Bacterial and viral respiratory pathogens in Bangladeshi infants with and without acute respiratory infection symptoms

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Background and aims

Acute respiratory infections (ARI) remain a leading cause of illness and death in infants and young children worldwide, in particular in developing countries. Better knowledge of the etiology of ARI can help to identify groups at risk and better inform preventive treatments and strategies. The aim of this study was to examine the presence of viral and bacterial respiratory agents in infants with ARI and in asymptomatic controls during the first four months of life.

Methods

Nasopharyngeal samples (NPS) were collected at 2 and 4 months of age from 236 infants (**Table 1**) enrolled in a birth cohort (from April 2013 to October 2016; Clinicaltrials.gov: NCT02361164) in Nandipara, a peri-urban community of Dhaka, Bangladesh (**Figure 1**). NPS were screened using TaqMan array card targeting 16 viral and 12 bacterial pathogens.

Figure 1. Study area

Table 1. Characteristics of study participants

	Infants (n=236)
	n or mean ± SD (min; max)
Gender	Boy: 110 / Girl: 126
Gestational age at birth	39.47 ± 1.84 (32.9; 44.7)
Birth weight ^a	2.80 ± 0.45 (1.7; 4.2)
Mode of delivery	V aginal: 175 / C-section: 61
Place of birth	Home: 129 / Health facility: 107
Season of birth	Pre-monsoon hot (MAR-MAY): 83 Rainy monsoon (JUN-OCT): 90 Cool dry winter (NOV-FEB): 63
Number of siblings ^b	None: 90 More than one: 143

^a 2 missing data; ^b 3 missing data

Results

- At the time of sampling, 86 (18%) infants displayed ARI symptoms (cough, runny nose/nasal congestion, fever, ear discharge, rapid breathing or refusal of feeding) and 381 (82%) were asymptomatic (**Table 2**).
- Among the 467 NPS collected, 37 (8%) were negative for pathogens, and 290 (62%) were positive for ≥1 virus and 400 (86%) for ≥1 bacteria (**Table 2**).
- Most prevalent viral and bacterial agents were rhinovirus (43%) and *S. pneumoniae* (66%), followed by enterovirus (9%) and *H. influenzae* (49%), respectively (**Table 2**).
- Similar pattern were observed in 2- and 4-month old infants, and in symptomatic and asymptomatic infants (**Table 2**).
- Multiple detection were more common among symptomatic (84%) than asymptomatic (77%), with >1 virus in 17 (20%) symptomatic and 46 (12%) asymptomatic, and >1 bacteria in 66 (77%) symptomatic and 241 (63%) asymptomatic infants.
- Codetection rates of respiratory agents were similar at 2 and 4 months (**Figure 2**).

Table 2. Prevalence of viral and bacterial respiratory agents in NPS at 2 and 4 months of age

Respiratory agents	All infants		Asymptomatic		Symptomatic	
	2 months (236 infants) n (%)	4 months (231 infants) n (%)	2 months (200 infants) n (%)	4 months (181 infants) n (%)	2 months (36 infants) n (%)	4 months (50 infants) n (%)
Adenovirus	2 (0.87)	4 (1.79)	1 (0.51)	3 (1.70)	1 (2.86)	1 (2.08)
Bocavirus	2 (0.86)	8 (3.54)	2 (1.02)	4 (2.27)		4 (8.00)
Enterovirus	18 (7.89)	23 (10.31)	15 (7.81)	15 (8.62)	3 (8.33)	8 (16.33)
Influenza A		4 (1.73)		3 (1.66)		1 (2.00)
Influenza B	1 (0.42)	1 (0.43)	1 (0.50)	1 (0.56)		
Coronavirus_all types	30 (12.71)	29 (12.55)	25 (12.50)	24 (13.26)	5 (13.89)	5 (10.00)
Metapneumovirus		3 (1.30)		2 (1.11)		1 (2.00)
Parainfluenza virus_3	2 (0.85)	2 (0.87)	2 (1.01)	1 (0.56)		1 (2.00)
Respiratory syncytial virus	7 (2.98)	19 (8.30)	4 (2.01)	16 (8.94)	3 (8.33)	3 (6.00)
Rhinovirus	85 (37.78)	114 (50.89)	72 (37.11)	83 (47.16)	13 (41.94)	31 (64.58)
<i>Bordetella pertussis</i>	2 (0.85)	3 (1.30)	2 (1.01)	2 (1.10)		1 (2.00)
<i>Chlamydia pneumoniae</i>		1 (0.43)		1 (0.55)		
<i>Streptococcus pyogenes</i> GAS	2 (0.85)		2 (1.01)			
<i>Streptococcus agalactiae</i> GBS	31 (18.90)	16 (9.82)	30 (21.28)	11 (8.46)	1 (4.35)	5 (15.15)
<i>Haemophilus influenzae</i>	104 (44.07)	123 (53.48)	87 (43.50)	92 (51.11)	17 (47.22)	31 (62.00)
<i>Klebsiella pneumoniae</i>	54 (30.51)	42 (27.63)	40 (27.03)	28 (23.93)	14 (48.28)	14 (40.00)
<i>Moraxella catarrhalis</i>	92 (39.32)	99 (43.04)	74 (37.37)	72 (40.00)	18 (50.00)	27 (54.00)
<i>Staphylococcus aureus</i>	88 (37.93)	43 (19.11)	77 (38.89)	31 (17.51)	11 (32.35)	12 (25.00)
<i>Streptococcus pneumoniae</i>	147 (62.55)	162 (70.74)	126 (63.32)	123 (68.72)	21 (58.33)	39 (78.00)
<i>Ureaplasma spp</i>	2 (0.85)	2 (0.87)	1 (0.50)	2 (1.10)	1 (2.78)	
No agent	22 (9.32)	15 (6.49)	19 (9.50)	13 (7.18)	3 (8.33)	2 (4.00)
Any agent	214 (90.68)	216 (93.51)	181 (90.50)	168 (92.82)	33 (91.67)	48 (96.00)
Any multiple agents (>1)	175 (74.15)	189 (81.82)	148 (74.00)	144 (79.56)	27 (75.00)	45 (90.00)
No virus	108 (45.76)	69 (29.87)	94 (47.00)	58 (32.04)	14 (38.89)	11 (22.00)
Any virus	128 (54.24)	162 (70.13)	106 (53.00)	123 (67.96)	22 (61.12)	39 (78.00)
1 virus	109 (46.19)	108 (46.75)	90 (45.00)	83 (45.86)	19 (52.78)	25 (50.00)
More than 1 virus	18 (8.05)	54 (23.38)	16 (8.00)	40 (22.10)	3 (8.33)	14 (28.00)
No bacteria	37 (15.68)	30 (12.99)	29 (14.50)	26 (14.36)	8 (22.22)	4 (8.00)
Any bacteria	199 (84.32)	201 (87.01)	171 (85.50)	155 (85.64)	28 (77.78)	46 (92.00)
1 bacteria	48 (20.34)	45 (19.48)	43 (21.50)	42 (23.20)	5 (13.89)	3 (6.00)
More than 1 bacteria	151 (63.98)	156 (67.53)	128 (64.00)	113 (62.43)	23 (63.89)	43 (86.00)

Fist and second most prevalent respiratory agents detected in NPS are highlighted in pink and orange, respectively

Figure 2. Codetection rate of viral and bacterial agents in NPS at 2 and 4 months of age

AdV = adenovirus, HBoV = bocavirus, EV = enterovirus, Flu = influenza virus, CoV = coronavirus, HMPV = metapneumovirus, HPEV = parainfluenza virus, PIV = parainfluenza virus, RSV = respiratory syncytial virus, HRV = rhinovirus, Bper = *Bordetella pertussis*, Ctra = *Chlamydia pneumoniae*, Ctra = *Chlamydia trachomatis*, Spyo = *Streptococcus pyogenes* GAS, Saga = *Streptococcus agalactiae* GBS, Hinf = *Haemophilus influenzae*, Kpne = *Klebsiella pneumoniae*, Mcat = *Moraxella catarrhalis*, Mpn = *Mycoplasma pneumoniae*, Saur = *Staphylococcus aureus*, Spne = *Streptococcus pneumoniae*, Uspp = *Ureaplasma spp*

Conclusions

- High prevalence of respiratory (viral and bacterial) agents was observed in 2- and 4-month old infants in community setting.
- Similar prevalence found in symptomatic and asymptomatic infants might be due to the fact that the majority of respiratory infections observed were mild.
- Further investigations are required to better understand the clinical role of respiratory agents detected during early life.

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