510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION
DECISION SUMMARY
ASSAY ONLY TEMPLATE

A. 510(k) Number:

k172257

B. Purpose for Submission:

New Device

C. Measurand:

Human Chorionic Gonadotropin (hCG)

D. Type of Test:

Qualitative chromatographic immunoassay

E. Applicant:

True Diagnostics, Inc.

F. Proprietary and Established Names:

TrueDX hCG Early Result Pregnancy Test (Midstream Format)
TrueDX hCG Early Result Pregnancy Test (Cassette Format)
VeriClear Early Result Pregnancy Test (Cassette Format)
VeriClear Early Result Pregnancy Test (Midstream Format)

G. Regulatory Information:

1. Regulation section:

   21 CFR § 862.1155 Human chorionic gonadotropin (hCG) test System

2. Classification:

   Class II

3. Product code:

   JHI, LCX

4. Panel:

   Chemistry (75)

H. Intended Use:

1. Intended use(s):

   See Indications for use below.

2. Indication(s) for use:

   TrueDX hCG Early Result Pregnancy Test

   TrueDX hCG Early Result Pregnancy Test (Midstream and Cassette Format) is a rapid chromatographic immunoassay for qualitative detection of human chorionic gonadotropin (hCG) in urine, as an aid in early detection of pregnancy, in some cases as early as five (5) days before the expected period, i.e., as early as six (6) days before the day of the missed period.

   Important note regarding negative result:
   Some pregnant women will not be able to detect hCG in their urine 5 days before the expected period. If you test negative before your missed period, but think you may still be pregnant, you should test against a few a few days after you missed period.

   Important note regarding positive results:
   Because this test detects low levels of hCG, it is possible that this test may give positive results even if you are not pregnant. If you test positive, but think you may not be pregnant, you should check with your doctor.

   All results should be confirmed by your healthcare provider, especially when making decision about future medical care.

   VeriClear Early Result Pregnancy Test

   VeriClear Early Result Pregnancy Test (Midstream and Cassette Format) is a rapid chromatographic immunoassay for qualitative detection of human chorionic gonadotropin (hCG) in urine, as an aid in early detection of pregnancy, in some cases as early as five (5) days before the expected period, i.e., as early as six (6) days before the day of the missed period.

   Important note regarding negative result:
   Some pregnant women will not be able to detect hCG in their urine 5 days before the expected period. If you test negative before your missed period, but think you may still be pregnant, you should test against a few a few days after you missed period.

Important note regarding positive results:
Because this test detects low levels of hCG, it is possible that this test may give positive results even if you are not pregnant. If you test positive, but think you may not be pregnant, you should check with your doctor.

All results should be confirmed by your healthcare provider, especially when making decision about future medical care.

3. Special conditions for use statement(s):

   TrueDX hCG Early Result Pregnancy Test (Midstream and Cassette Format) is intended for prescription use

   VeriClear Early Result Pregnancy Test (Midstream and Cassette Format) is intended for over-the-counter (OTC) use

4. Special instrument requirements:

   None

I. Device Description:

The TrueDX hCG Early Result Pregnancy Test is a qualitative lateral flow immunoassay for the detection of hCG. The device has two formats: Cassette and Midstream. Each device kit includes a pouch with all components to perform the test, an instruction for use and a desiccant package to control the moisture during the storage of the test kit. The cassette and midstream nitrocellulose test strips are mounted in a plastic housing. In addition, the cassette test kit contains a dropper.

The VeriClear Early Result Pregnancy Test and TrueDX hCG Early Result Pregnancy Test are the same devices, except the device names and type of use. the VeriClear Early Result Pregnancy Test is intended for OTC use while the TrueDX hCG Early Result Pregnancy Test is intended for prescription use.

J. Substantial Equivalence Information:

1. Predicate device name(s):

   FIRST RESPONSE Early Result Pregnancy Test

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

   k123436

3. Comparison with predicate:

Similarities		
Item	Device TrueDX hCG Early Result Pregnancy Test and VeriClear Early Result Pregnancy Test (k172257)	Predicate FIRST RESPONSE Early Result Pregnancy Test (k123436)
Intended Use	Aid in early detection of pregnancy	Same
Early Detection claim	Detects pregnancy as early as 5 days before the expected period or as early as 6 days before the day of the missed period.	Same
Test Principle	Lateral flow sandwich immunochromatographic assay	Same
Sample Matrix	Urine	Same
Traceability	WHO 4th International Standard	
Limit of Detection	10 mIU/mL	Same
Time to Result	3 minutes	Same
Differences		
Item	Device TrueDX hCG Early Result Pregnancy Test and VeriClear Early Result Pregnancy Test (k172257)	Predicate FIRST RESPONSE Early Result Pregnancy Test (k123436)
Target User	Prescription use (TrueDX hCG Early Result Pregnancy Test) OTC use (VeriClear Early Result Pregnancy Test)	OTC use only
Device format	Cassette, Midstream	Midstream
hCG isoforms detected	Intact hCG Hyperglycosylated hCG hCG β -subunit	Intact hCG Hyperglycosylated hCG hCG β -subunit hCG β -core fragment

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

None reference.

L. Test Principle:

The TrueDX Early Result Pregnancy Test (Midstream and Cassette Format) and VeriClear Early Result Pregnancy Test (Midstream and Cassette Format) are sandwich immunoassays employing mouse monoclonal antibodies specific for hCG, which are immobilized on the

membrane as test line, and goat anti-mouse IgG immobilized on the membrane as control line. After the urine specimen is applied to the device, the hCG present in the specimen will react with the mouse anti-hCG monoclonal antibody-colloidal gold conjugate. The complex migrates along the membrane towards the test and control zones. Two lines in the test window 3 minutes after the urine application indicate that hCG has been detected (pregnant); one line (control line) indicates that no hCG has been detected (not pregnant).

M. Performance Characteristics (if/when applicable):

The VeriClear Early Result Pregnancy Test and TrueDX hCG Early Result Pregnancy Test are identical; therefore, only one set of representative performance data is presented below.

1. Analytical performance:

   a. *Precision/Reproducibility:*
   A precision study was performed using samples with hCG concentrations of 3.0 5.0, 8.5, 10, 25, 50, and 100 mIU/ml, traceable to the WHO 4th International Standard. Each sample was tested in 10 replicates each day over 5 days, using 3 lots of devices (for both formats) by 5 operators. A total of 250 replicates (10 replicates/run x 5 operators x 5 days) per lot of device for each sample were obtained. The positive results observed over total number of tests are summarized in the following tables:

Precision Study for three lots Devices-Midstream Format

hCG level(mIU/ml)	**Lot 1**	**Lot 2**	**Lot3**	**% Positive**
0	0/250	0/250	0/250	0 %
3.0	0/250	0/250	0/250	0 %
5.0	0/250	0/250	0/250	0 %
8.5	135/250	139/250	130/250	53.8 %
10	250/250	250/250	250/250	100%
25	250/250	250/250	250/250	100%
50	250/250	250/250	250/250	100%
100	250/250	250/250	250/250	100%

Precision Study for three lots devices -Cassette Format

hCG level(mIU/ml)	**Lot 1**	**Lot 2**	**Lot3**	**% Positive**
0	0/250	0/250	0/250	0 %
3.0	0/250	0/250	0/250	0 %
5.0	0/250	0/250	0/250	0 %
8.5	115/250	110/250	135/250	48%
10	250/250	250/250	250/250	100%
25	250/250	250/250	250/250	100%
50	250/250	250/250	250/250	100%

hCG level(mIU/ml)	Lot 1	Lot 2	Lot3	% Positive
100	250/250	250/250	250/250	100%

Precision Study for five Operators –Midstream Format

hCG level (mIU/ml)	Operator 1	Operator 2	Operator 3	Operator 4	Operator 5	% Positive
0	0/150	0/150	0/150	0/150	0/150	0 %
3.0	0/150	0/150	0/150	0/150	0/150	0 %
5.0	0/150	0/150	0/150	0/150	0/150	0 %
8.5	84/150	82/150	79/150	74/150	85/150	53.8%
10	150/150	150/150	150/150	150/150	150/150	100%
25	150/150	150/150	150/150	150/150	150/150	100%
50	150/150	150/150	150/150	150/150	150/150	100%
100	150/150	150/150	150/150	150/150	150/150	100%

Precision Study for five Operators –Cassette Format

hCG level (mIU/ml)	Operator 1	Operator 2	Operator 3	Operator 4	Operator 5	% Positive
0	0/150	0/150	0/150	0/150	0/150	0 %
3.0	0/150	0/150	0/150	0/150	0/150	0 %
5.0	0/150	0/150	0/150	0/150	0/150	0 %
8.5	69/150	69/150	71/150	77/150	74/150	48%
10	150/150	150/150	150/150	150/150	150/150	100%
25	150/150	150/150	150/150	150/150	150/150	100%
50	150/150	150/150	150/150	150/150	150/150	100%
100	150/150	150/150	150/150	150/150	150/150	100%

b. *Linearity/assay reportable range:*

Linearity is not applicable since this is a qualitative test.

High dose hook effect study:
Negative urine samples were spiked with hCG at concentrations up to 450,000 mIU/ml, and then tested in 2 replicates per lot using two lots of devices for each format. The results demonstrated that no hook effect was observed at hCG concentrations up to 450,000 mIU/ml.

c. *Traceability, Stability, Expected values (controls, calibrators, or methods):*

The test is calibrated against the WHO 4th International Standards for hCG.

The stability testing protocol and acceptance criteria used to support the shelf life were reviewed and found to be acceptable. The sponsor claims a 24-month shelf life for both formats when stored in the sealed foil pouch at 39-86ºF (4-30ºC).

d. Detection limit:

An analytical sensitivity study was performed using negative human urine sample spiked with hCG traceable to the WHO 4th International Standards for hCG to obtain concentration of 0, 3.0, 5.0, 7.5, 8.5, 9.0, 10, 12.5, 15, and 25 mIU/ml hCG. The samples were measured in 15 replicates, using 3 different lots of each test format. The tests were performed by 3 different operators for 3 consecutive days. A different set of operators tested each format of the device. The positive results observed over the total number of tests are summarized in the following tables.

Midstream Format

Concentration (mIU/ml)	**Lot 1**	**Lot 2**	**Lot 3**	**% Positive**
0	0+/15	0+/15	0+/15	0%
3	0+/15	0+/15	0+/15	0%
5	0+/15	0+/15	0+/15	0%
7.5	3+/15	2+/15	3+/15	17.7%
8.5	8+/15	9+/15	9+/15	57.7%
9.0	14+/15	14+/15	14+/15	93.3 %
10	15+/15	15+/15	15+/15	100 %
12.5	15+/15	15+/15	15+/15	100 %
15	15+/15	15+/15	15+/15	100 %
25	15+/15	15+/15	15+/15	100 %

Cassette Format

hCG Concentration (mIU/ml)	**Lot 1**	**Lot 2**	**Lot 3**	**% Positive**
0	0+/15	0+/15	0+/15	0 %
3	0+/15	0+/15	0+/15	0%
5	0+/15	0+/15	0+/15	0%
7.5	3+/15	2+/15	4+/15	20%
8.5	8+/15	9+/15	8+/15	55 %
9.0	13+/15	14+/15	13+/15	88.8%
10	15+/15	15+/15	15+/15	100 %
12.5	15+/15	15+/15	15+/15	100 %
15	15+/15	15+/15	15+/15	100 %
25	15+/15	15+/15	15+/15	100 %

The results demonstrated that the analytical sensitivity of the new device (the lowest concentration that yields 100% positive results) is 10 mIU/ml.

e. Analytical specificity:

Negative and positive urine containing10 mIU/mL hCG were spiked with potentially interfering exogenous or endogenous substances, and then tested in 5 replicates per lot using two lots of devices for each device format. No interference effect was observed at the concentrations tested below:

Substance tested	**Highest Concentration tested that demonstrated no interference Concentration**
Acetaminophen	20 mg/dL
Acetylsalicylic acid	20 mg/dL
Human serum Albumin	2000 mg/dL
Ampicillin	20 mg/dL
Ascorbic acid	20 mg/dL
Atropine	20 mg/dL
Caffeine	20 mg/dL
Cortisol	200 ng/dL
EDTA	80 mg/dL
Phenylpropanolamine	20 mg/dL
Ephedrine	20 mg/dL
Gentisic acid	20 mg/dL
Glucose	2000 mg/dL
Tetracycline	20 mg/dL
Uric acid	10 mg/dL
Bilirubin	20 mg/dL
Ethanol	0.1 %
Salicylic Acid	20 mg/dL

Cross reactivity of structurally similar compounds

Negative and positive (10 mIU/ml hCG) urine samples were spiked with various potential cross reactants (hLH, hFSH, and hTSH), then tested in 5 replicates per lot using two lots of devices for each format. No cross reactivity was observed at the concentrations tested below:

Reactant	Concentration
hLH	1000 mIU/mL
hFSH	1000 mIU/mL
hTSH	1000 μIU/mL

Effect of urine pH and Specific Gravity:
Negative and positive (10 mIU/ml hCG) urine samples were adjusted to have pH values of 4.0, 5.0, 6.0, 7.0, 8.0, and 9.0, and then tested in 2 replicates per lot using two lots of devices for each format. The positive and negative hCG results were not affected by urine pH levels between the ranges of 4.0 and 9.0.

Negative and positive (10 mIU/ml hCG) urine samples were adjusted to have specific gravities of 1.000, 1.005, 1.010, 1.015, 1.020, 1.025, 1.030 and 1.035, and then tested in 2 replicates per lot using two lots of devices for each format. The positive and negative hCG results were not affected by urine specific gravity concentrations between 1.000 and 1.035.

Effect of hCG β-core fragment:
Negative urine samples (0 and 5 mIU/ml hCG) and positive urine samples (10, 25 and 20,000 mIU/ml hCG) were spiked with hCG β-core fragment at concentrations of 50,400, 102,000, 204,000 and 408,000 pmol/L, and then tested in 5 replicates per lot using two lots of devices for each format. All samples yielded correct results with hCG β-core fragment concentrations up to 408,000 pmol/L.

f. Assay cut-off:

See detection limit section M.1.d.

2. Comparison studies:

a. Method comparison with predicate device:

Urine samples were collected from 166 women at physician offices for pregnancy testing. Of the 166 women, 65 of them were suspected to be pregnant. Patient samples were randomly collected at various times throughout the day. Ages of these women ranged from 19 to 41 years. Samples were masked and randomized prior to testing by two health care professionals. Two lots of each device format (Midstream and Cassette) were tested with every sample. For the midstream format, one lot of test device was tested in the simulated mid-stream method, while the other lots were tested in dip method. The results are summarized in table below:

		Predicate Device		**Total**
		hCG +	**hCG-**	
Candidate Device	**hCG +**	65	0	65
	hCG-	0	101	101
Total		65	101	166

b. Matrix comparison:

Not applicable. The devices are intended for urine samples only.

3. Clinical studies:

a. Clinical Sensitivity:

Not applicable.

b. Clinical specificity:

Not applicable.

c. Other clinical supportive data (when a. and b. are not applicable):

Detection of hCG in Early Pregnancy Clinical Samples
A total of 616 urine samples were collected from 56 different women (25 - 45 years old) who planned to become pregnant. These women were followed throughout their conception cycles with urine collected from day -9 to day +1 of their expected period. The Candidate device (both formats) detected hCG in 71% of samples from, five days before the expected menstrual period, and 100% of samples from one day before the expected menstrual period. The early pregnancy detection results are summarized below:

Day in cycle relative to EMP	Midstream Format	Cassette Format	Overall Pregnancy Detection Rate (%)
-9 days	0%	0%	0%
-8 days	0%	0%	0%
-7 days	12.5%	12.5%	12.5%
-6 days	41%	41%	41%
-5 days	71%	71%	71%
-4 days	94%	94%	94%
-3 days	98%	98%	98%
-2 days	98%	98%	98%
-1 days	100%	100%	100%
0 days	100%	100%	100%
+1 days	100%	100%	100%

Lay user study

A lay user study was performed at an intended use site with a total of 218 females with diverse educational and professional backgrounds and ages, 18 years and older. 110 lay users tested with midstream format devices and 108 lay users tested with cassette format devices. Lay users were only provided with the package insert prior to performing the study. Lay user results compared to professional user results are listed below.

Pregnancy Result	**Lay user vs. professional**		
	Midstream	**Midstream-Dip**	**Cassette**
Pregnant	9/9 (100%)	9/9(100%)	6/6 (100%)
Non-pregnant	101/101 (100%)	101/101 (100%)	102/102 (100%)
Total	110/110 (100%)	110/110 (100%)	108/108 (100%)

Besides testing their own urine samples, lay users also tested 4 spiked urine samples around the cut-off level, at concentrations of 3.0, 7.0, 8.5 and 10 mIU/ml hCG. A total of 110 samples at each level were tested with the candidate device in both Cassette and Midstream formats. Among the 110 midstream format devices tested at each hCG level, 53 were tested in simulated midstream method while 57 were tested in dip method. An aliquot of each of the urine samples was also tested by a laboratory professional using the candidate device. The results are summarized below.

Midstream format, spiked urine samples, lay user vs professional

No. of samples	hCG Concentration (mIU/mL)	Lay person results		Professionals results	
		Number of Positive	% Positive	Number of Positive	% Positive
110	3.0	0/110	0%	0/110	0%
110	7.0	28/110	25.4%	27/110	24.5%
110	8.5	66/110	60.0%	70/110	63.6%
110	10	110/110	100%	110/110	100%

Cassette format, spiked urine samples, lay user vs professional

No. of samples	hCG Concentration (mIU/mL)	Lay person results		Professionals results	
		Number of Positive	% Positive	Number of Positive	% Positive
108	3.0	0/108	0%	0/108	0%
108	7.0	23/108	21.3%	26/108	24.1%
108	8.5	81/108	75.0%	84/108	77.8%
108	10	108/108	100%	108/108	100%

A Flesch-Kincaid reading analysis was performed on each OTC package insert and the score demonstrated a reading Grade Level of 7. The results of the questionnaire reflected that the consumers found the test easy to use and that they did not have trouble understanding the labeling or interpreting results.

Specificity study to determine false-positive result rate
A study was performed to determine the incidence of positive test results using the candidate device among non-pregnant women in three age groups: 18 - 41 years of age (Pre-menopausal), 42-55 years of age (peri-menopausal) and >55 year of age (post- menopausal). A total of 320 subjects provided urine samples: 100 from pre-menopausal subjects, 111 from peri-menopausal subjects, and 109 from post-menopausal subjects. Three lots of each test format of the candidate devices were used for this study. No positive results were observed in any of the age groups.

4. Clinical cut-off**:**

   Not applicable.

5. Expected values/Reference range:

   Not applicable.

N. Proposed Labeling:

The labeling is sufficient and it satisfies the requirements of 21 CFR Part 809.10.

O. Conclusion:

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