Overview of the Investigation of Drinking Water Exposures in Dennehotso, Ganado, Lower Greasewood, Red Mesa and Steamboat

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Public Health Concerns Related to Water Hauling on Navajo Nation

- Water hauling is widespread
  - ~14,000 households without potable water
- Use of unregulated, untreated source water
  - Mainly livestock wells and natural springs
  - Found to contain bacteria and chemicals (such as natural arsenic and uranium)
- Unsafe storage and handling
Household Investigation of Drinking Water Exposures- 2008

- Collaboration among CDC, Navajo EPA, Navajo Division of Health, Navajo Epidemiology Center, Navajo Veterinary Program, IHS
- Target 5 chapters based on source water survey findings
  - Red Mesa, Dennehotso, Steamboat, Lower Greasewood, Ganado
- Goals:
  To what extent does contamination of unregulated water sources represent a public health threat?
Investigation Design and Data Collection

- Surveyed 296 households in 5 Chapters with and without access to public water

- Community health representatives (CHRs) visited homes and collected information from 1 adult per household:
  - Document water use, hauling and storage methods
  - Test urine for chemical exposures in people
  - Test drinking water in home for bacteria and chemicals
  - Identify additional water sources for further testing
  - Geographic location of home and water sources
Investigation Results

Red Mesa = 42
Dennehosto = 48
Ganado = 95
Steamboat = 58
Lower Greasewood = 52

296 households participated
246 urine samples analyzed
296 household water samples analyzed

201 (68%) of respondents were connected to a public water system

*1 household had missing Chapter data
How Common is Water Hauling?

- 65 (22%) haul some or all of drinking water
- 175 (59%) do not haul water
- 56 (19%) could not be confirmed
Bacterial Analysis

<table>
<thead>
<tr>
<th>Total # tested for bacteria</th>
<th>Positive for <em>E. coli</em></th>
<th>Positive for total coliforms</th>
</tr>
</thead>
<tbody>
<tr>
<td>285</td>
<td>23 (8%)</td>
<td>94 (33%)</td>
</tr>
</tbody>
</table>

- A significantly higher proportion (73%) of hauled water samples had bacteria compared to non-hauled water samples (18%)
# Water Nitrates and Arsenic

<table>
<thead>
<tr>
<th>EPA Primary drinking water limit</th>
<th>N (%) samples above limit</th>
<th>Potential Health Effects associated with exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrates &gt; 1mg/L</td>
<td>42 (14%)</td>
<td>Blue Baby Syndrome: shortness of breath in infants &lt; 6 months old</td>
</tr>
<tr>
<td>Arsenic &gt; 10ug/L</td>
<td>33 (11%)</td>
<td>Skin changes, neuropathy, gastrointestinal illness, increased risk for lung, skin and bladder cancer</td>
</tr>
</tbody>
</table>
Geographic Distribution of Water Arsenic Levels

- 82% samples > Arsenic EPA limit were from Red Mesa
Human Exposures to Inorganic Chemicals (Urine Samples)

- Uranium = most frequent
  - Linking urine contaminant levels to direct health effects can be challenging
  - Compared levels to 95th percentiles of:
    - NHANES
    - New Mexico Biomonitoring Project
    - Fallon Nevada Study
  - No values at levels known to cause human health effects
95th Percentile of Urine Uranium Levels

Mcg/gm creatinine urine uranium

NHANES    Fallon, NV    Navajo    New Mexico

95th Percentile
Potential for known health effects
Geographic Distribution of Urine Uranium Levels > NHANES 95%

Navajo Nation
Urine Uranium Levels Above 95th Percentile

Legend
- Urine Uranium above 95th percentile
- Sampled Households
- Chapters

AGENCY
- Chinle
- Crown Point
- Fort Defiance
- Ship Rock
- Tuba City
- State Boundaries

MAP AUTHOR: S GRAHAM

PROJECTION: North America Albers Equal Area Conic
Summary of Key Findings

- 22% of households haul water for drinking, including some with access to public water
- Those that haul water are more likely to be exposed to bacterial contaminants in drinking water
- Human exposure to uranium as measured in urine was:
  - Lower than levels known to cause health effects
  - Higher in this population than the general US population
  - Comparable to other Southwest populations
- Drinking water contamination does not appear to be the sole source of uranium or other chemical exposures in this population
What This Data Does Not Tell Us

- The source of uranium exposure
- The contribution of mining to uranium exposure
- The extent of historical exposure to uranium
- Health impact of uranium exposure
Current Activities: Disseminate Results and Follow up

Individual Level:
- Reporting individual results to participants
- Offer urine testing to other family members
- Offer enrollment into IHS Medical Monitoring Program

Community Level:
- Identify and test new sources of drinking water
- Physician Awareness
- Community Awareness

National Level:
- Congressional Meetings- Navajo 5-Year Plan
NEXT STEPS

- Continue to share results and work with other agencies (IHS, EPA, and Navajo agencies) to assist in guiding policy and interventions to improve access to safe water

- Clinical GI illness study

- Potential Congressional funding
THANK YOU!!!
Cadmium

- Not detected in household water samples
- 10% of urine samples were unusually high
- Arsenic, nitrates, cadmium, and uranium are the primary chemicals to be discussed