

# Viruses Associated with Acute Respiratory Illnesses in Hospitalized Pediatric Patients 5-17 Years of Age in the US

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## Abstract

**Background:** Knowledge about the etiology of acute respiratory illnesses (ARI) in hospitalized children ≥5 years of age and adolescents is limited.

**Methods:** Children 5-17 years of age hospitalized with ARI were enrolled through active surveillance at 6 pediatric hospitals in the New Vaccine Surveillance Network (NVSN) between 10/1/2015 and 3/31/2016. Combined mid-turbinate and throat swabs were collected and tested for adenovirus, influenza, human metapneumovirus (HMPV), parainfluenza viruses (PIV), rhinovirus/enterovirus (HRV), and respiratory syncytial virus (RSV) using molecular techniques at each site.

**Results:** Among 479 children, viruses were detected in 254 (53%) in preliminary analysis. Median age of children was 8.3 years; 267 (56%) were male, 236 (49%) were white, and 329 (69%) were publicly insured. A single virus was detected in 234 (49%) samples; ≥2 viruses were identified in 15 (3%) samples. HRV was most commonly detected (n=152, 32%), followed by RSV (n=40, 8%), and influenza (n=27, 6%).

**Conclusion:** Current data using molecular diagnostics to identify viruses in children hospitalized with ARI could improve prevention, evaluation, and treatment by healthcare professionals and inform future vaccine policy.

## Introduction

- Although much is known about the etiology of ARI in hospitalized children <5 years of age, data are lacking for older hospitalized children with ARI.

## Methods

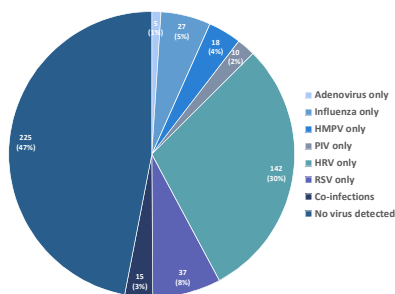
- Active surveillance was conducted among children 5-17 years of age hospitalized with ARI at 6 pediatric hospitals participating in the Centers for Disease Control and Prevention's New Vaccine Surveillance Network during October through March, 2016
- Children meeting the following criteria were eligible for enrollment:
  - Admitted within past 48 hours
  - Residence in defined site-specific surveillance area
  - Hospitalized with fever and/or respiratory symptoms
  - Symptom onset within past 14 days

## Methods

- Children were ineligible for enrollment if:
  - Admitted for fever and neutropenia (ANC <500/μL)
  - Had a known, non-respiratory cause of illness
  - Admitted <5 days after a prior hospitalization
  - Previously enrolled <14 days prior
  - Newborns who had not been discharged home
- Data were collected using standardized case report forms
  - Illness history
  - Demographic factors
  - Hospital course
- Combined mid-turbinate and throat swabs were obtained and tested for adenovirus, influenza, HMPV, PIV, HRV, and RSV using molecular techniques at each site

## Results

Figure 1. Virus detection



## Results

Table 1. Demographic characteristics of children with ARI, by virus detected

	Adenovirus n=12 (3%)	Influenza n=27 (6%)	HMPV n=21 (4%)	PIV n=13 (3%)	HRV n=152 (32%)	RSV n=40 (8%)	Co-infections n=15 (3%)
Male, n (%)	9 (75)	12 (44)	13 (62)	6 (46)	96 (63)	21 (53)	10 (67)
Age (year)	7.4	9.5	7.6	6.5	7.8	7.2	6.4
Median, range	5.2-13.3	5.5-16.8	5.6-16.0	5.6-15.7	5.0-17.7	5.0-16.6	5.1-11.5
Race, n (%)							
White	8 (67)	13 (48)	13 (62)	7 (54)	65 (43)	23 (58)	7 (47)
Black	4 (33)	7 (26)	5 (24)	2 (15)	55 (36)	11 (28)	7 (47)
Other	--	7 (26)	3 (14)	4 (31)	32 (21)	6 (14)	1 (6)
Ethnicity, n (%)							
Hispanic	3 (25)	8 (30)	5 (24)	5 (38)	35 (23)	14 (35)	2 (13)
Non-Hispanic	9 (75)	19 (70)	16 (76)	8 (62)	115 (76)	26 (65)	13 (87)
Unknown	--	--	--	--	2 (1)	--	--
Insurance, n (%)							
Public	6 (50)	21 (78)	15 (71)	8 (62)	110 (72)	24 (60)	12 (80)
Private	6 (50)	5 (19)	6 (29)	5 (38)	37 (24)	16 (40)	3 (20)
None	--	1 (4)	--	--	5 (3)	--	--

Table 2. Clinical presentation

	Virus Detected n=254 N (%)	No Virus Detected n=225 N (%)	P-value
Cough	246 (97)	204 (91)	<b>0.015</b>
Dyspnea	222 (87)	174 (77)	<b>0.013</b>
Wheezing	197 (78)	146 (65)	<b>0.001</b>
Retractions	178 (70)	124 (55)	<b>0.001</b>
Apnea	19 (7)	16 (7)	0.470
Nasal congestion	209 (82)	138 (61)	<b>&lt;0.001</b>
Ear pain	15 (6)	14 (6)	0.874
Sore throat	26 (10)	17 (8)	0.262
Chronic condition	235 (93)	184 (82)	<b>&lt;0.001</b>

Table 3. Hospital course

	Virus Detected n=254 N (%)	No Virus Detected n=225 N (%)	P-value
ICU stay	53 (21)	35 (16)	0.20
Supplemental O <sub>2</sub>	146 (57)	122 (54)	0.54
Intubation	8 (3)	4 (2)	0.35
Cyanosis*	4 (2)	5 (2)	0.59
Mean LOS (days)	3.2	4.3	0.16
Max. respiration rate (breaths/min)*	36.2	34.3	0.07
Min. O <sub>2</sub> saturation (%)*	92.0	93.6	<b>0.003</b>

\*In first 24 hours of hospitalization

## Results

- Respiratory specimens were obtained from 479 children 5-17 years of age.
- Median age of children was 8.3 years; 267 (56%) were male, 236 (49%) were white, and 329 (69%) were publicly insured.
- A viral cause of illness was identified in 254 of 479 (53%) hospitalized children with ARI.
- HRV was most commonly detected (32%), followed by RSV (8%), influenza (6%), HMPV (4%), PIV (3%), and adenovirus (3%).
- Children from whom a respiratory virus was identified were more likely to present with cough, dyspnea, wheezing, nasal congestion, and to have a chronic medical condition than children from whom no virus was identified.
- No differences were observed in mean length of stay, admission to an ICU, use of supplemental oxygen, intubation, cyanosis, or maximum respiration rate in children from whom a virus was identified compared with those from whom no virus was identified.

## Conclusions

- Current data using molecular diagnostics to identify the viral causes of ARI in hospitalized children ≥5 years of age could be used to improve prevention, evaluation, and treatment by healthcare professionals.
- Information about the burden of respiratory viruses in children ≥5 years could be used to inform vaccine development and policy.

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