# Results of the Multi-site Nunavut Acute Childhood Gastroenteritis Surveillance Project

Desai S<sup>1</sup>, Miners A<sup>2</sup>, Smieja M<sup>3</sup>, Amagoalik L<sup>4</sup>, Barker B<sup>3</sup>, Nishi W<sup>2</sup>, Serra E<sup>5</sup>, Yansouni CP<sup>5</sup>, Pernica JM<sup>3</sup>, Barker K<sup>6</sup>, Goldfarb DM<sup>3,7</sup>

<sup>1</sup>Public Health Agency of Canada, Ottawa, Canada; <sup>2</sup>Qikqiktani General Hospital, Iqaluit, Canada; <sup>3</sup>McMaster University, Hamilton, Canada; <sup>4</sup>Qaujigiartiit Health Research Centre, Iqaluit, Canada; <sup>5</sup>McGill University, Montreal, Canada, <sup>6</sup>Department of Health, Government of Nunavut, Iqaluit, Canada; 7University of British Columbia, Vancouver, Canada

### Abstract

Background: Rotavirus gastroenteritis is a common cause of diarrhea in young children. The burden of illness among children residing in Nunavut is unknown. Rotavirus vaccine has been available in Canada since 2008, but has not been introduced in all Canadian jurisdictions including Nunavut. The purpose of this project is to characterize the burden of illness due to rotavirus and other enteric pathogens in children who reside in Nunavut.

Methods: Pediatric flocked swabs or stool samples were collected children ≤ 5 years of age presenting with acute gastroenteritis to Health Centres in 6 communities across Nunavut. Samples were stored frozen until testing with a previously validated multiplex polymerase chain reaction (PCR) assay that detects 22 enteropathogen targets (13 bacteria, 4 protazoan parasites, and 5 viruses) simultaneously (BioFire Filmarray™ Gastrointestinal panel, bioMerieux Inc.). All testing was done at the Qikqitani General Hospital, Iqaluit, Nunavut.

Results: 80 samples were collected between September 26th, 2014 and September 13th, 2017. 55% were male and the median age was 12 months (interquartile range was 8.5 to 18 months). Sixty subjects (75%) had at least one pathogen detected. The leading viral pathogens detected were sapovirus, (n=22), rotavirus, (n=16) and norovirus (n=14). The leading bacterial pathogens detected were enteropathogenic E. coli (n=9) and C. difficile toxin A/B (n=8). No protozoan parasites were detected.

Discussion: Rotavirus was found to be the second leading cause of acute gastroenteritis in Nunavummiut children and the planned territorial vaccination program should result in a significant reduction in childhood diarrheal disease. Sources of other prevalent pathogens (e.g. diarrheagenic E. coli) are not clear and need further study.

# Background

Gastroenteritis is a common illness in children under the age of five years internationally and appears to be particularly common in Inuit regions of Canada.

Testing of clinical gastroenteritis samples submitted in Inuit regions in northern Canada has recently revealed a very high rate of Cryptosporidium spp. detection (1), particularly among young children (2).

Viral pathogens for which there are current and potential vaccines are common causes of gastroenteritis in much of the world but are rarely tested for in northern communities, so the relative contributions of these infections are not known.

The objective of this study was to describe the microbiology and epidemiology of acute pediatric gastroenteritis in Nunavut prior to the introduction of a universal rotavirus vaccine program.

# Study population

We conducted a prospective cohort study of children ≤ 5 years of age presenting for acute gastroenteritis to either the Qikiqtani General Hospital (QGH) or one of 5 health centres at other smaller communities (2 in Qikiqtaaluk region, 2 in Kivalliq region, and 2 in Kitikmeot region).

### **Surveillance Sites**



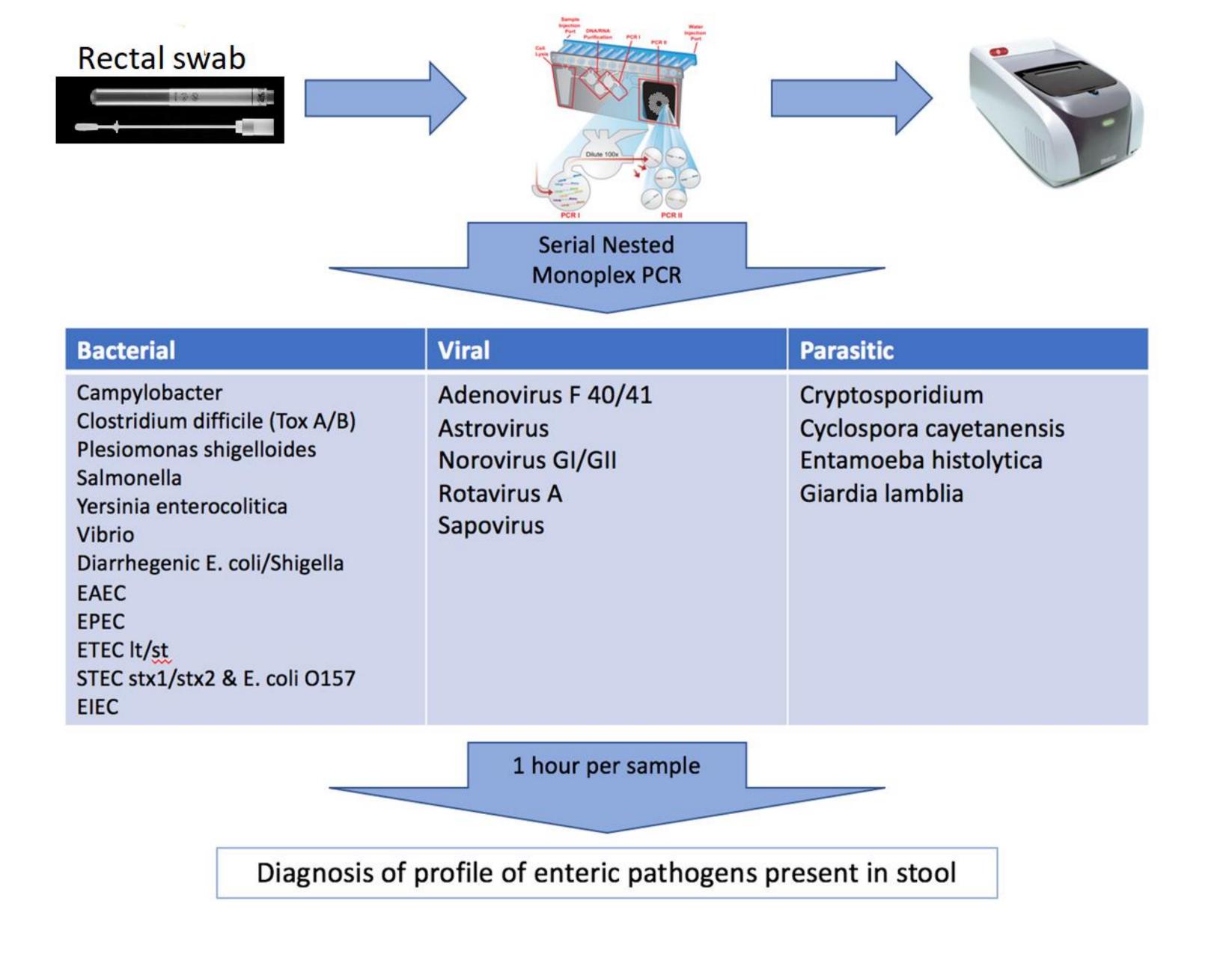
### **Data Collection**

Acute gastroenteritis was defined as the occurrence of >3 episodes of diarrhea (stools of a less formed character than usual) OR >2 episodes of vomiting within a 24 hour period prior to the current visit. Children were excluded if they had diarrhea due to a known medical condition (e.g. Inflammatory bowel disease) or were known to be neutropenic (Absolute neutrophil count < 1,000). Community of origin, sex, age, presence of diarrhea and/or vomiting was recorded by clinic staff that enrolled patients. From July 7th, 2017 onwards stool samples received at the QGH laboratory from children ≤ 5 years of age for clinical microbiology testing as part of routine care were also included.

# **Laboratory Methods**

Anatomically designed flocked rectal swabs (Fecal Swab, Copan Italia SpA, Brescia Italy) which have previously been extensively validated for use for molecular detection of enteric pathogens were collected and then immediately stored dry at – 20C. Swabs were transported in batches on ice for testing at the QGH laboratory. Swabs were either eluted in either 2ml modified Cary Blair (Copan Italia SpA) or 2 ml easyMAG lysis buffer (bioMerieux Inc.) and then 200ul of the eluate was tested with the BioFire Filmarray Gastrointestinal Panel (bioMerieux Inc.) – see Figure 1.

# Fig.1 BioFire FilmArray Enteric Pathogens Panel



### Results

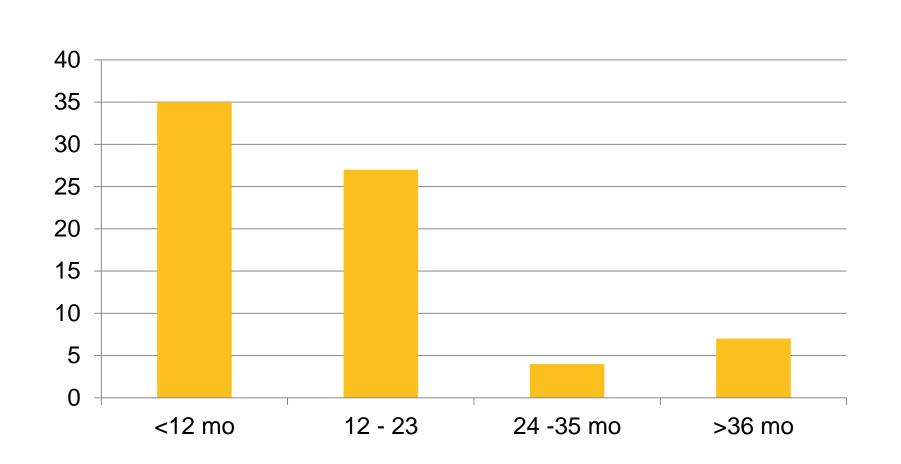
A total of 82 children were enrolled across the 6 sites between Sept 2014 and Oct 2017 – see Table 1 for characteristics.

Table 1. Characteristics of the children enrolled in the study

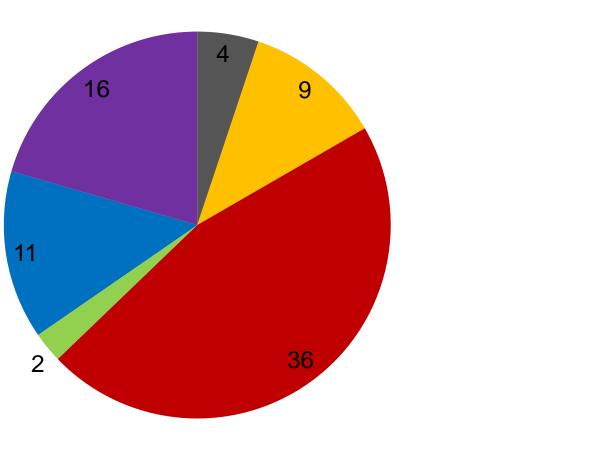
| Characteristic         |                             |
|------------------------|-----------------------------|
| Gender (M/F) n =76     | 33 female and 43 (56%) male |
| Age (Median, IQR) n=78 | 12 months (9-18 months)     |
| Symptoms:              | N (%)                       |
| Vomiting (n=71)        | 43 (60%)                    |
| Diarrhea (n=73)        | 71 (93%)                    |

### Results (cont'd)

### Age Distribution of Subjects

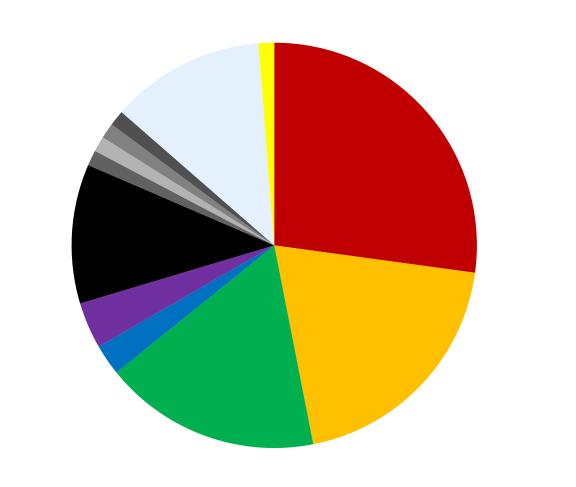


### **Community Distribution of Subjects**



■ Igloolik Kimmirut ■ Cambridge Bay Gjoa Haven Arviat QGH

# Microbiology



■ 22 Sapovirus 16 Rotavirus ■ 14 Norovirus ■2 Adenovirus 40/41

■ 3 Astrovirus

■9 EPEC ■1 EAEC ■ 1 Campylobacter ■ 1 O157 stx1/2 ■ 1 Vibrio

10 C. difficile

EPEC: Enteropathogenic E. coli; EAEC, Enteroaggregative E coli;

- No Cryptosporidium detected.
- Rotavirus second leading pathogen detected
- EPEC is also highly prevalent (9/82 children)

### Conclusions

- Data supports the planned territorial introduction of universal rotavirus vaccination
- Cryptosporidium did not appear to be a common cause of pediatric gastroenteritis in Nunavut during the period of study, reinforcing the importance of ongoing territorial surveillance
- Significant reductions in pediatric gastroenteritis should be expected following the introduction fo the rotavirus vaccine program, however this requires ongoing monitoring

### References

1. Goldfarb DM, et al. (2013), Nanolitre real-time PCR detection of bacterial, parasitic, and viral agents from patients with diarrhoea in Nunavut, Canada. Int J Circumpolar Health. 72:19903.

2. Yansouni C, et al. (2016), Cryptosporidium hominis Is a Newly Recognized Pathogen in the Arctic Region of Nunavik, Canada: Molecular Characterization of an Outbreak. PLoS Negl Trop Dis 10(4): e0004534

# Acknowledgements

- We thank the parents and children who agreed to participate in this study
- o Members of the Iqaluit Qikqitani General Hospital Laboratory as well as all the staff at the participating health centres
- o Kathy Luinstra at St. Joseph's Hospital, Hamilton for assisting with testing o Funding provided by the Public Health Agency of Canada



**Health Centre** 

