Implementation of a Novel Intervention to Enhance Public Waterborne Disease Surveillance: Initial Findings

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Introduction: Waterborne Disease

- Waterborne disease attributable to drinking water is a national problem.
  - 16.4 million cases of enteric illnesses/year
  - 22.5 waterborne outbreaks, 10,628 cases, 14 deaths/year
  - Estimated annual costs for health care and productivity losses over $22 billion (based on 7 million cases)
- Concern for emerging infectious diseases and bioterrorist activity is increasing.

Introduction: Waterborne Disease

- Contaminated source water
- Contamination within distribution systems via intrusion events
  - Accidental events, e.g., water main breaks
  - Deliberate events, e.g., terrorism

Surveillance of Waterborne Disease

Passive Surveillance

- **Water Utilities:**
  - Monthly water quality tests
- **Health Departments:**
  - Investigate disease reports
- **Advantages:**
  - Cheap, operational
- **Disadvantages:**
  - Utilities: insensitive to intermittent contamination
  - Health Departments: time delays, under-reporting

Syndromic Surveillance

- Integrated Model
  - **Health departments** utilizing **Water Utility** databases
- **Advantages:**
  - Offer "real-time" data
  - Increased sensitivity
- **Disadvantages:**
  - Interfacing systems
  - Interpretation of "alarms"
  - Utility database: not validated

Methods: Study Design

- Community Exposure Study
  - Exploratory Study

Methods: Objectives

- Evaluate the efficacy of customer reports of water quality concerns
  - Aesthetic concerns:

    Taste/odor, color, dirt, cloudy
  - Illness concerns: gastrointestinal, rash
  - Other concerns: pressure, outages, suspicious activity
- Evaluate the efficacy of expanded panel of water quality tests

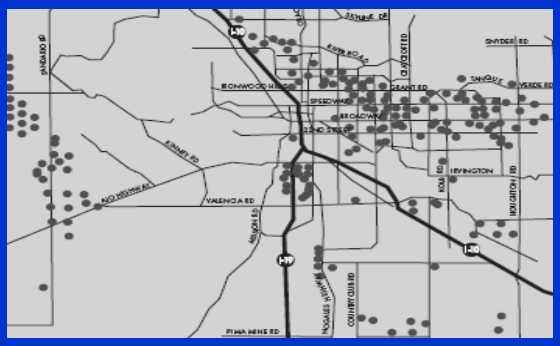
Expected Outcome

- Enhanced water surveillance model that includes standardized water utility protocols:
  - Assess exposure based on type of customer concern
  - Record and assess suspected tap water illnesses
  - Appropriate triggers to public health department
    - Minimize investigation of "false alarms"
    - Facilitate coordinated early investigation of WBDOs

Methods: Sample Population

- **Sample**:
  - Tucson Water customers residing in and around the metropolitan city of Tucson (775,000 customers)
  - Callers with water quality concerns

Methods: Distribution System



Challenges:

- Largest public water system in southern Arizona
- Over 200 individual groundwater wells with varying water quality
- In 2008 groundwater wells met U.S. EPA standards
- < 0.5% monthly water quality tests positive for coliform bacteria and 0% for *E. coli*

Methods -- Sequence of Events:

Water contamination event

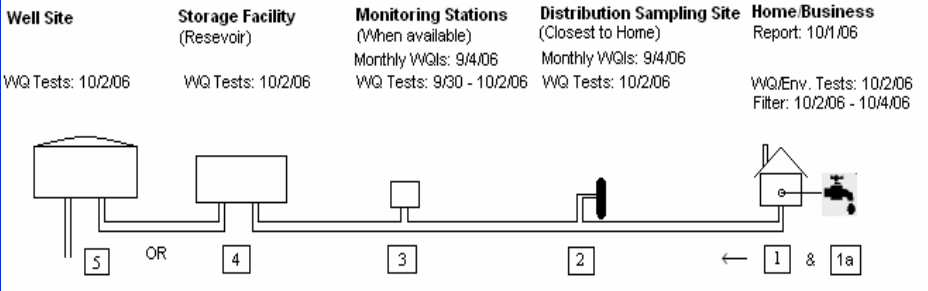
Exposure

Early detection facilitates earlier response

Customer Concerns

Potential numbers affected

Methods – Assessment and Monitoring:



Enhanced assessment of customers' water quality concerns:

- Expanded panel of indicator tests : bacterial, viral, chemical
- 45- item exposure assessment to evaluate reported symptoms, and risk factors to other exposures, e.g., food, animals, person-to-person

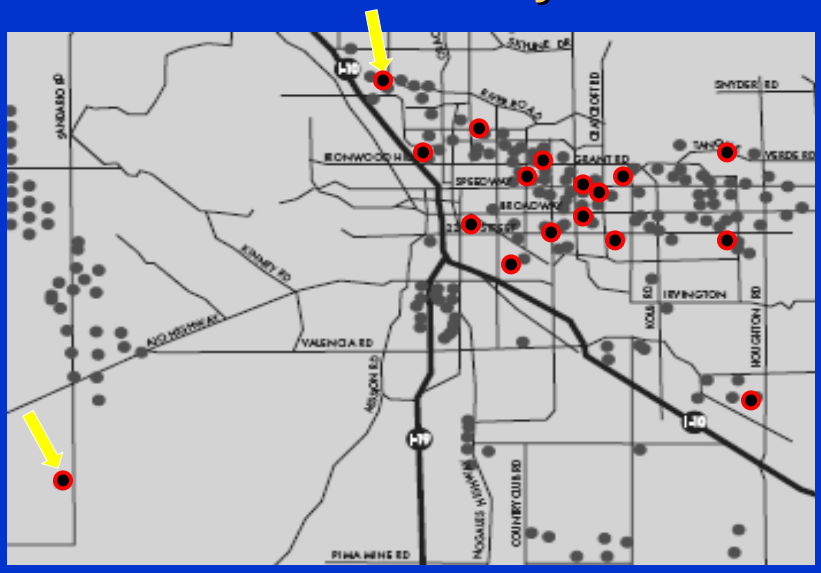
Preliminary Results

- 19 households enrolled
- Exposure data collected on 38 subjects
- 8 (42%) of households with suspected tap water illnesses

Results/Demographic Data:

- Enrollment: 19 households/38 subjects
- Age Range:
  - 22 (58%) 25 -64 years of age
  - 7 (24%) ≥ 65 years of age
- Racial/Ethnic
  - 32 (83%) Non-minority
  - 6 (17%) Minority
- Health Status:
  - 20 (53%) : excellent or very good
  - 7 (19%): underlying chronic medical condition

Results: Distribution System Trends



Yellow Arrows: Neighborhood Trends Detected

Results/Field Investigations

- Validated customers water quality concerns
  - Majority of concerns linked to premise plumbing
  - Limited trends detected in the distribution system; none related to microbial contamination
    - Impurities: rust, discolored water, vegetable oil
    - Reduced chlorine level
    - High chlorine level
    - Elevated electroconductivity levels
    - Air

Results/Exposure Assessment

- Primary source of drinking water:
  - 5 (26%) households tap water without home treatment
- Tap water consumption (following concern):
  - 11 (58%) reduced consumption (brushing teeth/bathing)
  - 2 (11%) restricted use (bathing or none)
- Neighbor with similar water quality concern:
  - 7 (37%) communicated concern to ≥ one neighbor
    5: no concerns; 2: similar concern
  - 12 (63%): unaware

Conclusions

- Customers' water quality concerns were validated
  - Majority concerns linked to premise plumbing
  - Two neighborhood trends detected
    - None related to microbial contaminants
- Study results valuable information for the utility
- Customers report high satisfaction
- No investigation of "false alarms" by health department

Unresolved Issues

- Sample point trends detected were unrelated to customer water quality concerns
  - Taste/odor concerns linked to low chlorine residual and other impurities in the distribution system
- Additional water quality tests needed to assess water quality concerns
  - Unknown whether elevated electroconductivity tests in the distribution system are linked to organic or inorganic sources

Limitations

- Preliminary results
- Non-representative sample
  - Other customer concerns linked to distribution events may have occurred that were not reported and therefore not evaluated

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