Evaluation of the FilmArray® Gastrointestinal Pathogen Detection System for Infectious Diarrhea

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INTRODUCTION
An estimated 215-730 million episodes of diarrheal illness occur each year in the United States, resulting in 72,000 physician consultations, 1.8 million hospitalizations, and 3000 deaths.[1-2]

The overwhelming challenge in diagnosing infectious diarrhea is the large number of pathogens that are known to cause diarrhea, including viruses, bacteria, and protozoa. Present diagnostic practices are inefficient as it requires multiple tests which are labor-intensive, expensive, and slow. Additionally, many GI pathogens have limited test availability and low sensitivity. Rapid, accurate diagnosis would improve the management and treatment of patients with diarrhea.

Idaho Technology, Inc. (Boise, Idaho) is developing a panel to detect gastrointestinal pathogens (GI) in stool for use on the FilmArray™ instrument. The FilmArray GI Detection System is a completely processed test that allows detection of multiple pathogens in stool specimens in 90 minutes. The FilmArray GI Panel will be used to test stool samples for gastrointestinal pathogens (GIs), including bacteria, parasites, and viruses. The FilmArray GI Panel is designed to identify 36 GI pathogens, including Salmonella, Shigella, E. coli O157:H7, Campylobacter, C. difficile, Cryptosporidium, Giardia, Adenovirus, and Norovirus.

METHODS
One thousand one hundred eighty-two (1182) stool specimens from symptomatic patients submitted to the Primary Children’s Medical Center (PCMC) laboratory for standard-of-care testing between August 2010 and March 2012 were used in this study. One to seven standard laboratory tests (Figure 2) were performed by PCMC laboratory on each sample according to physicians requests. The number of tests and the percentage of positive detections from each test is shown in Figure 2. Conventional testing resulted in 17.3% of patients diagnosed with a causative pathogen leaving 82.7% of un-diagnosed patients (Figure 5). A subset of 226 medical samples out of the 1182 PCMC specimens consisting of 126 negative specimens and 100 specimens in which pathogens had been identified by the laboratory methods were re-tested using the FilmArray GI Panel.

RESULTS
The specificity of the current version of the FilmArray GI Panel was initially validated using (1) stool samples spiked with well-characterized strains and (2) viral RNA from clinical specimens (data not shown). The performance of the FilmArray GI Panel was evaluated on 232 residual stool specimens from the PCMC collection. The FilmArray GI Panel detected 214 organisms compared to 103 detected by standard clinical methods as ordered by a physician (Figure 6). Overall concordance between clinical and FilmArray GI testing was 87% and the FilmArray GI Panel demonstrated improved sensitivity for a number of pathogens (Figure 7). The discrepancies between testing methods were resolved using sequencing analysis.

The advantage of simultaneous testing for a broad number of pathogens provided by the FilmArray GI Panel was demonstrated by the number of identified pathogens for which testing was not requested by a physician (Figure 8) and was not available (Figure 9).

The FilmArray GI Panel testing among the negative specimens resulted in a total of 32 pathogens being detected in 126 specimens, raising the rate of positive detection in the previously undiagnosed patients by 45% compared to standard-of-care testing (Figure 10).

The FilmArray GI Panel testing revealed co-infections in 32% (34/103) of the patients in which a single organism was identified by standard-of-care testing (Figure 11).

REFERENCES

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CONCLUSION
One hundred three (103) specimens in which single pathogens had been identified by standard-of-care testing were re-tested with the FilmArray GI Panel. All 103 specimens were evaluated as ordered by a physician in the PCMC laboratory. The FilmArray GI panel was able to identify a pathogen in 64% of specimens, raising the rate of positive detection in the previously undiagnosed patients by 45% compared to standard-of-care testing.

CONCLUSION
The FilmArray GI Detection System promises to provide rapid, accurate, and comprehensive detection of GI pathogens and improve treatment of patients presenting with diarrhea.