

# Distribution of influenza and other acute respiratory viruses during the first year after the 2009–2010 influenza pandemic in the English- and Dutch-speaking Caribbean countries

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**Background** Limited specimen collection and testing for influenza occurred in the English and Dutch-speaking Caribbean countries prior to the 2009/2010 influenza pandemic. Caribbean Epidemiology Centre (CAREC) member countries rapidly mobilized to collect specimens during the pandemic and a vast majority of confirmed cases during the pandemic period were influenza A (H1N1)pdm09.

**Objectives** To describe the aetiology and distribution of acute respiratory illness (ARI) among laboratory confirmed cases during the first year after the 2009/2010 influenza pandemic in the English- and Dutch-speaking Caribbean.

**Results** In total, 774 specimens were tested and 394 (52.7%) cases had positive laboratory confirmation. Respiratory syncytial virus (RSV) (28.4%) and influenza A(H3N2) (23.1%) were most frequently detected. RSV activity peaked in July 2011 while influenza

A(H3N2) peaked in October 2010. Influenza was responsible for illness in greater numbers in persons 15–64 years while RSV was seen in primarily in children <5 years and adults >65 years. Other agents confirmed include rhinovirus (12.9%), influenza B (10.9%) and influenza A(H1N1)pdm09 (9.4%).

**Conclusions** RSV and influenza A(H3N2) were the most common viruses identified during the first year after the influenza A(H1N1)pdm09 pandemic. Influenza was detected every month with peak activity corresponding to that typically seen in North America (October to March). In order to determine the seasonality of influenza and RSV, laboratory data from subsequent years and increased specimen submission is needed.

**Keywords** Caribbean, epidemiology, influenza, respiratory syncytial virus (RSV).

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## Background

Viral respiratory tract infections, including influenza, are a leading cause of morbidity and mortality worldwide.<sup>1</sup> Influenza, commonly known as “the flu,” is a contagious respiratory (nose, throat, lungs) illness caused by influenza viruses.<sup>2</sup> Illness can be mild to severe, and life-threatening complications can occur, especially among those aged 65 years and more, those aged less than 2 years, pregnant women, those with chronic medical conditions, and immunocompromised persons.<sup>2,3</sup> Respiratory syncytial virus (RSV) is a major cause of hospitalizations due to lower respiratory tract infections in children.<sup>2,4</sup> Human metapneumovirus (hMPV) infections result in symptoms and sequelae similar to that of RSV and are typically seen in young children.<sup>5,6</sup> Rhinovirus is a frequent cause of the “common

cold” and is generally associated with mild upper respiratory tract infections.<sup>7,8</sup>

Twenty-four English- and Dutch-speaking Caribbean countries report data to the Caribbean Epidemiology Centre (CAREC)<sup>1</sup> and most utilize the CAREC laboratory for testing services. From 2005 to 2007, syndromic surveillance for cases of acute respiratory illness (ARI) was implemented in many CAREC member countries. In 2007, a new protocol for enhanced respiratory illness surveillance was implemented in

<sup>1</sup>In 2011, the total population was approximately 7 million and consisted of 24 countries, namely Anguilla, Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, BES Islands (Bonaire, St. Eustatius and Saba), Bermuda, British Virgin Islands, Cayman Islands, Dominica, Grenada, Guyana, Jamaica, Montserrat, Netherlands Antilles, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, Trinidad and Tobago and Turks and Caicos Islands.

seven CAREC member countries, with focus on both epidemiological and virological surveillance. The countries were sensitized using a Caribbean protocol adapted from one developed by the United States' Centers for Disease Control and Prevention (CDC) and the Pan American Health Organization (PAHO). The protocol required countries to collect data on acute respiratory infection (ARI) and severe ARI (SARI) and to increase testing for influenza and other viral respiratory agents. Prior to introduction of this new protocol, limited collection and testing for influenza and other respiratory viruses was conducted among CAREC member countries.

In April 2009, a new strain of influenza A also known as influenza A(H1N1)pdm09 was identified in the Americas.<sup>9–11</sup> The rate of severity and hospitalization among cases varied according to geographic area examined.<sup>12,13</sup> Globally, the hospitalization ratio was highest among children under 5 years of age, and the case fatality rate was generally less than 0.5%.<sup>14</sup> Influenza A(H1N1)pdm09 cases were first detected in a CAREC member country in May 2009 and continued to be reported periodically.<sup>15,16</sup> During the pandemic period (epidemiologic week (EW) 16, 2009 to EW 32, 2010), 1,728 cases with acute respiratory illness (ARI) were laboratory confirmed, and influenza A(H1N1)pdm09 was the primary virus identified in circulation [Table 1].<sup>17</sup>

On August 10, 2010, the Director General of the World Health Organization declared that the influenza pandemic was concluded and that the world was entering a post-pandemic period.<sup>18</sup> We examined the epidemiology of influenza and other acute respiratory viruses in CAREC member countries in the first year of the post-pandemic period (September 1, 2010–August 31, 2011).

**Table 1.** Laboratory confirmed respiratory virus cases, English and Dutch Caribbean (CAREC member countries), Epidemiologic week 16, 2009–Epidemiologic week 32, 2010\*

Agent	% of confirmed	
	No. cases	Cases
Influenza A(H1N1)pdm09	1517	87.8
Influenza B	102	5.9
Influenza A(H3N2)	49	2.8
Influenza A(H1N1) seasonal strain	28	1.6
RSV	24	1.4
Parainfluenza types 1, 2, 3	4	0.2
Adenovirus	4	0.2
Total	1728	100%

\*Results from 10 003 samples tested at the CAREC Laboratory and other country submitted reports of cases.

## Methods

For surveillance purposes, CAREC recommends collection of at least six specimens each week for “common illness syndromes” including ARI, in addition to collection of a specimen from all severe acute respiratory infection (SARI) cases. A nasopharyngeal or throat swab taken from a patient with ARI or SARI is tested within one week of specimen collection. Real-time polymerase chain reaction (PCR) testing is conducted at CAREC and in two other countries included in this study.<sup>19,20</sup> Initial screening by immunofluorescence assay (IFA) and rapid testing for influenza are conducted in several CAREC member countries (CMCs), while other countries send specimens directly to CAREC for testing. All CMCs have at least one person from International Air Transport Association (IATA) certified to ship specimens, so those without in-country influenza testing or with limited or no respiratory virus testing capacity in-country ship specimens to the CAREC laboratory as required. The CAREC laboratory first tests specimens for influenza A and influenza B. If a specimen tests negative for influenza at CAREC, it is then tested using a PCR panel for RSV, parainfluenza (PIV) types 1, 2, and 3, rhinovirus, adenovirus, and hMPV.<sup>19,20</sup> The PCR panel testing for non-influenza viruses was implemented in November 2010, and selected cases that tested negative prior to November 2010 were re-tested using the new PCR panel.<sup>21</sup>

Specimens tested at the CAREC laboratory and in 2 CMCs with enhanced testing capacity for influenza were included in this analysis. Laboratory test results for pathogens causing respiratory illness were analyzed for ARI cases with an onset of symptoms between September 1, 2010 and August 31, 2011. Epidemiological information including age, gender, hospitalization status, and symptoms was collected from the laboratory test request form submitted along with the specimen.

Respiratory outbreaks reported from CMCs from September 1, 2010 to August 31, 2011 were reviewed, analyzed, and will be discussed in this report. Statistical analysis was completed using Epi-Info version 3.4.3 software (United States' Centers for Disease Control and Prevention, 2007, Atlanta, Georgia, USA).

## Results

Specimens from 747 ARI cases, including 210 hospitalized cases, were tested during the first 12 months after the pandemic [Table 2]. In total, 394 (52.7%) ARI cases were positive for one respiratory virus, while an additional 24 (3.2%) ARI cases had multiple virus detections. The median age of all confirmed cases was 5 years (range: 13 days–97 years) and males represented 51.5% of confirmed cases. Influenza viruses were confirmed in 23.4% of ARI cases tested including influenza A(H3N2) (12.2%), influenza B (5.8%),

**Table 2.** Demographic characteristics of confirmed cases of influenza and other respiratory viruses, CAREC member countries, September 1, 2010–August 31, 2011\*

Agent	No. confirmed cases	Percent (%) positive	Median age (years)	Age range
RSV	112	15.0	1	2 months–97 years
Influenza A H3N2	91	12.2	25	13 days–92 years
Rhinovirus	51	6.8	4	2.5 months–50 years
Influenza B	43	5.8	15	6 months–69 years
Influenza A(H1N1)pdm09	37	5.0	20	6 weeks–83 years
Parainfluenza types 1,2,3	23	3.1	1.5	6 months–80 years
Human Metapneumovirus	19	2.5	1	8 months–35 years
Adenovirus	15	2.0	2	4 months–10 years
Influenza A (untyped)	3	0.4	17	4–47 years
Total	282	37.8	5	13 days–97 years

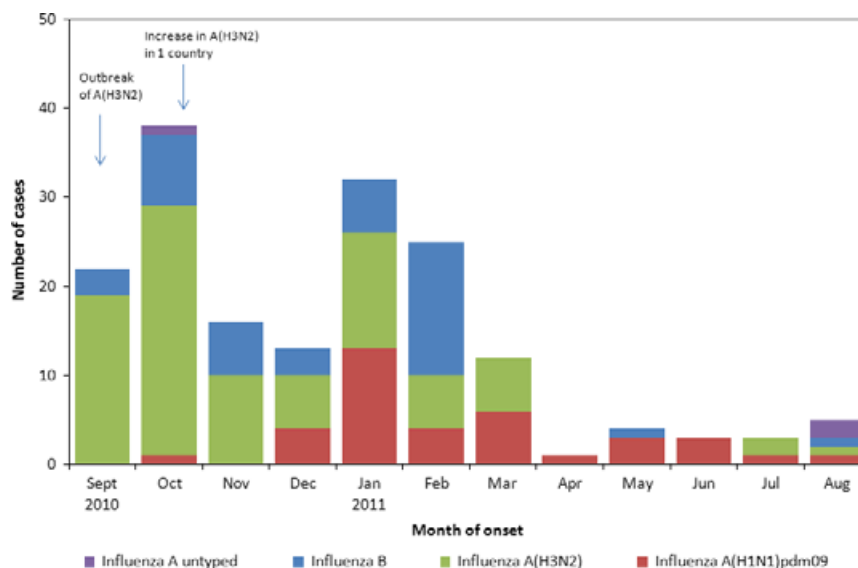
\*Includes only cases with one respiratory virus identified; 24 cases with co-detection of more than one virus were excluded from this analysis.

and influenza A(H1N1)pdm09 (5%). Respiratory syncytial virus (16.1%) was the causative agent most frequently identified among ARI cases tested. A causative agent was confirmed during all 12 months under study with a peak during July [Figure 1–5]. In total, 211 (50.8%) confirmed cases were hospitalized, and the virus identified among those cases include RSV (48.5%), influenza B (7.4%), and adenovirus (6.8%). Two outbreaks due to respiratory viruses were reported during the period under surveillance: one outbreak of RSV among an elderly long-term care facility and one outbreak of influenza at a facility.

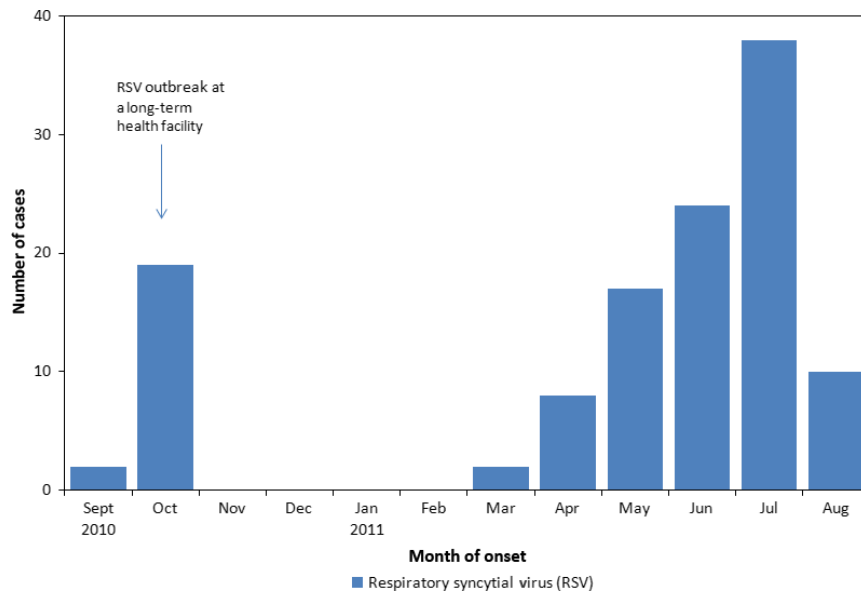
### Influenza viruses

The median age of all influenza cases ranged from 15 years for influenza type B cases to 25 years for influenza A(H3N2) cases

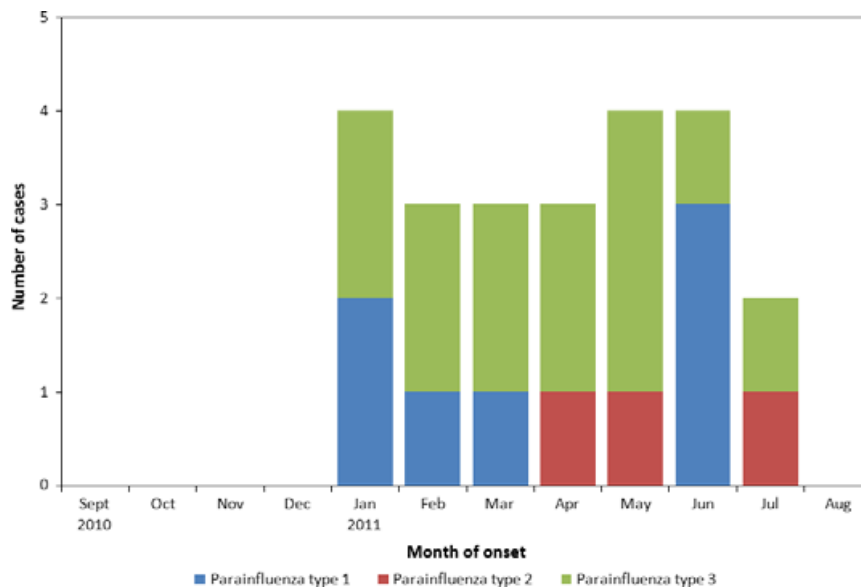
[Table 2]. Slightly more females than males were infected with influenza A(H3N2) (female-to-male ratio = 1.2:1), whereas the influenza B cases had a male-to-female ratio of 1.7:1. An equal proportion of males and females were infected by influenza A(H1N1)pdm09. A peak in influenza A(H3N2) cases was noted during October 2010 during the second month after the declaration that the world had entered the post-pandemic period [Figure 1]. Most cases of influenza A(H3N2) were identified from September 2010 to March 2011, and several isolated cases were identified during July and August 2011. An outbreak of influenza A(H3N2) was reported among persons at an institution in September 2010 and included two laboratory-confirmed cases and 48 epidemiologically linked cases. Two cases in this outbreak were hospitalized, and there were no deaths. A cluster of 12



**Figure 1.** Month of onset for laboratory confirmed influenza cases, CAREC member countries, September 2010–August 2011.



**Figure 2.** Month of onset for respiratory syncytial virus (RSV) cases, CAREC member countries, September 2010–August 2011.



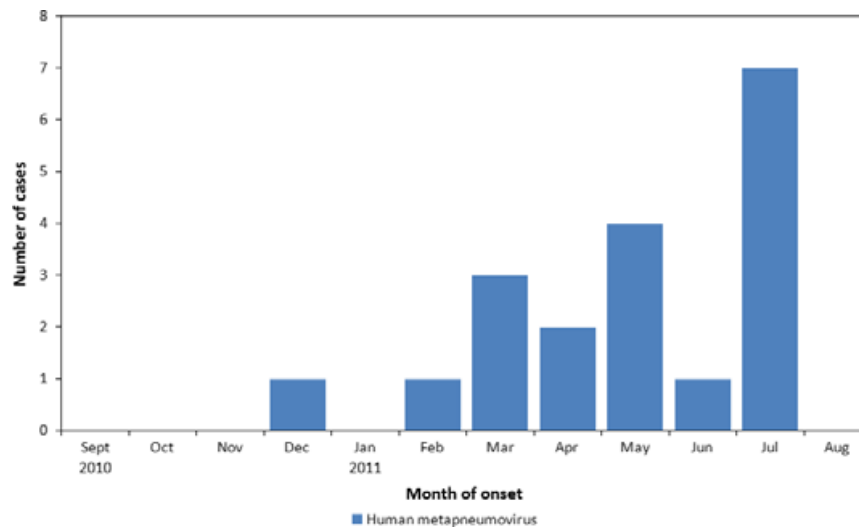
**Figure 3.** Month of onset for parainfluenza type 1, 2 and 3 cases, CAREC member countries, September 2010–August 2011.

influenza A(H3N2) cases was identified in one country in October and November 2010, although an outbreak was not officially reported. Influenza A(H3N2) was the causative agent identified in more than half of the confirmed cases aged 25–44 years, and it was also confirmed in all age groups.

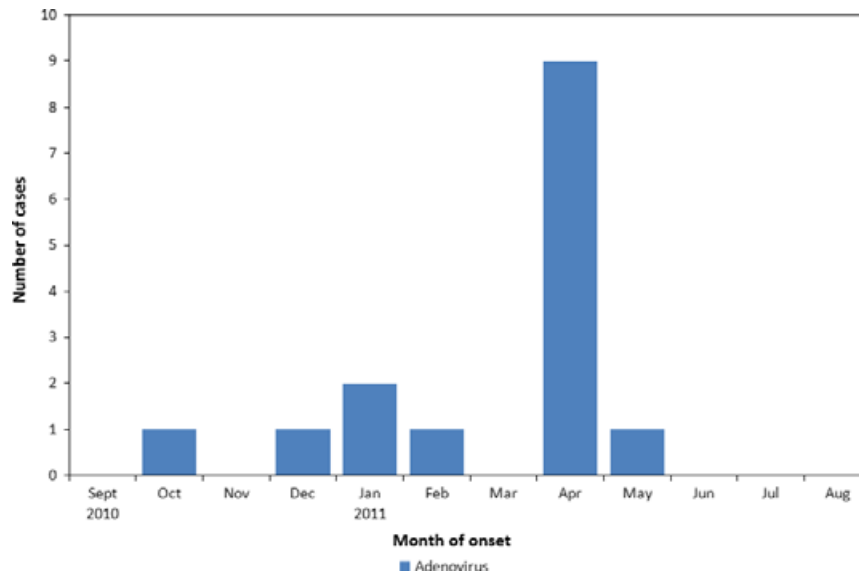
Influenza B was identified in 8 of the 12 months under study with a peak in cases noted during January and February 2011 [Figure 1]. The age group with the highest proportion of infections due to influenza type B was 15–24 years (21.4%). Three cases of influenza A that were not

further typed were identified. These specimens were confirmed at the country level and were not sent to the CAREC laboratory for further testing.

Influenza A(H1N1)pdm09 was the third most frequently confirmed influenza virus with 37 cases [Table 2]. The median age of cases (20 years) was similar to that of other influenza cases, and cases were identified in all age groups. Influenza A(H1N1)pdm09 was identified in 10 of the 12 months studied, with the highest number of cases detected during January 2011 [Figure 1]. Confirmed cases



**Figure 4.** Month of onset for metapneumovirus cases, CAREC member countries, September 2010–August 2011.



**Figure 5.** Month of onset for adenovirus cases, CAREC member countries, September 2010–August 2011.

reported a larger proportion of gastrointestinal symptoms (32.4%) than cases with other viruses identified [Table 3].

### Other respiratory viruses

RSV was the most frequently identified virus; 112 (16.1%) ARI cases were confirmed with RSV alone, while an additional 12 ARI cases had a mixed infection with RSV and at least one other virus detected [Table 5, Table 6]. One country had a majority (72.3%) of all confirmed RSV cases. The median age of RSV cases was 1 year with a range of 2 weeks to 97 years [Table 2]. Children under 5 years of age represented 75% of confirmed cases. Respiratory syncytial

virus cases were detected in 8 months of the year with two peaks in RSV activity noted [Figure 2]. The first peak occurred in October 2010 and was due to an RSV outbreak reported among persons living in an elder care facility with cases ranging in age from 73 to 97 years. The second peak in RSV activity occurred in July 2012 primarily among pediatric patients. Respiratory syncytial virus cases confirmed from March to August 2011 were identified in five countries. Respiratory syncytial virus cases reported the highest rate of lower respiratory symptoms among any virus detected (47.3%) [Table 3]. Commonly reported diagnoses among RSV cases included bronchopneumonia, bronchiolitis, and bronchitis.

**Table 3.** Clinical characteristics of confirmed cases of influenza and other acute respiratory viruses, CAREC member countries, September 2010–August 2011

Agent*	No. confirmed cases	Upper respiratory No. (%)	Lower respiratory No. (%)	Gastrointestinal symptoms No. (%)
Influenza A H3N2	91	78 (85.7)	14 (15.4)	21 (23.1)
Influenza A(H1N1)pdm09	37	31 (83.8)	7 (18.9)	12 (32.4)
Influenza A (untyped)	3	2 (66.7)	0	0
Influenza B	43	31 (72.1)	8 (18.6)	6 (14)
RSV	112	79 (70.5)	53 (47.3)	29 (25.9)
Rhinovirus	51	30 (58.8)	17 (33.3)	11 (21.6)
Human Metapneumovirus	19	14 (73.7)	7 (38.8)	4 (21.1)
Adenovirus	15	5 (33.3)	3 (20)	2 (13.3)
Parainfluenza types 1, 2, 3	23	11 (47.8)	3 (13)	4 (17.4)
Total	394	281 (71.3)	112 (28.4)	89 (22.6)

\*Includes only cases with one respiratory virus identified; 24 cases with co-detection of more than one virus were excluded from this analysis.

**Table 4.** Hospitalization and laboratory confirmation status among all acute respiratory illness patients tested, CAREC member countries, September 1, 2010–August 31, 2011

Laboratory confirmed with one or more viruses	Hospitalized		Total
	Yes *	No	
Hospitalized			
Yes	211	0	211
No	204	330	534
Total	415	342	745

\*Hospitalization status was missing for three positive cases.

**Table 5.** Number of cases specimens with two viruses detected, CAREC member countries, September 2010–August 2011 ( $n = 20$ )

	hRV	hMPV
RSV	8	4
hRV	x	1
ADV	3	1
PIV	3	0

hRV, rhinovirus; hMPV, human metapneumovirus; RSV, respiratory syncytial virus; ADV, adenovirus; PIV, parainfluenza virus types 1–3.

Several cases were confirmed with other respiratory viruses including parainfluenza types 1, 2, or 3 (3.1%), hMPV (2.5%), and adenovirus (2.0%). The median age for cases with these viruses ranged from a low of 1 year for hMPV to a

**Table 6.** Acute respiratory virus types identified in cases with three viruses identified, CAREC member countries, September 2010–August 2011 ( $n = 4$ )

Case 1	RSV	hRV	PIV
Case 2	RSV	hRV	PIV
Case 3	RSV	hRV	ADV
Case 4	RSV	hMPV	ADV

hRV, rhinovirus; hMPV, human metapneumovirus; RSV, respiratory syncytial virus; ADV, adenovirus; PIV, parainfluenza virus types 1–3.

high of 2 years for adenovirus. The peak in adenovirus cases in April 2010 includes cases from four countries. All adenovirus cases were under 11 years of age. A peak in hMPV cases occurred in July 2011 and includes cases from three countries.

### Hospitalized cases

Among ARI cases with at least one virus detected, 211 (50.8%) were hospitalized [Table 4]. At least one respiratory virus was confirmed in 100% of hospitalized ARI cases and in 38.2% of ARI cases that did not require hospitalization. Respiratory syncytial virus was confirmed in almost half (47.8%) of all the hospitalized cases followed by rhinovirus (17.9%) and influenza B (7.6%).

### Co-detection of more than one virus

In 24 patients with ARI, there was co-detection of more than one virus. Twenty cases had two viruses confirmed and four cases had three viruses confirmed [Table 5, Table 6]. Rhinovirus (75%) and RSV (67%) were the most frequently confirmed viruses among these cases.

## Discussion

During the first year after the influenza A(H1N1)pdm09 pandemic, the virus continued to be confirmed in the Caribbean. Influenza A(H1N1)pdm09 cases were detected in almost every month under study, with a peak of cases in January 2011. Travel to the Caribbean during the December holiday season from North America and Europe may be responsible for the increase in influenza A(H1N1)pdm09 activity. Virological data indicate that the influenza A(H1N1)pdm09 may continue to be a common virus in circulation in the Caribbean with displacement of the previous strain of influenza A(H1N1) noted. Approximately one-third of influenza A(H1N1)pdm09 cases reported gastrointestinal symptoms, which is consistent with data previously reported.<sup>14,22,23</sup> Influenza A(H3N2) was the most frequently confirmed influenza virus, and overall influenza activity peaked in October 2010 with cases confirmed in five Caribbean countries.

Respiratory syncytial virus was the most frequently confirmed virus among patients with ARI in the first year after the influenza A(H1N1)pdm09 pandemic with a majority of cases occurring in children under 5 years of age. A majority of RSV cases were reported from one Caribbean country, and it should be noted that pediatricians in this country are exceptionally vigilant for respiratory sample collection and testing among hospitalized cases. The Caribbean's high level of RSV activity is likely due to the exemplary work of influenza surveillance efforts in that country. Respiratory syncytial virus was among the most frequently confirmed acute respiratory virus during this period in Central American countries including Guatemala, Panama, and Costa Rica as well as in Chile and Paraguay.<sup>24,25</sup> This is in contrast to data reported from Greece and Italy who identified primarily influenza A(H1N1)pdm09 among their population.<sup>26,27</sup> Similar to what was noted in the Caribbean, the United States reported influenza A(H3N2) was the most frequently confirmed virus in circulation during the year after the influenza A(H1N1)pdm09 pandemic.<sup>28</sup>

Acute respiratory illness cases due to RSV reported a higher frequency of lower respiratory symptoms than other cases, which was expected based on historical information about RSV infections.<sup>4</sup> Respiratory syncytial virus typically occurs in children and is a leading cause of hospitalization among this age group.<sup>4</sup> While a majority of RSV cases were confirmed in children, there was one outbreak of RSV in the elderly population. Respiratory syncytial virus among older adults has rarely been described in the literature, and this finding of this study suggests that testing for RSV should be considered when acute respiratory illness is noted among this population.

Influenza testing capacity in the Caribbean increased during the influenza A(H1N1)pdm09 pandemic, and results of testing during the first year after the pandemic are

important to begin the examination of seasonality for influenza, RSV, and other viruses. It is important to continue routine testing of influenza and other respiratory viruses to further characterize temporal trends for these viruses.

## Study limitations

Enhanced surveillance and laboratory testing for respiratory viruses was introduced in CAREC member countries in 2007, and increased sampling and testing for influenza truly began when influenza A (H1N1)pdm09 was first identified in May 2009. Prior to the influenza A H1N1 pandemic, which was first detected in the Caribbean in May 2009, very limited testing was conducted for influenza and other respiratory viruses. This lack of data makes it difficult to infer whether trends noticed were typical of respiratory illness patterns in the Caribbean or unusual disease patterns were detected during the 12-month period under surveillance. While the CAREC laboratory tests specimens from 23 CAREC member countries, 78% of specimens submitted to the CAREC laboratory for respiratory virus testing were from three countries. This study did not include respiratory virus testing data from the other WHO-collaborating National Influenza Centre (NIC) in the Caribbean. Multiple viruses were detected in 24 cases that were excluded from this analysis, which may have artificially minimized the overall detection rate for selected viruses. Testing for non-influenza agents by PCR was implemented at the CAREC laboratory in November 2010, and this testing is not available in any other laboratories in CAREC member countries. It is possible that the rate of non-influenza organisms may be underestimated, particularly prior to November 2010.

## Conclusions

Since the pandemic, there has been a shift in respiratory virus types identified with fewer influenza A (H1N1)pdm09 cases confirmed among persons with acute respiratory illness in CAREC member countries. Respiratory syncytial virus and influenza A(H3N2) were the dominant viruses in circulation during the first year post-pandemic. With the addition of enhanced testing for non-influenza viruses at the CAREC laboratory, a majority (>90%) of hospitalized ARI cases were laboratory confirmed. Additional efforts are necessary to increase influenza sampling and testing among many Caribbean countries. Laboratory data from subsequent years are needed to identify seasonality trends among influenza and other respiratory viruses under surveillance.

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