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Etiology and Incidence of Viral Acute Respiratory Infections among Refugees Aged 5 Years and Older in Hagadera Camp, Dadaab, Kenya

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Abstract. We used the Centers for Disease Control and Prevention–Kenya Medical Research Institute Acute Respiratory Infection (ARI) Surveillance System data to estimate severe acute respiratory infection (SARI) hospitalization rates, viral etiology, and associated complaints of influenza-like illnesses (ILI) and SARI conditions among those aged 5 years and older in Hagadera, Dadaab refugee camp, Kenya, for 2010–2012. A total of 471 patients aged ≥ 5 years met the case definition for ILI or SARI. SARI hospitalization rates per 10,000 person-years were 14.7 (95% confidence interval [CI] = 9.1, 22.2) for those aged 5–14 years; 3.4 (95% CI = 1.6, 7.2) for those aged 15–24 year; and 3.8 (95% CI = 1.6, 7.2) for those aged ≥ 25 years. Persons between the ages of 5 and 14 years had 3.5 greater odds to have been hospitalized as a result of SARI than those aged ≥ 25 years (odds ratio [OR] = 3.5, $P < 0.001$). Among the 419 samples tested, 169 (40.3%) were positive for one or more virus. Of those samples having viruses, 36.9% had influenza A; 29.9% had adenovirus; 20.2% had influenza B; and 14.4% had parainfluenza 1, 2, or 3. Muscle/joint pain was associated with influenza A ($P = 0.002$), whereas headache was associated with influenza B ($P = 0.019$). ARIs were responsible for a substantial disease burden in Hagadera camp.

INTRODUCTION

Refugee camps may host large numbers of people in a confined area; these people are especially prone to infectious diseases and are at a higher risk of developing acute respiratory infections (ARIs) due to overcrowding, inadequate food and shelter, and malnutrition.[1] Globally, as of the end of 2013, the United Nations High Commissioner of Refugees (UNHCR) reported an estimated 11.7 million refugees worldwide. This figure represents the highest number of refugees UNHCR has seen since 2001; many of whom have been housed for years in protracted camp settings, including those in Kenya.[2]

Overall, pneumonia is a leading cause of mortality among all age groups in crisis.[3] ARIs, in general, are the largest baseline contributor to disability-adjusted life years.[3] Even with this huge burden, humanitarian responses do not prioritize interventions directly targeting pneumonia.[4] Although ARI-attributable mortality is known to decline with age after the first 5 years of life,[4] the burden in older children and adults is uncertain. There are few comprehensive data available on etiologies of ARIs in older children and adults in Africa, and even fewer among camp-based refugees.[5] The World Health Organization (WHO) recommends presumptive diagnosis and treatment of these illnesses based on clinical symptoms.[6] However, recent studies raise concerns over the frequency of treatment failure in Africa.[7] This raises the question that whether these infections might be of viral etiology and therefore not treatable with antibacterial agents. Determining the burden and the viral etiology of ARIs is an important step in designing specific interventions such as vaccinations and other preventive measures, and perhaps reducing the overreliance on antibacterial agents for treatment of ARIs among children and adults over the age of 5 years.

This study examines the burden and viral etiologies of ARI among older children and adults and makes recommendations for the prevention of ARIs.

METHODS

Setting. Dadaab refugee camps are located in Garissa County, Kenya, about 100 km from the Kenya–Somalia border, and have existed since the early 1990s. As of December 30, 2012, Dadaab hosted 456,774 refugees and Hagadera, one of five camps within Dadaab, hosted 140,592 refugees alone (E. Moturi, UNHCR, personal communication, January 2013). The Hagadera camp has five health posts and one hospital.

Data sources. In 2007, the U.S. Centers for Disease Control and Prevention (CDC) and Kenya Medical Research Institute (KEMRI), in conjunction with UNHCR established the Hagadera ARI Surveillance System. The International Rescue Committee began providing support for the system in 2009. This system collects facility-based patient data from one of the five health posts and from the hospital for patients whose signs and symptoms match the WHO case definition of influenza-like illnesses (ILI) and severe acute respiratory infections (SARI). An ILI is a nonspecific ARI with the case definition of fever and cough and/or sore throat. A patient with SARI is a person meeting the ILI case definition and, in addition, having shortness of breath or difficulty breathing and requiring hospital admission. There is considerable overlap between the different case definitions and one may progress to the other.[5] All patients meeting SARI case definition and the first three meeting the ILI case definition daily from January 2010 to December 2012 were eligible for inclusion in the ARI Surveillance System and testing. Demographic and medical information were collected and entered daily into Microsoft® Excel 2010 (Microsoft Corp., Silicon Valley, CA) and analyzed using Epi-Info 7 (CDC, Atlanta, GA). Nasopharyngeal and oropharyngeal swabs from eligible, consenting patients were collected and processed for influenza A and B

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Table 1
Total population figures from HIS and age distribution based on UNHCR ProGres database proportions, Hagadera Refugee Camp, 2010–2012

Age group* (years)	% Population	Total population 2010	Total population 2011	Total population 2012	Total population (3 years average: 2010–2012)
< 5	15.28	15,668	18,914	21,374	18,652
> 5	84.72	86,873	104,866	118,509	103,416
5–14	33.47	34,320	41,429	46,819	40,856
15–24	20.12	20,631	24,905	28,144	24,560
25–54	26.37	27,040	32,641	36,887	32,189
≥ 55	4.75	4,871	5,880	6,644	5,798
Total (HIS)	100	102,541	123,780	139,883	122,068

HIS = health information system; UNHCR = the United Nations High Commissioner of Refugees.
*Age group populations were rounded off to the nearest one digit.

viruses, respiratory syncytial virus (RSV), adenovirus, parainfluenza serotypes 1, 2, and 3 (PIV 1–PIV 3), and human metapneumovirus (hMPV), as described previously.[1]

The Health Information System (HIS) is a standardized tool used by UNHCR to design, monitor, and evaluate refugee public health programs with the aim of improving the health status of refugees.[8] UNHCR HIS provides camp-based populations by two age groups (< 5 and ≥ 5 years) and was used for population figures for the three study years. The UNHCR ProGres† database of camp population and detailed age structure information was available only for May 2014. Since the HIS database had only two age groups (< 5 and 5 years and older), the 2014 ProGres age structure proportions for 2014 were used to extrapolate detailed age group populations for 2010, 2011, and 2012 (Table 1).[8]

Data analysis. *Rates of SARI hospitalization.* The rates of SARI hospitalization per 10,000 persons per year were calculated by dividing the total number of SARI cases by the age-specific population per 10,000 persons. The 3-year average was calculated by taking the average cases for the 3-year study period and dividing by the average age-specific populations for the 3 years.

Viral etiology and additional presenting symptoms. The frequency distribution of viral etiology of ILI and SARI for the 3-year period among children and adults 5 years and older was determined. For the 3-year period, a frequency distribution of the other presenting complaints—headache, lethargy, nausea, diarrhea, muscle/joint pain, and convulsions—was determined for each viral etiology. Viral etiology was used as an exposure variable for the outcome of ILI or SARI to determine whether there was an association between etiology and the ARI syndrome identified in the patient. Presenting symptoms were also used as exposure variables for the outcome of "any viral etiology present" or "specific viral etiology present" or "not present" to determine whether certain symptoms were associated with specific viral etiology. Prevalence ratio was used as a measure of association between exposure and outcome of interest. Finally, virus-specific SARI hospitalization rates for the three common isolated viruses were determined by dividing the number of enrolled patients with a specific virus by the age-specific population. Rate and odds ratios were compared using χ^2 test. Proportions were compared using Mantel–Haenszel method for χ^2 test. Fischer exact test was used when the cell value was less than 5. A P value of < 0.05 was considered significant.

Ethical considerations. A Non-Research Determination for this analysis was granted by Emory University and CDC. Permission to use data from the two sources was obtained from both CDC Kenya and UNHCR. To conduct this study, no personal identifiers were collected. The ARI surveillance activity was undertaken under KEMRI protocol no. 2654.

RESULTS

Burden of disease. Using the ProGres age structure proportions for 2014 gave the 3-year average for the four age categories (Table 1).

Between January 2010 and December 2012, 471 patients aged 5 years or older (range 5–70 years, mean 13.1 years, median 8.0 years) who met the case definition of either ILI or SARI were enrolled in ARI surveillance, with 217 (53.9%) having ILI and 254 (46.1%) having SARI. Of these, 345 patients (73.3%) were between 5 and 14 years, 54 (11.5%) were between 15 and 24 years, 67 (14.2%) were between 25 and 54 years, and 5 (1.1%) were 55 years old or older. There were slightly more males (259, 55.0%) than females (212, 45.0%), but there was no evidence of an association between gender and presentation with either ILI or SARI.

The SARI hospitalization rates per 10,000 person-years were 14.7 (95% CI = 9.1, 22.2) for those aged 5–14 years, 3.4 (95% CI = 1.6, 7.2) for those aged 14–24 years, and 3.8 (95% CI = 1.6, 7.2) for those aged 25 years or older. Compared with the ≥ 25 year-old age group, there was a high SARI hospitalization rate among the 5- to 14-year-old age group (rate ratio 3.5, $P < 0.001$) and a decreased hospitalization rate among the 15- to 24-year-old age group (rate ratio 0.8, $P < 0.120$) (Table 2).

Viral etiology and additional presenting symptoms. Of the 471 patients aged ≥ 5 years with ARI, 419 (90.0%) had samples tested. Among the 419 samples tested, 169 (40.3%) were found to have at least one virus. This included 62 patients (36.9%) with influenza A; 50 (29.9%) with adenovirus; 34 (20.2%) with influenza B; 24 (14.4%) with parainfluenza serotypes 1, 2, and 3; 16 (9.5%) with RSV; and 14 (8.4%) with hMPV (Table 3). A total of 18.3% patients had more than one virus isolated. Adenovirus was most frequently associated with more than one virus isolated in a specimen, ranging from two times in specimens containing influenza B virus to nine times in samples containing parainfluenza (1, 2, or 3).

At least one virus was detected in 86 (39.3%) of the 165 SARI patients tested. The most common viruses detected were influenza A (37/85 [43.5%]) and adenovirus (24/84

†ProGres is the UNHCR standardized system for refugee registration developed with Microsoft and other partners (http://www.microsoft.com/publicsector/ww/international-organizations/projects/Pages/proGres-refugee-registration-platform.aspx).

TABLE 2

SARI hospitalization rates per 10,000 persons among those aged 5 years and older, Hagadera Refugee Camp, 2010–2012, ARI surveillance

Age group*	SARI hospitalization rate per 10,000 (*n*, %) 2010	SARI hospitalization rate per 10,000 (*n*, %) 2011	SARI hospitalization rate per 10,000 (*n*, %) 2012	Average cases per year 2010–2012	Average SARI rate per 10,000, 2010–2012 (rate ratio, *P* value)
5–14 years	23.3 (73, 84.9)	18.3 (76, 67.9)	6.8 (32, 57.1)	60	14.7 (3.5, < 0.001)
15–24 years	1.5 (3, 3.5)	6.4 (16, 14.3)	2.1 (7, 12.5)	9	3.4 (0.8, 0.120)
≥ 25 years	3.1 (10, 11.6)	5.2 (20, 17.9)	3.0 (17, 30.4)	16	3.8 (REF)
All ages	8.4 (86, 100)	9.2 (112, 100)	3.6 (56, 100)	85	6.8 (NA)

ARI = acute respiratory infection; SARI = severe respiratory infection; REF = reference; NA = not applicable.
*Age groups estimated from UNHCR ProGres database proportions.

[28.6%]) (Table 3). At least one virus was detected in 41.5% of the 200 patients tested with ILI, with adenovirus (26/83 [31.3%]), influenza A (25/83 [30.1%]), and influenza B (21/83 [25.3%]) contributing the majority of the cases (Table 3). There was no statistical evidence of association between viral etiology and having ILI or SARI (Table 3).

Among the enrolled 471 patients diagnosed with ARI symptoms included in the case definition, cough was present in 457 (97.0%) and sore throat was present in 304 (65.0%). Both cough and sore throat were present in 291 (64.1%) of the enrolled ARI patients. Additional common symptoms were headache 205 (43.7%), lethargy 180 (38.2%), nausea 109 (23.3%), and muscle/joint pains in 77 (16.5%). Of the 254 SARI cases, 244 (96.1%) presented with cough and 115 (45.8%) had sore throat. Both cough and sore throat were present in 106 (44.0%). Of the 217 patients who met the case definition of ILI, 123 (98.2%) had cough and 189 (87.1%) had sore throat. Headache (32.9%) and lethargy (11.1%) were also common among enrolled patients with ILI. Other common symptoms such as headache, lethargy, nausea, and muscle pain were more frequent among patients with SARI compared with those with ILI ($P < 0.001$).

After running univariate analysis among all the patients with ARI, lethargy was found to be significantly associated with the isolation of any virus from a specimen (prevalence ratio [PR] = 1.5, $P = 0.026$), whereas muscle/joint pain was associated with the isolation of influenza A (PR = 2.2, $P = 0.002$), and headache was associated with the isolation of influenza B (PR = 2.2, $P = 0.019$). Among patients with SARI, muscle/joint pain continued to be associated with isolation of influenza A (PR = 1.9, $P = 0.004$) and also with RSV (PR = 4.6, $P = 0.0096$), whereas headache was negatively associated with isolation of hMPV (PR = 0.1, $P = 0.008$). Finally, among patients with ILI, only isolation of influenza B was associated with headache (PR = 2.7, $P = 0.024$) (Table 4).

The rate of SARI hospitalization among those aged 5 years and older was 6.0 (95% CI = 4.6, 7.6) per 10,000 per year for influenza A, 4.8 per 10,000 (95% CI = 3.6, 6.3) for adenovirus, and 3.3 per 10,000 (95% CI = 2.3, 4.5) for influenza B. Among children aged 5–14 years with SARI, adenovirus and influenza A had similar hospitalization rates per 10,000 (11.0 and 11.7 per 10,000, respectively). Although influenza A affected the oldest age groups more than adenovirus (1.6 and 0.5 per 10,000, respectively), this was not found to be significantly different. Because the rates may have been unstable among the two age groups 15 years and older, especially for adenovirus and influenza B due to the small numerators, we aggregated these two upper age groups but there was still no significant difference (Table 5). Influenza B for all ages was less often isolated and therefore had lower rates compared with influenza A and adenovirus across all estimated age groups (3.3 versus 6.0 and 4.8 per 10,000, respectively).

DISCUSSION

Our study demonstrated that the burden of ARIs among children and adults older than 5 years in Hagadera, Dadaab refugee camp was substantial, especially among those aged 5–14 years. The age-specific SARI hospitalization rate was highest in the 5- to 14-year-old age group, and it was almost four times higher compared with the ≥ 25-year-old age group, suggesting more disease burden and severity in this age group. Our results are similar to the findings in two studies conducted in a crisis setting and a noncrisis setting in sub-Saharan Africa, respectively.[4,5] The high burden of ARI in crisis-affected areas was reported by Bellos and others in a review article that evaluated 25 conflict-affected areas, 18 of which were refugee camps. In that review, respiratory tract infections were consistently ranked among the highest in both admissions and cause-specific mortality in both children

TABLE 3

Viral etiology of ILI vs. SARI cases among those 5 years and older, Hagadera Refugee Camp, 2010–2012, ARI surveillance

	ARI	ILI	SARI	
	n (%; CI)	*n* (%; CI)	*n* (%; CI)	OR (*P* value)
At least one virus	169/419 (40.3; 35.6, 45.2)	83/200 (41.5; 34.6, 48.7)	86/169 (39.3; 32.8, 46.1)	REF
Adenovirus	50/167 (29.9; 23.1, 38.0)	26/83 (31.3; 21.6, 42.4)	24/84 (28.6; 19.2, 39.5)	1.140 (0.699)
Influenza A	62/168 (36.9; 29.6, 44.7)	25/83 (30.1; 20.5, 41.2)	37/85 (43.5; 32.8, 54.7)	0.559 (0.073)
Influenza B	34/168 (20.2; 14.4, 27.1)	21/83 (25.3; 16.4, 36.0)	13/85 (15.3; 8.4, 24.7)	1.876 (0.108)
Parainfluenza 1,2,3	24/167 (14.4; 9.4, 20.6)	12/82 (14.6; 7.8, 24.2)	12/85 (14.1; 7.5, 23.4)	1.043 (0.924)
hMPV	14/167 (8.4; 4.7, 13.7)	4/83 (4.8; 1.3, 11.9)	10/84 (11.9; 5.86, 20.8)	0.375 (0.100)
RSV	16/168 (9.5; 5.5, 15.0)	11/83 (13.3; 6.8, 22.5)	5/85 (5.9; 1.9, 13.2)	2.44 (0.105)

CI = confidence interval; hMPV = human metapneumovirus; ILI = influenza-like illness; OR = odds ratio; RSV = respiratory syncytial virus; SARI = severe acute respiratory infection; REF = reference.

TABLE 4
Association between of muscle/joint pains and type of viruses isolated among those aged 5 years and older, Hagadera Refugee Camp, 2010–2012, ARI surveillance

		Muscle/joint pains		Headache		Lethargy	
	Virus isolated	Prevalence ratio	*P* value	Prevalence ratio	*P* value	Prevalence ratio	*P* value
ARI	Any virus	1.0	1.0	1.3	0.069	1.5	0.026
	Adenovirus	0.7	0.437	1.0	0.880	1.3	0.475
	Influenza A	2.2	0.002	1.3	0.266	1.6	0.134
	Influenza B	0.4	0.248	2.2	0.019	1.0	0.696
	hMPV	0	0.606	0.5	0.411	2.1	1.000
	RSV	1.5	0.437	0.8	0.799	0.5	0.186
	Parainfluenza	0.6	0.742	1.4	0.420	0.9	0.661
SARI	Any virus	0.9	0.872	1.2	0.331	1.2	0.255
	Adenovirus	0.8	0.803	1.5	0.386	1.2	0.823
	Influenza A	1.9	0.004	1.3	0.467	1.6	0.193
	Influenza B	0.3	0.194	2.1	0.254	1.9	0.382
	hMPV	0	0.07	0.1	0.008	0.9	1.0
	RSV	4.6	0.096	1.4	1.0	0.9	1.000
	Parainfluenza	0.6	0.739	1.5	0.571	0.9	1.000
ILI	Any virus	0.6	0.644	1.4	0.092	1.4	0.176
	Adenovirus	0	1.0	0.8	0.654	2.2	0.099
	Influenza A	0	1.0	1.2	0.6547	1.5	0.501
	Influenza B	2.4	0.365	2.7	0.024	1.2	0.717
	hMPV	0	1.0	6.1	0.104	7.6	0.072
	RSV	0	1.0	0.8	1.0	0.8	1.000
	Parainfluenza	0	1.0	1.3	0.76	1.4	0.652

ARI = acute respiratory infection; hMPV = human metapneumovirus; ILI = influenza-like illness; RSV = respiratory syncytial virus; SARI = severe acute respiratory infection.

under 5 years and older age groups. Two of the studies compared precrisis and crisis situations and showed the greatest excess risk of mortality occurred among children aged 5–14 years and adults.[5] This might be explained by the exclusion of children above the age of 5 years from routine childhood immunization and nutrition feeding programs since they may still be vulnerable to risk of infections and malnutrition, especially in crisis areas. The overall 2011 SARI hospitalization rate was higher than that of 2010 and 2012. In 2011, the camp had the highest population growth and malnutrition rates (global acute malnutrition prevalence rate among children aged < 5 years was 13.4%), greatest overcrowding, and the largest measles outbreak (attributed to 17% of all deaths) of the 3-year study period.[9,10] Therefore, this greater SARI rate was partly explained by the complications of measles and malnutrition in the camp that followed the 2011 Horn of Africa food crisis, which also affected older age groups.[9,10]

TABLE 5
Virus-specific SARI hospitalization rates for three common isolated viruses among those aged 5 years and older, Hagadera Refugee Camp, 2010–2012, ARI surveillance

Virus	Age group* (years)	SARI (*n*)	SARI rate per 10,000 (95% CI)
Adenovirus	5–14	45	11.0 (8.1,14.6)
	15–24	3	1.2 (0.3, 3.3)
	≥ 25	2	0.5 (0.1, 1.7)
	≥ 15	5	0.8 (0.3, 1.9)
	All age groups	50	4.8 (3.6, 6.3)
Influenza A	5–14	48	11.7 (8.8, 15.4)
	15–24	8	3.3 (1.5, 6.2)
	≥ 25	6	1.6 (0.6, 3.3)
	> 15	14	2.4 (1.3, 3.9)
	All age groups	62	6.0 (4.6, 7.6)
Influenza B	5–14	26	6.4 (4.2, 9.2)
	15–24	5	2.0 (0.7, 4.5)
	≥ 25	3	0.8 (0.2, 2.1)
	≥ 15	8	1.3 (0.6, 5.5)
	All age groups	34	3.3 (2.3, 4.5)

ARI = acute respiratory infection; CI = confidence interval; SARI = severe acute respiratory infection.
*Age groups from the UNHCR ProGres database proportions.

Viral causes of ARI, especially adenovirus and influenza A and B, had high incidences, suggesting that these viruses are an important cause of ARI in refugee camp settings among all age groups. In the ARI surveillance, at least one virus was isolated in 40% of the specimens tested. A previous study from the same surveillance project revealed adenovirus and RSV as the leading causes of viral etiologies in children < 5 years of age where more than 50% of specimens were positive for at least one virus.[1] Although presence of a virus does not confirm it as the cause of the symptoms, it does suggest the importance and contribution of viral etiologies to both ILI and SARI. In a 2007–2010 study conducted in western Kenya, Feikin and others[5] reported that among children and adults aged ≥ 5 years, 23% of specimens had at least one virus isolated and influenza A and B viruses, RSV, and hMPV were the most prevalent viruses. The burden of viral ARIs in Hagadera refugee camp is greater than in other locations in Kenya, but whether this finding persists with further testing or additional years remains to be determined. If it remains true, this could be associated with the living conditions in the camps.[3,4] Our study also showed almost one in five specimens had more than one virus isolated; the western Kenya and a Chinese study had similar findings suggesting coinfection in viral pathogenesis or that the presence may have a lack of clinical significance.[5] The type of virus isolated among those with ILI and SARI was not found to be statistically different, suggesting similar causation between the two syndromes or even progression of one to the other.[11] Although either cough or sore throat is needed for case definition of SARI or ILI, more patients presented with cough than sore throat. This is comparable to another study done in Angola.[12] All other symptoms were significantly more common in patients with SARI compared with those with a diagnosis of ILI, implying the severity of this syndrome. Among patients with ARI, muscle/joint pain was associated with influenza A, whereas headache was positively associated with influenza B. One previous study by Puzelli and others[13] demonstrated the similar association between muscle/joint pains and headache and influenza infection. However, another study by Yang X and others, Beijing failed to demonstrate that muscle/joint pains or headache were associated with influenza virus.[14] In our study, the association with muscle/joint pain and influenza A persisted when examining patient with only SARI, but headache and influenza B did not persist among patients with SARI.

Our findings are subject to some limitations. The assumption that the age structure for May 2014 (ProGres) could be used to determine age groups for our study years of 2010, 2011, and 2012 may not have been totally correct. The massive influx of refugees during the 2011 Horn of Africa famine may have temporarily impacted on these proportions but, other data were not available. In addition, the surveillance staff may have put in more effort in identifying cases in pediatric wards than the adult and obstetric wards. Third, not all the SARI and ILI cases were tested for viruses (419 out of 471) and when a sample was found to have more than one viral etiology, we assumed that the results were independent of one another. Fourth, only the first three patients with ILI were sampled. This may have introduced a selection bias because those who arrived at the health posts early may have been sicker and were more likely to be selected. These patients may have been sicker, which may have influenced the severity of patients in the ARI Surveillance System. Finally, there were no data to show how many patients with SARI who needed hospitalization were actually hospitalized. This may have underestimated the actual rates of SARI.

We have demonstrated in our study that respiratory tract infections were a leading cause of morbidity and mortality in the refugee camp studied among older children and adults. To our knowledge, our study is the first to demonstrate viral etiology among children older than 5 years and adults in a refugee camp setting. There is a need by humanitarian agencies to include ARI preventive measures in crisis-affected areas. Reduction of overcrowding, indoor air pollution, and malnutrition rates, and scaling up of measles, *Haemophilus influenza* type B, and pneumococcal vaccination coverage in older children should be prioritized. More research is needed to better characterize the epidemiology and etiology of viral ARI in crisis populations, particularly the role of viral–bacterial, as well as viral–viral coinfections. Even though viral–bacterial respiratory coinfections as well as post-viral respiratory bacterial infections may occur, with this high incidence of viral etiology, the overreliance of antibacterial therapy for the treatment of these cases among older children needs to be reexamined in this era of increasing drug resistance among common bacterial respiratory pathogens,[15] especially when additional symptoms such as headache and muscle/joint pain are present.

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