Adaptation and Validation of the Hebrew Version of the Nasal Obstruction Symptom Evaluation (NOSE) Scale

Narin N. Carmel Neiderman MD MSc[1,2], Nir Halevy MD[1,2], Tal Kas MD[1,2], Anat Wengier MD[1,2], Ahmad Safadi MD[1,2], and Avraham Abergel MD[1,2]

[1]Department of Otolaryngology, Head and Neck Surgery, Tel Aviv Sourasky Medical Center, Tel Aviv, Israel
[2]Sackler Faculty of Medicine, Tel Aviv University, Tel Aviv, Israel

ABSTRACT **Background:** Nasal obstruction is one of the most common complaints in the practice of rhinology.

Objective: To adapt the Nasal Obstruction Scale Evaluation (NOSE) questionnaire to Hebrew (H-NOSE) and to assess its sensitivity and specificity.

Methods: Candidates for surgical intervention due to isolated nasal obstruction and healthy volunteers (controls) were included in the validation. The English NOSE questionnaire was translated into Hebrew and re-translated for translation validity. Patients completed the H-NOSE questionnaire before and after surgery for nasal obstruction. The same questionnaire was completed by the controls. Test–retest reliability was performed within 2 weeks. Psychometric properties (reliability, reproducibility, validity, and responsiveness) were assessed by a test–retest procedure, internal consistency, correlation to the Hebrew Sino-Nasal Outcome Tool 22 (He-SNOT-22), and response sensitivity.

Results: In total, 179 patients with nasal obstruction and 74 controls completed the questionnaire. Cronbach's alpha score was 0.93 for internal consistency. The receiver operating characteristic curve demonstrated high sensitivity and specificity (< 90%) and area under the curve was 0.97. We found no significant difference in test–retest reliability. The difference between the pre- and postoperative questionnaire scores was highly significant (13.9 ± 4.0 vs. 3.2 ± 4.1, respectively, $P < 0.001$).

Conclusions: The H-NOSE questionnaire demonstrated reliable internal consistency, sensitivity, specificity, and reliability. The Hebrew version differentiated between patients and heathy controls and was easy to administer. This instrument is useful for Hebrew speaking patients who undergo surgery for nasal obstruction.

IMAJ 2023; 25: 564–567

KEY WORDS: deviated nasal septum, septoplasty, nasal obstruction, Nasal Obstruction Scale Evaluation (NOSE), quality of life (QoL)

Nasal obstruction is caused by multiple etiologies [1,2] and has a major impact on quality of life (QoL) [3]. It is one of the most common complaints in the practice of rhinology. Assessment of the validation for corrective surgery for nasal obstruction is almost entirely based on patient self-reports and self-assessments and is poorly correlated with objective measurements and imaging studies [4]. Objective assessment of nasal obstruction, such as rhinomanometry, peak nasal inspiratory flow [5-7], and cross-sectional imaging measurements were not found to be predictive of, or to correlate with, patient symptoms. As such, disease-specific health-related QoL questionnaires serve as an important methodology to assess the ongoing burden resulting from the presence of nasal airway obstruction.

Stewart and colleagues [8] introduced the Nasal Obstruction Symptom Evaluation (NOSE) scale in 2004 as a self-report instrument to quantify the subjective burden of nasal obstruction. Responses to questions related to nasal obstruction are provided on a 5-point Likert-type scale resulting in a score ranging from 0 to 20. The questionnaire is easy to complete and requires little effort. It includes features that contribute to its global popularity in research and surgical technique evaluations, as illustrated by its validated adaptations in Spanish [9], Italian, French [10], Greek [11], Portuguese, and Lithuanian [12]. It was even found to be feasible among pediatric patients [13]. The NOSE questionnaire was found to correlate with endoscopic evaluations and computed tomographic findings [14] and to be efficacious for postoperative assessment [15,16]. The primary goal of this study was to translate the NOSE questionnaire into Hebrew and validate its application to Hebrew-speaking patients. Our aim was to establish the translated instrument's validity, reliability, and sensitivity for managing nasal obstruction.

PATIENTS AND METHODS

DESIGN

This prospective cross-cultural adaptation and validation study was conducted between April 2020 and January 2022 at Otolaryngology, Head and Neck Surgery, Tel Aviv Sourasky Medical Center. The study was approved by the institutional review board (TLV 565-20). Informed consent was provided.

CROSS-CULTURAL ADAPTATION TO THE HEBREW LANGUAGE

The accepted guidelines for the process of cross-cultural adaptation were followed as described by Beaton et al. [17]. Forward translation of the original NOSE questionnaire was performed by two bilingual native Hebrew-speaking otolaryngologists and one bilingual native Hebrew-speaking professional translator. A single Hebrew translation of the NOSE scale was conducted after reconciliation between the two forward translations. That version was re-translated by two native English-speaking translators without any medical background into the original English language. These backward translations were compared with the original NOSE scale and checked for discrepancies and item content, resulting in the final corresponding Hebrew version of the NOSE questionnaire.

PATIENT AND DATA ACQUISITION

Patients undergoing functional septorhinoplasty and inferior partial turbinectomy were included in the study. After being diagnosed as having isolated nasal obstruction, patietns were asked to complete the translated NOSE scale as well as the Hebrew version of the Sino-Nasal Outcome Test–22 (HE-SNOT-22) [18] questionnaire during preoperative outpatient consultation. Operated patients completed a second questionnaire 2 to 4 months after surgery. Inclusion criteria were non-pregnant patients older than 18 years of age, ability to sign informed consent, and fluency in written Hebrew language. Patients with isolated septoplasty or concomitant procedures, chronic sinonasal disease, previous sinus surgery, or malignancy were excluded from the study. The healthy volunteers who were free of nasal complaints were recruited as controls and further assessed to rule out any medical history of nasal obstruction, prior surgical intranasal interventions, and/or use of intranasal medications. All the controls were assessed by a specialist rhinologist and underwent fiberoptic and rhinoscopic evaluations prior to study entry.

STATISTICAL VALIDATION METHODS

Generally accepted quality criteria for validation were used as guidelines [19]. Questionnaires with missing items were excluded from the study.

Test reliability was defined by its internal consistency by Cronbach's alpha values were considered fair (0.70–0.79), good (0.80–0.8), and excellent (> 0.90) [20]. Test–retest reproducibility was investigated by administering a second H-NOSE questionnaire approximately 2 weeks after the first questionnaire. Data for patients who changed medications or nasal pharmaceuticals or who sustained symptoms due to upper or lower airway infections were excluded. Test–retest reproducibility was measured with the Wilcoxon test. A sufficient test–retest reliability was assumed for $P > 0.05$.

The questionnaire's discrimination ability was evaluated by the area under the receiver operating characteristic curve (ROC), and specificity and sensitivity were calculated. The discriminant validity of the H-NOSE was also tested by comparison of the patients' and the control' responses to both the H-NOSE and He-SNOT22 questionnaires by means of the Mann-Whitney test. The Spearman correlation coefficient was applied to evaluate the association between H-NOSE and He-SNOT-22. Finally, responsiveness was measured by comparison between the preoperative and postoperative NOSE scores with the Wilcoxon test.

Results with a *P*-value ≥ 0.05 were considered non-significant. Statistical analyses were performed using IBM Statistical Package for the Social Sciences statistics software, version 24 (SPSS, IBM Corp, Armonk, NY, USA).

RESULTS

We collected 1353 questionnaires from 672 individuals between April 2020 and January 2022. In total, 253 participants met the study inclusion criteria: 179 patients who presented clinically with isolated nasal obstruction and 74 asymptomatic healthy controls. The mean ± standard deviation age of the patients was 32.61 ± 13.82 years; 150 (59.1%) were males. All the study participants completed the final version of the H-NOSE. Ninety-seven patients underwent septoplasty or functional septorhinoplasty and inferior partial turbinectomy in our department by

Table 1. H-NOSE scores preoperative and postoperative

	Preoperative, (n=67)	Postoperative, (n=67)	*P*-value
H-NOSE score			< 0.001
Mean ± standard deviation	13.9 ± 4.0	3.2 ± 4.1	
Interquartile range	14 (10–17)	2 (0–5)	

H-NOSE = Hebrew version of nasal obstruction symptom evaluation scale [7]

Table 2. He-SNOT22 and H-NOSE scores of patients with nasal obstruction vs. healthy controls

	Patients with INO (n=179)	Healthy controls (N=74)	*P*-value
He-SNOT22 score			< 0.001
Mean ± standard deviation	38.2 ± 24.45	8.1 ± 10.96	
Interquartile range	38 (16–57)	2.5 (0–14)	
H-NOSE score			< 0.001
Mean ± standard deviation	13.3 ± 4.52	1.4 ± 2.46	
Interquartile range	14 (10–16)	0 (0–2)	

H-NOSE = Hebrew version of nasal obstruction symptom evaluation scale [7], He-SNOT22 =Hebrew version of the sinonasal outcome test [17]

Values are given as mean ± standard deviation and median (interquartile range)

Table 3. Test and re-test H-NOSE scores

	H-NOSE score, (n=23)	Re-test score, (n=23)	*P*-value
H-NOSE score			0.59
Mean ± standard deviation	9.1 ± 6.9	8.6 ± 6.6	
Interquartile range	10 (2–15)	9 (3–14)	

H-NOSE = Hebrew version of the nasal obstruction symptom evaluation scale [7]

Table 4. Sensitivity and specificity of the H-NOSE questionnaire in ROC curve analyses

Score ≥	Sensitivity	Specificity
0.5	98%	58.1%
1.5	98.3%	79.9%
4.5	95.5%	87.8%
5.5	93.9%	93.2%
7.5	89.9%	94.6%

H-NOSE = Hebrew version of the nasal obstruction symptom evaluation scale [7]

ROC = receiver operating characteristic curve

three authors (AS, AW, AA) to restore nasal patency, and 67 patients (69%) completed both pre- and postoperative H-NOSE questionnaires. In addition, 23 patients also completed the questionnaire a second time up to 2 weeks after the first. Regarding the operated patients, the postoperative mean NOSE scores were significantly lower compared to the preoperative scores (13.9 ± 4.0 vs. 3.2 ± 4.1, respectively, $P < 0.001$) [Table 1].

The internal consistency of the H-NOSE questionnaire was high (Cronbach's alpha 0.93). There were no significant differences in the test–retest (n=23) H-NOSE scores, further supporting reproducibility. The H-NOSE questionnaire showed excellent discrimination between patients with isolated nasal obstruction and the 74 healthy controls, with significant differences in both the He-SNOT22 scores (38.2 ± 24.45 vs. 8.1 ± 10.96, respectively, $P < 0.001$) and the H-NOSE scores (13.3 ± 4.52 vs. 1.4 ± 2.46, $P < 0.001$) [Table 2]. He-SNOT22 scores correlated highly with H-NOSE scores in the Spearman correlation (*rs* 0.78, $P < 0.001$) [Table 3]. Sensitivity and specificity were found to be high in a ROC curve analysis [Table 4], area under the curve 0.97 and 95% confidence interval 0.96–0.99, $P < 0.001$.

DISCUSSION

Patient-reported outcome measurements (PROMs) are important in decision-making processes regarding surgical interventions in cases of nasal obstruction surgeries [4]. The use of PROMs has become common practice in rhinology clinics. PROMS may help healthcare providers if the instruments used are comparable. In the absence of gold standard objective instruments to evaluate nasal obstruction, a validated PROM is an important clinical tool for a more comprehensive evaluation of the severity and burden of disease among patients with nasal obstruction.

There are several validated questionnaires that may be used in rhinology practice to assess PROMs and QoL. These include the Chronic Sinusitis Survey (CSS) [21], the Rhinoconjunctivitis Quality of Life Questionnaire (RQLQ) [22], the Rhinosinusitis Disability Index (RSDI) [23], SNOT-20 and SNOT-22 [24] and the Allergy Outcome Survey (AOS) [21]. The CSS, RSDI, and SNOT-20 questionnaires, however, were designed for use in patients with chronic sinusitis and not isolated nasal obstruction. Moreover, the RQLQ and AOS questionnaires were primarily designed for patients with allergic rhinitis and conjunctivitis. The changes in health status in isolated nasal obstruction are too subtle or disease-specific to be assessed with a rhinosinusitis-specific instrument, which requires its own disease-specific health status instrument.

SNOT-22 is not the instrument of choice in the assessment of isolated nasal obstruction nor is it commonly used even though it originally seemed to have a potential contribution in the evaluation of PROMs among affected patients [25]. Interestingly, our experience was that SNOT-22 had added value in the assessment of patients with complaints of allergy and nasal obstruction but without sinusitis. We recommend further evaluation of the contribution of He-SNOT-22 in the assessment of PROMs in those patients.

The NOSE scale is a validated globally accepted disease-specific instrument for quantifying the burden related to nasal obstruction-related QoL. Since its introduction in 2004, it has been in common use in rhinology practices worldwide [4]. Every translation and adaptation to another language, however, carries the risk of potential a loss of information, validity, and reliability. Cross-cultural adaptation of the NOSE scale for the comparison of surgical outcome and to conduct a long-term assessment of surgical outcomes among Hebrew speaking patients is needed. In this study, we validated a Hebrew-language version of the NOSE scale. Internal consistency was excellent, with Cronbach's alpha of 0.93, which is higher than the internal consistency that had been achieved during the design of the original questionnaire]8,10,11]. Like many similar tools, the NOSE scale was validated for use in groups of patients and not for individual patients. It compares the disease-specific health status before and after treatment and the effects of different treatments. It assesses differences in outcome when different surgical techniques are used. It could also be used to compare symptom severity between different groups of patients. It was not designed to be used with individual patient data or to predict outcomes in individuals.

Our study has several limitations. First, it was performed during the coronavirus disease 2019 (COVID-19) pandemic, which might have contributed to decreased patient compliance to arrive at the clinic for postoperative physical examination to complete the follow-up questionnaires. All patients were questioned about their COVID-19 status. Patients with COVID-19 did not undergo surgery and were excluded from our study. Patients with prolonged post-COVID-19 were excluded from the study. It was a single-center study with a limited number of surgeons, potentially causing a selection bias. In the original validation study by Stewart and colleagues [8], however, the NOSE questionnaire revealed good measurement properties in a multicenter study involving four academic hospitals, and Larrosa and co-authors [9] included both a tertiary and regional center with comparable results. To preserve homogeneity, radio frequency ablation and local treatments were not included in this study.

CONCLUSIONS

H-NOSE was found to have high internal consistency, high sensitivity and specificity, and high reliability. It is easily applicable in the clinical setting and differentiates well between healthy controls and patients with isolated nasal obstruction. The H-NOSE scale can be used for QoL outcome research in rhinology practice among Hebrew-speaking patients and is recommended for routine use in the clinical setting.

Correspondence

Dr. A. Abergel
Dept. of Otolaryngology, Head and Neck Surgery, Tel Aviv Sourasky Medical Center, Tel Aviv 6423906, Israel
Phone: (972-3) 697-3573
Fax: (972-3) 697-4840
Email: avrahamab@tlvmc.gov.il

References

1. Hsu DW, Suh JD. Anatomy and physiology of nasal obstruction. *Otolaryngol Clin North Am* 2018; 51 (5): 853-65.
2. Saxon S, Johnson R, Spiegel JH. Laterality and severity of nasal obstruction does not correlate between physicians and patients, nor among physicians. *Am J Otolaryngol* 2021; 42 (6): 103039.
3. Rhee JS, Sullivan CD, Frank DO, Kimbell JS, Garcia GJ. A systematic review of patient-reported nasal obstruction scores: defining normative and symptomatic ranges in surgical patients. *JAMA Facial Plast Surg* 2014; 16 (3): 219-25; quiz 232.
4. Ta NH, Gao J, Philpott C. A systematic review to examine the relationship between objective and patient-reported outcome measures in sinonasal disorders: recommendations for use in research and clinical practice. *Int Forum Allergy Rhinol* 2021; 11 (5): 910-23.
5. Pannu KK, Chadha S, Kaur IP. Evaluation of benefits of nasal septal surgery on nasal symptoms and general health. *Indian J Otolaryngol Head Neck Surg* 2009; 61 (1): 59-65.
6. Stewart MG, Smith TL. Objective versus subjective outcomes assessment in rhinology. *Am J Rhinol* 2005; 19 (5): 529-35.
7. Gliklich RE, Metson R. Techniques for outcomes research in chronic sinusitis. *Laryngoscope* 1995; 105 (4 Pt 1): 387-90.
8. Stewart MG, Witsell DL, Smith TL, Weaver EM, Yueh B, Hannley MT. Development and validation of the Nasal Obstruction Symptom Evaluation (NOSE) scale. *Otolaryngol Head Neck Surg* 2004; 130 (2): 157-63.
9. Larrosa F, Roura J, Dura MJ, Guirao M, Alberti A, Alobid I. Adaptation and validation of the Spanish version of the Nasal Obstruction Symptom Evaluation (NOSE) Scale. *Rhinology* 2015; 53 (2): 176-80.
10. Marro M, Mondina M, Stoll D, de Gabory L. French validation of the NOSE and RhinoQOL questionnaires in the management of nasal obstruction. *Otolaryngol Head Neck Surg* 2011; 144 (6): 988-93.
11. Lachanas VA, Tsiouvaka S, Tsea M, Hajiioannou JK, Skoulakis CE. Validation of the Nasal Obstruction Symptom Evaluation (NOSE) scale for greek patients. *Otolaryngol Head Neck Surg* 2014; 151 (5): 819-23.
12. Balsevicius T, Padervinskis E, Pribuisiene R, Kuzminiene A, Vaitkus S, Liutkevicius V. Cross-cultural adaptation and validation of Lithuanian-NOSE scale. *Eur Arch Otorhinolaryngol* 2021; 278 (4): 1053-8.
13. Kawai K, Dombrowski N, AuYeung T, Adil EA. Validation of the Nasal Obstruction Symptom Evaluation Scale in Pediatric Patients. *Laryngoscope* 2021; 131 (9): E2594-E2598.
14. Stewart MG, Witsell DL, Smith TL, Weaver EM, Yueh B, Hannley MT. Development and validation of the Nasal Obstruction Symptom Evaluation (NOSE) scale. *Otolaryngol Head Neck Surg* 2004; 130 (2): 157-63.
15. Kahveci OK, Miman MC, Yucel A, Yucedag F, Okur E, Altuntas A. The efficiency of Nose Obstruction Symptom Evaluation (NOSE) scale on patients with nasal septal deviation. *Auris Nasus Larynx* 2012; 39 (3): 275-9.
16. Kahraman E, Cil Y, Incesulu A. The Effect of nasal obstruction after different nasal surgeries using acoustic rhinometry and Nasal Obstruction Symptom Evaluation Scale. *World J Plast Surg* 2016; 5 (3): 236-43.
17. Beaton DE, Bombardier C, Guillemin F, Ferraz MB. Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine* 2000; 25 (24): 3186-91.
18. Shapira Galitz Y, Halperin D, Bavnik Y, Warman M. Sino-Nasal Outcome Test–22. *Otolaryngol Neck Surg* 2016; 154 (5): 951-6.
19. Aaronson N, Alonso J, Burnam A, et al. Assessing health status and quality-of-life instruments: attributes and review criteria. *Qual Life Res* 2002; 11 (3): 193-205.
20. Cicchetti D V. Guidelines, criteria, and rules of thumb for evaluating normed and standardized assessment instruments in psychology. *Psychol Assess* 1994; 6 (4): 284-90.
21. Kemker BJ, Corey JP, Branca J, Gliklich RE. Development of the allergy outcome survey for allergic rhinitis. *Otolaryngol Head Neck Surg* 1999; 121 (5): 603-5.
22. Juniper EF, Guyatt GH. Development and testing of a new measure of health status for clinical trials in rhinoconjunctivitis. *Clin Exp Allergy* 1991; 21 (1): 77-83.
23. Benninger MS, Senior BA. The development of the Rhinosinusitis Disability Index. *Arch Otolaryngol Head Neck Surg* 1997; 123 (11): 1175-9.
24. Zhou AS, Prince AA, Maxfield AZ, Corrales CE, Shin JJ. The Sinonasal Outcome Test-22 or European Position Paper: Which is more indicative of imaging results? *Otolaryngol Head Neck Surg* 2021; 164 (1): 212-8.
25. Buckland JR, Thomas S, Harries PG. Can the Sino-nasal Outcome Test (SNOT-22) be used as a reliable outcome measure for successful septal surgery? *Clin Otolaryngol Allied Sci* 2003; 28 (1): 43-7.

There is nothing like returning to a place that remains unchanged to find the ways in which you yourself have altered.

Nelson Mandela (1918–2013), South African anti-apartheid activist, political leader, and Nobel laureate who served president of South Africa from 1994 to 1999