SNOT 22 in a Control Population

The CRES Group

Aim:

To assess SNOT-22 and its subscales in a non-rhinosinusitis UK-wide population.

Methodology/Principle

This analysis uses data from the 'Chronic Rhinosinusitis Epidemiology Study' (CRES) which recruited from 30 centres across the UK, and the Socioeconomic Cost of ChrOnic Rhinosinusitis study' (SocCoR); 250 volunteers without CRS were recruited as part of these studies. Study-specific questionnaires including demographics, socioeconomic factors and past medical history as well as SNOT-22 and SF-36 were distributed. The control (non-CRS) population had no self-reported nasal problems in the past, no chronic conditions undergoing active treatment and no hospital admissions in the preceding 12 months.

Results:

The mean SNOT-22 total score overall was 12.0. The mean was 10.2 for males with a median of 6.5, and a mean of 13.2 for females with a median of 9. Females scored significantly more highly than males on the sleep/fatigue and facial domains.

Conclusions

Our data demonstrate differences in SNOT-22 amongst males and females. These data can be used in future studies for comparison with different disease populations with rhinosinusitis.

Introduction

Chronic rhinosinusitis (CRS) affects a significant proportion of the population; a recent European study found a prevalence of 11% (Hastan, Fokkens et al. 2011). Patient reported outcome measures (PROMs) are a means of collecting information on the effectiveness of care delivered to patients, as perceived by the patients themselves, and are increasingly important in clinical practice and in research (Timmins 2008, HaSCI 2014) (Greenhalgh, Long et al. 2005) on a background of increasing costs of healthcare across the world. The most widely accepted and best validated patient self-report symptom evaluation tool for use in CRS is the SNOT-22, whose 22 items incorporate both nasal and non-nasal symptoms(Hopkins, Gillett et al. 2009)(Rudmik, Hopkins et al. 2015). Within SNOT-22, self-reported symptom severity is graded from 0-5, with 5 being a severe problem. It is a modification of the 31-question Rhinosinusitis Outcome Measure (RSOM-31)(Piccirillo, Edwards et al. 1995). Factor analysis identifies four principal SNOT domains – nasal, facial, sleep and mood (Browne, Hopkins et al. 2007) (Lange, Thilsing et al. 2011, Lange, Holst et al. 2013, DeConde, Mace et al. 2014). Factor analysis for SNOT-22 was validated in a Danish population of 40 patients (Lange, Thilsing et al. 2011).The four subscales are:- rhinological symptoms (questions 1-5, 7and 8), ear and facial symptoms (questions 9-12), sleep function (questions 13-15) and psychological issues (questions 17-22). The questions regarding cough and waking up tired were not included in these subscales. There are limited SNOT-22 data for a non-CRS population, particularly from within the UK (Farhood, Schlosser et al. 2015).

The overarching aim of the Chronic Rhinosinusitis Epidemiology Study (CRES) was to aid better understanding of medical and non-medical factors contributing to development or worsening of CRS. The aim of the Socioeconomic Cost of ChrOnic Rhinosinusitis study (SocCoR) was to identify the socio-economic costs of CRS to improve the understanding of the impact of CRS disease to the patient and the NHS. The purpose of this analysis was to yield large dataset of SNOT-22 information for a control population in the UK.

Materials and Methods

CRES was conducted as a cross-sectional cohort study and recruited from a total of 30 sites from around the UK (including the devolved nations of Wales and Scotland), between 2007 and 2013. Controls included family and friends of those attending ENT outpatient clinics and hospital staff, inclusion criteria required that they had no diagnosis of persistent nose or sinus problems and had not been admitted to hospital in the previous 12 months. Questionnaires were returned by participants using a Freepost envelope and scanned to a secure database using Formic. Two members of the research team checked the accuracy of electronic scanning of returned questionnaires. The SocCoR study recruited participants meeting the same criteria, but only from East Anglia

The CRES was approved by the Oxford C Research Ethics Committee, sponsored by the University of East Anglia (UEA) and funded by the Anthony Long and Bernice Bibby Trusts. The study specific questionnaire was anonymous and therefore no consent was taken but implied through participation. Participant information leaflets were provided. SocCoR was approved by the North Scotland REC1 Research Ethics Committee.

Results

A total of 251 non-CRS controls completed the SNOT-22 questionnaire.

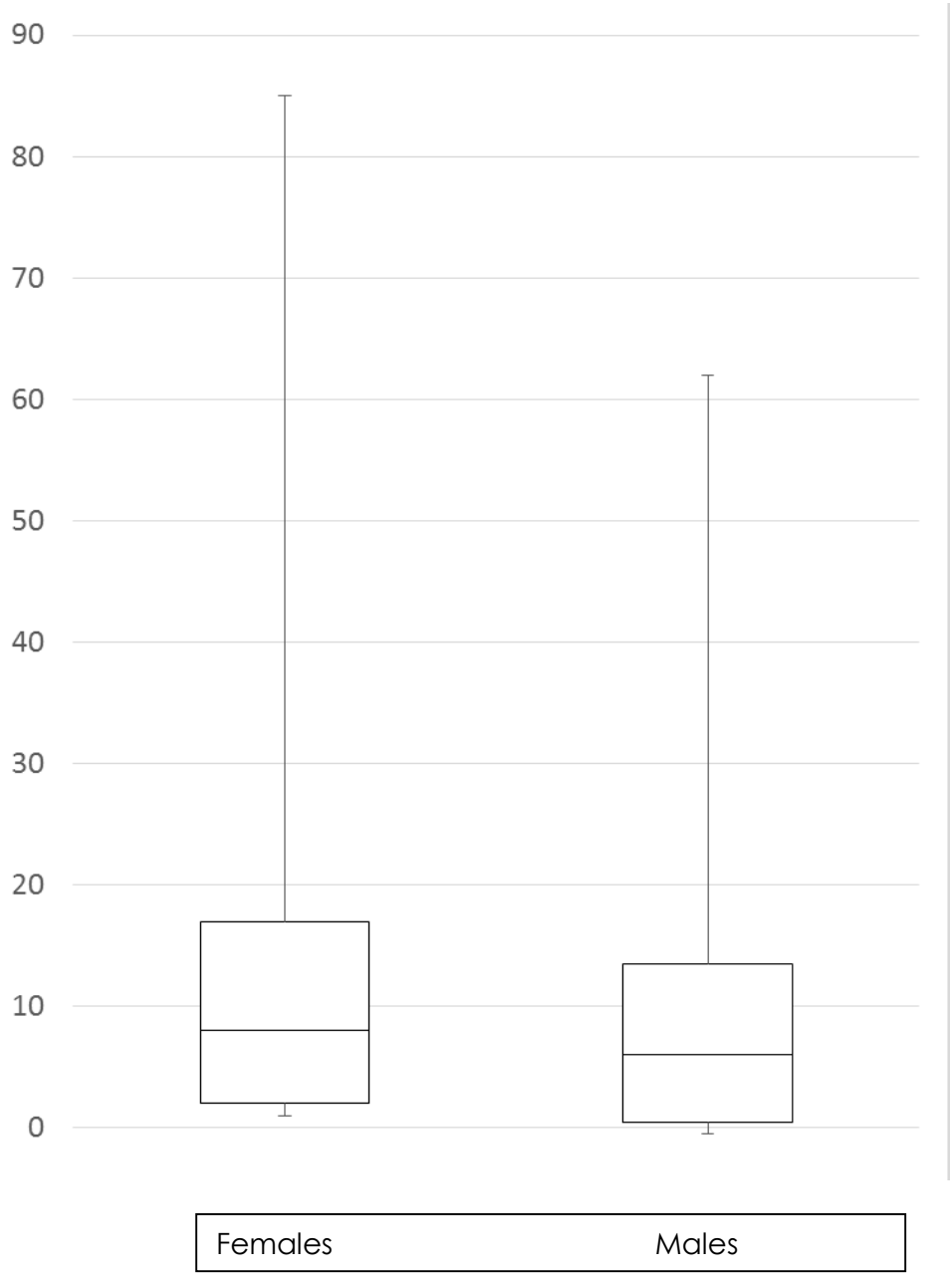
Participation rate for the study overall was 66%, data were not specifically collected regarding controls.

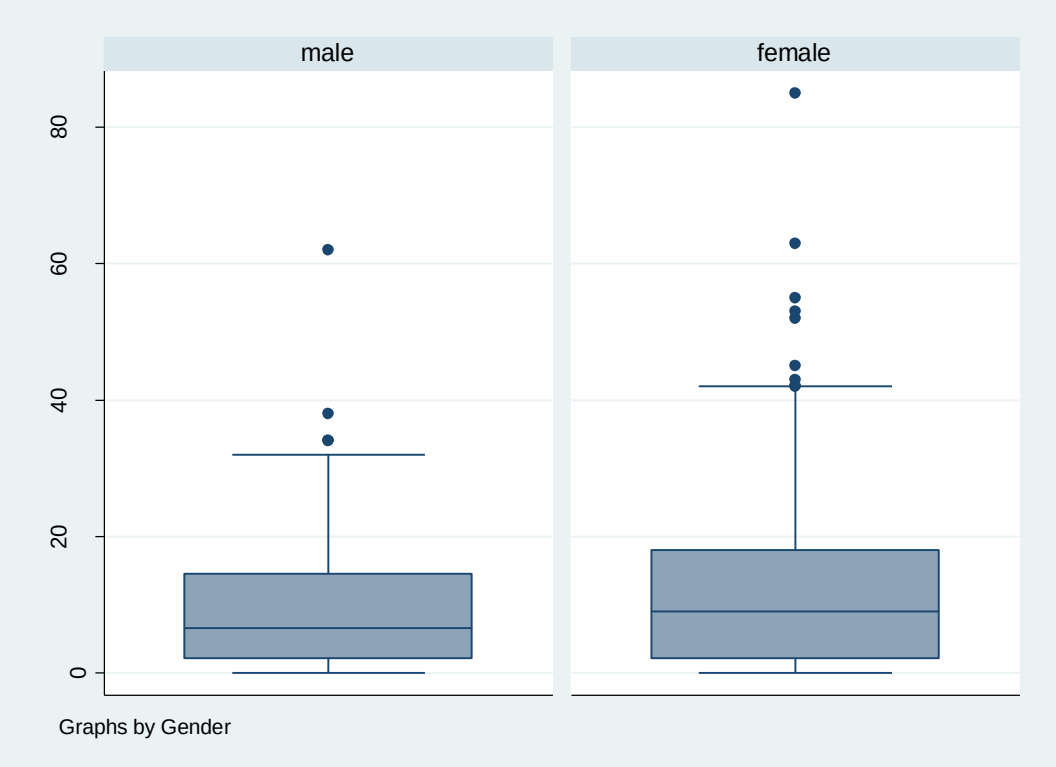
Table 1: SNOT-22 and its subscales

		Age (range)	SNOT-22		Nasal	Facial	Sleep fatigue	Emotional
	n		mean (sd)	Median (IQR)	mean (sd)	mean (sd)	mean (sd)	mean (sd)
Total	251	47.5 (19-80)	12.0 (13.6)	8 (2-17)	2.5 (4.0)	1.1 (2.5)	2.9 (3.6)	3.5 (5.3)
Females	143	46.8 (14.4) 19-80	13.2 (15.0)	9 (2-18)	2.3 (3.6)	1.4 (2.9)	3.4 (3.9)	3.8 (6.0)
Males	96	48.8 (15.8) 22-82	10.2 (11.1)	6.5 (2-14.5)	2.8 (4.4)	0.7 (1.4)	2.2 (2.7)	3.0 (4.1)
Differences (p values)			0.092[1]	0.297[3]	0.363[2]	0.006[1]	0.005[1]	0.193[1]

[1]t-test (unequal variances) ; [2] t-test (equal variances) ; [3] Mann-Whitney test

Boxplot to show SNOT-22 for males and females





Females tended to score more highly than males overall. They also had a wider range of scores. Females scored more highly on each of the domains; this was statistically significant within the sleep fatigue and facial domains.

Participants were asked about the frequency at which they suffer from upper respiratory tract infections; no differences were found in the numbers of upper respiratory tract infections between males and females.

Table to characterize outliers

Total SNOT-22	Nasal Domain (% of total domain score)	Facial Domain	Sleep Domain	Emotional Domain
Females 85	21 (60)	17 (85)	15 (100)	26 (87)
63	13 (37)	15 (75)	9 (60)	21 (70)
55	14 (51)	6 (30)	10 (67)	18 (60)
52	5 (14)	2 (10)	15 (100)	26 (87)
45	18 (51)	10 (50)	4 (27)	13 (43)
43	8 (23)	2 (10)	9 (60)	21 (70)
Males 62	19 (54)	9 (45)	10(75)	18 (60)
38	20 (57)	0	3 (20)	11 (37)
34	14 (51)	0	6 (40)	11 (37)
32	1 (3)	0	10 (75)	18 (60)

The table of outliers shows that outlying females tended to score highest amongst sleep and emotional domains. Outlying males scored highly across all domains other than facial.

Discussion

Our data describe a large population of non-CRS volunteers from across the UK. We found a mean SNOT-22 score of 10.2 for males with a median of 6.5, and a mean of 13.2 for

females with a median of 9. The standard deviation was higher amongst females. Our control results were not normally distributed; this is to be expected since there should be a large number of individuals who score very low (floor effect). Previous studies of a healthy control population have found a median of 7-9 (Gillett, Hopkins et al. 2009, Gregório, Andrade et al. 2015). The population (n=116) recruited by Gillett et al included a higher proportion of males and also those recruited through a tennis club who may have been healthier than the general population. A study using a random sample of the Danish population (n=271 for those without CRS) similarly found a median SNOT-22 value of 7 (IQR2-15), (Lange, Holst et al. 2013, Lange, Thilsing et al. 2015); they do not differentiate by gender. In a study of 539 healthy volunteers in Sao Paulo, Gregorio et al also found SNOT-22 scores were distributed significantly differently between men and women. Men presented significantly lower normal values than women (men: mean = 8.58 and median = 7 versus women: mean = 10.94 and median = 9;p = 0.005). A median score of 7-10 for males and 9-13 for females therefore appears to be reproducible benchmark for 'normal' SNOT-22. A recent systematic review of SNOT-22 scores in a non-CRS population found that scores varied significantly according to the nature of the group studied (Farhood, Schlosser et al. 2015). The review also found differences between those with and without asthma and amongst smokers. Similar results were found in the CRES study between all subgroups of CRS patients, and will be reported elsewhere. The importance of using non-CRS SNOT scores from a comparable population is therefore key, and our data provide this for a very diverse UK population. The average SNOT-22 score identified should not be used as an 'absolute' normal score to assign care for CRS or as a diagnostic threshold, but is a useful figure to consider when assessing SNOT-22 in the context of CRS in both clinic and research.

Conclusion

Our data provide reference data for scores across SNOT-22 in a non-CRS population across a wide cross section of the UK population and they demonstrate the differences in

reporting in males and females. These data can be used in future studies for comparison with different disease populations with rhinosinusitis.

Acknowledgments Jane Woods

Browne, J. P., C. Hopkins, R. Slack and S. J. Cano (2007). "The Sino-Nasal Outcome Test (SNOT): Can we make it more clinically meaningful?" Otolaryngology - Head and Neck Surgery **136**(5): 736-741.
DeConde, A. S., J. C. Mace, T. Bodner, P. H. Hwang, L. Rudmik, Z. M. Soler and T. L. Smith (2014). "SNOT-22 quality of life domains differentially predict treatment modality selection in chronic rhinosinusitis." International Forum of Allergy & Rhinology **4**(12): 972-979.
Farhood, Z., R. J. Schlosser, M. E. Pearse, K. A. Storck, S. A. Nguyen and Z. M. Soler (2015). "b" Int Forum Allergy Rhinol.
Gillett, S., C. Hopkins, R. Slack and J. P. Browne (2009). "A pilot study of the SNOT 22 score in adults with no sinonasal disease." Clinical Otolaryngology **34**(5): 467-469.
Greenhalgh, J., A. F. Long and R. Flynn (2005). "The use of patient reported outcome measures in routine clinical practice: lack of impact or lack of theory?" Social Science & Medicine **60**(4): 833-843.
Gregório, L. L., J. S. C. Andrade, F. A. Caparroz, P. Saraceni Neto and E. M. Kosugi (2015). "Influence of age and gender in the normal values of Sino Nasal Outcome Test–22." Clinical Otolaryngology **40**(2): 115-120.
HaSCI. (2014). "Monthly Patient Reported Outcome Measures (PROMs) in England: A guide to PROMs methodology." from http://www.hscic.gov.uk/media/1537/A-Guide-to-PROMs-Methodology/pdf/PROMs_Guide_V8.pdf.
Hastan, D., W. J. Fokkens, C. Bachert, R. B. Newson, J. Bislimovska, A. Bockelbrink, P. J. Bousquet, G. Brozek, A. Bruno, S. E. Dahlén, B. Forsberg, M. Gunnbjörnsdóttir, L. Kasper, U. Krämer, M. L. Kowalski, B. Lange, B. Lundbäck, E. Salagean, A. Todo-Bom, P. Tomassen, E. Toskala, C. M. van Drunen, J. Bousquet, T. Zuberbier, D. Jarvis and P. Burney (2011). "Chronic rhinosinusitis in Europe – an underestimated disease. A GA2LEN study." Allergy **66**(9): 1216-1223.
Hopkins, C., S. Gillett, R. Slack, V. J. Lund and J. P. Browne (2009). "Psychometric validity of the 22-item Sinonasal Outcome Test." Clinical Otolaryngology **34**(5): 447-454.
Lange, B., R. Holst, T. Thilsing, J. Baelum and A. Kjeldsen (2013). "Quality of life and associated factors in persons with chronic rhinosinusitis in the general population: a prospective questionnaire and clinical cross-sectional study." Clin Otolaryngol **38**(6): 474-480.

Lange, B., T. Thilsing, A. Al-kalemji, J. Baelum, T. Martinussen and A. Kjeldsen (2011). "The Sino-Nasal Outcome Test 22 validated for Danish patients." Dan Med Bull **58**(2).
Lange, B., T. Thilsing, J. Baelum and A. D. Kjeldsen (2015). "The Sino Nasal Outcome Test 22 score in persons without chronic rhinosinusitis." Clin Otolaryngol **12**(10): 12481.
Piccirillo, J. F., D. Edwards, A. Haiduk, C. Yonan and S. E. Thawley (1995). "Psychometric and Clinimetric Validity of the 31-Item Rhinosinusitis Outcome Measure (RSOM-31)." American Journal of Rhinology **9**(6): 297-306.
Rudmik, L., C. Hopkins, A. Peters, T. L. Smith, R. J. Schlosser and Z. M. Soler (2015). "Patient-reported outcome measures for adult chronic rhinosinusitis: A systematic review and quality assessment." J Allergy Clin Immunol **136**(6): 1532-1540 e1532.
Timmins, N. (2008). "NHS goes to the PROMS." BMJ : British Medical Journal **336**(7659): 1464-1465.