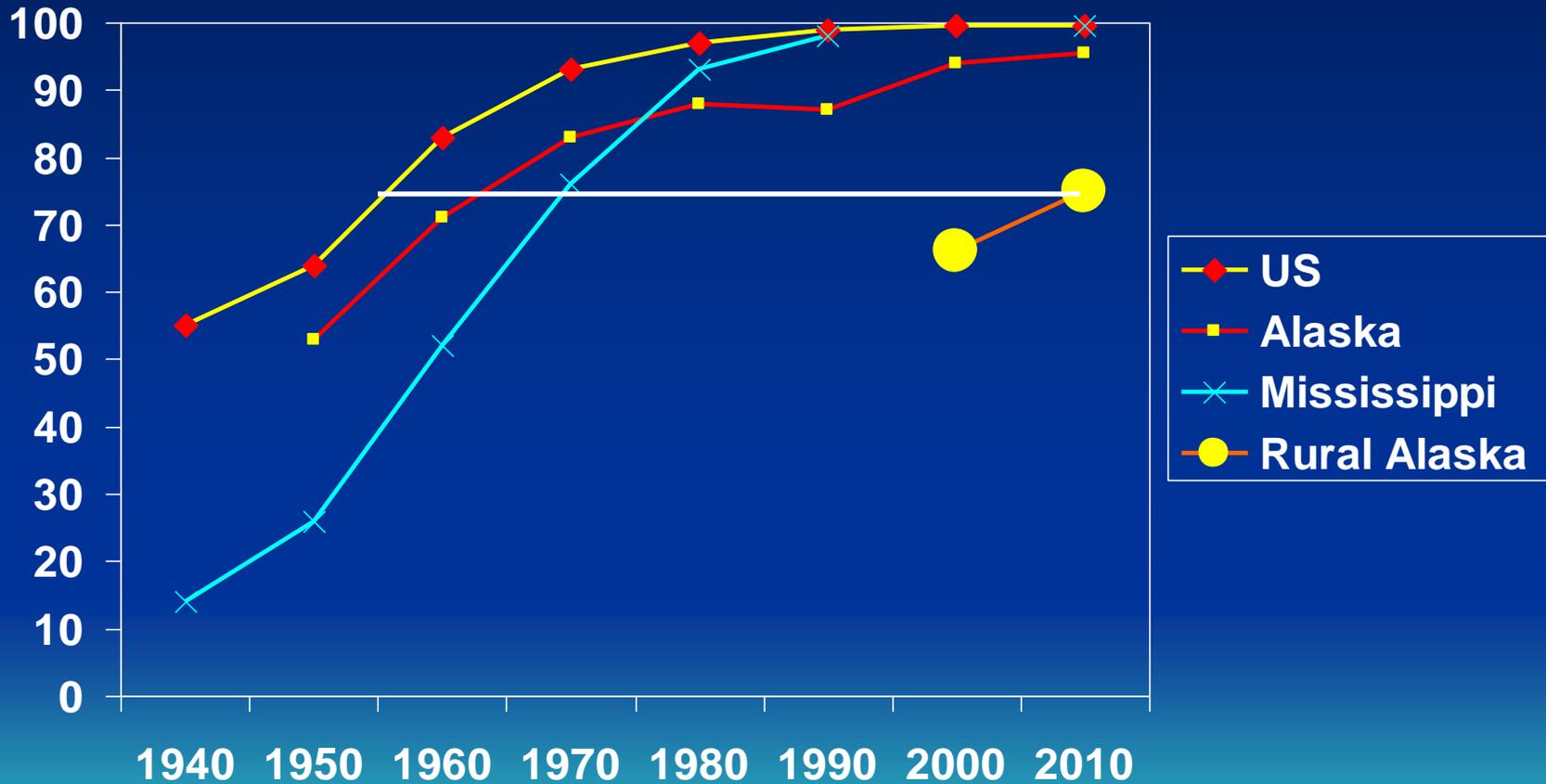


How Water and Sanitation Services Affect Health in Rural Alaska

Tom Hennessy, MD, MPH
Arctic Investigations Program
Centers for Disease Control and
Prevention



Proportion of US homes with complete plumbing, 1940 - 2010

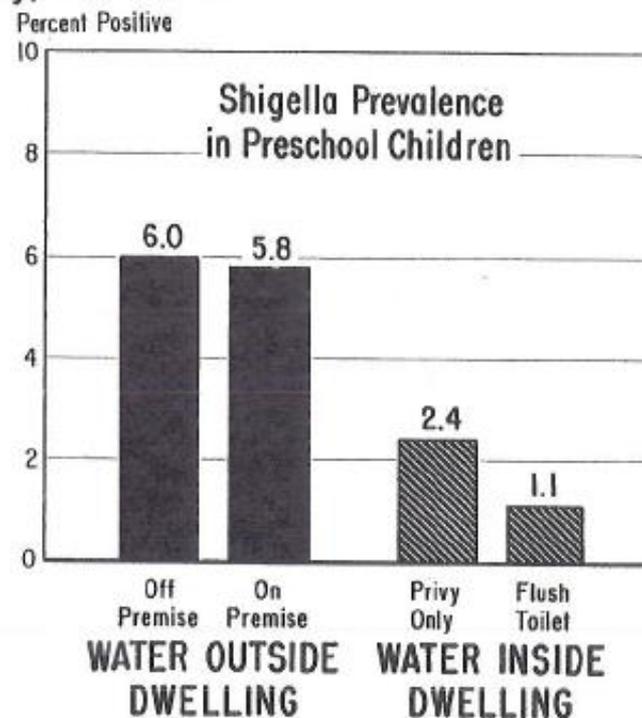
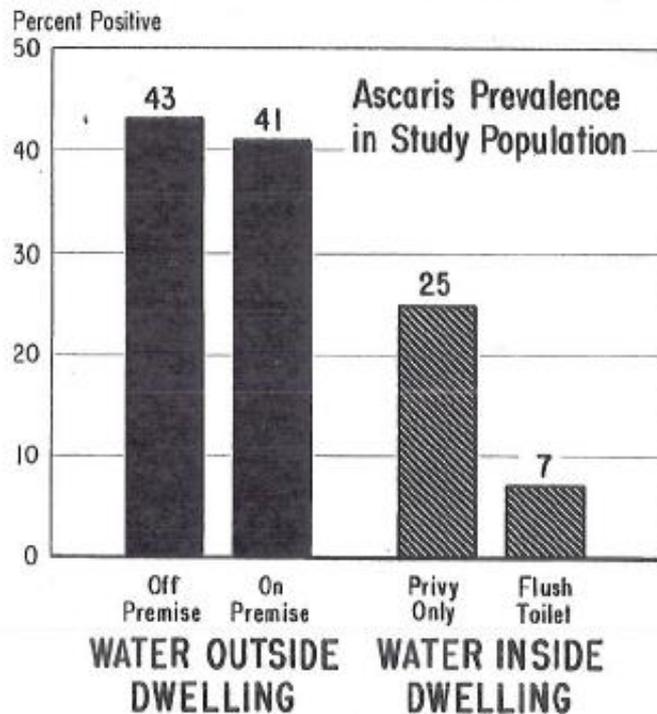


Homes without Complete Plumbing, American Community Survey, 2008-12

Census Region	Percentage Without Complete Plumbing	Rank among US Counties
Bethel	39%	1
Yukon-Koyukok	39%	2
Wade Hampton	36%	3
Northwest Arctic	20%	4
Nome	20%	5
Lake and Peninsula	17%	6
North Slope	13%	10



RELATIONSHIP OF ENVIRONMENTAL FACTORS TO ENTERIC DISEASE
ASCARIS AND SHIGELLA INFECTIONS
ACCORDING TO SELECTED SANITARY FACILITIES
 Eastern Kentucky, 1954-1956



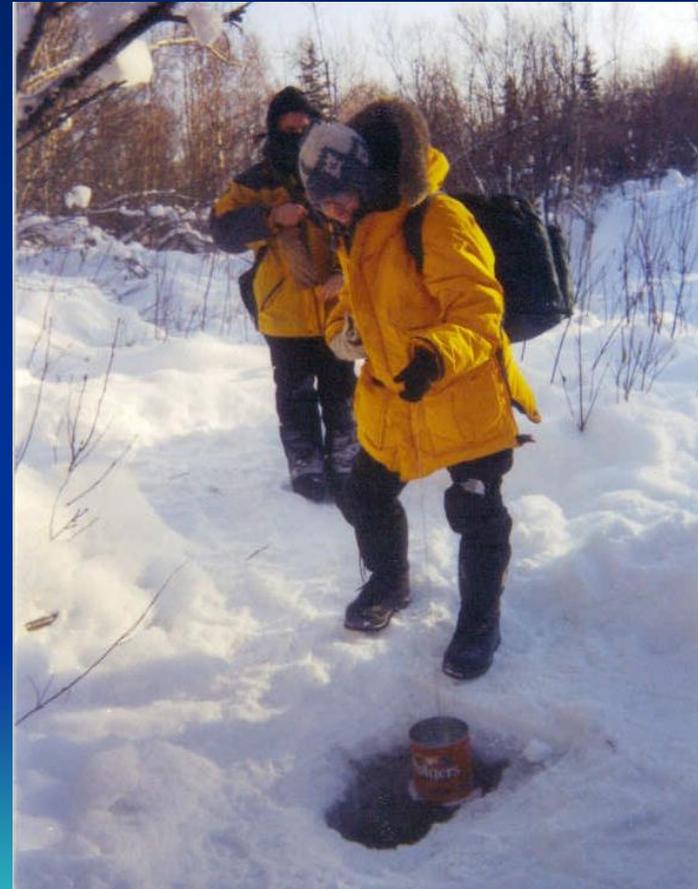
Source: Public Health Monograph No. 54-1956 (PHS Publication No. 591)

Does the lack of in-home water and sanitation services affect the health of Rural Alaska people?





Hierarchy of Water Requirements

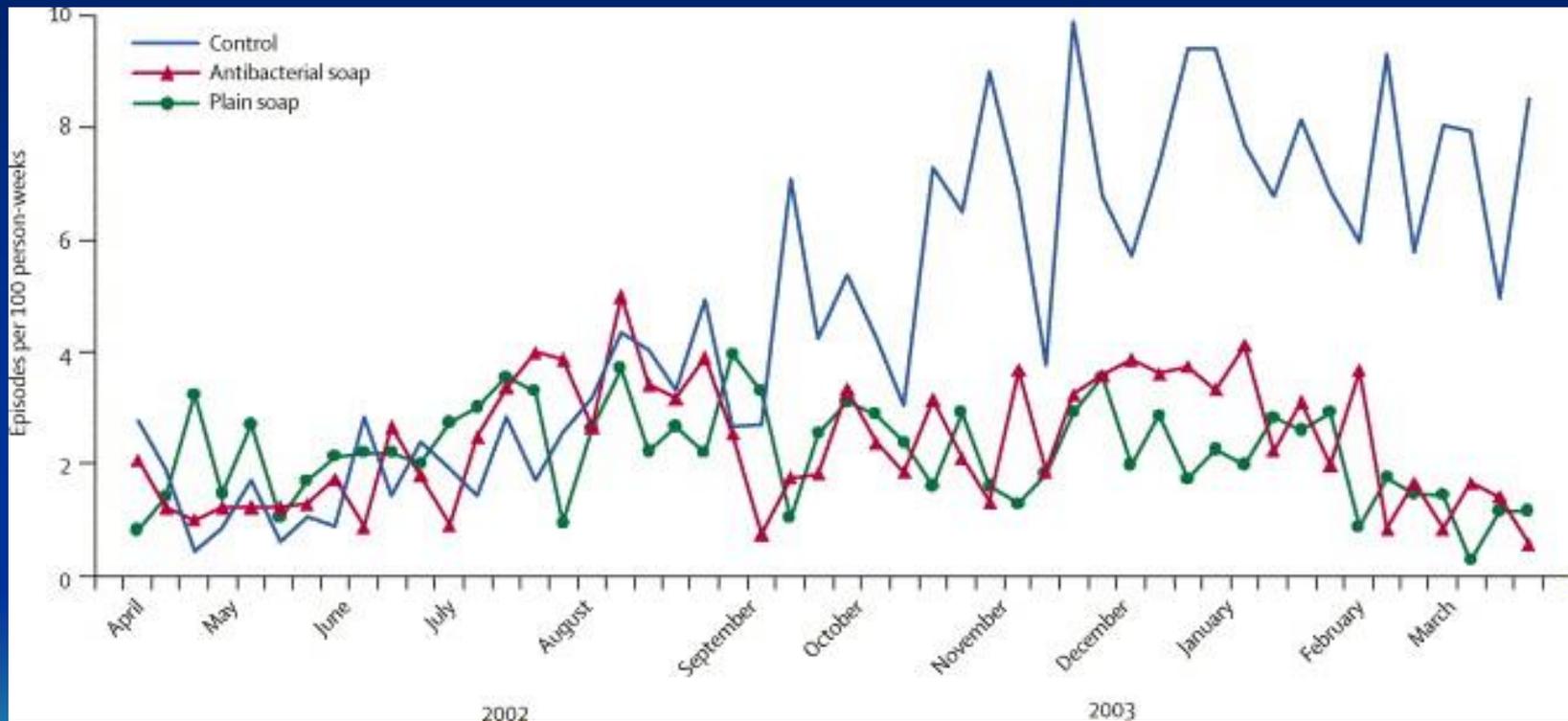


Water-related Infections

- **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

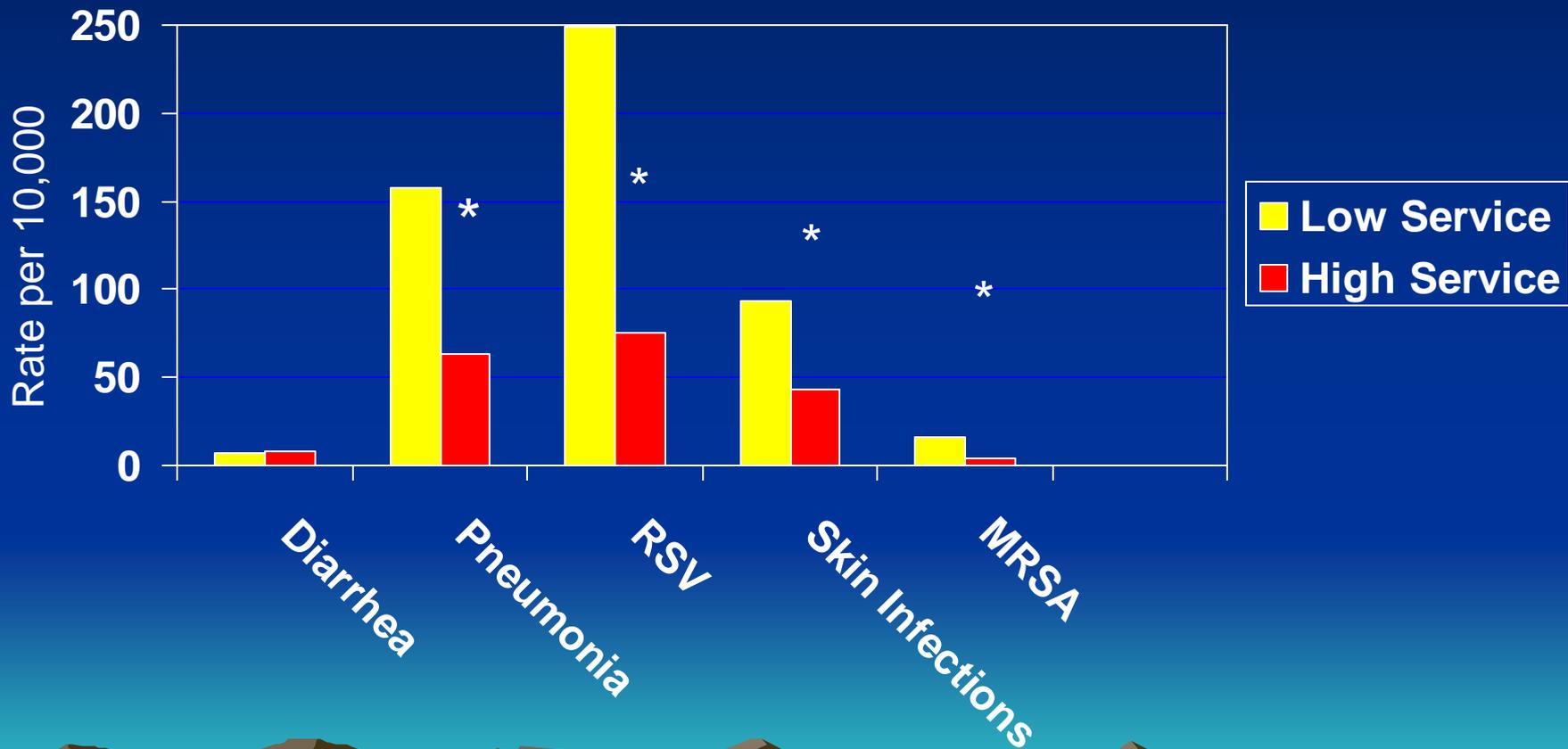
* “Drawers of Water”; White, Bradley, White; U of Chicago Press, 1972

Incidence of pneumonia in children younger than 5 years, Pakistan

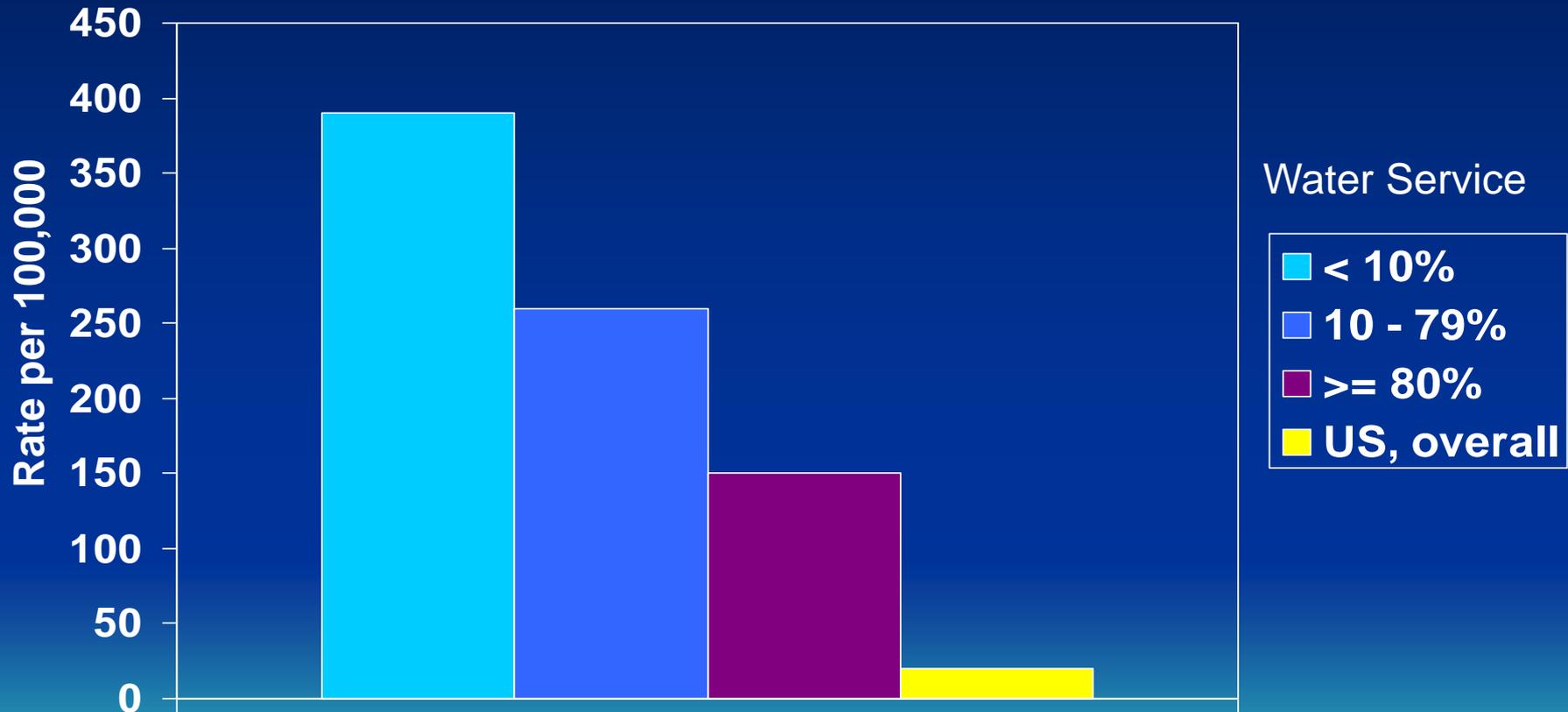


Effect of handwashing on child health: a randomised controlled trial. S. Luby, M. Agboatwalla, D. Feikin
The Lancet. 2005: (366) 9481

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

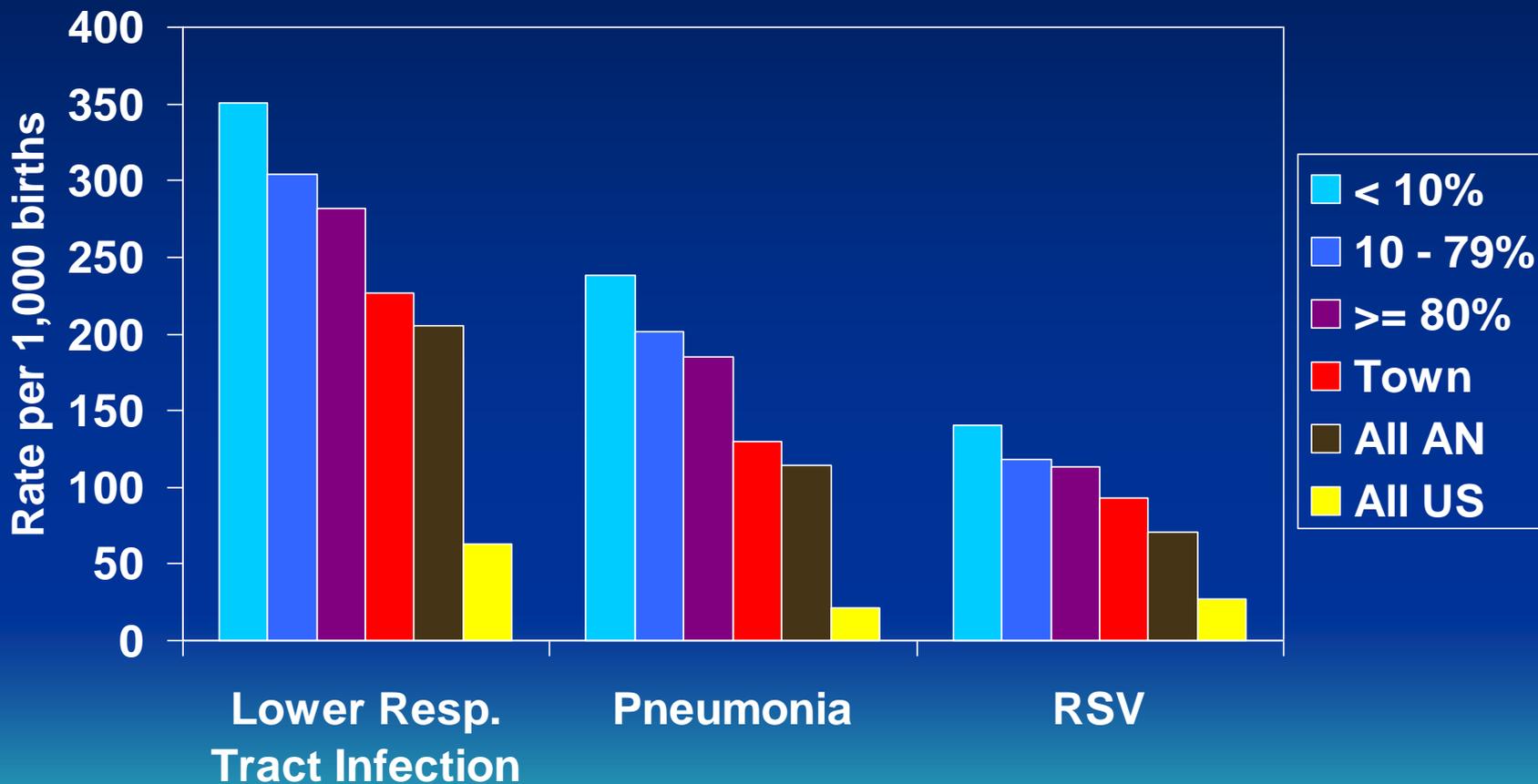


Serious infections with Pneumococcus in children < 5 years old, Southwest Alaska, 2001-2007



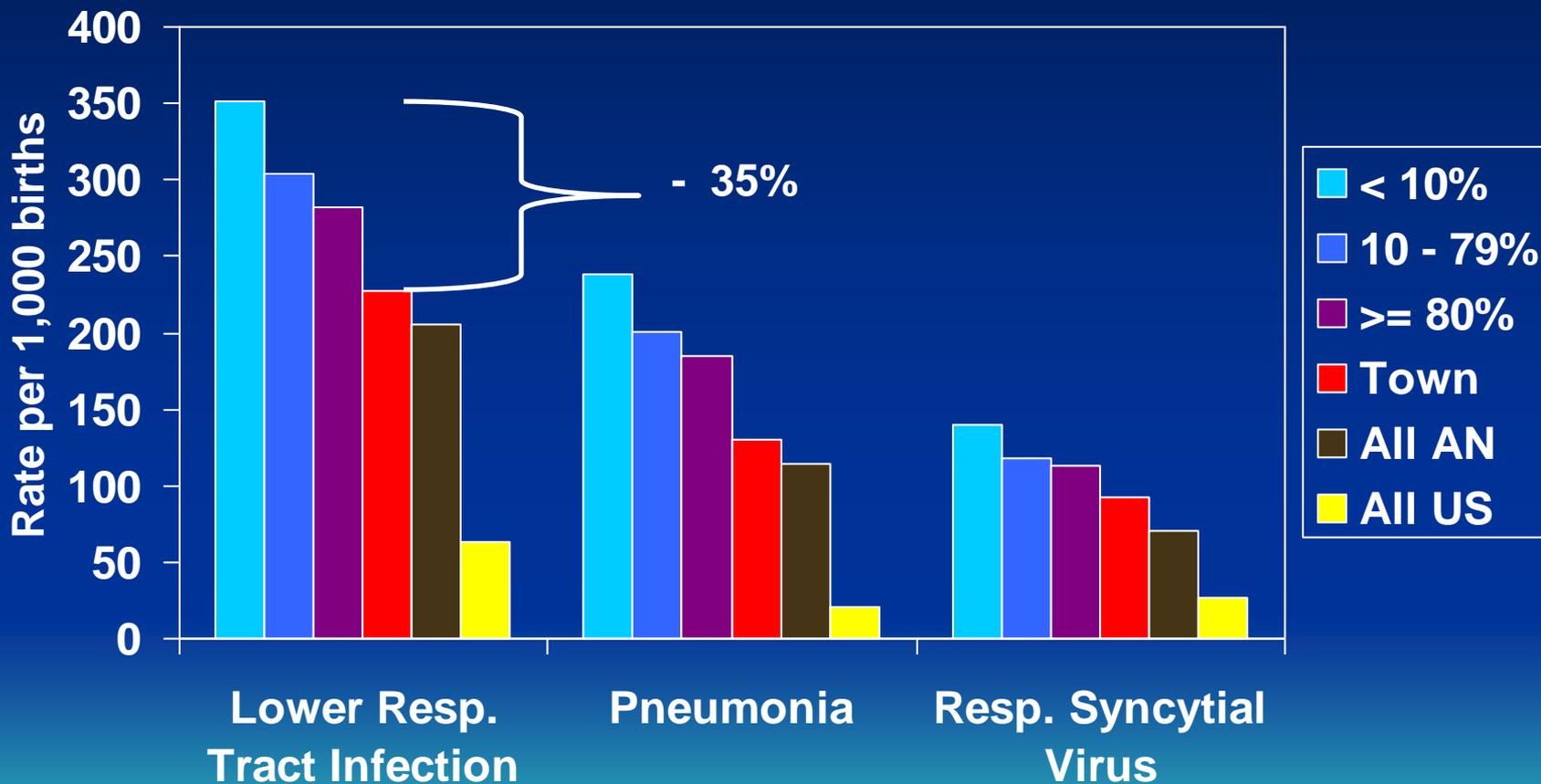
* J Wenger, 2010, Pediatric Infectious Diseases

Hospitalization rates for Alaska Native infants, by percent of community homes with water service 1999 - 2004*



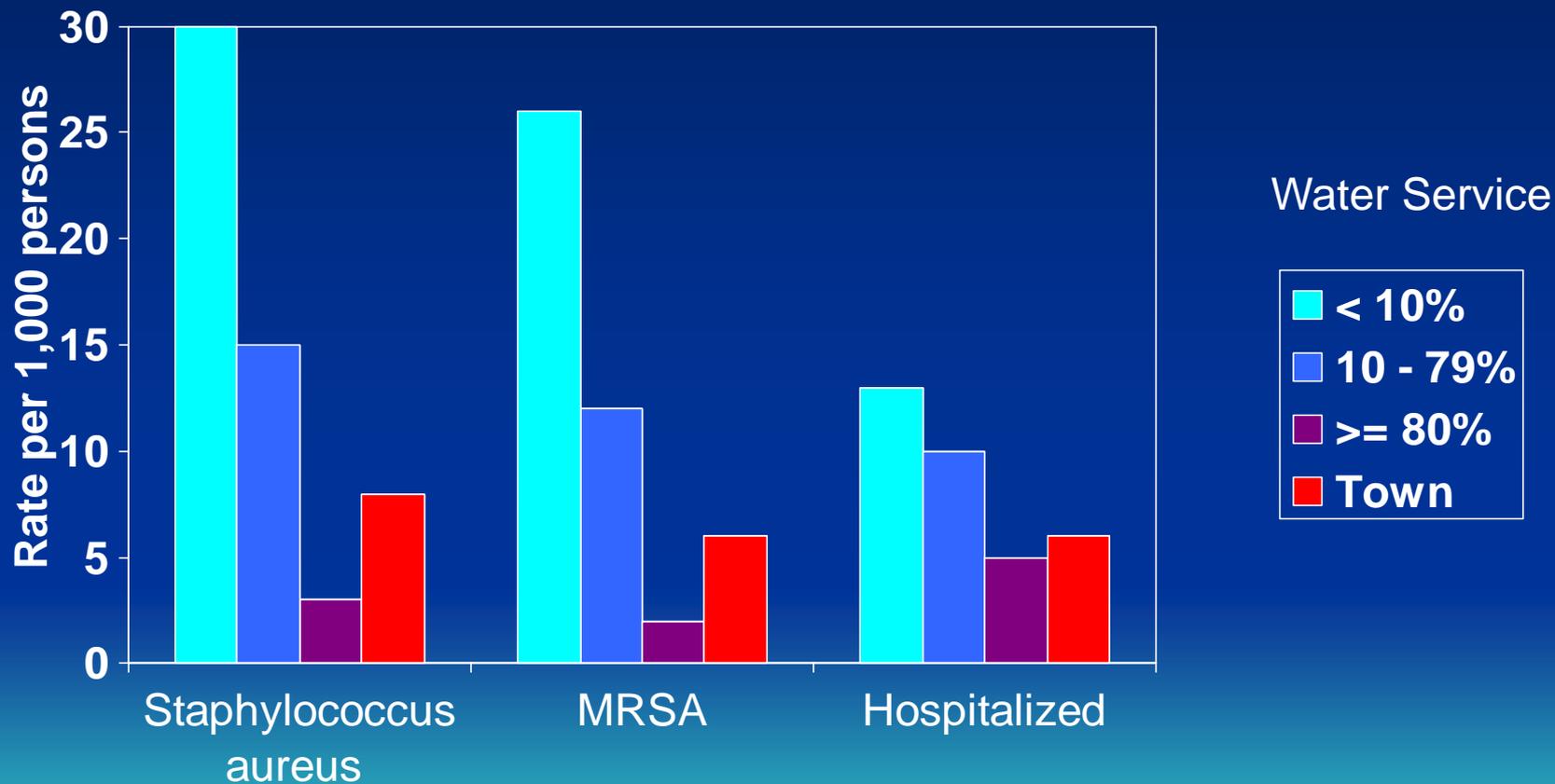
* Hennessy, AJPH, 2008

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

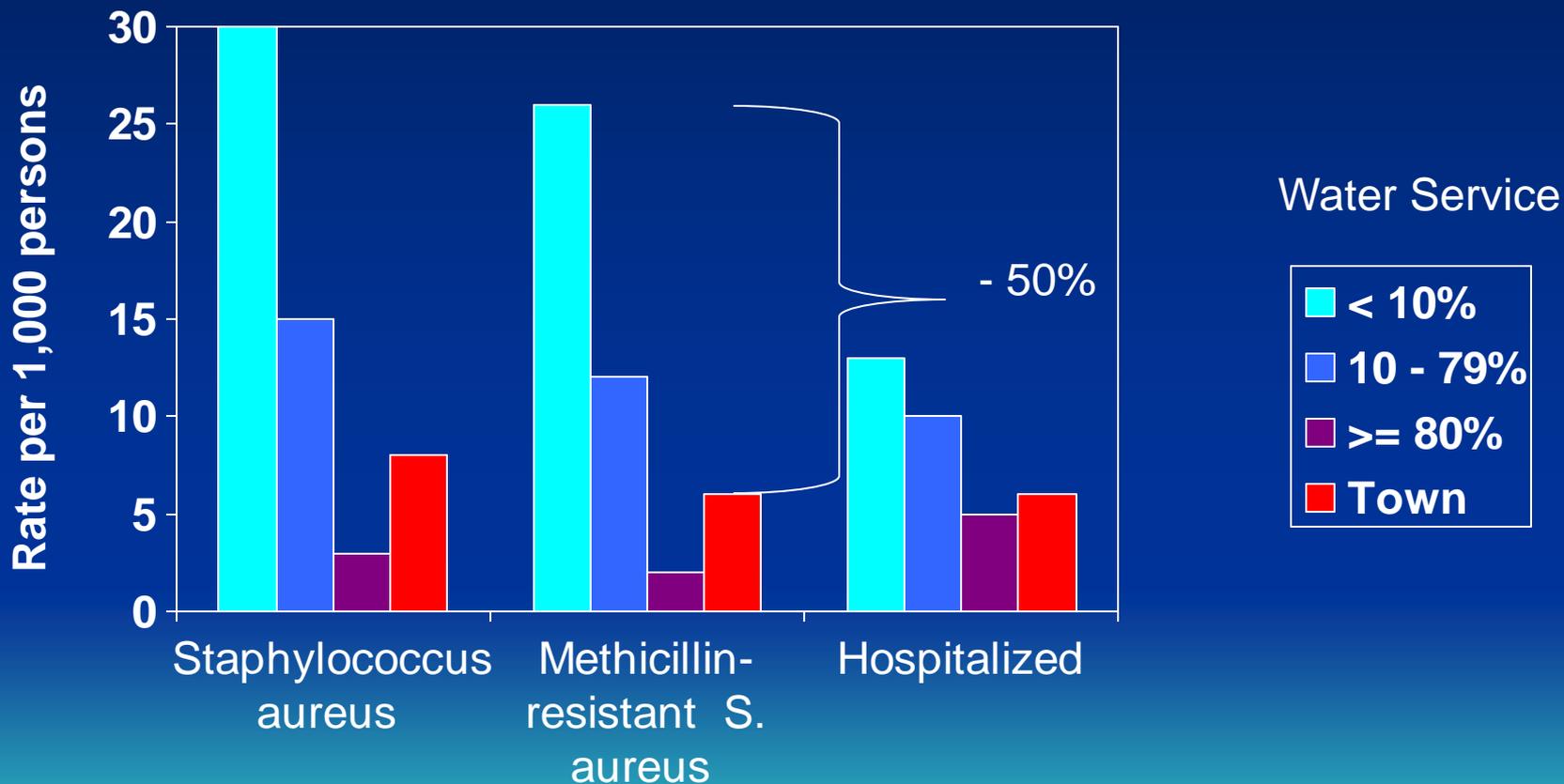


* Hennessy, AJPH, 2008

Skin infection rates, all ages, by village water service, Southwest Alaska, 1999 - 2000



Skin infection rates, all ages, by village water service, Southwest Alaska, 1999 - 2000



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**

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

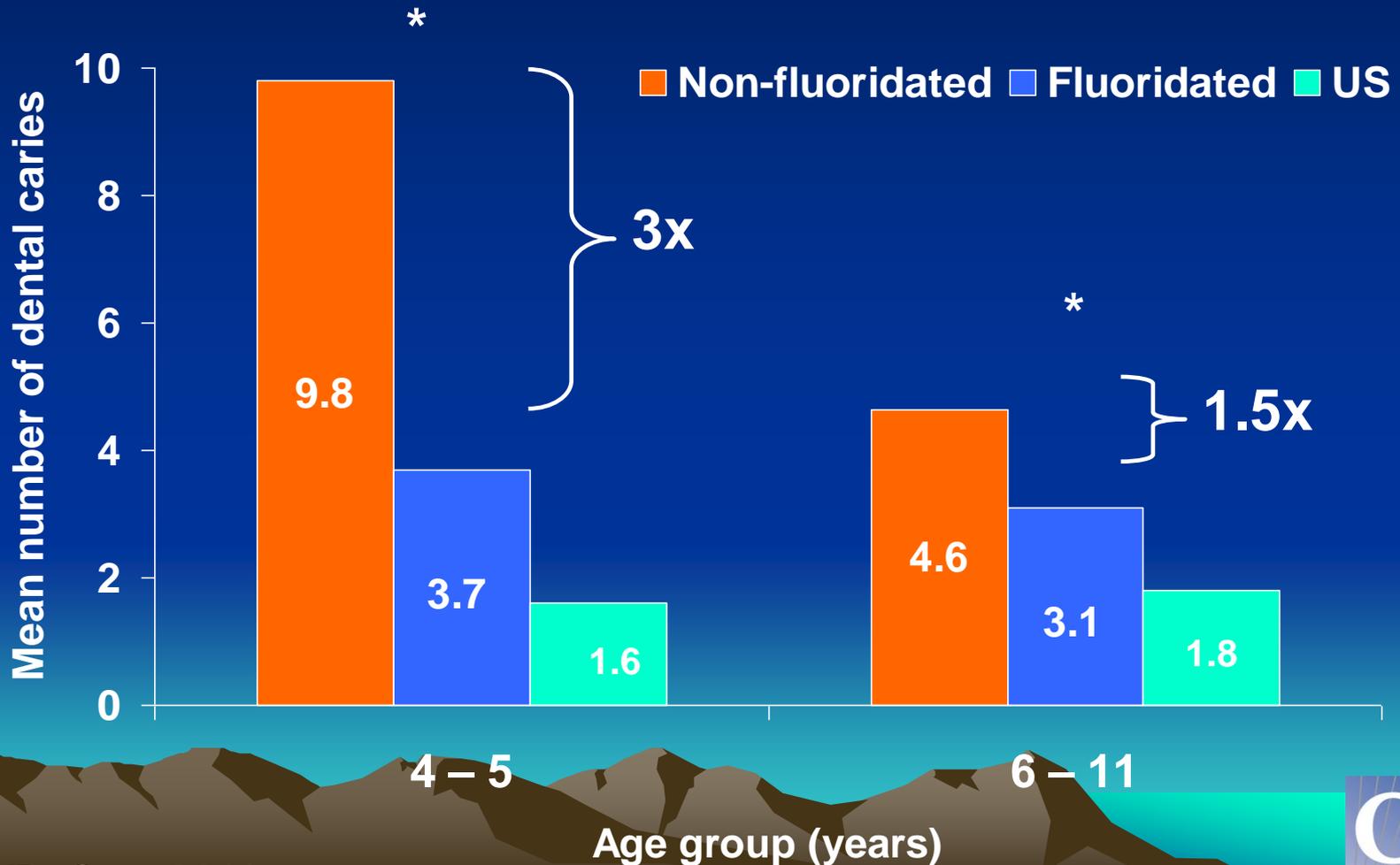
- **General Anesthesia**
- **Multiple extractions**
- **Restorative procedures**
 - Fillings
 - Crowns
- **Cost: \$9000**
 - Medicaid



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



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**

- Troy Ritter
- Jeff Smith
- Timothy Thomas
- Ros Singleton

- **YKHC**

- Joe Klejka
- Dane Lenaker