



# Cost burden for healthcare and patients related to the unawareness towards laryngopharyngeal reflux

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## Abstract

**Objective** To investigate the impact of physician unawareness towards laryngopharyngeal reflux (LPR) on healthcare costs.

**Methods** Patients with a confirmed LPR diagnosis were consecutively recruited from Belgian Hospitals. Demographics and clinical outcomes (impedance-pH testing features, reflux symptom score, and reflux sign assessment) were extracted. The past consultations and additional examinations dedicated to the investigation of laryngopharyngeal symptoms and findings without suspicion of LPR were collected. The estimated costs of consultations and procedures were those indicated in the National Health Insurance Institute's Charges for 2022. Part was reimbursed by the social security system, and the rest was paid by patients.

**Results** Seventy-six patients were recruited. Seventeen patients (22.4%) had no previous consultation or additional examination for their LPR-symptoms. The estimated mean (standard deviation) costs related to the unawareness of LPR for the healthcare system and patient, were  $310.06 \pm 370.49$  €, and  $54.05 \pm 46.28$  €, respectively. The highest estimated costs were related to gastroenterology consultations and procedures, which did not lead to a confirmation of LPR diagnosis. The total estimated cost for the Belgian healthcare system and patients (11,590,000 million), could range from 359 359 540 € to 1 078 078 620 €; and 62 643 950 € to 187 931 850 €, respectively. The estimated costs related to gastroenterology practice of patients with severe disease were significantly higher than patients with mild disease.

**Conclusion** The unawareness of practitioners toward LPR leads to significant costs for healthcare system and patients. The teaching and awareness towards LPR need to be improved in medical schools and clinical practice.

**Keywords** Laryngopharyngeal · Reflux · Gastroesophageal reflux disease · Cost · Awareness · Burden · Unawareness · Healthcare

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## Introduction

Laryngopharyngeal reflux (LPR) is defined as a disease of the upper aerodigestive tract resulting from the direct and/or indirect effects of gastroduodenal content reflux, inducing morphological and/or neurological changes in the upper aerodigestive tract [1]. The clinical diagnosis is still challenging according to the non-specific laryngeal and extra-laryngeal symptoms and findings that can be found in many other otolaryngological conditions [2, 3]. In the United States, the number of publications dedicated to LPR progressively increased since the end of the nineties [4–6], which improved the awareness of American practitioners towards the differences between LPR and gastroesophageal reflux disease (GERD), and the related LPR management [7]. The findings of a recent international survey supported awareness differences towards LPR across world regions [8]. Precisely, LPR and GERD are often considered the same disease by European practitioners, which may lead to delayed LPR diagnosis, and cost burden related to inadequate management (additional examination and ineffective treatments) [9]. To date, there is no European study assessing the practitioner's unawareness towards LPR in terms of cost impact on the healthcare system. According to the prevalence of LPR and some associated conditions or complications, e.g. chronic rhinosinusitis, chronic otitis media; vocal fold benign lesions, or chronic tonsillitis [1, 4], it is important to perform a rapid and not delayed diagnosis.

This study aimed to investigate the impact of physician unawareness of LPR on healthcare and patient costs.

## Methods

### Subjects and setting

Patients with laryngopharyngeal symptoms, findings, and a positive diagnosis of LPR at the 24-h hypopharyngeal-esophageal multichannel intraluminal impedance-pH (HEMII-pH) were consecutively recruited from two Belgian hospitals (Cesar de Pape and CHU Saint-Pierre-Porte de Halle, Brussels, Belgium). Patients were recruited from September 2022 to December 2022 and followed until June 2023. Patients did not have a LPR diagnosis before the initial otolaryngological consultation indicating the HEMII-pH. Upper gastrointestinal (GI) endoscopy was indicated for patients with GERD-related symptoms. The following exclusion criteria were considered: upper respiratory tract infection within the last month, neurological or psychiatric illness, head and neck malignancy, history of head and neck radiotherapy, or other undiagnosed conditions associated with similar LPR symptoms and findings.

The local IRB approved the study protocol (CHU Saint-Pierre, Brussels, n°BE076201837630).

### Hypopharyngeal-esophageal impedance-pH testing

The settings of HEMII-pH were reported in previous publications [10] and adhered to the Dubai consensus [1]. The catheter was composed of 8 impedance ring pairs and 2 pH electrodes (Versaflex Z®, LPR ZNID22+8R FGS 9000–17; DigiTrapper pH-Z testing System, Medtronic, Hauts-de-France, France). Six impedance segments were placed along the esophagus zones (Z1 to Z6) below the upper esophagus sphincter (UES). Two impedance segments were placed 1 and 2 cm above the UES in the hypopharyngeal cavity, whereas two pH electrodes were placed 5 cm above LES and 1–2 cm above UES. The HEMII-pH probe was placed in the morning before breakfast (8:00 AM) off antireflux medication. A hypopharyngeal reflux event (HRE) was defined as an episode that reached two hypopharyngeal impedance sensors. The diagnosis consisted of > 1 acid (pH < 4.0), weakly acid (pH = 4.0–7.0), or nonacid (pH > 7.0) HRE [1]. GERD was defined according to the Lyon consensus [11].

### Clinical evaluations

Symptoms were evaluated with Reflux Symptom Score (RSS) [12], which is a validated 22-item reported-outcome questionnaire assessing frequency, severity, and quality-of-life (QoL) impact of otolaryngological, digestive, and respiratory symptoms. RSS-QoL was used to document potential acute (RSS-QoL = 6–25), recurrent (RSS-QoL = 26–38), and chronic (RSS-QoL > 38) LPR [13]. Reflux Sign Assessment (RSA) was used to rate findings associated with LPR [14]. The patient stress/anxiety was assessed with the French version of the perceived stress scale (PSS), which is a validated 10-item patient-reported outcome questionnaire. The PSS score ranges from 10 to 50. Fifty is considered as a high stress or anxiety score.

### Consultation and additional examination outcomes and costs

Patients completed a standardized survey that documented the number and types of past consultations, and additional examinations, which were indicated for their (undiagnosed) laryngopharyngeal symptoms and findings. The following past consultations were considered: otolaryngology (including the nasofibroscope), gastroenterology, pulmonology, primary care, and psychiatry. The questionnaire related to the past additional examinations included sinus, head and neck, brain, chest, and abdominal tomodensitometry or magnetic resonance imaging (MRI), neck ultrasonography, RAST, skin prick test, lung assessment, (past) GI endoscopy,

esophageal manometry, or impedance/pH metry (excluding HEMII-pH). The patient responses were controlled by the practitioner (J.R.L.) using the regional healthcare system (Reseaux Sante Wallon or Reseaux Sante Bruxellois).

The estimated costs of consultations and procedures are those indicated in the National Health Insurance Institute's tariffs for 2022. These are the tariffs billed by hospitals. Part is reimbursed by the social security system, and the rest is paid by patients (Table 1). In certain circumstances, patients may still have to pay a surcharge. As these surcharges vary from hospital to hospital and from doctor to doctor, we have chosen not to take them into account. A system of additional flat-rate charges increasing radiology fees was also included in this study.

**Table 1** Costs of procedures in Belgian Healthcare System

Outcomes	NHI tariff	HCR	Patient cost
<b>1. Consultations</b>			
Gastroenterology	34.65	22.65	12.00
Pulmonology	38.73	26.73	12.00
Primary care	23.06	17.06	6.00
Psychiatry	47.51	35.51	12.00
Otolaryngology and nasofibros- copy	30.13	25.62	4.51
<b>2. Imaging procedures</b>			
Neck tomodensitometry	102.38	99.90	2.48
Sinus tomodensitometry	63.54	61.06	2.48
Chest tomodensitometry	141.20	138.72	2.48
Chest radiography	14.64	12.89	1.75
Neck MRI	120.68	118.20	2.48
Neck ultrasonography	28.97	26.49	2.48
Mean Imaging bundle	55.90	48.46	7.44
<b>3. Respiratory and allergic procedures</b>			
Lung evaluations	35.10	29.84	5.26
RAST	2.07	2.07	0
Common skin prick test	57.71	50.40	7.31
Food skin prick test	21.43	18.22	3.21
<b>4. Gastrointestinal procedures</b>			
GI endoscopy	135.30	126.62	8.68
Single probe pH-metry	57.44	48.83	8.61
Videofluoroscopy	45.25	42.77	2.48
High-resolution manometry	76.58	67.90	8.68
<b>5. Fundoplicature</b>			
	600.29	600.29	0

APF additional private fees, HCR healthcare reimbursement, GI gastrointestinal, MRI magnetic resonance imaging, NA not available

## Statistical methods

Statistical analyses were performed using the Statistical Package for the Social Sciences for Windows (SPSS version 22,0; IBM Corp, Armonk, NY, USA). The total number of consultations, or procedures, mean cost, and standard deviation were assessed for patients and healthcare costs. The association between the severity of symptoms (including the type of LPR) and the number and cost related to their management was evaluated with Spearman rho. A level of significance of  $p < 0.05$  was used.

## Results

Seventy-six patients completed the evaluations. There were 37 females (49%). Body mass index, allergies, and lactose intolerance are reported in Table 2. The HEMII-pH features reported that most HRE was weakly acid. GI endoscopy was normal in 27 patients (48%). The mean RSS at baseline was  $91.2 \pm 69.6$ . There were 40 (53%), 16 (21%), and 20 (26%) acute, recurrent, and chronic LPR (Table 2). Seventeen patients (22.4%) had no previous consultation or additional examination for their LPR symptoms. The number of consultations, imaging, respiratory, allergic, and gastrointestinal procedures related to the unawareness of LPR for the entire cohort are reported in Table 3. The gastroenterology consultations and procedures were associated with the highest estimated costs. The estimated mean (standard deviation) costs related to the unawareness of LPR for the healthcare system and patient, were  $310.06 \pm 370.49$  € (95%CI: 226.32; 393.8), and  $54.05 \pm 46.28$  € (95%CI: 43.57; 64.53), respectively. According to the current finding supporting a LPR prevalence of 10% to 30% in Western country populations [4, 16, 17], the total estimated cost for the Belgian healthcare system, patients (11,590,000 million), could range from 359 359 540 € to 1 078 078 620 €; and 62 643 950 € to 187 931 850 €, respectively.

## Consultation findings

A total of 240 consultations were conducted by other practitioners before the diagnosis, which consists of a mean of 3.16 consultations per patient. Gastroenterology was the main medical specialty where patients consulted before the confirmation of the LPR diagnosis with 19, 14, and 26 one, two, or three consultations (Table 3). The mean consultation estimated cost for the healthcare system and patient, were  $824.49 \pm 65.90$  €, and  $38.30 \pm 29.85$  €, respectively.

**Table 2** Clinical features of patients

Features	N=76 patients
Age (m, SD)	52.05 ± 15.41
Gender (N, %)	
Females	37 (49)
Males	39 (51)
BMI (m, SD)	25.31 ± 5.89
Allergies (current status)	
None	14 (18)
Unknown (no test/symptom)	42 (55)
Active and treated	20 (26)
Lactose intolerance	3 (4)
Perceived-Stress Scale (m, SD)	27.0 ± 7.8
HEMII-pH findings (m, SD)	
Acid hypopharyngeal reflux events	1.7 ± 2.9
Weakly acid hypopharyngeal reflux events	38.9 ± 75.2
Alkaline hypopharyngeal reflux events	0.2 ± 0.5
Total number of reflux events	40.8 ± 75.7
Gastrointestinal endoscopy (N, %)	56 (74)
Normal examination	27 (48)
Hiatal hernia	8 (14)
Lower esophageal sphincter insufficiency	11 (20)
Esophagitis (A to D)	10 (18)
Gastritis	11 (20)
Helicobacter pilory	4 (7)
Reflux symptom score (m, SD)	91.2 ± 69.6
QoL-Reflux symptom score (m, SD)	28.0 ± 18.4
Types of reflux	
Acute reflux (RSS-QoL: 6–25)	40 (53)
Recurrent reflux (RSS-QoL: 26–38)	16 (21)
Chronic reflux (RSS-QoL > 38)	20 (26)
Reflux sign assessment (m, SD)	28.9 ± 8.0

BMI body mass index, N number, RSS-QoL reflux symptom score quality of life, SD standard deviation

### Additional examination procedures

Thirty-eight imaging procedures were performed before the diagnosis, which corresponds to a mean of 0.5 per patient (Table 3). Sinus come beam was the most indicated imaging. The imaging procedure estimated costs for the healthcare system and patient were  $37.56 \pm 104.90$  €, and  $2.34 \pm 5.71$  €, respectively (Table 3).

Lung evaluations, RAST, or skin prick tests were used to investigate LPR symptoms in 2–20 patients (2.6–26.3%) for a total of 51 examinations (mean: 0.7 procedures per patient). The total estimated cost for the healthcare system and patient, were  $20.73 \pm 38.18$  €, and  $3.21 \pm 5.82$  €, respectively (Table 3).

In addition to the gastroenterology consultations, patients mainly underwent additional GI endoscopy,

primary pH-metry, or high-resolution manometry for a total estimated cost for the healthcare system and patient, of  $145.58 \pm 107,36$  €, and  $10.21 \pm 7.96$  €, respectively (Table 3). Three patients underwent unsuccessful fundoplicature, which cost for healthcare system and patient,  $23.70 \pm 117.66$  €, and 0 €, respectively (Table 3).

The Spearman analysis reported a significant positive association between the RSS-QoL and the estimated cost for healthcare system related to gastroenterology consultation and procedures ( $r_s = 0.277$ ;  $p = 0.015$ ). The RSS-QoL was similarly significantly associated with the total estimated cost of gastroenterology management for patients ( $r_s = 0.269$ ;  $p = 0.019$ ).

### Discussion

In the United States, the economic burden of caring for patients with suspected LPR was estimated to be 5.6 times higher than those reported for typical GERD, with a total expenditure estimated as > \$50 billion annually [18]. This American study, which is unique in the LPR field, reported that the cost burden was attributed to the consumption of medication, the variety of LPR non-specific symptoms, and the related visits to gastroenterologists, otolaryngologists, primary care, and internal medicine providers. To date, there is no similar study investigating the cost burden of LPR in European countries, which may be attributed to the lack of awareness of European practitioners towards LPR [8, 19].

The present study is the first study evaluating the estimated cost for the healthcare system, and patients, related to physician unawareness of LPR in a European country. In our study, gastrointestinal procedures and specialist consultations consisted of the main expenditure costs related to the management of LPR symptoms and findings, which corroborate the data of Francis et al. [18], who reported that the first-year expenditure for office visit and procedures (e.g. nasofibroscope and GI endoscopy) for LPR symptoms accounted for 47% of the overall 5-year expenditure. Importantly, our correlation analysis suggested that patients with the highest estimated costs in gastroenterology practice were patients with a severe (chronic) disease according to RSS-QoL, which may suggest an evolution of the disease when patients are not diagnosed early [13]. Interestingly, Francis et al. found that of the overall estimated cost, 52% was attributable to the use of proton pump inhibitors. The intake of ineffective medication before the diagnosis was not evaluated in the present study, and could be an additional cost burden for healthcare, patients, and insurance. In the same vein, the work absenteeism, or the cost related to the management of other conditions associated with LPR (e.g. chronic rhinosinusitis) are additional uninvestigated outcomes that may significantly increase the total cost burden [20–22].

**Table 3** Costs related to consultations, and additional examinations

Outcomes	N (tot)				Healthcare reimbursement	Patient cost
	0	1	2	3	Mean (SD)	Mean (SD)
1. Consultations						
Gastroenterology	17	19	14	26	37.25 ± 26.60	19.74 ± 14.09
Pulmonology	58	17	1	0	6.68 ± 12.44	3.00 ± 5.59
Primary care	39	37	0	0	8.31 ± 8.58	2.92 ± 3.02
Psychiatry	74	1	1	0	1.40 ± 9.06	0.47 ± 3.06
Otolaryngology	24	49	2	1	28.85 ± 22.48	12.17 ± 9.48
Consultation total costs					82.49 ± 65.90	38.30 ± 29.85
2. Imaging procedures						
Neck tomodensitometry	70	6	0	0	7.89 ± 27.12	0.20 ± 0.67
Sinus come bean	64	12	0	0	9.64 ± 22.41	0.39 ± 0.91
Chest tomodensitometry	73	3	0	0	5.48 ± 27.19	0.10 ± 0.49
Chest radiography	68	8	0	0	1.36 ± 3.98	0.18 ± 0.54
Neck MRI	74	2	0	0	3.11 ± 19.05	0.07 ± 0.40
Neck ultrasonography	69	7	0	0	2.44 ± 7.71	0.23 ± 0.72
Imaging bundle fee	65	12	0	0	7.65 ± 17.79	1.17 ± 2.73
Imaging total costs					37.56 ± 104.90	2.34 ± 5.71
3. Respiratory and allergic procedures						
Lung evaluations	55	20	1	0	8.64 ± 14.47	1.52 ± 2.55
RAST	63	13	0	0	0.35 ± 0.78	–
Common skin prick test	62	14	0	0	11.26 ± 23.85	1.60 ± 3.39
Food skin prick test	74	2	0	0	0.48 ± 2.94	0.08 ± 0.52
Respiratory & allergic total costs					20.73 ± 38.18	3.21 ± 5.82
4. Gastrointestinal procedures						
GI endoscopy	19	30	27	0	139.95 ± 98.25	9.59 ± 6.74
Single probe pH-metry	73	3	0	0	1.93 ± 9.57	0.34 ± 1.69
Videofluoroscopy	71	5	0	0	2.81 ± 10.67	0.16 ± 0.62
High-resolution manometry	75	1	0	0	0.89 ± 7.79	0.11 ± 1.00
Gastrointestinal total costs					145.58 ± 107.36	10.21 ± 7.96
5. Fundoplicature						
	73	3	0	0	23.70 ± 117.66	–

APF additional private fees, GI gastrointestinal, MRI magnetic resonance imaging, SD standard deviations

Although our cost analysis cannot be transposed to other European countries, our findings probably highlight a critical European practitioner's unawareness of LPR. A recent World survey reported that European otolaryngologists were less aware of the usefulness and existence of HEMII-pH compared to other world region otolaryngologists (48.0% versus 36.8%), and, similarly, most European otolaryngologists ignored the existence of weakly acid and non-acid LPR, which are however more prevalent than acid LPR [8].

Acknowledging the LPR as an existing different disease from GERD is the first step to improve patient care. Nowadays, the existence of disease is still controversial in some medical specialties, including gastroenterology [23, 24], or otolaryngology [25]. However an increasing number of basic science and clinical studies have demonstrated the relationship between pharyngeal reflux events at the HEMII-pH, deposit of gastroduodenal enzymes, and the development of mucosa injuries and symptoms [1, 4, 26].

Caring LPR symptoms and findings may lead to a significant reduction of cost burden. Indeed, it has been demonstrated that GERD patients with LPR symptoms reported greater sickness-related absent hours per week, and greater percentages of overall work impairment than those without LPR (31.1% versus 20.8%) [22]. Improving the knowledge and skills of practitioners may probably lead to earlier detection of disease, and the prescription of an empirical therapeutic trial based on diet and stress/anxiety management with or without medications [21]. The first step to improve awareness of LPR is to teach the latest knowledge related to the disease in medical schools. Because the main works differentiating GERD and LPR dated from the 2000s, most practitioners who were at medical school at that time did not receive the information related to LPR physiology and clinical presentation. Nowadays, the knowledge is sufficiently advanced to teach the LPR in medical schools. The second step could be to reinforce the teaching of the disease in

post-graduate primary care, pulmonologist, otolaryngologist, and gastroenterologist practitioners. The media can play a critical role as well.

Further efforts are needed not only in LPR teaching, but also in therapeutic management because most practitioners prescribe PPIs, which are however not evidence-based according to meta-analyses [27].

The overuse of PPIs and ineffective medications in the management of patients with LPR symptoms and findings were not evaluated in the present study, which is its primary limitation. The low number of patients is an additional limitation. In the present study, we estimated to cost for healthcare and patients considering a prevalence of 10% to 30%, which involves that all patients with LPR can consult a practitioner. In practice, it is unsure that all patients with LPR-chronic symptoms consult practitioners and, consequently, represent cost for the healthcare system. The originality of the present study is its primary strength. Indeed, to the best of our knowledge, there is no similar study investigating the cost burden related to the unawareness towards LPR that was conducted in Europe.

## Conclusion

The unawareness of practitioners toward LPR leads to significant costs for the healthcare system and patients. The teaching and awareness of LPR need to be improved in medical schools and clinical practice.

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**Author contributions** J. Lechien: design, acquisition of data, data analysis & 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. J Brauner: design, acquisition of data, data analysis & 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. M. Pirson: design, data analysis & interpretation, revising the manuscript for important intellectual content. P. Leclercq: 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.

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**Data availability** Data are available on request.

## Declarations

**conflicts of interest** Authors have no conflict of interest.

**Ethical approval** The local IRB approved the study protocol (CHU Saint-Pierre, Brussels, n°BE076201837630).

**Informed consent** Patients consented to participate.

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