Clin. Lab. 2024;70:XXX-XXX

LETTER TO THE EDITOR

Assessment of the Clinical Utility of the FilmArray™ Gastrointestinal Panel for Detecting Gastrointestinal Pathogens

Ying-Ju Chen [1], Si-Yu Chen [1], Tze-Kiong Er [1, 2]

[1] *Division of Laboratory Medicine, Asia University Hospital, Asia University, Taichung, Taiwan*
[2] *Department of Medical Laboratory Science and Biotechnology, Asia University, Taichung, Taiwan*

SUMMARY

Background: **Gastrointestinal infections present a significant public health concern as they lead to diverse clinical presentations and healthcare challenges. The rapid and accurate identification of causative pathogens is imperative for effective patient management. This study aimed to assess the clinical utility of the FilmArray™ Gastrointestinal (GI) Panel for detecting gastrointestinal pathogens.**
Methods: **Between November 1, 2022, and December 31, 2023, we analysed gastrointestinal specimens collected from a cohort of patients aged 21 to 91 at Asia University Hospital. These specimens were analyzed using the FilmArray™ GI Panel.**
Results: **The study included 76 patients for whom the FilmArray™ GI assay was conducted, with 40 (52.6%) showing positive results. Among the positive specimens, 23 (57.5%) had a single pathogen, while the remaining 17 (42.5%) had multiple pathogens. The remaining 36 (47.4%) specimens showed no pathogens. The overall positivity rate of the specimens was 52.6%. The most frequently detected pathogens included *Salmonella*, *Clostridium difficile* (toxin A/B), and Enteropathogenic *Escherichia coli* (EPEC).**
Conclusions: **This study underscores the clinical value of the FilmArray™ GI assay as a rapid and reliable tool for diagnosing gastrointestinal infections. Its capacity to detect multiple pathogens simultaneously enhances diagnostic accuracy and gives information to use in clinical decision-making. We strongly recommend its integration into clinical practice to expedite the diagnosis and management of gastrointestinal infections, ultimately leading to improved patient care and healthcare efficiency.**
(Clin. Lab. 2024;70:xx-xx. DOI: 10.7754/Clin.Lab.2024.240125)

Correspondence:
Tze-Kiong Er, PhD
Division of Laboratory Medicine
Asia University Hospital
No. 222, Fuxin Rd.
Wufeng Dist., Taichung City 413
Taiwan
Phone: +886 4-37061668, ext. 1297
E-mail: tzekiong92@gmail.com
ORCID ID: https://orcid.org/0000-0002-7068-1652

Letter to the Editor accepted January 18, 2024

KEYWORDS

FilmArray gastrointestinal PCR panel, viral and bacterial pathogens, coinfection

LETTER TO THE EDITOR

Infectious gastroenteritis continues to be a prevalent source of illnesses and fatalities worldwide, posing a significant public health concern [1]. Patients admitted with gastroenteritis symptoms such as diarrhea and vomiting are placed in isolation until the diagnostic test results are available or until an alternative, non-infectious cause has been determined [2]. Diarrhea is a major contributor to morbidity and mortality worldwide, ranking as the second leading cause of morbidity and mor-

tality among children under five years old in low-income countries [3,4]. These infections can manifest in diverse clinical presentations, posing diagnostic challenges and healthcare complexities. Effective patient management relies heavily on the swift and accurate identification of causative pathogens, especially in cases of suspected bacterial infectious diarrhea. Stool cultures have long been the conventional method for diagnosing the microbial causes of such infections. However, stool cultures often demand significant resources, consume valuable time, and frequently yield a low rate of positive results [5,6]. Furthermore, their application by physicians can be inconsistent. These challenges underscore the urgent need for a rapid and reliable alternative, such as molecular assays.

Multiplex panels for the simultaneous detection of nucleic acids from bacterial or viral pathogens in a single reaction are gaining popularity for identifying multiple pathogens. The implementation of high-speed molecular testing has greatly improved the efficiency of pathogen identification, enabling the detection of multiple pathogens simultaneously and ultimately reducing the time required for clinical treatment. Recent advances in molecular diagnostics have provided promising tools for improving the speed and accuracy of pathogen detection in gastrointestinal infections. One such tool is the FilmArray™ Gastrointestinal (GI) Panel, a multiplex PCR-based assay designed to detect a wide range of gastrointestinal pathogens simultaneously. The FilmArray™ GI panel (BioFire® Diagnostics, Salt Lake City, UT, USA) is a multiplex polymerase chain reaction (PCR) assay that is also fully automated. It is designed to detect 22 of the most common GI pathogens [2]. In a previous study, Machiels JD, et al. demonstrated the effectiveness of the BioFire FilmArray GI panel in reducing unnecessary isolation days, minimizing antibiotic use, and preventing additional diagnostic procedures in patients suspected of having infectious gastroenteritis. This comprehensive multiplex gastrointestinal panel has a quick turnaround time, making it a valuable tool in clinical practice [2].

This study aimed to evaluate the prevalence and distribution of viral and bacterial pathogens within the gastrointestinal tract. We conducted a retrospective analysis of gastrointestinal specimens collected from patients admitted to Asia University Hospital between November 1, 2022, and December 31, 2023. These specimens, obtained from patients aged 21 to 91, were subsequently analyzed using the FilmArray™ GI Panel. During the study period, 76 patients underwent testing with the FilmArray™ GI Panel. Among these patients, 40 (52.6%) tested positive for gastrointestinal pathogens. The most commonly identified pathogens in our study were *Salmonella* (15/64, 23.4%), *Clostridium difficile* (toxin A/B) (12/64, 18.8%), and Enteropathogenic *E. coli* (EPEC) (9/64, 14.1%) (Table 1). Table 2 showed that 17 (42.5%) patients were coinfected with multiple pathogens. Intriguingly, 12 of the 17 patients had coinfections with two pathogens (70.6%), three patients had coinfections with three pathogens simultaneously (17.6%), and two patients had coinfections with more than three pathogens simultaneously (11.8%).

Salmonella infections pose a significant global public health concern, affecting both industrialized and developing nations, and they have substantially increased the economic burden on healthcare systems [7]. *Salmonella* is a leading cause of foodborne illnesses worldwide, responsible for an estimated 80.3 million cases annually, with most human infections attributed to the consumption of contaminated food or water [8].

A prior study conducted in southeast Ethiopia found an overall prevalence of 6.9% for *Salmonella* and 4.3% for *Shigella* isolates [9]. Additionally, the study revealed that compared to other age groups, children aged 1 to 3 exhibited a relatively higher isolation rate for both *Salmonella* and *Shigella*. Our results showed that *Salmonella* was the most commonly identified pathogen in our study populations.

The emergence and ongoing increase in *C. difficile* infections as a prominent factor in hospitalizations and fatalities due to gastroenteritis, especially among older adults, is well documented [10,11]. Huang SH, et al. revealed *Salmonella* spp. and *C. difficile* toxin A/B as the predominant causes of diarrhea in northern Taiwan. Furthermore, these pathogens were associated with coinfections in both children and individuals aged ≥ 60 years. Notably, norovirus GI/GII was identified in 72.2% of cases involving coinfections in children [12]. Our findings also revealed a patient with a coinfection of *C. difficile* (toxin A/B) and norovirus GI/GII.

Enteropathogenic *E. coli* (EPEC) ranks among the leading causes of infantile diarrhea [13]. EPEC, the first recognized pathotype of diarrhoeagenic *E. coli*, was pinpointed as the causative agent in numerous infantile diarrhea outbreaks from 1940 to 1950 [14]. A study revealed that EPEC emerged as the predominant pathogen detected in mixed intestinal infections [15]. Our results showed that EPEC represents the third most commonly identified pathogen in our study populations.

In conclusion, our study underscores the clinical significance of the FilmArray™ GI Panel as an invaluable tool for diagnosing gastrointestinal infections. Our findings not only offer insights into the prevalent pathogens in our region but also facilitate the development of targeted treatment approaches. The panel's ability to simultaneously detect multiple pathogens enhances diagnostic precision and aids clinical decision-making. We strongly advocate for its integration into routine clinical practice to expedite the diagnosis and management of gastrointestinal infections, ultimately enhancing patient care and healthcare efficiency.

Source of Support:
This study was supported by grants from Asia University Hospital (ASIA-112-51007).

Table 1. Summary of findings from the FilmArray™ gastrointestinal panel.

Viral/bacterial pathogens	Total number findings
Salmonella	15
Clostridium difficile (toxin A/B)	12
Enteropathogenic *E. coli* (EPEC)	9
Campylobacter	7
Enterotoxigenic *E. coli* (ETEC) lt/st	7
Enteroaggregative *E. coli*	6
Norovirus GI/GII	3
Cryptosporidium	1
Astrovirus	1
Plesiomonas shigelloides	1
Sapovirus	1
Shiga-like toxin-producing *E. coli* (STEC)	1

Table 2. Summary of multiorganism-positive samples.

Pathogens	Total number findings
Campylobacter + *Salmonella*	1
Enteroaggregative *E. coli* (EAEC) + Astrovirus	1
Enteropathogenic *E. coli* (EPEC) + Enterotoxigenic *E. coli* (ETEC) lt/st	1
Clostridium difficile (toxin A/B) + Sapovirus	1
Salmonella + Enteropathogenic *E. coli* (EPEC)	1
Salmonella + Enteroaggregative *E. coli* (EAEC)	1
Campylobacter + *Plesiomonas shigelloides*	1
Clostridium difficile (toxin A/B) + Norovirus GI/GII	1
Clostridium difficile (toxin A/B) + Enteroaggregative *E. coli* (EAEC)	1
Clostridium difficile (toxin A/B) + Enteropathogenic *E. coli* (EPEC)	1
Salmonella + Enterotoxigenic *E. coli* (ETEC) lt/st	1
Enteroaggregative *E. coli* (EAEC) + Enterotoxigenic *E. coli* (ETEC) lt/st	1
Clostridium difficile (toxin A/B) + Enteropathogenic *E. coli* (EPEC) + Enterotoxigenic *E. coli* (ETEC) lt/st	1
Salmonella + Enteropathogenic *E. coli* (EPEC) + Enterotoxigenic *E. coli* (ETEC) lt/st	1
Clostridium difficile (toxin A/B) + Enterotoxigenic *E. coli* (ETEC) lt/st + Shiga-like toxin-producing *E. coli* (STEC)	1
Campylobacter + *Clostridium difficile* (toxin A/B) + *Salmonella* + Enteroaggregative *E. coli* (EAEC)	1 *
Clostridium difficile (toxin A/B) + *Salmonella* + Enteropathogenic *E. coli* (EPEC) + Enterotoxigenic *E. coli* (ETEC) lt/st	1 *

* - In accordance with the manufacturer's instructions, if 4 or more distinct organisms are detected in a specimen, the sample should be retested to confirm the polymicrobial result.

Declaration of Interest:
There are no conflicts of interest associated with this paper.

References:

1. Kosek M, Bern C, Guerrant RL. The global burden of diarrhoeal disease, as estimated from studies published between 1992 and 2000. Bull World Health Organ 2003;81(3):197-204. (PMID: 12764516)

2. Machiels JD, Cremers AJH, van Bergen-Verkuyten M, et al. Impact of the BioFire FilmArray gastrointestinal panel on patient care and infection control. PLoS One 2020;15(2):e0228596. (PMID: 32027698)

3. GBD 2016 Diarrhoeal Disease Collaborators. Estimates of the global, regional, and national morbidity, mortality, and aetiologies of diarrhoea in 195 countries: a systematic analysis for the Global Burden of Disease Study 2016. Lancet Infect Dis 2018; 18(11):1211-28. (PMID: 30243583)

4. Khairy RMM, Fathy ZA, Mahrous DM, Mohamed ES, Abdelrahim SS. Prevalence, phylogeny, and antimicrobial resistance of Escherichia coli pathotypes isolated from children less than 5 years old with community acquired- diarrhea in Upper Egypt. BMC Infect Dis 2020;20(1):908. (PMID: 33256619)

5. Bennett WE, Jr., Tarr PI. Enteric infections and diagnostic testing. Curr Opin Gastroenterol 2009;25(1):1-7. (PMID: 19114768)

6. Torres-Miranda D, Akselrod H, Karsner R, et al. Use of BioFire FilmArray gastrointestinal PCR panel associated with reductions in antibiotic use, time to optimal antibiotics, and length of stay. BMC Gastroenterol 2020;20(1):246. (PMID: 32727381)

7. Gong B, Li H, Feng Y, et al. Prevalence, serotype distribution and antimicrobial resistance of non-typhoidal Salmonella in hospitalized patients in Conghua District of Guangzhou, China. Front Cell Infect Microbiol 2022;12:805384. (PMID: 35186792)

8. Mukherjee N, Nolan VG, Dunn JR, Banerjee P. Sources of human infection by Salmonella enterica serotype Javiana: A systematic review. PLoS One 2019;14(9):e0222108. (PMID: 31479476)

9. Assefa A, Girma M. Prevalence and antimicrobial susceptibility patterns of Salmonella and Shigella isolates among children aged below five years with diarrhea attending Robe General Hospital and Goba Referral Hospital, South East Ethiopia. Trop Dis Travel Med Vaccines 2019;5:19. (PMID: 31832223)

10. Zilberberg MD, Shorr AF, Kollef MH. Increase in adult Clostridium difficile-related hospitalizations and case-fatality rate, United States, 2000 - 2005. Emerg Infect Dis 2008, 14(6):929-31. (PMID: 18507904)

11. Hall AJ, Curns AT, McDonald LC, Parashar UD, Lopman BA. The roles of Clostridium difficile and norovirus among gastroenteritis-associated deaths in the United States, 1999 - 2007. Clin Infect Dis 2012;55(2):216-23. (PMID: 22491338)

12. Huang SH, Lin YF, Tsai MH, et al. Detection of common diarrhea-causing pathogens in Northern Taiwan by multiplex polymerase chain reaction. Medicine (Baltimore) 2018;97(23):e11 006. (PMID: 29879060)

13. Clarke SC, Haigh RD, Freestone PP, Williams PH. Virulence of enteropathogenic Escherichia coli, a global pathogen. Clin Microbiol Rev 2003;16(3):365-78. (PMID: 12857773)

14. Croxen MA, Law RJ, Scholz R, Keeney KM, Wlodarska M, Finlay BB. Recent advances in understanding enteric pathogenic Escherichia coli. Clin Microbiol Rev. 2013;26(4):822-80. (PMID: 24092857)

15. Spina A, Kerr KG, Cormican M, et al. Spectrum of enteropathogens detected by the FilmArray GI Panel in a multicentre study of community-acquired gastroenteritis. Clin Microbiol Infect 2015; 21(8):719-28. (PMID: 25908431)