

Enteric infections among symptomatic and asymptomatic preschool-age children in Nunavik: Interim results from a prospective cohort study

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Abstract

Background: Human infections with intestinal parasites, particularly from *Cryptosporidium*, are recently recognized as being highly prevalent among people with diarrhea in parts of the Arctic. However, data are lacking about their transmission among asymptomatic community members as a potential reservoir of endemicity. This is important because cryptosporidiosis has been repeatedly associated with impaired growth and development in children, and may synergize with other challenges faced by remote Arctic communities, such as overcrowding and food-insecurity.

Method/Study design: A prospective cohort of daycare-attending children (age <5 years) in Kuujuaq, Nunavik, was assembled in collaboration with community stakeholders. Stool specimens and anthropometric data were collected every 4 months, and a questionnaire was administered to parents asking about diarrhea symptoms. Stool specimens were stored frozen until testing with a previously validated multiplex polymerase chain reaction (PCR) assay that detects 22 enteropathogen targets (13 bacteria, 4 protozoan parasites, and 5 viruses) simultaneously (BioFire Filmarray™ Gastrointestinal panel, bioMérieux Inc.).

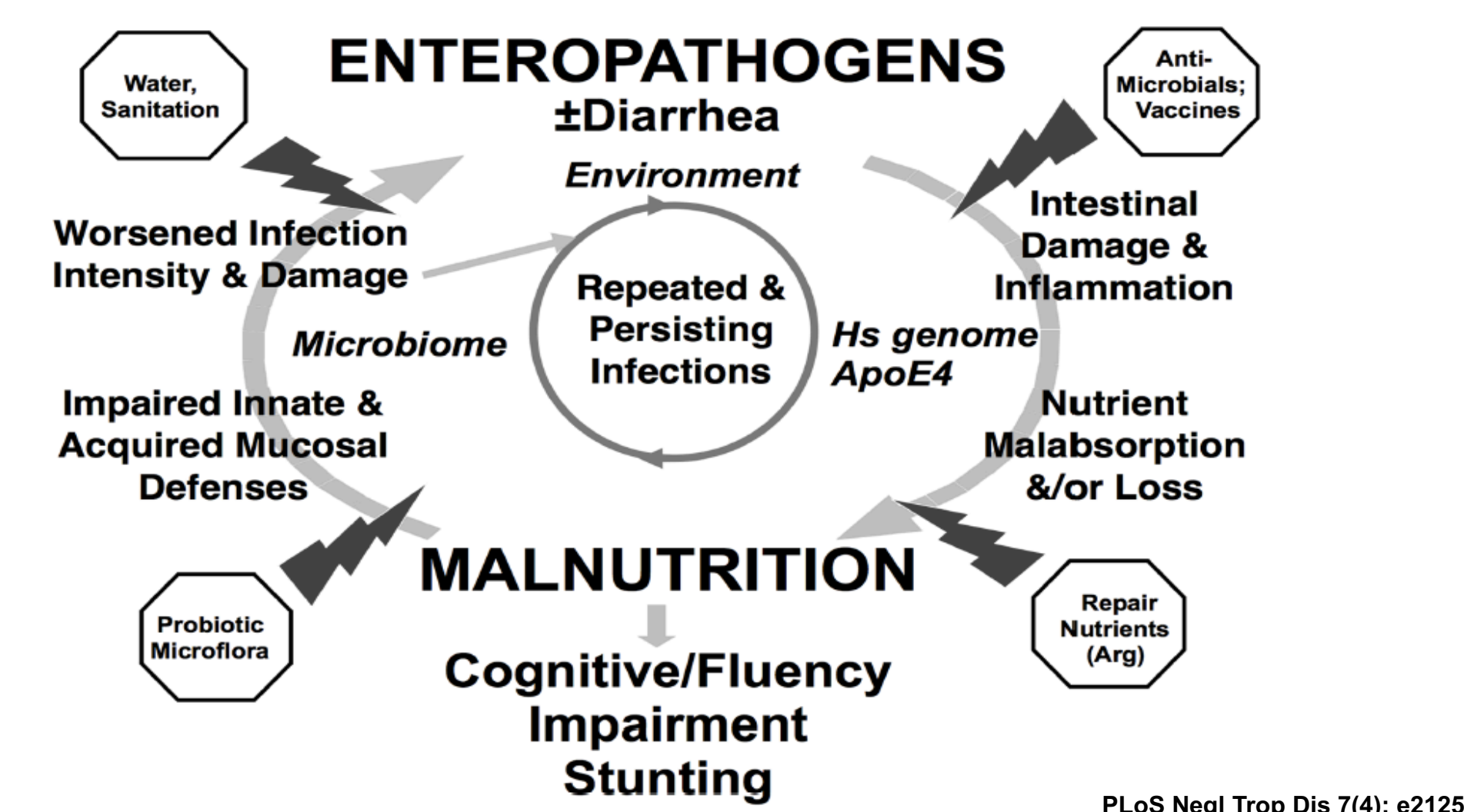
Results: We present results of an interim analysis of the first 8 months of serial data collection on the causative spectrum of enteric infections in young children from a 2-year prospective cohort study.

Hypothesis & Objective

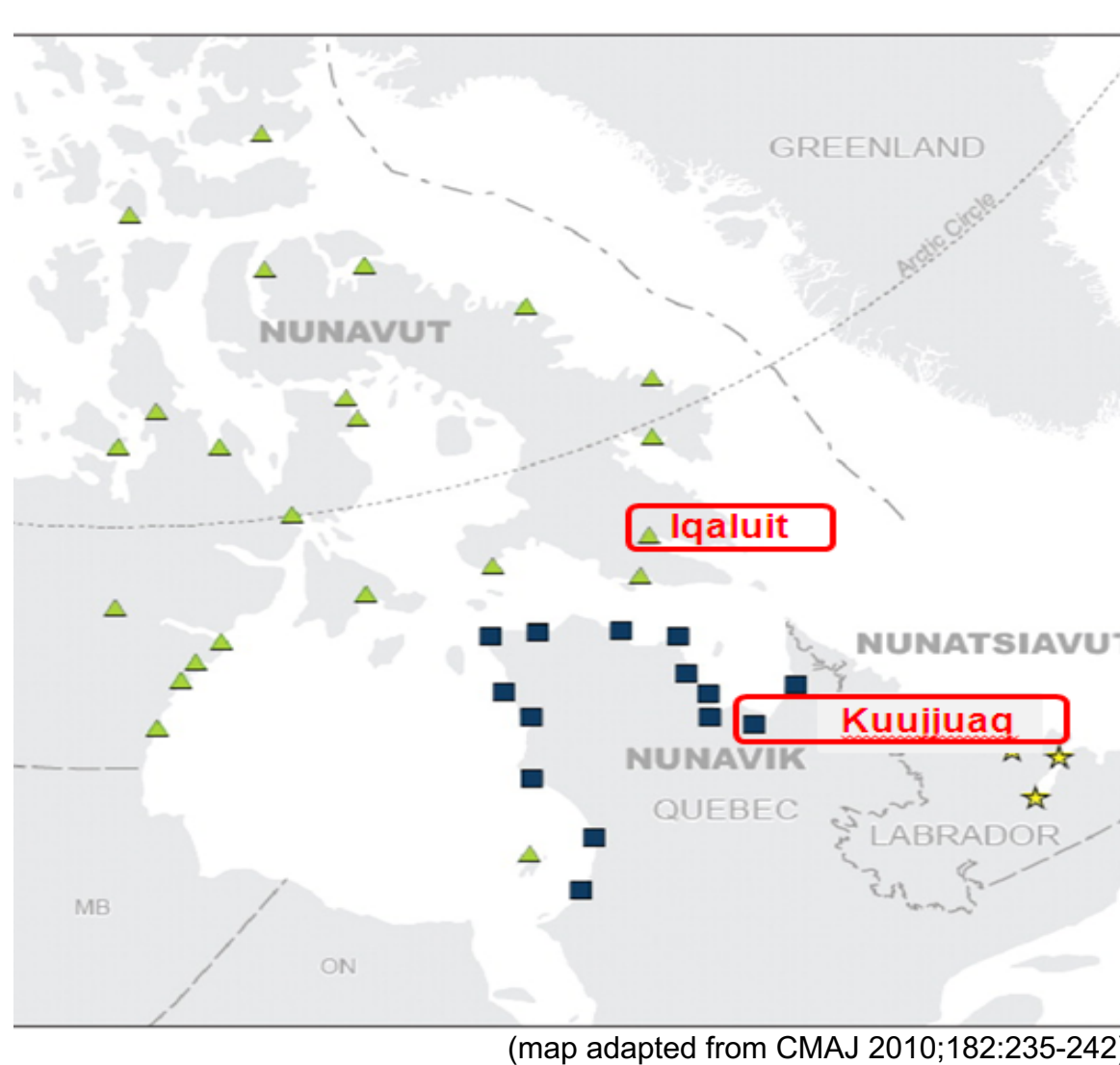
Hypothesis: Notifiable enteric infections are common and may contribute to stunting in young children in Canadian Arctic communities.

Objectives: (i) To assess the frequency and etiologic spectrum of intestinal pathogens circulating among daycare-attendees in Nunavik. (ii) To determine the incidence of diarrhea in this group, and (iii) to determine whether enteropathogens are associated with diarrhea

Enteropathogens and Diarrhea



Health in Northern Canada



Multiplicity of risk factors:

- Possible food insecurity
- Home overcrowding
- Limited access to health services
- Geographical isolation and difficulty of travel
- Indigenous communities facing severe socio-economic challenges

Daycares in Kuujuaq

Tumiapiit:
30 children enrolled.

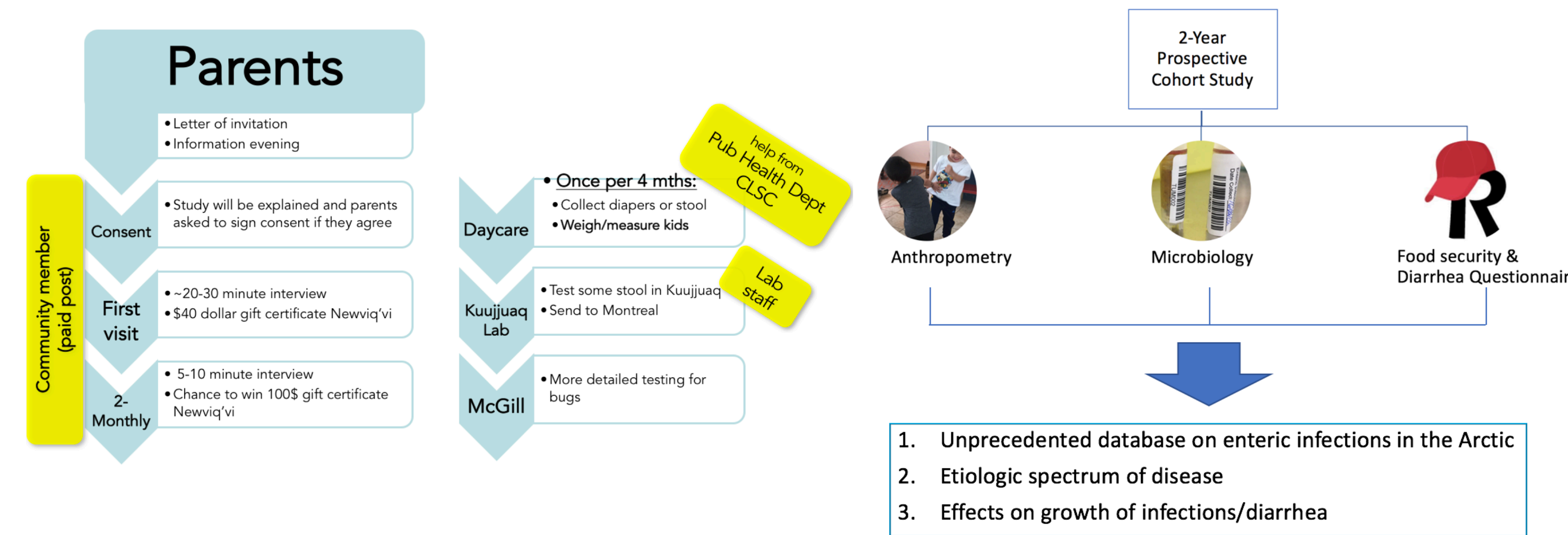
Iqitauvik:
34 children enrolled.
(80 children per site)

Specific inclusion criteria:

- Age 0-59 months
- Parents/guardians with written informed consent

No exclusion criteria

Study Design



Data Collection

Stool and Anthropometry data collection

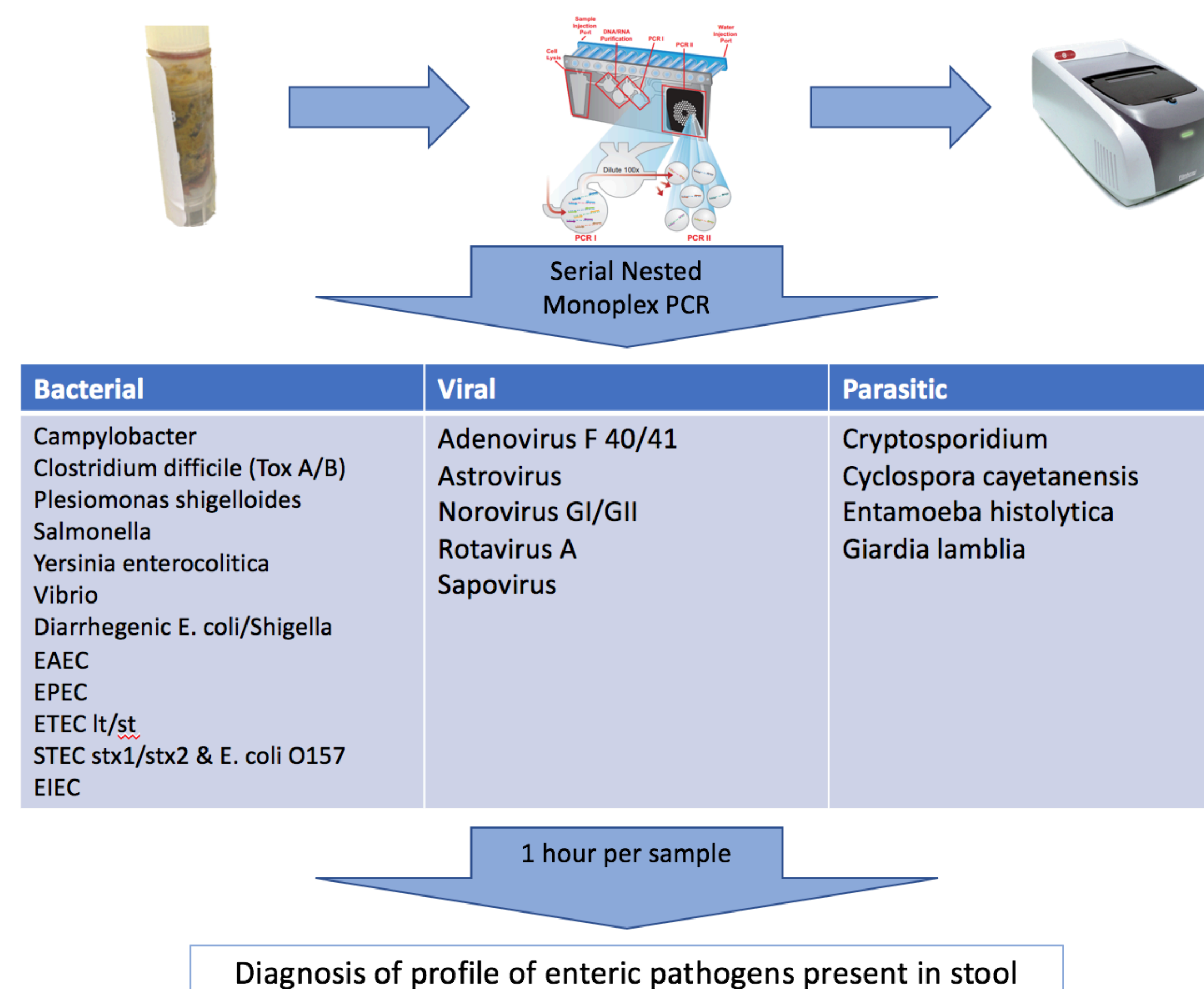


- Soiled diapers and bulk stool samples collected from daycares
- Samples processed at the Kuujuaq Ungava Tulattavik Health Centre
- Stored at -80°C until analysis



- Weights and heights measured on-site
- Smaller infants were measured using digital baby scale and measuring board
- Local Inuit family-education social workers helped with this process

Microbiology: BioFire FilmArray Enteric Pathogens Panel



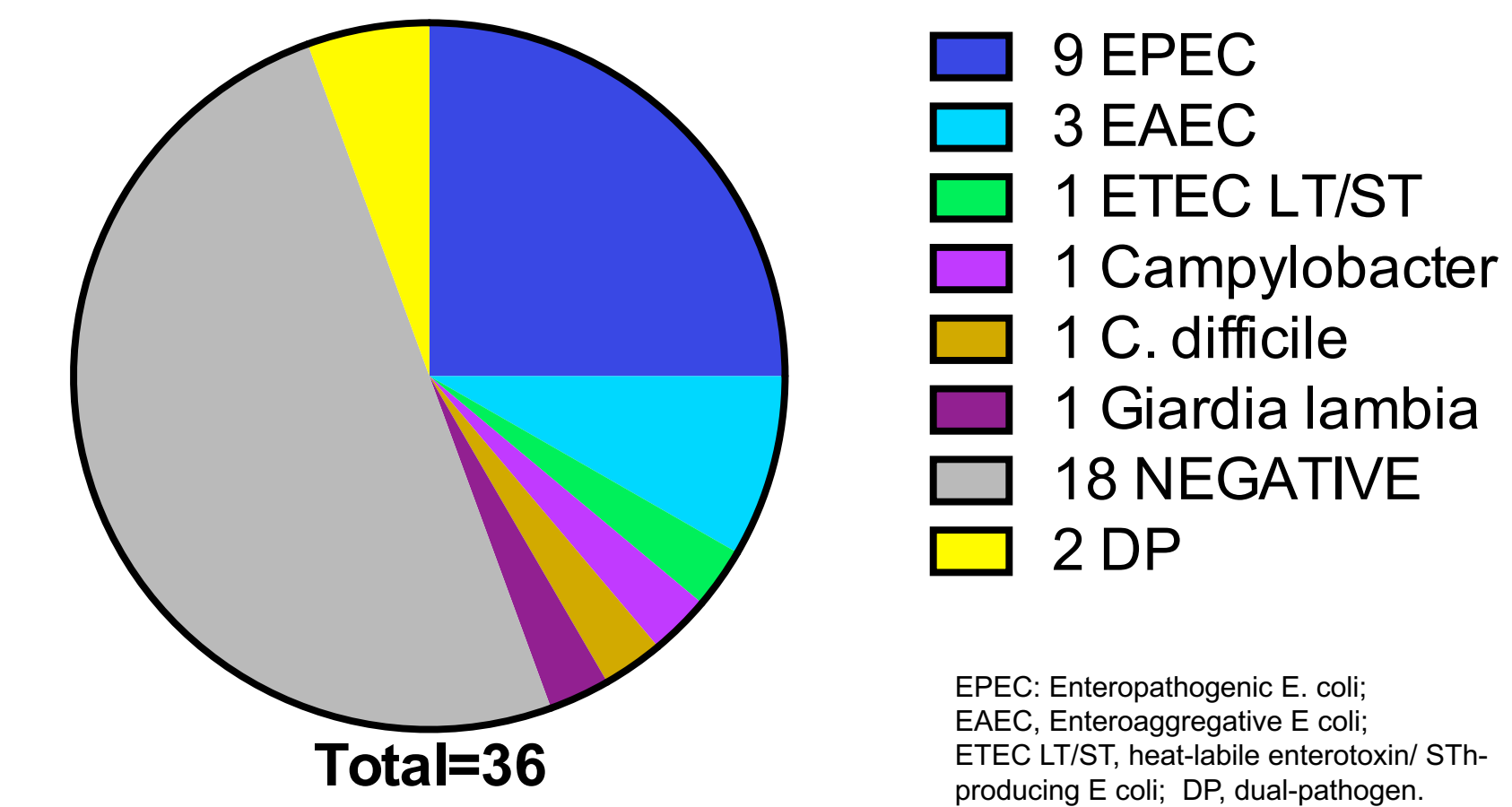
Diarrhea and Food Safety Questionnaire

- 15-minute phone interviews with enrolled children's parents
 - Frequency of diarrhea
 - Food security

Preliminary Results at 8 Months (2 Collections):

Microbiology

Profile of Enteric Pathogens in Kuujuaq Daycares



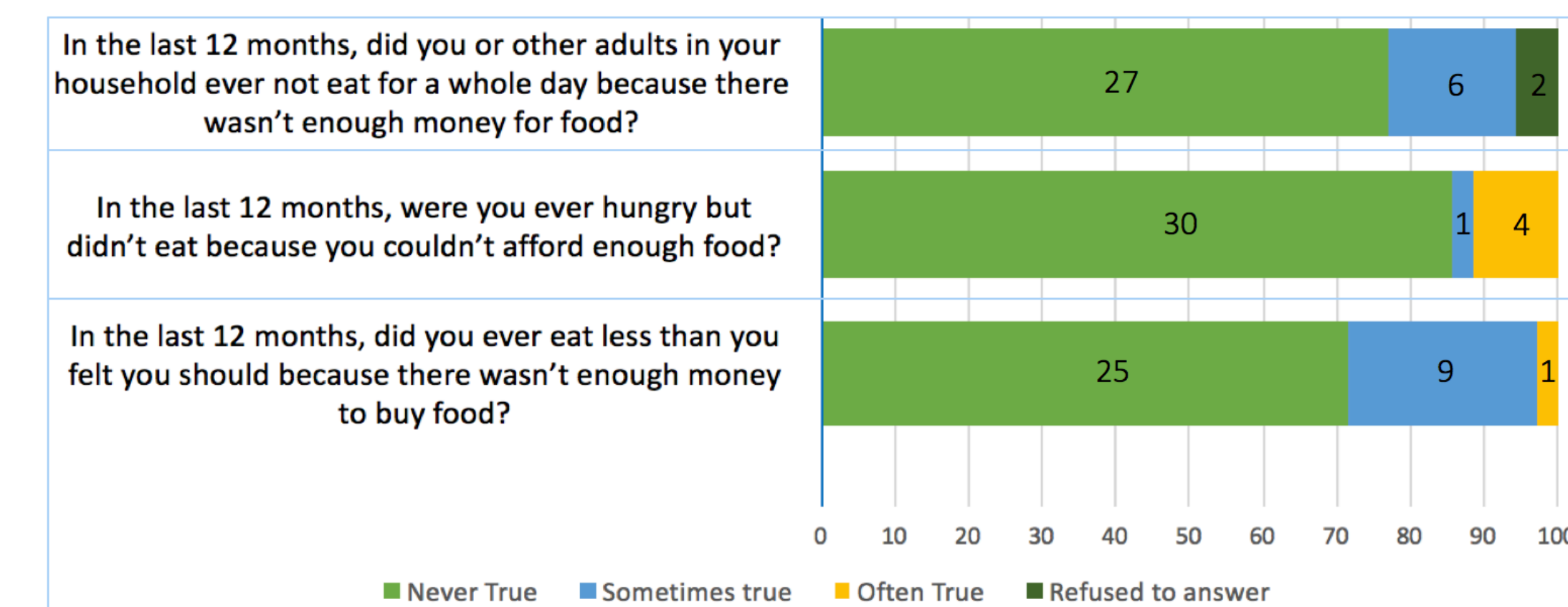
- No *Cryptosporidium* detected.
- Few notifiable infections (2/32 children)
- EPEC is highly prevalent (9/32 children)

Diarrhea Questionnaire

	stool +	stool -	no specimen	Total
symptoms+	3	4	9	16
symptoms-	4	8	25	37
no questionnaire	7	6	12	25
Total	14	18	46	78

- 16/53 (30.2%) children reported vomiting/diarrhea during study period
- Preliminary data so far precludes correlation of diarrhea symptoms to infection

Food Security



What next?

Continue recruitment of children in daycares
Build a complete dataset

- Analyze concomitant questionnaire data to determine incidence of diarrhea in this group, and relationship to enteropathogen carriage
- Understand the epidemiology of enteric pathogens circulating among daycare-attending children in Nunavik
- Investigate anthropometric data to determine if asymptomatic or symptomatic infections contribute to decreased growth velocity
- Inform public health priorities in Northern Canada

References

- 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.
- Lima, A. A. et al. (2008). Malnutrition as an enteric infectious disease with long-term effects on child development. *Nutrition Reviews*, 66(9), 487-505. <http://doi.org/10.1111/j.1753-4887.2008.00082.x>
- Goldfarb D, et al. (2016). Enteric Parasites in Arctic Communities: Tip of the Iceberg?. *Trends in Parasitology*, Volume 32, Issue 11, 2016, Pages 834-838, ISSN 1471-4922, <https://doi.org/10.1016/j.pt.2016.08.004>.

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- Members of the Iqaluit Qikqitani General Hospital Laboratory