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Detection of *E. coli*/Total coliforms and Antibiotic Resistance Genes in Drinking Water Collected from Three First Nations Communities in Manitoba

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Background

- >100 First Nations reserves are under a Boil Water Advisory today (October/November 2016)
- In previous studies, *E. coli* and total coliforms were found in drinking water in different First Nations communities
- Other than indicator bacteria, antibiotic resistance genes (ARGs) were found in drinking water as well
- Bacteria would survive from antibiotics if carried ARGs
- Surface water is a reservoir of them



Objectives

1. Detect *E. coli* and total coliforms in drinking water in First Nations communities
2. Detect antibiotic resistance genes in drinking water in First Nations communities



Study - Sampling

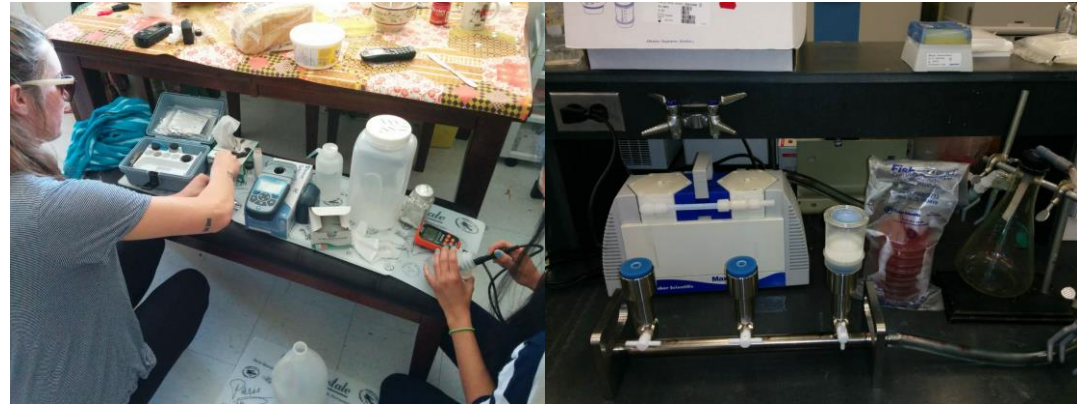
- Started in Summer 2016
- Three First Nations: communities A, B, and C
- Two sampling rounds in each community

		Source	WTP	truck	pipeline	Cistern	Private Well	Shared Well
A	Trip 1	3	3	3	6	5	6	-
	Trip 2	2	2	2	3	3	3	-
B	Trip 1	3	3	3	6	7	-	-
	Trip 2	2	2	2	6	7	-	-
C	Trip 1	1	-	2	-	5	5	5
	Trip 2	1	-	2	-	5	4	5



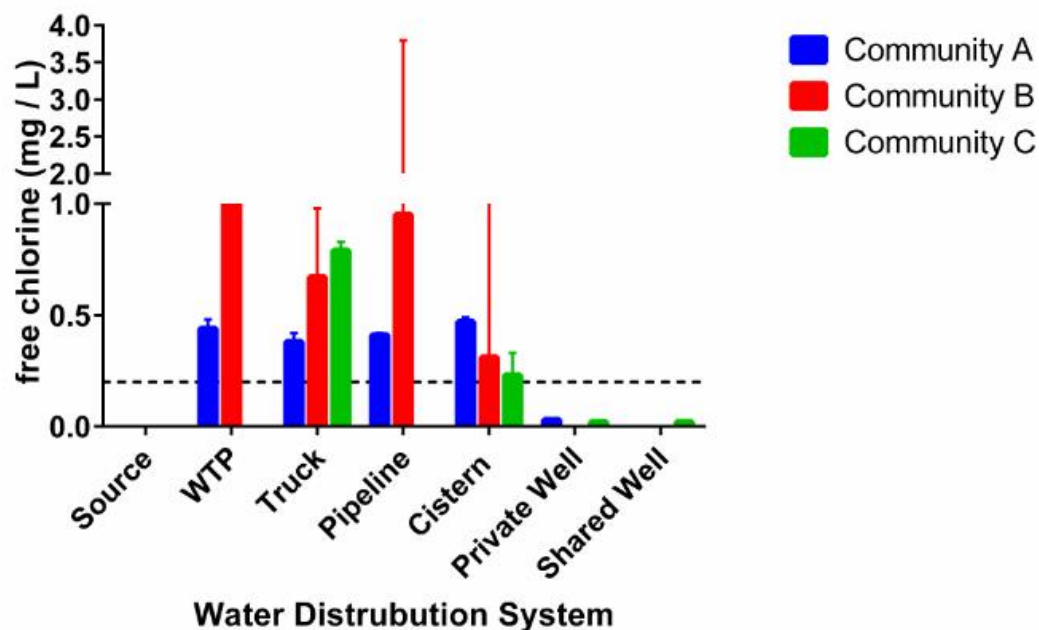
Study - Analysis

- Chlorine, pH, and turbidity were measured during sample collection
- *E. coli*/total coliforms counting and ARGs were tested in lab on campus



Study - Results

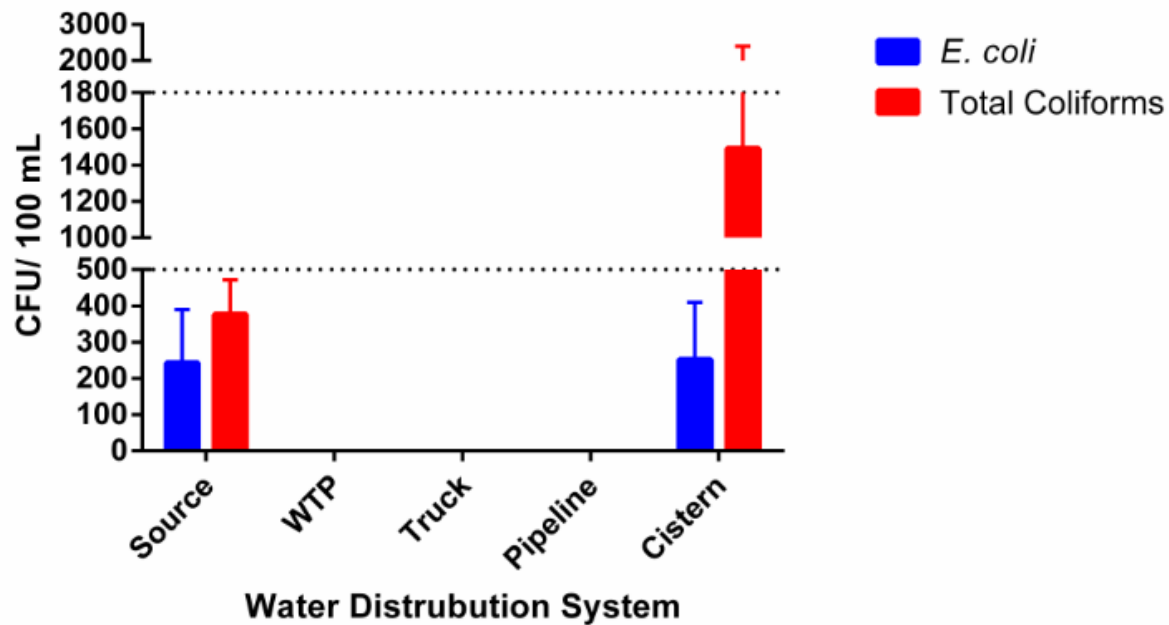
- Free Chlorine: > 0.2 mg/L is recommended by WHO



Free Chlorine Residual in three First Nations communities

Study - Results

- *E. coli*/ total coliforms in community B

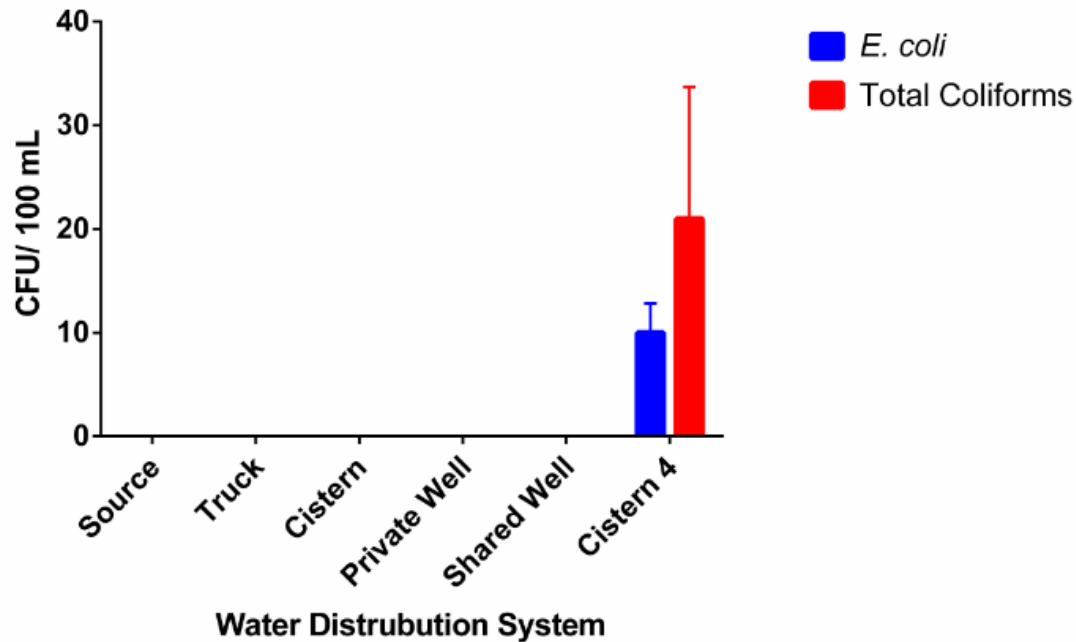


E. coli and Total coliforms in community B



Study - Results

- *E. coli*/ total coliforms in community C



E. coli and Total coliforms in community C

Study - Results

- 4 antibiotic resistance genes (*vanA*, *ampC*, *tetA*, *mecA*) were tested

	A	B	C
<i>ampC</i>	+	-	-
<i>vanA</i>	-	-	-
<i>tetA</i>	-	-	-
<i>mecA</i>	-	-	-

- *ampC* was found in one well sample in community A



Study - Summary

- Drinking water quality is poor in homes with cisterns
- Cistern waters were contaminated with bacteria but no ARGs were found
- Determination of contamination source would be important as it may aid in determining appropriate solutions to reduce the risk of contaminated drinking water in First Nations communities



Plan of This Summer

- Focus on cisterns in community B

Issues in cisterns:

1. All cisterns are underground and many of them are cracked
2. Usage time > recommendation
3. 40 plastic and rests are concrete
4. Cleaning plan is not clear
5. About 25ft to sewage tank (cracked)



Information about sewage system:

1. No sewage treatment plant
2. Most of homes are equipped with sewage tanks
3. Sewage is loaded in a lagoon and treated by natural process

Plan of This Summer

- Two sampling trips(early June and late July)
- Cisterns (12) + sewage tank (12) + lagoon (6) + Truck (3) + WTP (3)
- *E. coli*/ total coliforms will be tested
- Antibiotic resistance genes will be tested (*vanA*, *ampC*, *tetA*, *mecA*, *mcr-1*, *sul1*)
- Bacteria community might be examined as well



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