

# The Impact of Water and Sanitation Services on Health

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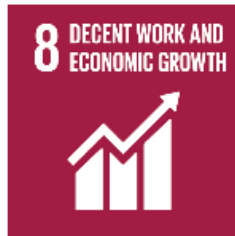
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# SUSTAINABLE DEVELOPMENT GOALS





# SUSTAINABLE DEVELOPMENT GOALS

17 GOALS TO TRANSFORM OUR WORLD

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## Goal 6: Ensure access to water and sanitation for all

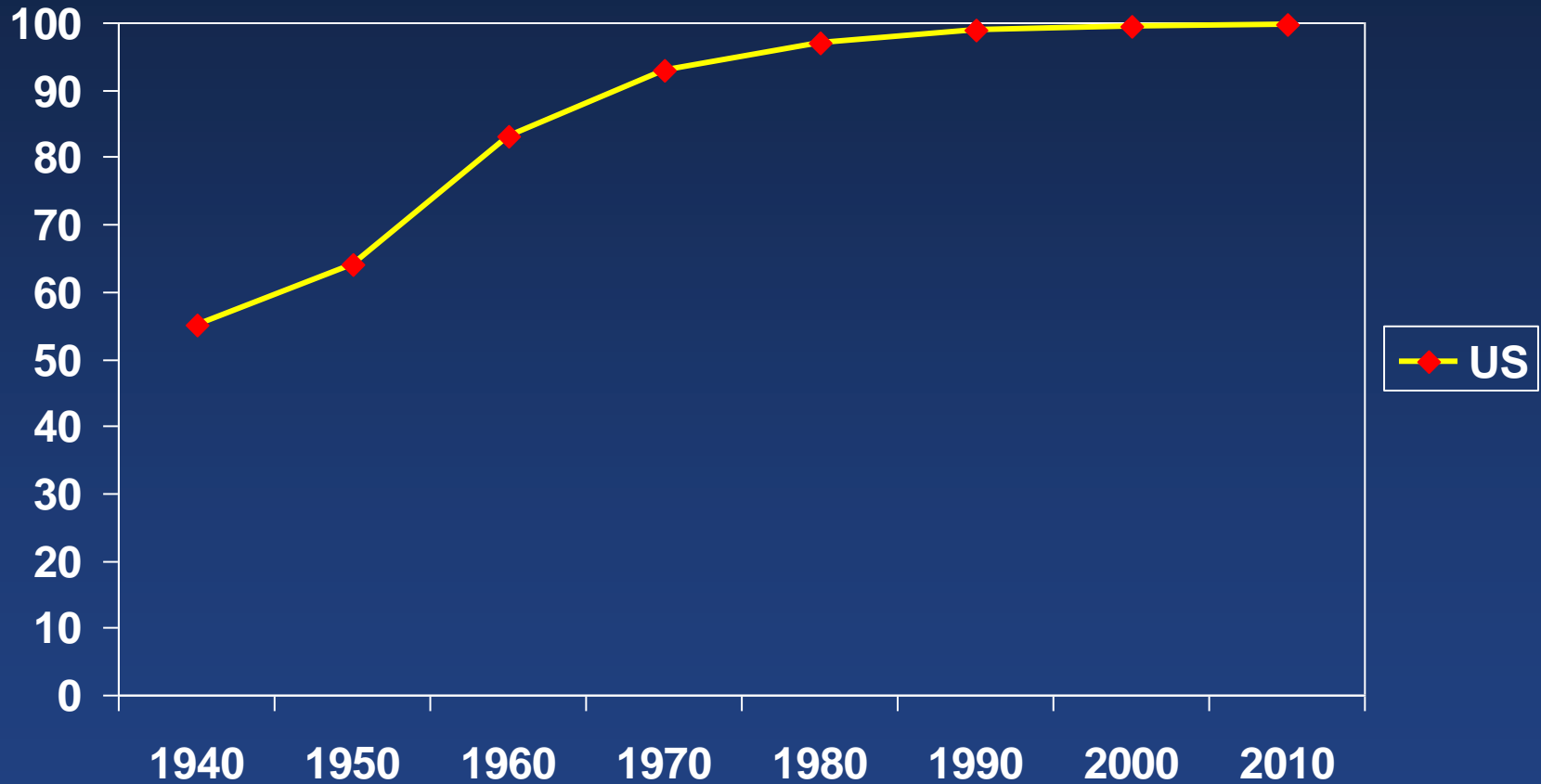


**Is water and sanitation  
service only a problem of the  
developing world?**

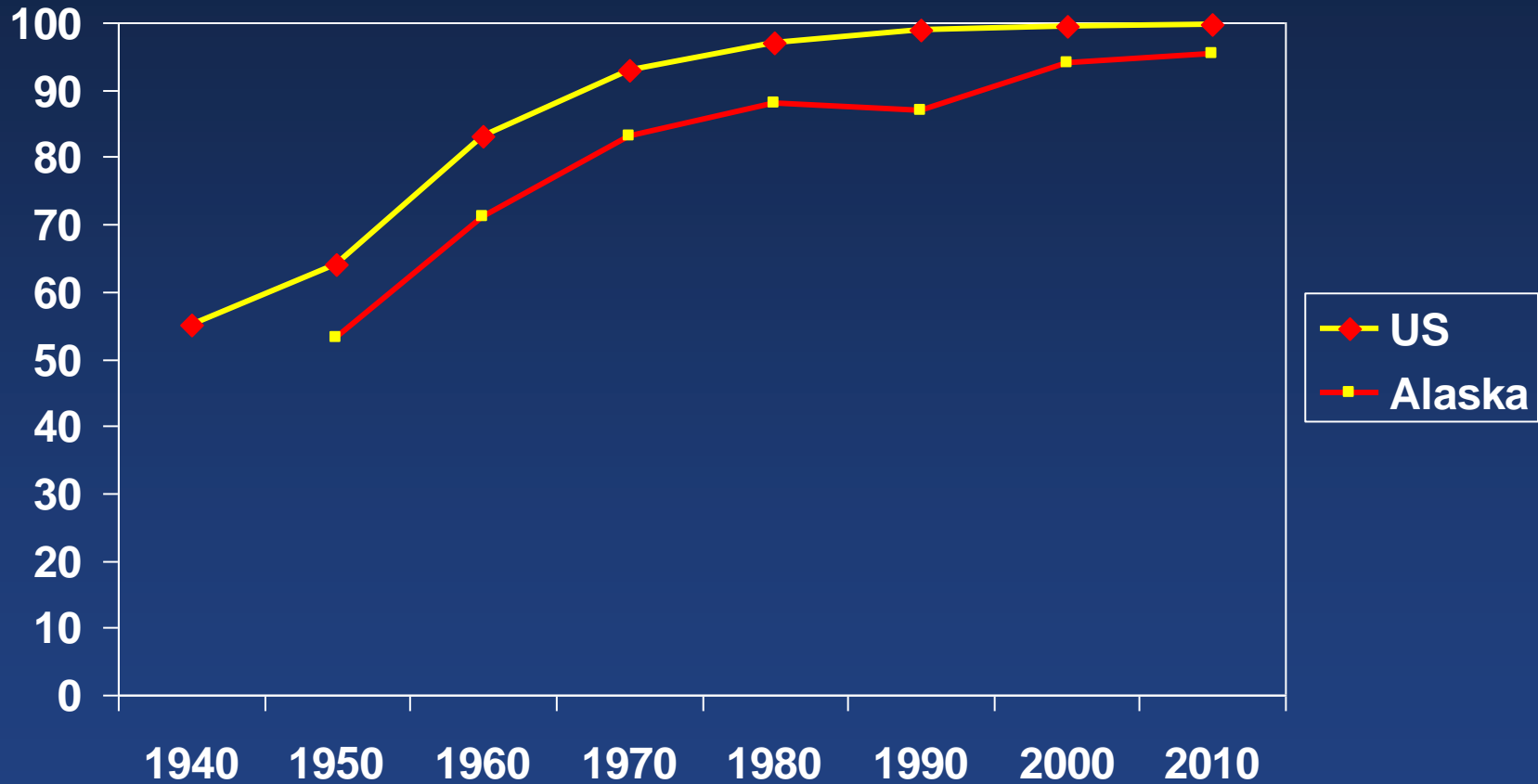
**Many Arctic and Subarctic  
residents don't have  
adequate access to in-home  
running water and sewer**

**Russia, Alaska, Canada, Greenland**

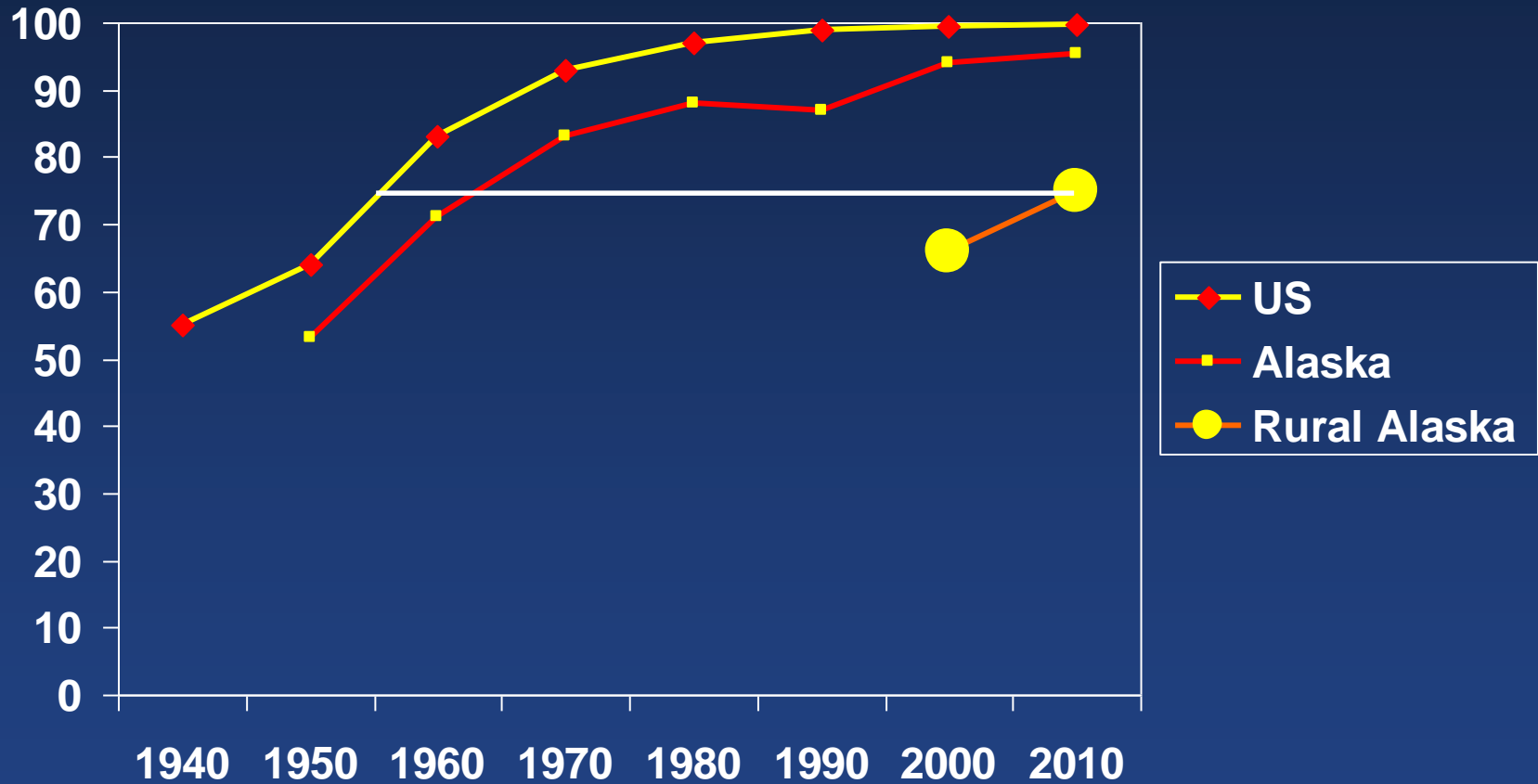
# Percentage of US homes with complete plumbing, 1940 – 2010, US Census



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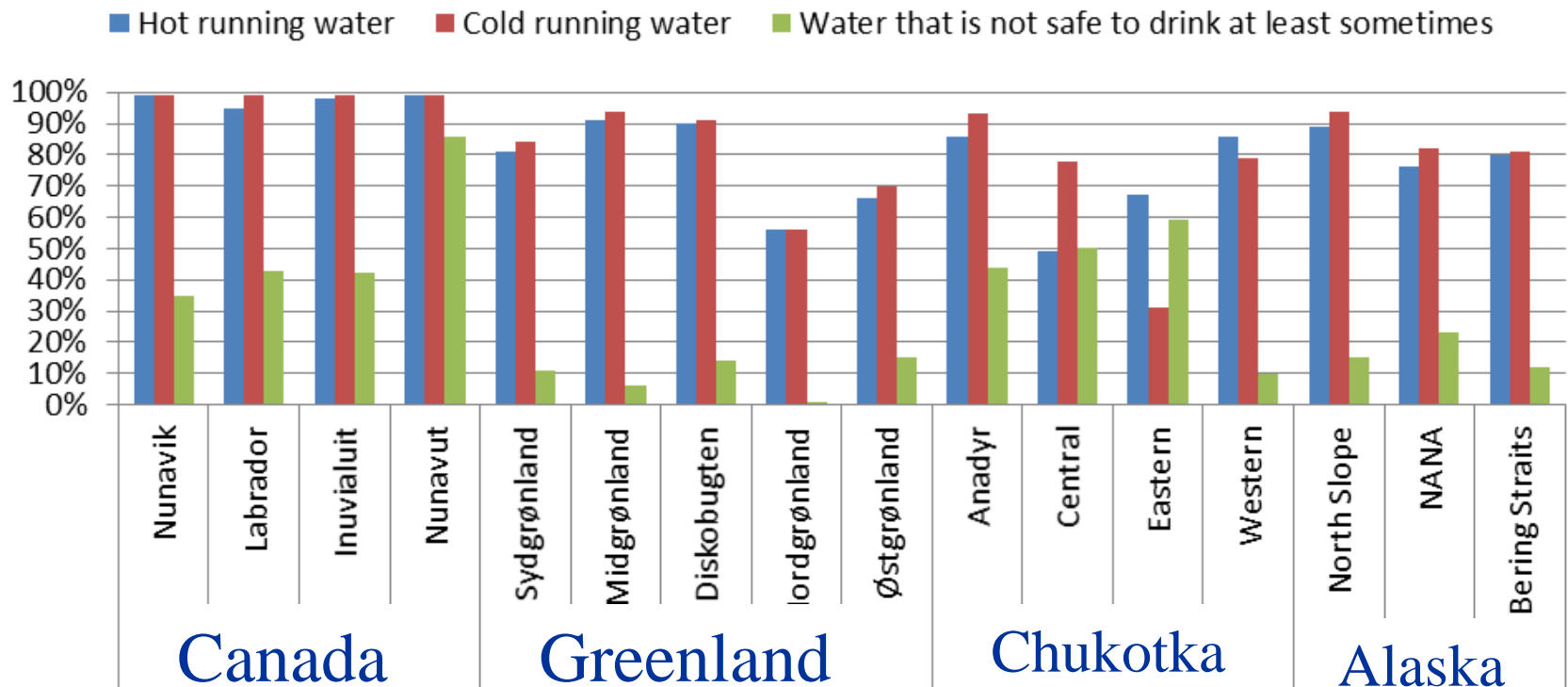




# Sewer Service, Russian Arctic UN Development Report, 2006



# In-Home Running Water Service, Survey of Living Conditions in Arctic, 2006



# Main Message #1

- The Sustainable Development Goal for water and sanitation has not been met in the Circumpolar North
  - Alaska, Canada, Greenland, Russia



ONE ARCTIC

ARCTIC COUNCIL  
**U.S. CHAIRMANSHIP**  
2015-2017

# Arctic Council Water/Sanitation Project

- “Improving Health through Safe and Affordable Access to Household Running Water and Sewer in Arctic and Sub-Arctic communities.”
- Objectives:
  - a) Promote innovations in water and sewer technologies and services provision.
  - b) Document the status of water and sewer service and associated health outcomes.
  - c) Describe climate-related vulnerabilities and adaptation strategies for community water and sewer systems and source water protection.
    - a) Water and sanitation survey, open until Sep 30, 2016
    - b) Jonathan Bressler in Climate Change session

## ARTEK Event 2016

- › Presentations
- › Pictures
- › WASH - an Arctic Council endorsed project
- › **Special ESPR issue on Sanitation in Cold Climate Regions**

## Calendar

## Special ESPR issue on Sanitation in Cold Climate Regions

The journal [Environmental Science and Pollution Research](#) (ESPR) will be publishing a special issue focusing on Sanitation in Cold Climate Regions.

The special issue will feature both critical reviews and research papers and will include but not be restricted to these topics:

- Waste water
- Solid waste
- Water supply
- Health
- Safety
- Environmental impacts
- Treatment
- Infrastructural issues

The submission deadline for papers has been set as 31st of October 2016. Earlier submissions are encouraged, and papers will be published online as soon as they have been accepted for publication.

Download this [document](#) for information on how to submit your contribution to the ESPR special issue on Sanitation in Cold Climate Regions.

For further information about this special issue, please [read this invitation letter](#) or contact [Associate Professor Pernille Erland Jensen](#).

## Contact



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## Environmental Science and Pollution Research

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ADDITIONAL INFORMATION

# Hierarchy of Water Requirements





# Factors Linking Water to Health

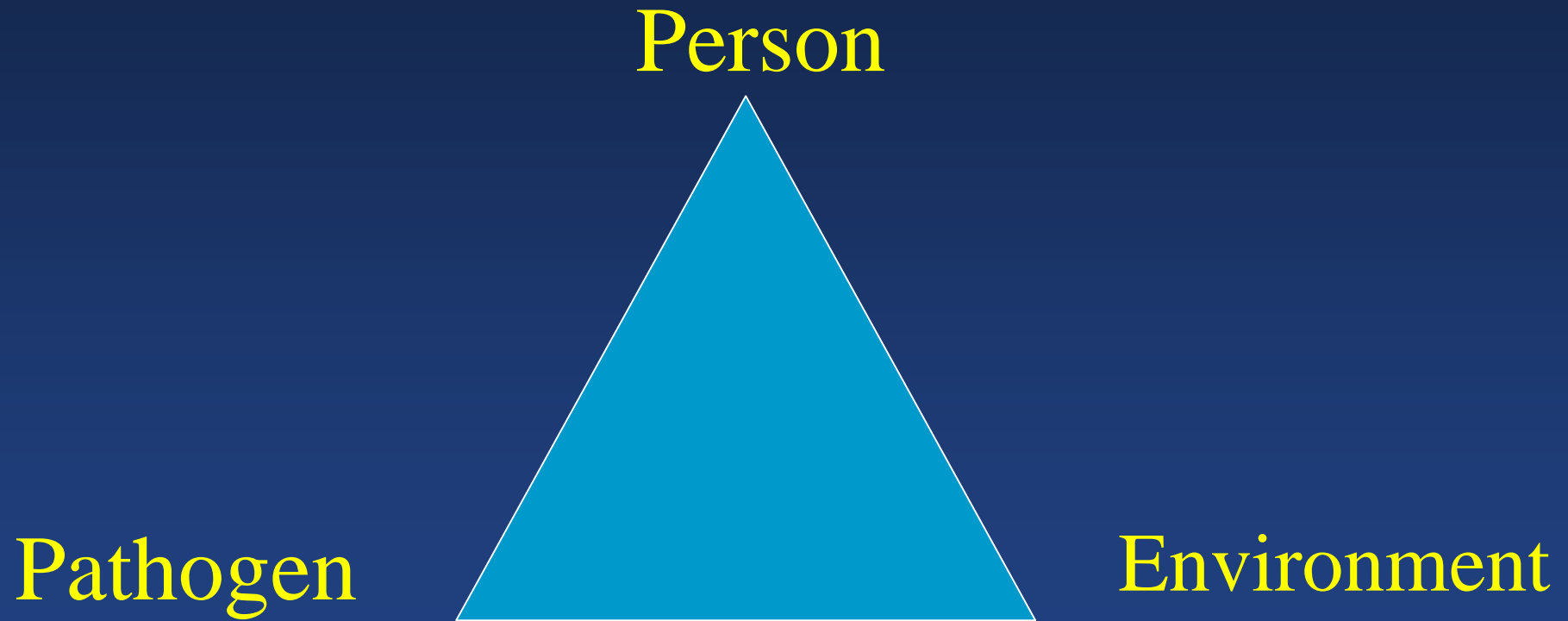
- **Water Quality**

- Prevents illness from drinking water
  - Water-borne diseases
    - Cholera, Typhoid fever, dysentery

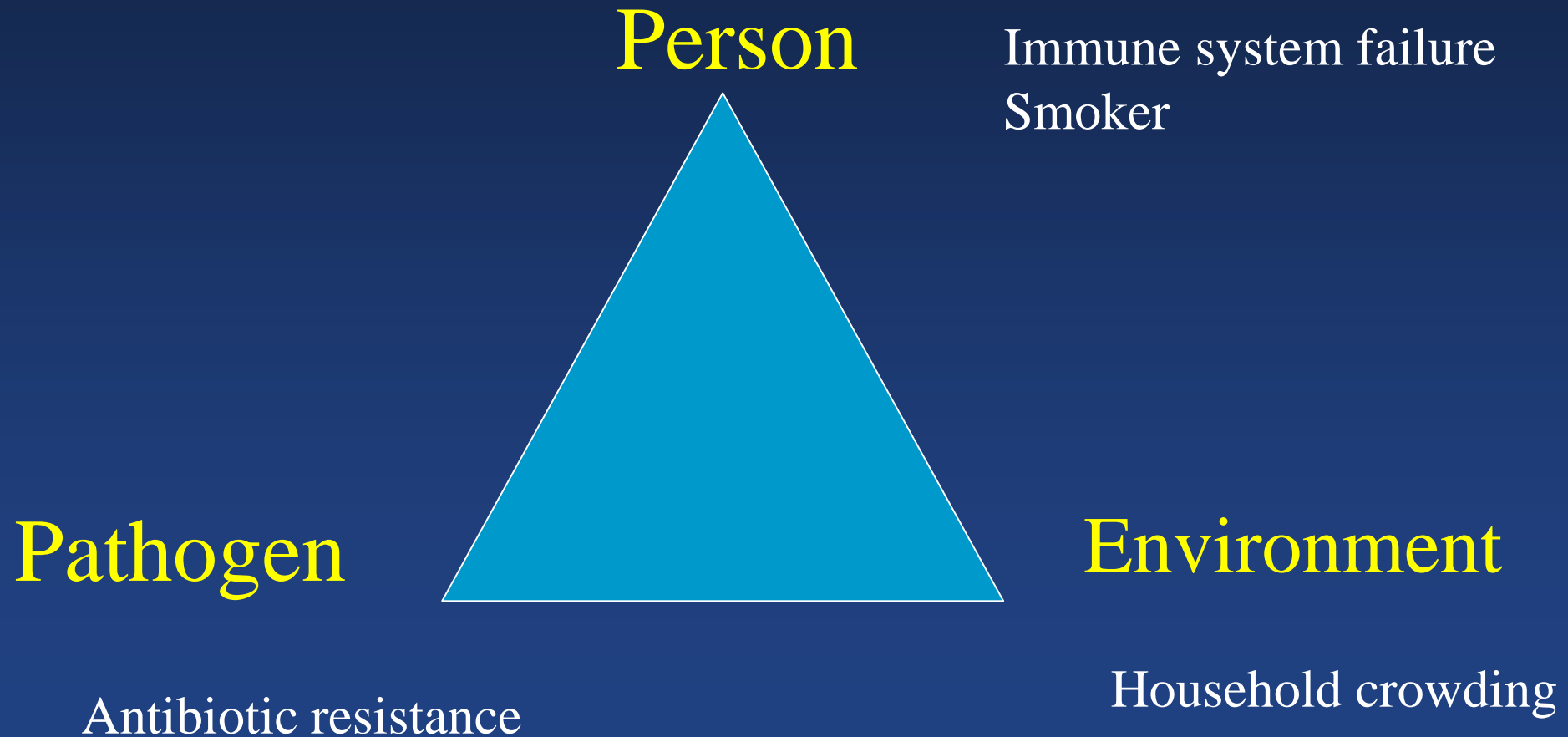
- **Adequate water Quantity**

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

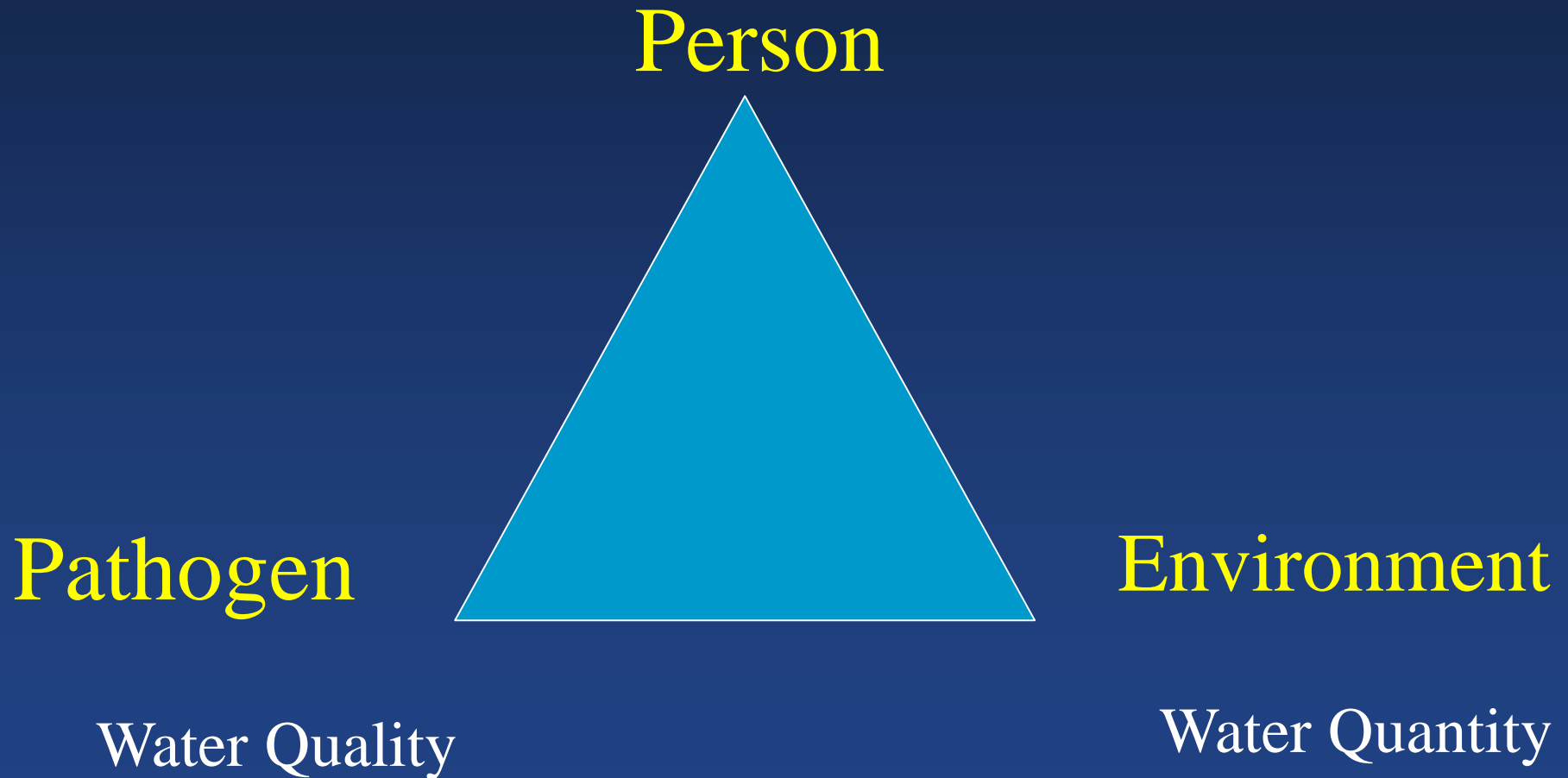
# The Infectious Disease Triangle



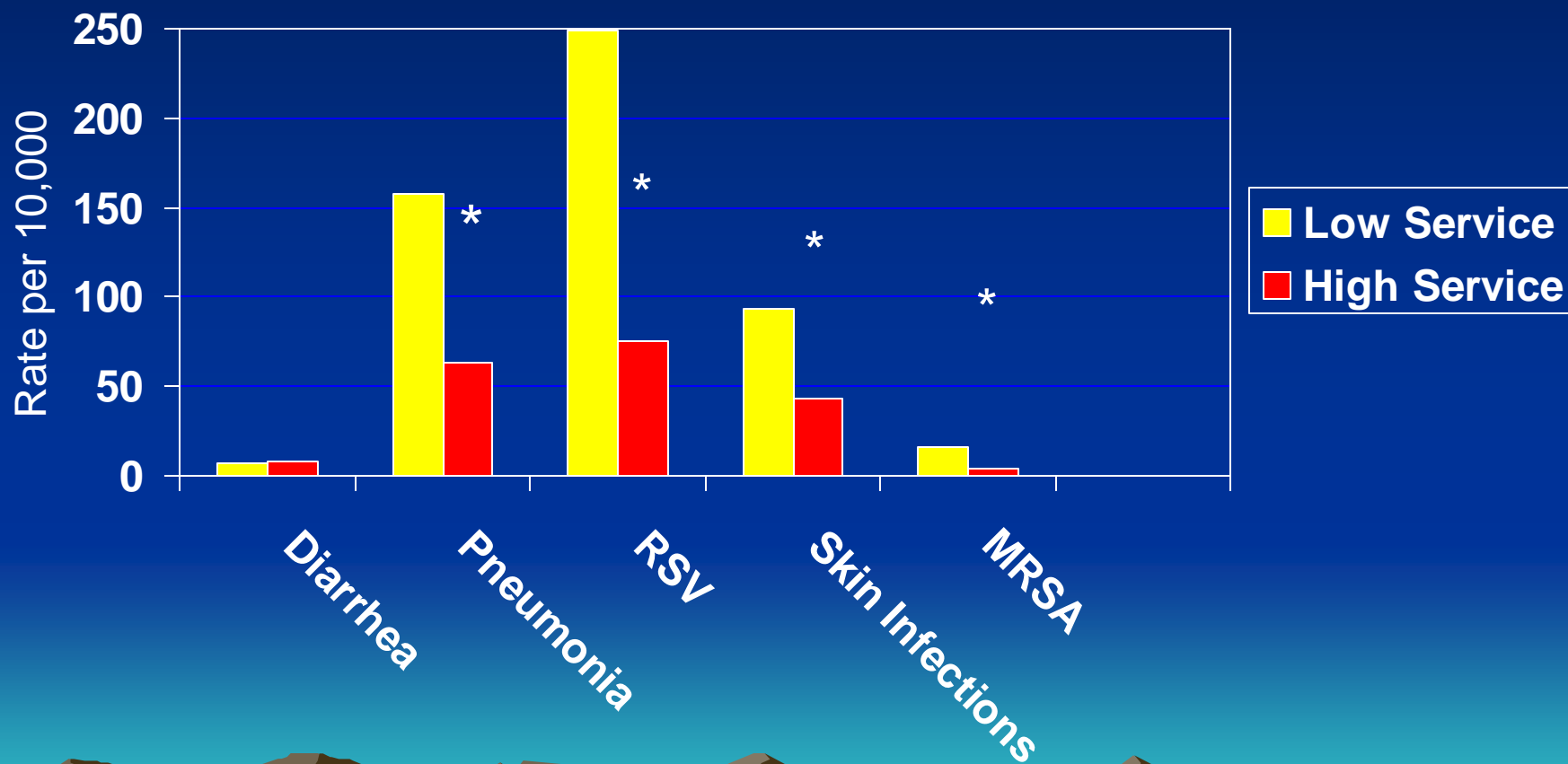
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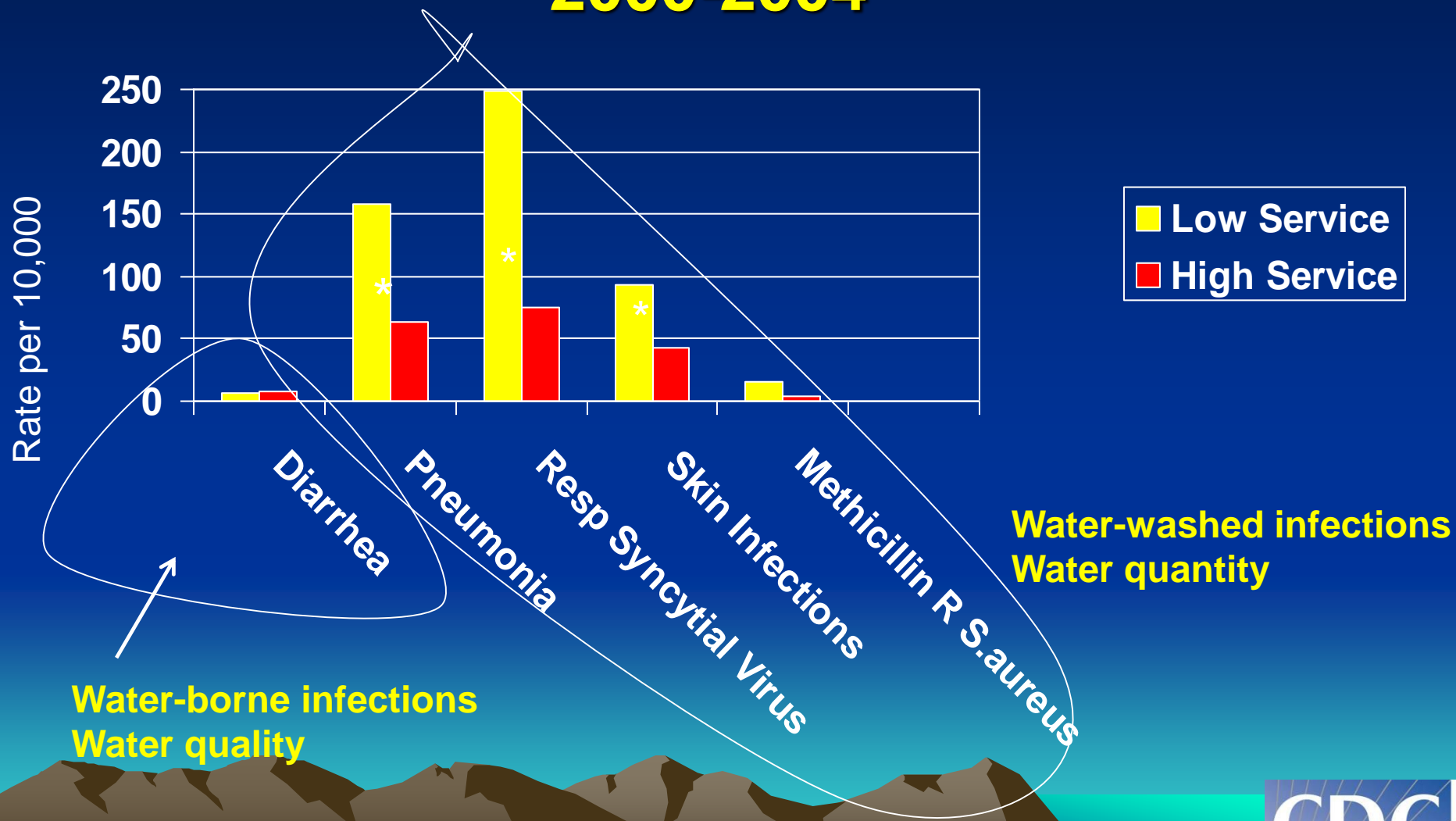
# The Infectious Disease Triangle



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



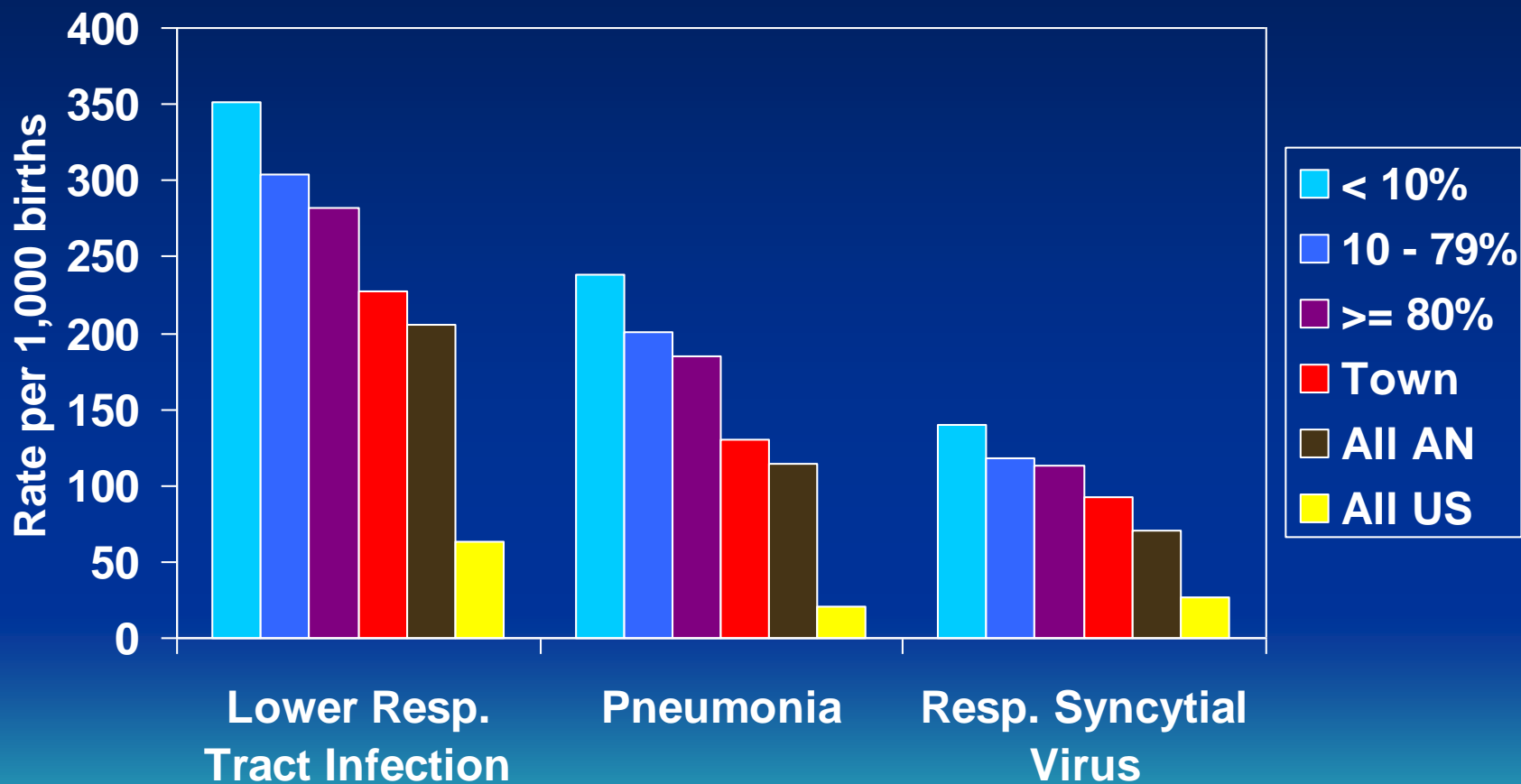
# Hospitalization Rates for “High” and “Low” Water Service Regions, Alaska, 2000-2004



# Main Message #2

- For health, water quantity is as important as water quality.

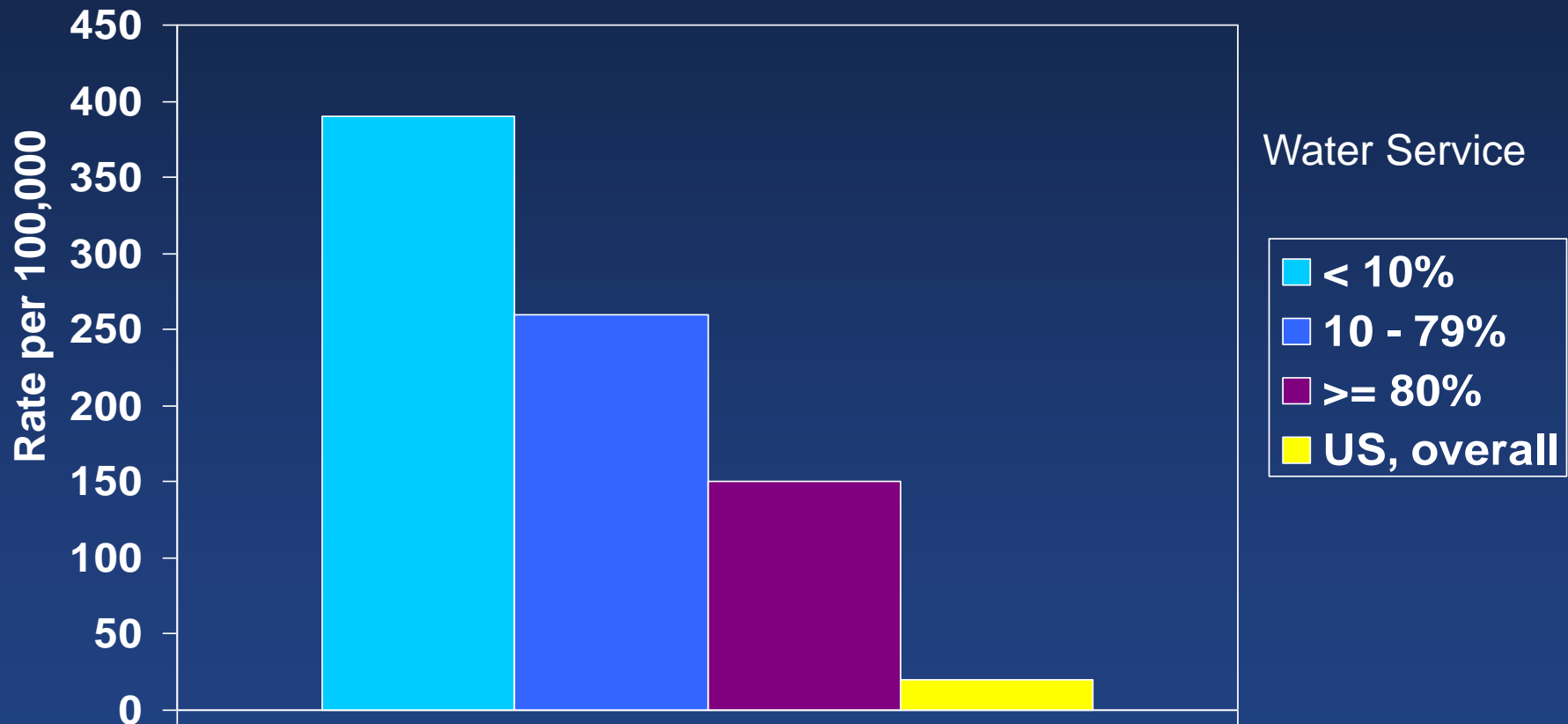
# Hospitalization rates for Alaska Native infants, according to percent of homes with water service 1999 - 2004\*



\* Hennessy, AJPH, 2008



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

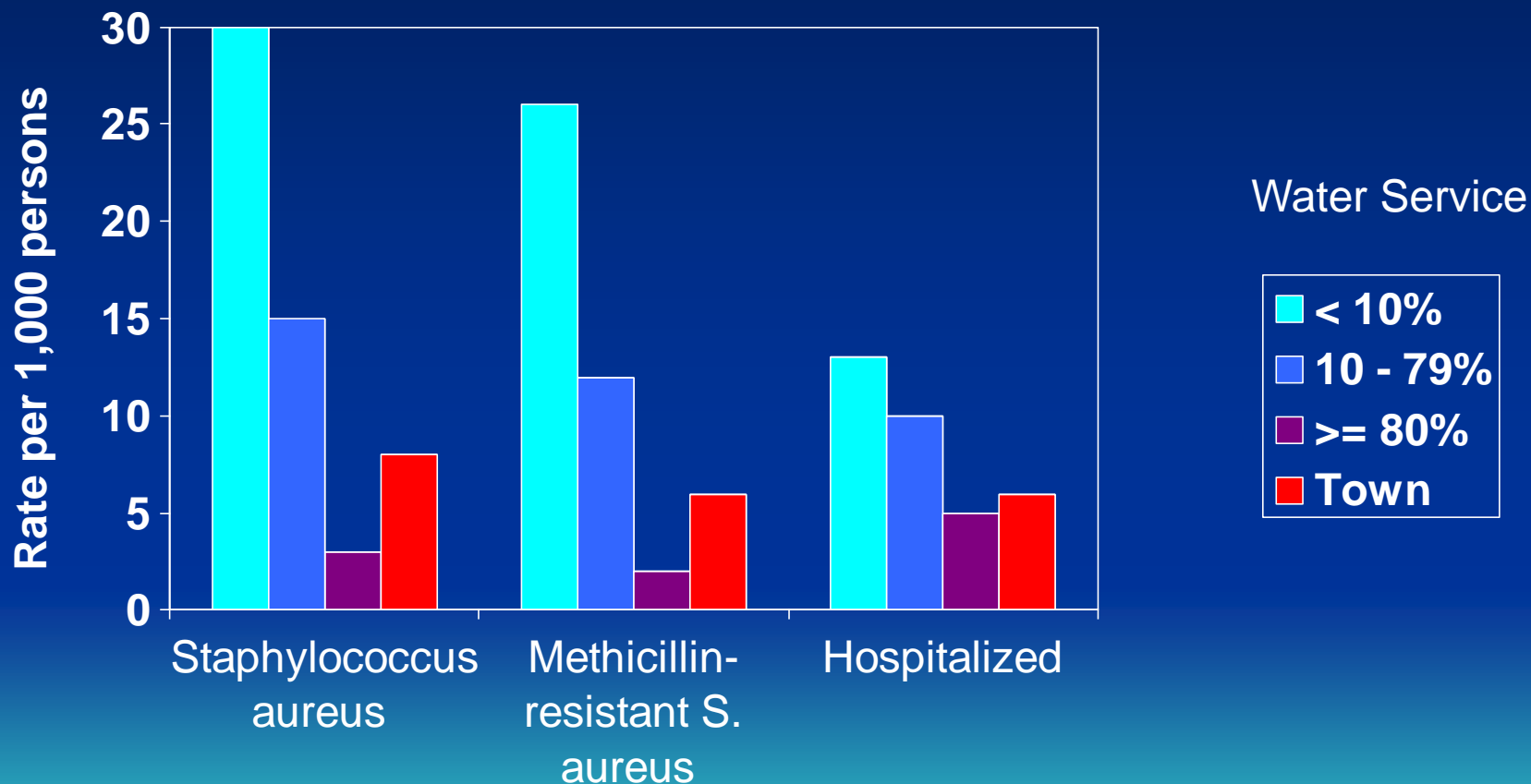


\* Wenger, 2010, Pediatric Infectious Diseases

# How water helps to prevent Respiratory Infections

- Transmitted by
  - Cough/sneeze droplets
  - Contaminated hands or surfaces
- Transmission prevented by
  - Hand washing, surface cleaning
- Other factors play a role
  - Crowding, vaccinations, cough/sneeze hygiene, breastfeeding

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



# How water helps to prevent Skin Infections (Boils and Impetigo)

## – Spread by

- Person to person contact
- Self inoculation
- Contaminated surfaces or objects (laundry, sauna benches)

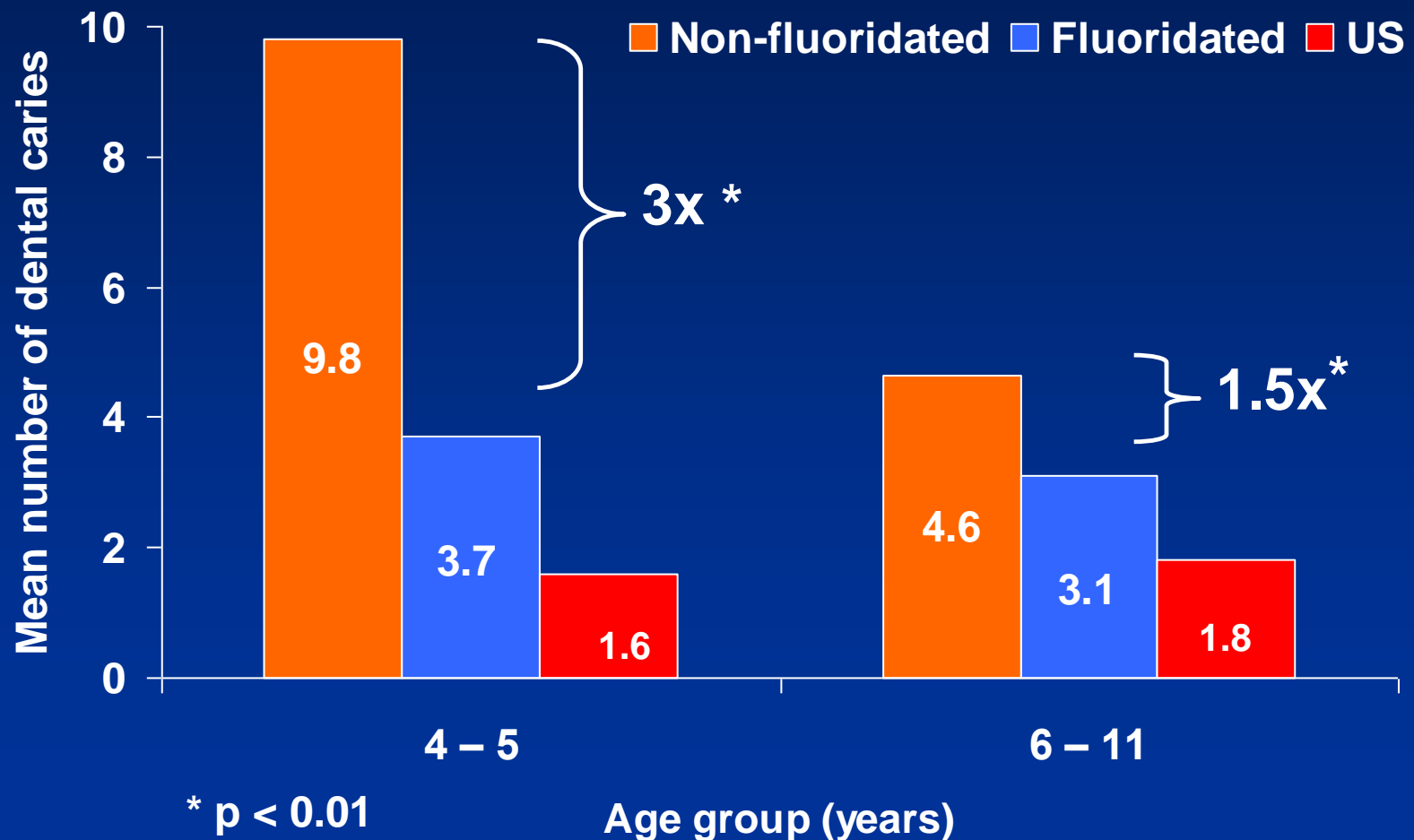
## – Spread prevented by

- Hand and body hygiene
- Cleaning home environment and saunas
- Laundry (bleach, hot water)

## – Other factors

- Crowding, long lasting colonization of skin,
- Antibiotic use

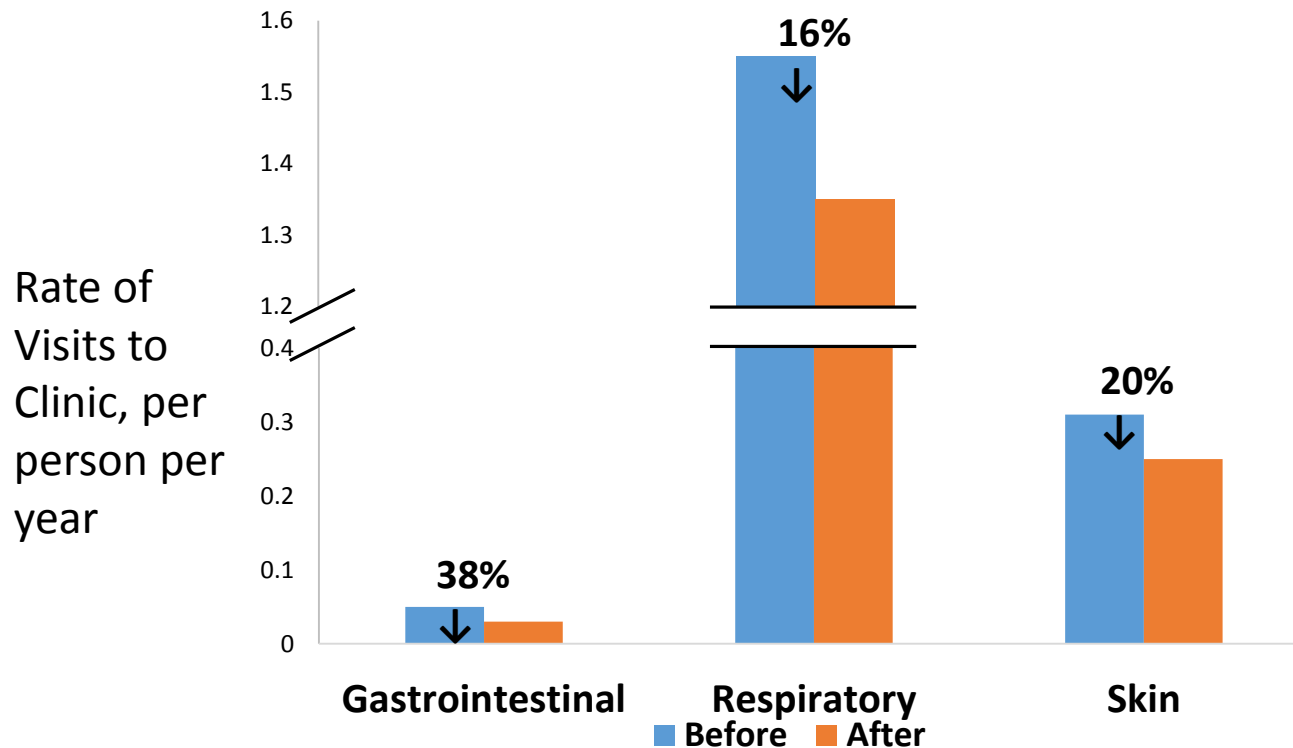
# Number of Cavities in Primary Teeth by Village Water Fluoridation Status, Alaska



# How water helps to prevent Dental Cavities

- Caused by excess *Strep. mutans* bacteria
  - Produces acid and destroys tooth enamel
- Prevented through
  - Water for brushing teeth
  - Fluoridated water
    - only available in piped distribution systems
  - Good tasting water may decrease soda drinking
- Other factors
  - Dietary sugar, use of toothpaste, strength of tooth enamel, access to dental care

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



# How water helps to prevent Gastroenteritis (Diarrhea)

- Germs spread through
  - Contaminated water or food
  - Person to person
- Transmission prevented through
  - Providing and protecting drinking water
  - Cleaning food preparation surfaces, utensils, dishes
  - Hand hygiene
- Other factors
  - Contaminated food, cooking temperatures, cross-contamination, storage of foods



## Main Message #3

- The health benefits of running water includes prevention of:
  - Respiratory infections
  - Skin infections
  - Dental cavities, and
  - Diarrhea

**How much disease can we prevent  
by adequate water service?**

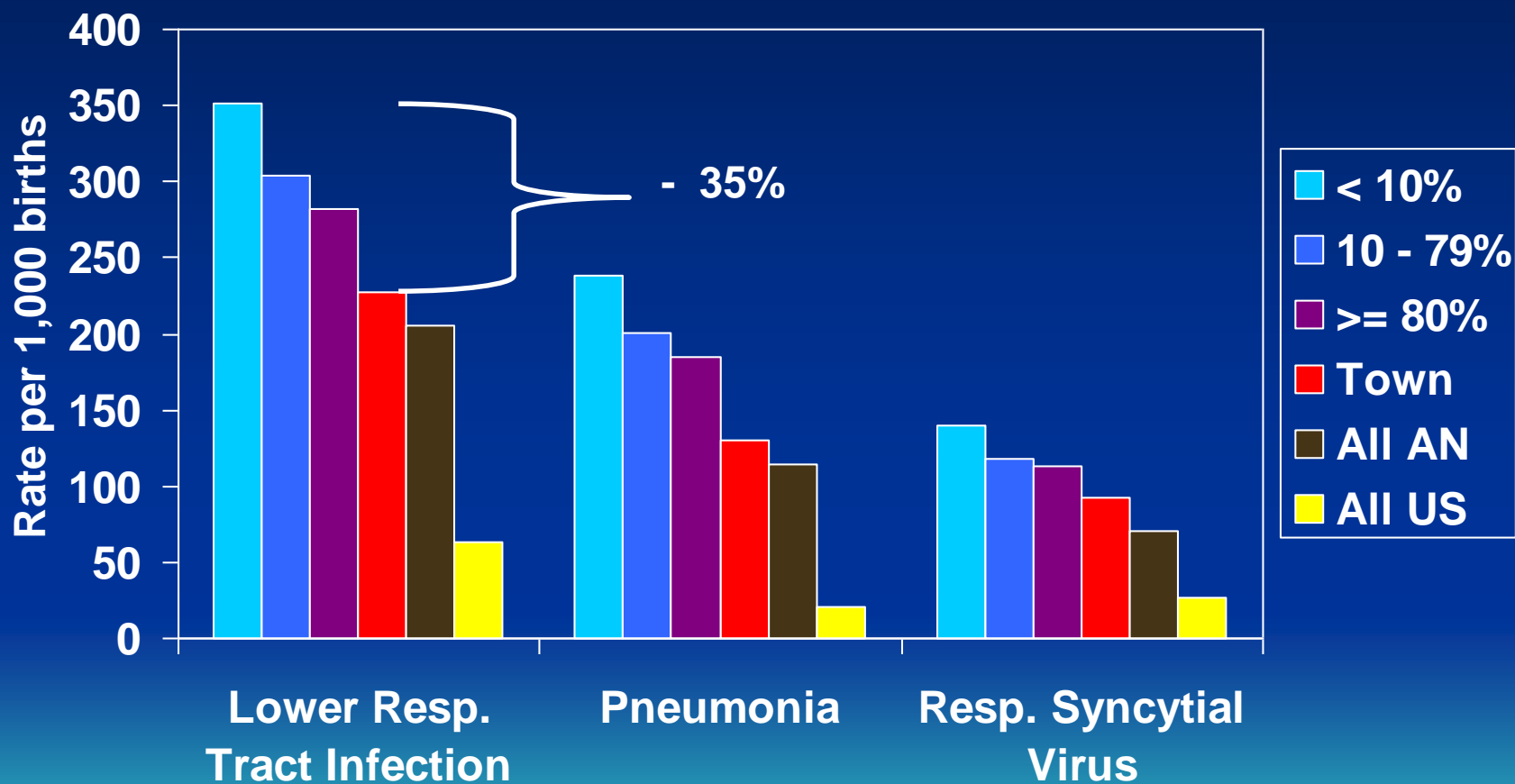
# How much disease can we prevent by adequate water service?

- Karachi, Pakistan
  - 606 households
  - Randomized trial of soap and handwashing promotion efforts
  - 50% drop in pneumonia, diarrhea, impetigo
    - Luby, et al. *Lancet* 2005

# How much disease can we prevent by adequate water service?

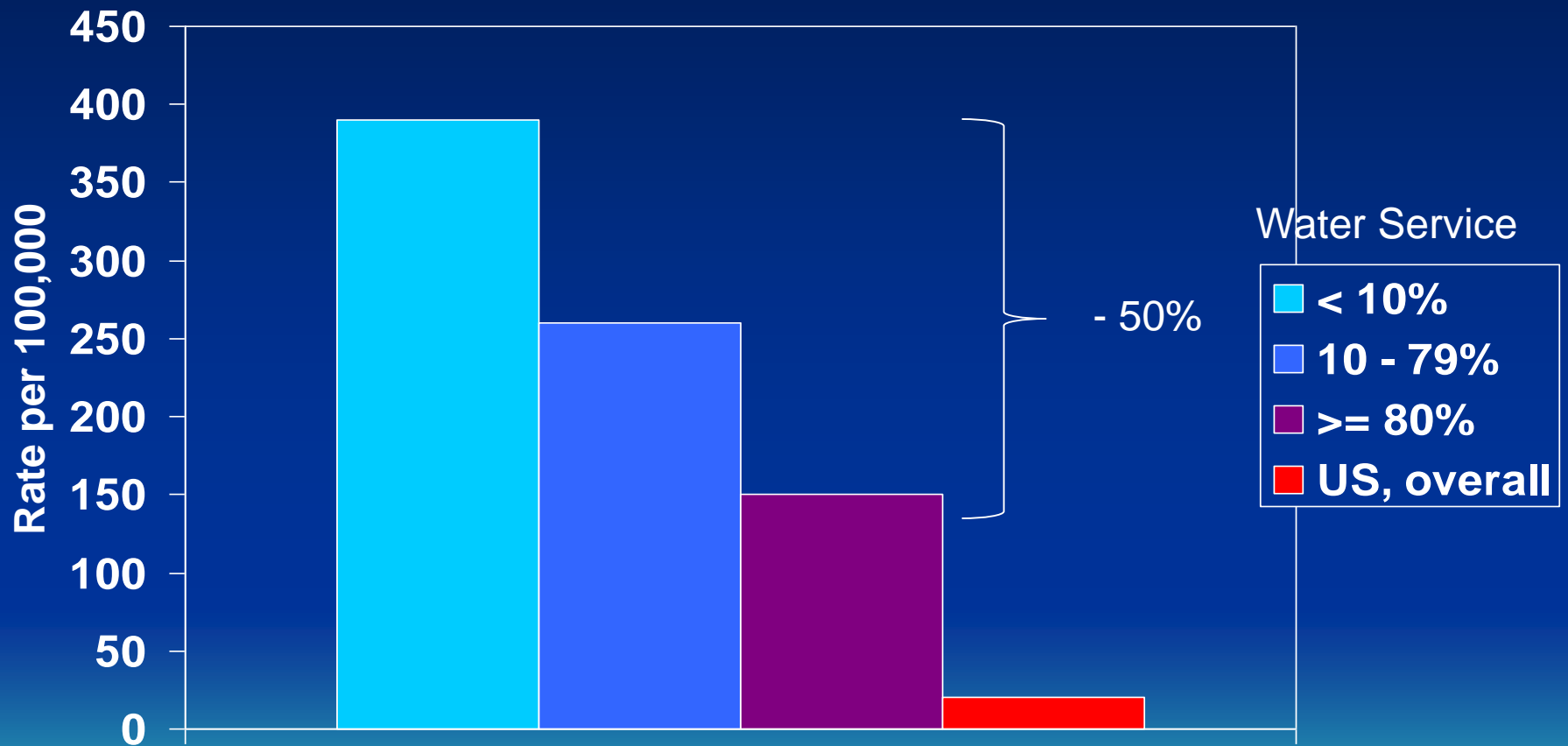
- Karachi, Pakistan
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    - Luby, et al. *Lancet* 2005
- Rural Alaska villages
  - Compare rates
    - Served vs. unserved villages
    - Before and after water service

# Respiratory Hospitalizations in Children



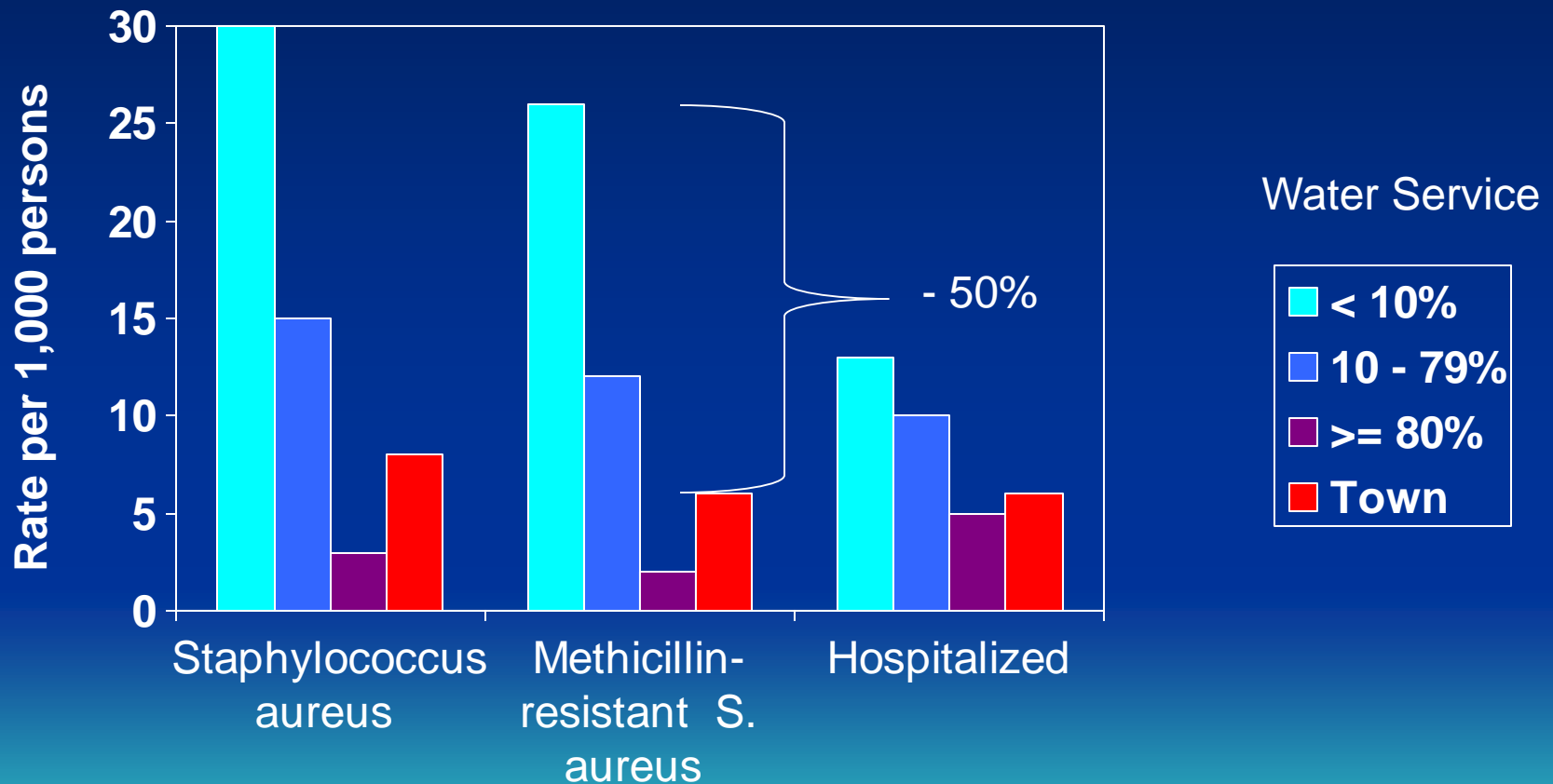
\* Hennessy, AJPH, 2008

# Serious infections with *Streptococcus pneumoniae* in children

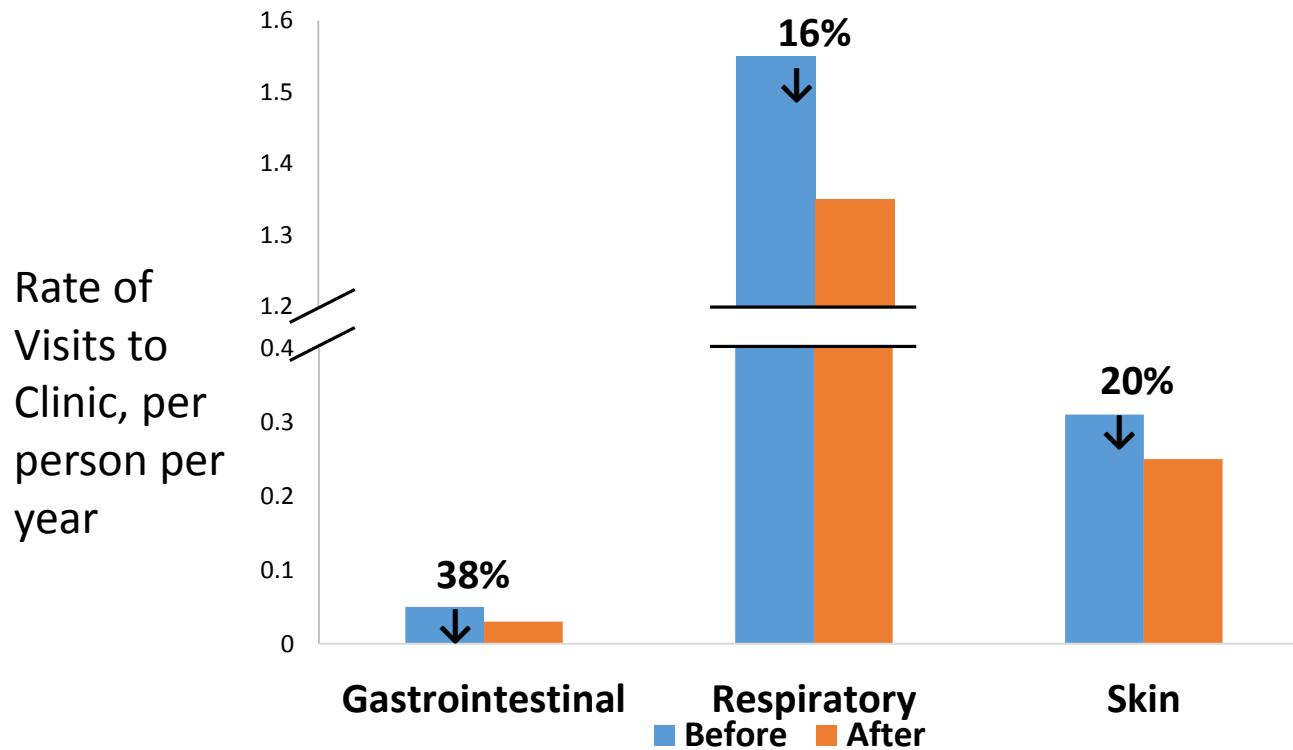


\* J Wenger, 2010, Pediatric Infectious Diseases

# Skin infections, All Ages



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





## Main Message #4

- We can prevent a lot of illness and suffering by providing adequate water and sanitation.
  - 35% to 50% fewer infections

# How much water is enough to improve health?

# World Health Organization

WHO/SDE/WSH/03.02  
English only

## **Domestic Water Quantity, Service Level and Health**

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**Jamie Bartram**

Co-ordinator, Water, Sanitation and Health Programme, World Health  
Organization, Geneva, Switzerland

[http://cdrwww.who.int/water\\_sanitation\\_health/diseases/WSH03.02.pdf](http://cdrwww.who.int/water_sanitation_health/diseases/WSH03.02.pdf)

**Table S1: Summary of requirement for water service level to promote health**

Service level	Access measure	<i>Needs met</i>	Level of health concern
No access (quantity collected often below 5 l/c/d)	More than 1000m or 30 minutes total collection time	Consumption – cannot be assured Hygiene – not possible (unless practised at source)	Very high
Basic access (average quantity unlikely to exceed 20 l/c/d)	Between 100 and 1000m or 5 to 30 minutes total collection time	Consumption – should be assured Hygiene – handwashing and basic food hygiene possible; laundry/bathing difficult to assure unless carried out at source	High
Intermediate access (average quantity about 50 l/c/d)	Water delivered through one tap on-plot (or within 100m or 5 minutes total collection time)	Consumption – assured Hygiene – all basic personal and food hygiene assured; laundry and bathing should also be assured	Low
Optimal access (average quantity 100 l/c/d and above)	Water supplied through multiple taps continuously	Consumption – all needs met Hygiene – all needs should be met	Very low

# Is 50 Liters or 13 gallons per person per day needed to protect health?

- Could we conserve water?
  - Low-flow faucets
  - Water recycling
  - Separating or dry toilets
- Is all water needed in home?
  - Community facility for
    - laundry, shower / bathing, sauna
  - Home: drinking, toilet, cooking, handwashing, home cleaning

# Handwashing Basin in Alaska Home



# **What is the “Return on Investment” for Providing Water and Sewer Service?**

# What is the Return on Investment for Water/sewer services?

- Direct health costs
  - Use rate differences to calculate costs of
    - Excess hospitalizations, clinic visits
  - Quality of Life measures
    - Quality Adjusted Life Years



# Return on Investment, continued

- Indirect costs
  - Being ill or caring for an ill family member
    - Missed work – loss of income or job
    - Missed school – lower educational success
    - Less subsistence or cultural activity
  - Hauling water and waste
    - Opportunity cost of time
    - Reduced tourism or business opportunities
  - Water insecurity
    - Stress, mental health effects

# The Human Cost

- A child born in November, returns to a village that has no running water...
- A child lives in a village with no running water, or where water has an unpleasant taste...

## **Main Message #5**

- **Water and sewer service is a fundamental issue of health and social justice.**
- **The costs connected with lack of service are mostly unmeasured.**
- **These costs are being paid by the people living in communities without water service and also by the rest of society.**


# Healthy Alaskans 2020 (HA2020)



- **Public health initiative to improve health and ensure health equity**
- **25 health priorities**
  - Measureable targets to reach by 2020
  - Provides strategies and specific actions
  - Identifies key partners across the state to engage in the work

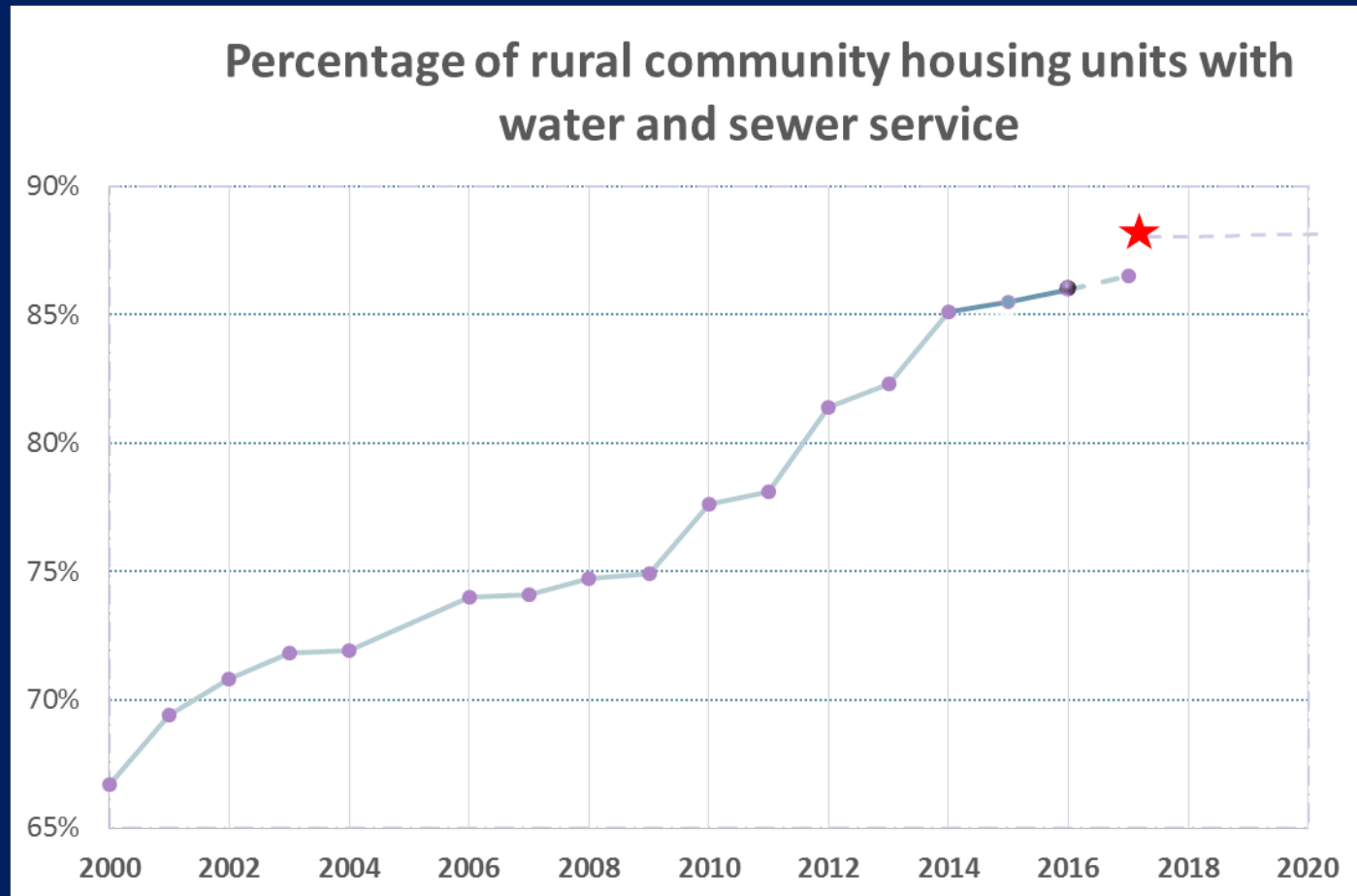
# HA2020 Dashboard

## Increase the proportion of Alaskans with access to in-home water and wastewater services

Indicator	Progress	Baseline (2010)	HA 2020 Target
19: Percentage of rural community housing units with water and sewer services		78%	87%



# Healthy Alaskans 2020: Rural Sanitation Target



**Thank you!**