

# Does nasal obstruction mean that the nose is obstructed?

Thomas Kjærgaard\*, Milada Cvancarova\*\*, Sverre K Steinsvåg\*, \*\*\*  
\*Dept. of Otolaryngology, Head and Neck Surgery, Sorlandet Hospital, Norway. \*\*The Norwegian Radium Hospital, National Resource Centre for Longterm Outcome after Cancer, Oslo. \*\*\*Dept. of Otolaryngology, Head and Neck Surgery, Haukeland University Hospital, Norway.

## OBJECTIVE

It is still a matter of controversy to what extent the sense of nasal obstruction is associated with objective measures for nasal space and air flow. We evaluated the relationship between subjective nasal obstruction and the corresponding anatomic and physiological nasal parameters using Acoustic Rhinometry (AR) and Peak Nasal Inspiratory Flow (PNIF).

## METHOD

2341 consecutive patients referred to ENT specialist for evaluation of obstructive sleep apnea, snoring or nose related complaints were included in this cross-sectional study. Associations between Nasal Obstruction Visual Analogue Scale recordings (NO-VAS) and measurements of PNIF and AR were evaluated with ANOVA (crude associations) and linear regression adjusted for age, sex, body mass index and asthma, allergy and smoking history.

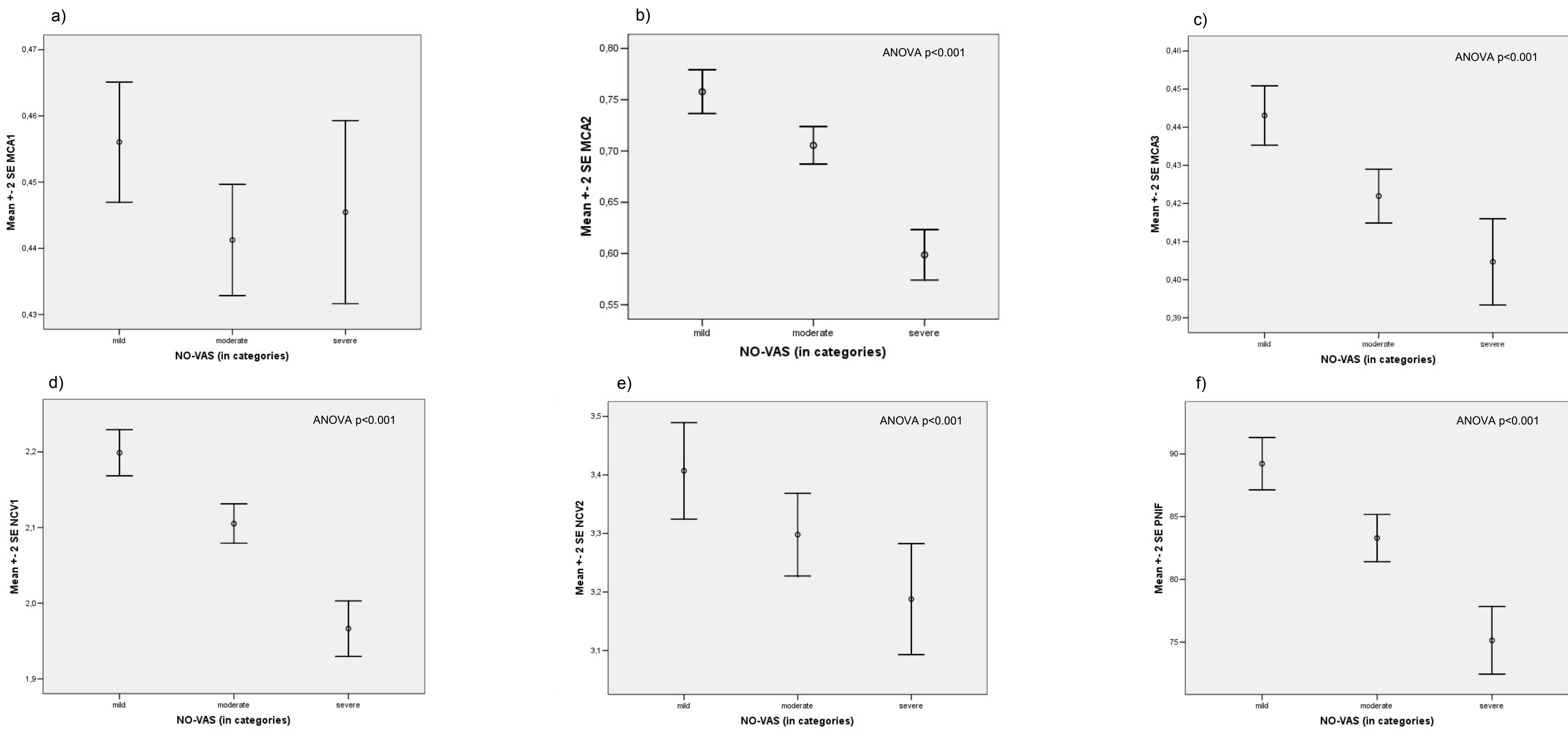
### SAMPLE DEMOGRAPHICS

	n (%)	Median	Min - max
Age (yr)		46	16 - 87
BMI (kg/ m <sup>2</sup> )		26.6	15 - 85
Gender			
Male	1761 (70)		
Female	762 (30)		
Asthma	278 (11)		
Allergy	732 (29)		
Smoking	833 (33)		

## RESULTS

Subjective nasal obstruction was correlated to PNIF, volumes and minimal cross-sectional areas in the nasal cavities.

### CRUDE ASSOCIATIONS



### MULTIPLE LINEAR REGRESSION -adjusted estimates†

	B	95% CI	p-value
MCA1	-5.3	-13.7; 3.0	0.2
MCA2	-15.8	-19.6; -12.1	<0.001
MCA3	-25.6	-34.9; -16.3	<0.001
NCV1	-12.8	-15.6; -10.1	<0.001
NCV2	-1.9	-2.9; -0.9	<0.001
PNIF*	-4.0	-4.9; -3.0	<0.001

MCA1= minimal cross-sectional area (MCA) 0-3 cm behind the nostril (cm²), MCA2= MCA 3-5.2 cm behind the nostril, MCA3= MCA 0-5.2 cm behind the nostril, NCV1= nasal cavity volume (NCV) 0-3 cm behind the nostril (cm³), NCV2= NCV 3-5.2 cm behind the nostril, PNIF= Peak Nasal Inspiratory Flow (L/min). NO-VAS: Nasal Obstruction VAS; mild: VAS 0-30; moderate: VAS 31-70; severe: VAS 71-100.

Crude associations (graphs): (a-c) relationship between NO-VAS in 3 categories and MCA. (d-e) relationship between NO-VAS in 3 categories and NCV. (f) relationship between NO-VAS in 3 categories and PNIF. There was a negative relationship between NO-VAS and 5 of 6 objective measures, suggesting that smaller nasal cavities and lower nasal airflow was related with greater symptoms of nasal obstruction. No significant association between MCA1 and NO-VAS.

Adjusted estimates (table): †adjusted for age, gender, BMI, smoking status, allergy and asthma. \*4 categories of PNIF: (1) >119 L/min, (2) 90-119 L/min, (3) 60-89 L/min, 4) 0-59 L/min. The adjusted analyses confirmed the negative relationship between subjective and objective measures of nasal obstruction found in the unadjusted analyses.

## CONCLUSION

Our study indicates significant associations between subjective nasal obstruction and corresponding measures of nasal space, area and air flow. We conclude that AR and PNIF are valuable objective investigational tools well correlated with the sensation of nasal obstruction.



# SMOKER`S NOSE

Thomas Kjærgaard\*, Milada Cvancarova\*\*, Sverre K Steinsvåg\*, \*\*\*  
\*Dept. of Otolaryngology, Head and Neck Surgery, Sorlandet Hospital, Norway. \*\*The Norwegian Radium Hospital, National Resource Centre for Long-term Outcome after Cancer, Oslo. \*\*\*Dept. of Otolaryngology, Head and Neck Surgery, Haukeland University Hospital, Norway

## OBJECTIVES

Do smokers have more upper airway complaints than non-smokers? The aim of our study was to evaluate the role of cigarette smoking in relation to upper airway symptoms.

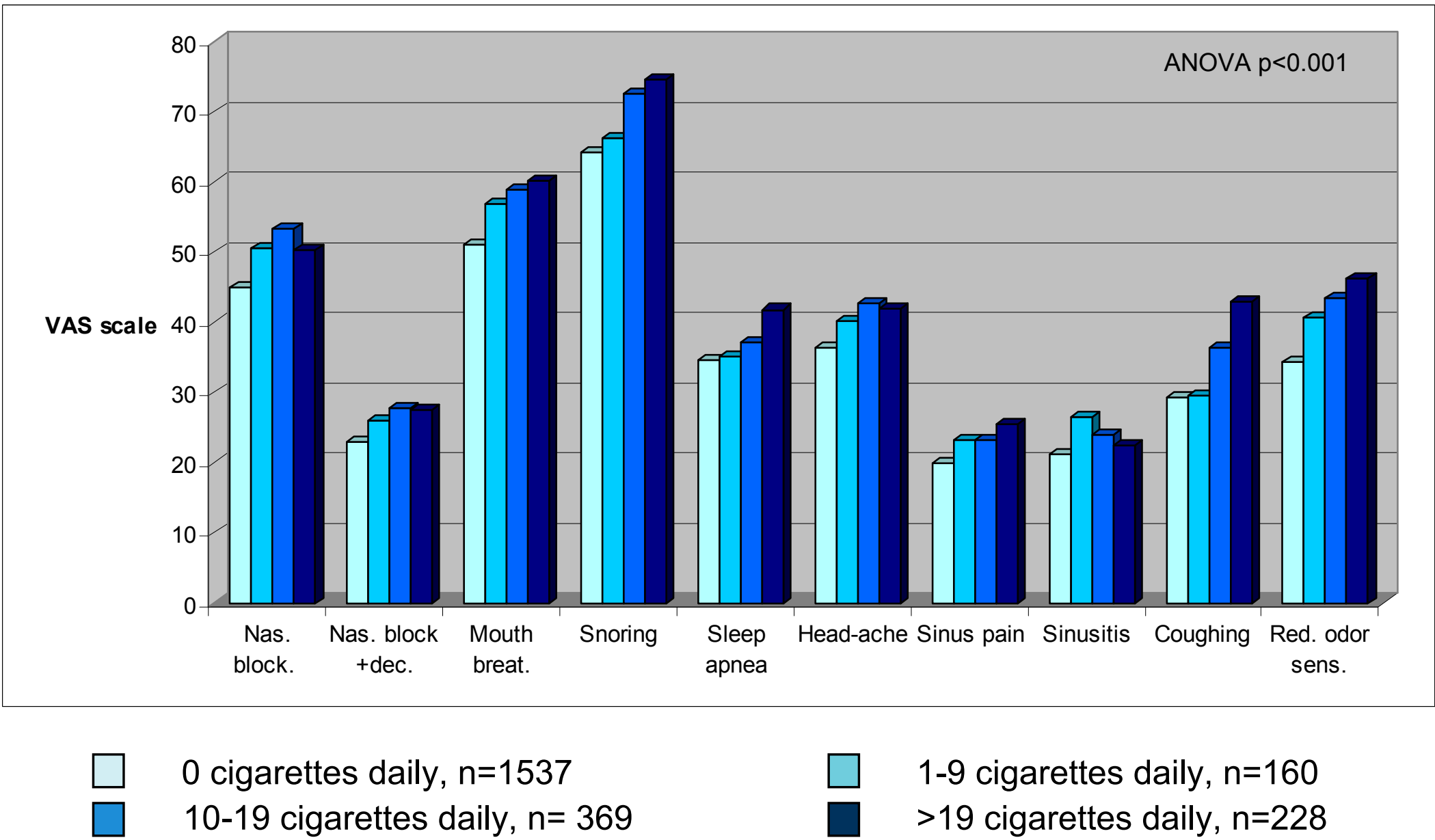
## METHOD

2294 consecutive patients referred to ENT specialist for evaluation of obstructive sleep apnea, snoring or nose related complaints were included in this cross-sectional study. Subjects completed a detailed questionnaire including 13 mainly upper airway symptoms which were graded using Visual Analogue Scales (VAS). Associations between VAS recordings and smoking status were evaluated using ANOVA (crude associations) and linear regression analysis adjusted for age, sex, body mass index, asthma and allergy. Bonferroni correction was applied to correct for multiple testing and p<0.01 was considered statistically significant. Differences of 10% or more were regarded as clinically relevant.

## RESULTS

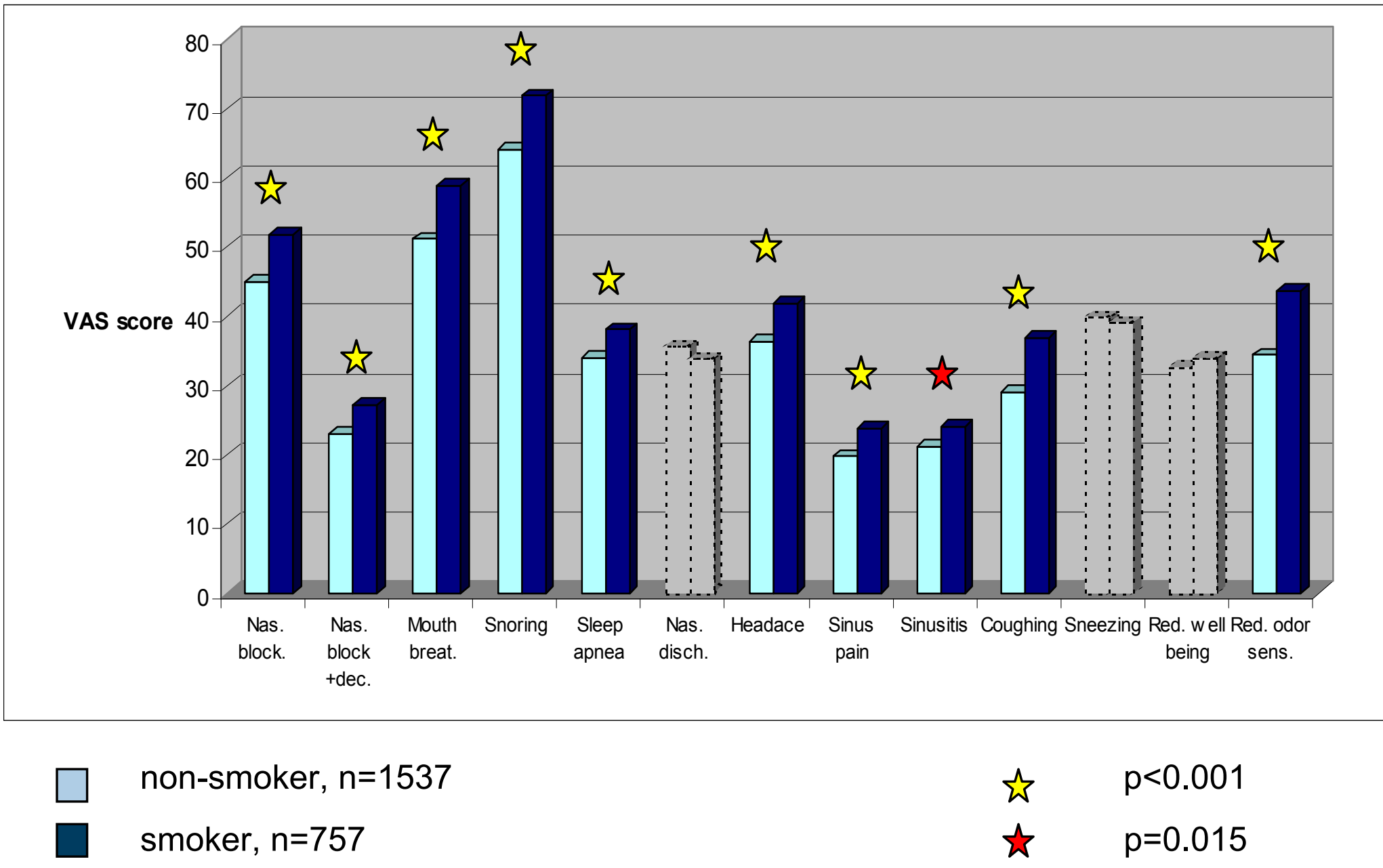
Smokers had higher VAS scores in 10 out of 13 symptoms compared with non-smokers (including one incident of borderline significance), indicating more subjective complaints. Further, there was a positive association between VAS scores and daily cigarette consumption.

CRUDE ASSOCIATIONS -daily cigarette consumption



Within several symptom categories there was a trend towards dose-response relationship between daily cigarette consumption and subjective complaints (ANOVA). In general, high daily cigarette consumption was associated with higher levels of subjective complaints.

CRUDE ASSOCIATIONS -smokers vs. non-smokers



Smokers had higher mean VAS-scores than non-smokers in 10 out of 13 symptom categories (ANOVA), including one incident of borderline significance. Differences in mean VAS scores between smokers and non-smokers were 12-27% and therefore considered clinically relevant.

ADJUSTED ASSOCIATIONS -smokers vs. non-smokers

	B	95% CI	p
Nasal blockage, baseline	5.8	3.4; 8.1	p<0.001
Nasal blockage, decong.	4.1	2.0; 6.2	p<0.001
Mouth breathing	6.8	4.3; 9.4	p<0.001
Snoring	9.2	6.6; 11.8	p<0.001
Sleep apnea	5.4	2.8; 8.2	p<0.001
Nasal discharge	-1.9	-4.3; 0.6	p=0.142
Head ache	5.4	3.0; 7.9	p<0.001
Sinus pain	4.6	2.4; 6.7	p<0.001
Sinusitis	2.9	0.6; 5.2	p=0.015
Coughing	8.2	6.0; 10.4	p<0.001
Sneezing	-0.2	-2.4; 2.0	p=0.875
Reduced well-being	2.1	-0.4; 4.6	p=0.102
Reduced odor sensation	8.2	5.6; 10.9	p<0.001

Linear regression confirmed the crude associations: smokers had more subjective complaints from the upper airways than non-smokers. Estimates were adjusted for age, gender, asthma, allergy and BMI.

## CONCLUSION

Our study indicates that smokers have more subjective complaints from the upper airways than non-smokers. Further, there seems to be a trend towards dose-response relationship between symptoms and daily cigarette consumption.