How Water and Sanitation Services Affect Health in Rural Alaska

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Centers for Disease Control and Prevention
Proportion of US homes with complete plumbing, 1940 - 2010
# Homes without Complete Plumbing, American Community Survey, 2008-12

<table>
<thead>
<tr>
<th>Census Region</th>
<th>Percentage Without Complete Plumbing</th>
<th>Rank among US Counties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bethel</td>
<td>39%</td>
<td>1</td>
</tr>
<tr>
<td>Yukon-Koyukok</td>
<td>39%</td>
<td>2</td>
</tr>
<tr>
<td>Wade Hampton</td>
<td>36%</td>
<td>3</td>
</tr>
<tr>
<td>Northwest Arctic</td>
<td>20%</td>
<td>4</td>
</tr>
<tr>
<td>Nome</td>
<td>20%</td>
<td>5</td>
</tr>
<tr>
<td>Lake and Peninsula</td>
<td>17%</td>
<td>6</td>
</tr>
<tr>
<td>North Slope</td>
<td>13%</td>
<td>10</td>
</tr>
</tbody>
</table>
RELATIONSHIP OF ENVIRONMENTAL FACTORS TO ENTERIC DISEASE

ASCARIS AND SHIGELLA INFECTIONS
ACCORDING TO SELECTED SANITARY FACILITIES

Eastern Kentucky, 1954-1956

<table>
<thead>
<tr>
<th>Condition</th>
<th>Off Premise</th>
<th>On Premise</th>
<th>Privy Only</th>
<th>Flush Toilet</th>
</tr>
</thead>
<tbody>
<tr>
<td>WATER OUTSIDE DWELLING</td>
<td></td>
<td>43</td>
<td>41</td>
<td>25</td>
</tr>
<tr>
<td>WATER INSIDE DWELLING</td>
<td></td>
<td></td>
<td></td>
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<tbody>
<tr>
<td>Shigella Prevalence</td>
<td></td>
<td>6.0</td>
<td>5.8</td>
<td>2.4</td>
</tr>
<tr>
<td>in Preschool Children</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Public Health Monograph No. 54-1958 (PHS Publication No. 591)
Does the lack of in-home water and sanitation services affect the health of Rural Alaska people?
Hierarchy of Water Requirements

- Drinking
- Cooking
- Personal hygiene
- Washing clothing
- Cleaning home
Water-related Infections

• **Water-borne**
  – Pathogen ingested with water
    • Cholera, other enteric infections

• **Water-washed**
  – Person-to-person transmission
  – Lack of water for hygiene
    • Skin infections, trachoma

• **Water-based**
  – Aquatic intermediate host
    • Schistosomiasis, guinea worm

• **Water-related insect vector**
  – Insects breed or bite near water
    • Malaria, dengue

*“Drawers of Water”; White, Bradley, White; U of Chicago Press, 1972*
Incidence of pneumonia in children younger than 5 years, Pakistan

Effect of handwashing on child health: a randomised controlled trial. S. Luby, M. Agboatwalla, D. Feikin
The Lancet, 2005; (366) 9481
Hospitalization Rates for “High” and “Low” Water Service Regions, Alaska, 2000-2004

Hennessy, AJPH, 2008
Serious infections with Pneumococcus in children < 5 years old, Southwest Alaska, 2001-2007

* J Wenger, 2010, Pediatric Infectious Diseases
Hospitalization rates for Alaska Native infants, by percent of community homes with water service 1999 - 2004*

* Hennessy, AJPH, 2008
Hospitalization rates for Alaska Native infants, according to percent of homes with water service 1999 - 2004*

* Hennessy, AJPH, 2008
Skin infection rates, all ages, by village water service, Southwest Alaska, 1999 - 2000

Bar chart showing skin infection rates per 1,000 persons for Staphylococcus aureus, MRSA, and hospitalized rates. The rates are categorized by water service type: < 10%, 10 - 79%, and >= 80%. The chart indicates a range of rates for each category, with different colors representing the water service types.
Skin infection rates, all ages, by village water service, Southwest Alaska, 1999 - 2000

- Rate per 1,000 persons

- Water Service
  - < 10%
  - 10 - 79%
  - >= 80%

- Water Service - 50%
What happens when communities receive in-home piped water?

- 4 villages in SW Alaska 2007 – 2012
  - From honeybuckets to piped delivery
- Water use increases
  - 1 - 2 gallons / person / day to 25 gallons
  - Improved hand hygiene
- Fewer infectious disease clinic visits
  - Respiratory: - 21%
  - Skin: - 19%
  - Diarrhea: - 40%
- People feel healthier

ANTHC and CDC, unpublished data, 2014
Dental Cavities (Caries)
Dental Cavities in Rural Alaska Children

• Survey of 5 YKHC Communities, 2008
  – 87% of 4 - 5 year olds with cavities
    • Number 5X higher than US general pop.
  – 400 full mouth dental restorations
    • 600 births per year
    • Approximately 20% of 4 - 6 year olds

Morbidity and Mortality Weekly Report (MMWR), Sept 2011
Full Mouth Reconstructions

- General Anesthesia
- Multiple extractions
- Restorative procedures
  - Fillings
  - Crowns
- Cost: $9000
  - Medicaid
Are Dental Cavities a Water-washed Disease?

• Access to in-home running water can affect:
  – Tooth brushing habits
  – Soda consumption
  – Access to optimally fluoridated water
    • 5 YKHC communities fluoridate water
    • 17 others could fluoridate
      – Piped distribution, adequate facilities
    • 26 communities can’t provide fluoridated water
Number of Dental Caries in Primary Teeth by Village Fluoridation Status

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Mean number of dental caries</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 – 5</td>
<td>9.8</td>
</tr>
<tr>
<td>6 – 11</td>
<td>3.7</td>
</tr>
<tr>
<td>4 – 5</td>
<td>3.1</td>
</tr>
<tr>
<td>6 – 11</td>
<td>1.8</td>
</tr>
</tbody>
</table>

MMWR, Sept 2011
Summary

• In-home water service is linked to health in rural Alaska
  – Quantity of water is likely key factor

• Expanding access to adequate supplies of in-home water will likely improve health status for
  • Respiratory infections
  • Skin infections
  • Severe bacterial infections
  • Dental cavities
  • Other diseases?
Remaining Questions

• What are the healthcare costs associated with lack of in-home water?

• What are the long-term health consequences due to lack of in-home water service?
  – Meningitis: deafness, cognitive function
  – Chronic lung disease
  – Poor dentition
Healthy Alaskans 2020

• 25 leading health indicators
  – Critical health priorities for Alaska

• Indicator #19
  – “Increase the proportion of Alaskans with access to in-home water and wastewater services”
    • % of rural community housing units with water and sewer services
      • 2010: 78%
      • Target: 87%
Thanks to...

- **CDC**
  - Dana Bruden
  - Lisa Bulkow
  - Michael Bruce
  - Kathy Byrd
  - Bob Holman
  - Jay Wenger
  - Charisma Atkins
  - Martin Meltzer

- **ANTHC**
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  - Jeff Smith
  - Timothy Thomas
  - Ros Singleton

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  - Joe Klejka
  - Dane Lenaker