Pressing the Issue:
Effects of news media on private well water testing behavior in Maine

Kathleen P. Bell\textsuperscript{a}, Hollie Smith\textsuperscript{b}, Karyn Butts\textsuperscript{c}, Rebecca Lincoln\textsuperscript{c}, and Andrew E. Smith\textsuperscript{c}

\textsuperscript{a}School of Economics, University of Maine
\textsuperscript{b}Department of Communication and Journalism, University of Maine
\textsuperscript{c}Environmental & Occupational Health Programs, Maine Center for Disease Control and Prevention

National Conference On
Health Communication, Marketing, & Media
August 20, 2013, Atlanta, GA
Outline

• Introduction
  • Collaborative research project
  • Private well-water
    • Public health challenge
    • Communication challenge
  • Maine CDC response
• Research Project
• Conclusions
Collaborative Research Project

- Goal: Support evidence-based health communication to improve drinking water safety
- Partners: UMaine and Maine CDC
- Interdisciplinary Team: toxicology, public health, communication, economics
- Research: Link media coverage of well water and well-water testing behavior
Previous Research

Graph showing the number of Arsenic Test Requests and Newspaper Articles from 1993 to 2003. The x-axis represents the years from 1993 to 2003, while the y-axis represents the number of requests and articles from 0 to 3500. The graph indicates fluctuations in both categories over the years.
Public Health Challenge - USA

- 15% of USA households rely on private well water

- Mostly unregulated; well owners responsibility to test and treat

- Contaminants of concern vary regionally
  - Health effects include cancer and non-cancer outcomes
Public Health Challenge - Maine

- 56% of households rely on private well water (2009, BRFSS)
  - Highest per capita in U.S.
  - Natural and anthropogenic water contamination
  - No regulation, little funding for public health action

- Contaminants of major concern
  - Arsenic: ~10% exceed federal standard (10 ppb); max: 3,000 ppb
  - Uranium: ~5% exceed Maine’s standard (20 ppb); max: 6,000 ppb
  - Radon, Fluoride, Manganese
Communication Challenges

- Population
  - Few comprehensive lists of households
  - “Hard-to-reach” populations (rural, seasonal)

- Self-detection
  - Contaminants are tasteless & odorless
  - Health effects can take a long time to emerge

- Testing and treatment can be costly and complex
# Well Testing Schedule

## How to Read the Safe Limits

Compare the numbers and letters on your test results with the numbers and letters under the Safe Limits. Make sure the letters match and that your test result numbers are at or below the limits.

## Well Problem Can Cause Safe Limit

### Test Every Year

- **Bacteria**
  - Diarrhea and Vomiting
  - 0
  - If coliform bacteria test is positive, test for E. coli bacteria

- **Nitrate Nitrogen**
  - Infant blood problems
  - 10 mg/L or less

- **Nitrite Nitrogen**
  - Infant blood problems
  - 1 mg/L or less

### Test Every 3 to 5 Years

- **Arsenic**
  - Cancer/Low Birth Weight
  - 10 ug/L or less

- **Radon**
  - Cancer
  - 4,000 pCi/L or less

- **Uranium**
  - Kidney Problems
  - 20 ug/L or less

- **Lead - First Draw Test**
  - Brain Damage
  - 10 ug/L or less
  - if planning a baby, pregnant, or have a child under age 6

- **Fluoride**
  - Too little - increased chance of tooth decay
  - Between 0.6 mg/L and 2 mg/L
  - Too much - stained teeth

## Other Times to Test Your Well:

- You’re expecting a baby.
- Your water changes in smell, taste, or color. Drink bottled water. Call us to learn which tests to do.
- You put in new parts to the system, like a new pump or new pipes or water softener. Test for bacteria.
- The well runs dry and comes back. Test for bacteria.
- You put in a water treatment system to fix a problem. Test the treated water each year for that problem.

If you’re not 100% sure you understand your water test results, call us.

**Maine CDC Toll Free in Maine: 866-292-3474 or http://wellwater.maine.gov**
Maine CDC Response

• Brochures, telephone hot-line, website materials, and small, targeted community interventions when high results identified

• Media Campaigns: Align campaigns with issues of concern (often reactive) - for example, arsenic media campaign in response to 1990’s cluster in Buxton/Hollis area after identification of elevated levels of arsenic in local school tap water
Improving but.....?
Research Project

- **Objective**
  - Assess the impact of newspaper coverage of well water on well water testing behavior

- **Research questions**
  - Does newspaper coverage influence testing behavior?
    - If so, does the impact vary with media content?
      - Prescriptive messages (testing)
      - Framing
      - Source (DHHS/CDC, MDEP, MGS, SCI STUDY)
Prior Research – Media & Health

- The media has proven to be an important and consistent source of information on health-related issues for audiences (Schwitzer et al., 2005)

- Research shows message effects being as important, if not more important, than other forms of communication (Fishman, 2006)

- Statistical analysis can help us evaluate the effectiveness of media at changing attitudes and behaviors (e.g., Farrelly et al. 2005 and 2007)
Prior Research - Messages

- Prescriptive messaging / Efficacy
  - Messages need to explain the link between risk and individual behavior, offer recommendations, and emphasize the efficacy of the recommendations.
  - Meijnders, Midden & Wilke (2001)

- Sources
  - Reliance on expert sources (Tanner, 2004; Wallington et al., 2010)
  - “Most crucial decision in the construction of a news story is who is chosen to speak authoritatively.” (Corbett, 2006, p. 230)
Prior Research - Frames

• Loss / gain
  • Loss-frame = Detective behavior (Schneider, Salovey, Apanovitch, et al, 2001; Edwards, Elwyn, Covey, Matthews, & Pill, 2001)
  • Gain-frame = Consistent behavior change (Detweiler et al., 1999)

• Episodic / thematic
  • Public health issues are rarely framed thematically in news stories (Dorfman & Schiraldi, 2001; Dorfman et al., 2005; Lawrence, 2004)
Methods

- Bangor Daily News
- Portland Press Herald
- Kennebec Journal

- 14 of Maine's 16 Counties (USA)
Media Data (2005-2009)

- Lexus Nexus Search
- Search terms “well water”
- Excluded letters to editor or editorials
- $N = 36$ articles
Media Analysis

- Content Analysis (Riffe et al. 2005)

**Arsenic in Maine: Threat from below**

Well-water studies reveal toxic hot spots across the state, with homeowners often in the dark.

By MECHELE COOPER Kennebec Journal

READFIELD - When retired hydrologist Marc Loiselle built his home, getting safe drinking water was not one of his chief concerns.

"Then you drill a well, and surprise!" Loiselle said. "Most people assume it's fresh, pure, natural water, and perfectly safe to drink."

Loiselle found out his wasn't -- after he later had his well tested as part of a Columbia University study.

It showed arsenic levels of 30 parts per billion.

"It was below the contaminated level, so we
Select Media Content Codes

- Date (Month/Day/Year)
- Publication

- Prescription of Test
- Sources
- Frame 1
  - Episodic vs. Thematic
- Frame 2
  - Loss vs. Gain
Media Content: Sources

- DHHS/Maine CDC (CDC)
  - Maine Drinking Water Program
- Maine Geological Survey (MGS)
- Maine DEP (MDEP)
Household Testing Data (2005-2009)

- N=16,518 test results
  - Tests conducted by private households in the study region at the Maine Health & Environmental Testing Lab (QA/QC CDC Collaborators)

- Timing and spatial location
  - Date analyzed: month, day, year
  - Location: town

- Results for select contaminants
  - As, F, Mn, nitrate, nitrite, and uranium
Analysis

- Media content analysis of newspaper coverage
- Descriptive and spatial analysis of newspaper coverage and testing data
Analysis

- Count model regressing weekly tests completed on weekly media coverage (including lags), month and year fixed effects
  - 260 weeks of tests (2005-2009); more than 260+ weeks of media data (lags include weeks from end of 2004)
  - Descriptive statistics
  - Multicollinearity testing
  - Lag structure (include 7 lag terms)
  - Rejected Poisson Count Model (over-dispersed data)
  - Ran Negative Binomial Count Models
  - Tested media counts and content running independent regressions; controlled for month and year effects
  - Tested hypotheses based on parameter estimates
Articles - Annual Counts

Counts of Well Water Articles by Year

<table>
<thead>
<tr>
<th>Year</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>4</td>
</tr>
<tr>
<td>2006</td>
<td>13</td>
</tr>
<tr>
<td>2007</td>
<td>5</td>
</tr>
<tr>
<td>2008</td>
<td>5</td>
</tr>
<tr>
<td>2009</td>
<td>8</td>
</tr>
<tr>
<td>Variable</td>
<td>Mean</td>
</tr>
<tr>
<td>---------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Prescriptive Message</td>
<td></td>
</tr>
<tr>
<td>TESTPRE</td>
<td>0.17</td>
</tr>
<tr>
<td>Source</td>
<td></td>
</tr>
<tr>
<td>DHHS</td>
<td>0.22</td>
</tr>
<tr>
<td>MGS</td>
<td>0.17</td>
</tr>
<tr>
<td>MDEP</td>
<td>0.42</td>
</tr>
<tr>
<td>SCI_STUDY</td>
<td>0.14</td>
</tr>
<tr>
<td>Frame</td>
<td></td>
</tr>
<tr>
<td>FR_LOSS</td>
<td>0.64</td>
</tr>
<tr>
<td>FR_GAIN</td>
<td>0.31</td>
</tr>
<tr>
<td>FR_EPISODIC</td>
<td>0.56</td>
</tr>
<tr>
<td>FR_THEMATIC</td>
<td>0.44</td>
</tr>
<tr>
<td>Timing</td>
<td></td>
</tr>
<tr>
<td>Day (i.e. 1 to 31)</td>
<td>14.58</td>
</tr>
<tr>
<td>Month (i.e. 1 to 12)</td>
<td>6.53</td>
</tr>
<tr>
<td>Week (i.e. 1 to 52)</td>
<td>26.33</td>
</tr>
<tr>
<td>Other Content</td>
<td></td>
</tr>
<tr>
<td>Mention Testing</td>
<td>0.64</td>
</tr>
<tr>
<td>Mention Testing Cost</td>
<td>0.11</td>
</tr>
<tr>
<td>Mention Treatment Options</td>
<td>0.53</td>
</tr>
<tr>
<td>Mention State Testing Lab</td>
<td>0.19</td>
</tr>
<tr>
<td>BDN</td>
<td>0.47</td>
</tr>
<tr>
<td>PPH</td>
<td>0.14</td>
</tr>
<tr>
<td>KJ</td>
<td>0.39</td>
</tr>
</tbody>
</table>
Well Tests – Annual Counts

Completed Well Tests By Year

- 2005
- 2006
- 2007
- 2008
- 2009
<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Counts of test</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Counts by year</td>
<td>3075.80</td>
<td>685.77</td>
<td>2031</td>
<td>3775</td>
</tr>
<tr>
<td>Counts by month</td>
<td>1281.58</td>
<td>290.32</td>
<td>722</td>
<td>1687</td>
</tr>
<tr>
<td>Counts by week</td>
<td>295.75</td>
<td>73.86</td>
<td>100</td>
<td>423</td>
</tr>
<tr>
<td><strong>Timing of test</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>samp_month</td>
<td>6.48</td>
<td>3.16</td>
<td>1</td>
<td>12</td>
</tr>
<tr>
<td>samp_week</td>
<td>26.33</td>
<td>13.70</td>
<td>1</td>
<td>31</td>
</tr>
<tr>
<td>samp_day</td>
<td>15.89</td>
<td>8.73</td>
<td>1</td>
<td>52</td>
</tr>
<tr>
<td>jan</td>
<td>0.08</td>
<td>0.26</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>feb</td>
<td>0.06</td>
<td>0.24</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>march</td>
<td>0.08</td>
<td>0.27</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>april</td>
<td>0.08</td>
<td>0.26</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>may</td>
<td>0.09</td>
<td>0.28</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>june</td>
<td>0.11</td>
<td>0.31</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>july</td>
<td>0.11</td>
<td>0.31</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>august</td>
<td>0.10</td>
<td>0.30</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>sept</td>
<td>0.09</td>
<td>0.29</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>oct</td>
<td>0.09</td>
<td>0.28</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>nov</td>
<td>0.07</td>
<td>0.26</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>dec</td>
<td>0.05</td>
<td>0.21</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>2005</td>
<td>0.18</td>
<td>0.39</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>2006</td>
<td>0.23</td>
<td>0.42</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>2007</td>
<td>0.25</td>
<td>0.43</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>2008</td>
<td>0.21</td>
<td>0.41</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>2009</td>
<td>0.13</td>
<td>0.34</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>
Spatial variation in tests
Count Regression Model Results

- Overall Coverage
  - No significant relationship among media coverage and completed tests
Count Regression Model

- Prescriptive test message
  - Articles with prescriptive testing message have a positive impact on weekly testing counts
    - Increase appears 2 weeks after media coverage (1 additional article increases expected weekly test counts by 23% two weeks later)
Statewide Count Regression Model Results

- **Sources**
  - **MGS**
    - Positive relationship between weekly test counts and weekly counts of articles with MGS source (1 additional article of this type increases expected weekly test counts by 30% two weeks later)
  - **MDEP**
    - Positive relationship between weekly test counts and weekly counts of articles with MDEP source (1 additional article of this type increases expected weekly test counts by 16% two weeks later)
Statewide Count Regression Model Results

- DHHS and Scientific Study Sources
  - Negative relationship detected (1 additional article w/DHHS sources reduces expected counts by 20% four weeks later; 1 additional article w/Scientific Sources reduces expected counts by 29% two weeks later and 30% four weeks later)
Statewide Count Regression Model Results

• Frames
  • Loss / gain frame
    • No significant relationships detected
  • Episodic / thematic
    • No significant relationships detected
Discussion

- Content matters

- What variables make a difference?
  - Prescriptive messages

- Source
  - State agencies linked with natural resource and environmental protection
Discussion

- Literature offered mixed expectations for our study. Effectiveness of mass media campaigns is associated with targeted and persistent campaigns.

- Results showed no significant relationship between frame and testing behavior.

- Prescriptive recommendations did have a positive significant relationship – questions remain about source use.
Limitations

- Only snapshot in time
- Only testing at state lab
- Parsimonious regression
Future Research

- Cluster analysis of newspaper articles by content features and timing to allow for joint consideration of effects

- Isolate CDC media from other DHHS

- Comparison studies of traditional and new media platforms
Acknowledgements

- Funding and support from Maine CDC and Maine’s Sustainability Solutions Initiative (NSF Award #EPS-0904155)

i’m meSSi!
maine’s sustainability solutions initiative
<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Contaminants</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>astest</td>
<td>0.69</td>
<td>0.46</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>ftest</td>
<td>0.79</td>
<td>0.41</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>mntest</td>
<td>0.60</td>
<td>0.49</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>nrtest</td>
<td>0.59</td>
<td>0.49</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>nritest</td>
<td>0.59</td>
<td>0.49</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>utest</td>
<td>0.65</td>
<td>0.48</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>Targeted newspaper area</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BDN Market Area</td>
<td>0.76</td>
<td>0.43</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>KJ Market Area</td>
<td>0.19</td>
<td>0.39</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>PPH Market Area</td>
<td>0.27</td>
<td>0.44</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>BDN Home Delivery Area</td>
<td>0.39</td>
<td>0.49</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>KJ Home Delivery Area</td>
<td>0.03</td>
<td>0.17</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>
References
