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# Water Quality and Health in Northern Canada: Contamination of Stored Drinking Water and Associations with Acute Gastrointestinal Illness in an Inuit Community

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Carlee Wright

J. Sargeant, V. Edge, J. Ford, I. Shiwak, K. Farahbakhsh, RICG, IHACC  
Research Team, and S.L. Harper

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## Background: Waterborne Disease in Northern Canada

- Inuit communities in the Canadian Arctic have one of the highest self-reported incidence rates of Acute gastrointestinal illness (AGI) in the world
- Concerns over drinking water supply
  - Safety of municipal tap water
  - Water is a potential source of AGI

**Inuvialuit**

**Nunavut**

**Nunatsiavut**

**Nunavik**

**Nain**

**Hopedale**

**Postville**

**Makkovik**

**Rigolet**



0 250 500 1,000 Kilometers

Sources: Esri, DeLorme, USGS, NPS, NOAA



# Background: Drinking Water in Rigolet

**Tap water**



**Purchased  
water**



**Brook water**



**ADWS water  
Jan 2014**



# Background: Drinking Water in Rigolet



- ADWS: Residents collect own water
- Community member identified research question
  - Can storing water have negative health impacts?



# Goal & Objectives

## **Goal**

Understand household stored drinking water and its potential associations with self-reported AGI in Rigolet, Nunatsiavut

## **Objectives:**

1. Describe drinking water sources and water-related practices, and how they differ across demographic groups
2. Determine the prevalence of *E. coli* and total coliforms in stored water containers, and identify risk factors for secondary water contamination; and
3. Examine potential associations between AGI and environmental and behavioural risk factors, *E. coli*, and total coliform levels in containers.



# Materials & Methods



June 2014: Retrospective, cross-sectional census survey

## Questionnaire

- Risk factors for secondary water contamination
- Water-related risk factors for AGI
- Self-reported AGI

## Water Sampling

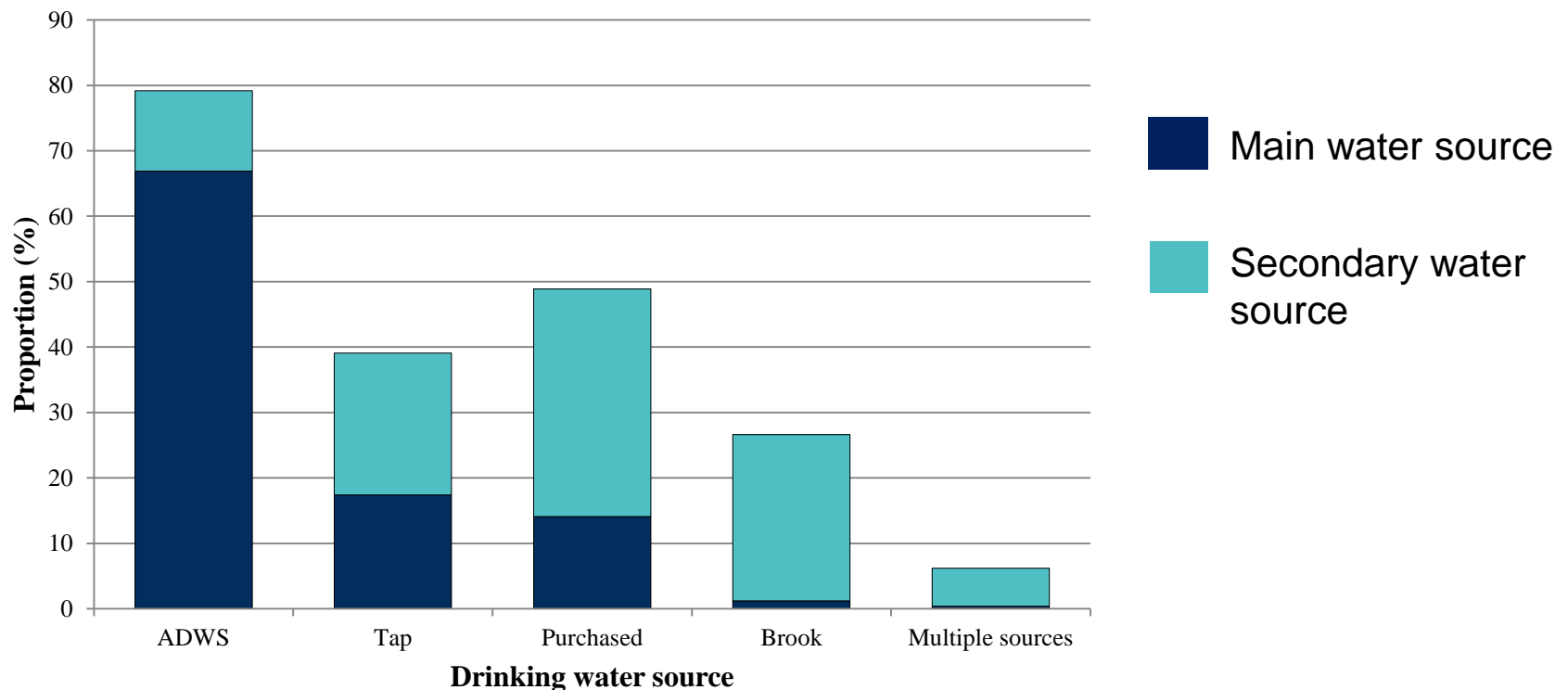
- Sampled all identified water storage containers
- Analyzed for total coliforms & *E. coli*
- Data on container characteristics

Response rate: 92.8% (n=246)



## Results: Drinking Water Use

- ADWS primary or secondary water source for 74.8% of people (95% CI 68.9%-79.9%)







## Results: Total Coliforms in Stored Water

- Over 90% of households had stored water
- Samples from 104 containers
  - Total coliforms: 25.2% (95% CI 17.7%-34.7%)
  - *E. coli*: One sample positive
- 67.0% (95% CI 57.0%-75.6%) cleaned once/month or less



## Results: Total Coliforms in Stored Water


- **Dippers:** Odds of total coliform presence in containers with dippers 13.5 times greater than containers where no dipper was present (p=0.006)
- **Transfer dippers:** Odds of total coliform presence 3.4 times greater when transfer dippers were present in water, compared to if water was not transferred (p=0.028, 95% CI 1.15 – 10.0)





## Results: Acute Gastrointestinal Illness

- Annual incidence rate 2.43 cases/person-year
  - 42 cases
  - 4 week period prevalence 17.2% (95% CI 12.9-22.5%)
- No significant water-related risk factors in June 2014



## Discussion

- ADWS recently installed & widely used in community
  - Necessitates storage of drinking water
  - Infrequent cleaning → microbial regrowth
- Total coliforms detected in large proportion of samples
  - Recontamination after collection → transfer devices
  - Lack of chlorine in ADWS water



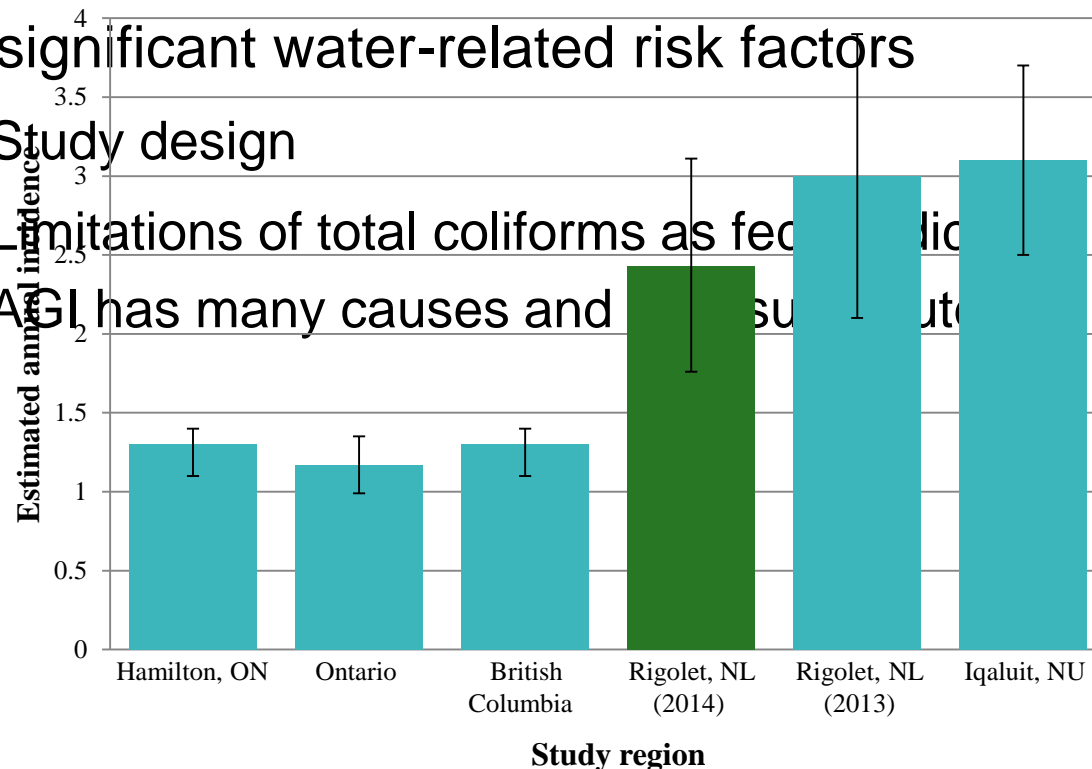


## Discussion

- Incidence rate of AGI similar to past research → significantly higher than in other studies in southern Canada & globally

- No significant water-related risk factors

- Study design
- Limitations of total coliforms as fecal indicator
- AGI has many causes and



## Conclusions & Next Steps

- Various factors could contribute to high rates of AGI
- Minimize possible exposure to waterborne pathogens through simple interventions



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- Rigolet Inuit Community Government
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- IK-Adapt
- Indigenous Health Adaptation to Climate Change (IHACC) Research Team





A photograph of a coastal town at dusk. The sky is a deep, dark blue with some lighter clouds. In the foreground, there are tall, dark grasses. In the middle ground, a body of water reflects the lights of a town on the opposite shore. The town's lights are a mix of warm yellow and orange, and some cooler blue and white lights. The overall mood is peaceful and serene.

# Thank You!

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September 18<sup>th</sup>-21<sup>st</sup>, 2016