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Epidemiologic, clinical, and virologic characteristics of human rhinovirus infection among otherwise healthy children and adults Rhinovirus among adults and children

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ABSTRACT

Background: human rhinovirus (HRV) is a major cause of influenza-like illness (ILI) in adults and children. Differences in disease severity by HRV species have been described among hospitalized patients with underlying illness. Less is known about the clinical and virologic characteristics of HRV infection among otherwise healthy populations, particularly adults.
Objectives: to characterize molecular epidemiology of HRV and association between HRV species and clinical presentation and viral shedding.
Study design: observational, prospective, facility-based study of ILI was conducted from February 2010 to April 2012. Collection of nasopharyngeal specimens, patient symptoms, and clinical information occurred on days 0, 3, 7, and 28. Patients recorded symptom severity daily for the first 7 days of illness in a symptom diary. HRV was identified by RT-PCR and genotyped for species determination. Cases who were co-infected with other viral respiratory pathogens were excluded from the analysis. We evaluated the associations between HRV species, clinical severity, and patterns of viral shedding.
Results: eighty-four HRV cases were identified and their isolates genotyped. Of these, 62 (74%) were >18 years. Fifty-four were HRV-A, 11HRV-B, and 19HRV-C. HRV-C infection was more common among children than adults (59% vs. 10%, $P < 0.001$). Among adults, HRV-A was associated with higher severity of upper respiratory symptoms compared to HRV-B ($P = 0.02$), but no such association was found in children. In addition, adults shed HRV-A significantly longer than HRV-C (P trend = 0.01).
Conclusions: among otherwise healthy adults with HRV infection, we observed species-specific differences in respiratory symptom severity and duration of viral shedding.

1. Background

Human rhinovirus (HRV)—the most prevalent respiratory virus—causes up to half of common colds [1,2] and imposes a significant economic burden [3]. HRV has also been associated with bronchiolitis [4], pneumonia [5], and exacerbation of breathing difficulties in populations with underlying respiratory conditions,

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Table 1
Characteristics of HRV patients by species.

	Total	Among rhinovirus positive ($n=84$)						P[a]
		HRV-A ($n=54$)		HRV-B ($n=11$)		HRV-C ($n=19$)		
	N	*N*	(%)	*N*	(%)	*N*	(%)	
Age (years)								
0–17	22	9	(40.9)	0	(0.0)	13	(59.1)	<0.01
18–65	62	45	(72.6)	11	(17.7)	6	(9.7)	
Sex								
Male	48	31	(64.6)	6	(12.5)	11	(22.9)	1.00
Female	36	23	(63.9)	5	(13.9)	8	(22.2)	
Study site[b]								
SAMHS, San Antonio, TX	3	2	(66.7)	0	(0.0)	1	(33.3)	0.71
NMCSD, San Diego, CA	13	6	(46.1)	3	(23.1)	4	(30.8)	
NMCP, Portsmouth, VA	64	43	(67.2)	8	(12.5)	13	(20.3)	
MAMC, Tacoma, WA	4	3	(75.0)	0	(0.0)	1	(25.0)	
Ethnicity								
Caucasian	57	39	(68.4)	6	(10.5)	12	(21.1)	0.09
African American	17	6	(35.3)	4	(23.5)	7	(41.2)	
Asian	4	4	(100)	0	(0.0)	0	(0.0)	
Other	6	5	(83.3)	1	(16.7)	0	(0.0)	
Current smoker (only for patients >13 years of age)[c]								
Yes	17	10	(22.2)	4	(36.4)	3	(50.0)	0.21
No	45	35	(77.8)	7	(63.6)	3	(50.0)	
N/A[c] or missing	22	9		0		13		
Smoker in the household								
Yes	28	19	(67.9)	3	(10.7)	6	(21.4)	0.87
No	49	32	(65.3)	4	(8.2)	13	(26.5)	
Missing		3		4		0		
Children attending daycare								
Yes	7	3	(42.9)	0	(0.0)	4	(57.1)	1.00
No	13	6	(46.2)	0	(0.0)	7	(53.8)	
N/A[d] or missing	64	45		11		8		
Household member attending daycare								
Yes	24	16	(66.7)	2	(8.3)	6	(25.0)	1.00
No	51	34	(66.7)	5	(9.8)	12	(23.5)	
Missing	9	4		4		1		
Hospitalization								
Yes	4	2	(50.0)	0	(0.0)	2	(50.0)	0.30
No	80	52	(65.0)	11	(13.7)	17	(21.3)	

[a] *P*-value of exact test.
[b] SAMHS: San Antonio Military Health System, TX, NMCSD: Naval Medical Center San Diego, CA, NMCP: Naval Medical Center Portsmouth, VA, MAMC: Madigan Army Medical Center, Tacoma, WA.
[c] This question was not available to children under 13 years of age.
[d] This question was not available to adults and was excluded from the analysis.

including asthma, cystic fibrosis, and chronic obstructive pulmonary disease (COPD) [6–8]. Prior to the era of molecular testing, rhinovirus was considered to be a relatively mild pathogen of questionable importance. However, with the ability to more readily identify HRV infection and species—including the newly identified species (HRV-C)—evidence is emerging that severity of HRV may be dependent upon the species and/or serotype.

The three species of HRV (A–C) comprise a large group of genetically diverse viruses with more than 150 serotypes [9,10]. HRV-A and C are associated with more severe clinical manifestations in children [11–13] and adults [14]. In particular, HRV-C is associated with more severe illness in young children, particularly those with asthma [12,15,16] or cystic fibrosis [17]. However, less is known about the epidemiology and clinical characteristics of HRV infection in otherwise healthy populations, especially adults without underlying illness. Moreover, little is known about the persistence of HRV shedding, which may influence duration of symptoms, clinical course, and infectiousness.

2. Objectives

The objective of the study was to understand the full spectrum of HRV disease and species-specific differences in symptom severity, clinical course, and viral shedding among patients with HRV infection in a longitudinal study of influenza-like illness (ILI) among otherwise healthy individuals.

3. Study design

3.1. Overview of the ARIC study

Established in July 2009, the Acute Respiratory Infection Consortium (ARIC) is a multi-site, multi-disciplinary clinical research network for the study of ILI among otherwise healthy military personnel and beneficiaries. At the core of the ARIC is the natural history study, an observational, longitudinal cohort study to determine the etiology, epidemiology, and clinical characteristics