



**510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION  
DECISION SUMMARY  
ASSAY AND INSTRUMENT**

**I Background Information:**

**A 510(k) Number**

K252329

**B Applicant**

QIAGEN GmbH

**C Proprietary and Established Names**

QIAstat-Dx Gastrointestinal Panel 2; QIAstat-Dx GI Panel 2 Mini B&V; QIAstat-Dx GI Panel 2 Mini B

**D Regulatory Information**

Product Code(s)	Classification	Regulation Section	Panel
PCH	Class II	21 CFR 866.3990 - Gastrointestinal Microorganism Multiplex Nucleic Acid-Based Assay	MI - Microbiology

**II Submission/Device Overview:**

**A Purpose for Submission:**

- To unmask the following analytes for the FecalSwab sample type that were not included in the original clearances for the QIAstat-Dx Gastrointestinal Panel 2 (K220062), QIAstat-Dx GI Panel 2 Mini B&V (K243813), and QIAstat-Dx GI Panel 2 Mini B (K250324) devices.
  - Shiga-like toxin *E.coli* (STEC) *stx1/stx2*, *E.coli* O157, and Enteropathogenic *E.coli* (EPEC) for the QIAstat-Dx Gastrointestinal Panel 2.
  - Shiga-like toxin *E.coli* (STEC), for the QIAstat-Dx GI Panel 2 Mini B&V and the QIAstat-Dx GI Panel 2 Mini B.

## **B Measurand:**

Targeted nucleic acid sequences of the following gastrointestinal microorganisms:

- Adenovirus F40/F41
- Astrovirus
- Norovirus GI/GII
- Rotavirus A
- *Campylobacter* (*C. jejuni*, *C. coli* and *C. upsaliensis*)
- *Shigella*/Enteroinvasive *Escherichia coli* (EIEC)
- Enteropathogenic *Escherichia coli* (EPEC)
- Enterotoxigenic *Escherichia coli* (ETEC) *lt/st*
- Shiga-like toxin-producing *Escherichia coli* (STEC) *stx1/stx2*\* (including specific identification of *E. coli* O157 serogroup within STEC)
- *Salmonella*
- *Plesiomonas shigelloides*
- *Yersinia enterocolitica*
- *Cryptosporidium*
- *Cyclospora cayetanensis*
- *Entamoeba histolytica*
- *Giardia lamblia*

## **C Type of Test:**

A multiplex nucleic acid-based test intended for use with the QIAstat-Dx system for the qualitative *in vitro* detection and identification of multiple bacteria, viruses, and parasites in preserved stool samples collected from individuals suspected of gastrointestinal infection.

## **III Intended Use/Indications for Use:**

### **A Intended Use(s):**

See Indications for Use below.

### **B Indication(s) for Use:**

#### **QIAstat-Dx Gastrointestinal Panel 2**

The QIAstat-Dx Gastrointestinal Panel 2 is a multiplexed nucleic acid test intended for use with the QIAstat-Dx Analyzer 2.0 for the simultaneous *in vitro* qualitative detection and identification of nucleic acids from multiple viruses, bacteria, and parasites directly from preserved stool samples (Para-Pak C&S or FecalSwab) obtained from individuals with signs and/or symptoms of gastrointestinal infection. The following viruses, bacteria (including several diarrheagenic *E. coli*/Shigella pathotypes), and parasites are identified with the QIAstat-Dx Gastrointestinal Panel 2:

- Adenovirus F40/F41
- Astrovirus

- Norovirus GI/GII
- Rotavirus A
- *Campylobacter* (*C. jejuni*, *C. coli* and *C. upsaliensis*)
- Shigella/Enteroinvasive *Escherichia coli* (EIEC)
- Enteropathogenic *Escherichia coli* (EPEC)
- Enterotoxigenic *Escherichia coli* (ETEC) *lt/st*
- Shiga-like toxin-producing *Escherichia coli* (STEC) *stx1/stx2* (including specific identification of *E.coli* O157 serogroup within STEC)
- *Salmonella*
- *Plesiomonas shigelloides*
- *Yersinia enterocolitica*
- *Cryptosporidium*
- *Cyclospora cayetanensis*
- *Entamoeba histolytica*
- *Giardia lamblia*\*

\* Also known as *Giardia intestinalis* and *Giardia duodenalis*

Concomitant culture is necessary for organism recovery and further typing of bacterial agents. The QIAstat-Dx Gastrointestinal Panel 2 is indicated as an aid in the diagnosis of specific agents of gastrointestinal illness, in conjunction with other clinical, laboratory, and epidemiological data. Positive results do not rule-out co-infection with organisms not detected by the QIAstat-Dx Gastrointestinal Panel 2. The organisms detected may not be the sole or definitive cause of the disease.

Negative QIAstat-Dx Gastrointestinal Panel 2 results in the setting of clinical illness compatible with gastroenteritis may be due to infection by pathogens that are not detected by this assay test or non-infectious causes such as ulcerative colitis, irritable bowel syndrome, or Crohn's disease.

### **QIAstat-Dx GI Panel 2 Mini B&V**

The QIAstat-Dx GI Panel 2 Mini B&V is a multiplexed nucleic acid test intended for use with the QIAstat-Dx Analyzer 2.0 for the simultaneous in vitro qualitative detection and identification of nucleic acids from multiple bacteria and one virus directly from preserved stool samples (Para-Pak C&S or FecalSwab) obtained from individuals with signs and/or symptoms of gastrointestinal infection. The following virus and bacteria (including several diarrheagenic *E.coli*/Shigella pathotypes) are identified with the QIAstat-Dx GI Panel 2 Mini B&V:

- Norovirus
- *Campylobacter*
- *Shigella*
- Shiga-like toxin *E.coli* (STEC)
- *Salmonella*

Concomitant culture is necessary for organism recovery and further typing of bacterial agents. The QIAstat-Dx GI Panel 2 Mini B&V is indicated as an aid in the diagnosis of specific agents of gastrointestinal illness, in conjunction with other clinical, laboratory, and epidemiological data. Positive results do not rule-out co-infection with organisms not detected by the QIAstat-Dx GI Panel 2 Mini B&V. The organisms detected may not be the sole or definitive cause of the disease.

Negative QIAstat-Dx GI Panel 2 Mini B&V results in the setting of clinical illness compatible with gastroenteritis may be due to infection by pathogens that are not detected by this assay test or non-infectious causes such as ulcerative colitis, irritable bowel syndrome, or Crohn's disease.

### **QIAstat-Dx GI Panel 2 Mini B**

The QIAstat-Dx GI Panel 2 Mini B is a multiplexed nucleic acid test intended for use with the QIAstat-Dx Analyzer 2.0. for the simultaneous in vitro qualitative detection and identification of nucleic acids from multiple bacteria directly from preserved stool samples (Para-Pak C&S or FecalSwab) obtained from individuals with signs and/or symptoms of gastrointestinal infection. The following bacteria (including several diarrheagenic *E.coli*/ *Shigella* pathotypes) are identified with the QIAstat-Dx GI Panel 2 Mini B:

- *Campylobacter*
- *Shigella*
- Shiga-like toxin *Escherichia coli* (STEC)
- *Salmonella*
- *Yersinia enterocolitica*

Concomitant culture is necessary for organism recovery and further typing of bacterial agents. The QIAstat-Dx GI Panel 2 Mini B is indicated as an aid in the diagnosis of specific agents of gastrointestinal illness, in conjunction with other clinical, laboratory, and epidemiological data. Positive results do not rule-out co-infection with organisms not detected by the QIAstat-Dx GI Panel 2 Mini B. The organisms detected may not be the sole or definitive cause of the disease.

Negative QIAstat-Dx GI Panel 2 Mini B results in the setting of clinical illness compatible with gastroenteritis may be due to infection by pathogens that are not detected by this assay test or non-infectious causes such as ulcerative colitis, irritable bowel syndrome, or Crohn's disease.

### **C Special Conditions for Use Statement(s):**

Rx - For Prescription Use Only

For *in vitro* diagnostic Use Only

**D Special Instrument Requirements:**

The QIAstat-Dx Analyzer 2.0.

**IV Device/System Characteristics:**

**A Device Description:**

The QIAstat-Dx Gastrointestinal Panels were originally cleared in K220062, K243813, and K250324.

The QIAstat-Dx Gastrointestinal Panel 2 assay is run on the QIAstat-Dx Analyzer 2.0. The QIAstat-Dx Gastrointestinal Panel 2 cartridge is a single-use cartridge that includes all reagents needed for nucleic acid extraction, nucleic acid amplification, and detection of bacteria, viruses or parasites associated with gastrointestinal infection. Testing requires a 200 µL specimen volume and minimal hands-on time, and the results are available in approximately 80 minutes. The QIAstat-Dx GI Panel 2 Mini B&V and QIAstat-Dx GI Panel 2 Mini B panels are identical to the QIAstat-Dx Gastrointestinal Panel 2 device except only select analytes are reported as described in the intended use statements for these devices above. Validation data obtained in the original clearance for the QIAstat-Dx Gastrointestinal Panel 2 was also relied upon to support the alternative versions of the panel.

**B Principle of Operation:**

The principle of operation remains unchanged from the original clearances (K220062, K243813, and K250324). Refer to the original published decision summaries for specific details on the principle of operation of the device.

**V Substantial Equivalence Information:**

**A Predicate Device Name(s):**

QIAstat-Dx Gastrointestinal Panel 2, QIAstat-Dx GI Panel 2 Mini B&V, QIAstat-Dx GI Panel 2 Mini B

**B Predicate 510(k) Number(s):**

K220062, K243813, K250324

**C Comparison with Predicate(s):**

<b>Device &amp; Predicate</b>	<u>K252329</u>	<u>K220062</u>
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Device(s):		
Device Trade Name	QIAstat-Dx Gastrointestinal Panel 2	QIAstat-Dx Gastrointestinal Panel 2
General Device Characteristic Similarities		
Intended Use/Indications For Use	<p>The QIAstat-Dx Gastrointestinal Panel 2 is a multiplexed nucleic acid test intended for use with the QIAstat-Dx Analyzer 2.0 for the simultaneous <i>in vitro</i> qualitative detection and identification of nucleic acids from multiple viruses, bacteria, and parasites directly from preserved stool samples (Para-Pak C&amp;S or FecalSwab) obtained from individuals with signs and/or symptoms of gastrointestinal infection. The following viruses, bacteria (including several diarrheagenic <i>E.coli/Shigella</i> pathotypes), and parasites are identified with the QIAstat-Dx Gastrointestinal Panel 2:</p> <ul style="list-style-type: none"> <li>• Adenovirus F40/F41</li> <li>• Astrovirus</li> <li>• Norovirus GI/GII</li> <li>• Rotavirus A</li> <li>• <i>Campylobacter</i> (<i>C. jejuni</i>, <i>C. coli</i> and <i>C. upsaliensis</i>)</li> <li>• <i>Shigella</i>/Enteroinvasive <i>Escherichia coli</i> (EIEC)</li> <li>• Enteropathogenic <i>Escherichia coli</i> (EPEC)</li> <li>• Enterotoxigenic <i>Escherichia coli</i> (ETEC) <i>lt/st</i></li> <li>• Shiga-like toxin-producing <i>Escherichia coli</i> (STEC) <i>stx1/stx2</i> (including specific identification of <i>E.coli</i> O157 serogroup within STEC)</li> <li>• <i>Salmonella</i></li> <li>• <i>Plesiomonas shigelloides</i></li> <li>• <i>Yersinia enterocolitica</i></li> <li>• <i>Cryptosporidium</i></li> <li>• <i>Cyclospora cayetanensis</i></li> </ul>	<p>The QIAstat-Dx Gastrointestinal Panel 2 is a multiplexed nucleic acid test intended for use with the QIAstat-Dx Analyzer 1.0 and the QIAstat-Dx Analyzer 2.0 for the simultaneous <i>in vitro</i> qualitative detection and identification of nucleic acids from multiple viruses, bacteria, and parasites directly from preserved stool samples (Para-Pak C&amp;S or FecalSwab) obtained from individuals with signs and/or symptoms of gastrointestinal infection. The following viruses, bacteria (including several diarrheagenic <i>E.coli/ Shigella</i> pathotypes), and parasites are identified with the QIAstat-Dx Gastrointestinal Panel 2:</p> <ul style="list-style-type: none"> <li>• Adenovirus F40/F41</li> <li>• Astrovirus</li> <li>• Norovirus GI/GII</li> <li>• Rotavirus A</li> <li>• <i>Campylobacter</i> (<i>C. jejuni</i>, <i>C. coli</i> and <i>C. upsaliensis</i>)</li> <li>• <i>Shigella</i>/Enteroinvasive <i>Escherichia coli</i> (EIEC)</li> <li>• Enteropathogenic <i>Escherichia coli</i> (EPEC)*</li> <li>• Enterotoxigenic <i>Escherichia coli</i> (ETEC) <i>lt/st</i></li> <li>• Shiga-like toxin-producing <i>Escherichia coli</i> (STEC) <i>stx1/stx2</i> (including specific identification of <i>E.coli</i> O157 serogroup within STEC)*</li> <li>• <i>Salmonella</i></li> <li>• <i>Plesiomonas shigelloides</i></li> <li>• <i>Yersinia enterocolitica</i></li> </ul>

	<ul style="list-style-type: none"> <li>• <i>Entamoeba histolytica</i></li> <li>• <i>Giardia lamblia</i>*</li> </ul> <p>*Also known as <i>Giardia intestinalis</i> and <i>Giardia duodenalis</i></p> <p>Concomitant culture is necessary for organism recovery and further typing of bacterial agents. The QIAstat-Dx Gastrointestinal Panel 2 is indicated as an aid in the diagnosis of specific agents of gastrointestinal illness, in conjunction with other clinical, laboratory, and epidemiological data. Positive results do not rule-out co-infection with organisms not detected by the QIAstat-Dx Gastrointestinal Panel 2. The organisms detected may not be the sole or definitive cause of the disease.</p> <p>Negative QIAstat-Dx Gastrointestinal Panel 2 results in the setting of clinical illness compatible with gastroenteritis may be due to infection by pathogens that are not detected by this assay test or non-infectious causes such as ulcerative colitis, irritable bowel syndrome, or Crohn's disease.</p>	<ul style="list-style-type: none"> <li>• <i>Cryptosporidium</i></li> <li>• <i>Cyclospora cayetanensis</i></li> <li>• <i>Entamoeba histolytica</i></li> <li>• <i>Giardia lamblia</i> (also known as <i>Giardia intestinalis</i> and <i>Giardia duodenalis</i>)</li> </ul> <p>*Only with Para-Pak C&amp;S, not reported for FecalSwab</p> <p>Concomitant culture is necessary for organism recovery and further typing of bacterial agents. The QIAstat-Dx Gastrointestinal Panel 2 is indicated as an aid in the diagnosis of specific agents of gastrointestinal illness, in conjunction with other clinical, laboratory, and epidemiological data. Positive results do not rule-out co-infection with organisms not detected by the QIAstat-Dx Gastrointestinal Panel 2. The organisms detected may not be the sole or definitive cause of the disease.</p> <p>Negative QIAstat-Dx Gastrointestinal Panel 2 results in the setting of clinical illness compatible with gastroenteritis may be due to infection by pathogens that are not detected by this assay test or non-infectious causes such as ulcerative colitis, irritable bowel syndrome, or Crohn's disease.</p>
Specimen Types	Same	Preserved stool in Para-Pak C&S or FecalSwab transport media
Nucleic Acid Extraction	Same	Extraction of nucleic acids using silica membrane
Technology	Same	Detection of amplified targets uses an increase in fluorescence due to specific probe binding to generate the assay results.

General Device Characteristic Differences		
Masking/Unmasking of Targets for the FecalSwab Sample Type	All results are reported for both Para-Pak C&S and FecalSwab sample types.	All results are reported for both Para-Pak C&S and FecalSwab sample types except for STEC, <i>E.coli</i> O157, and EPEC which are only reported with Para-Pak C&S (i.e., masked for FecalSwab).
Amplification and Detection Instrument System	QIAstat-Dx Analyzer 2.0	QIAstat-Dx Analyzer 1.0 and 2.0

Device & Predicate Device(s):	<u>K252329</u>	<u>K243813</u>
Device Trade Name	QIAstat-Dx GI Panel 2 Mini B&V	QIAstat-Dx GI Panel 2 Mini B&V
General Device Characteristic Similarities		
Intended Use/Indications For Use	<p>The QIAstat-Dx GI Panel 2 Mini B&amp;V is a multiplexed nucleic acid test intended for use with the QIAstat-Dx Analyzer 2.0 for the simultaneous in vitro qualitative detection and identification of nucleic acids from multiple bacteria and one virus directly from preserved stool samples (Para-Pak C&amp;S or FecalSwab) obtained from individuals with signs and/or symptoms of gastrointestinal infection. The following virus and bacteria (including several diarrheagenic <i>E.coli</i>/Shigella pathotypes) are identified with the QIAstat-Dx GI Panel 2 Mini B&amp;V:</p> <ul style="list-style-type: none"> <li>• Norovirus</li> <li>• <i>Campylobacter</i></li> <li>• <i>Shigella</i></li> <li>• Shiga-like toxin <i>E.coli</i> (STEC)</li> </ul>	<p>The QIAstat-Dx GI Panel 2 Mini B&amp;V is a multiplexed nucleic acid test intended for use with the QIAstat-Dx Analyzer 1.0 and the QIAstat-Dx Analyzer 2.0 for the simultaneous in vitro qualitative detection and identification of nucleic acids from multiple bacteria and one virus directly from preserved stool samples (Para-Pak C&amp;S or FecalSwab) obtained from individuals with signs and/or symptoms of gastrointestinal infection. The following virus and bacteria (including several diarrheagenic <i>E.coli</i>/Shigella pathotypes) are identified with the QIAstat-Dx GI Panel 2 Mini B&amp;V:</p> <ul style="list-style-type: none"> <li>• Norovirus</li> <li>• <i>Campylobacter</i></li> <li>• <i>Shigella</i></li> <li>• Shiga-like toxin <i>Escherichia coli</i> (STEC)*</li> </ul>



	<p>• <i>Salmonella</i></p> <p>Concomitant culture is necessary for organism recovery and further typing of bacterial agents. The QIAstat-Dx GI Panel 2 Mini B&amp;V is indicated as an aid in the diagnosis of specific agents of gastrointestinal illness, in conjunction with other clinical, laboratory, and epidemiological data. Positive results do not rule out co-infection with organisms not detected by the QIAstat-Dx GI Panel 2 Mini B&amp;V. The organisms detected may not be the sole or definitive cause of the disease.</p> <p>Negative QIAstat-Dx GI Panel 2 Mini B&amp;V results in the setting of clinical illness compatible with gastroenteritis may be due to infection by pathogens that are not detected by this assay test or noninfectious causes such as ulcerative colitis, irritable bowel syndrome, or Crohn's disease.</p>	<p>• <i>Salmonella</i></p> <p>*Only with Para-Pak C&amp;S, not reported for FecalSwab</p> <p>Concomitant culture is necessary for organism recovery and further typing of bacterial agents. The QIAstat-Dx GI Panel 2 Mini B&amp;V is indicated as an aid in the diagnosis of specific agents of gastrointestinal illness, in conjunction with other clinical, laboratory, and epidemiological data. Positive results do not rule-out co-infection with organisms not detected by the QIAstat-Dx GI Panel 2 Mini B&amp;V. The organisms detected may not be the sole or definitive cause of the disease.</p> <p>Negative QIAstat-Dx GI Panel 2 Mini B&amp;V results in the setting of clinical illness compatible with gastroenteritis may be due to infection by pathogens that are not detected by this assay test or noninfectious causes such as ulcerative colitis, irritable bowel syndrome, or Crohn's disease.</p>
Specimen Types	Same	Preserved stool in Para-Pak C&S or FecalSwab transport media
Nucleic Acid Extraction	Same	Extraction of nucleic acids using silica membrane
Technology	Same	Detection of amplified targets uses an increase in fluorescence due to specific probe binding to generate the assay results.
<b>General Device Characteristic Differences</b>		
Masking/Unmasking	All results are reported for both Para-Pak C&S and FecalSwab sample types.	All results are reported for both Para-Pak C&S and FecalSwab sample types except for STEC

of Targets for the FecalSwab Sample Type		which is only reported with Para-Pak C&S (i.e., masked for FecalSwab).
Amplification and Detection Instrument System	QIAstat-Dx Analyzer 2.0	QIAstat-Dx Analyzer 1.0 and 2.0

Device & Predicate Device(s):	<u>K252329</u>	<u>K250324</u>
Device Trade Name	QIAstat-Dx GI Panel 2 Mini B	QIAstat-Dx GI Panel 2 Mini B
General Device Characteristic Similarities		
Intended Use/Indications For Use	<p>The QIAstat-Dx GI Panel 2 Mini B is a multiplexed nucleic acid test intended for use with the QIAstat-Dx Analyzer 2.0. for the simultaneous in vitro qualitative detection and identification of nucleic acids from multiple bacteria directly from preserved stool samples (Para-Pak C&amp;S or FecalSwab) obtained from individuals with signs and/or symptoms of gastrointestinal infection. The following bacteria (including several diarrheagenic <i>E.coli</i>/ Shigella pathotypes) are identified with the QIAstat-Dx GI Panel 2 Mini B:</p> <ul style="list-style-type: none"> <li>• <i>Campylobacter</i></li> <li>• <i>Shigella</i></li> <li>• Shiga-like toxin <i>Escherichia coli</i> (STEC)</li> <li>• <i>Salmonella</i></li> <li>• <i>Yersinia enterocolitica</i></li> </ul> <p>Concomitant culture is necessary for organism recovery and further typing of bacterial agents. The QIAstat-Dx GI Panel 2 Mini B is indicated as an aid in the diagnosis of specific agents of gastrointestinal illness, in</p>	<p>The QIAstat-Dx GI Panel 2 Mini B is a multiplexed nucleic acid test intended for use with the QIAstat-Dx Analyzer 1.0 and the QIAstat-Dx Analyzer 2.0 for the simultaneous in vitro qualitative detection and identification of nucleic acids from multiple bacteria directly from preserved stool samples (Para-Pak C&amp;S or FecalSwab) obtained from individuals with signs and/or symptoms of gastrointestinal infection. The following bacteria (including several diarrheagenic <i>E.coli</i>/Shigella pathotypes) are identified with the QIAstat-Dx GI Panel 2 Mini B:</p> <ul style="list-style-type: none"> <li>• <i>Campylobacter</i></li> <li>• <i>Shigella</i></li> <li>• Shiga-like toxin <i>Escherichia coli</i> (STEC)*</li> <li>• <i>Salmonella</i></li> <li>• <i>Yersinia enterocolitica</i></li> </ul> <p>*Only with Para-Pak C&amp;S, not reported for FecalSwab</p> <p>Concomitant culture is necessary for organism recovery and</p>

	<p>conjunction with other clinical, laboratory, and epidemiological data. Positive results do not rule out co-infection with organisms not detected by the QIAstat-Dx GI Panel 2 Mini B. The organisms detected may not be the sole or definitive cause of the disease.</p> <p>Negative QIAstat-Dx GI Panel 2 Mini B results in the setting of clinical illness compatible with gastroenteritis may be due to infection by pathogens that are not detected by this assay test or non-infectious causes such as ulcerative colitis, irritable bowel syndrome, or Crohn's disease.</p>	<p>further typing of bacterial agents. The QIAstat-Dx GI Panel 2 Mini B is indicated as an aid in the diagnosis of specific agents of gastrointestinal illness, in conjunction with other clinical, laboratory, and epidemiological data. Positive results do not rule-out co-infection with organisms not detected by the QIAstat-Dx GI Panel 2 Mini B. The organisms detected may not be the sole or definitive cause of the disease.</p> <p>Negative QIAstat-Dx GI Panel 2 Mini B results in the setting of clinical illness compatible with gastroenteritis may be due to infection by pathogens that are not detected by this assay test or noninfectious causes such as ulcerative colitis, irritable bowel syndrome, or Crohn's disease.</p>
Specimen Types	Same	Preserved stool in Para-Pak C&S or FecalSwab transport media
Nucleic Acid Extraction	Same	Extraction of nucleic acids using silica membrane
Technology	Same	Detection of amplified targets uses an increase in fluorescence due to specific probe binding to generate the assay results.
<b>General Device Characteristic Differences</b>		
Masking/Unmasking of Targets for the FecalSwab Sample Type	All results are reported for both Para-Pak C&S and FecalSwab sample types.	All results are reported for both Para-Pak C&S and FecalSwab sample types except for STEC which is only reported with Para-Pak C&S (i.e., masked for FecalSwab).
Amplification and Detection Instrument System	QIAstat-Dx Analyzer 2.0	QIAstat-Dx Analyzer 1.0 and 2.0

## **VI Standards/Guidance Documents Referenced:**

None

## **VII Performance Characteristics (if/when applicable):**

### **A Analytical Performance:**

#### 1. Precision/Reproducibility:

A reproducibility study was previously performed for the QIAstat-Dx Gastrointestinal Panel 2 performance in the original clearance (K220062). Please refer to the published decision summary for additional information.

#### 2. Linearity:

The QIAstat-Dx Gastrointestinal Panels are qualitative assays and therefore linearity studies are not applicable.

#### 3. Analytical Specificity/Interference:

Analytical specificity and interfering substances studies were performed for the original QIAstat-Dx Gastrointestinal Panel 2 performance evaluation (K220062). Please refer to the published decision summary for additional information.

#### 4. Assay Reportable Range:

The QIAstat-Dx Gastrointestinal Panels are qualitative assays thus the assay reportable range is not applicable.

#### 5. Traceability, Stability, Expected Values (Controls, Calibrators, or Methods):

No changes were made to the assay and assay reagents. For additional information, please refer to the original published decision summary of K220062.

#### 6. Detection Limit:

A limit of detection (LoD) study was performed to support clearance of the original QIAstat-Dx Gastrointestinal Panel 2 (K220062). Additional testing to demonstrate sample type equivalency for the FecalSwab sample type was also performed. For additional information, please refer to the original published decision summary of K220062.

#### 7. Assay Cut-Off:

Original QIAstat Dx Gastrointestinal Panel 2 includes defined Ct value cutoffs for each assay target. For additional information regarding the assay cut-offs refer to the published decision summary for the QIAstat Dx Gastrointestinal Panel 2 (K220062).

8. Carry-Over:

The QIAstat-Dx Analyzer 1.0 and the QIAstat-Dx Analyzer 2.0 use the same analytical module and workflow and belong to the same instrument family. The carry-over of QIAstat-Dx Analyzer 1.0 was evaluated in K220062. Please refer to the published K220062 decision summary for additional information.

**B Comparison Studies:**

1. Method Comparison with Predicate Device:

N/A

2. Matrix Comparison:

N/A

**C Clinical Studies:**

1. Clinical Sensitivity:

Prospective Clinical Study

The clinical performance of QIAstat-Dx Gastrointestinal Panel 2 was established during a multi-center international prospective study conducted at thirteen clinical settings representatives of different geographical areas within the US and Europe (nine sites in US and four sites in Europe) between May and July 2021. All study sites were hospital-associated or independent clinical diagnostics laboratories that perform routine diagnostics of gastrointestinal infections. A total of 1,222 prospectively collected FecalSwab-preserved stool specimens were obtained from patients with clinical indications of diarrhea caused by gastrointestinal infection. Table 1 provides a summary of specimen distribution across all study sites, and Table 2 includes a summary of patient demographic information. Performance data for other analytes on the panel is described in more detail in the published decision summary for K220062.

**Table 1: FecalSwab-preserved Specimens Distribution Across the study sites**

Site/Country	No. of FecalSwab-preserved prospective specimens
Germany	293
Denmark	293
Spain	247

Site/Country	No. of FecalSwab-preserved prospective specimens
France	63
USA site 1	0
USA site 2	0
USA site 3	282
USA site 4	0
USA site 5	44
USA site 6	0
USA site 7*	0
USA site 8	0
USA site 9	0
Total	1,222

**Table 2. Demographic data for prospective specimens**

Demographic data	FecalSwab-preserved	
	Number of specimens	Percentage (%)
<b>Gender</b>		
Female	628	51.4
Male	594	48.6
<b>Age Group</b>		
0-5 years	182	14.9
6-21 years	121	9.9
22-49 years	290	23.7
50+ years	629	51.5
Not Reported	0	0.0
<b>Patient population</b>		
Emergency room	46	3.8
Hospitalized	342	28.0
Immunocompromised	3	0.2
Outpatient	491	40.2
No information available	340	27.8
<b>No. Days between Symptom Onset and QIAstat-Dx Testing</b>		

Demographic data	FecalSwab-preserved	
	Number of specimens	Percentage (%)
> 7 days	89	7.3
≤ 7 days	146	11.9
Not Reported	987	80.8

The performance of the QIAstat-Dx Gastrointestinal Panel 2 was evaluated for each panel test result using one FDA-cleared test as comparator for EPEC and *E.coli* O157 while a composite comparator consisting of three independent FDA-cleared test methods was used for STEC (Table 3). The composite endpoint was determined as the majority of the three results.

**Table 3. QIAstat-Dx Gastrointestinal Panel 2 clinical studies comparator method**

QIAstat-Dx GI Panel 2 target	Comparator Method
<i>E.coli</i> O157	One FDA-cleared test method
Enteropathogenic <i>E.coli</i> (EPEC)	
Shiga-like toxin- <i>E.coli</i> (STEC) <i>stx1/stx2</i>	Composite of three FDA-cleared test methods

Where a composite comparator was used (i.e., for STEC), the result was determined as the majority of the three individual test results (i.e., a positive composite comparator result is based on positive results for at least two comparator tests, and a negative composite comparator result is based on negative results for at least two comparator tests). If insufficient pathogen positive sample was available to obtain a majority test result a worst-case model was applied in the PPA calculation. In this model the PPA was calculated including all observed true positive and false negative samples between QIAstat-Dx and the composite comparator, while the following procedure was used for the samples where it was not possible to conduct testing with the complete comparator due to insufficient sample volume:

- Samples that were negative in QIAstat-Dx and positive for one comparator test, negative (or insufficient volume) for a second comparator and insufficient volume for a third comparator were included in the calculations as worst-case false negatives.
- Samples that were positive in QIAstat-Dx and positive in one comparator test, negative (or insufficient volume) for a second comparator and insufficient volume for the third comparator, were considered as worst-case false positives and therefore excluded in the PPA calculations.

The PPA was calculated as  $100\% \times (TP / (TP + FN))$ . True positive (TP) indicates that both the QIAstat-Dx Gastrointestinal Panel 2 and comparator method showed a positive result for this specific target, and false negative (FN) indicates that the QIAstat-Dx Gastrointestinal Panel 2 result was negative while the comparator method result was positive. The NPA was calculated as  $100\% \times (TN / (TN + FP))$ . True negative (TN) indicates that both the QIAstat-Dx Gastrointestinal Panel 2 and the comparator method showed negative results, and a false positive (FP) indicates that the QIAstat-Dx Gastrointestinal Panel 2 result was positive, but the comparator method result was negative. The exact binomial two-sided 95% confidence intervals for PPA and NPA were calculated.

Discrepancies between the QIAstat-Dx Gastrointestinal Panel 2 and the comparator methods on these samples were not further investigated.

Results for the prospective clinical study are presented in Table 4.

**Table 4. Clinical Performance in the Prospective Study for FecalSwab Specimens**

Analyte	Positive Percent Agreement			Negative Percent Agreement		
	TP/TP+FN	%	95% CI	TN/TN+FP	%	95% CI
Diarrheagenic <i>E.coli</i>						
<b>Enteropathogenic <i>E.coli</i> (EPEC)</b>	126 / 145	86.9	80.4-91.5	1,059 / 1,063	99.6	99.0-99.9
<b>Shiga-like toxin <i>E.coli</i> (STEC) <i>stx1/stx2</i></b>	3 / 5 <sup>a</sup>	60.0	23.1-88.2	434 / 438 <sup>a</sup>	99.1	97.7-99.6
<b><i>E.coli</i> O157</b>	0 / 0 <sup>b</sup>	N/A	N/A	3 / 3 <sup>b</sup>	100.0	43.9-100.0

<sup>a</sup> Eight (8) FecalSwab sample positive for STEC in both QIAstat-Dx and one FDA-cleared comparator were excluded from the PPA calculations because the samples did not have sufficient volume for complete composite comparator testing. The sample size for NPA is smaller for STEC as only a portion of the samples with a negative result in QIAstat-Dx and in one FDA-cleared comparator was tested with the complete composite comparator in the prospective study.

<sup>b</sup> Three (3) positive and nine (9) negative samples for *E.coli* O157 by QIAstat-Dx were excluded from the PPA/NPA calculations because reporting of the *E.coli* O157 result is dependent on the preceding STEC result (*E. coli* O157 is subtype within STEC) and the STEC result for all twelve (12) samples is negative, or not available or unconfirmed with the (composite) reference test.

#### Co-infections involving EPEC, STEC and *E.coli* O157 in FecalSwab specimens

The QIAstat-Dx Gastrointestinal Panel 2 reported multiple organism detections (i.e., co-infections) for a total of 58 prospective specimens in FecalSwab. This represents 18.6% of positive specimens (58/312) and 4.7% of all analyzed specimens (58/1,222). The QIAstat-Dx Gastrointestinal Panel 2 detected 50 co-infections involving EPEC, *E.coli* O157 or STEC, representing 86.2% of all co-infections detected (50/58). Most of these co-infections contained two organisms (43/50; 86.0%), while 10.0% (5/50) contained three organisms and 4.0% (2/50) contained four organisms. The most common co-infections involving EPEC, STEC or *E.coli* O157 are shown in Table 5.

**Table 5. Most Prevalent Multiple Detection Combinations (≥2 instances) as Determined by the QIAstat-Dx Gastrointestinal Panel 2 in FecalSwab specimens**

Multiple Detection Combination	Number of FecalSwab Specimens
Adenovirus F40/F41 + Enteropathogenic <i>E.coli</i> (EPEC)	2
Campylobacter + Rotavirus A	2
<i>Campylobacter</i> + Enteropathogenic <i>E.coli</i> (EPEC) + Rotavirus A	2
<i>E.coli</i> O157 + Shiga-like toxin <i>E.coli</i> (STEC) <i>stx1/stx2</i>	2



Multiple Detection Combination	Number of FecalSwab Specimens
Enteropathogenic <i>E.coli</i> (EPEC) + Enterotoxigenic <i>E.coli</i> (ETEC) <i>lt/st</i> + Norovirus GI/GII	2
Enteropathogenic <i>E.coli</i> (EPEC) + <i>Giardia lamblia</i>	2
Enteropathogenic <i>E.coli</i> (EPEC) + Rotavirus A	2
Enteropathogenic <i>E.coli</i> (EPEC) + <i>Yersinia enterocolitica</i>	2
Enteropathogenic <i>E.coli</i> (EPEC) + Enterotoxigenic <i>E.coli</i> (ETEC) <i>lt/st</i>	4
Enteropathogenic <i>E.coli</i> (EPEC) + Norovirus GI/GII	12
Campylobacter + Enteropathogenic <i>E.coli</i> (EPEC)	13

The analyte most commonly found in mixed infections was EPEC (45). STEC was found in 5 mixed infections and *E.coli* O157 in 3 mixed infections. Other pathogens were found in mixed infections (72) as shown in Table 6.

**Table 6. Prevalence of EPEC, STEC and *E.coli* O157 in Mixed Infections in FecalSwab specimens as determined by the QIAstat-Dx Gastrointestinal Panel 2**

Analyte	N	%
Enteropathogenic <i>E.coli</i> (EPEC)	45	36.0
Shiga-like toxin <i>E.coli</i> (STEC) <i>stx1/stx2</i>	5	4.0
<i>E.coli</i> O157	3	2.4
Other QIAstat-Dx GI2 analytes	72	57.6

#### Prospective Archived Specimen Testing

Additional prospectively collected archived specimens positive for STEC were collected (75 specimens). These were prospectively collected samples from three different collection sites in the US, where only those positive for the pathogen by standard of care method were archived and transferred into FecalSwab collection vials for analysis alongside 17 negative specimens. Results from the prospective archived specimen testing are presented in Table 7.

**Table 7. Clinical Performance in the Prospective Archived Study**

Analyte	Sample Type	Positive Percent Agreement			Negative Percent Agreement		
		TP/TP+FN	%	95% CI	TN/TN+FP	%	95% CI
Diarrheagenic <i>E.coli</i>							
Shiga-like toxin <i>E.coli</i> (STEC) <i>stx1/stx2</i>	FecalSwab	24 / 24 <sup>a</sup>	100.0	86.2-100.0	67 / 68 <sup>a</sup>	98.5	92.1-99.7

<sup>a</sup> For STEC fifty-one out of the seventy-five (51/75) prospectively archived FecalSwab samples (positive by standard of care) were negative by the composite comparator and therefore included as negative samples in the NPA calculations.

#### Retrospective Archived Study (Pre-selected specimens)

In addition, to supplement the results of the prospective clinical studies, a total of 317 preselected archived frozen (retrospective) FecalSwab specimens were also evaluated. These specimens served to increase the sample size for analytes that showed low prevalence in the clinical prospective study. The same Comparator Methods detailed in Table 3 were used as confirmatory testing for the presence of the nucleic acids from the expected analytes. Results from the retrospectively archived specimens testing are presented in Table 8.

**Table 8. Clinical Performance in the Retrospective Study**

Analyte	Sample Type	Positive Percent Agreement			Negative Percent Agreement		
		TP/TP+FN	%	95% CI	TN/TN+FP	%	95% CI
Diarrheagenic <i>E.coli</i>							
Enteropathogenic <i>E.coli</i> (EPEC)	FecalSwab	46 / 48	95.8	86.0-98.9	164 / 164	100.0	97.7-100.0
Shiga-like toxin <i>E.coli</i> (STEC) <i>stx1/stx2</i>	FecalSwab	2 / 3 <sup>a</sup>	66.7	20.8-93.9	62 / 63 <sup>b</sup>	98.4	91.5-99.7
<i>E.coli</i> O157	FecalSwab	0 / 0 <sup>c</sup>	N/A	N/A	2 / 2	100.0	34.2-100.0

<sup>a</sup> One (1) FecalSwab sample negative in QIAstat-Dx and positive with one (1) FDA-cleared comparator with insufficient volume for complete composite comparator testing was classed as false negative in the PPA calculations.

<sup>b</sup> Fifteen (15) FecalSwab sample positive for STEC in both QIAstat-Dx and one FDA-cleared comparator were excluded from the PPA calculations because the samples did not have sufficient volume for complete composite comparator testing. The sample size for NPA is smaller for STEC in FecalSwab as only a portion of the samples with a negative result in QIAstat-Dx and in one FDA-cleared comparator was tested with the complete composite comparator in the retrospective study.

<sup>c</sup> One (1) positive sample for *E.coli* O157 by QIAstat-Dx was excluded from the PPA calculation because reporting of the *E.coli* O157 result is dependent on the preceding STEC result (*E. coli* O157 is subtype within STEC) and the STEC result for that sample is unconfirmed.

For the clinical study, the proportion of failed or invalid runs on initial attempt and following repeat testing are summarized in Table 9. The failure rates due to instrument, invalid result (IC failure), sample too concentrated and other run failures are summarized in Table 10.

**Table 9. Failures Rate Summary**

Transport media	Study	Initial Runs			Final Runs		
		N/Total	%	95% CI	N/Total	%	95% CI
FecalSwab	<b>Prospective</b>	16/1227	1.3	0.8 - 2.1	3/1227	0.2	0.1 - 0.7
	<b>Prospective Archived</b>	0/145	0.0	0.0 - 2.6	0/145	0.0	0.0 - 2.6
	<b>Retrospective</b>	11/366	3.0	1.7 - 5.3	5/366	1.4	0.6 - 3.2
	<b>Total</b>	<b>27/1738</b>	<b>1.6</b>	<b>1.1 - 2.3</b>	<b>8/1738</b>	<b>0.5</b>	<b>0.2 - 0.9</b>

**Table 10. Failures Types Breakdown**

Transport Media	Study	Failure Reason	Initial Runs		Final Runs	
			N/Total	%	N/Total	%
FecalSwab	Prospective	Instrument	0/1227	0.0	0/1227	0.0
		Invalid*	0/1227	0.0	0/1227	0.0
		Sample too Concentrated†	5/1227	0.4	0/1227	0.0
		Other‡	11/1227	0.9	3/1227	0.2
	Prospective Archived	Instrument	0/145	0.0	0/145	0.0
		Invalid	0/145	0.0	0/145	0.0
		Sample too Concentrated	0/145	0.0	0/145	0.0
		Other	0/145	0.0	0/145	0.0
	Retrospective	Instrument	1/366	0.3	0/366	0.0
		Invalid	1/366	0.3	0/366	0.0
		Sample too Concentrated	0/366	0.0	0/366	0.0
		Other	9/366	2.5	5/366	1.4

\* Internal Control failures with at least one analyte detected and the other analytes reported as ‘invalid’

† Run failures related to ‘sample concentration too high’. These specimens were repeated with 100 microliters as detailed in Appendix C.

‡ Run failures related to workflow checkpoints.

### Contrived Specimens Testing

Some analytes are so rare that both prospective and retrospective testing efforts were insufficient to demonstrate system performance, that was the case for *E.coli* O157 in FecalSwab specimens. Therefore, to supplement the prospective and retrospective specimens’ test results, an evaluation of contrived specimens was also performed. Contrived specimens were prepared using negative residual specimens that had previously tested negative by QIAstat-Dx Gastrointestinal Panel 2 and comparator methods. At least 50% of these specimens were spiked at concentrations slightly above the Limit of Detection (2x LoD) and the rest at 5x and 10x LoD, using quantified strains for each pathogen. Approximately half of the specimens spiked were stools preserved in FecalSwab, and the other half were stools preserved in Para-Pak C&S. The analyte status of each contrived specimen was blinded to the users analyzing the specimens. Results are summarized in Table 11.

**Table 11. Test Results Summary for Contrived Specimens**

QIAstat-Dx GI2 Target	Sample Type	Positive Percent Agreement (PPA)		
		Fraction	Percentage	95% CI
<i>E.coli</i> O157	FecalSwab	35 / 35	100.0	90.1-100.0
	Para-Pak C&S	34 / 34	100.0	89.9-100.0

**2. Clinical Specificity:**

See the information above.

**D Clinical Cut-Off:**

N/A

**E Expected Values/Reference Range:**

A summary of the QIAstat-Dx Gastrointestinal Panel 2 test results for EPEC, STEC and *E.coli* O157 obtained during the prospective clinical performance evaluation of the QIAstat Dx Gastrointestinal Panel 2 is provided in Table 4. In total, 1,222 eligible stool specimens preserved in FecalSwab (COPAN) were collected and tested. The number and percentage of positive results as determined by the QIAstat-Dx Gastrointestinal Panel 2, are stratified by age group and presented in Table 12. Overall, EPEC and STEC were detected in 132 and 15 subjects, respectively, across all age groups while *E.coli* O157 was detected in three subjects from the 0-5 years age group.

**Table 12. Expected Values Summary by Age Group for the Prospective Clinical study as determined by the QIAstat-Dx Gastrointestinal Panel 2**

Pathogen	Sample Type	Overall	0-5 years	6-21 years	22-49 years	50+ years	Not Reported
<b>Diarrheagenic <i>E.coli</i>/Shigella</b>							
<b>Enteropathogenic <i>E.coli</i> (EPEC)</b>	FecalSwab	132 (10.8%)	47 (25.8%)	12 (9.9%)	34 (11.7%)	39 (6.2%)	0 (0.0%)
<b>Shiga-like toxin <i>E.coli</i> (STEC) <i>stx1/stx2</i></b>	FecalSwab	15 (1.2%)	9 (4.9%)	1 (0.8%)	2 (0.7%)	3 (0.5%)	0 (0.0%)
<b><i>E.coli</i> O157</b>	FecalSwab	3 (0.2%)	3 (1.6%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

**F Other Supportive Instrument Performance Characteristics Data:**

N/A

## **VIII Proposed Labeling:**

The labeling supports the finding of substantial equivalence for this device.

## **IX Conclusion:**

The submitted information in this premarket notification is complete and supports a substantial equivalence decision.