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Validation and reliability of the Italian version of the Self-reported Mini Olfactory Questionnaire (Self-MOQ) / Riva, G., Pecorari, G., Motatto, G.M., Rivero, M., Canale, A., Albera, R., Albera, A.. - In: ACTA OTORHINOLARYNGOLOGICA ITALICA. - ISSN 1827-675X. - 44:3(2024). [10.14639/0392-100X-N2386]

Availability:
This version is available at: 11583/2991490 since: 2024-08-04T21:26:52Z

Publisher:
PACINI EDITORE

Published
DOI:10.14639/0392-100X-N2386

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27 November 2026

ACTA OTORHINOLARYNGOLOGICA ITALICA 2024 Apr 30 [Online ahead of print]; doi: 10.14639/0392-100X-N2386

RHINOLOGY

Validation and reliability of the Italian version of the Self-reported Mini Olfactory Questionnaire (Self-MOQ)

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SUMMARY

Objective. Olfactory dysfunction (OD) represents a frequent complaint in general population and especially in patients with chronic sinonasal diseases. The aim of this study was the cross-cultural adaptation and validation of the Self-reported Mini Olfactory Questionnaire (Self-MOQ) into Italian.

Methods. One hundred fifty patients affected by chronic sinonasal diseases and reporting hyposmia were enrolled. Other 150 normosmic subjects without inflammatory or neoplastic sinonasal disorders were used as a control group. The Short-form 36 (SF-36) questionnaire was used for clinical validity.

Results. Cronbach's alpha coefficient was 0.825. The test-retest reliability was excellent. The good correlation between the Self-MOQ and the Visual Analogue Scale scores ($p < 0.05$) demonstrated the construct validity of the questionnaire. The Self-MOQ was able to distinguish between subjects with or without OD ($p < 0.05$). Higher Self-MOQ score was found in case of nasal obstruction and posterior rhinorrhoea ($p < 0.05$). Self-MOQ showed significant correlation with SF-36 general health, SF-36 role functioning/physical, and SF-36 pain ($p < 0.05$).

Conclusions. The Italian version of the Self-MOQ showed good internal consistency, test-retest reliability, construct, and clinical validity.

KEY WORDS: smell, olfactory disorders, chronic rhinosinusitis, quality of life, rhinitis questionnaire

Introduction

Chronic sinonasal diseases, such as chronic rhinosinusitis (CRS) with or without nasal polyps, allergic rhinitis (AR) and non-allergic rhinitis (NAR), present a worldwide diffusion affecting a large proportion of general population (prevalence 3-12% for CRS, 10-40% for AR, 4-10% for NAR) [1-3]. The main symptoms include nasal obstruction with congestion, facial pain or pressure, serous, mucous and/or purulent rhinorrhoea, and olfactory dysfunction (OD) [4]. In particular, OD occurs in 40-80% of CRS patients and in 19-24% of general population (depending on age) and may determine reduced productivity, economic influences and reduced quality of life (QoL) [5-7]. Indeed, smell disorders increase the risk of developing environmental and social anxiety, depression (also due to the frustration of apparent absence of treatment options), and weight and food disorders [8]. OD is also associated with major health outcomes, such as neurodegenerative disease and death [9]. Moreover, in the last three years, due to the spread of novel coronavirus disease 2019 (COVID-19), a high percentage of infected subjects reported smell and taste impairments, with anosmia as the first and more frequently diagnosed symptom [10].

Given the high number of patient suffering of chronic sinonasal diseases and the complications related to OD, it is of primary importance to perform a

Received: September 20, 2022
Accepted: October 15, 2023

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How to cite this article: Riva G, Pecorari G, Motatto GM, et al. Validation and reliability of the Italian version of the Self-reported Mini Olfactory Questionnaire (Self-MOQ). Acta Otorhinolaryngol Ital 2024 Apr 30 [Online ahead of print]. https://doi.org/10.14639/0392-100X-N2386

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careful evaluation of olfactory function and QoL in these patients. The Sino-Nasal Outcome Test 22 (SNOT-22) is a self-administered questionnaire already in use for the evaluation of the QoL of patients with sinonasal disorders, but it fails to effectively capture smell complaints [11]. A good questionnaire for the evaluation of QoL in OD patients is the Questionnaire of Olfactory Disorders - Negative Statements (QOD-NS) and its short version. It has reached good psychometric validity and correlation with objective olfactory loss [12].

Concerning psychophysical tools, the Sniffin' Sticks test and the University of Pennsylvania Smell Identification test (UPSIT) are specific for smell with good reliability and validity, but require time to perform, are expensive and give no information about QoL [13,14]. On the contrary, the Visual Analogue Scale (VAS) is easy, quick to administer and costless. However, it may be too simple and with little information in clinical practice and studies. Therefore, Zou et al. developed the Self-reported Mini Olfactory Questionnaire (Self-MOQ), a 5-item questionnaire able to sufficiently evaluate the grade of OD that is quick to administer [15]. However, it is not yet validated in the Italian language. This questionnaire was devised in order to give clinicians an inexpensive and easy-to-administer instrument for quantitative OD evaluation without impacting the accuracy of measuring and without consuming time. The Self-MOQ was administered to subjects with different kinds of olfactory disorder (idiopathic, post-viral, sinonasal, post-traumatic, neurodegenerative) [15].

The aim of this study was the cross-cultural adaptation and validation of the Self-MOQ into Italian. We determined its reliability and usefulness in patients affected by chronic sinonasal diseases (CRS, AR, NAR).

Materials and methods

Participants

One hundred fifty patients affected by chronic sinonasal diseases, including CRS, AR and NAR (diagnosed by an otorhinolaryngologist), and reporting hyposmia were enrolled (OD group). Other 150 normosmic subjects without inflammatory or neoplastic sinonasal disorders were enrolled and used as control group. Exclusion criteria were as follows: age < 18 years; neurodegenerative diseases causing dementia; previous head trauma; previous surgical treatments for CRS, AR or NAR; sinonasal tumours or previous radiation therapy of the head and neck region; previous COVID-19. The mean age was 50.3 ± 17.2 years (range 18-89 years) in the OD group, while it was 52.8 ± 16.7 years (range 18-81 years) in the control group. Table I reports clinical characteristics of both groups. Mean disease duration in the OD group was 8.5 ± 7.9 years (range 2-25 years). The two groups were comparable for demographic features ($p > 0.05$), but not for subjective sinonasal symptoms that were higher in the OD group ($p < 0.05$).

Table I. Characteristics of patients and control groups (number, %).

Characteristic	OD group ($n = 150$)	Control group ($n = 150$)
Sex		
Male	74 (49.3)	69 (46)
Female	76 (50.7)	81 (54)
Smoke	31 (20.7)	32 (21.3)
Allergy	59 (39.3)	48 (32)
Nasal obstruction	113 (75.3)	54 (36)
Anterior rhinorrhoea	100 (66.7)	41 (27.3)
Posterior rhinorrhoea	32 (21.3)	5 (3.3)
Facial pain	43 (28.7)	16 (10.7)
Sneezing	33 (23.3)	21 (14)
Nasal itch	47 (31.3)	24 (16)
Disease		
Allergic rhinitis	17 (11.3)	-
Non-allergic rhinitis	11 (7.3)	-
CRS without nasal polyps	77 (51.4)	-
CRS with nasal polyps	45 (30)	-

OD: olfactory disfunction; CRS: chronic rhinosinusitis.

Cross-cultural adaptation

The Self-MOQ questionnaire consists of 5 true/false items. Each item is formulated as a personal statement reflecting complaints about smell in daily life (e.g., "I do not recognise the smell of freshly mowed grass"). A Self-MOQ total score can be calculated by summing all items (range 0-5). Higher scores indicate higher levels of OD-related problems.

For the translation procedure, we followed the World Health Organization criteria for cross-cultural adaptation [16]. Two independent researchers (health professionals, familiar with terminology of the area) translated into Italian the items of the English Self-MOQ and obtained a consensus version. The latter was translated back to English by independent qualified translator. Next, this last English version of the questionnaire was compared with the original one. The researchers discussed discrepancies and produced a final Italian version (Tab. II). The questionnaire was administered to subjects at enrolment.

Validation and reliability

Cronbach's alpha coefficient was used to evaluate the internal consistency of the Italian version of Self-MOQ. Values greater than 0.8 and 0.9 were considered "good" and "excellent", respectively. Test-retest reliability analysis was used to assess the reproducibility of the question-

Table II. English and Italian versions of the Self-MOQ.

Yes/*Si*: 1; No/*No*: 0
Items:
1. In perfumeries, I hardly perceive the fragrance
In profumeria, faccio fatica a sentire i profumi
2. I do not perceive the smell of coffee and fresh bread
Non percepisco l'odore del caffè e del pane fresco
3. I like to look around the flower shop, but I cannot smell anything
Mi piace guardarmi attorno nei negozi di fiori, ma non sento nessun profumo
4. I do not smell the fresh tar at a road construction site
Non sento l'odore del catrame nelle sedi di costruzione delle strade
5. I do not recognize the smell of freshly mowed grass
Non riconosco l'odore dell'erba appena tagliata

naire. For this purpose, a subgroup of 50 patients repeated Self-MOQ questionnaire after 7 days from first compilation. This time was long enough to let individuals forget their previous answers, but short enough not to allow changes in patients' OD.

Self-MOQ was compared with VAS for olfactory function in order to evaluate the construct validity. The VAS score ranges from 0 to 10, where 0 means anosmia and 10 indicates perfect olfactory function.

The clinical validity of the Self-MOQ was assessed by comparing the scores of the patients and the data obtained from the control group. Moreover, we analysed the relationship between Self-MOQ score and clinical features (age, sex, smoke, allergies, nasal symptoms) and QoL in the patient group. QoL was assessed with the Short-Form 36 (SF-36) questionnaire. It assesses health-related QoL and consists of 36 items, based on a 2- to 6-point scales. Eight SF-36 domains can be identified: physical functioning, role functioning/physical, role functioning/emotional, energy/fatigue, emotional well-being, social functioning, pain, and general health. All scores range 0 to 100. Higher scores indicate higher levels of QoL.

Statistical analysis

All statistical analyses were carried out using Statistical Package for Social Sciences (SPSS), version 20.0. A descriptive analysis of all data was performed and reported as means or percentages and standard deviations. Cronbach's alpha coefficient was used to assess the internal consistency. The test-retest reliability was evaluated using intraclass correlation coefficient (ICC). Ninety-five percent confidence interval (95% CI) was reported. High ICC (> 0.80) would indicate adequate test-retest reliability. Since the Kolmogorov-Smirnov test demonstrated a non-Gaussian distribution of variables, nonparametric tests were used for the analysis of construct and clinical validity. Spearman's test was used to assess the correlation between Self-MOQ, VAS and SF-36 scores. Differences between groups in the mean of continuous variables were assessed by the Mann-Whitney U-test. Comparison of categorical variables between groups was evaluated using Spearman's rank correlation test. A p value less than 0.05 was considered statistically significant.

Results

Internal consistency

The internal consistency of Self-MOQ (5 items), assessed by Cronbach's alpha coefficient, was 0.825. Therefore, it could be considered good.

Reliability

For Self-MOQ total score, the ICC was 0.978 (95% CI, 0.969-0.984) and can be considered excellent. ICC values for each item ranged from 0.797 to 0.979 (Tab. III).

Construct validity

Mean Self-MOQ total score was 3.27 ± 0.72 for the OD group and 0.10 ± 0.55 for the control group, while mean VAS score for olfactory function was 4.81 ± 1.87 for the OD group and 8.84 ± 1.60 for the control group, respectively. Analysing the entire sample of 300 individuals, a significant correlation was identified between Self-MOQ and VAS scores ($p < 0.001$). In particular, higher Self-MOQ scores correlated with lower VAS scores, both indicating worse olfactory function.

Clinical validity

A significant difference was found for Self-MOQ total score between the OD and control groups (3.27 ± 0.72 and 0.10 ± 0.55, respectively; $p < 0.001$). Similarly, VAS for olfactory function was worse in patients compared to controls (4.81 ± 1.87 and 8.85 ± 1.60, respectively; $p < 0.001$). The study showed that OD patients had worse

Table III. Test-retest analysis for Self-MOQ ($n = 50$).

Item	Intraclass correlation coefficient (ICC)
1	0.953 (0.935-0.966)
2	0.909 (0.874-0.934)
3	0.966 (0.953-0.975)
4	0.797 (0.720-0.853)
5	0.979 (0.972-0.985)
Self-MOQ total score	0.978 (0.969-0.984)

Table IV. Correlation between Self-MOQ total score and nasal symptoms (OD group, *n* = 150).

	Self-MOQ total score	p value*
Nasal obstruction		
Yes (*n* = 113)	3.34 ± 0.8	0.020
No (*n* = 37)	3.05 ± 0.33	
Anterior rhinorrhoea		
Yes (*n* = 100)	3.22 ± 0.58	0.645
No (*n* = 50)	3.36 ± 0.94	
Posterior rhinorrhoea		
Yes (*n* = 32)	3.47 ± 0.8	0.017
No (*n* = 118)	3.21 ± 0.69	
Facial pain		
Yes (*n* = 43)	3.37 ± 0.76	0.16
No (*n* = 107)	3.22 ± 0.7	
Sneezing		
Yes (*n* = 33)	3.30 ± 0.98	0.690
No (*n* = 117)	3.26 ± 0.63	
Nasal itch		
Yes (*n* = 47)	3.30 ± 0.88	0.974
No (*n* = 103)	3.25 ± 0.64	

** Mann-Whitney U test.*

Self-MOQ score than controls. Therefore, Self-MOQ was able to distinguish between healthy subjects and patients with olfactory loss.

Significant higher scores of Self-MOQ were found in case of nasal obstruction and posterior rhinorrhoea (p = 0.020 and p = 0.017, respectively). No statistical correlation was found between Self-MOQ score and other clinical characteristics (age, sex, allergies, smoke, anterior rhinorrhoea, facial pain, sneezing, nasal itch; Table IV).

Mean SF-36 general health score was 52.18 ± 22.28 for patients with OD. Self-MOQ showed significant correlation with SF-36 general health, SF-36 role functioning/physical, and SF-36 pain (p < 0.05, Table V). Others SF-36 scores did not correlate to Self-MOQ (p > 0.05).

Table V. Spearman's correlation coefficients and p values among SF-36 and Self-MOQ scores (OD group, *n* =150).

	Self-MOQ total score	
	r	p
SF-36 physical functioning	-0.140	0.088
SF-36 role functioning/physical	-0.175	0.033
SF-36 role functioning/emotional	-0.098	0.233
SF-36 energy/fatigue	-0.105	0.2
SF-36 emotional well-being	-0.065	0.426
SF-36 social functioning	-0.110	0.181
SF-36 pain	-0.199	0.015
SF-36 general health	-0.224	0.006

Discussion

Olfactory dysfunction (OD) affects about 20% of the general population [17]. Given the increase of chronic sinonasal diseases worldwide, estimating the severity of OD and its impact on QoL has become of primary importance [18]. Moreover, smell disorders are also present after treatment of head and neck cancer (surgery and/or chemoradiation therapy) [19-22].

The grade of olfactory loss can be easily and rapidly assessed by a VAS in a subjective manner. On the other hand, some questionnaires that evaluate QoL in patients affected by chronic sinonasal diseases, like SNOT-22 and SNOT for Neurosurgery (SNOT-NC), have been validated into Italian, but fail to effectively capture OD [11,23]. Globally, we need a more specific questionnaire to assess olfactory loss in Italian language, which is valid, easy to perform and more informative than VAS.

Recently, a questionnaire for the evaluation of OD severity was validated into English: the Self-MOQ [15]. It is a 5-item questionnaire that quickly evaluates olfactory loss in patients with smell disorders (only 2 minutes to administer). The definitive Self-MOQ derives from a former and wider questionnaire of 14 true/false items that were posed as personal declarations reflecting complaints about olfactory problems in daily life. Higher scores indicate higher levels of olfaction-related problems. The convergent validity analysed in the validation study demonstrated negative correlations between the Self-MOQ total score and Sniffin' Sticks scores, indicating that the questionnaire is an efficient tool to measure OD [15].

The aim of our study was to validate the Self-MOQ questionnaire into Italian. With this purpose, Self-MOQ was administered to 300 subjects (150 affected by chronic sinonasal diseases and 150 healthy people).

Our study showed that the Italian version of Self-MOQ, similar to the English version, had a good internal consistency (Cronbach's alpha coefficient was 0.845). The test-retest reliability reached an excellent result for the entire questionnaire (ICC was 0.901) and for the majority of the items. Construct validity was assessed through the correlation between Self-MOQ and VAS for smell. The analysis of clinical validity showed that Self-MOQ was able to discriminate between normosmic and hypo/anosmic subjects. An inverse correlation between Self-MOQ and global QoL emerged. In particular, Self-MOQ total score was inversely related to SF-36 general health and role functioning/physical. The correlation with SF-36 pain should be further studied to better understand the possible reasons.

In agreement with the previous validation study, we did not find any correlation between Self-MOQ and age. Indeed, Croy et al. reported that the significance of the sense of smell did not change with age [24]. The reason was probably a gradual habituation to age-related OD.

The main strength of our study is the presence of a control group composed of healthy subjects. This allowed us to verify that the Self-MOQ can discriminate among subjects who had OD or not. A second strength is the analysis of test-retest reliability that was not performed in the original validation by Zou et al. [15]. Thus, we confirmed that the questionnaire is also valid in its reliability over time. Another strength is the analysis of global QoL in relationship to Self-MOQ score. Indeed, the impact of olfactory loss on patients' QoL is often neglected but represents an important outcome that should be evaluated in clinical practice. A limitation of this study is the lack of psychophysical tests. However, in its first validation study, the association between Self-MOQ and Sniffin' Sticks has been already demonstrated.

Conclusions

The Italian version of Self-MOQ showed good internal consistency, excellent test-retest reliability, construct, and clinical validity, as good as the original version. It is easy and quick to submit and is costless. Therefore, it can be considered a good instrument to discriminate between normosmic and hypo/anosmic subjects. However, Self-MOQ should not completely replace olfactory tests, such as Sniffin' Sticks, even though it seems to be more indicative than VAS. Further studies are needed to assess the role of Self-MOQ in evaluating OD before and after medical or surgical treatments for sinonasal diseases.

Conflict of interest statement

The authors declare no conflict of interest.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Author contributions

All authors contributed to the study conception and design. GR, GP, GMM, MR, AC, RA, AA: material preparation, data collection and analysis; GR, GMM: written the first draft of the manuscript; all authors commented on previous versions of the manuscript; all authors read and approved the final manuscript.

Ethical consideration

This study was approved by the Institutional Ethics Committee (AOU Città della Salute e della Scienza di Torino - AO Ordine Mauriziano - ASL Città di Torino, approval number 303/2020). The research was conducted ethically, with all study procedures being performed in accordance with the requirements of the World Medical Association's Declaration of Helsinki. Written informed consent was obtained from each participant/patient for study participation and data publication.

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