510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION
DECISION SUMMARY

A. 510(k) Number:
K190441

B. Purpose for Submission:

To obtain a Substantial Equivalence Determination for a new 510(k) application for Xpert CT/NG performed on the Cepheid GeneXpert Instrument Systems for new specimen types; rectal swab and pharyngeal swab.

C. Measurand:

Unique sequences in the genomic DNA for *Chlamydia trachomatis* (CT) and *Neisseria gonorrhoeae* (NG).

D. Type of Test:

Automated, multiplex real-time polymerase chain reaction (PCR) assay intended for the *in vitro* qualitative detection and differentiation of DNA from *Chlamydia trachomatis* (CT) and/or *Neisseria gonorrhoeae* (NG).

E. Applicant:

Cepheid

F. Proprietary and Established Names:

Xpert CT/NG
Xpert CT/NG Assay

G. Regulatory Information:

1. Regulation section:
   866.3393 Device to detect nucleic acids from non-viral microorganism(s) causing sexually transmitted infections and associated resistance marker(s)

2. Classification:
   Class II

3. Product codes:
   QEP: Nucleic Acid Detection System For Non-Viral Microorganism(s) Causing Sexually Transmitted Infections
   LSL: DNA-Reagents, Neisseria
   MKZ: DNA Probe, Nucleic Acid Amplification, Chlamydia
   OOI: Real Time Nucleic Acid Amplification System
   QBD: Microbial Nucleic Acid Storage and Stabilization Device

4. Panel:
   Microbiology (83)

H. Intended Use:

1. Intended use(s):

   Device Intended Use:
   The Xpert® CT/NG test, performed on the GeneXpert® Instrument Systems, is a qualitative *in vitro* real-time PCR test for the automated detection and differentiation of genomic DNA from *Chlamydia trachomatis* (CT) and/or *Neisseria gonorrhoeae* (NG) to aid in the diagnosis of chlamydial and gonorrheal disease in the urogenital tract and extragenital sites (pharynx and rectum). The assay may be used to test the following specimens from asymptomatic and symptomatic individuals: female and male urine, patient-collected vaginal swabs (collected in a clinical setting), clinician-collected endocervical swabs, and female and male pharyngeal and rectal swabs.

   Ancillary Collection Kits:

   Xpert Vaginal/Endocervical Specimen Collection Kit
   The Cepheid Xpert® Swab Specimen Collection Kit is designed to collect, preserve, and transport *Chlamydia trachomatis, Neisseria gonorrhoeae,* and *Trichomonas vaginalis* DNA in endocervical swab specimens (collected by a clinician) and patient-collected vaginal swab specimens (collected in a clinical setting) from symptomatic and asymptomatic women prior to analysis with the Xpert CT/NG Assay and the Xpert TV Assay.

   Xpert Urine Specimen Collection Kit
   The Cepheid Xpert® Urine Specimen Collection Kit is designed to preserve and transport *Chlamydia trachomatis, Neisseria gonorrhoeae,* and *Trichomonas vaginalis* DNA in first-catch female and male urine specimens from symptomatic and asymptomatic individuals prior to analysis with the Xpert CT/NG Assay and the Xpert TV Assay.

   Xpert Swab Specimen Collection Kit
   The Xpert® Swab Specimen Collection Kit is designed to collect, preserve, and transport endocervical, vaginal, pharyngeal, and rectal swab specimens. This transport system is for use for testing with Xpert tests.

2. Indication(s) for use:
   Same as Intended Use

3. Special conditions for use statement(s):
   For Prescription Use Only

4. Special instrument requirements:
   Gene Xpert System

I. Device Description:

The Xpert CT/NG test is an automated *in vitro* diagnostic test for qualitative detection and differentiation of DNA from *Chlamydia trachomatis* (CT) and/or *Neisseria gonorrhoeae* (NG). The test is performed on the Cepheid GeneXpert Instrument Systems. The Xpert CT/NG test on the GeneXpert Instrument System automates and performs the following procedures; sample purification, nucleic acid amplification through real-time polymerase chain reaction (PCR), and detection of the target sequences. The system consists of an instrument, personal computer, and preloaded software for running the tests and viewing the results. The system requires the use of single-use disposable cartridges that hold the PCR reagents and host the PCR process. Because the cartridges are self-contained, cross- contamination between samples is minimized.

The Xpert CT/NG test includes reagents for the detection and differentiation of CT and NG. A Sample Processing Control (SPC), a Sample Adequacy Control (SAC), and a Probe Check Control (PCC) are also included. The SPC is present to control for adequate processing of the target bacteria and to monitor the presence of inhibitors in the PCR reaction. The SAC reagents detect the presence of a single copy human gene and monitor whether the specimen contains human cells. The PCC verifies reagent rehydration, PCR tube filling in the cartridge, probe integrity, and dye stability.

The GeneXpert Instrument Systems, comprised of the GeneXpert Dx Systems, the GeneXpert Infinity-48 System, GeneXpert Infinity-48s, and the GeneXpert Infinity-80 System, have 1 to 80 randomly accessible modules, depending upon the instrument, that are each capable of performing separate sample preparation and real-time PCR tests.

Each module contains a syringe drive for dispensing fluids (i.e., the syringe drive activates the plunger that works in concert with the rotary valve in the cartridge to move fluids between chambers), an ultrasonic horn for lysing cells or spores, and a proprietary I-CORE® thermocycler for performing real-time PCR and detection.

The ancillary specimen collection kits for use with the Xpert CT/NG test are the Xpert Vaginal/Endocervical Specimen Collection Kit, Xpert Swab Specimen Collection kit, and the Xpert Urine Specimen Collection kit.

J. Substantial Equivalence Information:

1. Predicate device name(s):
   Aptima Mycoplasma Genitalium Assay

2. Predicate 510(k) number(s):
   DEN180047

3. Comparison with predicate:

Table 1. Similarities between device and predicate.

Similarities		
	Device	**Predicate Device**
Item	**Cepheid Xpert CT/NG**	**Aptima Mycoplasma Genitalium Assay**
Nucleic Acid Extraction	Yes	Yes
Assay Results	Qualitative	Same
Indication for Use	Asymptomatic and symptomatic patients	Same

Table 2. Differences between device and the predicate

Differences		
Item	**Device**	**Predicate Device**
	Cepheid Xpert CT/NG	**Aptima Mycoplasma Genitalium Assay**
Technology/ Detection	Multiplex real-time polymerase chain reaction (PCR)	Transcription -mediated nucleic acid amplification and hybridization
Specimen Type	Female and male urine, endocervical swab, patient-collected vaginal swab (collected in a clinical setting), and female and male pharyngeal and rectal swabs	Clinician-collected and self-collected vaginal swabs (in a clinical setting), clinician-collected endocervical swabs, female and male urine, clinician-collected male urethral swabs, and self-collected penile meatal swabs (in a clinical setting)

Intended Use	The Xpert® CT/NG test, performed on the GeneXpert® Instrument Systems, is a qualitative *in vitro* real-time PCR test for the automated detection and differentiation of genomic DNA from *Chlamydia trachomatis* (CT) and/or *Neisseria gonorrhoeae* (NG) to aid in the diagnosis of chlamydial and gonorrheal disease in the urogenital tract and extragenital sites (pharynx and rectum). The assay may be used to test the following specimens from asymptomatic and symptomatic individuals: female and male urine, patient-collected vaginal swabs (collected in a clinical setting), clinician-collected endocervical swabs, and female and male pharyngeal and rectal swabs.	The Aptima Mycoplasma genitalium assay is an *in vitro* nucleic acid amplification test (NAAT) for the qualitative detection of ribosomal RNA (rRNA) from *Mycoplasma genitalium* on the fully automated Panther system. It is intended for use as an aid in the diagnosis of *M. genitalium* urogenital infections in male and female patients suspected of *M. genitalium* infection. The assay may be used to test the following specimens: clinician-collected and self-collected vaginal swabs (in a clinical setting), clinician-collected endocervical swabs, female and male urine, clinician-collected male urethral swabs, and self-collected penile meatal swabs (in a clinical setting). For females, a vaginal swab is the preferred specimen type due to higher clinical sensitivity for detecting *M. genitalium* than other specimen types; however, female urine or clinician-collected endocervical swabs may be used as alternative specimens when vaginal swab specimens are not available. If female urine or clinician-collected endocervical swab specimens test negative, testing with a vaginal swab may be indicated, if *M. genitalium* infection is suspected.
Assay Targets	DNA from *Chlamydia trachomatis* (CT) and/or *Neisseria gonorrhoeae* (NG)	Ribosomal RNA from *Mycoplasma genitalium*
Instrument System	Cepheid GeneXpert Instrument System	Panther System
Assay Controls	Internal sample processing control (SPC), sample adequacy control (SAC), and probe check control (PCC). External controls available.	Internal Control (IC). External calibrators available.

K. Standard/Guidance Document Referenced (if applicable):

N/A

L. Test Principle:

The assay detects bacterial genomic DNA that has been extracted from a patient sample. A multiplex real-time PCR reaction is carried out under optimized conditions generating amplicons for *Chlamydia trachomatis* and/or *Neisseria gonorrhoeae* and the Sample Process Control (SPC). Identification of *Chlamydia trachomatis*, *Neisseria gonorrhoeae*, and the SPC occurs by the use of target-specific primers and fluorescent-labeled probes that hybridize to conserved regions in the genomes.

M. Performance Characteristics (if/when applicable):

1. Analytical performance:

Several of the analytical studies in support of this 510(k) submission were conducted for and described in submission K121710. Testing for all analytical studies reported with K121710 was performed using the identical Cepheid Xpert CT/NG Assay, and no changes to the assay were made since the 510(k) clearance of K121710. The additional analytical studies described below were performed in support of the new specimen types included in the Intedned Use for this submission.

a. Precision/Reproducibility:
Please refer to the Decision Summary for submissions K121710.

b. Linearity/assay reportable range:
Please refer to submission K121710.

c. Traceability, Stability, controls and calibrators:
Please refer to submission K121710.

Stability:
Stability studies have been performed to support device performance for the new specimen types:

Sample Stability:

To examine sample stability of pharyngeal and rectal swabs in Cepeid Xpert swab transport reagent (STR), positive samples for two serovars of CT and two strains of NG were generated. Bacteria was seeded at 3xLoD into pooled negative clinical matrix for each sample type. Pooled negative clinical matrix was used for negative samples. Positive and Negative samples were stored at 2°C, 8°C, 15°C and 30°C to represent extremes of refrigerated and room-temperature storage conditions. Replicates of 8 positive and 4 negative samples were tested for each sample type and bacteria at time 0, 1 day, 2 days, 4 days, 8 days, 16 days, 41 days

and 61 days for each storage condition.

Under the conditions of this study, all positive and negative samples at all storage conditions and temperatures tested were correctly identified using the Xpert CT/NG test.

The following specimen stability claims are supported by study data:

- 2-30°C for up to 60 days

Kit Stability:
The following kit stability claims are supported by study data from K121710:

- 2-28°C until expiration date provided on label

Cartridge Hold Time:
The following stability claim for prepared samples waiting on the GeneXpert Instrument Systems was confirmed in a new study with pharyngeal and rectal specimen types:

- Up to 4.5 hours at room temperature

Carryover:
Please refer to submission K121710.

d. Detection limit:

Studies were performed to determine the analytical limit of detection (LoD) of the Xpert CT/NG for rectal swab and pharyngeal swabs. Pooled negative clinical matrix was used for negative samples and was spiked to generate positive samples. Positive pharyngeal and rectal swabs in Cepeid Xpert swab transport reagent (STR) were generated for 2 serovars of CT and 2 strains of NG. Limiting dilutions of titered CT and NG were generated, 5 dilutions per serovar/strain with 20 replicates each. Testing was performed with two reagent lots per bacteria and occurred across 3 testing days. Probit model fit was used to estimate the LoD which was then confirmed with 20 replicates where ≥ 19/20 replicates were positive.

The LoD point values for each serovar/strain tested in paryngeal and rectal swab matrix are summarized in Tables below.

Table 3. Confirmed LoD (EB/mL): *Chlamydia tracomatis*

Organism Strain	**Confirmed LoD(EB/mL)**	
	Pharyngeal Swab	Rectal Swab
Chlamydia tracomatis serovar D	161	88
Chlamydia tracomatis serovar H	225	161

Table 4. Confirmed LoD (CFU/mL): *Neisseria gonorrhoeae*

Organism Strain	Confirmed LoD (CFU/mL)	
	Pharyngeal Swab	Rectal Swab
Neisseria gonorrhoeae ATCC 19424	7.1	4.9
Neisseria gonorrhoeae ATCC 49226	6.4	5.3

e. Analytical specificity:

Analytical Reactivity (inclusivity)

The analytical reactivity of the Xpert CT/NG test was evaluated against 14 CT serovars and 20 NG strains obtained from culture collections in the United States and Europe. Pooled negative clinical matrix was used for negative samples. Positive samples were prepared by spiking negative clinical matrix with bacteria at concentrations near the LoD. Three replicates of each serovar/strain were tested for both pharyngeal and rectal swabs in Cepeid Xpert swab transport reagent (STR).

Table 5: Analytical Reactivity Results of Xpert CT/NG with CT Serovars in Rectal Swab Matrix

***C. trachomatis* serovar**	**Concentration Tested in Rectal Swab Matrix**	**Test Result**	
		CT	**NG**
A	1800 EB/mL	POS	NEG
B	8.1 EB/mL	POS	NEG
Ba	0.81 EB/mL	POS	NEG
C	322 EB/mL	POS	NEG
E	322 EB/mL	POS	NEG
E/SW2	0.81 IFU/mL[a]	POS	NEG
F	322 EB/mL	POS	NEG
G	644 EB/mL	POS	NEG
I	0.16 EB/mL	POS	NEG
J	644 EB/mL	POS	NEG
K	644 EB/mL	POS	NEG
LGV I	322 EB/mL	POS	NEG
LGV II	322 EB/mL	POS	NEG
LGV III	644 EB/mL	POS	NEG

[a] IFU/mL = Infectious units per mL.

Table 6: Analytical Reactivity Results of Xpert CT/NG with NG Strains in Rectal Swab Matrix

***N. gonorrhoeae* Strain**	**Concentration Tested in Rectal Swab Matrix (CFU/mL)**	**Test Result**	
		CT	**NG**
9793	10.6	NEG	POS
9830	10.6	NEG	POS
19999	10.6	NEG	POS
27629	10.6	NEG	POS
27630	10.6	NEG	POS
27631	10.6	NEG	POS
31148	10.6	NEG	POS
31397	10.6	NEG	POS
31399	10.6	NEG	POS
31400	10.6	NEG	POS
1170	42.4	NEG	POS
6395	10.6	NEG	POS
13281	10.6	NEG	POS
34447	10.6	NEG	POS
37541	10.6	NEG	POS
10226	10.6	NEG	POS
10227	10.6	NEG	POS
10932	10.6	NEG	POS
11472	10.6	NEG	POS
50348	10.6	NEG	POS

Table 7: Analytical Reactivity Results of Xpert CT/NG with CT Serovars in Pharyngeal Swab Matrix

C. trachomatis **Serovar**	**Concentration Tested in Pharyngeal Swab Matrix**	**Test Result**	
		CT	**NG**
A	1800 EB/mL	POS	NEG
B	9 EB/mL	POS	NEG
Ba	0.9 EB/mL	POS	NEG
C	900 EB/mL	POS	NEG
E	450 EB/mL	POS	NEG
E/SW2	0.9 IFU/mL[a]	POS	NEG
F	450 EB/mL	POS	NEG
G	900 EB/mL	POS	NEG
I	0.18 EB/mL	POS	NEG
J	900 EB/mL	POS	NEG
K	900 EB/mL	POS	NEG
LGV I	450 EB/mL	POS	NEG
LGV II	450 EB/mL	POS	NEG
LGV III	450 EB/mL	POS	NEG

[a] IFU/mL = Infectious units per mL.

Table 8: Analytical Reactivity Results of Xpert CT/NG with NG Strains in Pharyngeal Swab Matrix

***N. gonorrhoeae* Strain**	**Concentration Tested in Pharyngeal Swab Matrix (CFU/mL)**	**Test Result**	
		CT	**NG**
9793	14.2	NEG	POS
9830	14.2	NEG	POS
19999	14.2	NEG	POS
27629	14.2	NEG	POS
27630	14.2	NEG	POS
27631	14.2	NEG	POS
31148	14.2	NEG	POS
31397	14.2	NEG	POS
31399	14.2	NEG	POS
31400	14.2	NEG	POS
1170	14.2	NEG	POS
6395	14.2	NEG	POS
13281	14.2	NEG	POS
34447	14.2	NEG	POS
37541	14.2	NEG	POS
10226	14.2	NEG	POS
10227	14.2	NEG	POS
10932	14.2	NEG	POS
11472	14.2	NEG	POS
50348	14.2	NEG	POS

The Xpert CT/NG detected all 14 CT serovars and 20 NG strains in pharyngeal and rectal swab specimens.

Cross-Reactivity

The cross-reactivity of the Xpert CT/NG test was evaluated in the presence of 43 microorganisms potentially present in rectal flora and 41 microoorganisms potentially present in pharyngeal flora. Pooled negative clinical matrix was used for negative samples. Positive samples were made by spiking negative clinical matrix at 10^6 CFU/ml for bacteria (except *Entamoeba histolytica* which was spiked at 10^5 CFU/mL). Parasites were tested at 10^6 cells/mL, and viruses were tested at 10^5 $TCID_{50}$/mL. Three replicates of each microorganism were tested in Cepeid Xpert swab transport reagent (STR).

Table 9: Analytical Specificity Determination for Xpert CT/NG with Rectal Microorganisms

Organism	**Concentration[a] (per cartridge)**	**CT**	**NG**
No Template Control	N/A	Not Detected	Not Detected
Acinetobacter baumannii	1.00E+06	Not Detected	Not Detected
Anaerococcus tetradius	1.00E+06	Not Detected	Not Detected
Anaerococcus hydrogenalis	1.00E+06	Not Detected	Not Detected
Bacteroides fragilis	1.00E+06	Not Detected	Not Detected
Bifidobacterium adolescent	1.00E+06	Not Detected	Not Detected
Campylobacter jejuni	1.00E+06	Not Detected	Not Detected
Candida albicans	1.00E+06	Not Detected	Not Detected
Citrobacter freundii	1.00E+06	Not Detected	Not Detected
Clostridium difficile	1.00E+06	Not Detected	Not Detected
Entamoeba histolytica	1.00E+05	Not Detected	Not Detected
Enterobacter cloacae	1.00E+06	Not Detected	Not Detected
Enterococcus faecalis	1.00E+06	Not Detected	Not Detected
Enterococcus faecium	1.00E+06	Not Detected	Not Detected
Enterovirus	1.00E+05	Not Detected	Not Detected
Escherichia coli	1.00E+06	Not Detected	Not Detected
Fusobacterium necrophorum	1.00E+06	Not Detected	Not Detected
Fusobacterium nucleatum	1.00E+06	Not Detected	Not Detected
Giardia lamblia	1.00E+06	Not Detected	Not Detected
Helicobacter pylori	1.00E+06	Not Detected	Not Detected
Klebsiella oxytoca	1.00E+06	Not Detected	Not Detected
Lactobacillus acidophilus	1.00E+06	Not Detected	Not Detected
Lactobacillus delbreueckii	1.00E+06	Not Detected	Not Detected
Listeria monocytogenes	1.00E+06	Not Detected	Not Detected
Morganella morganii	1.00E+06	Not Detected	Not Detected
Norovirus	1.00E+05	Not Detected	Not Detected
Peptostreptococcus anaerobius	1.00E+06	Not Detected	Not Detected
Plesiomonas shigelloides	1.00E+06	Not Detected	Not Detected
Prevotella bivia	1.00E+06	Not Detected	Not Detected
Prevotella oralis	1.00E+06	Not Detected	Not Detected
Proteus mirabilis	1.00E+06	Not Detected	Not Detected
Providencia stuartii	1.00E+06	Not Detected	Not Detected
Pseudomonas aeruginosa	1.00E+06	Not Detected	Not Detected
Salmonella enterica sb enterica sv minnesota	1.00E+06	Not Detected	Not Detected

Salmonella enterica sb enterica sv typhimurium	1.00E+06	Not Detected	Not Detected
Shigella flexneri	1.00E+06	Not Detected	Not Detected
Shigella sonnei	1.00E+06	Not Detected	Not Detected
Staphylococcus aureus	1.00E+06	Not Detected	Not Detected
Staphylococcus epidermidis	1.00E+06	Not Detected	Not Detected
Streptococcus agalactiae	1.00E+06	Not Detected	Not Detected
Streptococcus dysgalactiae	1.00E+06	Not Detected	Not Detected
Vibrio cholerae	1.00E+06	Not Detected	Not Detected
Vibrio parahaemolyticus	1.00E+06	Not Detected	Not Detected
Yersinia enterocolitica	1.00E+06	Not Detected	Not Detected

[a.] Bacteria are enumerated in CFU/mL; Viruses in $TCID_{50}$/mL or IFU/mL.

Table 10: Analytical Specificity Determination for Xpert CT/NG with Pharyngeal Microorganisms

Organism	**Concentration[a] (per cartridge)**	**CT**	**NG**
No Template Control	N/A	Not Detected	Not Detected
Actinobacillus actinomycetemcomitans	1.00E+06	Not Detected	Not Detected
Adenovirus	1.00E+05	Not Detected	Not Detected
Arcanobacterium haemolyticum	1.00E+06	Not Detected	Not Detected
Bordetella pertussis	1.00E+06	Not Detected	Not Detected
Campylobacter rectus	1.00E+06	Not Detected	Not Detected
Candida albicans	1.00E+06	Not Detected	Not Detected
Coronavirus	1.00E+05	Not Detected	Not Detected
Corynebacterium diphtheriae	1.00E+06	Not Detected	Not Detected
Fusobacterium necrophorum	1.00E+06	Not Detected	Not Detected
Haemophilus influenzae	1.00E+06	Not Detected	Not Detected
Herpes virus	1.00E+05	Not Detected	Not Detected
Human influenza virus A	1.00E+05	Not Detected	Not Detected
Human influenza virus B	1.00E+05	Not Detected	Not Detected
Human metapneumovirus	1.00E+05	Not Detected	Not Detected
Klebsiella pneumoniae	1.00E+06	Not Detected	Not Detected
Lactobacillus acidophilus	1.00E+06	Not Detected	Not Detected
Lactobacillus lactis	1.00E+06	Not Detected	Not Detected
Moraxella catarrhalis	1.00E+06	Not Detected	Not Detected
Mycoplasma pneumoniae	1.00E+06	Not Detected	Not Detected
Neisseria flavescens	1.00E+06	Not Detected	Not Detected

Peptostreptococcus micros	1.00E+06	Not Detected	Not Detected
Porphyromonas gingivalis	1.00E+06	Not Detected	Not Detected
Prevotella bivia	1.00E+06	Not Detected	Not Detected
Prevotella oralis[b]	1.00E+06	Not Detected	Not Detected
Pseudomonas aeruginosa	1.00E+06	Not Detected	Not Detected
Respiratory syncytial virus	1.00E+05	Not Detected	Not Detected
Rhinovirus	1.00E+05	Not Detected	Not Detected
Saccharomyces cerevisiae	1.00E+06	Not Detected	Not Detected
Staphylococcus aureus	1.00E+06	Not Detected	Not Detected
Staphylococcus epidermidis	1.00E+06	Not Detected	Not Detected
Streptococcus anginosus	1.00E+06	Not Detected	Not Detected
Streptococcus dysgalactiae	1.00E+06	Not Detected	Not Detected
Streptococcus mitis	1.00E+06	Not Detected	Not Detected
Streptococcus mutans	1.00E+06	Not Detected	Not Detected
Streptococcus pneumoniae	1.00E+06	Not Detected	Not Detected
Streptococcus pyogenes	1.00E+06	Not Detected	Not Detected
Streptococcus salivarius	1.00E+06	Not Detected	Not Detected
Streptococcus sanguinis	1.00E+06	Not Detected	Not Detected
Tannerella forsythia[c]	4.44E+07	Not Detected	Not Detected
Treponema denticola[d]	1.92E+06	Not Detected	Not Detected
Veillonella parvula	1.00E+06	Not Detected	Not Detected

[a.] Bacteria are enumerated in CFU/mL; Viruses in $TCID_{50}$/mL or IFU/mL; genomic DNA in genome equivalents/mL.
[b.] *Bacteroides oralis* is *Prevotella oralis*.
[c.] *Bacteriodes forsythus* is *Tannerella forsythia*.
[d.] Genomic DNA tested.

Under the conditions of this study, all 43 microorganisms potentially encountered in the rectum were correctly reported as “CT NOT DETECTED; NG NOT DETECTED” by the Xpert CT/NG test. All 41 microorganisms potentially encountered in the pharyngeal specimens were correctly reported as “CT NOT DETECTED; NG NOT DETECTED” by the Xpert CT/NG test. Based on the results of this study, the analytical specificity of the Xpert CT/NG test with rectal and pharyngeal swab specimens is acceptable.

Competitive Interference

Competitive interference of the Xpert CT/NG test was evaluated for positive CT and NG samples in the presence of 43 microorganisms potentially present in rectal flora and 41 microoorganisms potentially present in pharyngeal flora. Positive CT and NG samples were generated in pooled negative clinical matrix spiked at 2 x LoD with CT serovar H and NG strain ATCC 19424. Test samples were then prepared by spiking

CT and NG positive clinical matrix with other bacteria at 10^6 CFU/ml, parasites at 10^6 cells/mL (except *Entamoeba histolytica* at 10^5 CFU/mL), or viruses at 10^5 $TCID_{50}$/mL. Three replicates of each microorganism were tested in Cepeid Xpert swab transport reagent (STR).

Table 11: Analytical Specificity Determination for Xpert CT/NG with Rectal Microorganisms

Organism	**Concentration[a] (per cartridge)**	**CT**	**NG**
Positive No Template Control	N/A	Detected	Detected
Negative No Template Control	N/A	Not Detected	Not Detected
Acinetobacter baumannii	1.00E+06	Detected	Detected
Anaerococcus tetradius	1.00E+06	Detected	Detected
Anaerococcus hydrogenalis	1.00E+06	Detected	Detected
Bacteroides fragilis	1.00E+06	Detected	Detected
Bifidobacterium adolescent	1.00E+06	Detected	Detected
Campylobacter jejuni	1.00E+06	Detected	Detected
Candida albicans	1.00E+06	Detected	Detected
Citrobacter freundii	1.00E+06	Detected	Detected
Clostridium difficile	1.00E+06	Detected	Detected
Entamoeba histolytica	1.00E+05	Detected	Detected
Enterobacter cloacae	1.00E+06	Detected	Detected
Enterococcus faecalis	1.00E+06	Detected	Detected
Enterococcus faecium	1.00E+06	Detected	Detected
Enterovirus	1.00E+05	Detected	Detected
Escherichia coli	1.00E+06	Detected	Detected
Fusobacterium necrophorum	1.00E+06	Detected	Detected
Fusobacterium nucleatum	1.00E+06	Detected	Detected
Giardia lamblia	1.00E+06	Detected	Detected
Helicobacter pylori	1.00E+06	Detected	Detected
Klebsiella oxytoca	1.00E+06	Detected	Detected
Lactobacillus acidophilus	1.00E+06	Detected	Detected
Lactobacillus delbreueckii	1.00E+06	Detected	Detected
Listeria monocytogenes	1.00E+06	Detected	Detected
Morganella morganii	1.00E+06	Detected	Detected
Norovirus	1.00E+05	Detected	Detected
Peptostreptococcus anaerobius	1.00E+06	Detected	Detected
Plesiomonas shigelloides	1.00E+06	Detected	Detected
Prevotella bivia	1.00E+06	Detected	Detected
Prevotella oralis	1.00E+06	Detected	Detected

Proteus mirabilis	1.00E+06	Detected	Detected
Providencia stuartii	1.00E+06	Detected	Detected
Pseudomonas aeruginosa	1.00E+06	Detected	Detected
Salmonella enterica sb enterica sv minnesota	1.00E+06	Detected	Detected
Salmonella enterica sb enterica sv typhimurium	1.00E+06	Detected	Detected
Shigella flexneri	1.00E+06	Detected	Detected
Shigella sonnei	1.00E+06	Detected	Detected
Staphylococcus aureus	1.00E+06	Detected	Detected
Staphylococcus epidermidis	1.00E+06	Detected	Detected
Streptococcus agalactiae	1.00E+06	Detected	Detected
Streptococcus dysgalactiae	1.00E+06	Detected	Detected
Vibrio cholerae	1.00E+06	Detected	Detected
Vibrio parahaemolyticus	1.00E+06	Detected	Detected
Yersinia enterocolitica	1.00E+06	Detected	Detected

[a.] Bacteria are enumerated in CFU/mL; Viruses in $TCID_{50}$/mL or IFU/mL.

Table 12: Analytical Specificity Determination for Xpert CT/NG with Pharyngeal Microorganisms

Organism	**Concentration[a] (per cartridge)**	**CT**	**NG**
No Template Control	N/A	Not Detected	Not Detected
Actinobacillus actinomycetemcomitans	1.00E+06	Detected	Detected
Adenovirus	1.00E+05	Detected	Detected
Arcanobacterium haemolyticum	1.00E+06	Detected	Detected
Bordetella pertussis	1.00E+06	Detected	Detected
Campylobacter rectus	1.00E+06	Detected	Detected
Candida albicans	1.00E+06	Detected	Detected
Coronavirus	1.00E+05	Detected	Detected
Corynebacterium diphtheriae	1.00E+06	Detected	Detected
Fusobacterium necrophorum	1.00E+06	Detected	Detected
Haemophilus influenzae	1.00E+06	Detected	Detected
Herpes virus	1.00E+05	Detected	Detected
Human influenza virus A	1.00E+05	Detected	Detected
Human influenza virus B	1.00E+05	Detected	Detected
Human metapneumovirus	1.00E+05	Detected	Detected
Klebsiella pneumoniae	1.00E+06	Detected	Detected
Lactobacillus acidophilus	1.00E+06	Detected	Detected

Lactobacillus lactis	1.00E+06	Detected	Detected
Moraxella catarrhalis	1.00E+06	Detected	Detected
Mycoplasma pneumoniae	1.00E+06	Detected	Detected
Neisseria flavescens	1.00E+06	Detected	Detected
Peptostreptococcus micros	1.00E+06	Detected	Detected
Porphyromonas gingivalis	1.00E+06	Detected	Detected
Prevotella bivia	1.00E+06	Detected	Detected
Prevotella oralis[b]	1.00E+06	Detected	Detected
Pseudomonas aeruginosa	1.00E+06	Detected	Detected
Respiratory syncytial virus	1.00E+05	Detected	Detected
Rhinovirus	1.00E+05	Detected	Detected
Saccharomyces cerevisiae	1.00E+06	Detected	Detected
Staphylococcus aureus	1.00E+06	Detected	Detected
Staphylococcus epidermidis	1.00E+06	Detected	Detected
Streptococcus anginosus	1.00E+06	Detected	Detected
Streptococcus dysgalactiae	1.00E+06	Detected	Detected
Streptococcus mitis	1.00E+06	Detected	Detected
Streptococcus mutans	1.00E+06	Detected	Detected
Streptococcus pneumoniae	1.00E+06	Detected	Detected
Streptococcus pyogenes	1.00E+06	Detected	Detected
Streptococcus salivarius	1.00E+06	Detected	Detected
Streptococcus sanguinis	1.00E+06	Detected	Detected
Tannerella forsythia[c]	4.44E+07	Detected	Detected
Treponema denticola[d]	1.92E+06	Detected	Detected
Veillonella parvula	1.00E+06	Detected	Detected

[a.] Bacteria are enumerated in CFU/mL; Viruses in $TCID_{50}$/mL or IFU/mL; genomic DNA in genome equivalents/mL.
[b.] *Bacteroides oralis* is *Prevotella oralis*.
[c.] *Bacteriodes forsythus* is *Tannerella forsythia*.
[d.] Genomic DNA tested.

Under the conditions of this study, in the presence of all 43 microorganisms potentially encountered in the rectum CT and NG were correctly reported as “CT DETECTED; NG DETECTED” by the Xpert CT/NG test. In the presence of all 41 microorganisms potentially encountered in the pharyngeal CT and NG were correctly reported as “CT DETECTED; NG DETECTED” by the Xpert CT/NG test. Based on the results of this study, the competitive interference of the Xpert CT/NG test with rectal and pharyngeal swab specimens is acceptable.

Interfering Substances

Interference of the Xpert CT/NG test by substances potentially found in the oralpharynx or rectum was evaluated for positive CT and NG samples. Positive CT and NG samples were generated in pooled negative pharyngeal or rectal clinical matrix spiked at 2 x LoD with CT serovar D or H and NG strain ATCC 49226 or 19424, respectively. Test samples were then made by spiking CT and NG positive clinical matrix with the substances listed in the tables below. Eight positive and eight negative samples were tested per substance in Cepeid Xpert swab transport reagent (STR) using the Xpert CT/NG test.

Table 13: Potentially Interfering Substances Tested in Pharyngeal Swabs

Potentially Interfering Substances to be Evaluated	**Active Ingredient**	**Concentration Tested**
Control	N/A	N/A
Mucin (e.g., pig gastric mucin)	N/A	25 mg/mL
Whole human blood	N/A	5% v/v
Mouthwash (Cool Mint Listerine, antiseptic)	Eucalyptol 0.092%	5% v/v
	Menthol 0.042%	
	Methyl salicylate 0.060%	
	Thymol 0.064%	
Cough Medicine (1)	Guaifenesin (Guaiacol glyceryl)	5 mg/mL
Cough Medicine (2)	Dextromethorphan HBr	100 µg/mL
Antibiotic (1)	Penicillin G	1.2 mg/mL
Antibiotic (2)	Erythromycin	15 µg/mL
Sugar-containing cold and flu remedies (e.g., syrup or lozenges, Tylenol Cold Sore Throat)	Acetaminophen	5% v/v
Chloraseptic	Benzocaine	5% v/v
Salt-modifying remedies (e.g., sodium chloride or sodium bicarbonate spray or rinse)	Sodium chloride	50% v/v
Foods/drinks that increase salivary viscosity (e.g., bread, milk, xanthan gum)	Milk	5% v/v
pH Modifying Remedies	Orange Juice	5% v/v
Cold sore medication Abreva	Docosanol 10%	5% v/v

Table 14: Potentially Interfering Substances Tested in Rectal Swabs

Potentially Interfering Substances to be Evaluated	Active Ingredient	Concentration Tested
Control	N/A	N/A
Barium sulfate	N/A	0.25% w/v
Ciprofloxacin	N/A	0.25% w/v
Condom (with spermicide)	Nonoxynol-9	1 condom (#)
Cortizone	Hydrocortisone	0.25% w/v
ExLax	Sennosides	0.25% w/v
Fecal fat	Stearic acid/ Palmitic acid/Cholesterol	0.25% w/v
Imodium	Loperamide hydrochloride	0.25% w/v
K-Y Jelly	N/A	0.25% w/v
Milk of Magnesia	Calcium carbonate/ aluminum hydroxide/ magnesium hydroxide/ simethicone	0.25% w/v
Mineral Oil	Mineral oil	0.25% w/v
Neosporin	Polymixin B/ Neomycin/ Bacitracin	0.25% w/v
Nystatin	Nystatin	0.25% w/v
Pepcid	Famotidine	0.25% w/v
Pepto-Bismol	Bismuth subsalicylate	0.25% w/v
Preparation H	Phenylephrine	0.25% w/v
Prilosec	Oemprazole	0.25% w/v
Saline	Sodium chloride	0.25% w/v
Tagamet	Cimetidine	0.25% w/v
Vagisil	Benzocaine, resorcinol	0.25% w/v

Under the conditions of this study, all valid positive replicate samples were correctly identified using Xpert CT/NG when tested in the presence of all potentially interfering substances. All valid negative replicate samples were correctly identified using Xpert CT/NG in the presence of all interfering substances. Analysis of the cycle threshold (Ct value) demonstrated no clinically significant changes in Ct value for positive samples in

the presence of any substance tested. Based on this study no new limitations for interference were added to the package insert.

f. Assay cut-off:
Please refer to submission K121710.

2. Comparison studies:

a. Method comparison with predicate device:
N/A

b. Matrix comparison:
N/A

3. Clinical studies:

a. Clinical Sensitivity and Specificity:

Clinical Studies
Clinical evaluation of the Xpert CT/NG Assay to support throat and rectal swab specimen types was conducted in collaboration with the Antibacterial Resistance Leadership Group (ARLG) and funded by a grant from the National Institutes of Health (NIH) (Master GC, https://arlg.org/studies-in-progress; NCT02870101 https://clinicaltrials.gov/ct2/show/NCT02870101?term=NCT02870101&rank=1)

Performance characteristics of Xpert CT/NG were determined in a multi-site prospective investigational study, with samples collected at 9 US institutions, and tested at one of 2 reference laboratories. Xpert CT/NG was compared to an anatomic site infected status (ASIS) algorithm. The study was designed so that two comparator NAAT assays were run on every specimen.

The anatomic site was considered to be infected if both of the comparator test results were positive. The anatomic site was considered to be not infected when both reference test results were negative. If there was discordance between the two reference tests, an additional third NAAT was tested as a tiebreaker. As the tiebreaker test was not a combination test detecting both CT and NG, the tiebreaker assay was run only for the organism with a discordant result (e.g., if NG result disagreed between the two comparator tests and CT agreed, the tiebreaker was only run for NG). In this case, agreement of 2/3 comparatpr NAATs determined the ASIS result.

A detailed description of the ASIS for all possible outcomes was developed and applied to the study data. A summary of the ASIS result for all tested samples is presented in Tables 15-18.

Table 15: Anatomic Site Infected Status – Pharyngeal CT

ASIS[a]	NAAT1	NAAT2	Tiebreaker NAAT	Xpert	Total
NI	-	-	NA[b]	-	2504
NI	NR[c]	-	-	-	6
NI	-	-	NA	+	4
NI	-	+	-	-	5
NI	+	-	-	-	2
NI	-	+	-	+	1
NI	+	-	-	+	1
NI	EQ[d]	-	-	-	1
IND[e]	+	-	EQ	+	1
IND	NR	-	+	+	1
Total Non Infected					2526
I	+	+	NA	+	40
I	-	+	+	+	5
I	+	-	+	+	2
I	+	+	NA	-	1
I	-	+	+	-	1
Total Infected					49

a. ASIS = Anatomic Site Infected Status: NI=Not Infected; I=Infected; IND=indeterminate, considered not infected.

b. NA=Not applicable; both reference NAAT tests agreed.

c. NR = Not run

d. EQ=Equivocal

e. IND=Indeterminate. Considered infected if Xpert Negative and not infected if Xpert positive to evaluate under worst-case scenario.

Table 16: Anatomic Site Infected Status – Rectal CT

ASIS[a]	NAAT1	NAAT2	Tiebreaker NAAT	Xpert	Total
NI	-	-	NA[b]	-	2221
NI	NR[c]	-	-	-	47
NI	-	-	NA	+	12
NI	+	-	-	-	11
NI	-	+	-	-	10
NI	-	+	-	+	2
NI	-	EQ[d]	-	-	2
IND[e]	+	EQ	-	+	1
Total Non Infected					2306
I	+	+	NA	+	172
I	-	+	+	+	14
I	-	+	+	-	11
I	+	+	NA	-	9
I	+	-	+	+	6
I	+	-	+	-	5
I	+	EQ	+	+	3
I	-	EQ	+	-	2
I	NR	+	+	+	2
I	+	EQ	+	-	1
I	+	EQ	NR	-	1
I	NR	E	+	-	1
IND	-	NR	+	-	1
IND	+	-	NR	-	1
Total Infected					**229**

a. ASIS = Anatomic Site Infected Status: NI=Not Infected; I=Infected; IND=indeterminate, considered not infected.

b. NA=Not applicable; both reference NAAT tests agreed.

c. NR = Not run

d. EQ=Equivocal

e. IND=Indeterminate. Considered infected if Xpert negative and not infected if Xpert positive to evaluate under worst-case scenario.

Table 17: Anatomic Site Infected Status – Pharyngeal NG

ASIS[a]	NAAT1	NAAT2	Tiebreaker NAAT	Xpert	Total
NI	-	-	NA[b]	-	2317
NI	-	-	NA	+	19
NI	-	+	-	-	14
NI	-	+	-	+	4
NI	+	-	-	-	4
NI	+	-	-	+	4
NI	NR[c]	-	-	-	5
NI	-	EQ[d]	-	+	1
IND[e]	-	+	EQ	+	1
Total Non Infected					**2369**
I	+	+	NA	+	175
I	+	+	NA	-	4
I	-	+	+	+	16
I	-	+	+	-	5
I	+	-	+	+	2
I	NR	+	+	+	2
IND	+	EQ	-	-	1
IND	-	EQ	+	-	1
Total Infected					**206**

a. ASIS = Anatomic Site Infected Status: NI=Not Infected; I=Infected; IND=indeterminate, considered not infected.

b. NA=Not applicable; both reference NAAT tests agreed.

c. NR = Not run

d. EQ=Equivocal

e. IND=Indeterminate. Considered infected if Xpert negative and not infected if Xpert positive to evaluate under worst-case scenario.

Table 18: Anatomic Site Infected Status – Rectal NG

ASIS[a]	NAAT1	NAAT2	Tiebreaker NAAT	Xpert	Total
NI	-	-	NA[b]	-	2261
NI	NR[c]	-	-	-	49
NI	-	-	NA	+	6
NI	+	-	-	-	5
NI	-	+	-	-	4
NI	+	-	-	+	2
NI	-	EQ[d]	-	-	2
NI	-	NR	-	-	1
IND[e]	+	EQ	-	+	1
Total Non Infected					**2331**
I	+	+	NA	+	172
I	-	+	+	+	13
I	+	+	NA	-	8
I	-	+	+	-	8
I	+	-	+	+	1
I	+	EQ	+	+	1
I	NR	+	+	-	1
IND	-	EQ	+	-	1
Total Infected					**205**

a. ASIS = Anatomic Site Infected Status: NI=Not Infected; I=Infected; IND=indeterminate, considered not infected.
b. NA=Not applicable; both reference NAAT tests agreed.
c. NR = Not run
d. EQ=Equivocal
e. IND=Indeterminate. Considered infected if Xpert negative and not infected if Xpert positive to evaluate under worst-case scenario.

Study participants included adults seeking sexually transmitted disease (STD) testing at the participating clinics, which included clinics focused on sexually transmitted diseases, women's health, student health and family planning , as well as clinics specializing in lesbian, gay, bisexual, and transgender (LGBT) health. Potential subjects were identified, assessed for eligibility and approached for informed consent. Both symptomatic and asymptomatic individuals were included in the study population following informed consent. The study specimens consisted of prospectively collected rectal and pharyngeal swabs. Performance of Xpert CT/NG was calculated relative to the ASIS for each of the two sample types.

A total of 2767 study participants were enrolled in the study, of which 2577 pharyngeal swab and 2538 rectal swab specimens were eligible for inclusion in the data analyses. One hundred and ninety (190) pharyngeal specimens were excluded from the data analyses due to the following reasons: 167 for temperature excursions

during shipment, 4 specimens from participants who withdrew consent, 2 specimens that had shipment errors, 2 post-swab collection errors, 1 specimen not collected, 1 specimen from a participant receiving antibiotics, and 13 specimens with Xpert results that were either not available or indeterminate. Two hundred and twenty-nine (229) rectal specimens were excluded from the data analyses due to the following reasons: 167 for temperature excursions during shipment, 6 specimens from participants who withdrew consent, 5 specimens that had shipment errors, 2 post-swab collection errors, 1 specimen not collected, 1 specimen from a participant receiving antibiotics, and 46 specimens with Xpert results that were either not available or indeterminate.

Among the study participants included in the data analyses for pharyngeal swab performance 20.8% were female at birth and 79.2% were male at birth. The average age was 33.8 years (range = 18 to 76 years).

Among the study participants included in the data analyses for rectal swab performance 20.9% were female at birth and 79.1% were male at birth. The average age was 33.7 years (range = 18 to 76 years).

Of the 2572 study participants eligible for inclusion in the pharyngeal and rectal swab analyses for CT detection, 0.9% (22/2572) were positive for CT by pharyngeal swab and rectal swab by ASIS. Of the 2573 study participants eligible for inclusion in the pharyngeal and rectal swab analyses for NG detection, 3.7% (95/2573) were positive for NG by pharyngeal swab and rectal swab.

Among the 5163 tests performed, 198 (3.8%) had to be retested due to ERROR, INVALID or NO RESULT outcomes. Of those, 151 specimens yielded valid results upon repeat assay (2 specimens were not retested). The overall valid reporting rate of the assay was 99.1% (5116/5163).

The clinical performance for the Xpert CT/NG assay is shown below in Tables 19-31.

Table 19: Clinical Performance for CT Detection of the Xpert CT/NG for Pharyngeal Swabs

CT Detection Pharyngeal Swabs (2575 specimens)		ASIS for CT Detection Result	
		Positive	Negative
Xpert CT/NG	Positive	47	8
	Negative	2	2518
Total		49	2526
Sensitivity: 95.9% (47/49); 95% CI: (83.6% - 98.9%)			
Specificity: 99.7% (2518/2526); 95% CI: (99.4% - 99.8%)			

Table 20: Clinical Performance for CT Detection of the Xpert CT/NG for Pharyngeal Swabs for Symptomatic Subjects

CT Detection Symptomatic Pharyngeal Swabs (306 specimens)		ASIS for CT Detection Result	
		Positive	Negative
Xpert CT/NG	Positive	9	0
	Negative	0	297
Total		9	297
Sensitivity: 100.0% (9/9); 95% CI: (70.1% - 100.0%)			
Specificity: 100.0% (297/297); 95% CI: (98.7% - 100.0%)			

Table 21: Clinical Performance for CT Detection of the Xpert CT/NG for Pharyngeal Swabs for Asymptomatic Subjects

CT Detection Asymptomatic Pharyngeal Swabs (2269 specimens)		ASIS for CT Detection Result	
		Positive	Negative
Xpert CT/NG	Positive	38	8
	Negative	2	2221
Total		40	2229
Sensitivity: 95.0% (38/40); 95% CI: (83.5% - 98.6%)			
Specificity: 99.6% (2221/2229); 95% CI: (99.3% - 99.8%)			

Table 22: Clinical Performance for CT Detection of the Xpert CT/NG for Rectal Swabs

CT Detection Rectal Swabs (2535 specimens)		ASIS for CT Detection Result	
		Positive	Negative
Xpert CT/NG	Positive	197	15
	Negative	32	2291
Total		229	2306
Sensitivity: 86.0% (197/229); 95% CI: (80.9% - 89.9%)			
Specificity: 99.4% (2291/2306); 95% CI: (98.9% - 99.6%)			

Table 23 Clinical Performance for CT Detection of the Xpert CT/NG for Rectal Swabs for Symptomatic Subjects

CT Detection Symptomatic Rectal Swabs (188 specimens)		ASIS for CT Detection Result	
		Positive	Negative
Xpert CT/NG	Positive	22	1
	Negative	5	160
Total		27	161
Sensitivity: 81.5% (22/27); 95% CI: (63.3% - 91.8%)			
Specificity: 99.4% (160/161); 95% CI: (96.6% - 99.9%)			

Table 24 Clinical Performance for CT Detection of the Xpert CT/NG for Rectal Swabs for Asymptomatic Subjects

CT Detection Asymptomatic Rectal Swabs (2347 specimens)		ASIS for CT Detection Result	
		Positive	Negative
Xpert CT/NG	Positive	175	14
	Negative	27	2131
Total		202	2145
Sensitivity: 86.6% (175/202); 95% CI: (81.3% - 90.7%)			
Specificity: 99.4% (2131/2145); 95% CI: (98.9% - 99.6%)			

Table 25: Clinical Performance for NG Detection of the Xpert CT/NG for Pharyngeal Swabs

NG Detection Pharyngeal Swabs (2575 specimens)		ASIS for NG Detection Result	
		Positive	Negative
Xpert CT/NG	Positive	195	29
	Negative	11	2340
Total		206	2369
Sensitivity: 94.7% (195/206); 95% CI: (90.7% - 97.0%)			
Specificity: 98.8% (2340/2369); 95% CI: (98.3% - 99.2%)			

Table 26: Clinical Performance for NG Detection of the Xpert CT/NG for Pharyngeal Swabs for Symptomatic Subjects

NG Detection Symptomatic Pharyngeal Swabs (306 specimens)		ASIS for NG Detection Result	
		Positive	Negative
Xpert CT/NG	Positive	39	3
	Negative	3	261
Total		42	264
Sensitivity: 92.9% (39/42); 95% CI: (81.0% - 97.5%)			
Specificity: 98.9% (261/264); 95% CI: (96.7% - 99.6%)			

Table 27: Clinical Performance for NG Detection of the Xpert CT/NG for Pharyngeal Swabs for Asymptomatic Subjects

NG Detection Asymptomatic Pharyngeal Swabs (2269 specimens)		ASIS for NG Detection Result	
		Positive	Negative
Xpert CT/NG	Positive	156	26
	Negative	8	2079
Total		164	2105
Sensitivity: 95.1% (156/164); 95% CI: (90.7% - 97.5%)			
Specificity: 98.8% (2079/2105); 95% CI: (98.2% - 99.2%)			

Table 28: Clinical Performance for NG Detection of the Xpert CT/NG for Rectal Swabs

NG Detection Rectal Swabs (2536 specimens)		ASIS for NG Detection Result	
		Positive	Negative
Xpert CT/NG	Positive	187	9
	Negative	18	2322
Total		205	2331
Sensitivity: 91.2% (187/205); 95% CI: (86.6% - 94.4%)			
Specificity: 99.6% (2322/2331); 95% CI: (99.3% - 99.8%)			

Table 29: Clinical Performance for NG Detection of the Xpert CT/NG for Rectal Swab for Symptomatic Subjects

NG Detection Symptomatic Rectal Swabs (188 specimens)		ASIS for NG Detection Result	
		Positive	Negative
Xpert CT/NG	Positive	38	0
	Negative	1	149
Total		39	149
Sensitivity: 97.4% (38/39); 95% CI: (86.% - 99.6%)			
Specificity: 100.0% (149/149); 95% CI: (97.5% - 100.0%)			

Table 30: Clinical Performance for NG Detection of the Xpert CT/NG for Rectal Swab for Asymptomatic Subjects

NG Detection Asymptomatic Rectal Swabs (2348 specimens)		ASIS for NG Detection Result	
		Positive	Negative
Xpert CT/NG	Positive	149	9
	Negative	17	2173
Total		166	2182
Sensitivity: 89.8% (149/166); 95% CI: (84.2% - 93.5%)			
Specificity: 99.6% (2173/2182); 95% CI: (99.2% - 99.8%)			

4. Clinical cut-off**:**
   N/A

5. Expected values/Reference range:

   Prevalence was calculated for valid Xpert CT/NG samples using ASIS positive samples for each organism and anatomical site. Prevalence rates for each are listed below by site (9 sites) and combined overall. The nine sites included both low and high prevalence sites.

Table 31: Prevalence of CT and NG in oral and rectal swabs

Organism and Anatomical Site	Clinical Site Number	Number of Specimens Collected at Each site	Prevalence
CT, Oral	15	143	2.80%
	93	225	0.40%
	106	359	0.80%
	226	112	0.00%
	351	334	1.50%
	431	393	1.50%
	609	288	2.40%
	625	367	4.40%
	637	354	2.00%
	All Sites	2575	1.90%
NG, Oral	15	143	9.10%
	93	225	0.90%
	106	359	5.60%
	226	112	1.80%
	351	334	4.80%
	431	393	7.10%
	609	288	9.70%
	625	367	10.40%
	637	354	16.70%
	All Sites	2575	8.00%
CT, Rectal	15	142	12.70%
	93	221	7.20%
	106	355	10.40%
	226	108	1.90%
	351	330	7.30%
	431	385	2.90%
	609	279	9.70%
	625	363	12.70%
	637	352	13.60%
	All Sites	2535	9.03%
NG, Rectal	15	143	8.40%
	93	221	1.80%
	106	355	7.90%
	226	108	0.90%
	351	330	5.80%

	431	385	6.80%
	609	280	9.30%
	625	363	7.70%
	637	351	17.40%
	All Sites	2536	8.08%

N. Instrument Name:

This assay can be run on the following GeneXpert instruments: Dx R1, Dx R2, Infinity-48, and Infinity G2 (includes the Infinity-80 and Infinity 48s). Dx R1 is a family of instruments composed of the GX-I, GX-IV, and GX-XVI. The Dx R2 family currently consists only of the GX-II instrument.

O. System Descriptions:

1. Instrument Name:

   Instrument software for the GeneXpert Instrument Systems is associated with currently cleared devices as follows:

   - GeneXpert Dx instruments utilize GeneXpert Dx software v5.1 (last reviewed by FDA[1] was Dx v4.8);
   - Infinity-48 utilizes Xpertise v4.6a;
   - Infinity G2 instruments utilize Xpertise v6.5. The current submission contains review documentation for the use of Dx software version 6.0 and Xpertise software version 6.6 (for the G2 Instruments).
   - Generation 1 Instrument Infinity-48 is not currently intended for software upgrade beyond the already reviewed version 4.6a.

2. System Description:

   The GeneXpert Instrument System family (GeneXpert Dx and Infinity Systems) automates and integrates sample purification, nucleic acid amplification and detection of target sequences within compatible, assay-specific, single-use cartridges. The instrument systems each contain a computer and preloaded software for running tests and viewing the results.

3. Software:

   FDA has reviewed applicant's Hazard Analysis and software development processes for this line of product types.

   Yes _____X_____ or No _____

4. Level of Concern

   Moderate

5. Software Description

See software consult(s) for previously cleared Xpert Xpress assays (e.g. K162456 and K171552).

P. Other Supportive Instrument Performance Characteristics Data Not Covered In The "Performance Characteristics" Section above:

Not Applicable

Q. Proposed Labeling:

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

R. Conclusion:

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