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Development and Validation of the Short Version of the Reflux Symptom Score: Reflux Symptom Score–12

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Abstract

Objective. To develop and validate a short version of the Reflux Symptom Score—the 12-question Reflux Symptom Score–12 (RSS-12)—for patients with laryngopharyngeal reflux disease (LPR).

Study Design. Prospective study.

Setting. Multicenter academic hospitals.

Methods. Patients with LPR diagnosed via multichannel intraluminal impedance pH monitoring were enrolled from 3 European hospitals. Healthy individuals completed the study. Individuals completed the Reflux Symptom Score, Reflux Symptom Index (RSI), and Voice Handicap Index (VHI) at baseline and 3 months posttreatment. The Reflux Symptom Score was completed twice within a 7-day period to assess test-retest reliability. Cronbach's α was used for assessing internal consistency. The RSS-12 was developed and validity assessed through a comparison of the RSS-12, RSI, and VHI. Responsiveness to change was evaluated through the pre- to posttreatment evolution of the RSS-12 total score. Receiver operating characteristic analysis was used to determine the RSS-12 threshold that is suggestive of LPR.

Results. The RSS-12 was characterized by high test-retest reliability (r_s = 0.956) and adequate internal consistency reliability (α = 0.739). The RSS-12 was significantly correlated with the RSI (r_s = 0.845), suggesting high external validity. The RSS-12 total and item scores were significantly higher in patients with LPR as compared with healthy individuals (P = .001), supporting high internal validity. RSS-12, VHI, and RSI significantly improved throughout treatment. Regarding the receiver operating characteristic curve, an RSS-12 score >11 is suggestive of LPR, exhibiting a sensitivity of 94.5% and a specificity of 86.2%.

Conclusion. The RSS-12 is a shorter, reliable, and valid self-administered patient-reported outcome measure questionnaire that can be used in the outpatient setting to suggest and monitor LPR.

Keywords

laryngopharyngeal, reflux, laryngitis, tool, outcome, symptom

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Laryngopharyngeal reflux disease (LPR) is an inflammatory condition related to the direct and indirect effects of gastroduodenal content reflux, which induces morphologic changes in tissues of the upper aerodigestive tract.[1] Approximately 10% to 30% of outpatients visiting otolaryngology departments and up to 50% of patients in laryngology practices have LPR-related symptoms.[2-4] The clinical diagnosis of reflux is difficult because symptoms and signs are nonspecific and may be encountered in many

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Reflux Symptom Score-12

Au cours du dernier mois, j'ai souffert d'un/plusieurs symptôme(s) suivant: évaluation à faire entre 0 et 5.

Fréquence: 0= je n'ai pas eu ce symptôme au cours du dernier mois; 1;2;3;4 = j'ai eu ce symptôme 1-2; 2-3; 3-4; 4-5 fois par semaine au cours du dernier mois.

5= la plainte est présente une à plusieurs fois par jour. - Sévérité: 0=le problème n'est pas du tout sévère, 5 = le problème est très gênant lorsqu'il survient.

	Fréquence des plaintes	**Sévérité des plaintes**		**Impact sur la qualité de vie**	
Symptômes O.R.L.			Score total		Score total
1. Problèmes avec ma voix	0 - 1 - 2 - 3 - 4 - 5	0 - 1 - 2 - 3 - 4 - 5	……..	0 - 1 - 2 - 3 - 4 - 5	……..
2. Douleur(s) de gorge au repos ou lorsque j'avale	0 - 1 - 2 - 3 - 4 - 5	0 - 1 - 2 - 3 - 4 - 5	……..	0 - 1 - 2 - 3 - 4 - 5	……..
3. Difficultés à la déglutition de gélules, de liquides, ou d'aliments solides	0 - 1 - 2 - 3 - 4 - 5	0 - 1 - 2 - 3 - 4 - 5	……..	0 - 1 - 2 - 3 - 4 - 5	……..
4. Raclements de gorge	0 - 1 - 2 - 3 - 4 - 5	0 - 1 - 2 - 3 - 4 - 5	……..	0 - 1 - 2 - 3 - 4 - 5	……..
5. Sensation d'avoir quelque chose de coïncé dans la gorge	0 - 1 - 2 - 3 - 4 - 5	0 - 1 - 2 - 3 - 4 - 5	……..	0 - 1 - 2 - 3 - 4 - 5	……..
6. Excès de sécrétions collantes dans la gorge ou sensation d'écoulements à l'arrière du nez	0 - 1 - 2 - 3 - 4 - 5	0 - 1 - 2 - 3 - 4 - 5	……..	0 - 1 - 2 - 3 - 4 - 5	……..
7. Mauvaise haleine	0 - 1 - 2 - 3 - 4 - 5	0 - 1 - 2 - 3 - 4 - 5	……..	0 - 1 - 2 - 3 - 4 - 5	……..
8. Remontées acides, brûlures d'estomac, nausées, régurgitations ou eructions	0 - 1 - 2 - 3 - 4 - 5	0 - 1 - 2 - 3 - 4 - 5	……..	0 - 1 - 2 - 3 - 4 - 5	……..
9. Douleurs abdominales ou diarrhées	0 - 1 - 2 - 3 - 4 - 5	0 - 1 - 2 - 3 - 4 - 5	……..	0 - 1 - 2 - 3 - 4 - 5	……..
10. Indigestion, distensions abdominales et/ou flatulences	0 - 1 - 2 - 3 - 4 - 5	0 - 1 - 2 - 3 - 4 - 5	……..	0 - 1 - 2 - 3 - 4 - 5	……..
11. Toux	0 - 1 - 2 - 3 - 4 - 5	0 - 1 - 2 - 3 - 4 - 5	……..	0 - 1 - 2 - 3 - 4 - 5	……..
12. Difficultés respiratoires, essouflement, ou sifflements lors de la respiration	0 - 1 - 2 - 3 - 4 - 5	0 - 1 - 2 - 3 - 4 - 5	……..	0 - 1 - 2 - 3 - 4 - 5	……..

Score total: …… **Score total de qualité de vie**: ……

Figure 1. Reflux Symptom Score–12. Severity item (5 points) is multiplied by frequency (5 points) to obtain a symptom score (0-25). The sum is calculated to obtain a final score (0-300).

other otolaryngologic conditions, such as allergy, rhinosinusitis, and chronic pharyngolaryngitis related to tobacco or alcohol consumption.[4-6] Thus, the use of patient-reported outcome measures (PROMs) makes sense for improving the accuracy of the clinical diagnosis and disease course.[7,8] In 2001, Belafsky et al published a survey of LPR-related symptoms known as the Reflux Symptom Index (RSI)[9]: a 9-item PROM designed to assess the otolaryngologic symptoms associated with reflux. However, there are 2 criticisms of the RSI: it considers only the severity of a patient's symptoms, and it was developed with pH-only data. As such, some prevalent LPR-related symptoms are missing from the RSI, including throat pain, odynophagia, halitosis, regurgitations, nausea, and burps.[10,11]

Because of these shortcomings of the RSI, the Reflux Symptom Score (RSS) was developed (**Figure 1**). The RSS is a self-administered 22-item French PROM to diagnose and monitor LPR, including the disease's impact on quality of life (QoL).[12] The RSS demonstrated high reliability, excellent criterion-based validity, and more discriminative properties as compared with the RSI in patients with LPR who were diagnosed with pharyngeal reflux events based on hypopharyngeal-esophageal multichannel intraluminal impedance pH testing (HEMII-pH).[12] Due to the length and somewhat less practical clinical use of the original RSS, the aim of this study was to explore, develop, and validate a shortened version of the RSS that could then be validated in English, specifically in the United States. The current study was initiated to (1) statistically analyze the prevalence of symptoms in a larger cohort of patients with LPR who completed the original RSS and (2) determine the occurrences of positive significant correlations among symptom items in an effort to merge items and thus decrease the length of the RSS. Through this approach, we hope to maintain the specificity and sensitivity of the original RSS while lessening the question burden on the patient and clinician.

Materials and Methods

The local ethics committee approved the study protocol (CHU Saint-Pierre Committee, BE076201837630). Informed consent was obtained from enrolled patients.

Reflux Symptom Score–12 Development

The development of the Reflux Symptom Score–12 (RSS-12) was based on a cohort of 73 patients who completed the French version of the original 22-question RSS at the time of diagnosis. The same group of data was used to develop and validate the RSS-12. The 3 ''other'' choices from the original RSS were eliminated. Of the original 22 RSS items, 4 were eliminated because their prevalence among patients did not reach 50%: ear pressure/pain (daytime or nighttime), tongue burning, constipation, and chest pain. After the correlation analysis was performed on the original RSS items, the following 11 items were merged into 5 new ones: (1) ''throat pain'' with ''pain during swallowing time''; (2) ''heartburn, stomach acid coming up'' with ''regurgitation of liquids, solid foods and burps'' and with ''nausea''; (3) ''abdominal pain'' with ''diarrheas''; (4) ''indigestion'' with ''abdominal distension and/or flatus''; and (5) ''cough (daytime)'' with ''cough after lying down or eating.'' The names of the items are as they appear in the original French-to-English translation of the RSS. For each patient and based on one's prior responses to the RSS, a new symptom score was calculated for each of the 5 new RSS-12 items. The 5 new scores were calculated by taking the mean of the patient's original RSS item scores that had been combined to make the new item. For example, if the original RSS ''throat

Reflux Symptom Score-12

Within the last month, I suffered from one/several followed symptoms

Frequency: 0= I don't have this complaint over the past month, 1;2;3;4 = I had 1-2;2-3;3-4;4-5 weekly over the past month; 5= complaint occurs daily

Severity: 0= problem is not severe, 5 = problem very troublesome when it occurs

	Disorder Frequency	Disorder Severity		Quality of Life impact	
Ear Nose and Throat Disorders			Total score		Total score
1. Hoarseness or a voice problem	0 - 1 - 2 - 3 - 4 - 5	0 - 1 - 2 - 3 - 4 - 5	.....	0 - 1 - 2 - 3 - 4 - 5	.....
2. Throat pain or pain during swallowing	0 - 1 - 2 - 3 - 4 - 5	0 - 1 - 2 - 3 - 4 - 5	.....	0 - 1 - 2 - 3 - 4 - 5	.....
3. Difficulty swallowing (pills, liquids or solid foods)	0 - 1 - 2 - 3 - 4 - 5	0 - 1 - 2 - 3 - 4 - 5	.....	0 - 1 - 2 - 3 - 4 - 5	.....
4. Throat clearing (not cough)	0 - 1 - 2 - 3 - 4 - 5	0 - 1 - 2 - 3 - 4 - 5	.....	0 - 1 - 2 - 3 - 4 - 5	.....
5. Sensation of something being stuck in the throat	0 - 1 - 2 - 3 - 4 - 5	0 - 1 - 2 - 3 - 4 - 5	.....	0 - 1 - 2 - 3 - 4 - 5	.....
6. Excess mucous in the throat and/or post nasal drip sensation	0 - 1 - 2 - 3 - 4 - 5	0 - 1 - 2 - 3 - 4 - 5	.....	0 - 1 - 2 - 3 - 4 - 5	.....
7. Bad breath	0 - 1 - 2 - 3 - 4 - 5	0 - 1 - 2 - 3 - 4 - 5	.....	0 - 1 - 2 - 3 - 4 - 5	.....
8. Heartburn, stomach acid coming up, regurgitation, burping, or nausea	0 - 1 - 2 - 3 - 4 - 5	0 - 1 - 2 - 3 - 4 - 5	.....	0 - 1 - 2 - 3 - 4 - 5	.....
9. Abdominal pain or diarrhea	0 - 1 - 2 - 3 - 4 - 5	0 - 1 - 2 - 3 - 4 - 5	.....	0 - 1 - 2 - 3 - 4 - 5	.....
10. Indigesiton, abdominal distension and/or flatus	0 - 1 - 2 - 3 - 4 - 5	0 - 1 - 2 - 3 - 4 - 5	.....	0 - 1 - 2 - 3 - 4 - 5	.....
11. Coughing (not just throat clearing)	0 - 1 - 2 - 3 - 4 - 5	0 - 1 - 2 - 3 - 4 - 5	.....	0 - 1 - 2 - 3 - 4 - 5	.....
12. Breathing difficulties,breathlessness, or wheezing	0 - 1 - 2 - 3 - 4 - 5	0 - 1 - 2 - 3 - 4 - 5	.....	0 - 1 - 2 - 3 - 4 - 5	.....

RSS total score:..... **Quality of Life score:**.....

Figure 2. Reflux Symptom Score–12. US otolaryngologists have translated the French version into English, and this is will be validated in the United States.

pain'' symptom score was 16 and the ''pain during swallowing (time)'' symptom score was 20, the new mean symptom score for the single item now called ''throat pain and pain during swallowing'' in the RSS-12 was calculated to be 18; this new mean score was then used in the current RSS-12 validation calculations as the item ''throat pain and pain during swallowing.'' The RSS-12 total score was calculated by adding the 5 new combined mean item symptom scores to the remaining original 7 symptom scores for a total of 12 items (RSS-12; **Figure 2**). The final RSS-12 is composed of 7 ENT symptom items (ear, nose, and throat) as well as 3 digestive symptom items and 2 respiratory symptom items. In summary, 11 of the 22 original items from the RSS were combined into 5 new merged items in the RSS-12, while 7 items of the RSS-12 remained identical to the original RSS. Ultimately, the 12 most consistent items of the RSS were chosen for the RSS-12 based on the prevalence of symptoms and the occurrence of positive significant correlation between specific items.

Patients and Setting

The patients and setting are taken from the prior work[12] describing the original RSS. Patients were enrolled from January 2017 to January 2019 from the departments of otolaryngology–head and neck surgery of CHU Saint-Pierre (Brussels, Belgium), Cesar De Pape (Brussels, Belgium), and the Polyclinique Elsan (Poitiers, France). Patients were included if they had symptoms and findings of LPR and a positive diagnosis of LPR on HEMII-pH testing. Details about the placement of the HEMII-pH catheter (Versaflex Z, Digitrapper pH-Z Testing System; Medtronic) is reported in previous publications.[12,13] Patients were excluded if they presented with one of the following conditions: smoking history, alcohol dependence, pregnancy, neurologic or psychiatric illness, upper respiratory tract infection within the last month, current use of antireflux treatment (ie, proton pump inhibitors, H2 blockers, alginate, and/or magaldrate), history of neck surgery or trauma, benign or malignant vocal fold lesions, history of ENT radiotherapy, or active seasonal allergies or asthma.

A distal reflux event was defined as an episode reaching the lowest impedance sensors closest to the lower esophageal sphincter. A pharyngeal reflux event was defined as an episode that reached both highest impedance sensors (in the hypopharynx). According to a recent study that defined normative data of HEMII-pH in LPR, the LPR diagnosis was based on the occurrence of $\geq$1 pharyngeal episode.[14] Gastroesophageal reflux disease (GERD) was defined as a length of time $>$4.0% of the 24-hour recording spent below pH 4.0 in the lower pH sensor, or a DeMeester score $>$14.72.[15] An acid reflux episode was defined as an episode with pH $<$4.0. A non–acid reflux episode was defined as an episode with pH $>$4.0. LPR was defined as acid when the ratio of the number of pharyngeal acid reflux episodes to the number of nonacid pharyngeal reflux episodes was $>$2. LPR was defined as nonacid when the ratio of the number of pharyngeal acid reflux episodes to the number of nonacid pharyngeal reflux episodes $<$0.5. Mixed LPR consisted of a ratio that ranged from 0.51 to 2.0.

Gastrointestinal endoscopy was offered to patients with GERD symptoms. Due to prior studies that showed a reduction of GERD symptom recognition in older people with LPR, gastrointestinal endoscopy was systematically performed in patients $\geq$60 years old.[16] The control group was composed of 80 asymptomatic individuals without symptoms of LPR (RSS $<$13), aged 18 to 59 years old. They completed a questionnaire to investigate the presence of the exclusion conditions and were excluded if $\geq$1 exclusion criteria were met.

Table 1. Epidemiologic and Clinical Characteristics of the Included Patients.

Characteristic	No.	%
Age, y	47.49 ± 16.77 (19-90)[a]	
Body mass index	26.45 ± 6.37[a]	
Sex		
Male	30	41
Female	43	59
Gastrointestinal endoscopy (n = 56)		
Normal	8	14
Esophagitis, Los Angeles grade		
A	21	38
B	2	4
C	1	2
D	2	4
Hiatal hernia	20	36
LES insufficiency	36	64
Gastritis	25	45
Duodenitis	4	7
Helicobacter pylori	6	11
HEMII-pH profiles[b]		
Acid reflux	35	48
Nonacid reflux	19	26
Mixed reflux	19	26
LPR + GERD	29	40

Abbreviations: GERD, gastroesophageal reflux disease; HEMII-pH, hypopharyngeal-esophageal multichannel intraluminal impedance pH monitoring; LES, lower esophageal sphincter; LPR, laryngopharyngeal reflux disease.
[a]Mean ± SD (range).
[b]The ratio of the number of pharyngeal acid episodes to the number of pharyngeal nonacid episodes was used for the definition of reflux profile: acid LPR, >2; nonacid LPR, <0.4; mixed LPR, 0.4-2.0.

Treatment

LPR treatment was based on the recent recommendations of the LPR Study Group of the Young Otolaryngologists of the International Federation of ORL Societies.[4] Patients were treated with a personalized treatment plan, including diet, behavioral changes, and use of proton pump inhibitors (pantoprazole, 20 mg twice daily) ± alginate (Gaviscon Advance; Reckitt Benckiser) ± magaldrate (Riopan; Takeda) based on the type of reflux (acid, nonacid, or mixed) demonstrated on their HEMII-pH results. Patients with nonacid LPR did not take proton pump inhibitors.

Statistical Methods

The original RSS was completed twice over a 7-day period—baseline/day zero (T0) and 1 week—and after 6 and 12 weeks of treatment. Patients with LPR completed items of the French versions of the RSI[17] and Voice Handicap Index (VHI)[18] at T0 and at 3 months posttreatment.

Reliability. Cronbach's alpha was used for measuring internal consistency for all items on the developed RSS-12 at T0 for patients and healthy individuals (N = 154). Test-retest reliability between the RSS-12 at T0 and RSS-12 at 6 weeks was assessed for each item and for the total score with Spearman's rank correlation coefficient: $r \geq 0.80$ was considered ideal, whereas $r \geq 0.70$ was considered adequate.[7]

Table 2. Test-Retest Reliability for Each Item Score and Total Score.

RSS-12 items	r_s[a]	95% CI
1. Voice disorder	0.868	1.43
2. Throat pain or odynophagia	0.891	1.27
3. Dysphagia	0.877	1.17
4. Throat clearing	0.869	2.14
5. Globus sensation	0.925	2.19
6. Excess throat mucus	0.916	2.42
7. Halitosis	0.838	2.00
8. Heartburn, stomach acid coming up, regurgitations, burps, nausea	0.906	1.31
9. Abdominal pain or diarrheas	0.782	1.30
10. Indigestion, abdominal distension, and/or flatus	0.866	1.36
11. Cough after eating or lying down or daytime troublesome cough	0.916	1.44
12. Breathing difficulties, breathlessness, or wheezing	0.846	1.70
QoL score	0.960	2.49
RSS-12 total score	0.951	10.87

Abbreviations: QoL, quality of life; r_s, Spearman correlation coefficient; RSS-12 = Reflux Symptom Score–12.
[a]Each item, $P < .001$.

Validity. External validity was assessed by correlations among RSS-12 at T0, RSI at T0, and VHI at T0 per Spearman's rank correlation coefficient. A statistical comparison between the RSS-12 item scores at T0 and the total score of patients and healthy individuals was performed with the Mann-Whitney *U* test (internal validity).

Responsiveness. The RSS-12 total symptom score pre- to posttreatment was assessed for responsiveness to change. Pre- to posttreatment changes in the RSS-12, RSI, and VHI were evaluated with the Wilcoxon signed-rank test.

Statistical analyses were performed with the SPSS (v 22.0; IBM Corp). The RSS-12 cutoff for determining the presence and absence of LPR was examined through receiver operating characteristic (ROC) analysis.

Results

A total of 73 patients and 81 healthy individuals completed the study (**Table 1**). Cronbach's alpha for the items of the RSS-12 for all individuals (N = 154) was 0.739, which indicates adequate internal consistency. The test-retest reliability between RSS-12 at T0 and RSS-12 at 1 week was high for the total score ($r_s = 0.956$, $P < .001$) and all item scores (**Table 2**). There were significant correlations between RSS-12 and RSI scores ($r_s = 0.845$, $P < .001$) and between RSS-12 and VHI scores ($r_s = 0.567$, $P = .001$), suggesting high external validity.

Table 3. RSS-12 at Baseline in Patients With LPR and Without.[a]

	Frequency × severity scores			QoL scores		
Item	LPR	Controls	*P* value	LPR	Controls	*P* value
1. Voice disorder	4.12 ± 6.23	0.17 ± 0.93	.001	1.08 ± 1.48	0.09 ± 0.32	.001
2. Throat pain or odynophagia	4.54 ± 5.52	0.61 ± 1.82	.001	1.49 ± 1.42	0.16 ± 0.41	.001
3. Dysphagia	2.90 ± 5.09	0.42 ± 2.01	.001	1.07 ± 1.59	0.07 ± 0.47	.001
4. Throat clearing	9.60 ± 9.32	0.47 ± 1.21	.001	2.25 ± 1.93	0.19 ± 0.62	.001
5. Globus sensation	9.19 ± 9.54	0.31 ± 0.78	.001	2.33 ± 2.01	0.14 ± 0.35	.001
6. Excess throat mucus	10.74 ± 10.56	0.33 ± 1.16	.001	2.37 ± 2.10	0.24 ± 0.75	.001
7. Halitosis	6.63 ± 8.73	0.58 ± 2.54	.001	1.95 ± 1.98	0.24 ± 0.80	.001
8. Heartburn, stomach acid coming up, regurgitations, burps, nausea	5.80 ± 5.71	0.83 ± 2.75	.001	1.77 ± 1.42	0.28 ± 0.69	.001
9. Abdominal pain or diarrheas	3.83 ± 5.68	0.57 ± 2.18	.001	1.21 ± 1.52	0.22 ± 0.68	.001
10. Indigestion, abdominal distension, and/or flatus	4.76 ± 5.94	0.36 ± 1.37	.001	1.35 ± 1.29	0.13 ± 0.42	.001
11. Cough after eating or lying down or daytime troublesome cough	4.86 ± 7.18	0.29 ± 1.25	.001	1.38 ± 1.62	0.09 ± 0.31	.001
12. Breathing difficulties, breathlessness, or wheezing	4.64 ± 7.41	0.86 ± 2.76	.001	1.47 ± 1.73	0.28 ± 0.69	.001
QoL score				19.71 ± 11.44	2.01 ± 3.18	.001
RSS-12 total score	77.18 ± 50.25	6.49 ± 11.07	.001			

Abbreviations: LPR, laryngopharyngeal reflux disease; QoL, quality of life; RSS-12, Reflux Symptom Score–12.
[a]Values are presented as mean ± SD. The statistical comparison between groups was performed with the Mann-Whitney *U* test.

The mean RSS-12 scores of patients with LPR and healthy controls were 6.49 (95% CI, 4.07-8.91) and 77.18 (95% CI, 26.93-127.43), respectively, and are significantly different ($Z = –9.96$, $P < .001$). All items of the RSS-12 were significantly lower in controls than patients with LPR (**Table 3**), suggesting high internal validity. The ROC analysis reported that an RSS-12 cutoff value >11 is suggestive of LPR and exhibits high sensitivity (94.5%) and specificity (86.2%). The RSS-12 had better discriminative properties than the RSI regarding the surface under the ROC curve (RSI, 0.952; RSS-12, 0.981, $P < .05$; **Figure 3**). The RSS-12, RSI, and VHI significantly improved from T0 to 3 months posttreatment (**Table 4**). The RSS-12 responsiveness to change was especially higher from T0 to 6 weeks posttreatment. The symptoms in the RSS-12 with the most negative impact on QoL are excess globus sensation, throat clearing, and excess throat mucus.

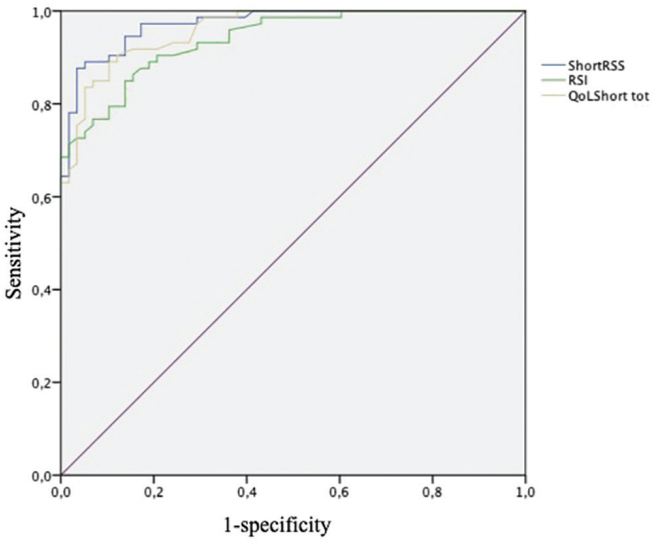

Figure 3. Receiver operating characteristic curve. A cutoff >11 is suggestive of laryngopharyngeal reflux, with a sensitivity of 94.5 and a specificity of 86.2. The Reflux Symptom Score–12 (ShortRSS) is significantly more discriminant than the Reflux Symptom Index (RSI) for the diagnosis of laryngopharyngeal reflux disease ($P < .05$). QoLShort tot, quality-of-life score of the Reflux Symptom Score–12..

Discussion

The initial version of the RSS was recently validated in French, exhibiting high reliability and excellent criterion-based validity.[12] However, because the RSS is composed of 22 items, it is time-consuming to fill out by the patient and the physician during a consultation. For that reason, a shorter version is offered: the 12-item RSS-12. At baseline, the RSS was developed to consider all prevalent LPR symptoms, which was not seen in previous LPR PROMs such as the RSI.[1,12] The development of the RSS-12 was rigorously completed by removing selected symptoms that were of lowest prevalence in patients with LPR and combining items that showed correlation. For example, similar symptoms reporting high correlation, such as throat pain and odynophagia or positional cough and troublesome cough, were combined into single items. In practice, patients with throat pain often have odynophagia, and those with troublesome cough often encounter cough after eating or lying down.

Table 4. Pre- to Posttreatment Changes of RSS-12 (Overall and Quality of Life), RSI, and VHI Scores in Patients with LPR.

RSS-12 items	Baseline	6 wk	*P* value[a]	T12wk	*P* value[b]
1. Voice disorder	4.12 ± 6.23	2.77 ± 3.54	.213	2.92 ± 5.84	.011
2. Throat pain or odynophagia	4.54 ± 5.52	4.02 ± 5.69	.188	2.65 ± 4.18	.001
3. Dysphagia	2.90 ± 5.09	2.03 ± 3.86	.082	1.49 ± 3.26	.008
4. Throat clearing	9.60 ± 9.32	7.73 ± 8.04	.004	7.53 ± 8.90	.006
5. Globus sensation	9.19 ± 9.54	6.67 ± 7.70	.003	8.68 ± 10.23	.364
6. Excess throat mucus	10.74 ± 10.56	7.30 ± 8.70	.001	7.46 ± 8.85	.001
7. Halitosis	6.63 ± 8.73	2.83 ± 4.40	.055	4.19 ± 6.83	.038
8. Heartburn, stomach acid coming up, regurgitations, burps, nausea	5.80 ± 5.71	2.49 ± 3.34	.002	2.78 ± 3.79	.004
9. Abdominal pain or diarrheas	3.83 ± 5.68	2.27 ± 2.99	.122	2.70 ± 5.36	.182
10. Indigestion, abdominal distension, and/or flatus	4.76 ± 5.94	3.23 ± 4.01	.018	3.42 ± 4.95	.001
11. Cough after eating or lying down or daytime troublesome cough	4.86 ± 7.18	3.25 ± 4.87	.021	3.51 ± 5.95	.092
12. Breathing difficulties, breathlessness, or wheezing	4.64 ± 7.41	3.87 ± 6.61	.186	3.46 ± 6.25	.103
RSS-12 total	77.18 ± 50.25	48.46 ± 36.28	.001	50.77 ± 40.49	.001
RSS-12 QoL	19.71 ± 11.44	16.43 ± 9.49	.090	15.30 ± 8.58	.080
RSI	16.53 ± 9.61			12.07 ± 7.71	.001
VHI	12.33 ± 15.43			10.65 ± 14.78	.024

Abbreviations: LPR, laryngopharyngeal reflux; QoL, quality of life; RSI, Reflux Symptom Index; RSS-12, Reflux Symptom Score–12; VHI, Voice Handicap Index.
[a]Baseline to 6 weeks.
[b]Baseline to 12 weeks.

The development of the short version of a PROM carries a risk of having lower internal consistency. The internal consistency of the RSS-12 is adequate and similar to other LPR-related PROMs: the RSI,[9] the LPR-HRQoL (LPR–Health-Related Quality of Life),[19] and the Pharyngeal Reflux Symptom Questionnaire.[10] It is, however, lower than the internal consistency of the original RSS (**Table 5**).[9,10,12,19-21] The RSS-12 has excellent test-retest reliability (r_s = 0.956). The test-retest coefficient is competitive with the coefficients of the initial version of RSS (r_s = 0.921)[12] and better than those of RSI (r_s = 0.81),[9] LPR-HRQoL (r_s = 0.64-0.90),[19] and Supraesophageal Reflux Questionnaire.[20] The RSS-12 exhibits significant positive correlation with the RSI (r_s = 0.845) and the VHI (r_s = 0.567), supporting a competitive convergent validity with the RSS.[12] A better convergent validity coefficient was found between the RSS-12 and the RSI because the complaints reported in the RSS-12 are more similar to the RSI as compared with the items of the VHI (assessing voice disorders). The total scores of the RSS-12, RSI, and VHI significantly improved from pre- to posttreatment, indicating high construct validity. Similar findings were found for the RSS,[12] the LPR-HRQoL,[19] and the RSI.[9] Although the improvement of symptoms differs from one to another, the improvement of the RSS-12 was significant from pretreatment to 6 and 12 weeks posttreatment. The improvement of complaints after 6 weeks of treatment was reported in previous publications[22] and could possibly support the tapering of medication between 6 and 12 weeks of therapy. The properties of the other PROMs are summarized in **Table 5**.[9,10,12,19-21]

Although not part of the current study, it is worth reiterating that the RSS-12 was developed to be administered as a stand-alone PROM; furthermore, as in the original RSS, the frequency and severity of each symptom, as well as its impact on QoL, are to be rated on a 5-point scale (patients are given precise instructions regarding how to select the frequency score for each item; **Figure 2**). For each item, the severity score is multiplied by the frequency score to get a symptom score ranging from 0 to 25. Of note, the RSS-12 symptom score is calculated in isolation from the RSS-12 QoL score. The sum of these symptom scores is calculated to obtain the RSS-12 final score, which ranges from 0 to 300. The QoL score is calculated separately from the RSS-12 final score by summing each item score, giving a total score that can range from 0 to 60.

The main strength of the RSS-12 is its well-defined rating system that considers severity and frequency of symptoms; it is associated with better content validity than other previous PROMs.[7,12] This is important because the rating of complaint severity with use of only a classical visual analog scale remains subjective and may depend on many sociocultural factors.[1] In addition, QoL evaluation remains a part of the RSS-12 PROM: while reported separately from the final RSS-12 score and easily omitted if so desired by the administering clinician, the QoL score offers important insight into the well-being and management of patients with chronic LPR.[12] In practice, we have observed that the QoL evaluation may be of interest in patients with a chronic course of the disease or a resistance to conventional treatment. Through the QoL score, physicians may specifically evaluate the impact that LPR has on a patient's lifestyle and may thus recommend different therapies based on this: more aggressive therapy for a patient with a significant QoL impairment versus long-term diet and lifestyle modifications

Table 5. Validated Patient-Reported Outcome Measures.[a]

Domain	Questionnaire (No. of items)					
	RSS (12)	RSI[b] (9)	LPR-34 (21)	LPR-HRQoL (19)	PRSQ (10)	SERQ (20)
LPR diagnosis criteria	Symptoms and findings	Symptoms and findings	Throat symptoms	Throat symptoms	Throat symptoms	Throat symptoms
Positive	MII-pH	pH-m			pH-m	
Cases	77-113	25	62	117	102	48-224
Controls	80	25			126 (RSI $\leq$13)	
Conceptual model	+	+	+	+	+	+
Construct definition	+	+	+	+	+	+
Target population	+	+	+	+	+	+
Expected subscales	+	+	–	+	+	+
Content validity						
Content expert involved	+	+	+	+	+	+
Description of item development	+	–	+	+	+	+
Involvement of patients in devise items	+	–	–	+	+	+
Reliability						
Internal consistency reliability, Cronbach α	0.97	0.72-0.99	–	0.84-0.93	0.79-0.93	–
Test-retest reliability	R_s = 0.92 (QoL=0.95)	R_{BP} = 0.81	–	R_{BP} = 0.64-0.90	–	kappa $\geq$0.43
Construct validity						
Responsiveness to change	+	+	–	+	–	
Convergent (external) validity	R_s = 0.83 (RSI)	+ (physical VHI)	R_{BP} = 0.1-0.72 (RSI)	R_{BP} = 0.41-0.88 (VHI)	$R_s \geq$ 0.40 (RSI)	kappa = 0.60 (RSI)
Known-groups validity	+	+	–	–	+	–
Interpretability and scoring						
Plan for scoring measure	+	+	+	+	+	+
Plan for missing data	+	–	–	–	+	–
Scaling described (subscales)	+	NA	NA	+	+	NA
Normative cutoff	RSS >13	RSI >13	–	–	–	–
Presentation						
Length	–	+	–	–	+	+
Literacy level	–	–	–	–	–	–

Abbreviations: LPR, laryngopharyngeal reflux; LPR-34, Laryngopharyngeal Reflux–34; LPR-HRQoL, LPR–Health-Related Quality of Life; MII-pH, multichannel intraluminal impedance-pH monitoring; NA, not applicable; pH-m, pH monitoring; PRSQ, Pharyngeal Reflux Symptom Questionnaire; QoL, quality of life; R_{BP}, Bravais-Pearson correlation coefficient; R_s, rho Spearman; RSI, Reflux Symptom Index; RSS, Reflux Symptom Score; SERQ, Supraesophageal Reflux Questionnaire; VHI, Voice Handicap Index.

[a]Only questionnaires focused on LPR were included. From the initial description of the psychometric properties (Table 1), we added a comparison analysis regarding the presentation of the questionnaires, including the length and literacy level.[8]

[b]American version of RSI.[9]

for patients with a less negative life impact. The results of a previous study confirmed that the QoL of patients with LPR significantly improved throughout treatment.[23] The lack of improvement of QoL score at 3 months posttreatment (P = .08) in the current study is surprising but may be attributed to the small sample size and the presence of patients who required more time to improve. The results of a previous study confirmed that the QoL of patients with LPR significantly improved throughout treatment.[23]

An additional benefit of the RSS-12 is its composition of the most relevant and prevalent symptoms taken from the validated 22-question RSS.[12] To our knowledge, this the first PROM that is based on a specific analysis of the prevalence and relevance of symptoms often encountered in LPR, and importantly, the chosen patients were proven to have any type of LPR (acidic, weakly acidic, or nonacidic) based on HEMII-pH technology rather than pH-only data (as used to develop the RSI).

The use of RSS-12 cannot replace the original RSS in all situations but has the advantage of taking less time for the patient and physician to complete. It is not uncommon for patients with LPR to have comorbid conditions that may involve digestive complaints, such as lactose intolerance, alimentary allergy, or GERD.[6,23] For these patients, the use of the original RSS may be more prudent because it considers many digestive complaints. Also, reflux has been recognized as an important cofactor in the development of nasal,[24] ear,[25] and oral[26] diseases, which is why symptom assessment for the ear (pressure or pain) and tongue (burning) is included in the original RSS[27]; however, these symptoms were removed from the RSS-12 due to low prevalence. The RSS and RSS-12 may have individual and/or complementary roles in terms of the otolaryngology practice type and patient populations being treated.

Because the RSS-12 is new, its main limitation is currently the lack of a validated version in English. However, an English version is currently being validated in America. Because reflux signs, much like symptoms, are nonspecific, future studies are needed to assess the reliability of PROMs and sign/examination assessment tools that could be used in tandem to better diagnose LPR. The RSS-12, for example, could be administered with a sign assessment score such as the Reflux Sign Assessment to achieve this goal.[13]

Conclusion

The RSS-12 is a shorter and more time-conscious PROM for LPR as compared with its predecessor, the RSS. The RSS-12 specifically considers the most prevalent LPR-associated symptoms based on symptom severity/frequency and QoL impact. The RSS-12 reported good validity and reliability and may be used by physicians to support their diagnosis of LPR and monitor disease progression. An RSS-12 score >11 is considered suggestive of LPR in a European population. The RSS-12 can serve an individual role or complement the original version of RSS.

Author Contributions

Jerome R. Lechien, design, acquisition of data, data analysis and interpretation, drafting, final approval, and accountability for the work, final approval of the version to be published, agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved; **Francois Bobin**, design, acquisition of data, data analysis and interpretation, drafting, final approval, and accountability for the work, final approval of the version to be published, agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved; **Alexandra Rodriguez**, design, data analysis and interpretation, revising the manuscript for important intellectual content, final approval of the version to be published, final approval, and accountability for the work, final approval of the version to be published, agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved; **Didier Dequanter**, design, acquisition of data, data analysis and interpretation, drafting some parts of the manuscript, final approval of the version to be published, final approval, and accountability for the work, final approval of the version to be published, agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved; **Vinciane Muls**, design, acquisition of data, data analysis and interpretation, drafting some parts of the manuscript; final approval of the version to be published, final approval, and accountability for the work, final approval of the version to be published, agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved; **Kathy Huet**, design, acquisition of data, data analysis and interpretation, drafting some parts of the manuscript, final approval of the version to be published, final approval, and accountability for the work, final approval of the version to be published, agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved; **Bernard Harmegnies**, design, acquisition of data, data analysis and interpretation, drafting some parts of the manuscript, final approval of the version to be published, final approval, and accountability for the work, final approval of the version to be published, agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. **Lise Crevier-Buchman**, design, acquisition of data, data analysis and interpretation, drafting some parts of the manuscript, final approval of the version to be published, final approval, and accountability for the work, final approval of the version to be published, agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved; **Stéphane Hans**, design, acquisition of data, data analysis and interpretation, drafting some parts of the manuscript, final approval of the version to be published, final approval, and accountability for the work, final approval of the version to be published, agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved; **Sven Saussez**, design, data analysis and interpretation,

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