Monitoring Report: Respiratory Syncytial Virus (RSV)

Truveta Research

February 17, 2023

Intended Audience: This technical report is intended for scientific audiences.

About this report

This report contains current hospitalization trends associated with respiratory syncytial virus (RSV). We used a subset of Truveta data to identify laboratory-confirmed RSV infections in children and adults. Truveta was formed and governed by US health systems with a shared vision of saving lives with data. Truveta's 25 members provide 16% of patient care in the United States in more than 20,000 clinics and 700 hospitals. Updated data are provided daily to Truveta. The subset of Truveta data used in this study was provided on February 15, 2023 and included de-identified patient care data primarily located across ten states (New York, Iowa, Washington, California, North Carolina, Alaska, Texas, Oregon, Illinois, and Montana).

The figures below are intended to describe trends and comparisons of RSV-associated hospitalizations in different demographic groups and across seasons. For the purposes of this report, seasons are defined as the period from October through September of the following year. Given the unadjusted nature of the data, the rates do not account for undertesting and other variability that exists across patient groups, providers, and systems. See the limitations section below for additional limitations and discussion of their implications.

What is new in this report?

This report provides updated data through January 31, 2023.

Importance of this report

RSV is a leading cause of lower respiratory disease in infants, children, and older adults (Pastula et al., 2017; Shi et al., 2017). RSV can lead to hospitalization and death. Estimates indicate that RSV is associated with over 75,000 pediatric hospitalizations

annually in the US (McLaughlin et al., 2022); however, representative and timely data to proactively monitor infections are scarce.

It is important for public health experts and clinical providers to understand the trends in RSV infection to inform decisions about public health, clinical care, and public policy. Connecting population-level trends with granular clinical information available in Truveta can be very useful to more deeply understand which cohorts are most impacted.

This report is intended to supplement the RSV surveillance data provided by the CDC (Centers for Disease Control and Prevention, 2022a). This report includes additional information about geographic regions and clinical detail that is not captured in other reports.

Data

RSV case definition

A case is defined by laboratory-confirmed RSV in a person who:

- 1. Was hospitalized in a Truveta-associated health system AND
- 2. Tested positive for RSV 14 days before or after the start of the hospitalization

For the purposes of this report, RSV test positivity is defined as a positive value for any LOINC code listed in Table S1.

Data acquisition

Our study included hospitalized patients who tested positive for RSV within 14 days before or during the hospitalization from October 01, 2018 to January 31, 2023 in Truveta data.

RSV-associated hospitalizations have been grouped such that every hospitalization within 90 days of an RSV-associated hospitalization is considered to be the same infection and thus only counted once.

Analysis

Our study population consists of 15,542 RSV-associated hospitalizations of 15,411 unique patients. To align with seasonality in RSV transmission, time periods include

October 1st through September 30th of the following year. The demographics of patients are as follows:

		. Demograp				
	2018/2019	2019/2020	2020/2021	2021/2022	2022/2023	Overall
	(N=3,635)	(N=3,775)	(N=1,402)	(N=2,600)	(N=3,999)	(N=15,411)
Age Group	-	-		-		-
0 - <6 months	801	757	478	586	893	3,515
	(22.0%)	(20.1%)	(34.1%)	(22.5%)	(22.3%)	(22.8%)
6 - <12 months	286	301	169	209	329	1,294
	(7.9%)	(8.0%)	(12.1%)	(8.0%)	(8.2%)	(8.4%)
1 - <2 years	322	300	188	267	387	1,464
	(8.9%)	(7.9%)	(13.4%)	(10.3%)	(9.7%)	(9.5%)
2 - 4 years	304	280	133	267	496	1,480
	(8.4%)	(7.4%)	(9.5%)	(10.3%)	(12.4%)	(9.6%)
5 - 17 years	72	84	33	92	195	476
	(2.0%)	(2.2%)	(2.4%)	(3.5%)	(4.9%)	(3.1%)
18 - 49 years	179	191	75	211	259	915
	(4.9%)	(5.1%)	(5.3%)	(8.1%)	(6.5%)	(5.9%)
50 - 64 years	366	402	97	247	337	1,449
	(10.1%)	(10.6%)	(6.9%)	(9.5%)	(8.4%)	(9.4%)
65+ years	1,305	1,460	229	721	1,103	4,818
	(35.9%)	(38.7%)	(16.3%)	(27.7%)	(27.6%)	(31.3%)
Sex						
Female	1,890	1,966	682	1,272	2,020	7,830
	(52.0%)	(52.1%)	(48.6%)	(48.9%)	(50.5%)	(50.8%)
Male	1,710	1,785	713	1,314	1,960	7,482
	(47.0%)	(47.3%)	(50.9%)	(50.5%)	(49.0%)	(48.5%)
Unknown	35	24	7	14	19	99
	(1.0%)	(0.6%)	(0.5%)	(0.5%)	(0.5%)	(0.6%)
Race						
White	2,216	2,249	800	1,489	2,254	9,008
	(61.0%)	(59.6%)	(57.1%)	(57.3%)	(56.4%)	(58.5%)
Black or African American	391	439	190	269	357	1,646
	(10.8%)	(11.6%)	(13.6%)	(10.3%)	(8.9%)	(10.7%)
Asian	201	182	51	135	202	771
	(5.5%)	(4.8%)	(3.6%)	(5.2%)	(5.1%)	(5.0%)
American Indian or Alaska Native	36	49	10	30	34	159

Table 1: Demographics

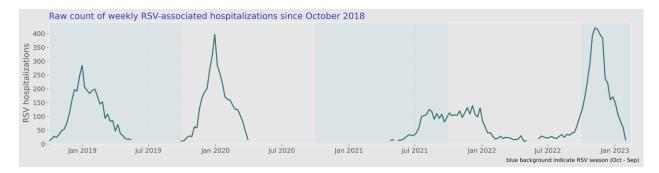
	2018/2019	2019/2020	2020/2021	2021/2022	2022/2023	Overall
	(N=3,635)	(N=3,775)	(N=1,402)	(N=2,600)	(N=3,999)	(N=15,411)
	(1.0%)	(1.3%)	(0.7%)	(1.2%)	(0.9%)	(1.0%)
Native Hawaiian or Other Pacific Islander	24	21	6	23	51	125
	(0.7%)	(0.6%)	(0.4%)	(0.9%)	(1.3%)	(0.8%)
Other Race	525	560	215	376	469	2,145
	(14.4%)	(14.8%)	(15.3%)	(14.5%)	(11.7%)	(13.9%)
Declined to answer	3	11	21	31	121	187
	(0.1%)	(0.3%)	(1.5%)	(1.2%)	(3.0%)	(1.2%)
Unknown	239	264	109	247	511	1,370
	(6.6%)	(7.0%)	(7.8%)	(9.5%)	(12.8%)	(8.9%)
Ethnicity						
Hispanic or Latino	466	488	185	361	583	2,083
	(12.8%)	(12.9%)	(13.2%)	(13.9%)	(14.6%)	(13.5%)
Not Hispanic or Latino	2,430	2,470	998	1,785	2,718	10,401
	(66.9%)	(65.4%)	(71.2%)	(68.7%)	(68.0%)	(67.5%)
Declined to answer	3	6	22	16	67	114
	(0.1%)	(0.2%)	(1.6%)	(0.6%)	(1.7%)	(0.7%)
Unknown	736	811	197	438	631	2,813
	(20.2%)	(21.5%)	(14.1%)	(16.8%)	(15.8%)	(18.3%)

In our population, 7,830 (50.8%) are female, while 7,482 (48.5%) are male. Since October 01, 2018, patients less than five years old constitute the largest age group in RSV-associated hospitalizations (7,753 (50.3%)). The second largest age group with RSV-associated hospitalizations are patients in the 65+ age group (4,818 (31.3%)). When only looking at the current RSV season (2022/2023), 2,105 (52.6%) are less than five years old and 1,103 (27.6%) are aged 65+.

Time series analysis

Figure 1 illustrates the count of RSV-associated hospitalizations in a given week.

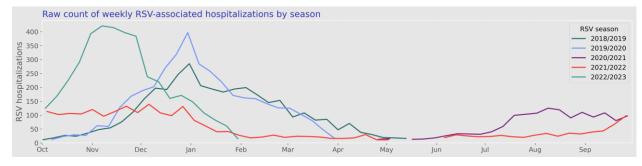
Figure 1: Raw count of weekly RSV-associated hospitalizations since October 2018



Season over season

Figure 2 overlays RSV seasons, starting in October 01, 2018.

Figure 2: Raw count of weekly RSV-associated hospitalizations by season



Infants and children (age 0-4)

Estimates of the hospitalization rate of infants and children (defined as individuals less than five years of age) with RSV are higher than other age groups (Centers for Disease Control and Prevention, 2022b). In Table 2, we report counts for demographic factors of this high-risk population. In the future, we plan to include high-risk comorbid states, such as congenital heart disease, chronic lung disease, preterm birth, asthma, and cystic fibrosis (Committee on Infectious Diseases and Bronchiolitis Guidelines Committee et al., 2014).

	2018/2019	2019/2020	2020/2021	2021/2022	2022/2023	Overall
	(N=1,713)	(N=1,638)	(N=968)	(N=1,329)	(N=2,105)	(N=7,753)
Age Group		-	-	-	-	-
0 - <6 months	801	757	478	586	893	3,515
	(46.8%)	(46.2%)	(49.4%)	(44.1%)	(42.4%)	(45.3%)
6 - <12 months	286	301	169	209	329	1,294
	(16.7%)	(18.4%)	(17.5%)	(15.7%)	(15.6%)	(16.7%)

Table 2: Table 1 for Infants and	Children less than five
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	2018/2019	2019/2020	2020/2021	2021/2022	2022/2023	Overall
	(N=1,713)	(N=1,638)	(N=968)	(N=1,329)	(N=2,105)	(N=7,753)
1 - <2 years	322	300	188	267	387	1,464
	(18.8%)	(18.3%)	(19.4%)	(20.1%)	(18.4%)	(18.9%)
2 – 4 years	304	280	133	267	496	1,480
	(17.7%)	(17.1%)	(13.7%)	(20.1%)	(23.6%)	(19.1%)
Sex						
Female	772	724	426	545	932	3,399
	(45.1%)	(44.2%)	(44.0%)	(41.0%)	(44.3%)	(43.8%)
Male	932	906	542	777	1,170	4,327
	(54.4%)	(55.3%)	(56.0%)	(58.5%)	(55.6%)	(55.8%)
Unknown	9	8	0	7	3	27
	(0.5%)	(0.5%)	(0%)	(0.5%)	(0.1%)	(0.3%)
Race						
White	866	775	543	670	1,010	3,864
	(50.6%)	(47.3%)	(56.1%)	(50.4%)	(48.0%)	(49.8%)
Black or African American	206	232	128	140	173	879
	(12.0%)	(14.2%)	(13.2%)	(10.5%)	(8.2%)	(11.3%)
Asian	116	92	21	63	103	395
	(6.8%)	(5.6%)	(2.2%)	(4.7%)	(4.9%)	(5.1%)
American Indian or Alaska Native	18	21	7	16	18	80
	(1.1%)	(1.3%)	(0.7%)	(1.2%)	(0.9%)	(1.0%)
Native Hawaiian or Other Pacific Islander	19	14	6	14	35	88
	(1.1%)	(0.9%)	(0.6%)	(1.1%)	(1.7%)	(1.1%)
Other Race	369	355	169	237	286	1,416
	(21.5%)	(21.7%)	(17.5%)	(17.8%)	(13.6%)	(18.3%)
Declined to answer	3	5	21	27	112	168
	(0.2%)	(0.3%)	(2.2%)	(2.0%)	(5.3%)	(2.2%)
Unknown	116	144	73	162	368	863
	(6.8%)	(8.8%)	(7.5%)	(12.2%)	(17.5%)	(11.1%)
Ethnicity						
Hispanic or Latino	355	348	153	216	389	1,461
	(20.7%)	(21.2%)	(15.8%)	(16.3%)	(18.5%)	(18.8%)
Not Hispanic or Latino	1,083	1,020	685	888	1,312	4,988
	(63.2%)	(62.3%)	(70.8%)	(66.8%)	(62.3%)	(64.3%)
Declined to answer	1	3	21	14	59	98
	(0.1%)	(0.2%)	(2.2%)	(1.1%)	(2.8%)	(1.3%)
Unknown	274	267	109	211	345	1,206

	2019/2020 (N=1,638)				
(16.0%)	(16.3%)	(11.3%)	(15.9%)	(16.4%)	(15.6%)

Time series analysis

The count of RSV-associated hospitalization for infants and children under five is shown in Figure 3. Figure 4 shows seasonality trends in the count of infants and children with RSV-associated hospitalizations. A rate of weekly RSV-associated hospitalizations compared to all hospitalizations was also calculated. Patients were included in this calculation on the first day of their hospitalization. If their stay was greater than one day, they were not counted in subsequent dates. Seasonal trends in this rate are shown in Figure 5.

Figure 3: Raw count of weekly RSV-associated hospitalizations since October 2018 for infants and children under five

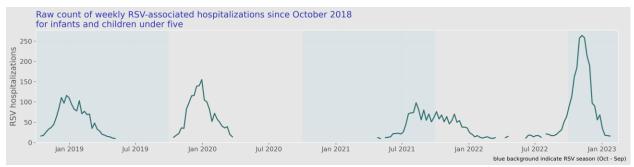


Figure 4: Raw count of weekly RSV-associated hospitalizations by season for infants and children under five

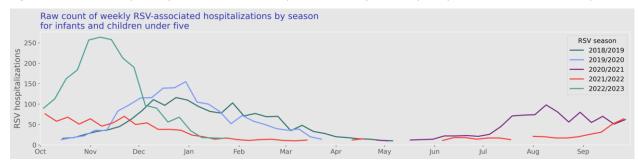
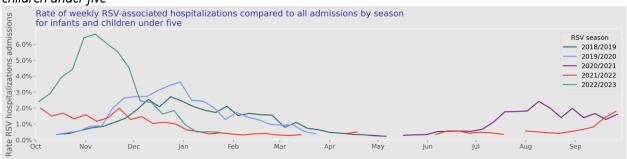


Figure 5: Rate of weekly RSV-associated hospitalizations compared to all admissions by season for infants and children under five



Older adults (age 65 and over)

RSV is also a major source of infection and hospitalizations in older adults (defined here as patients >=65 years of age). Incidence of RSV in older adults has been estimated between 3-10% annually (Boyce et al., 2000).

There are comorbidities that are associated with increased hospitalization risk for older adults, such as congestive heart failure and chronic lung disease (Lee et al., 2013). Further, asthma, COPD, and congestive heart failure can exacerbate RSV infections. Here we report counts for a selection of high-risk medical conditions congestive heart failure, immunocompromised (immunocompromising conditions), chronic lung diseases, chronic obstructive pulmonary disease, and asthma. In the future, we plan to include other high-risk groups.

	2018/2019	2019/2020	2020/2021	2021/2022	2022/2023	Overall
	(N=1,305)	(N=1,460)	(N=229)	(N=721)	(N=1,103)	(N=4,818)
Age Group	-	-		-		
65 - 74 years	443	472	89	276	402	1,682
	(33.9%)	(32.3%)	(38.9%)	(38.3%)	(36.4%)	(34.9%)
75 - 85 years	446	559	82	257	394	1,738
	(34.2%)	(38.3%)	(35.8%)	(35.6%)	(35.7%)	(36.1%)
85+ years	416	429	58	188	307	1,398
	(31.9%)	(29.4%)	(25.3%)	(26.1%)	(27.8%)	(29.0%)
Sex						
Female	793	870	141	430	640	2,874
	(60.8%)	(59.6%)	(61.6%)	(59.6%)	(58.0%)	(59.7%)
Male	499	583	86	287	454	1,909
	(38.2%)	(39.9%)	(37.6%)	(39.8%)	(41.2%)	(39.6%)

Table 3: Table 1 for Older Adults (65 years of age and older)

	2018/2019	2019/2020	2020/2021	2021/2022	2022/2023	Overall
	(N=1,305)	(N=1,460)	(N=229)	(N=721)	(N=1,103)	(N=4,818)
Unknown	13 (1.0%)	- 7 (0.5%)	2 (0.9%)	4 (0.6%)	9 (0.8%)	35 (0.7%)
Race						
White	988	1,075	160	513	818	3,554
	(75.7%)	(73.6%)	(69.9%)	(71.2%)	(74.2%)	(73.8%)
Black or African American	87	108	18	52	62	327
	(6.7%)	(7.4%)	(7.9%)	(7.2%)	(5.6%)	(6.8%)
Asian	58	59	16	45	48	226
	(4.4%)	(4.0%)	(7.0%)	(6.2%)	(4.4%)	(4.7%)
American Indian or Alaska Native	8	14	0	6	5	33
	(0.6%)	(1.0%)	(0%)	(0.8%)	(0.5%)	(0.7%)
Native Hawaiian or Other Pacific Islander	2	4	0	2	4	12
	(0.2%)	(0.3%)	(0%)	(0.3%)	(0.4%)	(0.2%)
Other Race	89	121	19	62	86	377
	(6.8%)	(8.3%)	(8.3%)	(8.6%)	(7.8%)	(7.8%)
Declined to answer	0	6	0	2	5	13
	(0%)	(0.4%)	(0%)	(0.3%)	(0.5%)	(0.3%)
Unknown	73	73	16	39	75	276
	(5.6%)	(5.0%)	(7.0%)	(5.4%)	(6.8%)	(5.7%)
Ethnicity						
Hispanic or Latino	57	59	12	49	71	248
	(4.4%)	(4.0%)	(5.2%)	(6.8%)	(6.4%)	(5.1%)
Not Hispanic or Latino	910	977	169	511	862	3,429
	(69.7%)	(66.9%)	(73.8%)	(70.9%)	(78.2%)	(71.2%)
Declined to answer	2	2	1	2	4	11
	(0.2%)	(0.1%)	(0.4%)	(0.3%)	(0.4%)	(0.2%)
Unknown	336	422	47	159	166	1,130
	(25.7%)	(28.9%)	(20.5%)	(22.1%)	(15.0%)	(23.5%)
Congestive Heart Failure	344	396	48	181	311	1,280
	(26.4%)	(27.1%)	(21.0%)	(25.1%)	(28.2%)	(26.6%)
Immunocompromised	94	103	17	62	97	373
	(7.2%)	(7.1%)	(7.4%)	(8.6%)	(8.8%)	(7.7%)
Chronic Lung Disease	190	196	30	91	163	670
	(14.6%)	(13.4%)	(13.1%)	(12.6%)	(14.8%)	(13.9%)
Obstructive Pulmonary Disease	413	447	66	222	365	1,513
	(31.6%)	(30.6%)	(28.8%)	(30.8%)	(33.1%)	(31.4%)

		2019/2020 (N=1,460)				Overall (N=4,818)
Asthma	218	245	25	123	199	810
	(16.7%)	(16.8%)	(10.9%)	(17.1%)	(18.0%)	(16.8%)

Time series analysis

The count of RSV-associated hospitalization for adults 65 and over is shown in Figure 6. Figure 7 shows seasonality trends for the population of adults 65 and older. Similar to the analysis completed for infants and children, a rate of weekly RSV-associated hospitalizations compared to all hospitalizations was also calculated. Patients were only included once, independent of their length of stay. Seasonal trends in this rate are shown in Figure 8.

Figure 6: Raw count of weekly RSV-associated hospitalizations since October 2018 for adults 65 years or older

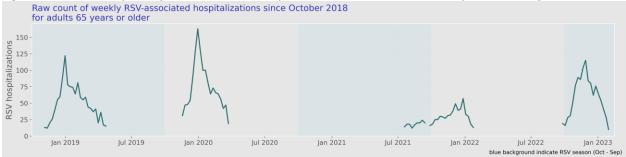


Figure 7: Raw count of weekly RSV-associated hospitalizations by season for adults 65 years or older

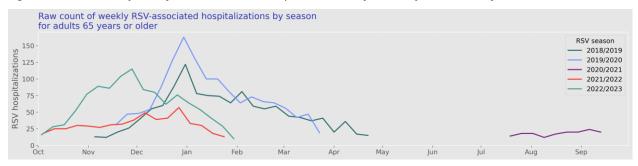
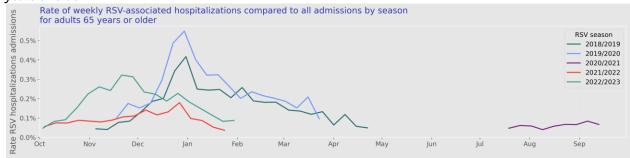


Figure 8: Rate of weekly RSV-associated hospitalizations compared to all admissions by season for adults 65 years or older



Trends in surveillance

Year-over-year trends indicate that overall counts of RSV-associated hospitalizations peaked earlier in the season, at a higher level, and sustained for a longer period (5 weeks) this season than during the 2019/2020 season. The 2019/2020 season was chosen as a comparison as the season occurred before the COVID-19 pandemic. RSV-associated hospitalization counts remained low throughout the beginning of the COVID-19 pandemic both for the overall population and for the specific age groups investigated. Infants and children constituted a larger proportion of the overall population with RSV-associated hospitalized this RSV season (2022/2023) compared to pre-COVID-19 era trends (2019/2020), and this difference is most pronounced in the 2–4-year-old age group. Older adults constituted a smaller proportion of the RSV-associated hospitalized population this season when compared to prior seasons.

This report presents new updated data through the end of January 2023, which suggests RSV-associated hospitalization counts continue to decrease over the last month. This trend is seen in both age groups of interest.

Limitations

- All data are preliminary and may change as additional data are obtained. These findings are consistent with data pulled February 15, 2023.
- These are raw counts and post-stratification methods have not been conducted.
- This analysis would not include patients hospitalized with RSV who were not tested for RSV or were tested later in their medical care (when laboratory tests results would have returned a negative result).
- The unknowns in this report either indicate the value was not included in the individual's electronic health record or that it was excluded from the data to protect an individual's identity as a part of Truveta's commitment to privacy (Truveta, 2022).

Suggested citation

Suggested citation: "Truveta Technical Report: Respiratory Syncytial Virus Hospitalization, Truveta Inc. Truveta.com/research. Accessed on DATE".

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Supplementary material

Table S1: LOINC codes for RSV lab test

Code System	Concept Code	Concept Name
LOINC	5874-3	Respiratory syncytial virus Ag [Presence] in Throat by Immunoassay
LOINC	5875-0	Respiratory syncytial virus Ag [Presence] in Throat by Immunofluorescence
LOINC	5876-8	Respiratory syncytial virus Ag [Presence] in Specimen by Immunoassay
LOINC	5877-6	Respiratory syncytial virus Ag [Presence] in Specimen by Immunofluorescence
LOINC	30075-6	Respiratory syncytial virus A RNA [Presence] in Specimen by NAA with probe detection
LOINC	30076-4	Respiratory syncytial virus B RNA [Presence] in Specimen by NAA with probe detection
LOINC	31949-1	Respiratory syncytial virus Ag [Presence] in Throat
LOINC	31950-9	Respiratory syncytial virus Ag [Presence] in Specimen
LOINC	32040-8	Respiratory syncytial virus Ag [Presence] in Nose by Immunofluorescence
LOINC	33045-6	Respiratory syncytial virus Ag [Presence] in Nose
LOINC	40988-8	Respiratory syncytial virus RNA [Presence] in Specimen by NAA with probe detection
LOINC	50329-2	Respiratory syncytial virus Ag [Presence] in Tissue by Immune stain
LOINC	60271-4	Respiratory syncytial virus RNA [Presence] in Isolate by NAA with probe detection
LOINC	68966-1	Respiratory syncytial virus Ag [Presence] in Nasopharynx by Immunoassay
LOINC	72885-7	Respiratory syncytial virus Ag [Presence] in Nasopharynx by Rapid immunoassay
LOINC	76088-4	Respiratory syncytial virus RNA [Presence] in Bronchoalveolar lavage by NAA with probe detection
LOINC	76089-2	Respiratory syncytial virus RNA [Presence] in Nasopharynx by NAA with probe detection
LOINC	77022-2	Respiratory syncytial virus A RNA [Presence] in Nasopharynx by NAA with probe detection
LOINC	77023-0	Respiratory syncytial virus B RNA [Presence] in Nasopharynx by NAA with probe detection
LOINC	77389-5	Respiratory syncytial virus Ag [Presence] in Bronchoalveolar lavage by Immunofluorescence
LOINC	77390-3	Respiratory syncytial virus Ag [Presence] in Nasopharynx by Immunofluorescence
LOINC	80597-8	Respiratory syncytial virus A 5' UTR RNA [Presence] in Nasopharynx by NAA with probe detection
LOINC	80598-6	Respiratory syncytial virus B F gene [Presence] in Nasopharynx by NAA with probe detection

Code System	Concept Code	Concept Name
LOINC	82176-9	Respiratory syncytial virus RNA [Presence] in Nasopharynx by NAA with non-probe detection
LOINC	85479-4	Respiratory syncytial virus RNA [Presence] in Upper respiratory specimen by NAA with probe detection
LOINC	88595-4	Respiratory syncytial virus A RNA [Presence] in Lower respiratory specimen by NAA with probe detection
LOINC	88597-0	Respiratory syncytial virus B RNA [Presence] in Lower respiratory specimen by NAA with probe detection
LOINC	88909-7	Respiratory syncytial virus Ag [Presence] in Lower respiratory specimen by Immunofluorescence
LOINC	91133-9	Respiratory syncytial virus RNA [Presence] in Lower respiratory specimen by NAA with probe detection
LOINC	91794-8	Respiratory syncytial virus B RNA [Presence] in Upper respiratory specimen by NAA with probe detection
LOINC	91795-5	Respiratory syncytial virus A RNA [Presence] in Upper respiratory specimen by NAA with probe detection
LOINC	92131-2	Respiratory syncytial virus RNA [Presence] in Respiratory specimen by NAA with probe detection
LOINC	92957-0	Respiratory syncytial virus RNA [Presence] in Lower respiratory specimen by NAA with non- probe detection

Table S1: LOINC Codes for RSV lab test

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