

Comparing Viral Respiratory Tract Infections in Symptomatic Children and Adults: Multiplex NAT from 2010 – 2015

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Background

Community-acquired respiratory viruses (CARVs) are a common health problem, which exacerbate in very young and very old patients, and in subjects with immune dysfunction. CARVs differ in seasonal frequency, which has not been comprehensively assessed over time.

OBJECTIVE: To compare CARV detection rates over 5 years of multiplex nucleic acid testing (NAT) in symptomatic adults and children

Materials and methods

Retrospective analysis of multiplex NAT results (RespiFinder-22), covering 22 different CARVs and bacterial respiratory pathogens, performed on symptomatic children and adults attending the University Adult and Children's Hospital Basel between 2010 and 2015.

Results 1 (Detection Rates)

We identified 255.670 results from 11446 samples

- Adults and children were equally represented
- Detection rates were 48.9% overall; and significantly higher in children (71.6%) than in adults (30.3%; $p < 0.05$);
- Co-infections (2 and more pathogens) were more frequent in children (10.9%) vs adults (6.4%; $p < 0.05$). (Table 1)

Detection	Type	Children (%)	Adults (%)	Total (%)
Positive		3674 (71.6)	1911 (30.3)	5585
Single pos	one virus	3193 (87)	1717 (90)	4910 (88)
	one bacteria	81 (2)	72 (4)	153 (3)
	virus + virus	372 (10)	113 (6)	485 (9)
	virus + bacteria	28 (1)	9 (1)	37 (1)
Multi pos	more bacteria	0	0	0
Negative		1456	4405	5861
Total		5130 (44.8)	6316 (55.1)	11446

Results 2 (Specimen Types)

Nasopharyngeal swabs (NPS) constituted 61.1%; bronchoalveolar lavage (BAL) 36.5% and others (tracheal secretions, throat swabs) 2.4%. Specimens and detection rates differed between children and adults

- In children: NPS was 97%, BAL only 0.9%, but detection rates remained high
- In adults NPS was 32% and BAL 65.3% (Table 2)

	Specimen type % of total (detection rate %)		
	BAL	NPS	Others
Children	0.9 (65)	97 (72)	2.1 (55)
Adults	65.3 (22)	32 (46)	2.7 (36)
	$p < 0.0001$	$p < 0.0001$	$p = 0.0031$

Results 3 (Pathogen Incidence)

In children: Rhinoviruses (RhEV) were most frequent pathogens, followed by RSV, coronaviruses (CoV), influenza-A (INFA), adenovirus (ADV), metapneumovirus (MPV), parainfluenza (PIV), influenza-B (INFB). In adults: RhEV were also most frequent, though less than in children, and followed by CoV, INF-A, RSV, PIV, and MPV (Figure 1).

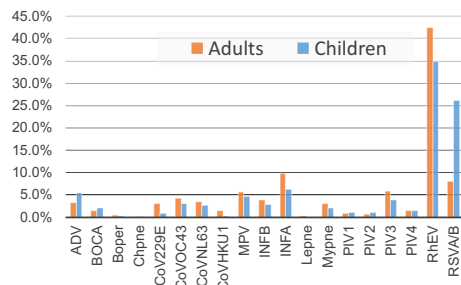


Figure 1. Detection Rates of Specific Respiratory Pathogens in Children and Adults (per positive results).

Results 4 (Pathogen Seasonality)

Influenza-A/B and RSV showed a strong seasonality for winter, as opposed to RhV being preferentially detectable throughout the rest of the year (e.g. spring, summer and fall). RSV showed increasing detection rates in children preceding the increases seen in adults suggesting that children were important epidemic amplifiers, whereas the reverse was true for INFA and CoV being first seen in adults before peaking in children (Figure 2).

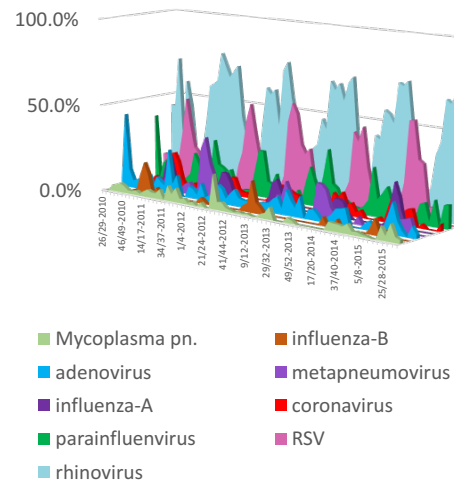


Figure 2. 5-years trend of CARVs in children.

Results 5 (Climate Factors)

Investigating rainfall, humidity and temperature data from the Basel area indicated that the increased humidity and temperature drop best correlated with increased detection rates in winter (Figure 3).

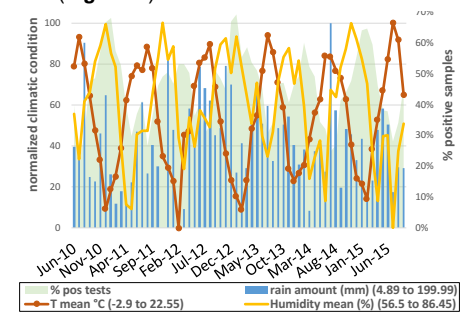


Figure 3. Influence of climate factors on CARV incidence.

Conclusions

This comprehensive CARV multiplex NAT study over 5 years provides relevant key information:

- All specimen types show higher detection rates in symptomatic children than in adults.
- BAL is a relevant material in adults, but given the diverse differential diagnosis, overall detection rates are still lower than in children.
- Children appear as major epidemic drivers of RSV; whereas adults seem to import INF-A and CoV into the community.
- Humidity and lower temperature are important facilitators of winter CARVs
- More precise interactions require advanced mathematical modelling being underway.