1115

Epidemiology of Infectious Pediatric Gastroenteritis in Salt Lake City, Utah in 2010-2012

M. Rogatcheva[1], Brad Graham[1], M. Vaughn[1], R. Crisp[1], C. Li[1], O.Cham[1], R. Trauscht[1], T. Healy[1], C. Stockman[2], A.T. Pavia[2], T. Barney[3], and J. Daly[3,2]

[1]BioFire Diagnostics, LLC, Salt Lake City, UT, [2]Univ. of Utah, Salt Lake City, UT, [3]Primary Children's Hospital, Salt Lake City, UT

INTRODUCTION

Determining the etiology of pediatric diarrhea is difficult due to the large number of diarrheagenic agents, overlapping clinical symptoms, and the need to select from among multiple diagnostic tests. More sensitive tests that can detect a broad range of pathogens could improve diagnosis and surveillance for infectious diarrhea.

The objective of this study was to assess the etiology of diarrhea in children in Salt Lake City and compare the diagnostic yield of standard testing selected by the treating clinician to the enriched yield from multi-target testing using the FilmArray™ Gastrointestinal (GI) Panel, a multiplex PCR diagnostic system that detects 22 bacterial, viral, and parasitic agents.

THE FILMARRAY GI PANEL

Simultaneous detection of 22 targets:

Bacteria

- *Campylobacter (jejuni, coli and upsaliensis)*
- *Clostridium difficile*
- *Plesiomonas shigelloides*
- *Salmonella*
- *Vibrio (parahaemolyticus, vulnificus and cholerae)*
- *Vibrio cholerae*
- *Yersinia enterocolitica*

Diarrheagenic *E. coli*/*Shigella*

- Enterotoxigenic *E. coli* (ETEC) *lt/st*
- Enteropathogenic *E. coli* (EPEC)
- Shiga-like toxin-producing *E. coli* (STEC) *stx1/stx2*
- *Shigella*/Enteroinvasive *E. coli* (EIEC)
- Enteroaggregative *E. coli* (EAEC)
- *E. coli* O157

Viruses

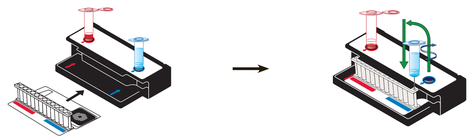
- Adenovirus F40/41
- Astrovirus
- Norovirus GI/GII
- Rotavirus A
- Sapovirus (I, II, IV, and V)

Parasites

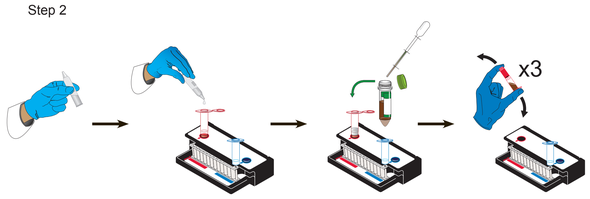
- *Cryptosporidium*
- *Cyclospora cayetanensis*
- *Entamoeba histolytica*
- *Giardia lamblia*

Sample Processing and Pouch Loading Instruction

Step 1



Step 2



Testing of stool samples with the FilmArray GI Panel requires minimal pre-processing of specimens. The stool is diluted in Cary Blair medium (1:4) and loaded into the FilmArray GI pouch using a novel filter-injection vial. The user enters the sample and pouch type (using a barcode reader) into the software and initiates a run. The result of the test is ready in about one hour.

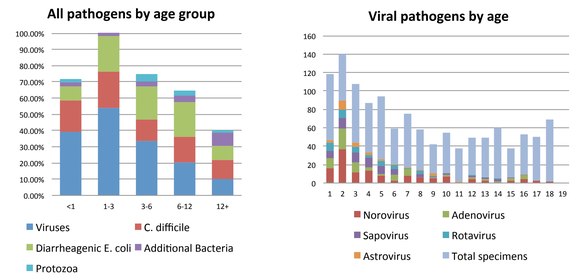
ACKNOWLEDGEMENTS

This study was supported by NIH Grant #5R01AI089489.

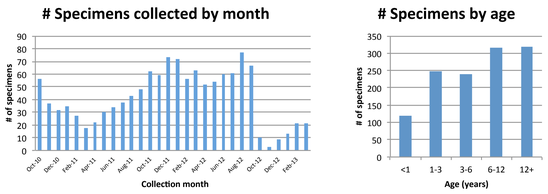
Standard of Care Versus Multi-target GI Panel

Organism	Standard Laboratory Methods No. Positive / No. Tested (%)	FilmArray GI Panel No. Positive / No. Tested (%)
Any Pathogen	267/1252 (21%)	633/1252 (51%)
Viral pathogens		
Norovirus GI/GII	NT	136/1252 (10.9%)
Adenovirus F 40/41	10/164 (6.1%)	79/1252 (6.3%)
Rotavirus A	19/235 (8.1%)	44/1252 (3.5%)
Sapovirus	NT	72/1252 (5.8%)
Astrovirus	NT	31/1252 (2.5%)
Bacterial pathogens		
Clostridium difficile	165/969 (17.0%)	198/1252 (16%)
Salmonella spp.	24/556 (4.3%)	24/1252 (2%)
Campylobacter spp.	5/556 (0.9%)	18/1252 (1.4%)
Yersinia enterocolitica	1/49(2.0%)	2/1252 (0.1%)
Plesiomonas shigelloides	NT	3/1252 (0.2%)
Vibrio	NT	1/1252 (0.08%)
Vibrio cholerae	NT	1/1252 (0.08%)
Shigella / EIEC	4/556 (0.7%)	22/1252 (1.8%)
EAEC	NT	35/1252 (2.8%)
ETEC	NT	12/1252 (1%)
EPEC	NT	97/1252 (7.7%)
All STEC	18/543 (3.3%)	46/1252 (3.7%)
E. coli O157	13/556 (2.3%)	23/1252 (1.8%)
other STEC	10/543 (1.8%)	23/1252 (1.8%)
Parasitic pathogens		
Giardia lamblia	14/304 (4.6%)	28/1252 (2.2%)
Cryptosporidium spp.	10/304 (3.3%)	10/1252 (0.8%)
Cyclospora cayetanensis	NT	0/1252
Entamoeba histolytica	0/63	0/1252

Pathogen Detections by Age



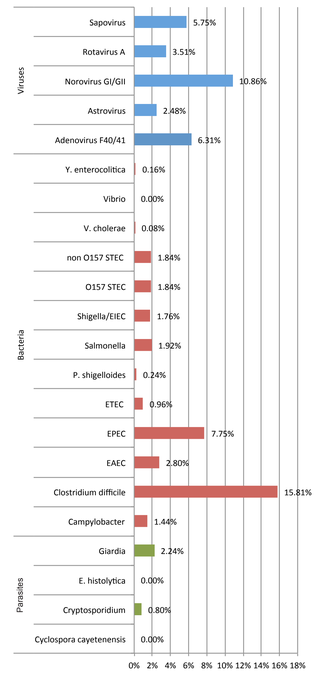
Materials and Methods



The FilmArray GI Panel was used to test residual frozen stool specimens from 1252 individual diarrheal episodes collected from symptomatic children (0-18 years) submitted to the Primary Children's Hospital (PCH) laboratory for standard-of-care testing between October 2010-September 2012. A few selected samples collected through March 2013 were added to the analysis. Specimens were preserved in Cary Blair transport medium and stored at -70˚C until FilmArray GI Panel testing.

Standard laboratory tests were performed by PCH according to the requests of the treating clinician. Each specimen was tested in the lab for 1 to 16 pathogens, whereas the FilmArray GI Panel assessed each specimen for 22 pathogens with a single test. Testing was done according to manufacturer's instructions. The FilmArray GI reports were compared with PCH lab detections for concordance when available.

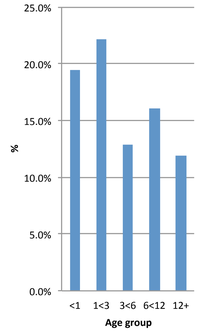
Pathogens Detected by the FilmArray GI Panel from 1252 Symptomatic Children, Salt Lake City, UT (October 2010-March 2013)



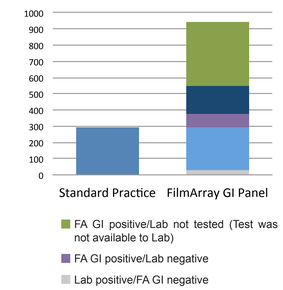
The most prevalent pathogens:

- *C. difficile* in 16% (198/1252) of episodes
- Norovirus GI/GII in 11% (136/1252) of episodes
- Enteropathogenic *E. coli* in 7.7% (97/1252) of episodes

C. difficile detections by age groups



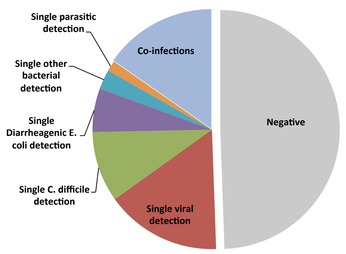
Means for Higher Diagnostic Yield



FilmArray GI Panel identified 890 pathogens in 633 episodes (51%).

Standard of care practice using available methods identified 273 pathogens in 267 episodes.

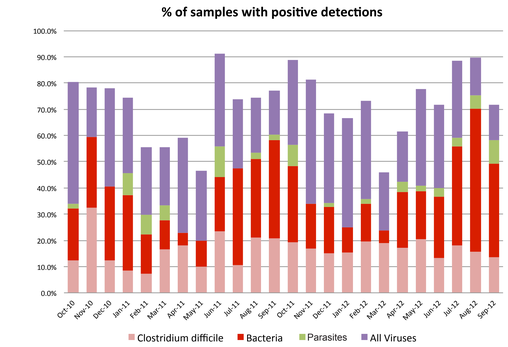
Co-infections in Children

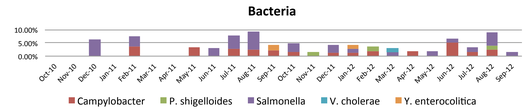


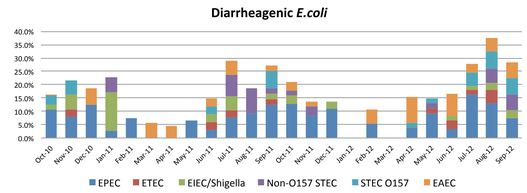
15% (192/1252) of all episodes contained 2 or more detections.

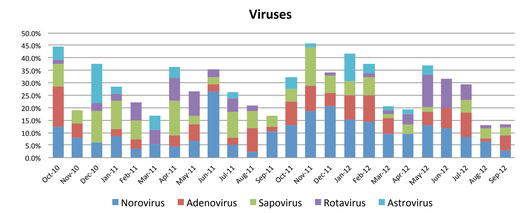
Clostridium difficile accounts for 52% (120/227) of single bacterial infections and 40.1% (78/192) of co-infection.

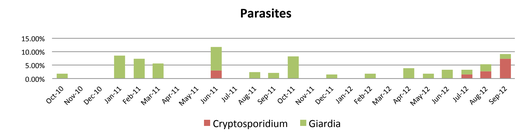
FilmArray GI Panel Detections by Month (October 2010-September 2012)











CONCLUSION

The use of the FilmArray GI Panel more than doubled the identification of possible etiologic agents in pediatric diarrhea. This highlights the potential importance of multiplex testing and of including tests for emerging pathogens such as diarrheagenic *E.coli* and enteric viruses.

Broader and more accurate pathogen detection may additionally improve patient treatment and reduce inappropriate antibiotic use and associated complications.

Public health may benefit from more rapid detection of GI pathogen-related outbreaks and hospital acquired infections and, overall, a broader understanding of the epidemiology of enteric illness.

BIOFIRE™
A BIOMÉRIEUX COMPANY

Presented at the American Society for Microbiology Conference, May 2014

CONTACT INFORMATION
Margarita Rogatcheva
BioFire Diagnostics
Margarita.Rogatcheva@BioFireDX.com