

Article

Validation and Agreement of the Taiwanese Versions of the Questionnaire of Olfactory Disorders–Negative Statements and Its Short Version

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Abstract: Olfactory dysfunction (OD) is a common sensory disorder that can substantially impair daily functioning and quality of life, yet objective psychophysical testing does not fully capture its patient-perceived burden. This prospective validation study translated and culturally adapted the Questionnaire of Olfactory Disorders–Negative Statements (QOD-NS) and its seven-item short version (svQOD-NS) into Traditional Chinese and evaluated their validity, reproducibility, and agreement. Between June 2025 and April 2026, 120 participants were enrolled at Taichung Veterans General Hospital, including 40 normosmic volunteers, 40 patients with hyposmia, and 40 with anosmia. All participants completed both questionnaires in randomized order. Normosmic participants repeated both questionnaires after at least 1 week. Olfactory function was classified using a phenyl ethyl alcohol odor detection threshold test. Mean item scores were compared across groups, and agreement was evaluated with paired comparisons, Bland–Altman analysis, and Spearman rank correlations. Both Taiwan-adapted Traditional Chinese instruments clearly discriminated participants with olfactory dysfunction from normosmic participants ($p < 0.05$), whereas neither instrument significantly differentiated hyposmia from anosmia. Test–retest identical mean-item-score agreement was 80.0% for QOD-NS and 92.5% for svQOD-NS; repeated administrations also showed strong positive rank correlations. No significant differences were observed between QOD-NS and svQOD-NS mean item scores in any group ($p = 0.125, 0.316, \text{ and } 0.930$), and Spearman correlations between the instruments were 0.72, 0.87, and 0.86 for normosmia, hyposmia, and anosmia, respectively (all $p < 0.001$). Bland–Altman analysis showed minimal bias. The Taiwan-adapted Traditional Chinese QOD-NS and svQOD-NS demonstrated satisfactory construct validity, temporal reproducibility, and strong agreement. The svQOD-NS may therefore provide a practical lower-burden alternative for routine clinical assessment and research in Taiwanese populations.

Keywords: Cross-Cultural Adaptation; Olfactory Dysfunction; Patient-Reported Outcome; Questionnaire of Olfactory Disorders; QOD-NS; svQOD-NS; Taiwan

1. Introduction

Olfactory dysfunction encompasses quantitative abnormalities of smell, including hyposmia and anosmia, as well as qualitative disturbances such as parosmia and phantosmia [1]. It may accompany sinonasal inflammatory disease, post-infectious syndromes, traumatic injury, neurodegenerative disease, congenital conditions, medica-

tion exposure, and aging [2]. Contemporary nomenclature emphasizes the importance of distinguishing quantitative loss from qualitative distortion because these phenotypes can have different clinical trajectories and different effects on patients' experiences [3]. Olfactory dysfunction is estimated to affect 3%–5% of the general population with complete loss of smell (anosmia) and 15%–25% with partial loss of smell (hyposmia). Its prevalence rises markedly with advancing age, reaching approximately 60% among individuals older than 65 years [2]. Olfactory dysfunction has profound effects on quality of life, physical and social function [4]. The increase in post-viral olfactory dysfunction following the COVID-19 pandemic has affected an increasing number of patients [5].

Olfactory dysfunction has clinical consequences that extend beyond impaired odor detection [6]. Olfaction contributes to flavor perception, appetite, food enjoyment, recognition of smoke and spoiled food, personal safety, emotional memory, social interactions, and occupational activities. Patients may describe reduced enjoyment of meals, altered food preferences, concerns about food safety, difficulties in social situations, embarrassment related to body odor, and anxiety about hazards that can no longer be detected reliably [4]. Quality-of-life effects are heterogeneous: some patients adapt effectively, whereas others experience substantial functional and psychosocial burden. This variability is one reason that a single psychophysical score cannot fully characterize the clinical significance of olfactory dysfunction [7,8].

Clinical evaluation therefore benefits from combining objective olfactory testing with patient-reported outcome measures (PROMs) [2]. Psychophysical tests quantify sensory performance, while patient-reported outcome measures address the consequences that matter directly to patients. The distinction is important because subjective burden and psychophysical performance are related but not interchangeable. Large multicenter studies have shown that self-assessed smell function and patient characteristics can explain important variation in olfactory-related quality of life even when objective testing is available [9]. More recent work has likewise emphasized multimodal outcome assessment, including disease-specific PROMs alongside psychophysical testing [10,11].

The Questionnaire of Olfactory Disorders–Negative Statements (QOD-NS) which was developed as a shortened version of the original 52-item Questionnaire for Olfactory Disorders, including 39 negative statements, 5 positive statements, and 8 socially desired statements is a validated patient-reported questionnaire that assesses the impact of olfactory dysfunction on olfactory-specific quality of life and the psychosocial consequences of smell loss [6,12,13]. The QOD-NS contains 17 negative statements [7], which focus on the adverse consequences of smell loss. Each statement is rated on a scale of 0–3, with higher scores indicating worse olfactory function [14]. The QOD-NS has become an important disease-specific measure because it addresses domains such as social functioning, eating, anxiety, and annoyance that are not represented by a threshold or identification test alone [9,15].

Despite its utility, the 17-item QOD-NS can impose a greater respondent burden than is desirable in high-volume clinics, longitudinal studies, and research protocols containing several instruments. Mattos and colleagues developed a seven-item short version (svQOD-NS) by applying item-reduction and bootstrap procedures to preserve the information contained in the longer questionnaire while reducing completion time [16]. Subsequent studies have supported the validity and reliability of svQOD-NS in different languages [17–21] and healthcare settings [22–24].

Cross-cultural adaptation is essential when a PROM is transferred to a new language or population. Literal translation alone may not preserve semantic, experiential, or conceptual equivalence, because the meaning and interpretation of items may vary across cultural and linguistic contexts [25]. Therefore, systematic translation and cultural adaptation are necessary to ensure that the target-language instrument measures the same underlying concepts as the original instrument [26]. Recommended procedures therefore include independent forward translation, reconciliation, backward translation, review by qualified experts, and psychometric evaluation in the target population [12,14].

A Taiwan-adapted Traditional Chinese version of the Questionnaire of Olfactory Disorders has not been validated. Traditional Chinese usage in Taiwan, local terminology, health-related communication, and respondents' interpretation of everyday situations may differ from the source-language and other language versions. Therefore, a Taiwan-adapted Traditional Chinese version requires independent cultural and linguistic validation. A validated Taiwanese instrument would allow clinicians to measure olfactory-related quality of life using standardized terminology and would facilitate comparison of treatment outcomes within Taiwan and with international studies.

The present study therefore aimed to translate and culturally adapt the QOD-NS and svQOD-NS into Traditional Chinese and to evaluate their psychometric performance in normosmic individuals and patients with hyposmia or

anosmia. The primary objectives were to determine whether the Taiwan-adapted Traditional Chinese questionnaires could discriminate between normal and impaired olfactory function, to assess temporal reproducibility in stable normosmic participants, and to determine whether the seven-item svQOD-NS produced measurements comparable with those of the 17-item QOD-NS. We hypothesized that both Taiwan-adapted Traditional Chinese instruments would demonstrate satisfactory construct validity and reproducibility and that the svQOD-NS would show good agreement with the full QOD-NS while reducing respondent burden.

2. Materials and Methods

2.1. Population

This prospective validation study was conducted at the Department of Otolaryngology, Taichung Veterans General Hospital, Taiwan, between June 2025 and April 2026. The study was designed as a translation, cultural-adaptation, and psychometric-validation investigation of the Taiwan-adapted Traditional Chinese versions of QOD-NS and svQOD-NS. The protocol was reviewed and approved by Institutional Review Board I of Taichung Veterans General Hospital (CE25166A; March 20, 2025) and Institutional Review Board II (CE25225B; CE25225B; May 6, 2025). The study was conducted in accordance with the Declaration of Helsinki, and written informed consent was obtained from all participants.

A total of 120 participants were consecutively recruited: 40 normosmic healthy volunteers, 40 patients with hyposmia, and 40 patients with anosmia. Normosmic volunteers were eligible if they reported normal olfaction, had no history of chronic olfactory dysfunction, had no sinonasal symptoms during the week preceding assessment, had no previous diagnosis of an olfactory disorder, and had a phenyl ethyl alcohol (PEA) detection threshold of ≤ -6 log units. Participants with self-reported partial smell loss and PEA thresholds > -6 and < -1 log units were categorized as hyposmic. Participants reporting complete loss of smell and demonstrating a PEA threshold of -1 log unit were categorized as anosmic. The study used these predefined categories for the purpose of validation rather than attempting to establish a new normative classification system. Participants were excluded if they had an acute upper respiratory tract infection, were unable to understand or complete the questionnaires, or declined written informed consent.

All participants completed the Taiwan-adapted Traditional Chinese versions of QOD-NS and svQOD-NS during the same study visit. To reduce potential order effects, questionnaire order was randomized. The 40 normosmic volunteers were invited to complete both questionnaires again after an interval of at least 1 week. No therapeutic intervention was provided during the interval. This repeat-administration cohort was selected because stable normosmia provided a relatively stable clinical state in which temporal reproducibility could be examined without the confounding influence of treatment or recovery.

2.2. Translation of the Traditional Chinese Versions of QOD-NS and svQOD-NS

Permission to translate and use the instruments was obtained from the Department of Otorhinolaryngology, Smell and Taste Clinic, Faculty of Medicine Carl Gustav Carus, Technische Universität Dresden, Germany, which holds the original instruments. The QOD-NS contains 17 negatively worded statements, whereas the svQOD-NS contains seven items selected through psychometric item reduction [16]. Each item uses a four-point response scale: “I agree,” “I agree partially,” “I disagree partially,” and “I disagree.” Responses are scored 3, 2, 1, and 0, respectively, according to the instrument’s scoring convention. Higher scores represent greater agreement with negative statements and therefore greater olfactory-related burden; this direction was explicitly maintained in the Taiwan-adapted Traditional Chinese version to avoid the ambiguity that can arise when describing “higher” quality-of-life scores.

Translation and cultural adaptation followed established cross-cultural PROM principles [12,14]. Two independent native Taiwanese speakers fluent in English produced separate forward translations. The translators worked independently so that wording differences could be identified rather than prematurely harmonized. A third bilingual native Taiwanese speaker reviewed the two translations, reconciled discrepancies, and selected wording that best preserved conceptual meaning while remaining natural and understandable in Taiwan. The reconciled Taiwan-adapted Traditional Chinese version was then back-translated into English by an independent certified professional translation service whose translators had no prior access to the original questionnaires. The back-translated ver-

sion was compared with the source version to identify semantic, conceptual, or culturally relevant discrepancies. Minor wording modifications were made where necessary, followed by final review and approval of the Taiwan-adapted Traditional Chinese versions.

The translation process emphasized conceptual rather than word-for-word equivalence. Particular attention was paid to expressions relating to social embarrassment, eating, annoyance, anxiety, and adaptation to smell changes because these concepts may be interpreted differently across cultural settings. The final versions were intended for administration in Traditional Chinese/Taiwanese clinical settings (**Figures 1 and 2**).

台灣版嗅覺障礙對生活影響問卷
(Taiwanese Version of the Questionnaire of Olfactory Disorders-Negative Statements) (QOD-NS)

編號： 性別： 年齡： 日期：

以下是一些與嗅覺相關的症狀與影響，請圈選最符合您目前狀況的選項。我們希望藉本問卷進一步瞭解您的困擾，這些問題的答案沒有所謂對錯。謝謝您的合作！

	我不同意	部分同意	部分同意	我同意
1 因為嗅覺變化，我現在去餐廳的頻率比以前少了。	0	1	2	3
2 我時常意識到我的嗅覺變化。	0	1	2	3
3 因為我的嗅覺變化，我對飲料和食物的享受不如以前了。	0	1	2	3
4 我擔心我永遠無法習慣嗅覺的變化。	0	1	2	3
5 因為我的嗅覺變化，我感到比往常焦慮。	0	1	2	3
6 嗅覺的變化是我大部分問題的根源。	0	1	2	3
7 我在吃東西時，嗅覺的變化讓我感到困擾。	0	1	2	3
8 因為我的嗅覺變化，我現在更少去拜訪朋友、親戚或鄰居。	0	1	2	3
9 因為嗅覺變化，我更努力地嘗試放鬆自己。	0	1	2	3
10 因為我的嗅覺變化，我有體重方面的問題。	0	1	2	3
11 嗅覺的變化讓我感到被孤立。	0	1	2	3
12 因為我的嗅覺變化，我總是去人多的地方。	0	1	2	3
13 因為嗅覺變化，我的自信心比以前少了或多多了。	0	1	2	3
14 因為嗅覺困難，我害怕接觸到某些危險（例如：瓦斯、變質的食物）。	0	1	2	3
15 因為嗅覺變化，我在日常生活中的參與有困難。	0	1	2	3
16 嗅覺的變化讓我感到生氣。	0	1	2	3
17 因為我的嗅覺變化，我與妻子/丈夫/伴侶的關係受到影響。	0	1	2	3

請問您是第幾次填寫這份問卷呢？ ☐ 第一次 ☐ 第二次
若您第二次填寫這份問卷，請繼續回答下列問題：
請問您從上次填寫到現在是否接受嗅覺治療？
☐ 無 ☐ 有 接受的治療為 ☐ 藥物 ☐ 手術 ☐ 其他 _____
療效 ☐ 明顯進步 ☐ 進步 ☐ 一樣 ☐ 退步 ☐ 明顯退步
謝謝您的耐心填寫！

第一版
2025.02.20

Taiwanese Version of the Questionnaire of Olfactory Disorders-Negative Statements (QOD-NS)

Participant Information

- ID: _____
- Sex: _____
- Age: _____
- Date: _____

Instructions
The following statements describe symptoms and the impact of changes in your sense of smell. Please circle the response that best reflects your current situation. There are no right or wrong answers. Your responses will help us better understand the difficulties you are experiencing. Thank you for your cooperation.

Questionnaire
Select one response for each statement.

- Because of changes in my sense of smell, I go to restaurants less often than I used to.
0 - I disagree; 1 - I partially disagree; 2 - I partially agree; 3 - I agree
- I am constantly aware of changes in my sense of smell.
0 - I disagree; 1 - I partially disagree; 2 - I partially agree; 3 - I agree
- Because of changes in my sense of smell, I enjoy food and beverages less than I used to.
0 - I disagree; 1 - I partially disagree; 2 - I partially agree; 3 - I agree
- I worry that I will never get used to the changes in my sense of smell.
0 - I disagree; 1 - I partially disagree; 2 - I partially agree; 3 - I agree
- Because of changes in my sense of smell, I feel more anxious than I used to.
0 - I disagree; 1 - I partially disagree; 2 - I partially agree; 3 - I agree
- Changes in my sense of smell are the source of most of my problems.
0 - I disagree; 1 - I partially disagree; 2 - I partially agree; 3 - I agree
- Changes in my sense of smell bother me when I eat.
0 - I disagree; 1 - I partially disagree; 2 - I partially agree; 3 - I agree
- Because of changes in my sense of smell, I visit friends, relatives, or neighbors less often than I used to.
0 - I disagree; 1 - I partially disagree; 2 - I partially agree; 3 - I agree
- Because of changes in my sense of smell, I make greater efforts to relax.
0 - I disagree; 1 - I partially disagree; 2 - I partially agree; 3 - I agree
- Because of changes in my sense of smell, I have problems with my weight.
0 - I disagree; 1 - I partially disagree; 2 - I partially agree; 3 - I agree
- Changes in my sense of smell make me feel isolated.
0 - I disagree; 1 - I partially disagree; 2 - I partially agree; 3 - I agree
- Because of changes in my sense of smell, I avoid crowded places.
0 - I disagree; 1 - I partially disagree; 2 - I partially agree; 3 - I agree
- Because of changes in my sense of smell, I eat less or more than I used to.
0 - I disagree; 1 - I partially disagree; 2 - I partially agree; 3 - I agree
- Because of my difficulty smelling, I am afraid of being exposed to certain dangers (e.g., gas leaks or spoiled food).
0 - I disagree; 1 - I partially disagree; 2 - I partially agree; 3 - I agree
- Because of changes in my sense of smell, I have difficulty participating in daily activities.
0 - I disagree; 1 - I partially disagree; 2 - I partially agree; 3 - I agree
- Changes in my sense of smell make me feel angry.
0 - I disagree; 1 - I partially disagree; 2 - I partially agree; 3 - I agree
- Because of changes in my sense of smell, my relationship with my spouse or partner has been affected.
0 - I disagree; 1 - I partially disagree; 2 - I partially agree; 3 - I agree

Is this your first or second time completing this questionnaire?
☐ First time ☐ Second time

If this is your second time completing the questionnaire, please answer the following questions.
Have you received any treatment for your olfactory dysfunction since completing the questionnaire last time?
☐ No ☐ Yes

If yes, please specify the treatment received:
☐ Medication ☐ Surgery ☐ Other: _____

How would you describe the effectiveness of the treatment?
☐ Marked improvement ☐ Improvement ☐ No change ☐ Deterioration ☐ Marked deterioration

Thank you for taking the time to complete this questionnaire!
Version 1.0 - February 10, 2025

Figure 1. Taiwan-adapted Traditional Chinese version of the Questionnaire of Olfactory Disorders–Negative Statements and its English version.

台灣版嗅覺障礙影響簡要問卷
(Taiwanese Version of the Short Version of the Questionnaire of Olfactory Disorders-Negative Statements) (svQOD-NS)

編號： 性別： 年齡： 日期：

以下是一些與嗅覺相關的症狀與影響，請圈選最符合您目前狀況的選項。我們希望藉本問卷進一步瞭解您的困擾，這些問題的答案沒有所謂對錯。謝謝您的合作！

	我不同意	部分同意	部分同意	我同意
1 嗅覺的變化讓我感到被孤立。	0	1	2	3
2 因為嗅覺變化，我在日常生活中的參與有困難。	0	1	2	3
3 嗅覺的變化讓我感到生氣。	0	1	2	3
4 因為嗅覺變化，我現在去餐廳的頻率比以前少了。	0	1	2	3
5 因為嗅覺變化，我的飲食量比以前少了或多了。	0	1	2	3
6 因為嗅覺變化，我更努力地嘗試放鬆自己。	0	1	2	3
7 我擔心我永遠無法習慣嗅覺的變化。	0	1	2	3

請問您是第幾次填寫這份問卷呢？ ☐ 第一次 ☐ 第二次
若您第二次填寫這份問卷，請繼續回答下列問題：
請問您從上次填寫到現在是否接受嗅覺治療？
☐ 無 ☐ 有 接受的治療為 ☐ 藥物 ☐ 手術 ☐ 其他 _____
療效 ☐ 明顯進步 ☐ 進步 ☐ 一樣 ☐ 退步 ☐ 明顯退步
謝謝您的耐心填寫！

第一版
2025.02.06

Taiwanese Version of the Short Version of the Questionnaire of Olfactory Disorders-Negative Statements (svQOD-NS)

Participant Information

- ID: _____
- Sex: _____
- Age: _____
- Date: _____

Instructions
The following statements describe symptoms and the impact of changes in your sense of smell. Please circle the response that best reflects your current situation. There are no right or wrong answers. We hope this questionnaire will help us better understand the difficulties you are experiencing. Thank you for your cooperation.

Questionnaire
1. Changes in my sense of smell make me feel isolated.
0 - I disagree; 1 - I partially disagree; 2 - I partially agree; 3 - I agree

2. Because of changes in my sense of smell, I have difficulty participating in daily activities.
0 - I disagree; 1 - I partially disagree; 2 - I partially agree; 3 - I agree

3. Changes in my sense of smell make me feel angry.
0 - I disagree; 1 - I partially disagree; 2 - I partially agree; 3 - I agree

4. Because of changes in my sense of smell, I go to restaurants less often than I used to.
0 - I disagree; 1 - I partially disagree; 2 - I partially agree; 3 - I agree

5. Because of changes in my sense of smell, I eat less or more than I used to.
0 - I disagree; 1 - I partially disagree; 2 - I partially agree; 3 - I agree

6. Because of changes in my sense of smell, I make greater efforts to relax.
0 - I disagree; 1 - I partially disagree; 2 - I partially agree; 3 - I agree

7. I worry that I will never get used to the changes in my sense of smell.
0 - I disagree; 1 - I partially disagree; 2 - I partially agree; 3 - I agree

Is this your first or second time completing this questionnaire?
☐ First time ☐ Second time

If this is your second time completing the questionnaire, please answer the following questions.
Have you received any treatment for your olfactory dysfunction since completing the questionnaire last time?
☐ No ☐ Yes

If yes, please specify the treatment received:
☐ Medication ☐ Surgery ☐ Other: _____

How would you describe the effectiveness of the treatment?
☐ Marked improvement ☐ Improvement ☐ No change ☐ Deterioration ☐ Marked deterioration

Thank you for taking the time to complete this questionnaire!
Version 1.0 - February 6, 2025

Figure 2. Taiwan-adapted Traditional Chinese version of the short version of the Questionnaire of Olfactory Disorders–Negative Statements and its English version.

2.3. Mean Item Scores of the Taiwan-Adapted Traditional Chinese Versions of QOD-NS and svQOD-NS

The Taiwan-adapted Traditional Chinese version of QOD-NS contains 17 items, giving a possible total score of 0–51, whereas the svQOD-NS contains seven items, giving a possible total score of 0–21. Because the instruments differ in length, total scores were not directly compared. Instead, a mean item score was calculated for each participant by dividing the total score by the number of completed items. Thus, QOD-NS mean item score = total QOD-NS score/17, and svQOD-NS mean item score = total svQOD-NS score/7. This standardized metric permits direct comparison of the two instruments on the same 0–3 item-response scale.

2.4. Phenyl Ethyl Alcohol Odor Detection Threshold Test

Objective olfactory function was assessed using a PEA odor detection threshold test. PEA was selected because it is commonly used as a relatively selective olfactory stimulus with limited trigeminal contribution.

In the traditional PEA odor detection threshold test [27], a two-alternative forced-choice single-staircase detection threshold procedure was used. It consists of the presentation of two glass sniff bottles to the subject. One contains 20 mL of a given concentration of PEA dissolved in light mineral oil, whereas the other contains the mineral oil alone. These two bottles are opened and positioned over the subject's nose in a random order. The subject indicates which bottle contains the stronger odor. If no difference is perceived, a guess is required. The first pair of scents contains PEA odorant at 10^{-6} log vol/vol. Correct identification of the scent that contains the PEA odorant in five successive trials triggers a reversal of the staircase to the next lower concentration, whereas a single incorrect identification triggers the reversal of the staircase to the next higher concentration. In the following, correct identification of the scent that contains the PEA odorant in two successive trials triggers a reversal of the staircase to the next lower concentration. When a total of seven reversals are acquired, the test is completed. The geometric mean of the last four reversed points of the seven reversals is used as the PEA threshold estimate, and PEA concentrations range from 10^{-1} to 10^{-9} log vol/vol in half-log concentration steps. The predefined threshold categories were then used to assign participants to normosmia, hyposmia, or anosmia.

2.5. Sample Size and Statistical Analyses

The sample size was selected using a pragmatic benchmark informed by a previous validation study of the Malay short version of the QOD-NS, in which approximately five participants per questionnaire item were recruited for psychometric evaluation [20]. Applying this general benchmark to the seven-item svQOD-NS would correspond to approximately 35 participants. We therefore enrolled 40 participants in each group to provide a modest margin above that target and to facilitate balanced group comparisons. This calculation should be regarded as a practical validation-study target rather than as a universally accepted sample-size rule; larger multicenter studies would provide more precise estimates of reliability and subgroup performance.

Continuous variables are reported as mean $\pm$ standard deviation (SD), and categorical variables as frequencies and percentages. Sex distribution among the three groups was compared using Pearson's chi-square test. Age and questionnaire mean item scores were compared using the Kruskal–Wallis test, followed by Dunn–Bonferroni post hoc comparisons. Differences between the QOD-NS and svQOD-NS mean item scores were examined using paired comparisons within each study group. Agreement between the two instruments was assessed with Bland–Altman analysis, including the mean difference (bias) and 95% limits of agreement calculated as the mean difference ± 1.96 SD. Spearman rank correlation was used to describe monotonic association between questionnaire scores.

For test–retest analysis, Spearman rank correlation was used to evaluate temporal consistency of participant rankings between the first and second administrations, while the percentage of participants with identical mean item scores was calculated as a direct descriptive measure of exact score agreement.

All analyses were performed using IBM SPSS Statistics version 22.0 (IBM Corp., Armonk, NY, USA). Tests were two-sided, and $p < 0.05$ was considered statistically significant. The analysis plan was directed toward construct discrimination, temporal reproducibility, and agreement between the full and short instruments.

3. Results

3.1. Patients

A total of 120 participants completed the study: 40 normosmic volunteers, 40 participants with hyposmia, and 40 with anosmia. There were 8 men and 32 women in the normosmic group, 24 men and 16 women in the hyposmic group, and 18 men and 22 women in the anosmic group. The overall sex distribution differed significantly among groups ($p < 0.05$). The normosmic group therefore contained a greater proportion of women than the two olfactory-dysfunction groups. The normosmic participants were 22–65 years old, with a mean age of 36.0 ± 10.7 years. The hyposmic group ranged from 18–71 years and had a mean age of 43.6 ± 14.1 years, while the anosmic group ranged from 23–77 years and had a mean age of 47.7 ± 14.6 years. Age differed significantly among groups ($p < 0.05$); post hoc testing showed that the hyposmic and anosmic groups were older than the normosmic group, whereas the hyposmic and anosmic groups did not differ significantly in age.

3.2. Mean Item Scores of the Taiwan-Adapted Traditional Chinese Versions of QOD-NS and svQOD-NS

Table 1 presents the comparison of the mean item scores of the Taiwan-adapted Traditional Chinese versions of the QOD-NS and svQOD-NS across the three study groups. For the Taiwan-adapted Traditional Chinese QOD-NS, mean item scores ranged from 0.00 to 1.06 among normosmic participants, 0.06 to 2.65 among hyposmic participants, and 0.00 to 2.82 among anosmic participants. Group mean scores were 0.08 ± 0.21 , 1.46 ± 0.69 , and 1.67 ± 0.73 , respectively. The overall between-group difference was statistically significant ($p < 0.05$). Both the hyposmic and anosmic groups had significantly higher scores than the normosmic group (both $p < 0.05$), whereas the hyposmic and anosmic groups did not differ significantly (Dunn–Bonferroni adjusted $p = 1.000$).

Table 1. Comparison of sex, age, and mean Taiwan-adapted Traditional Chinese versions of QOD-NS and svQOD-NS item scores across three groups, and assessment of agreement between the two Instruments using mean item scores, Bland–Altman analysis, and Spearman’s rank correlation.

Group	Normosmic Group	Hyposmic Group	Anosmic Group	<i>p</i>
Sex				
Male	8	24	18	<0.05
Female	32	16	22	
Age	36.0 ± 10.7	43.6 ± 14.1	47.7 ± 14.6	<0.05
QOD-NS score	0.08 ± 0.21	1.46 ± 0.69	1.67 ± 0.73	<0.05
svQOD-NS score	0.05 ± 0.17	1.51 ± 0.72	1.66 ± 0.81	<0.05
<i>p</i>	0.125	0.316	0.930	
Bland–Altman plot				
mean	−0.03	0.06	−0.01	
−1.96SD	−0.24	−0.62	−0.59	
+1.96SD	0.18	0.73	0.61	
<i>p</i>	0.125	0.316	0.930	
Spearman’s rank-order correlation				
ρ	0.72	0.87	0.86	
<i>p</i>	<0.05	<0.05	<0.05	

Note: QOD-NS: mean item score of Taiwan-adapted Traditional Chinese version of Questionnaire of Olfactory Disorders–Negative Statements, svQOD-NS: mean item score of Taiwan-adapted Traditional Chinese version of short version of QOD-NS, SD: standard deviation.

The Taiwan-adapted Traditional Chinese svQOD-NS showed a highly similar pattern. Mean item scores ranged from 0.00 to 0.86 in normosmic participants, 0.00 to 2.86 in hyposmic participants, and 0.00 to 2.86 in anosmic participants. Group means were 0.05 ± 0.17 , 1.51 ± 0.72 , and 1.66 ± 0.81 , respectively. The overall group difference was significant ($p < 0.05$), with both hyposmic and anosmic participants scoring higher than normosmic participants (both $p < 0.05$). Again, no significant difference was observed between hyposmia and anosmia (Dunn–Bonferroni adjusted $p = 1.000$). Thus, the two Taiwan-adapted Traditional Chinese instruments showed a consistent ability to identify the presence of clinically meaningful olfactory dysfunction compared with normosmia.

3.3. Test–Retest Reliability

Test–retest reproducibility was evaluated in the 40 normosmic volunteers who completed both questionnaires twice at least 1 week apart. Identical mean item scores were observed in 80.0% of participants for the Taiwan-

adapted Traditional Chinese version of QOD-NS and 92.5% for the Taiwan-adapted Traditional Chinese version of svQOD-NS. Spearman rank analyses also demonstrated strong positive associations between the first and second administrations. These findings support temporal stability of the translated instruments in a clinically stable normosmic cohort, while the higher exact-agreement percentage observed for the short version suggests that the seven-item instrument may be less sensitive to small response fluctuations in this sample.

3.4. Agreement between the Taiwan-Adapted Traditional Chinese Versions of QOD-NS and svQOD-NS

Table 1 summarizes the agreement between the Taiwan-adapted Traditional Chinese versions of QOD-NS and svQOD-NS based on mean item scores, Bland–Altman analysis, and Spearman’s rank correlation coefficient. Comparison of the QOD-NS and svQOD-NS showed no statistically significant differences in mean item scores in any study group. The paired comparison *p*-values were 0.125 for normosmia, 0.316 for hyposmia, and 0.930 for anosmia. Bland–Altman analysis showed mean differences of -0.03 , 0.06 , and -0.01 in the normosmic, hyposmic, and anosmic groups, respectively (**Figure 3**). These small mean differences suggested little systematic bias between the two instruments. The 95% limits of agreement were described as narrow and symmetrically distributed around the mean difference in the original analysis, supporting agreement across the observed score range. Spearman correlations between QOD-NS and svQOD-NS mean item scores were 0.72 in the normosmic group, 0.87 in the hyposmic group, and 0.86 in the anosmic group, with $p < 0.05$ for all comparisons. The strength of these associations, together with the paired comparisons and Bland–Altman findings, suggests that the short questionnaire produces scores that are closely associated with those of the full questionnaire across normal and impaired olfactory states.

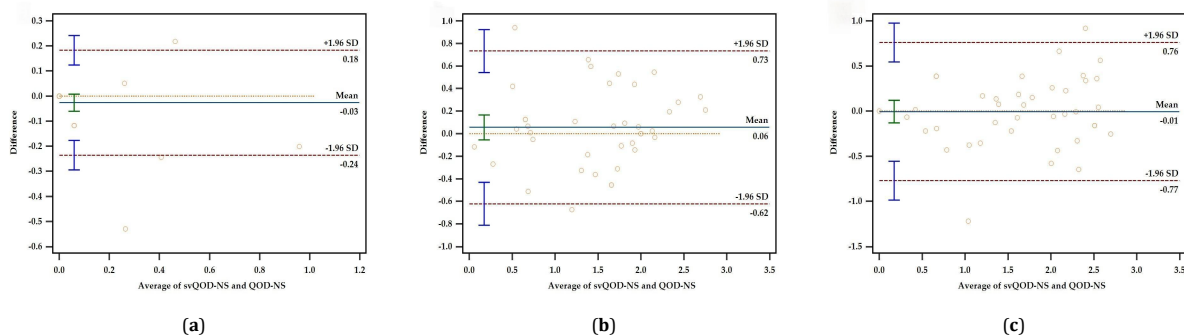


Figure 3. Bland–Altman plots comparing Taiwan-adapted Traditional Chinese versions of QOD-NS and svQOD-NS mean item scores in (a) normosmic, (b) hyposmic, and (c) anosmic groups.

4. Discussion

This study established Taiwan-adapted Traditional Chinese versions of the QOD-NS and svQOD-NS using a structured translation and cultural-adaptation process and evaluated their performance in 120 participants representing normosmia, hyposmia, and anosmia. The demographic imbalance is relevant to interpretation because age and sex can influence both olfactory performance and perceived quality of life. However, the primary purpose of the validation analysis was not to estimate population norms but to establish whether the translated instruments could distinguish clinically defined groups and whether the two questionnaires behaved similarly. Accordingly, the observed demographic differences should be considered a potential source of confounding in future population-based studies, while the within-study discrimination results remain informative for initial validation.

The principal findings were that both instruments discriminated olfactory dysfunction from normosmia, both showed good temporal reproducibility in stable normosmic volunteers, and the seven-item svQOD-NS showed good agreement with the 17-item QOD-NS. The results are clinically relevant because the burden of olfactory dysfunction is multidimensional and cannot be represented adequately by an odor threshold alone. Disease-specific PROMs provide complementary information about how smell loss affects eating, social participation, emotional responses, and daily activities [4,7–11].

The ability of both Taiwan-adapted Traditional Chinese questionnaires to distinguish normosmic participants

from patients with hyposmia or anosmia provides evidence of construct validity. Mean item scores were markedly higher in both dysfunction groups than in the normosmic group, with $p < 0.001$ for each comparison. This pattern is consistent with previous validation studies in other linguistic and cultural populations [17–21]. Cross-cultural replication of this group-discrimination pattern is important because it suggests that the underlying construct measured by the QOD-NS—negative consequences of impaired olfaction—has sufficient conceptual stability to be retained after linguistic adaptation.

The good agreement between the Taiwan-adapted Traditional Chinese versions of QOD-NS and svQOD-NS is important for clinical implementation. The full QOD-NS contains 17 negative statements and provides broad coverage of the burden associated with olfactory dysfunction. However, questionnaire length can influence completion time and patient fatigue, especially when PROMs are administered repeatedly or alongside other instruments. The svQOD-NS was specifically developed to reduce this burden while retaining information from the full instrument [16]. The present findings extend that evidence to Taiwan-adapted Traditional Chinese use: the mean scores were not significantly different, the mean biases were close to zero, and correlations were strong across all three study groups. These results support the short version as an efficient alternative when a brief disease-specific PROM is preferable. However, because the seven items of the svQOD-NS are selected directly from the 17-item QOD-NS, the two instruments are inherently non-independent, and a substantial correlation between their scores is expected. Furthermore, both questionnaires were administered during the same study visit, requiring participants to respond to the seven overlapping items twice within a relatively short interval. Therefore, the strong correlations and apparent agreement between the QOD-NS and svQOD-NS should not be interpreted as demonstrating independent validation of the two instruments. The normosmic group showed very low mean item scores and a narrow score distribution, indicating a potential floor effect. This concentration of scores near zero may increase the likelihood of identical scores at repeated administration and may also influence correlation and agreement estimates. Therefore, the relatively high exact-agreement rates observed in the normosmic retest cohort should be interpreted cautiously.

The use of Bland–Altman analysis strengthens the agreement assessment. Two instruments can correlate strongly while maintaining a systematic difference across the measurement range. In this study, the mean biases were -0.03 , 0.06 , and -0.01 , indicating little evidence of systematic shift between the two questionnaires. The combination of near-zero bias and strong correlation is therefore more informative than correlation alone.

Test–retest reliability requires particular statistical care. The present study reported strong Spearman correlations and exact mean-item-score agreement of 80.0% for the Taiwan-adapted Traditional Chinese version of QOD-NS and 92.5% for the Taiwan-adapted Traditional Chinese version of svQOD-NS. Spearman correlation is useful for assessing whether the relative ordering of participants is stable over time, but it does not by itself measure absolute agreement. We therefore revised the interpretation to distinguish rank stability from exact score agreement. This distinction avoids overstating the reliability evidence and aligns the manuscript with modern psychometric practice. On the other hand, the test–retest analysis was restricted to clinically stable normosmic participants. Reliability in patients with hyposmia or anosmia may differ because their symptom experience can fluctuate and because the underlying disease may be stable or progressive depending on etiology.

The high exact-agreement rate for the Taiwan-adapted Traditional Chinese version of svQOD-NS is notable. A shorter instrument can sometimes reduce reliability because fewer items are available to average measurement error; however, the seven selected items were originally chosen using psychometric reduction procedures designed to retain information from the full QOD-NS [16]. In the present sample, the Taiwan-adapted Traditional Chinese version of svQOD-NS had a higher proportion of identical mean scores at retest than the full questionnaire. This observation should be considered descriptive rather than proof that the short version is inherently more reliable. The difference may reflect the distribution of responses, rounding behavior of mean item scores, or the characteristics of the normosmic sample. Nevertheless, it provides reassurance that the abbreviated instrument did not produce obvious instability in repeated administration.

The translation procedure followed widely cited cross-cultural adaptation principles [12,14]. Independent forward translations allowed alternative interpretations to be identified. Reconciliation by a third bilingual reviewer provided a structured mechanism for resolving discrepancies, while independent backward translation allowed potentially important deviations from the source instrument to be detected. The final review focused on conceptual equivalence and natural language use rather than literal word matching. This approach is preferable for PROMs because an item that is linguistically faithful but unnatural to target respondents may have poorer measurement

properties than a carefully adapted expression with the same underlying meaning.

The present findings should also be considered in the context of the expanding landscape of olfactory PROMs. The development of Olfactory Dysfunction Outcomes Rating introduced a 28-item instrument designed to capture physical, functional, and emotional consequences and established a minimal clinically important difference for treatment studies [14]. More recent work has pursued broader instruments, including the Smell-Qx, which integrates olfactory and gustatory symptoms with quality-of-life domains and reported strong reliability and validity in its initial validation cohort [10]. An international COMET initiative also emphasized the need for standardized core outcomes in olfactory clinical trials [28]. These developments do not diminish the value of the QOD-NS; rather, they highlight the need to choose PROMs according to the research question. The QOD-NS and svQOD-NS remain particularly attractive when the principal construct is olfactory-specific quality-of-life burden and when brevity is important.

Recent international validation studies further support the concept that olfactory-specific PROMs require local adaptation. Polish, Italian, Arabic, and Brazilian studies have shown that QOD-based instruments can retain useful psychometric properties after translation, while also demonstrating that different versions may require distinct validation procedures and scoring considerations [17,20,21,23,24]. Comparisons of olfactory-specific questionnaires illustrate a broader movement toward standardized, patient-centered outcome measurement [11]. The Taiwan-adapted Traditional Chinese versions of QOD-NS and svQOD-NS add another language-specific option to this growing international evidence base.

The study has several methodological strengths. First, it included balanced numbers of participants in three olfactory-function categories, allowing the questionnaires to be evaluated across a clinically meaningful spectrum. Second, the investigators used objective PEA threshold testing rather than relying solely on self-reported smell status for group assignment. Third, questionnaire order was randomized, reducing potential order effects. Fourth, the study incorporated a retest interval of at least 1 week in a stable normosmic group, permitting assessment of temporal reproducibility. Finally, agreement between the full and short versions was evaluated using complementary approaches rather than relying on correlation alone.

Several limitations should be acknowledged. First, the study was conducted at a single tertiary referral center, which may limit generalizability to community populations. Second, the groups differed significantly in age and sex distribution. Although this does not invalidate the primary objective of evaluating whether the translated instruments could distinguish predefined olfactory-function categories, residual confounding cannot be excluded. Age and sex may influence both olfactory performance and perceived olfactory-related quality of life. Future studies with larger samples should incorporate age- and sex-adjusted analyses, preferably using multivariable models or other appropriate covariate-adjusted approaches. Third, because participant classification incorporated both self-reported olfactory status and predefined PEA threshold criteria, incorporation bias cannot be completely excluded. This consideration is particularly relevant because the QOD-NS and svQOD-NS are subjective measures of olfactory-related burden. Moreover, objective olfactory function was assessed using a PEA threshold test alone. Although this test provides an objective measure of olfactory sensitivity, it does not assess odor identification or discrimination and therefore does not capture all dimensions of olfactory performance. Fourth, the test-retest analysis was restricted to normosmic participants. Reliability in patients with hyposmia or anosmia may differ because their symptom experience can fluctuate and because the underlying disease may be stable or progressive depending on etiology. Fifth, the study did not evaluate responsiveness to clinical change, so the minimal clinically important change for the Taiwan-adapted Traditional Chinese versions of QOD-NS and svQOD-NS remains unknown. Sixth, internal consistency and factor structure were not examined. Cronbach's alpha, omega coefficients, exploratory or confirmatory factor analysis, and item-response analyses could provide additional evidence in future multicenter studies. A further limitation concerns the use of a pragmatic sample-size rule based on five participants per questionnaire item. Although this approach provided 40 participants per group and was consistent with the benchmark used in the cited prior validation work [20], it should not be presented as a universal requirement for psychometric studies. Contemporary sample-size planning should ideally be tied to the intended analysis, expected effect size, reliability precision, factor-analytic requirements, or confidence-interval width. The present sample is adequate for an initial validation study but does not eliminate the need for larger confirmatory studies.

The study also did not establish a minimally clinically important difference (MCID) for either Taiwan-adapted Traditional Chinese instrument. This is an important distinction between validation and responsiveness. The QOD

literature contains evidence that changes in QOD scores can be clinically meaningful, and the Olfactory Dysfunction Outcomes Rating has explicitly incorporated MCID estimation [14]. However, a translated instrument should not automatically inherit an MCID from another language or version because response distributions and cultural interpretation may differ. Future Taiwanese longitudinal studies should use anchor-based and distribution-based methods to estimate a clinically meaningful change threshold after treatment for chronic rhinosinusitis, post-viral olfactory dysfunction, traumatic olfactory dysfunction, or other etiologies.

The study population was also not stratified by etiology of olfactory dysfunction. Etiology may influence the relationship between objective smell performance and perceived burden. For example, post-viral patients may experience parosmia, whereas sinonasal obstruction may produce different functional limitations, and traumatic or neurodegenerative disorders may have distinct psychosocial consequences. Future studies should therefore evaluate the Taiwan-adapted Traditional Chinese instruments separately in major etiologic groups and determine whether the factor structure, reliability, and responsiveness remain stable across diagnoses.

From a clinical perspective, the findings support a complementary assessment model. The PEA threshold test provides an objective estimate of olfactory sensitivity, while the QOD-NS or svQOD-NS documents the patient's perceived consequences. A patient with a modest psychophysical deficit may report considerable quality-of-life impairment, whereas another patient with severe objective loss may report relatively little burden after adaptation. Neither measurement should therefore be interpreted in isolation. This multimodal approach is consistent with contemporary recommendations and with recent work showing limited direct correlation between psychophysical performance and some quality-of-life questionnaires [10].

For routine outpatient practice, the Taiwan-adapted Traditional Chinese version of svQOD-NS may be particularly useful because it reduces the number of items while preserving close agreement with the full QOD-NS. It may also be suitable for repeated assessments in longitudinal treatment studies, provided that future work confirms responsiveness and clinically meaningful change thresholds. The full QOD-NS may remain preferable when investigators need broader item coverage or when the questionnaire is being used as a detailed endpoint. The choice should therefore be driven by the purpose of assessment rather than by the assumption that one instrument is universally superior.

For research, validated Taiwanese PROMs can facilitate standardized outcome reporting across centers and support future clinical trials conducted in Taiwan. Their availability also makes it easier to compare Taiwanese cohorts with international studies, provided that differences in translation, scoring direction, population characteristics, and psychometric properties are explicitly considered. The instruments could be incorporated into studies of chronic rhinosinusitis, post-viral olfactory dysfunction, traumatic olfactory dysfunction, neurodegenerative disease, aging, and treatment interventions.

Overall, the present study provides a useful foundation for the clinical adoption of Taiwanese olfactory-specific PROMs. The findings support the QOD-NS as a comprehensive 17-item measure and the svQOD-NS as a practical seven-item alternative. The strongest evidence is the consistency of the findings across three analytic perspectives: group discrimination, repeated-administration stability, and agreement between instruments.

5. Conclusions

The Taiwan-adapted Traditional Chinese versions of QOD-NS and svQOD-NS were successfully translated and culturally adapted and demonstrated satisfactory initial psychometric performance in 120 participants with normal, reduced, or absent olfactory function. Both instruments clearly differentiated participants with olfactory dysfunction from normosmic individuals. The Taiwan-adapted Traditional Chinese version of svQOD-NS showed good agreement with the 17-item Taiwan-adapted Traditional Chinese version of QOD-NS, with no significant differences in mean item scores, near-zero mean biases, and strong correlations across all study groups. The Taiwan-adapted Traditional Chinese version of svQOD-NS offers a practical advantage for busy clinics, longitudinal follow-up, and research protocols in which respondent burden is an important consideration. Both instruments should be viewed as complements to objective olfactory testing rather than substitutes for psychophysical assessment.

The availability of validated Taiwanese-language olfactory-specific PROMs should facilitate patient-centered assessment and standardized reporting of treatment outcomes in Taiwan. Future multicenter studies with larger and more diverse populations should confirm the factor structure and internal consistency, establish robust test-retest reliability using intraclass correlation coefficient or other agreement coefficients, determine responsiveness

and MCID values, and evaluate performance across major etiologies of olfactory dysfunction.

Author Contributions

Conceptualization, R.-S.J.; methodology, R.-S.J. and M.-W.H.; validation, M.-W.H.; formal analysis, R.-S.J. and M.-W.H.; investigation, R.-S.J. and M.-W.H.; resources, R.-S.J.; data curation, K.-S.T. and M.-W.H.; writing—original draft preparation, M.-W.H.; writing—review and editing, K.-S.T. and R.-S.J.; visualization, R.-S.J.; supervision, R.-S.J.; project administration, M.-W.H. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement

This study was approved by the Institutional Review Board (I) of the Taichung Veterans General Hospital (protocol code CE25166A, date of approval: March 20, 2025) and the Institutional Review Board (II) of the Taichung Veterans General Hospital (protocol code CE25225B, date of approval: May 6, 2025).

Informed Consent Statement

Written informed consent was obtained from all subjects involved in the study.

Data Availability Statement

The data sets used and analyzed in this study are available from the corresponding author upon reasonable request.

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Conflicts of Interest

The authors declare that they have no conflicts of interest.

AI Use Statement

During the preparation of this manuscript, the authors used ChatGPT solely for language refinement. No AI tools were used for data analysis, interpretation, or generation of scientific content. All outputs were critically reviewed and edited by the authors. The authors take full responsibility for the integrity and accuracy of the work.

Abbreviations

OD	olfactory dysfunction
PEA	phenyl ethyl alcohol
PROM	patient-reported outcome measure
QOD	Questionnaire of Olfactory Disorders
QOD-NS	Questionnaire of Olfactory Disorders–Negative Statements
svQOD-NS	Short version of the Questionnaire of Olfactory Disorders–Negative Statements
SD	standard deviation

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