

**510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION  
DECISION SUMMARY**

**A. 510(k) Number:**

k101918

**B. Purpose for Submission:**

To obtain clearance for a Premarket notification

**C. Measurand:**

*Respiratory Syncytial virus antigen*

**D. Type of Test:**

Lateral flow immunoassay

**E. Applicant:**

Quidel Corporation

**F. Proprietary and Established Names:**

QuickVue® RSV 10

**G. Regulatory Information:**

1. Regulation section:

CFR 866.2660

2. Classification

I

3. Product code:

GQG

4. Panel:

83 Microbiology

**H. Intended Use:**

1. Intended use(s):

The QuickVue RSV 10 test is an immunoassay that allows for the rapid, qualitative detection of respiratory syncytial virus (RSV) antigen directly from nasopharyngeal swab and nasopharyngeal aspirate/wash specimens for symptomatic pediatric patients (less than six years old). The test is intended for use as an aid in the rapid diagnosis of acute RSV infection. Negative results do not preclude RSV infection and should not be used as the sole basis for treatment or for other management decisions. A negative test is presumptive. It is recommended that negative test results be confirmed by cell culture. The test is intended for professional and laboratory use.

2. Indication(s) for use:

Same as intended use

3. Special conditions for use statement(s):

Prescription use

4. Special instrument requirements:

Not applicable

**I. Device Description:**

The QuickVue RSV 10 test employs lateral flow immunoassay technology. Using this test allows for the rapid detection of RSV antigens.

To begin the test, a lyophilized reagent must be rehydrated in the reagent tube. This reagent facilitates exposure of the appropriate viral antigens to the antibodies used in the test. For a liquid specimen such as a nasopharyngeal aspirate/wash, the specimen is added directly to the reagent tube and rehydrates the reagent. When nasopharyngeal swabs are used, the reagent is first rehydrated with the provided reagent solution and the swab specimen is then inserted into the reagent tube. This reagent interacts with the specimen and facilitates exposure of the appropriate viral antigens to the antibodies used in the test. The test strip is added to the reagent tube now containing the specimen and reagent solution.

If the extracted specimen contains RSV antigens, a pink-to-red test line, along with a blue procedural control line will appear on the test strip indicating a positive result. If RSV antigen is not present, or is present at very low levels, only a blue procedural control line will appear.

**J. Substantial Equivalence Information:**

1. Predicate device name(s): QuickVue RSV test

2. Predicate 510(k) number(s): K061008 and K070747

3. Comparison with predicate:

<b>Features</b>	<b>QuickVue RSV 10 test (Proposed)</b>	<b>QuickVue RSV test (K061008 and K070747)</b>
FDA File Number	k101918	K061008 and K070747
Manufacturer	Quidel Corporation	Quidel Corporation
Intended Use	The QuickVue RSV 10 test is an immunoassay that allows for the rapid, qualitative detection of respiratory syncytial virus (RSV) antigen directly from nasopharyngeal swab and nasopharyngeal aspirate/wash specimens for symptomatic pediatric patients (less than six years old). The test is intended for use as an aid in the rapid diagnosis of acute RSV infection. Negative results do not preclude RSV infection and should not be used as the sole basis for treatment or for other management decisions. A negative test is presumptive. It is recommended that negative test results be confirmed by cell culture. The test is intended for professional and laboratory use.	The QuickVue RSV test is a dipstick immunoassay, which allows for the rapid, qualitative detection of respiratory syncytial virus (RSV) antigen (viral fusion protein) directly from nasopharyngeal swab, nasopharyngeal aspirate, nasal/nasopharyngeal wash specimens for symptomatic pediatric patients (eighteen years of age and younger). The test is intended for use as an aid in the diagnosis of acute respiratory syncytial viral infections. It is recommended that negative test results be confirmed by cell culture. Negative results do not preclude RSV infection and it is recommended that they not be used as the sole basis for treatment or other management decisions. The test is intended for professional and laboratory use.
Qualitative	Yes	Yes
Kit Storage	RT	RT
Specimen Types	Nasopharyngeal swab, Nasopharyngeal aspirate/wash	Nasopharyngeal swab, Nasopharyngeal aspirate/wash Nasal wash
Reagent	Lyophilized buffer containing detergents	Liquid buffer solution containing detergents
Read Result Time	10 Minutes	15 Minutes
Format	Lateral-flow immunoassay dipstick	Lateral-flow immunoassay dipstick
Control Features	Procedural Control Line Clearing of background	Procedural Control Line Clearing of background
External Controls	Positive RSV swab RSV negative swab coated with Streptococcus C antigen	Positive RSV swab RSV negative swab coated with Streptococcus C antigen
Sample Pad	Contains blocking agents to prevent non-specific reactions	Contains blocking agents to prevent non-specific reactions
Test Label	Mouse monoclonal anti-RSV antibody	Mouse monoclonal anti-RSV antibody

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

Non applicable

**L. Test Principle:**

The QuickVue RSV 10 test employs lateral flow immunoassay technology. Using this test allows for the rapid detection of RSV antigens.

To begin the test, a lyophilized reagent must be rehydrated in the reagent tube. This reagent facilitates exposure of the appropriate viral antigens to the antibodies used in the test. For a liquid specimen such as a nasopharyngeal aspirate/wash, the specimen is added directly to the reagent tube and rehydrates the reagent. When nasopharyngeal swabs are used, the reagent is first rehydrated with the provided reagent solution and the swab specimen is then inserted into the reagent tube. This reagent interacts with the specimen and facilitates exposure of the appropriate viral antigens to the antibodies used in the test. The test strip is added to the reagent tube now containing the specimen and reagent solution.

If the extracted specimen contains RSV antigens, a pink-to-red test line, along with a blue procedural control line will appear on the test strip indicating a positive result. If RSV antigen is not present, or is present at very low levels, only a blue procedural control line will appear.

**M. Performance Characteristics (if/when applicable):**

1. Analytical performance:

**ANALYTICAL SENSITIVITY AND LIMIT OF DETECTION**

The QuickVue RSV 10 test was shown to detect two different isolates of RSV A and one isolate of RSV B. In a separate experiment, the limit of detection was determined to be approximately  $7.9 \times 10^3$  TCID<sub>50</sub>/mL for RSV A and  $8.3 \times 10^3$  TCID<sub>50</sub>/mL for RSV B.

**ANALYTICAL SPECIFICITY AND CROSS REACTIVITY**

A total of thirty-four (34) bacterial and fungal and thirty-five (35) viral isolates were tested in triplicate in the QuickVue RSV 10 test. None (i.e., 0/34 bacterial/fungal and 0/35 viral isolates) of the microorganisms tested at the levels indicated showed any sign of cross-reactivity in the assay. Flow of the sample and appearance of the Control Line were also not affected. These results (Tables 2 and 3) confirm high immunological specificity of the QuickVue RSV 10 test.

**Table 2: Bacterial Panel\***

<u>Cross Reactant</u>	<u>Concentration</u>
Bacteroides fragilis	1.0x10 <sup>9</sup> org/mL
Bordetella pertussis	1.0x10 <sup>9</sup> cfu/mL
Candida albicans	1.0x10 <sup>8</sup> cfu/mL
Corynebacterium diphtheriae	1.0x10 <sup>7</sup> cfu/mL
Enterococcus faecalis	1.0x10 <sup>7</sup> org/mL
Escherichia coli	1.0x10 <sup>8</sup> cfu/mL
Gardnerella vaginalis	1.0x10 <sup>6</sup> org/mL
Haemophilus influenzae	1.0x10 <sup>8</sup> cfu/mL
Klebsiella pneumoniae	1.0x10 <sup>9</sup> cfu/mL
Lactobacillus casei	1.0x10 <sup>7</sup> cfu/mL
Lactobacillus plantarum	1.0x10 <sup>7</sup> cfu/mL
Legionella pneumophila	1.0x10 <sup>9</sup> cfu/mL
Listeria monocytogenes	1.0x10 <sup>9</sup> org/mL
Moraxella catarrhalis	1.0x10 <sup>9</sup> cfu/mL
Mycobacterium avium	1.0x10 <sup>8</sup> org/mL
Mycobacterium intracellulare	1.0x10 <sup>8</sup> org/mL
Mycobacterium tuberculosis	1.0x10 <sup>7</sup> org/mL
Mycoplasma pneumoniae	3.3x10 <sup>3</sup> cfu/mL
Neisseria gonorrhoeae	5.0x10 <sup>7</sup> org/mL
Neisseria meningitidis	1.0x10 <sup>8</sup> cfu/mL
Neisseria sicca	1.0x10 <sup>9</sup> cfu/mL
Neisseria subflava	1.0x10 <sup>6</sup> cfu/mL
Pseudomonas aeruginosa	1.0x10 <sup>9</sup> cfu/mL
Serratia marcescens	1.0x10 <sup>8</sup> org/mL
Staphylococcus aureus	2.5x10 <sup>7</sup> cfu/mL
Staphylococcus aureus (Cowen 1)	1.0x10 <sup>9</sup> cfu/mL
Staphylococcus epidermidis	1.0x10 <sup>8</sup> cfu/mL
Streptococcus mutans	5.0x10 <sup>8</sup> org/mL
Streptococcus pneumoniae	5.0x10 <sup>5</sup> cfu/mL
Streptococcus pyogenes Gp. A	1.0x10 <sup>8</sup> org/mL
Streptococcus sanguis	5.0x10 <sup>8</sup> org/mL
Streptococcus sp. Gp. B	1.0x10 <sup>8</sup> org/mL
Streptococcus sp. Gp. C	1.0x10 <sup>8</sup> cfu/mL
Streptococcus sp. Gp. G	1.0x10 <sup>8</sup> cfu/mL

\*Standard microbiological methods were used for determining the concentration of the bacteria and fungus.

**Table 3: Viral Panel\***

<u>Cross Reactant</u>	<u>[TCID50/mL]</u>
Adenovirus 3	1.0x10 <sup>7</sup>
Adenovirus 4	1.0x10 <sup>4</sup>
Adenovirus 5	1.0x10 <sup>7</sup>
Adenovirus 7	1.0x10 <sup>4</sup>
Adenovirus 11	1.0x10 <sup>6</sup>
Adenovirus 18	1.0x10 <sup>7</sup>
Coronavirus OC43	1.0x10 <sup>6</sup>
Coronavirus 229E	1.0x10 <sup>6</sup>
Coxsackievirus B5 (Faulkner)	1.0x10 <sup>8</sup>
Echovirus Type 3	1.0x10 <sup>6</sup>
Herpes simplex virus 1	1.0x10 <sup>6</sup>
Herpes simplex virus 2	1.0x10 <sup>6</sup>
Influenza A/FortMonmouth (H1N1)	1.0x10 <sup>6</sup>
Influenza A/NewJersey (H1N1)	1.0x10 <sup>6</sup>
Influenza A/Victoria (H3N2)	5.0x10 <sup>5</sup>
Influenza B/Allen	1.0x10 <sup>5</sup>
Influenza B/Hong Kong	1.0x10 <sup>6</sup>
Influenza B Lee	1.0x10 <sup>6</sup>
Influenza B/Panama	1.0x10 <sup>7</sup>
Influenza C/Taylor/1233/47	1.0x10 <sup>5</sup>
Measles (Edmonston)	1.0x10 <sup>6</sup>
Metapneumovirus	1.0x10 <sup>6</sup>
Mumps (Enders)	1.0x10 <sup>5</sup>
Parainfluenza virus 1	1.0x10 <sup>6</sup>
Parainfluenza virus 3	1.0x10 <sup>6</sup>
Parainfluenza virus 4A	1.0x10 <sup>6</sup>
Rhinovirus Type 1	1.0x10 <sup>5</sup>
Rhinovirus Type 2	1.0x10 <sup>5</sup>
Rhinovirus Type 3	1.0x10 <sup>4</sup>
Rhinovirus Type 7	1.0x10 <sup>6</sup>
Rhinovirus Type 15	1.0x10 <sup>7</sup>
Rhinovirus Type 16	1.0x10 <sup>8</sup>
Rhinovirus Type 18	4.0x10 <sup>5</sup>
Rhinovirus Type 37	1.0x10 <sup>5</sup>
VZV	4.0x10 <sup>4</sup> pfu/mL

\*Standard microbiological methods were used for determining the concentration of the viruses.

## **INTERFERING SUBSTANCES**

Several over-the-counter (OTC) products and common chemicals were evaluated and did not interfere with the QuickVue RSV 10 test at the levels tested. These included the following: three OTC mouthwashes (25%); three OTC cough drops (15%); three nasal sprays/gel (10%); Blood (2%); Acetamidophenol (10 mg/mL); Acetylsalicylic Acid (20 mg/mL); Chlorpheniramine (5 mg/mL); Dextromethorphan (10 mg/mL); Diphenhydramine (5 mg/mL); Mucin (4 mg/mL); Guaiacol (20 mg/mL); Phenylephrine (50 mg/mL); Rimantadine (50 µg/mL); and Albuterol (20 mg/mL).

### **2. Comparison studies:**

*a. Method comparison with predicate device:* Not applicable

*b. Matrix comparison:* Not applicable

### **3. Clinical studies:**

The performance of the QuickVue RSV 10 test was compared to viral cell culture methods and DFA in a multi-center clinical study during the RSV season in the United States. This study was performed by professional health care personnel at four distinct sites in various geographical regions within the United States. In this multi-center field trial, nasopharyngeal swabs and nasopharyngeal aspirate/wash specimens were collected from seven hundred nine (709) patients. Three hundred seventy-eight (378) provided a nasopharyngeal swab specimen and three hundred thirty-one (331) provided a nasopharyngeal aspirate/wash specimen. All clinical samples were collected from symptomatic patients (5 years of age and younger). 60% were male and 40% were female.

On-site testing of one nasopharyngeal swab specimen, or a portion of nasopharyngeal aspirate/wash specimen, was performed by physician office personnel with the QuickVue RSV 10 test. All samples were freshly collected and tested. The remaining sample was placed in viral transport media. Cell culture was performed either at the laboratory of the test site or at a local, readily accessible virus laboratory. Cells were inoculated with the specimen, incubated at 35-37°C for 16-72 hours, and then removed from culture and tested for RSV by direct fluorescent antibody (DFA) staining.

## **Results with Nasopharyngeal Aspirate/Wash Specimens**

Nasopharyngeal aspirate/wash specimens from three hundred thirty-one (331) patients were tested in QuickVue RSV 10 and in cell culture. The QuickVue RSV 10 test correctly identified 90% (62/69) RSV culture-positive specimens and 96% (251/262) RSV culture-negative specimens. These results are shown in Table 4.

**Table 4: QuickVue RSV 10 Nasopharyngeal Aspirate/Wash Specimen Results versus Culture**

	RSV Culture	
	+	-
QV Pos	62	11
QV Neg	7	251

Sensitivity =  $\frac{62}{69} = 90\%$   
(95% C.I. 80-95%)

Specificity =  $\frac{251}{262} = 96\%$   
(95% C.I. 93-98%)

PPV =  $\frac{62}{73} = 85\%$

NPV =  $\frac{251}{258} = 97\%$

**Results with Nasopharyngeal Swab Specimens**

Nasopharyngeal swab specimens from three hundred seventy-eight (378) patients were tested in QuickVue RSV 10 and in cell culture. The QuickVue RSV 10 test correctly identified 86% (60/70) RSV culture-positive specimens and 95% (292/308) RSV culture-negative specimens. These results are shown in Table 5.

**Table 5: QuickVue RSV 10 Nasopharyngeal Swab Specimen Results versus Culture**

	RSV Culture	
	+	-
QV Pos	60	16
QV Neg	10	292

Sensitivity =  $\frac{60}{70} = 86\%$   
(95% C.I. 75-92%)

Specificity =  $\frac{292}{308} = 95\%$   
(95% C.I. 92-97%)

PPV =  $\frac{60}{76} = 79\%$

NPV =  $\frac{292}{302} = 97\%$

## REPRODUCIBILITY STUDIES

The reproducibility of the QuickVue RSV 10 test was evaluated at five different laboratories, one of which was Quidel. Three different operators at each site tested a series of coded, contrived samples, ranging from high negative to moderate positive. Each had been carefully seeded with graded doses of RSV. The inter-laboratory agreement (Table 6) for negative samples was 99.3 to 100% and 99.1 – 99.8% for positive samples. The intra-laboratory agreement (Table 7) for all samples ranged from 99.2 to 100%.

**Table 6: QuickVue RSV 10 Reproducibility Study; Inter-laboratory Agreement**

Laboratory Site	High Negative Samples		Low Positive Samples		Moderate Positive Samples
	4.33x10 <sup>5</sup> vp/mL*	5.58x10 <sup>5</sup> vp/mL	8.38x10 <sup>5</sup> vp/mL	1.03x10 <sup>6</sup> vp/mL	5.03x10 <sup>6</sup> vp/mL
1	90/90	90/90	87/90	89/90	90/90
2	90/90	90/90	90/90	89/90	89/90
3	90/90	90/90	90/90	90/90	90/90
4	90/90	90/90	89/90	90/90	90/90
5	90/90	87/90	90/90	90/90	90/90
Total	450/450	447/450	446/450	448/450	449/450
% Overall Agreement (95% C.I.)	100% (99.0-100%)	99.3% (98.0-99.9%)	99.1% (97.7-99.7%)	99.6% (98.3-100%)	99.8% (98.6-100%)

\*The concentration of virus particles (vp/mL) was determined by electron microscopic techniques.

**Table 7: QuickVue RSV 10 Reproducibility Study; Intra-laboratory Agreement**

Laboratory Site	High Negative Samples		Low Positive Samples		Moderate Positive Samples	%Overall Agreement (95% C.I.)
	4.33x10 <sup>5</sup> vp/mL*	5.58x10 <sup>5</sup> vp/mL	8.38x10 <sup>5</sup> vp/mL	1.03x10 <sup>6</sup> vp/mL	5.03x10 <sup>6</sup> vp/mL	
1	90/90	90/90	87/90	89/90	90/90	99.2% (506/510) (97.9-99.8%)
2	90/90	90/90	90/90	89/90	89/90	99.6% (508/510) (98.5-100%)
3	90/90	90/90	90/90	90/90	90/90	100% (510/510) (99.1-100%)
4	90/90	90/90	89/90	90/90	90/90	99.8% (509/510) (98.8-100%)
5	90/90	87/90	90/90	90/90	90/90	99.4% (507/510) (98.2-99.9%)

**N. Proposed Labeling:**

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

**O. Conclusion:**

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