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Awareness of Chinese Otolaryngologists Towards Laryngopharyngeal Reflux Disease: A National Wide Survey

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ABSTRACT

Objectives

To investigate the current laryngopharyngeal reflux disease (LPRD) knowledge awareness status in Chinese otolaryngologists.

Design

Multi-center cross-sectional survey.

Setting

220 medical centers in different regions of China.

Participants

A total of 2254 otolaryngologists from 220 medical centers in China who were successfully on-site surveyed between Nov 2019 and Dec 2020.

Main outcome measures

Awareness of LPRD knowledge including risk factors, symptoms, laryngoscope signs, related diseases, current diagnostic methods, and treatments.

Results

The percentage of participants who had heard of LPRD could reach to 96.4%, with academic conference as the most common way of knowing this disease (73.3%). The most common knew risk factor, symptom, laryngoscope sign, related disease, diagnostic method, and treatment were alcohol drinking (44.0%), pharyngeal foreign body sensation (66.9%), hyperemia (52.4%), pharyngolaryngitis (54.8%), pH monitoring (47.6%), and medication (82.1%), respectively. Only 28.3% of all participants knew about the use of 24-hour pH or multichannel intraluminal impedance-pH monitoring as the most accurate diagnostic test. As high as 73.1% of all participants thought about proton pump inhibitors as the first-line treatment drugs. Analysis of the overall awareness status using a scoring system suggested that a better awareness was more obviously in otolaryngologists who had knew this disease via more accesses, worked at 3A hospitals, and with postgraduate or above educational backgrounds (all $P<0.05$).

Conclusion

Although the majorities of Chinese otolaryngologists had heard of LPRD, the overall awareness status of the disease knowledge was not optimistic. In future, more efforts are needed to increase the knowledge of LPRD among this group of physicians.

Trial registration Chictr.org.cn site identifier: ChiCTR1900025581

Strengths and limitations of this study

This prospective cross-sectional survey was carried out in up to 2254 otolaryngologists who worked in different hospitals around the whole China.

The whole surveys were all performed on-site under the supervision of designated surveyors.

The overall awareness status of laryngopharyngeal reflux disease knowledge was evaluated using a scoring scale basing on questions about risk factors, symptoms, laryngoscope signs, related diseases, current diagnostic methods, and treatments of this disease.

INTRODUCTION

Laryngopharyngeal reflux disease (LPRD) is an inflammatory condition of the upper aerodigestive tract tissues related to direct and indirect effect of gastric or duodenal content reflux.[1, 2] The incidence of LPRD is thought to be high. The studies conducted in America, the United Kingdom, and Greece reported that the prevalence of this disease could reach to 10%, 34.4%, and 18.8%, respectively.[3-5] In a national multi-center epidemiological survey conducted in China, our research group found that the prevalence of LPRD was as high as 10.15% at the otolaryngology-head and neck surgery clinics.[6] We further found that the frequency of a previous diagnosis of LPRD was extremely low among those with positive symptoms, which was only 14.09%.[6] In addition to the unspecific symptoms and clinical signs of this disease, which are easy to confused with other laryngopharyngeal disorders.[7] We hypothesized that an insufficient physician's knowledge about this disease might contribute a lot to such a low diagnose rate. One small research performed by our group in Beijing preliminarily confirmed our hypothesis.[8]

Beijing is an area with the highest medical levels in China. Therefore, the otolaryngologists' awareness about LPRD in the whole nation may be even worse. The present survey was performed in different regions around the whole nation, and the aim was to conduct a comprehensive investigation about LPRD awareness status in Chinese otolaryngologists. The results could be valuable references for making detailed plans to improve the awareness of this disease in China.

MATERIALS AND METHODS

Study design

This was a multi-center cross-sectional survey designed by a core group which included three study leaders (Shuifang Xiao, Jinrang Li, and Hongliang Zheng) and one statistician (Xiaoxia Peng). The whole survey was conducted under the supervision of three study leaders between Nov 2019 and Dec 2020. In each provincial district, there was also one designated practicing otolaryngologist who was in charge for the survey in that area. The district leader and the three study leaders proposed and decided the final hospital lists where the survey was conducted according to following criteria: (1) no more than 9 hospitals in each provincial district; (2) the hospital lists in each district should include both 3A and non-3A hospitals; (3) the hospital where the district leader was working for should not be included; (4) the hospital lists could only be changed during the survey under the approvements of all three study leaders; (5) included hospitals at primary lists could be deleted or replaced if local director refused the survey in his department, or if less than 80% of all otolaryngologists at this hospital were successfully surveyed.

The study method was approved by the Peking University First Hospital Institutional Review Board and had been registered on the chictr.org.cn site (ChiCTR1900025581). All otolaryngologists who were surveyed had provided their informed consents to the study.

Data collection

The survey in each provincial district was conducted by a local team which included the district leader and at least two assistants. All surveyors were trained to be familiar with study process to ensure the consistency of implementation. All otolaryngologists who worked in included hospitals at the time of survey were invited to fill an identical anonymous questionnaire. Communicating with others or accessing to relevant information were forbidden before and during the survey. A completed questionnaire was considered as ineffective if the handwriting could not be made out and the otolaryngologist refused to fill it again. All completed effective questionnaires were collected and checked by local teams, and were then uploaded to a designated database. The final data were checked, integrated, and analyzed by three study leaders and their assistants.

The English version of the questionnaire used in this study is shown in **Table 1**, which contains 15 questions that could be divided into three parts: (1) Personal information including educational background, years of working, and professional title; (2) Whether the respondent knew about LPRD, and if yes, what way(s) did he (she) knew about this disease. Three options are provided for this question, which were text book, literature, and academic conference; (3) awareness of LPRD knowledge including risk factors, symptoms, laryngoscope signs, related diseases, diagnostic methods, and treatments. In order to avoid intimation effects, all questions in PART 3 are provided with no options. The respondents need to write the answers they knew as much as possible.

Quantifications for awareness status of LPRD knowledge

In order to comprehensively evaluate the awareness status of LPRD knowledge, a scoring scale was used basing on all PART 3 questions (questions 6-15). One score could be got for each “right answer” of the ten questions. Here, the “right answers” were defined by consensus reached by three study leaders according to current literatures, which are as follows:

(1) Question 6: smoking, alcohol drinking, unhealthy eating habits, comorbid upper digestive disease, male sex, age, psychological pressure, obesity, and tea or coffee drinking had been accepted as common risk factors for LPRD.[2 6 9-11] A right answer for this question was defined if ≥3 items of the above factors had been written.

(2) Question 7: Reflux Symptom Index (RSI), proposed by Belafsky et al.,[12] includes scores for the severity of nine common LPRD-related symptoms. A right answer for this question was defined if ≥3 items among the nine symptoms in RSI had been written.

(3) Question 8: Reflux Finding Score (RFS), also proposed by Belafsky et al.,[13] includes scores for the severity of eight common LPRD-related laryngoscope signs. A right answer for this question was defined if ≥3 items among the eight laryngoscope signs had been written.

(4) Question 9: pharyngolaryngitis, vocal benign lesions, rhinitis or rhinosinusitis, laryngeal granuloma, laryngeal leukoplakia, cough, asthma, otitis media, obstructive sleep apnea syndrome, and malignant tumor were thought to be associated with LPRD.[14-21] A right answer was defined if ≥3 items of the above diseases had been written.

(5) Question 10: RSI or RFS evaluations, pH or multichannel intraluminal impedance-pH (MII-pH) monitoring, empiric therapeutic trial, and pepsin detection were current accepted diagnostic methods for LPRD.[2] A right answer was defined if ≥2 items of the above methods had been written.

(6) Question 11: behavior modifications, medication, and operation were current accepted treatments for LPRD.[2 22] A right answer was defined if ≥2 items of above treatments had been written.

(7) Question 12: the right answer was 13, as this is the most common cut-off score of RSI used in China.[23]

(8) Question 13: the right answer was 7, as this is the most common cut-off score of RFS used in China.[24]

(9) Question 14, the right answer was 24-hour pH or MII-pH monitoring. Despite controversies, such examinations are thought to be the most accurate method for diagnosing LPRD.[2 25]

(10) Question 15, the right answer was proton-pump inhibitors (PPI). Despite controversies, such drugs are thought to be the first-line medication for treating LPRD.[2 25]

Statistical analysis

All statistical analyses were performed using the SPSS 20.0 for Windows (IBM, Armonk, NY, USA). Continuous variables were expressed as means ± standard deviation. The awareness rates of different LPRD knowledge were expressed as percentages. The comparisons of awareness scores of LPRD knowledge among different groups of participants were all done using independent T tests. A P value less than 0.05 was considered statistically significant.

RESULTS

Medical institutions and personal information

Finally, 2254 effective questionnaires from 220 hospitals were collected. The numbers of hospitals and effective questionnaires according to geographical region were shown in **Table 2**, suggested that the survey had covered all geographical regions of China. The personal information of all 2254 otolaryngologists who were successfully surveyed were shown in **Table 3**, including their hospital levels, educational background, working time, and professional titles.

Awareness rate of LPRD and the way(s) of knowing this disease

Only 81 otolaryngologists from 46 hospitals (range: 1-7) said that they had never heard of LPRD, accounted for only 3.6% (81/2254). A total of 2173 otolaryngologists (96.4%) had heard about this disease. Among the three choices provided, academic conference was the most common way of knowing LPRD (1653, 73.3%), followed by literature (1382, 61.3%) and text book (1350, 59.9%), respectively. The numbers of otolaryngologists who knew about LPRD via zero, one, two and all three choices of ways were 183 (8.1%), 608 (27.0%), 612 (27.2%), and 851 (37.8%), respectively.

The awareness status of LPRD risk factors, symptoms, laryngoscope signs, and related diseases

The most common knew risk factor was alcohol drinking, followed by smoking, unhealthy eating habits, and comorbid upper digestive disease. The most common knew symptom was pharyngeal foreign body sensation, followed by stomach acid coming up or heart burn, hoarseness, and cough. The most common knew laryngoscope sign was hyperemia, followed by laryngeal edema, granuloma, and vocal cord edema. The most common knew LPRD related disease was pharyngolaryngitis, followed by vocal benign lesions, rhinitis or rhinosinusitis, and laryngeal granuloma. The details of the above results were shown in **Figure 1**.

The awareness status of LPRD diagnoses and treatments

The most common answer for diagnostic methods was pH monitoring, followed by laryngoscope, RSI or RFS evaluations, gastroscope, and empiric therapeutic trial. The most common answer for treatment options was medication, followed by behavioral modifications, and operation. The detailed results were shown in **Figure 2**.

The correct awareness rates for cut-off values of RSI and RFS were only 46.6% (1051/2254) and 44.9% (1012/2254), respectively. Only 28.3% (639/2254) of all participants knew about the use of 24-hour pH or MII-pH monitoring as a gold diagnostic test. As high as 73.1% (1647/2254) of all participants thought about the use of PPI as first-line drugs.

Overall awareness status of LPRD knowledge

The overall awareness scale score of all participants was 4.1±2.8, with a range of 0-10 (the score of the 81 otolaryngologists who never heard of LPRD was considered as 0). The numbers of participants according to different scores were shown in **Figure 3**, suggested that only 1.4% (32/2254) of all participants could get full marks and as high as 57.6% (1293/2018) of all participants could not even reach to half of full marks (0-4).

The awareness scales scores according to different ways of knowing this disease were shown in **Table 4**, suggested that knowing this disease via either of the three ways could increase the final scores (all $P<0.05$). Moreover, the awareness scale scores were significantly higher in otolaryngologists who knew about this disease via 2-3 ways (vs. those who knew about this disease via only 0-1 way) ($P<0.05$).

The awareness scale scores according to different personal information were shown in **Table 5**, suggested that the scores were significantly higher in otolaryngologists who worked at 3A hospitals (vs. non-3A hospitals) and with postgraduate or above educational backgrounds (vs. undergraduate or below educational backgrounds) (both $P<0.05$). No significant differences were found with respect to this score among otolaryngologists who had different professional titles and working times (both $P>0.05$).

DISCUSSION

The disease of LPRD has gradually gained attention during the past decades,[2] since Koufman systematically investigated the throat-related symptoms of gastroesophageal reflux disease (GERD) in 1991.[3] Currently, LPRD is considered to be an independent disease in the absence of GERD, as many such patients do not show typical symptoms of GERD.[6 26-28] However, unlike the wide spread of GERD knowledge in gastroenterologists, an insufficient LPRD knowledge in otolaryngologists had been suggested in several small sample studies conducted in British, Europe, and Beijing district of China.[8 29 30] China is vast in territory, and the medical levels differed significantly in different regions. Therefore, in order to comprehensively evaluate the awareness status of LPRD

knowledge among Chinese otolaryngologists, we conducted this nation-wide survey which included the largest sample size to date.

The most important finding of this study was that, although the majorities of otolaryngologists we surveyed had heard of LPRD, the overall awareness status of LPRD knowledge was not optimistic: only very few otolaryngologists got satisfied scores. We also found that the insufficient awareness of LPRD knowledge embodied in all aspects of this disease, including risk factors, symptoms, clinical signs, related diseases, diagnoses, and treatments. This could undoubtedly cause great difficulties in correct managements of this disease. Therefore, the extremely low previously diagnose rate of Chinese LPRD patients may attribute, a great extent, to insufficient otolaryngologists' knowledge about this disease.

A thorough knowledge of one disease among medical specialists is primary requirements for its timely diagnosis and suitable treatments. Specifically for LPRD, insufficient awareness of its knowledge showed by this study could cause the following potential problems: (1) An insufficient awareness of the unspecific symptoms and laryngoscope signs may cause missed or wrong diagnoses, as this disease is easy to be confused with some other laryngeal problems;[7] (2) An insufficient awareness of its related diseases could cause poor efficacies or recurrences in treating such diseases, as anti-reflux therapy has been accepted in treating some of these diseases, such as laryngeal leukoplakia,[31] laryngeal granuloma,[32] and cough;[33] (3) Currently, there are no perfect diagnostic and treatment methods for LPRD: simple ones are not so accurate or effective, such as RSI or RFS evaluations (diagnosis) and behavior changes (treatment), while accurate or effective ones are always invasive, such as pH-MII monitoring (diagnosis) or anti-reflux operations (treatment). Therefore, a reasonable practical algorithm is necessary for efficient managements of this disease.[1 2 25] Insufficient awareness of its diagnostic and treatment methods may cause otolaryngologists unable to provide reasonable advices. For example, few Chinese otolaryngologists knew about other treatments besides medication. This may cause them have no idea in treating patients who do not respond good to medication. The insufficient awareness of risk factors may also cause them give no comprehensive suggestions of behavior modifications in daily life.

In this study, we found several potential influencing factors for LPRD awareness status, including hospital level, educational background, and number of ways for knowing this disease. Such results could be valuable references for making further plans in improving the overall LPRD awareness status in China. Specifically speaking, otolaryngologists who work at low-level hospitals or with low educational backgrounds should be more encouraged to study about this disease. More ways should be provided for studying this disease, such as continuously updating

text books to include latest LPRD knowledge or holding more academic conferences about LPRD. Doing these are also helpful in facilitating timely diagnoses and suitable treatments for the large LPRD patient population in China.

In comparison with former studies, the main strengths of this study were as follows: First, the largest sample size to date, and what was more, the otolaryngologists we surveyed came from different levels of hospitals around the whole nation; Second, the whole surveys were performed on-site under the supervision of designated surveyors. Therefore, the veracity of the results could be ensured to a great extent; Third, questions 6-15, the major part of our questionnaire, were all provided with no options. Therefore, the intimation effects could be avoided to a great extent.

There were also several limitations that need to be addressed: First, the data collections at different regions were done by different groups of surveyors, and so, inter-group differences in study implementation could not be totally avoided. However, China is so vast in territory, and it is unrealistic and extremely high costs for one group to conduct all the survey. Second, the calculation criteria of the awareness scale were made subjectively by three experts according to current literatures. This may lead to some subjective bias and controversies. However, there is no international guideline for the management of LPRD until now,[34] and we think that such evaluations could well reflect the overall awareness status of this disease.

CONCLUSION

In summary, the results of this study suggested that the overall awareness status of LPRD knowledge in Chinese otolaryngologists was not optimistic. More efforts are needed to increase such knowledge among this group of physicians, especially in those who work in low-level hospitals, or with low educational backgrounds, or had few ways of studying this disease.

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Patient consent for publication Not required.

Ethics approval This study was approved by the ethics committee of Peking University First Hospital (No. 2019-191), and followed the Declaration of Helsinki. Written informed consent was obtained from all participants prior to conducting the study.

Data sharing statement Data are available upon reasonable request.

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Table 1 The English version of LPRD awareness questionnaire used in this study

PART 1	
1. Educational Background	□ Postgraduate or above □ Undergraduate or below
2. Years of Working	□ 0-5 □ 5-10 □ >10
3. Professional Title	□ Senior □ Intermediate □ Primary
PART 2	
4. Have you ever heard of LPRD?	□ Yes □ No
5. In what access(es) did you know LPRD?	
□ Text book □ Literature □ Academic conference	
PART 3 (No options were provided. For questions 6-15, write the most comprehensive answer you think)	
6. Risk factors for LPRD	
7. Subjective symptom of LPRD	
8. Laryngoscope signs suggesting for LPRD	
9. LPRD related diseases	
10. Current diagnostic methods for LPRD	
11. Current treatment methods for LPRD	
12. The cut-off value of RSI for diagnosing LPRD	
13. The cut-off value of RFS for diagnosing LPRD	
14. The current gold diagnostic method for LPRD	
15. The current first-line drug for treating LPRD	

LPRD, laryngopharyngeal reflux disease; RSI, Reflux Symptom Index; RFS, Reflux Findings Score

Table 2 The numbers included hospitals and effective questionnaires according to geographical region

Region	N. of hospitals	Hospital levels		N. of effective questionnaires
		3A	Non-3A	
Northeast China	17	12	5	202
East China	54	35	19	647
North China	47	29	18	440
Central China	26	16	10	277

South China	30	18	12	269
Southwest China	26	17	9	231
Northwest China	20	12	8	188
Total	220	139	81	2254

Table 3 The personal information of all 2254 otolaryngologists who were surveyed

	N. of otolaryngologists	Percent (%)
Hospital level		
3A	1666	73.9
Non-3A	588	26.1
Educational background		
Postgraduate or above	1157	51.3
Undergraduate or below	1097	48.7
Working time (years)		
≥10	1037	46.0
<10	1217	54.0
Professional titles		
Senior	755	33.5
Primary-Intermediate	1499	66.5

Table 4 The awareness scale scores according to different ways of knowing LPRD

	Awareness scale scores	P
Text book		<0.001
Yes	4.5±2.7	
No	3.4±2.7	
Literature		<0.001
Yes	4.8±2.6	

No	2.9±2.6	
Academic conference		<0.001
Yes	4.3±2.6	
No	3.5±3.0	
N. of ways		<0.001
2-3	4.7±2.7	
0-1	2.9±2.6	

Table 5 The awareness scale scores according to different personal information

	Awareness scale scores	P
Hospital level		<0.001
3A	4.3±2.7	
Non-3A	3.3±2.9	
Educational background		<0.001
Postgraduate or above	4.5±2.6	
Undergraduate or below	3.6±2.8	
Working time (years)		0.981
≥10	4.1±2.8	
<10	4.1±2.7	
Professional titles		0.342
Senior	4.1±2.7	
Primary-Intermediate	4.0±2.8	

Figure Captions

Figure 1 The most common knew LPRD risk factors (A), symptoms (B), laryngoscope signs (C), and related diseases (D).

Figure 2 The awareness rates for LPRD diagnostic methods (A) and treatment methods (B).

Figure 3 The numbers of participants according to different awareness scale scores.

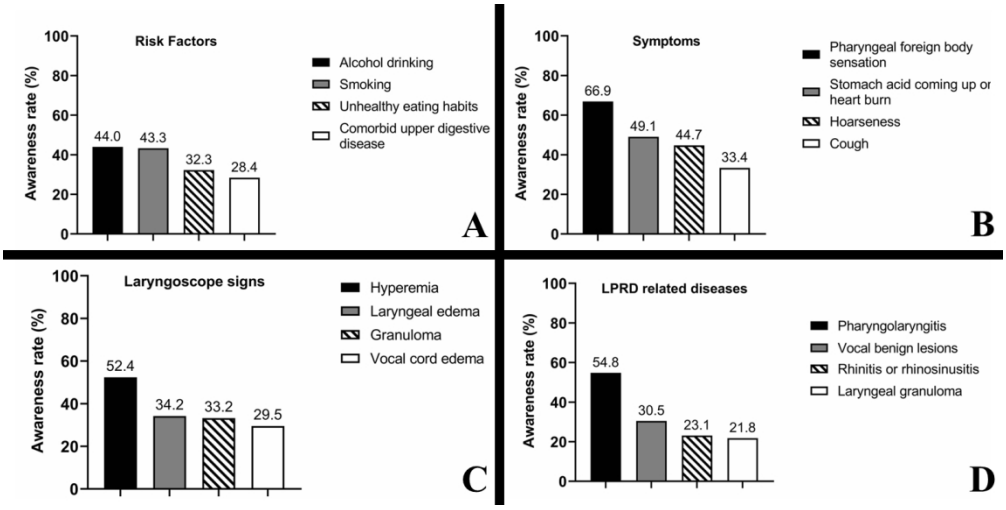

Figure 1 The most common knew LPRD risk factors (A), symptoms (B), laryngoscope signs (C), and related diseases (D).

564x282mm (72 x 72 DPI)

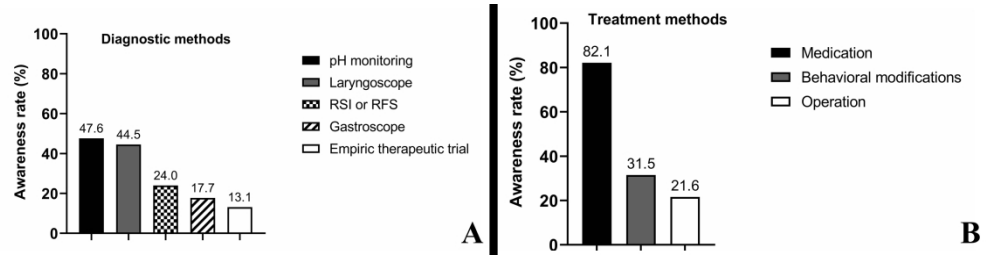

Figure 2 The awareness rates for LPRD diagnostic methods (A) and treatment methods (B).

1128x282mm (72 x 72 DPI)

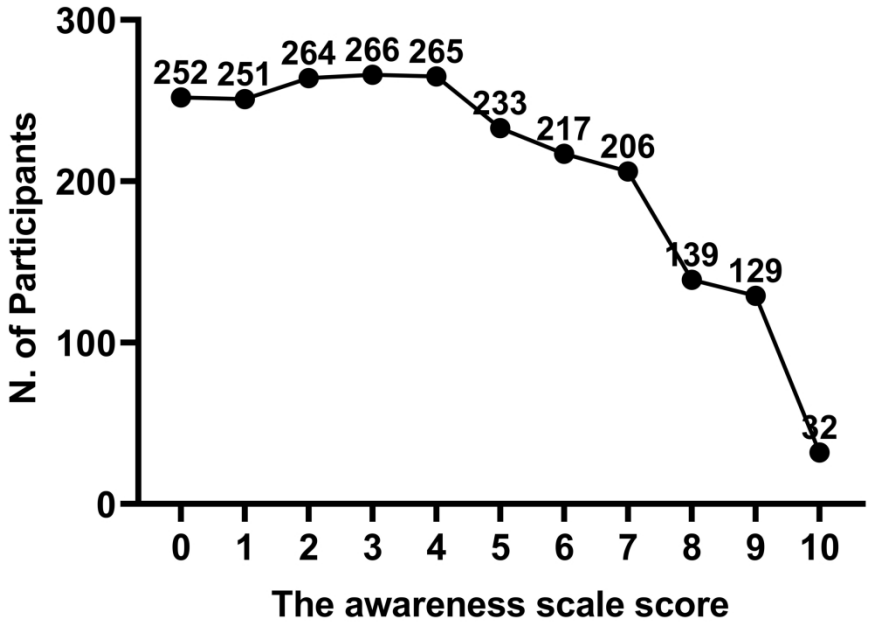

Figure 3 The numbers of participants according to different awareness scale scores.

127x88mm (600 x 600 DPI)

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract *Yes. A National Wide Survey in title and Multi-center cross-sectional survey in abstract (Page 1 and Page 4)*
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found *Yes. What was done: To investigate the current laryngopharyngeal reflux disease (LPRD) knowledge awareness status in Chinese otolaryngologists.* *What was found: Although the majorities of Chinese otolaryngologists had heard of LPRD, the overall awareness status of the disease knowledge was not optimistic. In future, more efforts are needed to increase the knowledge of LPRD among this group of physicians. (Page 4)*
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported *In a national multi-center epidemiological survey conducted in China, our research group found that the prevalence of LPRD was as high as 10.15% at the otolaryngology-head and neck surgery clinics. We further found that the frequency of a previous diagnosis of LPRD was extremely low among those with positive symptoms, which was only 14.09%. In addition to the unspecific symptoms and clinical signs of this disease, which are easy to confused with other laryngopharyngeal disorders. (Page 6)*
Objectives	3	State specific objectives, including any prespecified hypotheses *We hypothesized that an insufficient physician's knowledge about this disease might contribute a lot to such a low diagnose rate.* *The present survey was performed in different regions around the whole nation, and the aim was to conduct a comprehensive investigation about LPRD awareness status in Chinese otolaryngologists. (Page 6)*
Methods		
Study design	4	Present key elements of study design early in the paper *This was a multi-center cross-sectional survey (Page 6)*
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection *Setting: A multi-center cross-sectional survey conducted in 220 hospitals from different regions of China.* *Locations: 220 hospitals from different regions of China.* *Dates and periods of recruitment: Nov 2019-Dec 2020* *Exposure and follow up: none.* *Data collection: Seen in the data collection part in the method (Pages 6-7)*
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants *This could be seen in the study design part of the method (Page 6)*
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable *These could be seen in the data collection and Quantifications for awareness status of LPRD knowledge parts of the method. (Pages 7-8)*

Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group *These could be seen in the data collection and Quantifications for awareness status of LPRD knowledge parts of the method. (Pages 7-8)*
Bias	9	Describe any efforts to address potential sources of bias *The final hospital lists where the survey was conducted according to following criteria: (1) no more than 9 hospitals in each provincial district; (2) the hospital lists in each district should include both 3A and non-3A hospitals; (3) the hospital where the district leader was working for should not be included; (4) the hospital lists could only be changed during the survey under the approvements of all three study leaders; (5) included hospitals at primary lists could be deleted or replaced if local director refused the survey in his department, or if less than 80% of all otolaryngologists at this hospital were successfully surveyed. (Page 6)*
Study size	10	Explain how the study size was arrived at *All otolaryngologists who worked in included hospitals at the time of survey were invited to fill an identical anonymous questionnaire. (Page 7)*
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why *These could be seen in the Quantifications for awareness status of LPRD knowledge parts of the method. (Pages 7-8)*
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding *These could be seen in the statistical analysis part of the method. (Page 8)*
		(*b*) Describe any methods used to examine subgroups and interactions *These could be seen in the statistical analysis part of the method. (Page 8)*
		(*c*) Explain how missing data were addressed. *There were no missing data*
		(*d*) If applicable, describe analytical methods taking account of sampling strategy *Not applicable*
		(*e*) Describe any sensitivity analyses *Not applicable*
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed *Finally, 2254 effective questionnaires from 220 hospitals were collected. (Page 9)*
		(b) Give reasons for non-participation at each stage *Not applicable*
		(c) Consider use of a flow diagram *Not applicable*
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders *Table 3 of the paper (Page 17)*
		(b) Indicate number of participants with missing data for each variable of interest *Not applicable*
Outcome data	15*	Report numbers of outcome events or summary measures *These could be seen in the awareness status of LPRD risk factors, symptoms,*

		laryngoscope signs, and related diseases and the awareness status of LPRD diagnoses and treatments parts of the results (Pages 9-10)
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included *Not applicable*
		(*b*) Report category boundaries when continuous variables were categorized *Not applicable*
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period *Not applicable*
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses *This could be seen in Overall awareness status of LPRD knowledge part of the results (Page 10)*
Discussion		
Key results	18	Summarise key results with reference to study objectives *The second paragraph of the Discussion (Page 11)*
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias *There were also several limitations that need to be addressed: First, the data collections at different regions were done by different groups of surveyors, and so, inter-group differences in study implementation could not be totally avoided. However, China is so vast in territory, and it is unrealistic and extremely high costs for one group to conduct all the survey. Second, the calculation criteria of the awareness scale were made subjectively by three experts according to current literatures. This may lead to some subjective bias and controversies. However, there is no international guideline for the management of LPRD until now, and we think that such evaluations could well reflect the overall awareness status of this disease. (Page 12)*
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence *The 3rd and 4th paragraphs of the Discussion (Pages 11-12)*
Generalisability	21	Discuss the generalisability (external validity) of the study results *In comparison with former studies, the main strengths of this study were as follows: First, the largest sample size to date, and what was more, the otolaryngologists we surveyed came from different levels of hospitals around the whole nation; Second, the whole surveys were performed on-site under the supervision of designated surveyors. Therefore, the veracity of the results could be ensured to a great extent; Third, questions 6-15, the major part of our questionnaire, were all provided with no options. Therefore, the intimation effects could be avoided to a great extent. (Page 12)*
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based *There was no funding support for this study. (Page 12)*

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

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Primary Subject Heading:	Epidemiology

Secondary Subject Heading:	Ear, nose and throat/otolaryngology
Keywords:	OTOLARYNGOLOGY, EPIDEMIOLOGY, Laryngology < OTOLARYNGOLOGY

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Awareness about Laryngopharyngeal Reflux Disease among Chinese Otolaryngologists: A Nationwide Survey

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ABSTRACT

Objectives

This study aimed to investigate the status of the current knowledge about laryngopharyngeal reflux disease (LPRD) among Chinese otolaryngologists.

Design

Multi-center cross-sectional survey.

Setting

220 medical centers in different regions of China.

Participants

A total of 2254 otolaryngologists from 220 medical centers in China who were successfully on-site surveyed between Nov 2019 and Dec 2020.

Main outcome measures

Awareness about LPRD included knowledge about risk factors, symptoms, laryngoscope signs, related diseases, current diagnostic methods, and treatments.

Results

The percentage of participants who had heard of LPRD was 96.4%, with academic conferences as the most common source of information (73.3%). The most commonly known risk factor, symptom, laryngoscope sign, related disease, diagnostic method, and treatment were alcohol consumption (44.0%), pharyngeal foreign body sensation (66.9%), hyperemia (52.4%), pharyngolaryngitis (54.8%), pH monitoring (47.6%), and medication (82.1%), respectively. Only 28.3% of all participants knew that 24-h pH or multichannel intraluminal impedance pH monitoring was the most accurate diagnostic test. As many as 73.1% of all participants knew that proton pump inhibitors were the first-line treatment drugs. An analysis of the overall status of awareness using a scoring system suggested that otolaryngologists were better aware owing to more access, working at 3A hospitals, and postgraduate or above educational background (all $P < 0.05$).

Conclusion

Although the majority of Chinese otolaryngologists had heard of LPRD, their overall awareness about the disease was not encouraging. More efforts are needed to increase the knowledge about LPRD among this group of physicians.

Trial registration Chictr.org.cn site identifier: ChiCTR1900025581

Strengths and limitations of this study

This prospective cross-sectional survey was carried out in up to 2254 otolaryngologists who worked in different hospitals around the whole China.

The whole surveys were all performed on-site under the supervision of designated surveyors.

The overall awareness status about laryngopharyngeal reflux disease knowledge was evaluated using a scoring scale basing on questions about risk factors, symptoms, laryngoscope signs, related diseases, current diagnostic methods, and treatments of this disease.

INTRODUCTION

Laryngopharyngeal reflux disease (LPRD) is an inflammatory condition of the upper aerodigestive tract tissues related to direct and indirect effects of gastric or duodenal content reflux.[1,2] The incidence of LPRD is thought to be high. The studies conducted in the USA, the UK, and Greece reported that the prevalence of this disease could reach 10%, 34.4%, and 18.8%, respectively.[3–5] A national multicenter epidemiological survey conducted in China found that the prevalence of LPRD was as high as 10.15% at the otolaryngology-head and neck surgery clinics.[6] However, the frequency of a previous diagnosis of LPRD was found to be extremely low among those with positive symptoms, only 14.09%.[6] Besides the nonspecific symptoms and clinical signs which are easily to be confused with other laryngopharyngeal disorders.[7] We hypothesized that an insufficient knowledge about this disease among the physicians might contribute a lot to such a low diagnosis rate. One small research performed by our group in Beijing preliminarily confirmed this hypothesis.[8]

Beijing is an area with the highest level of medical knowledge in China. Therefore, the awareness about LPRD among otolaryngologists may be even worse in the whole country. The present survey was performed in different regions around the whole country with the aim to conduct a comprehensive investigation about the status of the awareness about LPRD among Chinese otolaryngologists. The results could be a valuable reference for making detailed plans to improve awareness about this disease in China.

MATERIALS AND METHODS

Study design

This study was a multicenter cross-sectional survey designed by a core group including three study leaders (Shuifang Xiao, Jinrang Li, and Hongliang Zheng) and one statistician (Xiaoxia Peng). The whole survey was conducted under the supervision of three study leaders between November 2019 and December 2020. One practicing otolaryngologist was made in charge of the survey in the respective provincial district. The district leader and the three study leaders proposed and decided the final hospital lists where the survey was conducted according to the following criteria: (1) no more than nine hospitals in each provincial district; (2) the hospital lists in each district including both 3A and non-3A hospitals; (3) the hospital where the district leader was working not included; (4) the hospital lists could only be changed during the survey with the approval of all three study leaders; (5) hospitals in primary lists could be deleted or replaced if the local director refused the survey in his department, or if less than 80% of all otolaryngologists at this hospital successfully surveyed.

The study method was approved by the Peking University First Hospital Institutional Review Board and registered on the chictr.org.cn site (ChiCTR1900025581). All otolaryngologists who were surveyed had provided their informed consents to the study.

Data collection

The survey in each provincial district was conducted by a local team, which included the district leader and at least two assistants. All surveyors were trained to be familiar with the study process to ensure the consistency of implementation. All otolaryngologists who worked in included hospitals at the time of the survey were invited to fill out an identical anonymous questionnaire. Communication with others or access to relevant information was forbidden before and during the survey. A completed questionnaire was considered ineffective if the handwriting was not clear and the otolaryngologist refused to fill it again. All completed effective questionnaires were collected and checked by local teams and then uploaded to a designated database. The final data were checked, integrated, and analyzed by three study leaders and their assistants.

The English version of the questionnaire used in this study is shown in **Table 1**. This contained 15 questions that could be divided into 3 parts: (1) personal information including educational background, years of working, and professional title; (2) whether the respondent knew about LPRD, and if yes, what way(s) did he (she) knew about this disease (3 options were provided for this question, which were textbooks, literature, and academic conferences); and (3) awareness about LPRD including risk factors, symptoms, laryngoscope signs, related diseases, diagnostic methods, and treatments. All questions in Part 3 did not have options. The respondents needed to write the answers they knew as much as possible.

Quantifications for the status of awareness about LPRD

A scoring scale based on all Part 3 questions (questions 6–15) was used to comprehensively evaluate the awareness about LPRD. Each "right answer" to the 10 questions scored one point. Here, the "right answers" were defined by consensus among three study leaders according to the current literature:

(1) Question 6: Smoking, alcohol drinking, unhealthy eating habits, comorbid upper digestive disease, male sex, age, psychological pressure, obesity, and tea or coffee drinking had been accepted as common risk factors for LPRD.[2,6,9–11] A correct answer for this question was defined as the one that included at least three items of the aforementioned factors.

(2) Question 7: Reflux symptom index (RSI), proposed by Belafsky et al.,[12] included scores for the severity of nine common LPRD-related symptoms. A right answer for this question was defined as the one that included at least three of the nine symptoms in the RSI.

(3) Question 8: Reflux finding score (RFS), also proposed by Belafsky et al.,[13] included scores for the severity of eight common LPRD-related laryngoscope signs. A right answer for this question was defined as the one that included at least three of the eight laryngoscope signs.

(4) Question 9: Pharyngolaryngitis, vocal benign lesions, rhinitis or rhinosinusitis, laryngeal granuloma, laryngeal leukoplakia, cough, asthma, otitis media, obstructive sleep apnea syndrome, and malignant tumor were thought to be associated with LPRD.[14–21] A right answer was defined as the one that included at least three of the aforementioned diseases.

(5) Question 10: RSI or RFS evaluations, pH or multichannel intraluminal impedance pH (MII-pH) monitoring, empiric therapeutic trial, and pepsin detection were current accepted diagnostic methods for LPRD.[2,22,23] A right answer was defined as the one that included at least two items of the aforementioned methods.

(6) Question 11: Behavior modification, medication, and operation were the currently accepted treatments for LPRD.[2,24] A right answer was defined as the one that included at least two items of the aforementioned treatments.

(7) Question 12: The right answer was 13, as this was the most common cutoff score of RSI used in China.[25]

(8) Question 13: The right answer was 7, as this was the most common cutoff score of RFS used in China.[26]

(9) Question 14: The right answer was 24-h pH or MII-pH monitoring. Despite controversies, such examinations were thought to be the most accurate method for diagnosing LPRD.[2,27]

(10) Question 15: The right answer was proton pump inhibitors (PPIs). Despite controversies, such drugs were thought to be the first-line medication for treating LPRD.[2,27]

Statistical analysis

All statistical analyses were performed using SPSS 20.0 for Windows (IBM, NY, USA). Continuous variables were expressed as mean ± standard deviation. The rate of awareness about LPRD was expressed as a percentage. The comparisons of awareness scores about LPRD among different groups of participants were all made using independent-sample *t* tests. A *P* value less than 0.05 indicated a statistically significant difference.

RESULTS

Medical institutions and personal information

There were 265 medical institutions from 31 provincial administrative districts of China initially participated in this study. 56 institutions from 15 districts withdrew before the survey was carried out. While at the same time, 13 institutions from 10 districts took the place of some withdrew institutions. Therefore, the survey was carried out in a total of 222 institutions, of which two were excluded because of fewer valid questionnaires (less than 80% of all otolaryngologists were successfully surveyed). Finally, 2254 effective questionnaires were collected from 220 hospitals in 27 provincial administrative districts. The flow diagram of the participated institutions is shown in **Figure 1**. The numbers of hospitals and effective questionnaires according to geographical region are shown in **Table 2 and Figure 2**, suggesting that the survey covered all geographical regions and nearly all provincial administrative districts of China. The personal information of all 2254 otolaryngologists who were successfully surveyed is shown in **Table 3**, including their hospital levels, educational background, working time, and professional titles.

Rate of awareness about LPRD and the way(s) of knowing this disease

Only 81 of 2254 otolaryngologists (3.6%) from 46 hospitals (range 1–7) had never heard of LPRD. Therefore, a total of 2173 otolaryngologists (96.4%) had heard about this disease. Among the three choices provided, academic conferences were the most common source of knowing LPRD (1653, 73.3%), followed by literature (1382, 61.3%) and textbooks (1350, 59.9%). The number of otolaryngologists who knew about LPRD via zero, one, two, and all three ways was 183 (8.1%), 608 (27.0%), 612 (27.2%), and 851 (37.8%), respectively.

Status of awareness about LPRD risk factors, symptoms, laryngoscope signs, and related diseases

The most commonly known risk factor was alcohol drinking, followed by smoking, unhealthy eating habits, and comorbid upper digestive disease. The most commonly known symptom was pharyngeal foreign body sensation, followed by stomach acid or heartburn, hoarseness, and cough. The most commonly known laryngoscope sign was hyperemia, followed by laryngeal edema, granuloma, and vocal cord edema. The most commonly known LPRD-related disease was pharyngolaryngitis, followed by vocal benign lesions, rhinitis or rhinosinusitis, and laryngeal granuloma. The details of the aforementioned results are shown in **Figure 3**.

Status of awareness about LPRD diagnoses and treatments

The most common answer for diagnostic methods was pH monitoring, followed by laryngoscopy, RSI or RFS evaluation, gastroscopy, empiric therapeutic trial, and salivary pepsin test. The most common answer for treatment options was medication, followed by behavioral modifications and operation. The detailed results are shown in **Figure 4**.

The correct rate of awareness for the cutoff values of RSI and RFS was only 46.6% (1051/2254) and 44.9% (1012/2254), respectively. Only 28.3% (639/2254) of all participants knew about the use of 24-h pH or MII-pH monitoring as a gold diagnostic test. As many as 73.1% (1647/2254) of all participants considered PPIs the first-line drugs.

Overall status of awareness about LPRD

The overall awareness scale score for all participants was 4.1 ± 2.8, with a range of 0–10 (the score of 81 otolaryngologists who never heard of LPRD was considered as 0). The number of participants according to different scores is shown in **Figure 5**. The data indicated that only 1.4% (32/2254) of all participants got full marks, and as many as 57.6% (1293/2018) of all participants could not even reach half marks (0–4).

The awareness scale scores according to different ways of knowing this disease are shown in **Table 4**. The data suggested that knowing this disease via either of the three ways could increase the final scores (all $P < 0.05$). Moreover, the awareness scale scores were significantly higher for otolaryngologists who knew about this disease via two to three ways (vs. those who knew about this disease via only 0 to one way) ($P < 0.05$).

The awareness scale scores according to different personal information are shown in **Table 5**. The data suggested that the scores were significantly higher in otolaryngologists who worked at 3A hospitals (vs. non-3A hospitals) and with postgraduate or above educational backgrounds (vs. undergraduate or below educational backgrounds) (both $P < 0.05$). No significant differences were found in this score among otolaryngologists who had different professional titles and working times (both $P > 0.05$).

DISCUSSION

LPRD has gradually gained attention during the last decades,[2] since Koufman systematically investigated the throat-related symptoms of gastroesophageal reflux disease (GERD) in 1991.[3] LPRD symptoms could exist in the absence of typical GERD symptoms, as the laryngopharyngeal mucosa is more sensitive to acid reflux.[6 28-30] However, unlike the widespread awareness about GERD among gastroenterologists, insufficient awareness about LPRD among

otolaryngologists has been suggested in several small sample studies conducted in the UK, Europe, and Beijing district of China.[8,31,32] China is vast in territory, and the levels of medical knowledge differ significantly with regions. Therefore, this nationwide survey, including the largest sample size to date, comprehensively evaluated the status of awareness about LPRD among Chinese otolaryngologists.

The most important finding of this study was that, although the majority of otolaryngologists surveyed had heard of LPRD, the overall status of awareness about LPRD was not encouraging: only very few otolaryngologists attained satisfactory scores. The insufficient awareness about LPRD was embodied in all aspects of this disease, including risk factors, symptoms, clinical signs, related diseases, diagnoses, and treatments. This could undoubtedly cause great difficulties in the correct management of this disease. Therefore, the extremely low diagnosed rates of LPRD in Chinese patients might be attributed to a great extent to insufficient knowledge about this disease among otolaryngologists.

Thorough knowledge of the disease among medical specialists is the primary requirement for its timely diagnosis and suitable treatment. Specifically, insufficient awareness about LPRD showed in this study could cause the following potential problems: (1) An insufficient awareness about the unspecific symptoms and laryngoscope signs might cause missed diagnoses, as this disease could be easily confused with some other laryngeal problems.[7] On the contrary, this might also cause false diagnoses of LPRD, which showed that the use of empirical PPI therapy did not lead to any improvement in persistent throat symptoms in 16 weeks or 12 months.[33] (2) An insufficient awareness about related diseases could cause poor efficacies or recurrences in treating such diseases, as antireflux therapy has been accepted in treating some of these diseases, such as laryngeal leukoplakia,[34] laryngeal granuloma,[35] and cough.[36] (3) Currently, no perfect diagnostic and treatment methods exist for LPRD: simple ones are not so accurate or effective, such as RSI or RFS evaluations (diagnosis) and behavioral changes (treatment), while accurate or effective ones are always invasive, such as pH-MII monitoring (diagnosis) or antireflux operations (treatment). Therefore, a reasonable practical algorithm is necessary for the efficient management of this disease.[1,2,27] Insufficient awareness about its diagnostic and treatment methods may prevent otolaryngologists from providing reasonable advice. For example, few Chinese otolaryngologists knew about other treatments besides medication. This meant that they had no idea of treating patients who did not respond to medication. On the contrary, a simple dietary change was an alternative cost-effective therapeutic approach for some patients with LPRD.[37] However, insufficient awareness about behavioral modifications might prevent otolaryngologists from giving clear advice on dietary changes.

In this study, we found several potential factors that influenced the status of awareness about LPRD, including hospital level, educational background, and number of ways of knowing this disease. Such results could be valuable references for making further plans in improving the overall status of awareness about LPRD in China. Specifically, otolaryngologists who work at low-level hospitals or with low educational backgrounds should be encouraged to study this disease. More ways should be provided for studying this disease, such as continuously updating textbooks to include the latest LPRD knowledge or holding more academic conferences about LPRD. These strategies may also help in facilitating timely diagnoses and suitable treatments for the large population of patients with LPRD in China.

The main strengths of this study compared with others were as follows: First, the sample size was the largest to date; moreover, the surveyed otolaryngologists came from different levels of hospitals around the country. Second, the whole surveys were performed onsite under the supervision of designated surveyors. Therefore, the veracity of the results could be ensured to a great extent. Third, questions 6–15, which were the major part of our questionnaire, were all provided with no options. Therefore, the intimation effects could be avoided to a great extent.

Several limitations also needed to be addressed. First, data from different regions were collected by different groups of surveyors; therefore, intergroup differences in study implementation could not be avoided. However, because China is a vast territory, conducting all surveys by one group was unrealistic and extremely expensive. Second, the calculation criteria of the awareness scale were made subjectively by three experts based on the current literature. This probably led to some subjective bias and controversies. However, no international guideline exists for the management of LPRD.[38] Such evaluations could well reflect the overall status of awareness about this disease.

CONCLUSION

In summary, the results of this study suggested that the overall status of awareness about LPRD in Chinese otolaryngologists was not encouraging. More efforts are needed to increase such knowledge among this group of physicians, especially among those who work in low-level hospitals or have low educational backgrounds or few ways of studying this disease.

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Contributors Study conception and design: SX, JL, HZ, XL, and HY. Study supervision: SX, JL, and HZ. Material preparation and data collection: SX, JL, HZ, XL, HY, JZ, XP, SZ, CZ, DC, XX, LS, HH, ZT, XC, YL, SQ, GW, TC, XC, LT, WZ, HF, YH, GY, ZL, LT, JH, RM, and ZY. Analysis and interpretation of data: SX, JL, HZ, XL, HY, JZ,

and XP. Manuscript writing: SX, JL, HZ, and JZ. All authors made critical revision for important intellectual content, read and approved the final manuscript.

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Patient and public involvement statement Patients and/or the public were not involved in the design, or conduct, or reporting or dissemination plans of this research.

Patient consent for publication Not required.

Ethics approval This study was approved by the ethics committee of Peking University First Hospital (No. 2019-191), and followed the Declaration of Helsinki. Written informed consent was obtained from all participants prior to conducting the study.

Data sharing statement Data are available upon reasonable request.

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Table 1 English version of the LPRD awareness questionnaire used in this study

PART 1	
1. Educational background	□ Postgraduate or above □ Undergraduate or below
2. Years of working	□ 0-5 □ 5-10 □ >10
3. Professional title	□ Senior □ Intermediate □ Primary
PART 2	
4. Have you ever heard of LPRD?	□ Yes □ No
5. In what access(es) did you know LPRD?	
□ Text books □ Literature □ Academic conferences	
PART 3 (no options were provided) (for questions 6-15, write the most comprehensive answer you think)	
6. Risk factors for LPRD	
7. Subjective symptoms of LPRD	
8. Laryngoscope signs suggesting LPRD	
9. LPRD related diseases	
10. Current diagnostic methods for LPRD	
11. Current treatment methods for LPRD	
12. The cut-off value of RSI for diagnosing LPRD	
13. The cut-off value of RFS for diagnosing LPRD	
14. The current gold diagnostic method for LPRD	
15. The current first-line drug for treating LPRD	

LPRD, laryngopharyngeal reflux disease; RSI, Reflux Symptom Index; RFS, Reflux Findings Score

Table 2 Numbers of hospitals and effective questionnaires according to geographical region

Region	No. of hospitals	Hospital level		No. of effective questionnaires
		3A	Non-3A	
Northeast China	17	12	5	202
East China	54	35	19	647
North China	47	29	18	440
Central China	26	16	10	277

South China	30	18	12	269
Southwest China	26	17	9	231
Northwest China	20	12	8	188
Total	220	139	81	2254

Table 3 Personal information of all 2254 otolaryngologists surveyed

	No. of otolaryngologists	Percent
Hospital level		
3A	1666	73.9
Non-3A	588	26.1
Educational background		
Postgraduate or above	1157	51.3
Undergraduate or below	1097	48.7
Working time (years)		
≥10	1037	46.0
<10	1217	54.0
Professional titles		
Senior	755	33.5
Primary-intermediate	1499	66.5

Table 4 Awareness scale scores according to different ways of knowing LPRD

	Awareness scale scores	P
Textbooks		<0.001
Yes	4.5±2.7	
No	3.4±2.7	
Literature		<0.001
Yes	4.8±2.6	

No	2.9±2.6	
Academic conferences		<0.001
Yes	4.3±2.6	
No	3.5±3.0	
No. of ways		<0.001
2-3	4.7±2.7	
0-1	2.9±2.6	

Table 5 Awareness scale scores according to different personal information

	Awareness scale scores	P
Hospital level		<0.001
3A	4.3±2.7	
Non-3A	3.3±2.9	
Educational background		<0.001
Postgraduate or above	4.5±2.6	
Undergraduate or below	3.6±2.8	
Working time (year)		0.981
≥10	4.1±2.8	
<10	4.1±2.7	
Professional titles		0.342
Senior	4.1±2.7	
Primary-intermediate	4.0±2.8	

Figure Captions

Figure 1 The flow diagram of participating institutions.

Figure 2 The provincial administrative districts with medical institutions participating in the study (marked in red).

Figure 3 The most commonly known LPRD risk factors (A), symptoms (B), laryngoscope signs (C), and related diseases (D).

Figure 4 The rates of awareness about LPRD diagnostic methods (A) and treatment methods (B).

Figure 5 The numbers of participants according to different awareness scale scores.

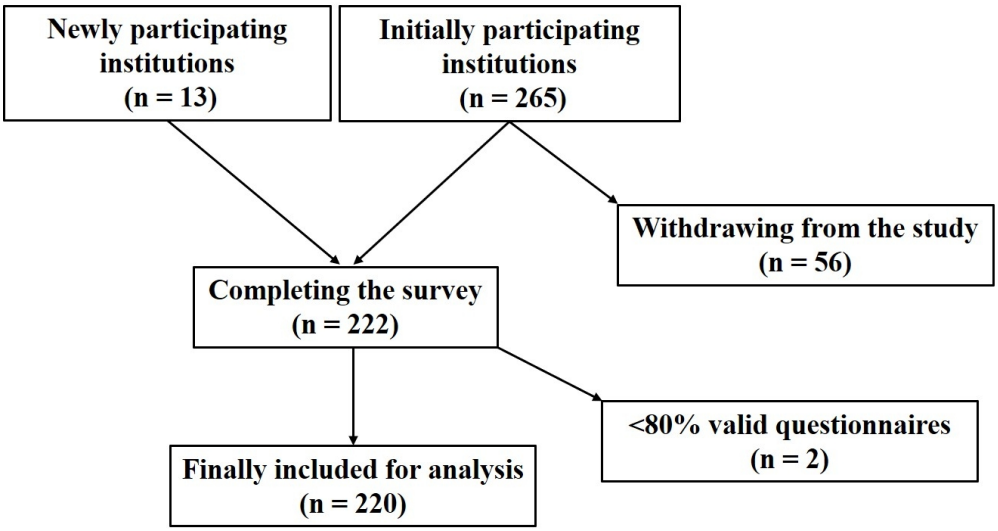

Figure 1 The flow diagram of participating institutions.

224x119mm (150 x 150 DPI)

Figure 2 The provincial administrative districts with medical institutions participating in the study (marked in red).

142x131mm (150 x 150 DPI)

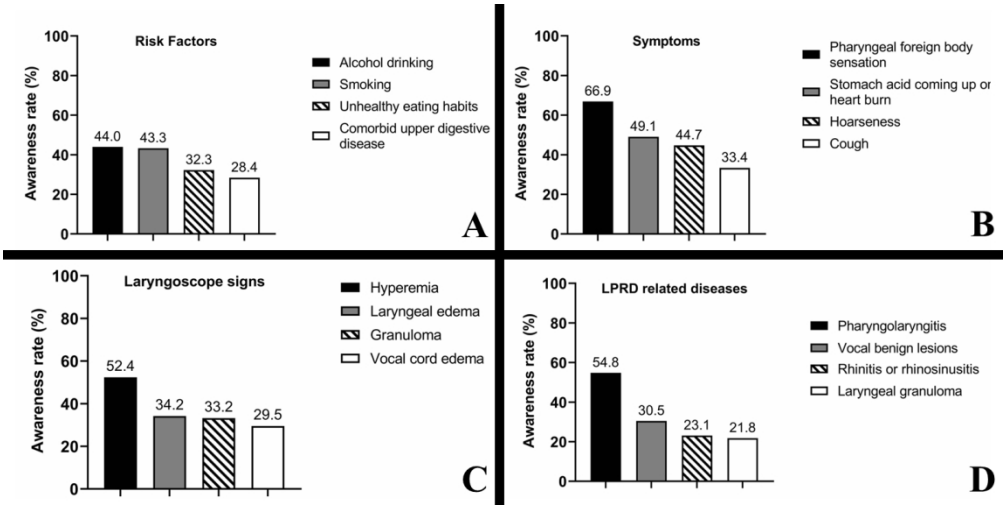

Figure 3 The most commonly known LPRD risk factors (A), symptoms (B), laryngoscope signs (C), and related diseases (D).

564x282mm (72 x 72 DPI)

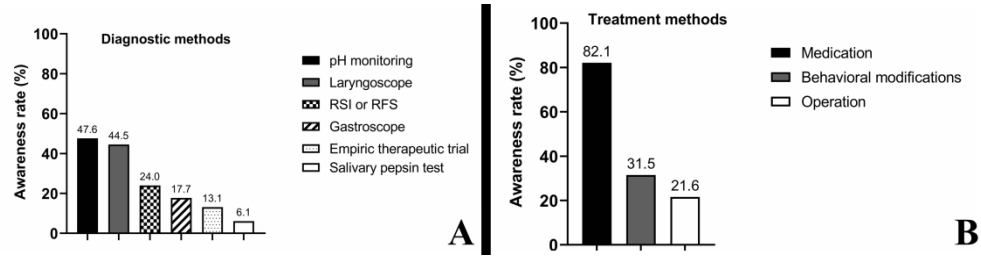

Figure 4 The rates of awareness about LPRD diagnostic methods (A) and treatment methods (B).

1128x282mm (72 x 72 DPI)

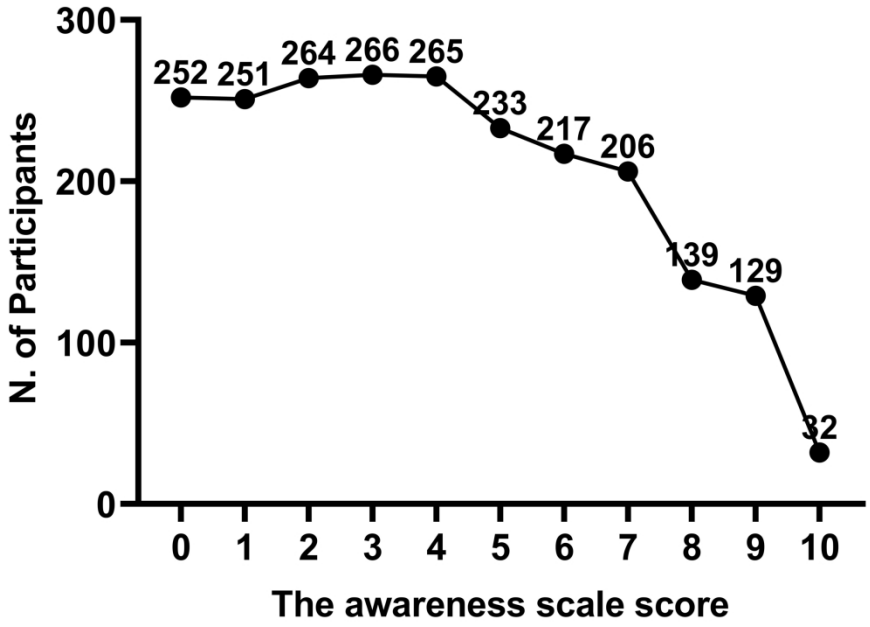

Figure 5 The numbers of participants according to different awareness scale scores.

127x88mm (600 x 600 DPI)

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract *Yes. A National Wide Survey in title and Multi-center cross-sectional survey in abstract (Page 1 and Page 4)*
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found *Yes. What was done: To investigate the current laryngopharyngeal reflux disease (LPRD) knowledge awareness status in Chinese otolaryngologists.* *What was found: Although the majorities of Chinese otolaryngologists had heard of LPRD, the overall awareness status of the disease knowledge was not optimistic. In future, more efforts are needed to increase the knowledge of LPRD among this group of physicians. (Page 4)*
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported *In a national multi-center epidemiological survey conducted in China, our research group found that the prevalence of LPRD was as high as 10.15% at the otolaryngology-head and neck surgery clinics. We further found that the frequency of a previous diagnosis of LPRD was extremely low among those with positive symptoms, which was only 14.09%. In addition to the unspecific symptoms and clinical signs of this disease, which are easy to confused with other laryngopharyngeal disorders. (Page 6)*
Objectives	3	State specific objectives, including any prespecified hypotheses *We hypothesized that an insufficient physician's knowledge about this disease might contribute a lot to such a low diagnose rate.* *The present survey was performed in different regions around the whole nation, and the aim was to conduct a comprehensive investigation about LPRD awareness status in Chinese otolaryngologists. (Page 6)*
Methods		
Study design	4	Present key elements of study design early in the paper *This was a multi-center cross-sectional survey (Page 6)*
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection *Setting: A multi-center cross-sectional survey conducted in 220 hospitals from different regions of China.* *Locations: 220 hospitals from different regions of China.* *Dates and periods of recruitment: Nov 2019-Dec 2020* *Exposure and follow up: none.* *Data collection: Seen in the data collection part in the method (Pages 6-7)*
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants *This could be seen in the study design part of the method (Page 6)*
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable *These could be seen in the data collection and Quantifications for awareness status of LPRD knowledge parts of the method. (Pages 7-8)*

Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group *These could be seen in the data collection and Quantifications for awareness status of LPRD knowledge parts of the method. (Pages 7-8)*
Bias	9	Describe any efforts to address potential sources of bias *The final hospital lists where the survey was conducted according to following criteria: (1) no more than 9 hospitals in each provincial district; (2) the hospital lists in each district should include both 3A and non-3A hospitals; (3) the hospital where the district leader was working for should not be included; (4) the hospital lists could only be changed during the survey under the approvements of all three study leaders; (5) included hospitals at primary lists could be deleted or replaced if local director refused the survey in his department, or if less than 80% of all otolaryngologists at this hospital were successfully surveyed. (Page 6)*
Study size	10	Explain how the study size was arrived at *All otolaryngologists who worked in included hospitals at the time of survey were invited to fill an identical anonymous questionnaire. (Page 7)*
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why *These could be seen in the Quantifications for awareness status of LPRD knowledge parts of the method. (Pages 7-8)*
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding *These could be seen in the statistical analysis part of the method. (Page 8)*
		(*b*) Describe any methods used to examine subgroups and interactions *These could be seen in the statistical analysis part of the method. (Page 8)*
		(*c*) Explain how missing data were addressed. *There were no missing data*
		(*d*) If applicable, describe analytical methods taking account of sampling strategy *Not applicable*
		(*e*) Describe any sensitivity analyses *Not applicable*
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed *Finally, 2254 effective questionnaires from 220 hospitals were collected. (Page 9)*
		(b) Give reasons for non-participation at each stage *Not applicable*
		(c) Consider use of a flow diagram *Not applicable*
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders *Table 3 of the paper (Page 17)*
		(b) Indicate number of participants with missing data for each variable of interest *Not applicable*
Outcome data	15*	Report numbers of outcome events or summary measures *These could be seen in the awareness status of LPRD risk factors, symptoms,*

		laryngoscope signs, and related diseases and the awareness status of LPRD diagnoses and treatments parts of the results (Pages 9-10)
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included *Not applicable*
		(*b*) Report category boundaries when continuous variables were categorized *Not applicable*
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period *Not applicable*
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses *This could be seen in Overall awareness status of LPRD knowledge part of the results (Page 10)*
Discussion		
Key results	18	Summarise key results with reference to study objectives *The second paragraph of the Discussion (Page 11)*
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias *There were also several limitations that need to be addressed: First, the data collections at different regions were done by different groups of surveyors, and so, inter-group differences in study implementation could not be totally avoided. However, China is so vast in territory, and it is unrealistic and extremely high costs for one group to conduct all the survey. Second, the calculation criteria of the awareness scale were made subjectively by three experts according to current literatures. This may lead to some subjective bias and controversies. However, there is no international guideline for the management of LPRD until now, and we think that such evaluations could well reflect the overall awareness status of this disease. (Page 12)*
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence *The 3rd and 4th paragraphs of the Discussion (Pages 11-12)*
Generalisability	21	Discuss the generalisability (external validity) of the study results *In comparison with former studies, the main strengths of this study were as follows: First, the largest sample size to date, and what was more, the otolaryngologists we surveyed came from different levels of hospitals around the whole nation; Second, the whole surveys were performed on-site under the supervision of designated surveyors. Therefore, the veracity of the results could be ensured to a great extent; Third, questions 6-15, the major part of our questionnaire, were all provided with no options. Therefore, the intimation effects could be avoided to a great extent. (Page 12)*
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based *There was no funding support for this study. (Page 12)*

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.