Agreement between nasal mid-turbinate and nasopharyngeal swabs to detect *Streptococcus pneumoniae* by polymerase chain reaction in children and adults

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Background

The nasopharynx (NP) is recommended by WHO as the preferred sampling site for detecting carriage with *S. pneumoniae* (SPN) [1]. Nasal mid-turbinate (nasal) sampling is more convenient and feasible than a NP swab and does not require trained staff. Our goal was to determine the agreement and the accuracy of a nasal swab with the NP swab as reference standard to detect SPN carriage in children and adults using PCR.

Methods

Pairs of NP and nasal swabs from participants of a study on influenza viral shedding [2] were retrospectively analysed for the presence of SPN using a real-time PCR (target *lytA* gene). We applied McNemar's test along with the exact 95% confidence interval (CI) and the paired sample t-test, and calculated the kappa coefficient (κ) and the intraclass correlation coefficient (ICC).

Table 1. Characteristics of the 152 individuals with paired nasal and nasopharyngeal (NP) swabs indicated as numbers (percentages).

	Overall n=152	0-5 years n=35	6-15 years n= 64	> 15 years n=53
Female participants	87 (57.2)	14 (40.0)	33 (51.6)	40 (75.5)
Acute respiratory infection	97 (63.8)	32 (91.4)	38 (59.4)	27 (50.9)
Rhinorrhea and/or sinus symptoms	84 (55.3)	31 (88.6)	26 (40.6)	0 (0.0)
SPN positive NP swabs	43 (28.3)	18 (51.4)	19 (29.7)	6 (11.3)
SPN positive nasal swabs	39 (25.7)	20 (57.1)	17 (26.6)	2 (3.8)
Paired (nasal and NP) swabs positive for SPN	29 (19.7)	17 (58.6[a])	10 (34.5[a])	2(6.9 [a])

[a] row percentages

Results

Overall, 53 (34.9%) of 152 individuals were positive for SPN (Figs. 1 and 2). The percentage difference in proportions (95% CI) of positive results between the NP and nasal site was 0.03 (-0.06 to 0.11). Sensitivity of the nasal swab was 67% and specificity was 91% (Table 2). The difference in mean SPN $\log_{10}$ copies/ml was -0.06 (SD 1.4) (P=.83).

Fig. 1. Frequency (absolute values; percentages) of detecting *Streptococcus pneumoniae* (SPN) in 152 individuals with paired nasal and nasopharyngeal swabs.

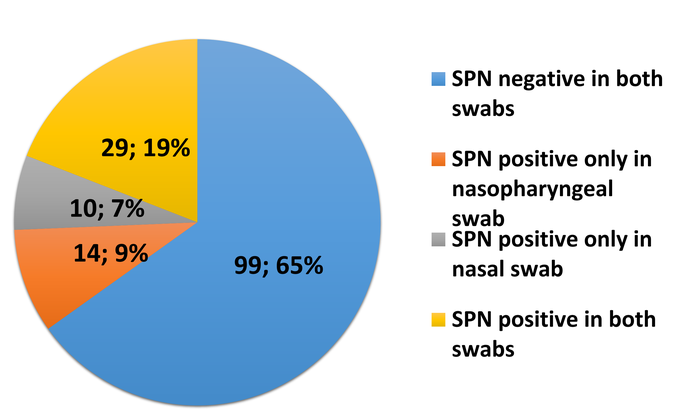

Fig. 2. Number of sites positive for *S. pneumoniae* according to age category.

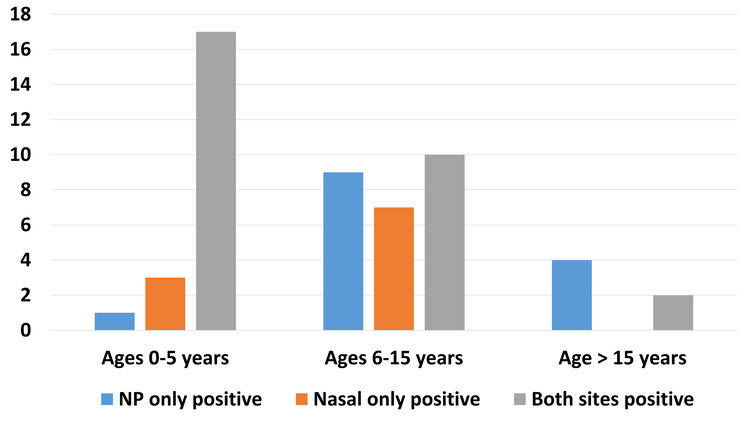

Table 2. Accuracy of the nasal swab and concordance between NP and nasal swab detection of *S. pneumoniae* (SPN).

	Overall	0-5 years	6-15 years	> 15 years
Sensitivity (95% CI)	67.4 (51.5-80.9)	94.4 (72.7- 99.9)	52.6 (28.9-75.6)	33.3 (4.3-77.7)
Specificity (95% CI)	90.8 (83.8-95.5)	82.4 (56.6-96.2)	84.4 (70.5-93.5)	100 (92.5-100.0)
Kappa (κ)	0.60	0.77	0.32	0.47
Interpretation of κ	moderate	good	fair	fair
ICC (95% CI)	0.78 (0.52-0.90)	0.80 (0.45-0.93)	0.05 (-4.54-0.78)	n.a.*
Interpretation of ICC	excellent	excellent	poor	n.a.*

Discussion

With respect to the youngest age group (0-5 years) agreement between nasal and NP swabs in detecting SPN using PCR-based method was good which is consistent with previous studies [3,4]. In older children, both, nasal and NP swabs had a high number of potentially false negative results. PCR from nasal and NP specimen yielded similar SPN log amounts. Positive subjects over 15 years were rare and confidence in the estimates in this age category is low.

Conclusion:

Agreement between NP and nasal swab was high in young children where the less convenient NP swab could be substituted by a nasal swab. This did not hold true for older children and adults.

Referemces:

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