Louisiana Office of Public Health Laboratories	
Test Name	BioFire FilmArray® Gastrointestinal (GI) Panel
PHL Location	Office of Public Health Laboratory Baton Rouge
CPT Code	<table><tr><th>Assay</th><th>Potential CPT Code</th></tr><tr><td>Campylobacter (jejuni, coli, and upsaliensis) Clostridium difficile (toxin A/B) Plesiomonas shigelloides Salmonella Yersinia enterocolitica Vibrio (parahaemolyticus, vulnificus, and cholerae) Vibrio cholerae Enteroaggregative E. coli (EAEC) Enteropathogenic E. coli (EPEC) Enterotoxigenic E. coli (ETEC) lt/st Shiga-like toxin-producing E. coli (STEC) stx1/stx2 E. coli O157 Shigella/Enteroinvasive E. coli (EIEC) Cryptosporidium Cyclospora cayetanensis Entamoeba histolytica Giardia lamblia Adenovirus F 40/41 Astrovirus Norovirus GI/GII Rotavirus A Sapovirus (I, II, IV, V)</td><td>87507</td></tr></table>
Synonyms	Biofire, GI Panel
Brief Description of Test	**Prior authorization required. Contact Infectious Disease Epidemiology at 800-256-2748.** The FilmArray Gastrointestinal (GI) Panel is a qualitative multiplexed nucleic acid-based in vitro diagnostic test intended for use with the FilmArray Instrument. The FilmArray GI Panel is capable of the simultaneous detection and identification of nucleic acids from multiple bacteria, viruses, and parasites directly from stool samples in Cary Blair transport media obtained from individuals with signs and/or symptoms of gastrointestinal infection. The following bacteria (including several diarrheagenic E. coli/Shigella pathotypes), parasites, and viruses are identified using the FilmArray GI Panel: Campylobacter (C. jejuni/C. coli/C. upsaliensis) Clostridium difficile (C. difficile) toxin A/B Plesiomonas shigelloides Salmonella Vibrio (V. parahaemolyticus/V. vulnificus/ V. cholerae), including specific identification of Vibrio cholerae Yersinia enterocolitica

	Enteroaggregative Escherichia coli (EAEC) Enteropathogenic Escherichia coli (EPEC) Enterotoxigenic Escherichia coli (ETEC) lt/st Shiga-like toxin-producing Escherichia coli (STEC) stx1/stx2 (including specific identification of the E. coli O157 serogroup within STEC) Shigella/ Enteroinvasive Escherichia coli (EIEC) Cryptosporidium Cyclospora cayetanensis Entamoeba histolytica Giardia lamblia (also known as G. intestinalis and G. duodenalis) Adenovirus F 40/41 Astrovirus Norovirus GI/GII Rotavirus A Sapovirus (Genogroups I, II, IV, and V)
Possible Results	For each target tested: Detected Not Detected N/A (applies to *E. coli* O157 and EPEC only) Invalid
Reference Range	Not Detected
Specimen Type	Stool Specimen Collection – Stool specimens should be collected in liquid Cary Blair transport media according to manufacturer's instructions.
Specimen Container(s):	Cary Blair Transport Note: Cary Blair liquid transport such as Remel R21610, not transport swabs.
Minimum volume accepted:	Cary Blair Transport
Collection Instructions	Label specimen with Patient Name and a 2nd Unique Identifier such as a chart number or medical record number. DOB is not considered unique. Complete a LAB Form 96 to accompany the sample. Lab submission form must be thoroughly completed with patient's first and last name, 2nd patient identifier, gender, date of birth, date and time of collection, specimen source, test requested, submitter's name, address, fax and contact number. Additional information regarding patients' address is requested. Transport specimen to laboratory as soon as possible after collection/incubation. Keep submission forms insulated from specimens.

Storage and Transport Instructions	Specimens should be processed and tested as soon as possible, though they may be stored at 15-30°C or 2-8°C for up to 4 days.
Causes for Rejection	• Received outside acceptable transport/storage conditions o 9-14°C is not an acceptable temperature range • Improper labeling • Incorrect source
Limitations of the Procedure	The performance of this test has only been validated with human stool collected in Cary Blair transport medium, according to the media manufacturers' instructions. It has not been validated for use with other stool transport media, raw stool, rectal swabs, endoscopy stool aspirates, or vomitus. This product should not be used to test stool samples in fixative (e.g., formalin or polyvinyl alcohol; PVA). The performance of this test has not been established for patients without signs and symptoms of gastrointestinal illness. Virus, bacteria, and parasite nucleic acid may persist in vivo independently of organism viability. Additionally, some organisms may be carried asymptomatically. Detection of organism targets does not imply that the corresponding organisms are infectious or are the causative agents for clinical symptoms. Results from this test must be correlated with the clinical history, epidemiological data, and other data available to the clinician evaluating the patient. Due to high rates of asymptomatic carriage of Clostridium difficile, especially in very young children and hospitalized patients, the detection of toxigenic C. difficile should be interpreted within the context of guidelines developed by the testing facility or other experts (e.g., guidelines/policy statements published by The American Academy of Pediatrics or the Society for Healthcare Epidemiology of America and the Infectious Disease Society of America). The performance of this test has not been established for monitoring treatment of infection with any of the panel organisms. Discrepancies between the FilmArray GI Panel and other microbial identification methods may be caused by the inability to reliably differentiate species based on standard phenotypic microbial identification methods. Examples include differentiation of Yersinia enterocolitica from other Y. enterocolitica group members such as Y. kristensenii or Y. fredricksonii, differentiation of Entamoeba histolytica from E. dispar, and differentiation of Helicobacter pullorum from Campylobacter.

	There is a risk of false negative values due to the presence of sequence variants in the gene targets of the assay, procedural errors, amplification inhibitors in specimens, or inadequate numbers of organisms for amplification. The identification of several diarrheagenic E. coli pathotypes has historically relied upon phenotypic characteristics, such as adherence patterns or toxigenicity in certain tissue culture cell lines. The FilmArray GI Panel targets genetic determinants characteristic of most pathogenic strains of these organisms but may not detect all strains having phenotypic characteristics of a pathotype. In particular, the FilmArray GI Panel will only detect Enteroaggregative E. coli (EAEC) strains carrying the aggR and/or aatA genes on the pAA (aggregative adherence) plasmid; it will not detect all strains exhibiting an aggregative adherence pattern. Target genes associated with the diarrheagenic E. coli/Shigella pathotypes are capable of horizontal transfer between strains, thus Detected results for multiple diarrheagenic E. coli/Shigella may be due to co-infection with multiple pathotypes or, less frequently, may be due to the presence of a single organism containing genes characteristic of multiple pathotypes. An example of the latter is the 2011 E. coli O104:H4 outbreak strain that contains determinants of both STEC and EAEC. The FilmArray GI Panel detects the heat-labile toxin (LT) and heat-stable toxin variants (ST1a and ST1b) of Enterotoxigenic E. coli (ETEC), which are associated with human disease. The variant LT-II toxin (structurally similar to LT) and the STB/ST2 toxin (structurally dissimilar to ST1) are not targeted by the ETEC assays and have not been established as important in human disease. The FilmArray GI Panel detects Enteropathogenic E. coli (EPEC) through targeting of the eae gene, which encodes the adhesin intimin. As some Shiga-like toxin-producing E. coli (STEC) also carry eae (in particular, strains identified as enterohemorrhagic E. coli; EHEC), the FilmArray GI Panel cannot distinguish between STEC containing eae and a co-infection of EPEC and STEC. Therefore, the EPEC result is not applicable (N/A) and not reported for specimens in which STEC has also been detected. Rare instances of other organisms carrying eae have been documented; e.g., Aeromonas spp., Citrobacter spp., Escherichia albertii, and Shigella boydii. Shigella dysenteriae possess a shiga toxin gene (stx) that is identical to the stx1 gene of STEC. The detection of both Shigella/Enteroinvasive E. coli (EIEC) and STEC stx1/stx2 analytes in the same specimen may indicate the presence of S. dysenteriae. Rare instances of the detection of shiga-like toxin genes in other

	genera/species have been reported; e.g., Aeromonas caviae, Acinetobacter haemolyticus, Shigella sonnei, Enterobacter cloacae, Citrobacter freundii, and Klebsiella pneumoniae. . The E. coli O157 result is only reported in association with STEC stx1/stx2. While non-STEC O157 strains have been detected in human stool, their role in disease has not been established. Serotype O157 EPEC have been identified and will be detected by the FilmArray GI Panel (by the EPEC assay) due to their carriage of the eae gene. The FilmArray GI Panel cannot distinguish between infections with a single toxigenic STEC O157 or rare coinfections of STEC (non-O157) with an stx1/stx2-negative E. coli O157. This test only detects Campylobacter jejuni, C. coli and C. upsaliensis and does not differentiate between these three species of Campylobacter. Additional testing is required to differentiate between these species and to detect other Campylobacter species that may be present in stool specimens. The detection of organism nucleic acid is dependent upon proper sample collection, handling, transportation, storage, and preparation. Failure to observe proper procedures in any one of these steps can lead to incorrect results. There is a risk of false positive and false negative results caused by improperly collected, transported, or handled specimens. The RNA process control and the PCR 2 control will not indicate whether or not nucleic acid has been lost due to inadequate collection, transport or storage of specimens. Due to the complex and highly variable nature of stool specimens, freezing may affect analyte integrity and subsequent test results for some specimens. A negative FilmArray GI Panel result does not exclude the possibility of gastrointestinal infection. Negative test results may occur from sequence variants in the region targeted by the assay, the presence of inhibitors, technical error, sample mix-up, or an infection caused by an organism not detected by the panel. Test results may also be affected by concurrent antimicrobial therapy or levels of organism in the sample that are below the limit of detection for the test. Negative results should not be used as the sole basis for diagnosis, treatment, or other management decisions. If four or more distinct organisms are detected in a specimen, retesting is recommended to confirm the polymicrobial result. The performance of the FilmArray GI Panel has not been established in individuals who received Rotavirus A vaccine. Recent oral administration of a Rotavirus A vaccine may cause positive results for Rotavirus A if the virus is passed in the stool.

	Several organisms were shown to have the potential to cross-react with FilmArray GI Panel assays. These include Entamoeba dispar when present at high levels (E. histolytica assay); Bifidobacterium spp. and Ruminococcus spp. (G. lamblia assay); certain strains of Citrobacter koseri, Citrobacter sedlakii, Hafnia alvei, and Cedeceae davisiae containing variants of a flagellar assembly protein (ETEC 2 assay), E. coli containing a variant type III secretion protein (Salmonella assay), Grimontia hollisae which was formerly classified as a Vibrio sp. (Vibrio assay), Yersinia frederiksenii and Yersinia kristensenii, which are members of the Y. enterocolitica group (Y. enterocolitica assay). Campylobacter inclusivity testing and in silico analyses demonstrated that the FilmArray GI Panel may have variable detection or reduced sensitivity for some organisms detected by the Campylobacter assays (Note: The Campylobacter assays only detect C. jejuni, C. coli, and C. upsaliensis). Campylobacter upsaliensis strain ATCC 43954 and Campylobacter jejuni subsp. doylei may not be detected and in silico analysis indicates primer mismatches that might lead to reduced assay sensitivity or lack of reactivity with 11/138 C. coli sequences currently in NCBI databases. Empirical testing and in silico sequence analysis indicate that the Vibrio assay (V. parahaemolyticus/V. vulnificus /V. cholerae) may react with some less common Vibrio species (i.e., V. alginolyticus, V. fluvialis, and V. mimicus) but it is not expected to detect the rarer Vibrio cincinnatiensis, Vibrio furnissii, and Vibrio metschnikovii (Note: Vibrio spp. not associated with human disease were not evaluated). V.cholerae isolates with highly divergent toxR genes will be non-reactive with the FilmArray GI Panel V. cholerae assay. Additionally, very rare strains of pathogenic V. cholerae that do not carry that toxR gene will also not be detected by the Vchol assay. Rare isolates of V. harveyi, V. mimicus, and V. vulnificus that have acquired a homolog of the toxR gene have been reported and may show cross-reactivity with the Vchol assay. Based on the available sequences, a few Cryptosporidium species, or certain variants of species, including C. bovis, C. ryanae, and C. xiaoi, may not be efficiently detected by the Cryptosporidium assays.These species are rarely detected in human samples. There is a risk of false negative results due to the presence of strains with sequence variability or genetic rearrangements in the target regions of the assays. Not all Salmonella serotypes were tested in validation studies; however, representatives of the 20 most prevalent

	serotypes recently circulating in the US (CDC National Salmonella Surveillance Annual Summary 2009) were evaluated. In silico sequence analysis supports detection of all subspecies and serotypes of Salmonella. Cross-reactivity with the Salmonella assay may occur with certain E. coli strains containing variants of the cryptic ETT2 type-III secretion system. Positive and negative predictive values are highly dependent on prevalence. False negative results are more likely during peak activity when prevalence of disease is high. False positive results are more likely during periods when prevalence is moderate to low. The performance of this test has not been evaluated for immunocompromised individuals.
Interfering Substances	Rotavirus A reassortant strains used in the manufacturing of Rotavirus A vaccines were tested and Rotavirus A Detected results were reported. Rotavirus A vaccine may be shed in stool following oral administration and Rotavirus A will be detected by the FilmArray GI Panel if vaccine is present in the test sample. Accurate detection of analytes was impaired (false negative results) for samples prepared in media containing fixatives, particularly those containing formalin.
References	FilmArray Gastrointestinal (GI) Panel Instruction Booklet
Additional Information	**Prior authorization required. Contact Infectious Disease Epidemiology at 800-256-2748.**
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