

SNORING, INTERMITTENT HYPOXIA AND ACADEMIC PERFORMANCE IN SCHOOL CHILDREN

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INTRODUCTION

- Sleep-disordered breathing (SDB) is associated with impaired attention and neurocognitive deficits.
- We assessed the association of snoring and intermittent hypoxia with poor academic performance in primary school children.

METHODS

- As part of a population-based, cross-sectional study on the prevalence of SDB in primary school children, all children attending the third grade of 27 randomly selected regular primary schools located in Hannover, Germany were asked to participate.
- Snoring frequency and intermittent hypoxia were investigated using parental questionnaire and nocturnal home pulse oximetry (NHPO).
- NHPO recordings were performed using an instrument (VitaGuard[®] 300; getemed AG; Teltow, Germany) with a new generation, motion-resistant oximeter module (Masimo SET[®], software version 3.0.2.1, 2-4 s averaging mode; Masimo Corp; Irvine, CA).
- A study nurse explained handling of the pulse oximeter to the children in their classroom. Children were instructed to start the recording at bedtime and terminate it in the morning.
- Recordings were analyzed for desaturation events to $\leq 90\%$ SpO₂ and desaturation clusters (≥ 5 desaturations by $\geq 4\%$ SpO₂ within 30 minutes).
- Desaturation indices, defined as desaturation events and clusters per hour of recording, were calculated (DI90 and DIC).
- Poor academic performance (PAP) was defined as mark 4 or worse on a 1-6 scale in numeracy, science, literacy, spelling, and/or handwriting in the most recent school report.
- Adjusted odds ratios (OR) and 95% confidence intervals (95%CI) for PAP were calculated for children who snored or had intermittent hypoxia (DI90 > 0.1 or DIC > 0.2).[†] Adjustments were made for gender, age, and parental education.

RESULTS

- A total of 1760 children was contacted and 1144 parents and their children (65%; study sample) agreed to participate and returned a completed questionnaire.
- There were 559 girls (48.9%); mean (SD) age was 9.6 years (0.7).
- Of 1129 children for whom information on snoring was available, 410 (36.3%) snored „never“ and 605 (53.6%) „occasionally“, 89 (7.9%) and 25 (2.2%) were reported to snore „frequently“ or „always“.
- Snoring „always“ was significantly associated with PAP in numeracy (OR; 95%CI: 3.5; 1.44-8.61), science (3.0; 1.18-7.68), and spelling (2.7; 1.12-6.73; Table 1).
- Snoring „frequently“ was also significantly associated with poor academic performance in numeracy (OR; 95%CI: 2.1; 1.17-3.63) and spelling (1.9; 1.09-3.24; Table 1).
- These associations were independent of intermittent hypoxia (Table 2).
- In addition, children with an DI90 > 0.1 showed a significantly increased risk for poor academic performance in numeracy (OR; 95%CI: 1.6; 1.03-2.52), which was independent of snoring status.

CONCLUSION

- Habitual snoring, defined as snoring „frequently“ or „always“, was found in 1/10 of these primary school children.
- Habitual snoring was associated with impaired academic performance with a clear dose-effect gradient.
- This relationship between habitual snoring and poor academic performance did not appear to be mediated primarily via intermittent hypoxia, as it was not diminished after adjustment for recurrent desaturation in an overnight study
- The occurrence of intermittent hypoxia (DI90 > 0.1) was also associated with an increased risk of poor academic performance, even after adjustment for snoring.
- Thus, snoring and intermittent hypoxia were both **independently** associated with impaired academic performance in these primary school children.

REFERENCES

1. Urschitz MS, Wolff J, vonEinem V, Urschitz-Duprat PM, Schlaud M, Poets CF. Reference values for nocturnal home pulse oximetry during sleep in primary school children. Chest 2003;123:96-101.

SNORING AND PAP

PAP in	Snoring Categories			
	Never	Occasionally	Frequently	Always
	OR	OR (95%CI)	OR (95%CI)	OR (95%CI)
Numeracy	1.0	1.2 (0.82-1.66)	2.1 (1.17-3.63)	3.5 (1.44-8.61)
Science	1.0	0.9 (0.62-1.39)	1.6 (0.87-3.08)	3.0 (1.18-7.68)
Literacy	1.0	0.8 (0.54-1.12)	1.1 (0.61-2.10)	1.2 (0.45-3.25)
Spelling	1.0	1.0 (0.74-1.43)	1.9 (1.09-3.24)	2.7 (1.12-6.73)
Handwriting	1.0	1.1 (0.72-1.57)	1.2 (0.60-2.35)	1.6 (0.57-4.34)

Table 1: ORs are adjusted for gender, age, and parental education. Reference category: snoring "never".

SNORING AND PAP ADJUSTED FOR INTERMITTENT HYPOXIA

PAP in	Snoring Categories			
	Never	Occasionally	Frequently	Always
	OR	OR (95%CI)	OR (95%CI)	OR (95%CI)
Numeracy	1.0	1.3 (0.86-1.86)	2.6 (1.40-4.74)	3.2 (1.19-8.63)
Science	1.0	1.0 (0.62-1.52)	1.6 (0.80-3.26)	3.2 (1.14-9.25)
Literacy	1.0	0.9 (0.58-1.31)	1.4 (0.70-2.73)	1.8 (0.60-5.21)
Spelling	1.0	1.1 (0.75-1.57)	2.3 (1.25-4.12)	3.3 (1.24-8.95)
Handwriting	1.0	1.2 (0.78-1.84)	1.4 (0.69-2.98)	1.9 (0.67-5.70)

Table 2: ORs are adjusted for gender, age, parental education, desaturation events, and desaturation clusters per hour of recording (DI90 and DIC). Reference category: snoring "never".