



## ORIGINAL RESEARCH

# Cross-cultural adaptation of the Hebrew Nasal Obstruction Symptom Evaluation (NOSE) scale

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**Abstract**

**Objective:** Nasal obstruction is a common complaint. The Nasal Obstruction Symptom Evaluation scale (NOSE) is a reliable validated tool used to assess the quality of life of patients with nasal obstruction. The purpose of this study is to validate the Hebrew version of the NOSE scale (He-NOSE).

**Methods:** A prospective instrument validation was conducted. The NOSE scale was translated primarily from English to Hebrew and then back from Hebrew to English according to the accepted guidelines of the cross-cultural adaptation process. The study group included surgery candidates suffering from nasal obstruction due to a deviated nasal septum and/or inferior turbinate hypertrophy. The study group completed the validated He-NOSE questionnaire twice prior to the surgery and once again, a month post-surgery. A control group of individuals with no history of nasal complaints or surgeries was asked to complete the questionnaire once. Reliability, internal consistency, validity, and responsiveness to change of the He-NOSE were evaluated.

**Results:** Fifty-three patients and 100 controls were included in this study. The scale showed excellent ability to discriminate between the study and the control group, exhibiting significantly lower scores in the control group (73.8 and 7 average scores respectively,  $p < .001$ ). Good internal consistency (Cronbach's alpha .71 and .76) and test-retest reliability (Spearman rank correlation  $r = .752$ ,  $p < .0001$ ) were measured. Moreover, the scale revealed remarkable responsiveness to change ( $p < .00001$ ).

**Conclusion:** The translated and adapted He-NOSE scale can be a useful tool to be applied in both clinical and research fields when assessing nasal obstruction.

**Level of evidence:** N/A.

**KEYWORDS**

nasal obstruction, NOSE scale, PROMS, quality of life, validation study

Amani Daoud and Netanel Eisenbach contributed equally to this study.

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## 1 | INTRODUCTION

Nasal obstruction is a common complaint. Approximately 20% of the population suffers from nasal obstruction and seeks treatment.<sup>1</sup> This problem is known to have a substantial negative impact on the quality of life.<sup>1</sup> The etiologies of nasal obstruction may be classified into two essential groups; the first being mucosal, which includes nasal polypoid and inferior turbinate hypertrophy, and the second being structural, where some of the main causes are septal deviation, pyriform aperture stenosis, and nasal valve collapse.<sup>2,3</sup>

To provide adequate treatment to patients with nasal obstruction, it is fundamental to have the tools for its assessment and quantification. Assessment can be either objective (e.g., rhinomanometry) or subjective (reported by the patient). Due to a lack of consistency in estimation using objective measures, the patient-reported outcome measures (PROMS) have become more frequently used for the evaluation of patients. In recent years, several quality-of-life questionnaires related to nasal function were developed, such as the SNOT-22, the Nasal Symptom Questionnaire (NSQ), and the Nasal Obstruction Symptom Evaluation (NOSE) scale. These questionnaires are implemented in clinical evaluation, decision-making, and in countless studies.<sup>4-6</sup>

In 2004, the NOSE scale was published by Stewart et al.<sup>4</sup> This questionnaire consists of five 5-point Likert Scale questions regarding nasal complaints including congestion, obstruction, trouble breathing, sleeping, and exercising. The NOSE scale is short and easy to complete, with a minimal respondent burden. Its simplicity has contributed to its widespread use as a research and evaluation tool for patient assessment. Questions were carefully selected, and all have high reliability and validity. Its growing popularity is demonstrated by the adaptation of NOSE scale in French,<sup>7</sup> Dutch,<sup>8</sup> Arabic,<sup>9</sup> German,<sup>10</sup> Greek,<sup>11</sup> Italian,<sup>12</sup> Polish,<sup>13</sup> and Slovak<sup>14</sup> versions.

In this work, we translated, made cross-cultural adaptations, and validated the questionnaire into the Hebrew language.

## 2 | METHODS

### 2.1 | Study design

We conducted a prospective instrument validation study. Prior to study initiation, permission to validate the questionnaire was granted from the original author of the NOSE scale. The study design adhered to the ethical principles outlined in the Declaration of Helsinki and was approved by the ethical review board of the Galilee Medical Center (0041-17-NHR). In this approval, we received an exemption from the informed consent papers and rather were allowed to have patients' consent verbally and hand out the questionnaire solely. This study was conducted between 1/2020 and 5/2021.

Patients were enrolled in the ENT clinics and department at the Galilee Medical Center. The study group included surgical candidates for septoplasty and/or inferior turbinoplasty due to a deviated nasal septum (DNS) and/or inferior turbinate hypertrophy (ITH).

Patients younger than 18 years of age were excluded, along with patients with a history of nasal surgeries or chronic rhinosinusitis, and those who had a different cause for nasal obstruction other than DNS or ITH. All surgeries were performed at the Galilee Medical Center, in Israel.

Patients in the study group were asked to complete the translated NOSE scale twice before surgery. Once at our ENT clinics when the diagnosis was established, and a second time at our ENT department upon their arrival for surgery. A month after surgery, the patients were asked to complete the translated NOSE scale a third time, upon their first follow-up visit. A control group consisting of healthy subjects, 18 years old or older, with no history of nasal disorders or nasal complaints and had no prior nasal surgeries were asked to complete the He-NOSE scale only once. In addition, all participants were asked to share their thoughts on the questionnaire regarding any difficulties, offensiveness, or misconceptions.

The original NOSE scale<sup>4</sup> is a questionnaire that aims to assess the quality-of-life of patients suffering from nasal obstruction in the preceding month. The scale consists of five questions: (1) nasal congestion or stuffiness, (2) nasal blockage or obstruction, (3) trouble breathing through my nose, (4) trouble sleeping, and (5) unable to get enough air through my nose during exercise or exertion. Each question is graded from 0 to 4 depending on severity ranging from (0) not a problem to (4) meaning a severe problem. The total score is then multiplied by 5, resulting in a final score ranging from 0 to 100.

### 2.2 | Translation process

The Hebrew NOSE scale (He-NOSE) translation process was performed using guidelines for cross-cultural adaptation.<sup>4,15,16</sup> Initially, two translations were made from English to Hebrew by two independent Hebrew-native translators; One translator was an ENT physician, and the other translator had no medical background. The two translated questionnaires were then incorporated into one joint questionnaire, where minor differences were resolved with discussion. Thereafter, the translation of the provisional He-NOSE questionnaire back to English was performed by two independent English-native translators. Accordingly, the original NOSE scale was compared to our translated version, by two independent examiners, fluent in both languages. Subsequently, a final version of the He-NOSE scale was completed.

### 2.3 | Statistical analysis

Descriptive analysis: Categorical data were described using frequencies and percentages. Continuous variables with normal distribution were presented as mean  $\pm$  standard deviation. Median value and range were used in variables that did not meet the normal distribution assumption.

Inferential analysis: Categorical variables were compared between the groups using the chi-square test, or Fisher's exact tests (when

## סולם הערכת תלונת חסימה אפית

← נא למלא את השאלון הבא כדי לעזור לנו להבין טוב יותר את ההשפעה של החסימה האפית על איכות חייך. תודה!

במהלך החודש האחרון, עד כמה היו המצבים הבאים בעייתיים עבורך?

נא להקיף בבקשה את התשובה הנכונה ביותר

בעיה חמורה	בעיה די קשה	בעיה בינונית	בעיה קלה מאוד	אין בעיה	
4	3	2	1	0	(1) גודש או תחושת מלאות באף
4	3	2	1	0	(2) אף סתום או חסום
4	3	2	1	0	(3) קושי לנשום דרך האף שלי
4	3	2	1	0	(4) הפרעות שינה בשל בעיה אפית
4	3	2	1	0	(5) חוסר יכולת להכניס מספיק אוויר דרך האף שלי בזמן אימון גופני או מאמץ

**FIGURE 1** He-NOSE scale. The final version of the Hebrew NOSE scale (He-NOSE)

expectancy is <5). Continuous variables were compared using Independent *T*-test or Wilcoxon rank-sum test depending on variables' distribution, if a normal distribution was found using a histogram, independent *T*-test was performed.

The discriminatory validity of the questionnaire was assessed using the Mann-Whitney test, comparing scores between control and study groups. The responsiveness of the questionnaire to change was performed using Wilcoxon signed-rank test. Statistical significance was defined as  $p < .05$ . Reliability was examined using internal consistency (Cronbach's alpha measure) and test-retest reproducibility. Test-retest reproducibility was assured by calculating Spearman rank correlation for the scores. Data analysis was performed using IBM SPSS (version 27.0), Armonk, NY: IBM Corp.

### 3 | RESULTS

#### 3.1 | Pilot review

We conducted a pilot review for the He-NOSE scale with 115 participants including ENT physicians and individuals with no medical background. The participants were asked to complete and evaluate the He-NOSE scale. Good feedback was given for questions 1-3 and 5. However, question number 4—"trouble sleeping," seemed to confuse participants as to whether sleeping problems unrelated to their nasal complaints should be taken into consideration when answering the question. Moreover, this issue was confirmed statistically with a low internal consistency between the questions overall (0.39 for healthy individuals and 0.66 for participants suffering from nasal

obstruction). Internal consistency improved dramatically when question number 4 was removed (0.7 and 0.8, respectively). After a discussion between the study team and translators, and as part of the cultural adaptation, we decided to further clarify this question into "trouble sleeping due to a nasal problem." Consequently, a final version of the He-NOSE was reached (Figure 1).

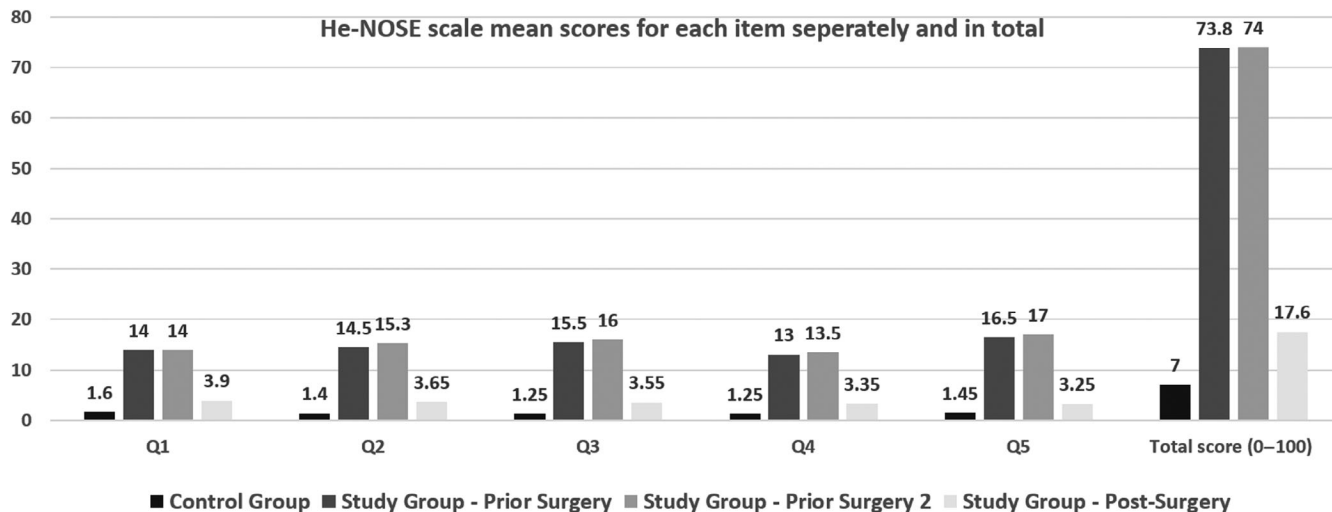
#### 3.2 | Demographics

A total of 153 participants were included in this study, 100 asymptomatic controls with no nasal complaints or disorders and no history of nasal surgeries, and 53 patients who met the inclusion criteria and composed the study group. In the study group, age ranged between 18 and 66 with an average of  $34.3 \pm 13.9$  of which 50.9% were male. The control group consisted of individuals with an average age of  $35.8 \pm 13.1$  (range 20-68) of which 37% were male. No statistical difference was demonstrated between the two groups concerning age or sex. ( $p = .5$  and  $.09$ , respectively).

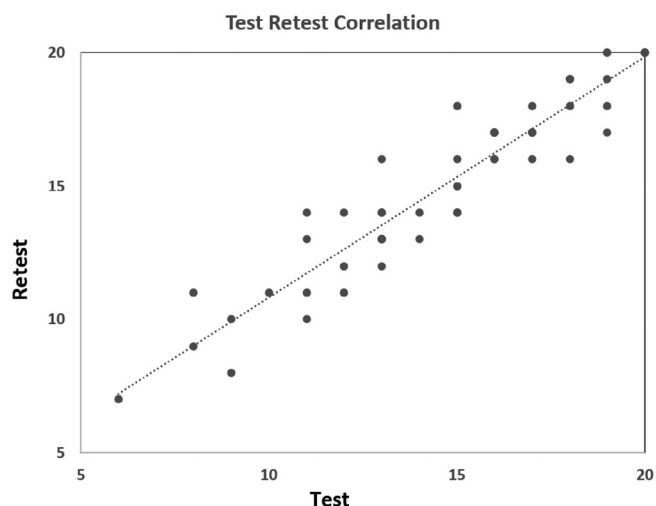
All participants were capable of answering the questionnaire fully without difficulties or complaints.

#### 3.3 | Discriminatory validity

A comparison between the He-NOSE scale means scores for each question and in total was performed and compared between the control and the pre-operative study group (mean total score of  $7 \pm 8$  vs.  $73.8 \pm 17.6$ , respectively). A significantly higher score for each item



**FIGURE 2** Mean H-NOSE scale scores. He-NOSE scale scores for each question separately and in total for the control group and for the study group in the setpoints (twice prior to surgery and once post-operatively). Comparisons between the different groups to assess discriminatory validity, test-retest reliability, and responsiveness to change are shown. Discriminatory validity measured by comparing the study group's mean scores prior to surgery to the control group showed a significant difference ( $p < .001$ ). Responsiveness to change assessed by comparing the prior and post-surgery results had a significant difference as well ( $p < .0001$ ).



**FIGURE 3** Test-retest correlation. The test-retest assessment shows a great correlation between the two categories (Spearman rank correlation  $r = .752$ ). *T*-test for the reproducibility comparison showed no significant difference for all 1-5 items and in total ( $p = 1.0, .143, .432, .453, .563$ , and  $.918$ , respectively).

individually and in total was demonstrated in the study group ( $p < .001$  for all comparisons; Figure 2).

### 3.4 | Reliability and internal consistency

Reliability was analyzed by performing a test-retest of the questionnaire and by calculating the Spearman rank correlation. When comparing study group scores between questionnaires completed at time of diagnosis and on admission prior surgery, no significant difference

was found in the mean score of each question separately and in total (mean total score of  $73.95 \pm 19.7$  and  $73.8 \pm 17.6$ ,  $p = .918$ ; Figure 2). Moreover, Spearman rank demonstrated great correlation between these two setpoints ( $r = .752$ ,  $p < .0001$ ; Figure 3).

The Bland-Altman plot illustrated that almost all differences between the test and retest were located between the upper and lower calculated thresholds of CI 95%  $[-1.9$  to  $2.7]$ , indicating good reliability (Figure 4). For internal consistency, Cronbach's coefficient value that was low in our pilot study prior to modifying item number 4, demonstrated significantly higher levels of 0.71 and 0.76, respectively, showing a satisfactory internal consistency.

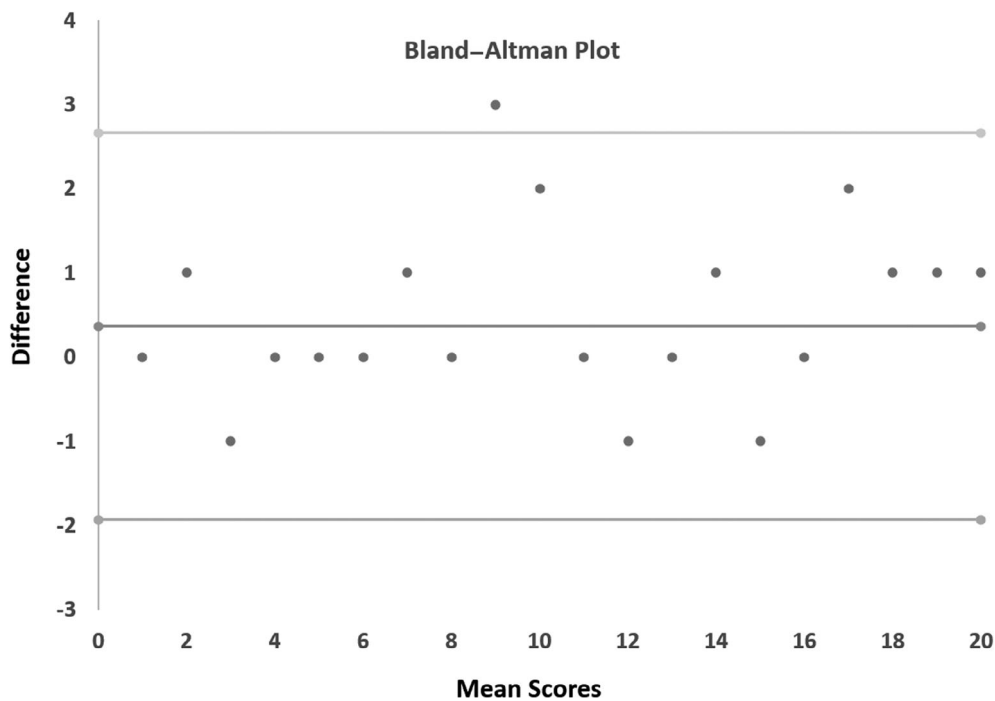
### 3.5 | Responsiveness to change

Wilcoxon signed-rank test was calculated to assess the change between pre- and post-surgery. Prior to surgery, the mean total He-NOSE score was  $73.8 \pm 17.6$  while a month post-surgery significantly lower scores were demonstrated at  $17.6 \pm 12.3$  ( $p = .000$  for the total score and each item independently). This finding is indicative of superb responsiveness to change (Figure 2).

## 4 | DISCUSSION

This study aimed to evaluate and adapt the NOSE scale into the Hebrew language. A step-by-step analysis of different parameters was performed according to the guidelines for translation and cross-cultural adaptation.<sup>4,15,16</sup>

The first step of this process was to translate the official NOSE scale and to establish an agreed upon translation between native



**FIGURE 4** Bland-Altman plot. Bland-Altman plot for test-retest reproducibility. The x-axis represents the mean scores of the test and retest scores and the y-axis shows the difference between these two setpoints. The 95% confidence interval of  $[-1.9, 2.7]$  is shown in dashed lines and a continuous line represents the average difference between them.

speakers of English and Hebrew, which lead to a final satisfactory version of the He-NOSE questionnaire. A pilot of the He-NOSE presented a problem with question number 4—"trouble sleeping," it was not clear for some of the participants whether the question was specific for nasal complaints, even when this was stated clearly in the questionnaire's introduction. This issue was also exhibited in the pilot study with a lower Cronbach's alpha measure for the internal consistency of the scale. Internal consistency describes the degree to which the questions in the scale are related to each other.<sup>17</sup> Consequently, as part of the cultural adaptation, we adapted a minor change to make it clearer, in which question number 4 became "trouble sleeping due to a nasal problem," a change agreed upon by the study team and translators. It is important to state that in the original article,<sup>4</sup> the lowest correlation was seen between this question and the others, a finding that was attributed to the item's ability to give a distinct addition to the scale, while still maintaining a unified construct along with the other items. Moreover, in the Dutch<sup>8</sup> and the Italian<sup>12</sup> NOSE scale validation studies, a low correlation was demonstrated for the 4th item of the scale when compared to the VAS score. Further, in the Polish validation study,<sup>13</sup> a lower correlation was seen for the item on trouble sleeping when tested with the nasal blockage or obstruction item and the exercise-related one. These findings might suggest that this question is less representative of the problem examined or that more specificity is required. Eventually, good Cronbach's alpha scores were received (.71 and .76). Although these scores are not very high, it is important to state that in the original article developing the NOSE scale, the internal consistency was 0.785, not much higher than our validated version.

The discriminatory validity of the measure is the questionnaire's ability to differentiate between patients suffering from a problem that is being studied, and healthy individuals.<sup>18</sup> When comparing our study

group to healthy controls using the Mann-Whitney test, mean score of the He-NOSE scale for each item of the scale and the total score between both groups was established. Statistically significant higher scores were exhibited in the study group ( $73.8 \pm 17.6$ ) compared to the control group ( $7 \pm 8$ ), underlining its ability to distinguish between patients and healthy individuals.

Reliability reflects the stability of a tool in different times, reproducing similar results.<sup>7</sup> We examined this by test-retest reproducibility and Spearman rank correlation. A non-significant difference was seen between the two times patients were required to complete the scale prior surgery (mean scores of  $73.8 \pm 17.6$  and  $74 \pm 19.7$ ,  $p = .918$ ) and a great correlation between these two setpoints was seen (Spearman rank correlation  $r = .752$ ,  $p < .0001$ ), suggesting excellent reliability. Similar findings were demonstrated in other adaptive languages of the NOSE scale.

Responsiveness to change is the ability of a tool to detect changes over time.<sup>11</sup> In this study, we compared the study group He-NOSE scores between the time before surgery and a month post-surgery using the Wilcoxon signed-rank test. A significant difference was seen in the comparisons of each question and the total scores (mean score of  $73.8 \pm 17.6$  and  $17.6 \pm 12.3$ , respectively,  $p < .001$ ). This finding portrays what was previously suggested by Stewart et al.,<sup>4</sup> that a short questionnaire does not necessarily decrease its significance or sensitivity to change.

This study had some limitations. This was a single-institute study in which selected patients with nasal obstruction due to ITH and DNS were examined. It should be noted that patients with nasal obstruction due to other causes were excluded. Nevertheless, we believe we would have obtained the same results for any other candidate for surgery due to nasal obstruction as seen in other studies.<sup>8,10,13</sup> Moreover, a test-retest reliability was performed only for the study group.

Although this is a limitation, we assume low variability in NOSE scores in the control group consisting of patients who do not have nasal complaints.

## 5 | CONCLUSION

In this study, we translated and adapted the Hebrew version of the NOSE scale using the protocols and instructions accepted worldwide. Results show satisfactory internal consistency, reliability, reproducibility, validity, and responsiveness in the adult patient. We believe the He-NOSE scale can be a useful tool in both clinical and research fields when assessing nasal obstruction in Hebrew-speaking patients.

### CONFLICT OF INTEREST

The authors have no conflict of interest to declare.

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