

# SAS™ RSVAlert

A Rapid Visual Assay for the Qualitative Detection of Respiratory Syncytial Virus Antigen in Nasopharyngeal Specimens

For *In-Vitro* Diagnostic Use

Store at 15° to 30°C

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## READ ALL INSTRUCTIONS BEFORE BEGINNING THE ASSAY

### INTENDED USE

SAS™ RSVAlert antigen test kit is a visual and rapid assay for the qualitative detection of Respiratory Syncytial Virus (RSV) antigen directly from nasopharyngeal specimens in neonatal and pediatric patients. The test is for in-vitro diagnostic use only. It is recommended that negative test results be confirmed by cell culture.

### BACKGROUND

Respiratory syncytial virus is a member of the *Paramyxoviridae* family and is the most significant respiratory pathogen for infants and children.<sup>1,7</sup> Infection usually causes mild to moderate severe upper respiratory illness that may lead to life threatening pneumonia or bronchiolitis. RSV infections are seasonal and are most prominent from December to March in the northern hemisphere. The virus is spherical in shape with a lipoprotein envelope synthesized from the plasma membrane of the infected host cell. The virus is spread rapidly through droplets dispersed in the air or secretions from the respiratory tract of infected individuals. The incubation period is 3-7 days.<sup>1</sup> Specimens from patients are obtained by using nasopharyngeal aspiration, washes and swabs.<sup>2</sup>

Several methods have been developed for the detection of RSV. This includes Direct and Indirect Immunofluorescence on exfoliated cells, Enzyme Immunoassay (EIA) from nasopharyngeal samples, and isolation of the virus from Cell Culture. Cell Culture has remained historically the "gold standard" used for diagnosis, but requires specialized equipment, highly trained personnel, specialized care in specimen collection and transportation, and long periods of time to obtain results. Rapid immunodetection methods have provided a cost effective detection option which allows for timely patient treatment to prevent possible nosocomial spread.<sup>3,5,6</sup>

### PRINCIPLE OF THE TEST

The SAS™ RSVAlert test utilizes a pair of Respiratory Syncytial Virus (RSV) specific antibodies in an immunochromatographic sandwich assay. The reaction between a positive sample and the colored particle-conjugated antibody forms a complex that migrates along the membrane. An immobilized capture antibody will form a colored line at the S (specimen) area upon reacting with the colored complex. An internal control line C (control) area is built-in to assure that the test has been carried out correctly.

### MATERIALS & REAGENTS PROVIDED

1. Test Devices.
2. SAS™ RSVAlert Extraction Buffer.  
(Contains mucolytic agent and 0.1% sodium azide as a preservative)
3. Disposable extraction tubes with filtered caps.
4. Package insert.

### MATERIALS NOT PROVIDED

1. Timer.
2. RSV positive control.
3. RSV negative control.
4. Pipette and Pipette tips that can hold up to 1000µl of sample.

### PRECAUTIONS

1. For in vitro diagnostic use only.
2. In accordance with the principles of Good Laboratory Practice it is strongly recommended that all specimens be

3. treated as potentially infectious and handled with all necessary precautions.
3. Discard all used devices into a biohazard container.
4. Do not use kits after the stated expiration date, and do not mix kit components from different lots.
5. Users are cautioned against over reading of membrane immunoassays. Only clearly visible line in the S area should be considered a positive result.
6. Follow test procedure for each specimen type as written. Extraction tube and dropper tips should only be used with bloody or mucoid samples.

### STORAGE CONDITIONS

SAS™ RSVAlert Test devices should be kept at room temperature (15-30°C) in the sealed pouches. Do not freeze the test kit or kit reagents.

### TRANSPORT MEDIA

The following transport media have been tested and found to be compatible with SAS™ RSVAlert Test.

PBS  
0.9% Saline  
PBS 0.5% Gelatin  
PBS 0.5% BSA  
Viral CULTURETTE™  
Todd Hewitt Broth  
EMEM  
EMEM with Lactalbumin hydrolysate  
Trypticase Soy Broth  
M4 VTM

### SPECIMEN COLLECTION, STORAGE AND TRANSPORTATION

Acceptable specimens for evaluation with the SAS™ RSVAlert Test include nasopharyngeal washes, aspirates and swabs.<sup>4</sup> Specimens should be transported to laboratory immediately after collection. Specimens may be stored at 2-8°C for up to 48 hours or at -20°C for up to one week.

### SPECIMEN PREPARATION

Acceptable specimens include nasopharyngeal washes, aspirates, and swabs.

Note: Mucoid or bloody specimens may fail to flow properly on the SAS™ RSVAlert Test causing an inconclusive test result (see Test Procedure). For excessive mucoid or bloody specimens, it may be helpful to treat the specimen with extraction buffer, followed by brief sonication, prior to addition to the SAS™ RSVAlert Test.

### Procedure For Use with Nasopharyngeal Washes:

1. Nasopharyngeal wash volumes of 2 to 4 ml are recommended. Excess wash volume may decrease test performance.
2. If specimen is mucoid or bloody see note above.

### Procedure for Use with Nasopharyngeal Aspirates:

1. Nasopharyngeal aspirates should be collected in volumes between 0.5 and 1ml.
2. Samples then should be dispersed in 2 or 4 ml of viral transport medium or physiological saline up to 4 ml, depending on volume of aspirate received.
3. If specimen is mucoid or bloody see note above.

### Procedure for Use with Nasopharyngeal Swabs:

1. Place swab specimen into 0.75-3 ml of transport medium or saline.

2. Mix the swab and transport media or saline vigorously.
3. Express excess liquid from swab.
4. Dispose of swab into appropriate container.

### TEST PROCEDURE FOR SPECIMENS

1. Remove test device from pouch and lay on flat surface. Label device with specimen type and ID.
2. Pipette 150µl of the nasopharyngeal specimen into test device.
3. Read results at 15 minutes. Some positive results may be observed in as briefly as 30 seconds depending on the concentration of the antigen. Do not interpret results after 30 minutes.

**Note: For Mucoid or Bloody Samples:** Add 250µl of the nasopharyngeal wash specimen to extraction tube. Add 2 drops of SAS™ RSVAlert Extraction buffer. Insert filter cap, mix, and dispense 3-4 drops of extracted specimen from extraction tube into a fresh test device. Some positive results may be observed in as short as 30 seconds depending on the concentration of the antigen. Do not interpret results after 30 minutes.

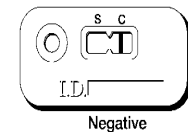
### TEST PROCEDURE FOR EXTERNAL CONTROLS

1. Remove test device from pouch and lay on flat surface. Label device with specimen type and ID.
2. Pipette 150µl of the external control into test device.
3. Read results at 15 minutes. Some positive results may be observed in as briefly as 30 seconds depending on the concentration of the antigen. Do not interpret results after 30 minutes.

### INTERPRETATION OF RESULTS

#### Negative Results

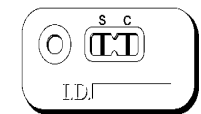
The test is negative if a colored line appears only in the C area (control).



Negative

#### Positive Results

The test is positive if two colored lines appear. One colored line will appear in the S area (specimen) and one in the C area (control). A colored line of any intensity in the specimen area should be considered positive.



Positive

#### Invalid Results

The test is invalid if no colored line appears in the C (control) area even if a colored line appears in the S (specimen) area. If this occurs, the test is invalid and should be repeated. Colored lines that appear after 30 minutes are not diagnostic and should be ignored.

**LIMITATIONS**

- The SAS™ RSVAlert Test is for the detection of viable and non-viable RSV particles. This test is not for confirmation of a respiratory infection caused by other microorganisms.
- The SAS™ RSVAlert Test is dependent on antigen load and may not correlate with other methods used for the detection of RSV such as Cell culture performed on the same specimen.
- Frozen specimens should be thawed and brought to room temperature before use.
- False negatives may result from inadequate specimen collection, such as over dilution, improper handling or transport.
- A negative test result does not rule out a possible RSV infection. Patient diagnosis should always include laboratory test results and all other clinical information available.

**QUALITY CONTROL**

**Internal Controls**

Each test device includes an internal procedural control. The appearance of a Control Line in the C region of the test device is a positive procedural control. Correct procedural technique, specimen flow and test device performance is confirmed when a colored line appears in the C (control) area of the membrane. If the colored line fails to appear in the C (control) area, the test result is invalid.

**External Controls**

Negative and positive controls for RSV antigen should be tested and the appropriate results obtained. External quality controls should be performed on each lot.

**PERFORMANCE CHARACTERISTICS**

**Accuracy by Comparison:**

**Laboratory Studies**

Sixty-three (63) frozen patient samples were obtained from several laboratories. An RSV viral culture was performed on each sample. Each sample was thawed and a SAS™ RSVAlert Test was performed.

		Cell Culture		
		+	-	
<b>SAS™ RSVAlert Test</b>	+	57	0	57
	-	*1	5	6
		58	5	63

\* Confirmed positive by EIA.

Percent Positive Agreement (57/58) x 100 = 98.3% (95%CI, 90.8% to 99.9%)

Percent Negative Agreement (5/5) x 100 = 100% (95%CI, 47.8% to 100%)

Percent Agreement (62/63) x 100 = 98.4% (95%CI, 91.5% to 99.9%)

Ninety-four (94) frozen patient samples were obtained from several laboratories. Each sample was thawed and a SAS™ RSVAlert Test and Other Commercial test were performed.

		Other Commercial Test		
		+	-	
<b>SAS™ RSVAlert Test</b>	+	83	0	83
	-	*4	7	11
		87	7	94

\*All 4 were confirmed positive by EIA and Cell Culture.

Percent Positive Agreement (83/87) x 100 = 95.4% (95%CI, 88.6% to 98.7%)

Percent Negative Agreement (7/7) x 100 = 100% (95%CI, 59.0% to 100%)

Percent Agreement (90/94) x 100 = 95.7% (95%CI, 89.6 to 98.3%)

**CLINICAL SPECIFICITY AND SENSITIVITY**

**Prospective Study**

One hundred thirty-two (131) clinical samples collected over two (2) seasons were tested blindly and prospectively using the SAS™ RSVAlert Test and compared to Cell Culture. The results are shown in the table below.

		Cell Culture		
		+	-	
<b>SAS™ RSVAlert Test</b>	+	5	0	5
	-	0	126	126
		5	126	131

Sensitivity (5/5) x100 = 100% (95% CI, 56.6 to 100%)

Specificity (127/127) x 100 = 100% (95% CI, 97.1 to 100%)

Correlation (131/131) x100 = 100% (95% CI, 97.2 to 100%)

**Retrospective Study**

Three clinical sites tested one hundred twenty four (124) clinical samples blindly and retrospectively using the SAS™ RSVAlert Test and compared the results to Cell Culture. Samples were stored frozen and thawed prior to testing. The results are shown in the table below.

		Cell Culture		
		+	-	
<b>SAS™ RSVAlert Test</b>	+	86	2	88
	-	4	32	36
		90	34	124

Relative Sensitivity (86/90) x100 = 95.6% (95%CI, 89.0 to 98.8%)

Relative Specificity (32/34) x100 = 94.1% (95%CI, 80.3 to 99.3%)

Relative Correlation (118/124) x100 = 95% (95%CI, 89.8 to 97.8%)

**CLINICAL COMPARISON**

**Nasopharyngeal Swabs**

Two clinical sites tested twenty-eight (28) clinical swab specimens blindly and prospectively using the SAS™ RSVAlert Test and the Other Commercial RSV Test. The results are shown below.

		Other Commercial RSV Test		
		+	-	
<b>SAS™ RSVAlert Test</b>	+	6	0	6
	-	5	17	22
		11	17	28

Percent Positive Agreement (6/11) x 100 = 54.5% (95%CI, 23.4% to 83.3%)

Percent Negative Agreement (17/17) x 100 = 100% (95%CI, 80.5% to 100%)

Percent Agreement (23/28) x 100 =82.1% (95%CI, 63.1% to 93.9%)

**ANALYTICAL SENSITIVITY (LIMIT OF DETECTION)**

The limit of detection (LOD) or the SAS™ RSVAlert Test was determined for five (5) RSV Strains. These strains included three (3) RSV B and two (2) RSV A strains.

Type	RSV Viral Strain	Limit of Detection (TCID <sub>50</sub> /0.2 ml)
A	RSV (Long)	1.7 x 10 <sup>3</sup>
A	RSV (A-2)	9.9 x 10 <sup>2</sup>
B	RSV (9320)	5.5 x 10 <sup>2</sup>
B	RSV (Washington)	1.1 x 10 <sup>3</sup>
B	RSV (Wild-type)	8.9 x 10 <sup>1</sup>

**CROSS REACTIVITY/INTERFERENCE STUDY**

To confirm the analytical specificity of the SAS™ RSVAlert Test, bacterial and viral cultures likely to be found in the respiratory tract were tested. Bacterial cultures were tested at 1 x 10<sup>8</sup> cfu/ml and the viral cultures at 1 x 10<sup>5.5</sup> to 1 x 10<sup>6.5</sup> TCID<sub>50</sub>/0.2 ml. All yielded negative results.

To confirm noninterference of the SAS™ RSVAlert Test, RSV whole virus 9320 at titer 1.11 x 10<sup>3</sup> TCID<sub>50</sub> /0.2 ml was added to bacterial and viral cultures likely to be found in the respiratory tract. Bacterial cultures were tested at 1 x 10<sup>8</sup> cfu/ml and the viral cultures at 1 x 10<sup>3.5</sup> to 1 x 10<sup>6.5</sup> TCID<sub>50</sub>/0.2 ml. All yielded positive results.

**Bacterial Cross Reactivity**

<i>Candida albicans</i>	<i>Serratia marcescens</i>	<i>Streptococcus sp gr G</i>
<i>Chlamydia trachomatis</i>	<i>Staphylococcus epidermidis</i>	<i>Streptococcus pneumoniae</i>
<i>Corynebacterium diphtheriae</i>	<i>Staphylococcus aureus</i>	<i>Mycoplasma pneumoniae</i>
<i>Haemophilus influenzae type A</i>	<i>Streptococcus sp gr A</i>	<i>Neisseria meningitidis</i>
<i>Klebsiella pneumoniae</i>	<i>Streptococcus sp gr F</i>	<i>Pseudomonas aeruginosa</i>

**Viral Cross Reactivity Panel**

Adenovirus 5	Echovirus 3	Parainfluenza 3
Adenovirus 7	Echovirus 6	Varicella zoster
Adenovirus 10	HSV Type-1	Rhinovirus 1A
Coxsackie A9	HSV Type-2	Rhinovirus 2
Coxsackie B5	Influenza A	Rhinovirus 13
Coxsackie B6	Influenza B-Hong Kong	Rhinovirus 15
Cytomegalovirus	Parainfluenza 1	Rhinovirus 37
Echovirus 11	Parainfluenza 2	

**REPRODUCIBILITY**

The reproducibility of the SAS™ RSVAlert Test was evaluated at three clinical laboratory sites. The SAS™ RSVAlert Test was tested against a panel of five (5) specimens of which included three levels of positives and two negatives. The low and high positives were from the RSV Long strain, and the medium positive was comprised of RSV A2 strain. Negative were comprised of either sample diluent or *Streptococcus Group A*. Three (3) different laboratory personnel assayed each specimen at each laboratory facility. The overall reproducibility for the SAS™ RSVAlert Test was 100%.

**REFERENCES**

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70-PI-RSV  
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