510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION
DECISION SUMMARY
ASSAY ONLY

I Background Information:

A 510(k) Number

K220052

B Applicant

Copan Italia

C Proprietary and Established Names

Copan FecalSwab Collection, Transport and Preservation System

D Regulatory Information

Product Code(s)	Classification	Regulation Section	Panel
JSM	Class I, reserved	21 CFR 866.2390 - Transport Culture Medium	MI - Microbiology

II Submission/Device Overview:

A Purpose for Submission:

In collaboration with Becton, Dickinson and Company (BD), Copan Italia is seeking substantial equivalence determination for the Copan FecalSwab Collection Transport and Preservation System for use with BD MAX Enteric Bacterial panel and BD MAX Extended Enteric Bacterial panel.

B Measurand:

Not Applicable

C Type of Test:

Copan FecalSwab Collection, Transport and Preservation System

III Intended Use/Indications for Use:

A Intended Use(s):

See Indications for Use below.

B Indication(s) for Use:

The Copan FecalSwab Collection, Transport and Preservation System is intended for collection and preservation of viable enteric pathogenic bacteria from rectal swabs and stool specimens during transport from the collection site to the testing laboratory. In the laboratory, FecalSwab specimens are processed using standard clinical laboratory operating procedures for culture. Stool specimens collected with the Copan FecalSwab are also suitable for use with the BD MAX Enteric Bacterial Panel and the BD MAX Extended Enteric Bacterial Panel.

C Special Conditions for Use Statement(s):

Rx - For Prescription Use Only

D Special Instrument Requirements:

The specimens collected will be tested using the BD MAX Enteric Bacterial Panel and BD MAX Extended Enteric Bacterial Panel on the BD MAX System.

IV Device/System Characteristics:

A Device Description:

The Copan FecalSwab Collection, Transport and Preservation System (Copan FecalSwab) is supplied in a collection kit format. Each collection kit consists of a package containing a plastic tube filled with 2 ml of FecalSwab transport and preservation medium and a specimen collection flocked swab intended both for rectal and stool specimen collection. In the laboratory, rectal and stool specimen are processed using standard clinical laboratory operating procedures for culture.

The Copan FecalSwab Collection, Transport and Preservation System was previously cleared (K142094) for the collection of rectal swab and fecal specimens and to preserve the viability of enteric pathogenic bacteria during transport from the collection site to the testing laboratory. In the laboratory, FecalSwab specimen are intended be processed using standard clinical laboratory operating procedures for culture but is not cleared for use with downstream molecular assays. The FecalSwab has been demonstrated to be suitable for testing samples with the BD MAX Enteric Bacterial Panel (EBP) and BD MAX Extended Bacterial Panel (xEBP).

B Principle of Operation:

The Copan FecalSwab Collection, Transport and Preservation System (FecalSwab) is supplied in a collection kit format. Each collection kit consists of a package containing a plastic screw-cap tube with conical shaped bottom filled with 2 ml of transport and preservation medium and a specimen collection swab that has a tip flocked with soft nylon fiber.

The FecalSwab transport and preservation medium is a maintenance medium designed to maintain the viability of enteric pathogenic bacteria during transit to the testing laboratory. The FecalSwab Transport and Preservation Medium is comprised of the following:

- Chloride salts
- Sodium salts
- Phosphate buffer
- L-Cysteine
- Agar
- Water

The nylon flocked specimen collection swabs provided with the Copan FecalSwab Collection, Transport and Preservation System has a solid plastic shaft with a molded breakpoint site and are sterile.

V Substantial Equivalence Information:

A Predicate Device Name(s):

Copan Fecalswab Collection, Transport And Preservation System

B Predicate 510(k) Number(s):

K142094

C Comparison with Predicate(s):

Device & Predicate Device(s):	Device: K220052	Predicate: K142094
Device Trade Name	Copan FecalSwab Collection, Transport and Preservation System	Copan FecalSwab Collection, Transport and Preservation System
General Device Characteristic	Copan FecalSwab is a Collection, Transport and Preservation System supplied in a collection kit format.	Copan FecalSwab is a Collection, Transport and Preservation System supplied in a collection kit format.
General Device Characteristic Similarities		
Intended Use; Collection Device	The Copan FecalSwab Collection, Transport and Preservation System is intended for collection and preservation of viable enteric pathogenic bacteria from	The Copan FecalSwab Collection, Transport and Preservation System is intended for the collection of rectal swab and fecal specimens and to

	rectal swabs and stool specimens during transport from the collection site to the testing laboratory for standard culture procedures. Stool specimens collected with the Copan FecalSwab are also suitable for use with the BD MAX Enteric Bacterial Panel and the BD MAX Extended Bacterial Panel.	preserve the viability of enteric pathogenic bacteria during transport from the collection site to the testing laboratory. In the laboratory, FecalSwab specimens are processed using standard clinical laboratory operating procedures for culture.
Specimen Type	Stool specimen, rectal specimen **Note:** The scope of this clearance does not intend to seek claims for use of rectal specimens with the BD MAX EBP and xEBP Assays.	Same
Microorganisms supported	Enteric pathogenic bacteria	Same
Single Use Device	Yes	Same
Container	Polypropylene conical bottom vial	Same
Product Configuration	Medium in vial & cap System including Medium and swab in peel pouch option.	Same
pH of Medium	6.90 – 7.50	Same
Storage Temperature	5-25ºC	Same
Medium Volume	2 mL	Same
Swab Shaft	Plastic	Same
Swab Tip	Flocked nylon	Same
Shelf Life	15 months	Same
Medium Formulation	Chloride salts Sodium salts Phosphate buffer L-Cysteine Agar Distilled water	Same
Product code	JSM, LIO	Same
General Device Characteristic Differences		

Claimed instrument platforms	The BD MAX Enteric Bacterial Panel and the BD MAX Extended Enteric Bacterial Panel.	None
List of claimed organisms	*Escherichia coli* *Escherichia coli O157:H7* *Salmonella typhimurium* *Shigella sonnei* *Campylobacter jejuni* *Yersinia enterocolitica* *Vibrio parahaemolyticus* *Enterococcus faecalis* *Vancomycin resistant (VRE)* *Clostridium difficile* ***Plesiomonas shigelloides***	*Escherichia coli* *Escherichia coli O157:H7* *Salmonella typhimurium* *Shigella sonnei* *Campylobacter jejuni* *Yersinia enterocolitica* *Vibrio parahaemolyticus* *Enterococcus faecalis* *Vancomycin resistant (VRE)* *Clostridium difficile*

VI Standards/Guidance Documents Referenced:

CLSI M40-A2:2014 Quality Control of Microbiological Transport Systems; Approved Standard – Second Edition

ISO 11137-2:2015 Sterilization of health care products – Radiation – Part 2: Establishing the radiation dose

VII Performance Characteristics (if/when applicable):

A Analytical Performance:

1. Precision/Reproducibility:

   Not Applicable

2. Linearity:

   Not Applicable

3. Analytical Specificity/Interference:

   PCR Interfering Substances
   Exogenous interfering substance studies were conducted in the original BD MAX EBP and BD MAX xEBP clearance. An additional interference study was conducted to assess the contents of the Copan FecalSwab Collection, Transport and Preservation System using the sample processing control (SPC) that is included with BD MAX EBP and BD MAX xEBP assays. The SPC target is intended to monitor the presence of potential inhibitory substances in each reaction. The study was designed to leave the swabs inside the transport device tubes

for the duration of the incubation period and amplification of the sample processing control (SPC) target was successful at every stability time point tested. The results indicate that there was no interference or inhibition in any of the components of the FecalSwab collection, transport, and preservation system. The SPC monitors DNA extraction, thermal cycling, reagent integrity and the presence of inhibitory substances. Results of tests are shown in table 1 below.

Table 1: PCR Interfering Substance SPC Results from FecalSwab Specimen Storage Stability Studies.

Specimen storage condition in FecalSwab	Specimen storage condition in Sample Buffer Tube (SBT)	Total Days	Number of replicates tested	Number of replicates providing amplification for SPC target
NA	NA	0	48	48/48
1 Day at 25±2°C	NA	1	24	24/24
2 Days at 25±2°C	NA	2	24	24/24
1 Day at 25±2°C	2 Days at 25±2°C	3	24	24/24
1 Day at 25±2°C	3 Days at 25±2°C	4	24	24/24
1 Day at 25±2°C	5 Days at 2-8°C	6	24	24/24
1 Day at 25±2°C	6 Days at 2-8°C	7	24	24/24
5 Days at 2-8°C	NA	5	24	24/24
6 Days at 2-8°C	NA	6	24	24/24
5 Days at 2-8°C	2 Days at 25±2°C	7	24	24/24
5 Days at 2-8°C	3 Days at 25±2°C	8	24	24/24
5 Days at 2-8°C	5 Days at 2-8°C	10	24	24/24
5 Days at 2-8°C	6 Days at 2-8°C	11	24	24/24

Microbial Interfering Substances

Microbial interference studies were conducted in the original BD MAX EBP and BD MAX xEBP clearance. No modifications were made to the BD MAX EBP and BD MAX xEBP assay design, reagents, workflow, algorithm, or interpretation of results. When the Copan FecalSwab device is used in combination with BD MAX EBP and BD MAX xEBP the media does not have any effect on BD instruments or any effect on signal overlap.

4. Assay Reportable Range:

   Not Applicable

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

   Sterilization

No changes to the sterile barrier (film-film peel-pouch), sterilization method, sterilization dose and SAL have been made to the device since the original clearance of the Copan FecalSwab Collection, Transport and Preservation System (K142094).

Shelf Life

The FecalSwab has a claimed shelf life of 15 months. The FecalSwab was verified to meet performance requirements for enteric bacteria viability through 15 months in the studies submitted with the original FecalSwab premarket notification (K142094).

Bacterial Recovery (Viability)

Bacterial Recovery (Viability) Studies in the original clearance for the Copan fecal swab (K142094) did not include *Plesiomonas shigelloides* (*P. shigelloides*) (ATCC 14029) as a claimed organism. *P. shigelloides* is a claimed organism on the BD MAX EBP and xEBP panel and as a result *P. shigelloides* is added to the claimed organisms for the subject device. All other organisms claimed on the BD MAX EBP and xEBP panel have been previously validated with viability studies using the subject device (K142094). Recovery studies were conducted to evaluate the ability of the FecalSwab to maintain viability of *P. shigelloides.* The organism was spiked into negative clinical fecal matrix then stored at 20 - 25ºC for 48 hrs. and at 2 - 8ºC for 72 hrs. The stability study was conducted using three production lots. Viability studies used the roll plate method and the swab elution method. Different dilutions of *P. shigelloides* were contrived using clinical negative fecal matrix followed by immediately adding the stool and organisms into the subject transport device. The negative clinical fecal matrix was prepared using formed stools from more than 4 healthy asymptomatic subjects. The pooled stool was then homogenized in Phosphate Buffer Saline (PBS) (30% stool in 70% PBS). The media was confirmed to be negative by plating a portion of each pool on an appropriate agar plate.

To distinguish and count the target colonies in the case of *P. shigelloides*, in the presence of resistant flora, a differential and selective agar were used to grow the target organism (Inositol Brilliant Green Bile Agar). For the swab elution method, the inoculum suspension was prepared by making a direct suspension in 0.85% physiological saline (pH 6.8-7.2) of isolated colonies from approximately 1.5 x 10^8 CFU/ml, (0.5 McFarland standard). This inoculum was diluted 10 folds in fecal matrix to provide suspensions with concentrations of 1.5 x 10^4 CFU/ml, 1.5 x 10^3 CFU/ml, and 1.5 x 10^2 CFU/mL. 100 µL of an inoculum was pipetted onto swabs and placed into tubes and stored (T = 0, 6, 24, 48, and 72 hours) (3 lots used) for each holding temperature or time combination. The zero-time controls were plated in triplicates for each inoculum concentrations prepared. All other spiked swabs and media were held at specified temperatures for specific times (at 20-25ºC for 6, 24, 48 hrs. and at 2-8ºC for 6, 24, 48, and 72 hrs.). After each specific time point and storage condition, all tubes were vortexed for a minimum of 5 seconds and the medium was then plated by pipetting 100 µL from each tube onto the appropriate culture medium in triplicates (Inositol Brilliant Green Bile Agar) and incubated at 35 ± 2ºC in an aerobic atmosphere for 24 hrs. The colonies were then counted (only pink colored colonies were appropriate for counting). The average CFU was determined for each concentration for each time point and storage condition.

The inoculum for the roll plate method was prepared the same way as the swab elution method above, with 100 µL aliquots of the prepared inoculum diluted to 1.5 x10^4, 1.5 x 10^3 and 1.5 x 10^2 CFU/ml. The dilutions were transferred into 24-wells at time 0, 6, 24, 48, and 72 hrs. for plating onto the appropriate culture medium and stored at 2-8ºC and 20-25ºC. The

swab was used to transfer the inoculum into the subject device according to the instructions for use. Each time point and storage condition were made in triplicate. At each time point tested, the swabs were removed from the subject device and the media was inoculated on the surface of Inositol Brilliant Green Bile Agar culture medium plates by rolling the swab across the surface of the culture media. Plates were incubated at 35-37ºC for 24 hrs. with only pink colonies being counted and the average CFU calculated from 3 plates from each holding temperature and each concentration.

The acceptance criteria for both bacterial recovery methods were as follows: Cultures from transport medium tubes held at both 2 - 8ºC and 20 - 25ºC for 6hrs., 24 hrs., 48 hrs., and 72hrs. for each temperature must remain within 2 $\log_{10}$ of the initial microorganism concentration (time point 0). All data demonstrated the ability of the FecalSwab to maintain viability of bacteria under the claimed conditions of use (table 2 and 3).

Table 2: Summary of *Plesiomonas shigelloides* Recovery Study ((Swab Elution Method)

	Average CFU recovered from three lots					
Holding Temperature	**T=0**	**T=6h**	**T=24h**	**T=48h**	**T=72h**	**T=48/72 hrs. Log reduction (-) or Log increase (+)**
2-8°C	1.19E+03	1.17E+03	1.02E+03	9.26E+02	8.01E+02	-0.17
20-25°C	1.19E+03	1.09E+03	2.23E+03	4.95E+03		0.61

Table 3: Summary of *Plesiomonas shigelloides* Recovery Study (Roll Plate Method)

	Average CFU recovered from three lots					
Holding Temperature	**T=0**	**T=6h**	**T=24h**	**T=48h**	**T=72h**	**T=48/72 hrs. Log reduction (-) or Log increase (+)**
2-8°C	1.31E+02	1.11E+02	1.12E+02	1.17E+02	1.35E+02	0.01
20-25°C	1.31E+02	1.21E+02	1.83E+02	1.09E+03		0.92

Specimen Storage Stability

Nucleic acid storage and stability was evaluated for specimens stored in the FecalSwab collection device under the same storage conditions claimed in BD MAX EBP and BD MAX xEBP clearance when using preserved stool specimens. Acceptable storage conditions for preserved stool specimens in the original clearance for BD MAX EBP and BD MAX xEBP

were either 25 ± 2ºC for 24 hrs. or 2-8ºC for 5 days prior to testing. A study was conducted to test the previously cleared stability claims of 25 ± 2ºC for 24 hrs. or 2-8ºC for 5 days, using the subject transport device.
Studies included a nested stability testing to show that specimens stored in FecalSwab medium at the described conditions (i.e., **Day 1**: 24 hours in FecalSwab at 25±2°C , Day 3: 24 hours in FecalSwab at 25±2°C + 48 hours at 25±2°C in SBT, Day 6: 24 hours in FecalSwab at 25±2°C+ 5 days at 2-8°C in SBT, Day 5: 5 days in FecalSwab at 2-8°C, Day 7: 5 days in FecalSwab at 2-8°C + 48 hours at 25±2°C in SBT, and Day 10: 5 days in FecalSwab at 2-8°C + 5 days at 2-8°C in SBT) continued to be stable at 2-8ºC for up to 120 hours (5 days) or at 25 ± 2ºC for up to 48 hours. The study included four panels consisting of two different organisms mixed into each panel. Each panel used clinical matrix and was contrived at a concentration of 2 x LoD (Table 4). The acceptance criteria for the Fecalswab were a minimum of 95% detection for all targets at 2-8ºC for up to 120 hours (5 days) or at 25 ± 2ºC for up to 48 hours when SBT was used as described above in parentheses and results showed that each organism tested for both BD MAX EBP and xEBP had ≥ 95% detection at all the target storage stability time points claimed in the package insert (as shown in Table 5).

Table 4: Specimen Stability Multiplex Organism Mix Compositions and Organisms Concentration in SBT during the test Expressed in Colony Forming Units (CFU/ml).

PANEL	ORGANISMS	CFUs/mL in SBT (LoD) from the PI	CFUs/mL in SBT (2XLoD) from the PI	Actual 2XLoD concentration of each strain in CFUs/mL SBT
BD MAX EBP multiplex mix #1	*Campylobacter jejuni*	10	20	56
	Shigella sonnei	124	248	144
BD MAX EBP multiplex mix #2	*Escherichia coli STX1*	223	446	361
	Salmonella typhimurium	193	386	373
BD MAX xEBP multiplex mix #1	*Yersinia enterocolitica*	227	454	576
	Escherichia coli ETEC	137	274	361
BD MAX xEBP multiplex mix #2	*Vibrio parahaemolyticus*	124	248	396
	Plesiomonas shigelloides	257	514	329

Table 5: Summary of FecalSwab specimen storage stability results with BD MAX EBP and BD MAX xEBP.

	FecalSwab 25±2°C nested to SBT at 2-8°C and 25±2°C			FecalSwab 2-8°C nested to SBT at 2-8°C and 25±2°C		
Organism	**Day**	**N° positive replicates**	***% Pos***	**Day**	**N° positive replicates**	***% Pos***
***Plesiomonas shigelloides* ATCC 14029**	1	23/24	96	5	24/24	100
	3	24/24	100	7	24/24	100
	6	24/24	100	10	24/24	100
	1	24/24	100	5	24/24	100

***Vibrio parahaemolyticus* ATCC 17802**	3	24/24	100	7	24/24	100
	6	24/24	100	10	24/24	100
***Yersinia enterocolitica* ATCC 9610**	1	24/24	100	5	24/24	100
	3	24/24	100	7	24/24	100
	6	24/24	100	10	24/24	100
***Escherichia coli ETEC* ATCC 35401**	1	24/24	100	5	24/24	100
	3	24/24	100	7	24/24	100
	6	24/24	100	10	24/24	100
***Campylobacter jejuni* ATCC 43429**	1	24/24	100	5	24/24	100
	3	24/24	100	7	24/24	100
	6	23/24	96	10	24/24	100
***Shigella sonnei* ATCC 9290**	1	24/24	100	5	24/24	100
	3	24/24	100	7	24/24	100
	6	24/24	100	10	24/24	100
***Escherichia coli STX1* ATCC 43890**	1	24/24	100	5	24/24	100
	3	24/24	100	7	24/24	100
	6	24/24	100	10	24/24	100
***Salmonella typhimurium* ATCC 14028**	1	24/24	100	5	24/24	100
	3	24/24	100	7	24/24	100
	6	24/24	100	10	24/24	100

6. Detection Limit (LoD):

LoD studies were performed to determine the analytical sensitivity with the BD MAX EBP and BD MAX xEBP System when used with the FecalSwab specimen collection device has similar analytical performance compared to raw stool when used with these systems. The pooled negative clinical stool matrix was pre-tested with an FDA cleared assay for each target organism and determined to be negative prior to use. The stool matrix was used as a negative sample or was spiked to generate positive samples with the following organisms: *Salmonella typhimurium*, ATCC 14028; *Escherichia coli* STX1, ATCC 43890; *Campylobacter jejuni*, ATCC 43429 and *Shigella sonnei*, ATCC 9290. A 0.5 McFarland standard was made for each organism and further diluted. The 0.5 McFarland was confirmed with culture to determine the CFU/mL concentration, each organism was then serially diluted down to the LoD. The LoD is reported in CFU/mL.

150 µL each of the inoculated stool samples was used to spike 12 tubes of the FecalSwab transport medium according to the IFU. After inoculation, 50 µL of each inoculated FecalSwab tube specimens were transferred into a total of 24 BD MAX sample buffer tubes (SBTs) in parallel according to the manufacturer's instructions for BD MAX assays. This procedure was repeated for each dilution and mix. The external controls were processed and tested as described in the BD MAX EBP and BD MAX xEBP IFUs. The LoD is the concentration at which > 95% of the sample tested positive. Table 6 and 7 include the LoD concentrations of organisms in CFU/mL when FecalSwab specimens were tested with the BD MAX EBP and BD MAX xEBP.

Table 6: Limit of Detection Concentrations (CFU/mL) for FecalSwab specimens tested with BD MAX Enteric Bacterial Panel

Specimen type	*Salmonella typhimurium* ATCC 14028	*Escherichia coli STX1* ATCC 43890	*Campylobacter jejuni* ATCC 43429	*Shigella sonnei* ATCC 9290
FecalSwab	7.16E+05	1.30E+05	1.17E+04	1.74E+05

Table 7: Limit of Detection Concentrations (CFU/mL) for FecalSwab specimens tested with BD MAX Extended Enteric Bacterial Panel

Specimen type	*Plesiomonas shigelloides* ATCC 14029	*Yersinia enterocolitica* ATCC 9610	*Vibrio parahaemolyticus* ATCC 17802	*Escherichia coli ETEC* ATCC 35401
FecalSwab	7.94E+04	1.23E+05	7.12E+04	1.23E+05

For each organism tested across both the BD MAX enteric bacterial panel and extended bacterial panel, an LoD was identified. These results support that the FecalSwab has equivalent analytical performance to raw stool when used with BD MAX EBP and BD MAX xEBP cleared devices.

Analytical Specificity-False positivity

The analytical specificity of the BD MAX System when used with the FecalSwab specimens was evaluated using data generated from the storage stability studies. This study was designed to demonstrate that the FecalSwab medium does not interfere with BD MAX EBP and BD MAX xEBP SBTs resulting in false positive results. Three lots of negative pooled stool matrix were prepared from 4 healthy, asymptomatic volunteers and homogenized in PBS to serve as negative fecal matrix (30% stool and 70% PBS). All of the FecalSwab tubes with the negative fecal matrix were processed according to the package insert. These samples were then tested on the BD MAX systems after generating two SBTs from each individual collection tube initially inoculated (3 Copan FecalSwab lots were used). Data from the FecalSwab media and negative fecal matrix is presented in table 8. Testing resulted in no false positive results.

Table 8: Analytical Specificity: False Positive Study results from FecalSwab Specimen Storage Stability Study

Number of FecalSwab prepared	Number of SBT tubes generated and tested	Number of replicates providing false positive result due to FecalSwab interference
168	336 (2 for each tube of FS-)	0/334*

*2 SBTs have been excluded from the final calculation since an environmental contamination occurred during test.

Cross-Reactivity of FecalSwab Specimens with BD MAX EBP and BD MAX xEBP

Cross-Reactivity studies were conducted and validated in the original clearance of the BD MAX EBP and BD MAX xEBP using unpreserved stool. In the previous clearance unpreserved stool was determined to be the most challenging specimen type. The FecalSwab collection device has no impact on the genetic sequences of potentially cross-reacting

organisms and no changes were made to the BD MAX EBP or BD MAX xEBP assay primers or probes to accommodate FecalSwab preserved stool specimens. It was concluded that no additional cross-reactivity studies were necessary.

7. Assay Cut-Off:

   Not Applicable

B Comparison Studies:

1. Method Comparison with Predicate Device:

   Not Applicable

2. Matrix Comparison:

   Not Applicable

C Clinical Studies:

1. Clinical Sensitivity:

   Not Applicable

2. Clinical Specificity:

   Not Applicable

3. Other Clinical Supportive Data (When 1. and 2. Are Not Applicable):

   Not Applicable

D Clinical Cut-Off:

Not Applicable

E Expected Values/Reference Range:

Not Applicable

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.