

Health effects of loss of water/sanitation service

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What's ahead?

■ Part I.

- Discuss links between water and health
- What happens to health when water and sewer services break down?
 - Kivalina
 - Alabama

■ Part 2

- Preparedness for water emergencies
- Health considerations

Factors Linking Water to Health

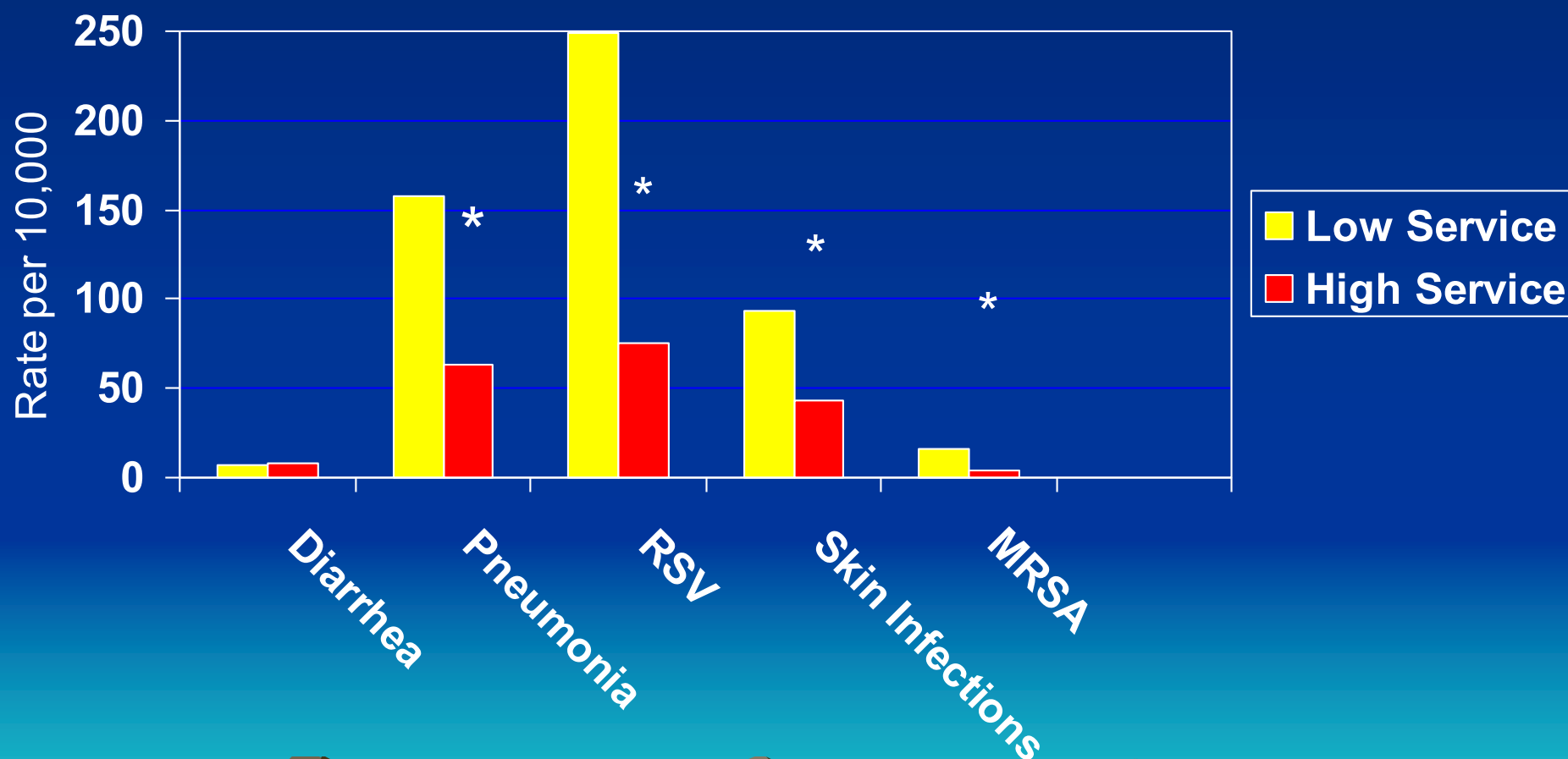
- **Water Quality**

- Prevents illness from drinking water
 - Water-borne diseases
 - Cholera, Typhoid, toxin-mediated

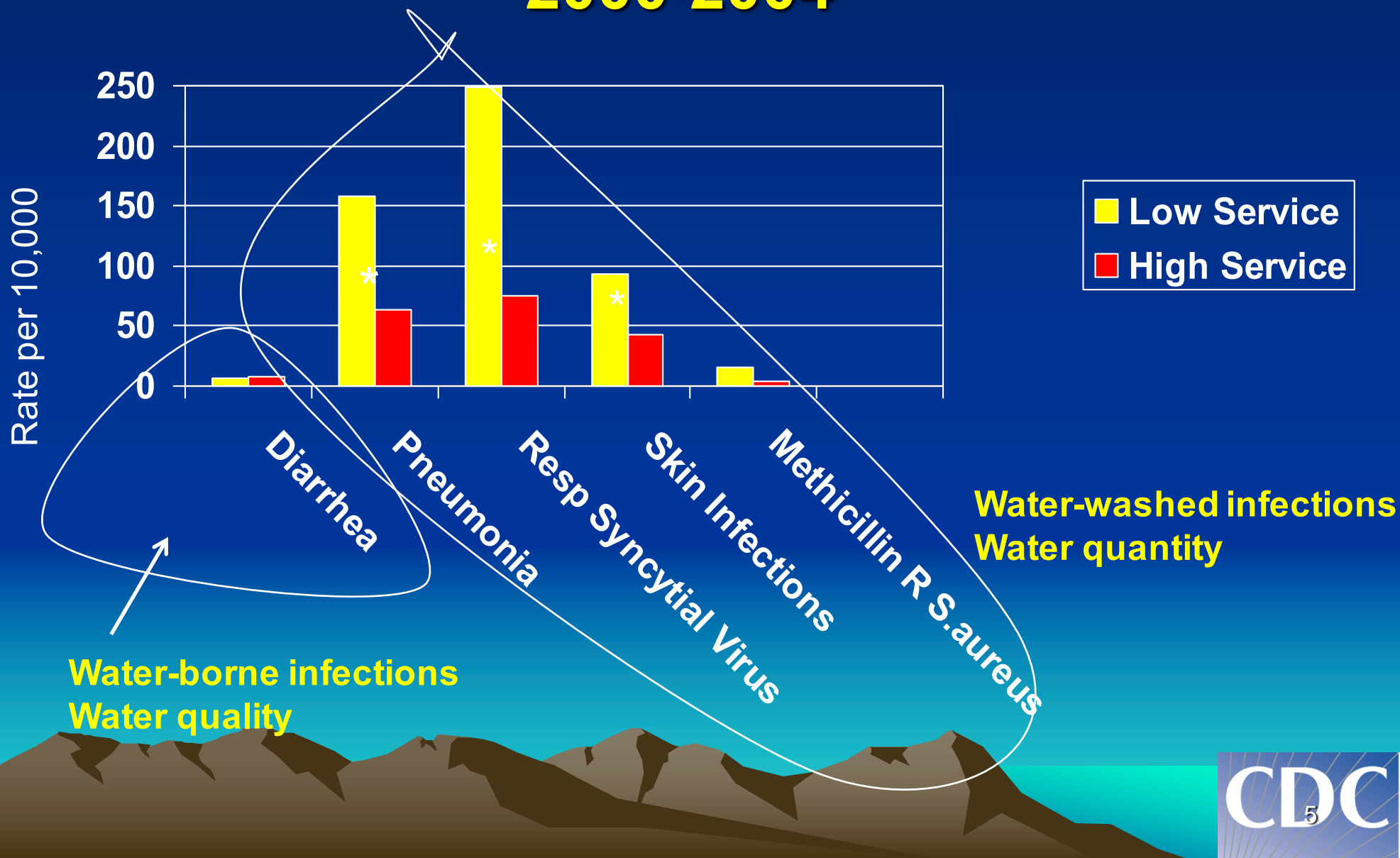
- **Adequate water Quantity**

- Drink, cook, wash: hands, body, clothes
- Prevents infections spread person-to-person
 - Water-washed diseases
 - Trachoma, respiratory infections, skin infections

Hospitalization Rates for “High” and “Low” Water Service Regions, Alaska, 2000-2004



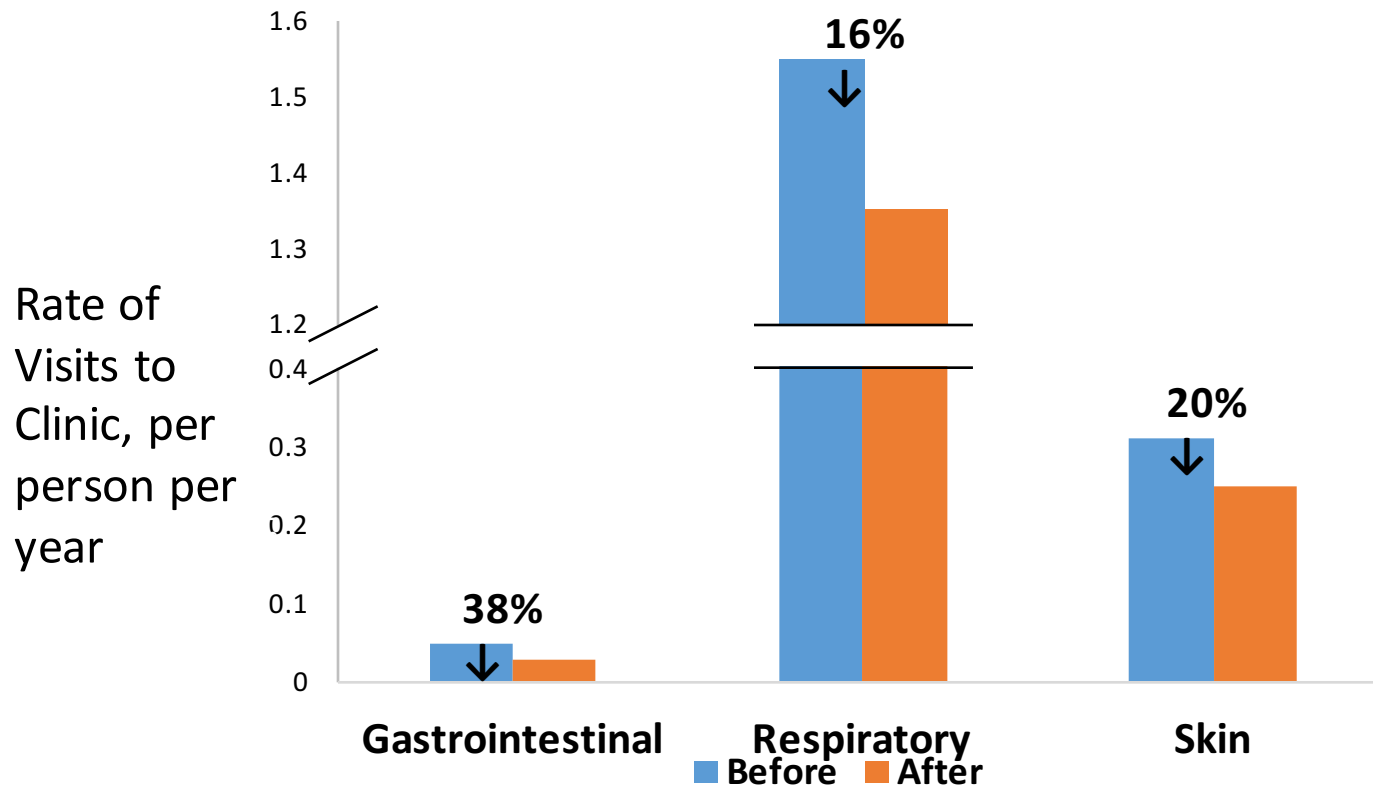
Hospitalization Rates for “High” and “Low” Water Service Regions, Alaska, 2000-2004



Infectious Diseases in Rural Alaska Communities Without In-home Water Service

- **Water-washed diseases**
 - Infant pneumonia hospitalizations
 - 2x higher
 - Skin infection hospitalizations, all ages
 - 2X higher
 - Serious bacterial infections in children
 - 2X higher
 - Dental caries (cavities) in children
 - 3x higher

Clinic visits for Water-related Infections Before and After Installation of Running Water, 4 villages in SW Alaska, 2007 -2013



Challenges

- **Illness outcomes may be rare**
 - Hospitalizations uncommon
 - Clinic visits
 - Lots of illness not documented
- **Small populations involved**
- **Multiple disease risk factors**
 - **Shigella infection sources**
 - Water, food, person to person, fomites

Published evidence of water/sewer service and health in Alaska

- Non-outbreak setting
 - Look-back evaluations (~5)
 - Served vs. unserved communities
 - 1 Prospective study: “4 village study”
- Outbreaks

Waterborne Illness Outbreaks in Alaska, Reported to CDC

- 1971 - 2009, drinking water sources
- 15 events
 - 6 bacteria
 - 2 chemical: copper, fluoride
 - 5 Giardia
 - 2 unidentified cause
- 6 community sources
 - 3 mobile home parks, 1 boat, 3 municipal



Published evidence linking water and sewer service to health in Alaska

- Non-outbreak setting
 - Look-back evaluations (5)
 - Served vs. unserved communities
 - 1 Prospective study: “4 village study”
- Outbreaks
 - **Rare events**
- Loss of water service events
 - Kivalina washeteria closure

Washeteria closures, infectious disease and community health in rural Alaska: a review of clinical data in Kivalina, Alaska

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Int Journal Circumpolar Health, 2013

Kivalina, pop 400

- No in-home piped service
- 2004 storm damaged washeteria septic
 - Intermittent, prolonged closure of facility
 - Affected bathing and laundry
 - Retained access to potable water
- 2009
 - ANTHC Center for Climate/ Health, CDC
 - Assessed health impact
 - Documented washeteria closures
 - Clinic visitation data
 - Gastrointestinal, respiratory, skin infections

Illness visit rates

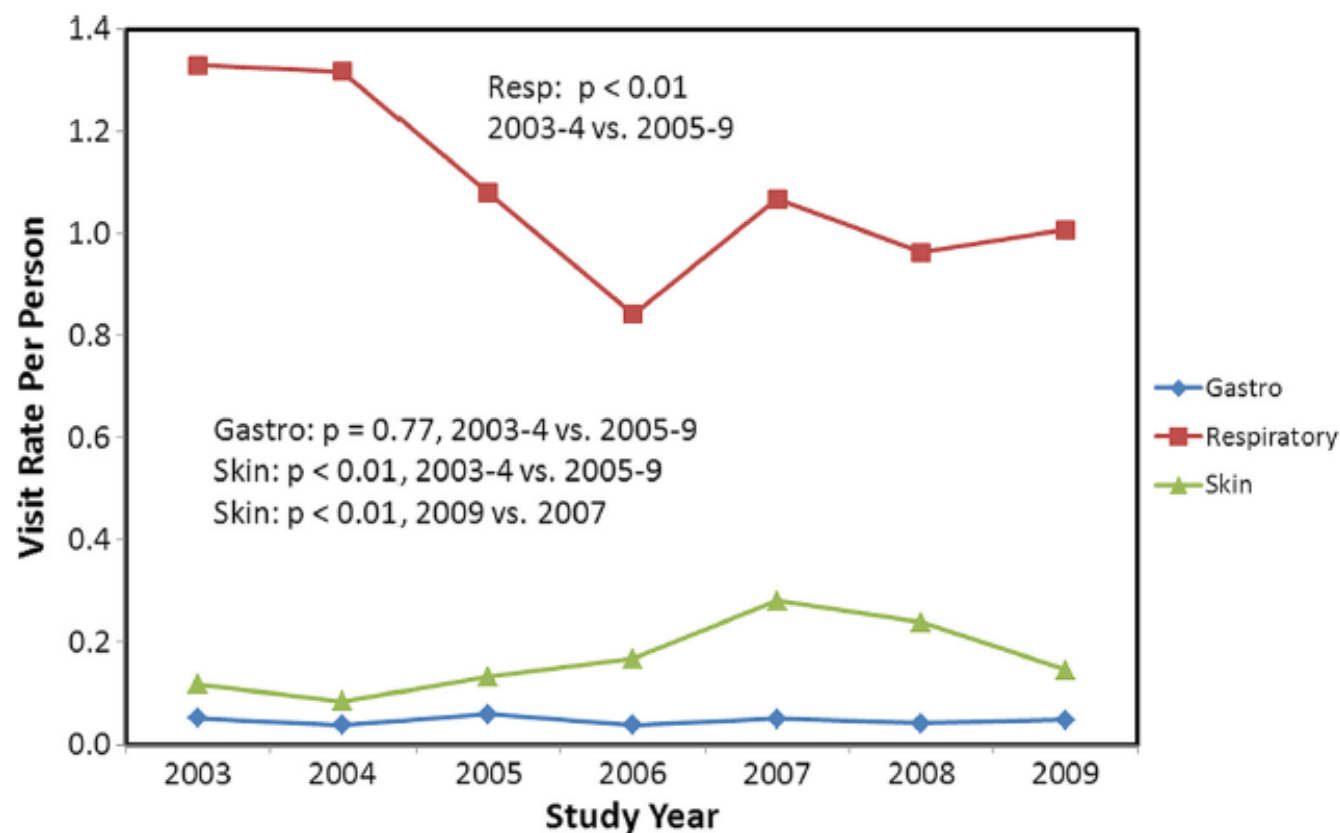


Fig. 2. Rates of gastrointestinal, respiratory and skin infection visits per person for the village of Kivalina by study year for all ages combined.

Illness rates and washeteria closures

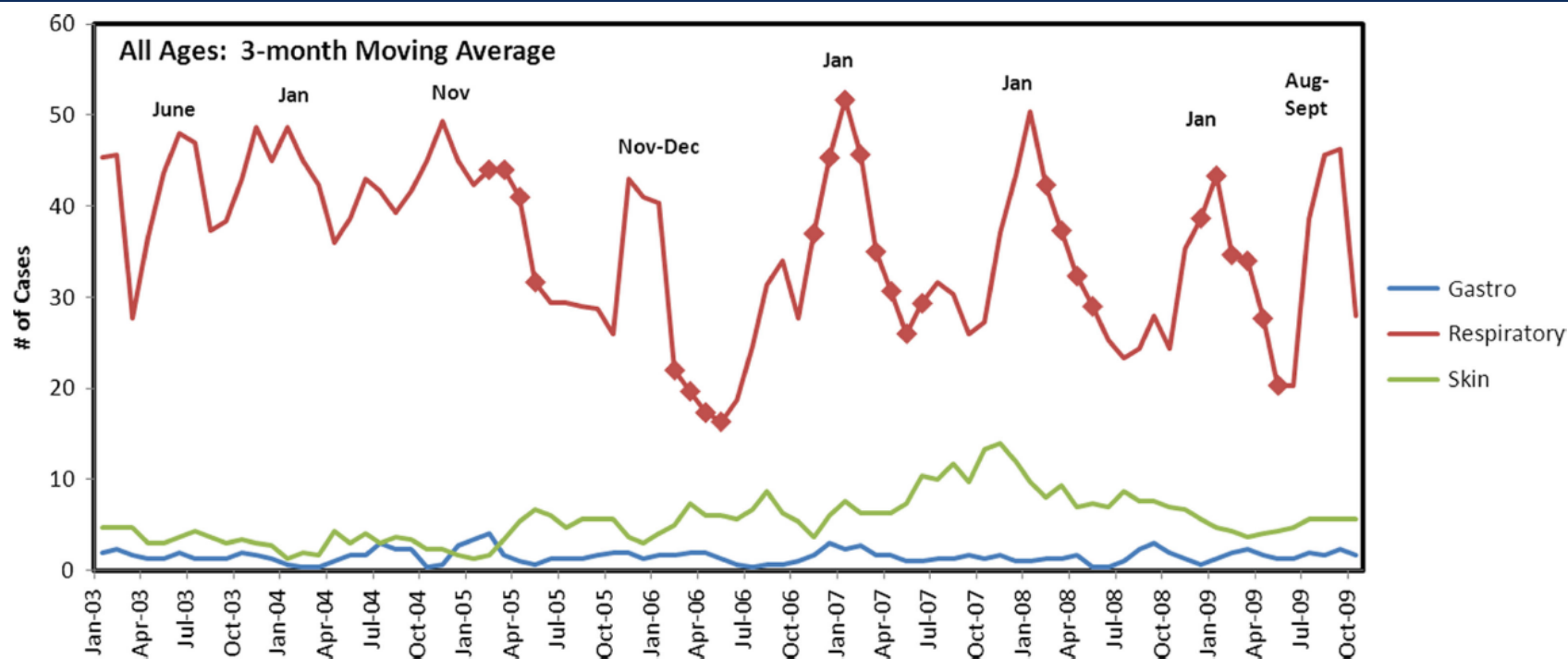


Fig. 3. Number of cases of gastrointestinal, respiratory and skin infection visits by year and month at the Kivalina clinic. Respiratory data points from months where washeteria was shut down for the entire month are marked with a diamond marker.

Conclusions

- No sustained increase in illness resulting from closures of washeteria
 - No correlation of illness with closures
 - Slowly evolving, intermittent service loss
 - Community adapted to lack of service
 - Increased use of in-home washing machines
- Respiratory infections most common
 - Declined, possibly due to increased vaccine use
- Skin infections increased then declined
- Gastrointestinal infections low, stable

S. Alabama Big Freeze

By CBSNEWS / CBS/AP / January 9, 2010, 8:24 AM

The Deep Freeze of 2010



Stuart Davis, 58, clears snow from a roof Friday, Jan. 8, 2010, in Hunting Valley, Ohio. In Ohio, the Weather Service warned of a possible lake effect: arctic air blowing over the Great Lakes, picking up moisture and carrying it inland, creating narrow bands of heavy snow. A winter storm warning is in effect until Saturday morning. (AP Photo/Tony Dejak) / **AP PHOTO/TONY DEJAK**

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Last updated at 11:50 p.m. Eastern time

The unyielding cold spell gripping much of the nation was expected to hang on tight over the weekend, though some areas that saw snowfall during the week were expected to have drier weather.

S. Alabama Big Freeze

- Jan 8 – 19, 2010
 - Low temperatures 12 - 21 degrees F
 - Water main breaks, residential pipe failures
 - Low pressure events, loss of service
- 18,000 people in 2 counties
 - Service loss of > 1 week
 - Surface water source disinfected with chlorine
 - No recognized outbreak of illness
- Investigation of household water exposure and illness

Methods

- Interviews of households
 - Statistical sample
 - Asked about gastro, respiratory, skin and eye illnesses
 - 6 weeks after freeze event
- Survey of business, clinics, hospitals, gov't

Results

- 470 households participated (77%)
 - 1283 persons
- 18% had no water service > 7 days
- Variable adherence to boil water notice
- Illness reported
 - GI: 8%
 - Respiratory: 15%
 - Skin: 2%
 - Eye: 1%

Results, II

■ Risk factors for GI illness

- Lost water service and had low pressure
 - 3x increased risk
- Length of loss of service
 - 2.5 X increase if > 7 days
- Use of unboiled tap water
 - 3X increased risk

■ Risk for respiratory illness

- Increased with longer time with low pressure
 - Marginal statistical finding

Results, III

- ½ of homes had stored water on-hand
 - < 10% had > 5 gallons
- 23% homes consumed unboiled tap water
- Emergency and government officials
 - Community not sufficiently prepared
 - Plans not in place
 - Little collaboration with utilities
 - Chain of command not clear
 - Bottled water distribution didn't meet needs
 - Especially vulnerable populations
 - Elderly, disabilities, high medical risk

Conclusions

- Failure of water system led to increased
 - Gastro intestinal illness
 - Some increase in respiratory illness
- An outbreak was not recognized
 - By clinic, hospital, or public health officials
- Better preparation needed for water emergencies

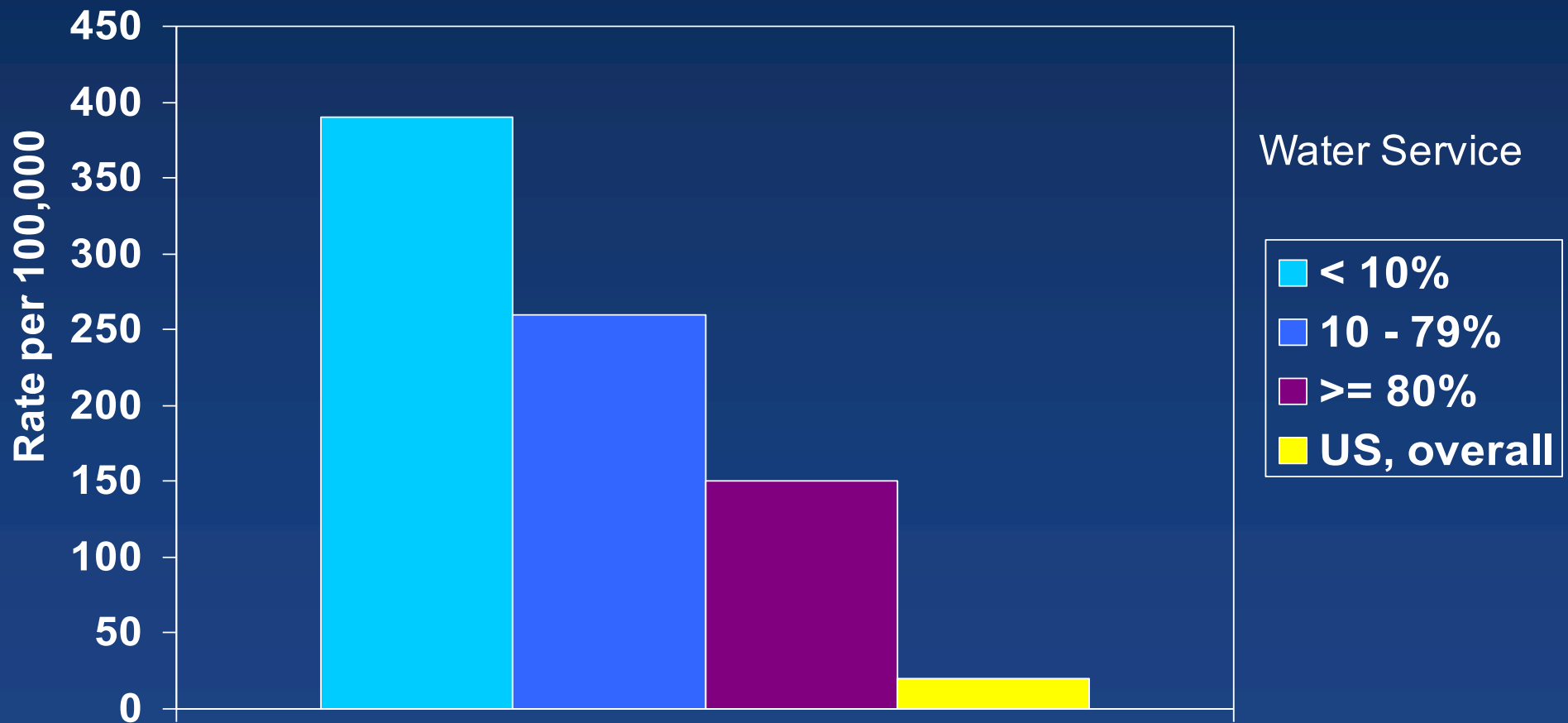
Thank you!

Waterborne Illness Outbreaks in Alaska, Reported to CDC, 2

- **Infectious, community sources (6)**
 - Anchorage, 1971, Shigella, 89 cases
 - Untreated ground water
 - Old Harbor, 1973, Shigella, 50 cases
 - Treatment deficiency
 - Juneau, 1974, Salmonella, 34 cases
 - Treatment deficiency
 - Unnamed Community, 1976, Shigella, 25 cases
 - Untreated surface water
 - Barge Unisea, 1980, Giardia, 189 cases
 - Plumbing system deficiency
 - Ketchikan, 1984, Giardia, 177 cases
 - Treatment deficiency



Serious Infections with Pneumococcus in Children < 5 years old, Southwest Alaska, 2001-2007



* Wenger, 2010, Pediatric Infectious Diseases

Ketchikan 1984

- **Aug through Nov**
 - **Giardiasis**
 - **177 cases**
 - Most from Carlanna Lake area
 - **City water was common source**
 - Carlanna Lake pretreatment water
 - giardia +
 - Construction was ongoing during this time



Hierarchy of Water Requirements

