Injury, Trauma</td>
<td>↓ Until 2005</td>
<td>↓</td>
</tr>
<tr>
<td>Annual Physicals &amp; Well-Child Exams</td>
<td>↓</td>
<td>↓</td>
</tr>
<tr>
<td>Cardiac</td>
<td>↓</td>
<td>↓</td>
</tr>
<tr>
<td>Ear, Nose &amp; Throat</td>
<td>↓</td>
<td>N/A</td>
</tr>
<tr>
<td>Endocrine</td>
<td>↓</td>
<td>=</td>
</tr>
<tr>
<td>Eye</td>
<td>↓</td>
<td>↓</td>
</tr>
<tr>
<td>GI &amp; Urinary</td>
<td>↓</td>
<td>=</td>
</tr>
<tr>
<td>Infection</td>
<td>=</td>
<td>↑</td>
</tr>
<tr>
<td>Mental Health</td>
<td>↓</td>
<td>=</td>
</tr>
</tbody>
</table>

**↓** GarCo rates generally lower than other counties

**↑** GarCo rates higher than other counties

**=** GarCo rates neither higher or lower than other counties

**N/A:** less than 200 visits per member months

Rates per 1,000 member months

GarCo rates generally lower than other counties.

GarCo rates higher than other counties.

GarCo rates neither higher or lower than other counties.

N/A: less than 200 visits per member months.

Rates per 1,000 member months.
### RMHP Member Data: Ambulatory Visits 2000–2007 (continued)

GarCo rates generally lower than other counties

GarCo rates higher than other counties

GarCo rates neither higher or lower than other counties

N/A: less than 200 visits per member months

Rates per 1,000 member months

<table>
<thead>
<tr>
<th>DRG Category</th>
<th>Adults (≥18)</th>
<th>Children (&lt;18)</th>
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</thead>
<tbody>
<tr>
<td>Musculoskeletal</td>
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<tr>
<td>Neurological</td>
<td>↓</td>
<td>N/A</td>
</tr>
<tr>
<td>Pregnancy &amp; Ob/Gyn</td>
<td>↓</td>
<td>=</td>
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<tr>
<td>Respiratory Conditions</td>
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<td>=</td>
</tr>
<tr>
<td>Skin/Allergy</td>
<td>↓</td>
<td>↓</td>
</tr>
<tr>
<td>DRG Category</td>
<td>Adults (≥18)</td>
<td>Children (&lt;18)</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>---------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Accident, Injury, Trauma</td>
<td>↓ Until 2005</td>
<td>↓</td>
</tr>
<tr>
<td>Cardiac</td>
<td>↓</td>
<td>N/A</td>
</tr>
<tr>
<td>Drug &amp; Alcohol</td>
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</tr>
<tr>
<td>Ear, Nose &amp; Throat</td>
<td>↓</td>
<td>=</td>
</tr>
<tr>
<td>Endocrine</td>
<td>↓</td>
<td>=</td>
</tr>
<tr>
<td>Eye</td>
<td>↓</td>
<td>↓</td>
</tr>
<tr>
<td>GI &amp; Urinary</td>
<td>↓</td>
<td>=</td>
</tr>
<tr>
<td>Infection</td>
<td>=</td>
<td>↑</td>
</tr>
</tbody>
</table>

- **GarCo rates generally lower than other counties**
- **GarCo rates higher than other counties**
- **GarCo rates neither higher or lower than other counties**
- **N/A: less than 200 visits per member months**
- **RNHP rates per 1,000 member months; GR rates per 1,000 visits**

<table>
<thead>
<tr>
<th>DRG Category</th>
<th>Adults (≥18)</th>
<th>Children (&lt;18)</th>
<th>Grand River (all ages)</th>
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<td>Mental Health</td>
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<td>=</td>
<td>Increasing</td>
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<tr>
<td>Neurological</td>
<td>↓</td>
<td>N/A</td>
<td>Increasing</td>
</tr>
<tr>
<td>Pregnancy &amp; Ob/Gyn</td>
<td>↓</td>
<td>N/A</td>
<td>Increasing since 2005</td>
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<tr>
<td>Respiratory</td>
<td>↓</td>
<td>=</td>
<td>Variable over period</td>
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<tr>
<td>Skin/Allergy</td>
<td>↓</td>
<td>↓</td>
<td>Increasing</td>
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</tbody>
</table>

GarCo rates generally lower than other counties
GarCo rates higher than other counties
GarCo rates neither higher or lower than other counties
N/A: less than 200 visits per member months
RNHP rates per 1,000 member months; GR rates per 1,000 visits
## Self-reported Health Status: Household Survey

<table>
<thead>
<tr>
<th>Zip Code</th>
<th>Census pop.</th>
<th>Households (with “land lines”)</th>
<th>Sample</th>
<th>Surveys Completed</th>
<th>% of households completed</th>
<th>Individuals “surveyed”</th>
<th>% of population surveyed</th>
</tr>
</thead>
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<tr>
<td>81601</td>
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<td>4,680</td>
<td>Mail</td>
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<td>49</td>
<td>1.05</td>
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<td>0.54</td>
<td>63</td>
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<td></td>
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<td></td>
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<td>355</td>
<td>48</td>
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<td>81635</td>
<td>5,041</td>
<td>1,947</td>
<td>Mail</td>
<td>186</td>
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<td>1.23</td>
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<td></td>
<td></td>
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<td>Phone</td>
<td>186</td>
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<td>1.13</td>
<td>57</td>
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<tr>
<td>81647</td>
<td>4,410</td>
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<td>0.66</td>
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<td></td>
<td>Phone</td>
<td>169</td>
<td>20</td>
<td>1.23</td>
<td>53</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>48,653</strong></td>
<td><strong>18,467</strong></td>
<td><strong>3,450</strong></td>
<td><strong>385</strong></td>
<td><strong>2.08</strong></td>
<td><strong>1,048</strong></td>
<td><strong>2.15</strong></td>
</tr>
</tbody>
</table>
Survey facts

- 2.08% of Garfield County households with listed phone numbers (USA Info listings) were surveyed
- Obtained information on 2.15% of 2004 census population
- Survey completion rate = 18% of randomly selected population
- Total calls made = 2,511
  - 219 calls completed
  - 2,336 refusals or no contact (no answer, answering machine, out of service, etc.)
- Total surveys mailed = 1,731
  - 166 returned (9.6% of total mailed)
- Interviews completed in Spanish = 49 out of 125 households identified
Survey sections

- Household demographics and environment
- Overall health status
- Diabetes
- Cardiovascular disease
- Blood pressure
- Respiratory (lung) health
- Cancer
- Neurological (nerve and muscle) symptoms
- Other health issues (skin, allergies, kidney, immune system)
- Tobacco Use
- Alcohol consumption
- Reproductive history/birth defects
- Health–related quality of life
- Occupational history
- Healthcare and income
- Concerns about environmental or chemical exposures
Household Survey Demographic Data

Longest Period of Residence

- Primarily Spanish-speaking residents
- Other County residents

0 10 20 30 40 50 60 70 80 90 100

Percentage of individuals

- Garfield County
- Colorado, outside of GarCo
- outside of Colorado
Household Survey Demographic Data

Length of Residence in Garfield County

- **Percentage of Households**

  - **Length of Residence**
    - ≤1 year
    - 1-5 years
    - >5 years
    - DK/Not sure

<table>
<thead>
<tr>
<th>Zip Code</th>
<th>Percentage of Households</th>
</tr>
</thead>
<tbody>
<tr>
<td>County</td>
<td></td>
</tr>
<tr>
<td>81601</td>
<td></td>
</tr>
<tr>
<td>81623</td>
<td></td>
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<tr>
<td>81635</td>
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<td>81647</td>
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</tr>
<tr>
<td>81650</td>
<td></td>
</tr>
<tr>
<td>81652</td>
<td></td>
</tr>
</tbody>
</table>
Household Survey Demographic Data

Length of Time in Current Residence

<table>
<thead>
<tr>
<th>Zip Code</th>
<th>≤1 year</th>
<th>1-5 years</th>
<th>&gt;5 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>County</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>81601</td>
<td></td>
<td></td>
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<tr>
<td>81623</td>
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<tr>
<td>81652</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Household Survey Demographic Data

Location of Residence in Garfield County

Percentage of Individuals

Zip Code

County  81601  81623  81635  81647  81650  81652

Urban  Rural/Near City  Ranch  Other Rural  Refused  DK/Not sure
Home Environment

Main Source of Home Water Supply

<table>
<thead>
<tr>
<th>Zip Code</th>
<th>Percentage of Individuals</th>
</tr>
</thead>
<tbody>
<tr>
<td>County</td>
<td>100%</td>
</tr>
<tr>
<td>81601</td>
<td>90%</td>
</tr>
<tr>
<td>81623</td>
<td>80%</td>
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<tr>
<td>81635</td>
<td>70%</td>
</tr>
<tr>
<td>81647</td>
<td>60%</td>
</tr>
<tr>
<td>81650</td>
<td>50%</td>
</tr>
<tr>
<td>81652</td>
<td>40%</td>
</tr>
</tbody>
</table>

Legend:
- City (Public)
- Private Well
- Small System (unreg)
- Spring
- Missing/DK
Household Survey Demographic Data

Household Ethnicity

<table>
<thead>
<tr>
<th>Zip Code</th>
<th>Percentage of Households</th>
</tr>
</thead>
<tbody>
<tr>
<td>County</td>
<td>81601</td>
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<tr>
<td></td>
<td>81623</td>
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<tr>
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<td>81647</td>
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<tr>
<td></td>
<td>81650</td>
</tr>
<tr>
<td></td>
<td>81652</td>
</tr>
</tbody>
</table>

*White* (Anglo or "white", not of Hispanic origin)

**Other** includes Asian, African-American, Native American, or "other"
Current Health

Percentage of Individuals

- Refused
- DK/Not sure
- Poor
- Fair
- Good
- Excellent

*Spanish as the primary language in the household
Health One Year Ago

Percentage of Individuals

County 81601 81623 81635 81647 81650 81652 SL*

*Spanish as the primary language in the household
Percentage of Individuals Reporting Selected Diseases and Symptoms
County Overall

- Anemia
- Skin
- Kidney
- Immune System
- Hay Fever
- Other Allergies
- Birth Defects
- Lack of interest in usual activities
- Depression
- Illness or injury affecting health >5 days

Legend:
- No
- Yes
- DK/Not sure
Percentage of Household Members with Asthma

*Data are not age-adjusted
Percentage of Household Members with COPD*

*Data are not age-adjusted
Percentage of Household Members with Emphysema*

*Data are not age-adjusted
Percentage of Household Members with Other Lung Problems*

<table>
<thead>
<tr>
<th>Zip Code</th>
<th>Percentage of Individuals</th>
</tr>
</thead>
<tbody>
<tr>
<td>County</td>
<td>3.5</td>
</tr>
<tr>
<td>81601</td>
<td>3.0</td>
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<tr>
<td>81650</td>
<td>5.0</td>
</tr>
<tr>
<td>81652</td>
<td>6.0</td>
</tr>
</tbody>
</table>

*Data are not age-adjusted
Mean Age of Household Residents

<table>
<thead>
<tr>
<th>Zip Code</th>
<th>Years</th>
</tr>
</thead>
<tbody>
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<td>County</td>
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<tr>
<td>81652</td>
<td>38.8</td>
</tr>
<tr>
<td>SL*</td>
<td>22.3</td>
</tr>
</tbody>
</table>

*Spanish as the primary language in the household
Percentage of Adults Employed in the Transportation, Communications, or Public Utilities Industries Reporting Selected Diseases and Symptoms

- Asthma
- Respiratory
- Cancer
- Bladder Cancer
- Kidney Cancer
- Leukemia
- Liver Cancer
- Lymphoma
- Thyroid Cancer
- Headaches/Migraines
- Twitching/Tremors
- Dizziness
- Numbness
- Weakness
- Ringing in Ears
- Anemia
- Skin
- Seizures
- Birth Defects

Percentage of Adults (≥19 years)

Current vs. Longest Duration
Percentage of Individuals Employed in the Mining Industry Reporting Selected Diseases and Symptoms

Percentage of Adults (≥19 years)

Asthma  Respiratory  Cancer  Bladder Cancer  Kidney Cancer  Leukemia  Liver Cancer  Lymphoma  Thyroid Cancer  Headaches/Migraines  Twitching/Tremors  Dizziness  Numbness  Weakness  Ringing in Ears  Anemia  Skin  Seizures  Birth Defects

Current  Longest
Percentage of Adults Employed in the Professional and Related Services Industries Reporting Selected Diseases and Symptoms

- Asthma
- Respiratory
- Cancer
- Bladder Cancer
- Kidney Cancer
- Leukemia
- Liver Cancer
- Lymphoma
- Thyroid Cancer
- Headaches/Migraines
- Twitching/Tremors
- Dizziness
- Numbness
- Weakness
- Ringing in Ears
- Anemia
- Skin
- Seizures
- Birth Defects

Percentage of Adults (≥19 years)

- Current
- Longest
Mean Age of Household Residents

<table>
<thead>
<tr>
<th>Zip Code</th>
<th>Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>County</td>
<td></td>
</tr>
<tr>
<td>81601</td>
<td></td>
</tr>
<tr>
<td>81623</td>
<td></td>
</tr>
<tr>
<td>81635</td>
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<tr>
<td>81647</td>
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</tr>
<tr>
<td>81650</td>
<td></td>
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<tr>
<td>81652</td>
<td></td>
</tr>
<tr>
<td>SL*</td>
<td></td>
</tr>
</tbody>
</table>

*Spanish as the primary language in the household
Reported Cancer Types

- Uterine: 1.9
- Thyroid: 1.9
- Squamous cell carcinoma: 1.9
- Prostate: 15.1
- Other skin cancer: 18.8
- Malignant melanoma: 3.8
- Lymphoma: 3.8
- Liver: 1.9
- Leukemia: 1.9
- Kidney: 1.9
- Glandular carcinoma: 1.9
- Colon: 7.5
- Cervical: 9.4
- Breast: 20.7
- Bladder: 1.9
- Basal cell carcinoma: 5.7

Percentage of all reported cancers
Percentage of Households Concerned that Health Problems May Be Related to Chemicals In or Near the Home

<table>
<thead>
<tr>
<th></th>
<th>County</th>
<th>81601</th>
<th>81623</th>
<th>81635</th>
<th>81647</th>
<th>81650</th>
<th>81652</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DK/Not sure</strong></td>
<td>8.2</td>
<td>6.7</td>
<td>1.4</td>
<td>15.6</td>
<td>5.9</td>
<td>9.8</td>
<td>14.6</td>
</tr>
<tr>
<td><strong>No</strong></td>
<td>88.4</td>
<td>90.5</td>
<td>98.6</td>
<td>75.6</td>
<td>94.1</td>
<td>85.4</td>
<td>80.5</td>
</tr>
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<td><strong>Yes</strong></td>
<td>3.4</td>
<td>2.9</td>
<td>0</td>
<td>8.9</td>
<td>0</td>
<td>4.9</td>
<td>4.9</td>
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</tbody>
</table>
Percentage of Households Concerned that Health Problems May Be Related to Environmental or Chemical Hazards in Their Neighborhoods

<table>
<thead>
<tr>
<th>County</th>
<th>81601</th>
<th>81623</th>
<th>81635</th>
<th>81647</th>
<th>81650</th>
<th>81652</th>
<th>SL*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refused</td>
<td>0.3%</td>
<td>1%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>DK/Not sure</td>
<td>5.8%</td>
<td>5.7%</td>
<td>4.2%</td>
<td>8.9%</td>
<td>2.9%</td>
<td>4.9%</td>
<td>9.8%</td>
</tr>
<tr>
<td>Very much</td>
<td>31.4%</td>
<td>19%</td>
<td>33.3%</td>
<td>37.8%</td>
<td>26.5%</td>
<td>41.5%</td>
<td>36.6%</td>
</tr>
<tr>
<td>A little</td>
<td>21.6%</td>
<td>18.1%</td>
<td>19.4%</td>
<td>28.9%</td>
<td>32.4%</td>
<td>20.7%</td>
<td>19.5%</td>
</tr>
<tr>
<td>Not at all</td>
<td>40.9%</td>
<td>56.2%</td>
<td>43.1%</td>
<td>24.4%</td>
<td>38.2%</td>
<td>32.9%</td>
<td>34.1%</td>
</tr>
</tbody>
</table>
Concern that Environmental or Chemical Hazards in the Neighborhood May Be Related to Health Problems: Correlation with Education

<table>
<thead>
<tr>
<th></th>
<th>≤High School</th>
<th>Some College and higher</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refused</td>
<td>0.7</td>
<td>0</td>
</tr>
<tr>
<td>DK/Not sure</td>
<td>7.2</td>
<td>4.5</td>
</tr>
<tr>
<td>Very much</td>
<td>41.4</td>
<td>24.7</td>
</tr>
<tr>
<td>A little</td>
<td>21.1</td>
<td>22</td>
</tr>
<tr>
<td>Not at all</td>
<td>29.6</td>
<td>48.9</td>
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</table>
Concern that Environmental or Chemical Hazards May Be Related to Health Problems: Correlation with Household Income

<table>
<thead>
<tr>
<th>Household Income</th>
<th>$&lt;25,000</th>
<th>$25,000-$50,000</th>
<th>$50,000-$75,000</th>
<th>$75,000-$100,000</th>
<th>$&gt;100,000</th>
<th>DK/Not sure</th>
<th>Refused</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refused</td>
<td>0</td>
<td>0.9</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>DK/Not sure</td>
<td>13.3</td>
<td>4.5</td>
<td>2.7</td>
<td>8.8</td>
<td>5.8</td>
<td>9.1</td>
<td>0</td>
</tr>
<tr>
<td>Very much</td>
<td>20</td>
<td>44.6</td>
<td>32.4</td>
<td>29.8</td>
<td>19.2</td>
<td>18.2</td>
<td>26.9</td>
</tr>
<tr>
<td>A little</td>
<td>31.1</td>
<td>15.2</td>
<td>24.3</td>
<td>19.3</td>
<td>15.4</td>
<td>27.3</td>
<td>38.5</td>
</tr>
<tr>
<td>Not at all</td>
<td>35.6</td>
<td>34.8</td>
<td>40.5</td>
<td>42.1</td>
<td>59.6</td>
<td>45.5</td>
<td>34.6</td>
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</tbody>
</table>
Percentage of Households Concerned That the Natural Gas Industry May Be Related to Health Problems

*Primarily Spanish-speaking households

<table>
<thead>
<tr>
<th></th>
<th>County</th>
<th>81601</th>
<th>81623</th>
<th>81635</th>
<th>81647</th>
<th>81650</th>
<th>81652</th>
<th>SL*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refused</td>
<td>0.3</td>
<td>1</td>
<td>1.4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>DK/Not sure</td>
<td>12.1</td>
<td>7.6</td>
<td>8.2</td>
<td>22.2</td>
<td>8.8</td>
<td>15.9</td>
<td>14.6</td>
<td>8.2</td>
</tr>
<tr>
<td>No</td>
<td>83.7</td>
<td>89.5</td>
<td>90.4</td>
<td>68.9</td>
<td>91.2</td>
<td>79.3</td>
<td>75.6</td>
<td>91.8</td>
</tr>
<tr>
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<td>3.9</td>
<td>1.9</td>
<td>1.4</td>
<td>8.9</td>
<td>0</td>
<td>4.9</td>
<td>9.8</td>
<td>0</td>
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</tbody>
</table>
Concern that the Natural Gas Industry May Be Related to Health Problems: Correlation with Education

<table>
<thead>
<tr>
<th></th>
<th>Some College and higher</th>
<th>High School</th>
</tr>
</thead>
<tbody>
<tr>
<td>DK/Not sure</td>
<td>13</td>
<td>11.1</td>
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<tr>
<td>No</td>
<td>82.5</td>
<td>85.6</td>
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<tr>
<td>Yes</td>
<td>4.5</td>
<td>3.3</td>
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</tbody>
</table>
Conclusions and Recommendation

**Conclusions**

- At the present time – based on our data sources – there is not a health crisis in Garfield County, but there are some health trends that should be monitored.

- We cannot say conclusively that any of these health trends are directly related to the presence of natural gas industry activities or to other factors.

- Risk modeling indicated that there are industry factors that could present a public health risk – use of best practices can reduce that risk.

**Recommendation**

- Establish a medical monitoring system – especially through primary care networks – to identify any changes in baseline data or trends and/or anomalies in medical practices.