

ORIGINAL ARTICLE

Airway Diseases

Quality of life is significantly impaired in nonallergic rhinitis patients

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Abstract

Background: In contrast to the well-known significant impairment of quality of life (QoL) in allergic rhinitis (AR), the degree of impairment in QoL in nonallergic rhinitis (NAR) remained unknown for a long time, due to a lack of a validated questionnaire to assess QoL in the NAR patient group. In this study, a validation of the mini-RQLQ questionnaire in NAR patients was performed, followed by an assessment of QoL in NAR patients compared to AR and healthy controls. Secondly, use of medication and treatment satisfaction in AR and NAR was assessed.

Methods: The study was an observational cohort study in 287 AR and 160 NAR patients. Patients with symptoms of rhinitis were recruited from a tertiary care outpatient clinic of the Otorhinolaryngology Department. Allergic rhinitis (AR) was defined as one or more positive results on skin prick testing and clinically relevant symptoms of rhinitis related to their sensitization. Nonallergic rhinitis (NAR) was defined as clinically relevant symptoms of rhinitis but without positive results on skin prick testing. The mini-RQLQ was successfully validated in this study for NAR patients.

Results: Quality of life (QoL) in NAR patients was equally—and for some aspects even more—impaired compared to AR. More than half of both AR and NAR patients were unsatisfied with treatment.

Conclusion: These results demonstrate a significant impairment in both AR and NAR patients in their QoL combined with a low treatment satisfaction, emphasizing the need for adequate treatment, especially in the NAR patient group.

KEYWORDS

allergic rhinitis, mini-RQLQ, nonallergic rhinitis, quality of life, treatment satisfaction

1 | INTRODUCTION

Both allergic rhinitis (AR) and nonallergic rhinitis (NAR) are amongst the most common chronic diseases with a significant impact on quality of life (QoL). Allergic rhinitis (AR) is an inflammatory condition

caused by an IgE-mediated response to allergen exposure.¹ Patients with NAR have similar symptoms without clinical evidence for an infectious, anatomical or allergic aetiology.¹

The worldwide estimated prevalence of NAR exceeds 200–400 million people.² Around half of the adult rhinitis patients (20%–70%) are considered to have NAR.^{2,3,4}

Clinically, NAR shows largely the same symptoms of rhinitis as AR.⁵ Also, NAR and AR patients have the same prevalence and type of nasal hyperreactivity, although in the past nasal hyperreactivity

Abbreviations: AR, allergic rhinitis; ARIA, allergic rhinitis and its impact on asthma; CRS, chronic rhinosinusitis; LAR, local allergic rhinitis; (Mini)-RQLQ, mini-rhinoconjunctivitis quality of life questionnaire; NAR, nonallergic rhinitis; NARES, nonallergic rhinitis with eosinophilia syndrome; SPT, skin prick test; QoL, quality of life.

was considered a hallmark of NAR patients only.⁶ However, some characteristic features of AR and NAR do exist. AR patients will have allergen-induced rhinitis symptoms that usually is accompanied by symptoms of conjunctivitis, more often seasonality and other signs of the atopic syndrome. Data on lower airway involvement are contradictory indicating lower or the same level of lower airway involvement in NAR compared to AR.^{4,7-10}

A number of subphenotypes can be discerned within the context of NAR: drug-induced rhinitis, gustatory rhinitis, hormonal-induced rhinitis, rhinitis of the elderly, atrophic rhinitis, NARES, LAR and idiopathic rhinitis.^{1,11}

When considering pathophysiology, a subdivision in a neurogenic and an inflammatory endotype is often made. Although not proven, one may consider anti-inflammatory treatment to be more effective in the inflammatory endotype like NARES and LAR and capsaicin to be more effective in the neurogenic endotype.¹²

A consequence of the lack of evidence-based treatment for NAR patients compared to AR is that many NAR patients are unsuccessfully treated. This could cause a high impairment of quality of life in NAR. In contrast to the significant literature on the impairment of the QoL seen in patients with AR,¹³⁻¹⁷ the degree of impairment of health-related QoL in NAR patients is under-evaluated.^{3,18,19} For this reason, we wanted to assess the QoL of NAR patients in comparison with AR and healthy controls.

In contrast to AR however, for NAR, no disease-specific and validated questionnaires to measure quality of life were available until now.²⁰

Van Oene et al¹³ showed that for the measurement of health-related quality of life in AR patients, the RQLQ(S) and the mini-RQLQ were the best tests with optimal discriminant validity and responsiveness. For that reason, we first validated the RQLQ for evaluation of QoL in patients with NAR. Then, we assessed QoL in NAR compared to healthy controls and AR patients as a positive control group.

Finally, we assessed the use of nasal medication in NAR and compared NAR with AR for number and type of nasal medication and treatment satisfaction.

2 | METHODS

2.1 | Study design

An observational cohort study was performed using questionnaires

Quality of life was assessed by comparing NAR with both healthy controls as with AR as a positive control group. The use of nasal medication was assessed by comparing NAR with AR.

Allergic rhinitis (AR) and NAR patients were recruited between June 2006 and February 2015 from a database composed of rhinitis patients visiting the outpatient clinic of the Ear-Nose-Throat Department of the Academic Medical Centre (Amsterdam, The Netherlands) that went for skin prick testing. If patients met inclusion and

exclusion criteria based on history, Ear-Nose-Throat routine examination and allergy skin prick testing, two sets of questionnaires (assessing quality of life and use of nasal medication) were sent to patient's home address. Questionnaires were sent between October 2011 and February 2015.

2.2 | Inclusion criteria

2.2.1 | AR patients

Allergic rhinitis (AR) patients had at least one positive skin prick test result and chronic rhinitis symptoms relevant to their sensitization. Rhinitis was defined as one or more of the following symptoms: watery, anterior rhinorrhea, paroxysmal sneezing, nasal obstruction and/or nasal pruritus. Patients were classified as having intermittent or persistent symptoms of rhinitis according to ARIA classification. This classification was done with help of a questionnaire that accompanied the skin prick test, assessing duration of symptoms (< or >4 days per week and/or < or >4 weeks per year) and severity of symptoms (influence on daily life). To assess allergic sensitization, we used the GA²LEN standardized method of skin prick testing (SPT).²¹ A positive reaction to SPT was defined as a skin reaction larger than 3 mm for one or more of the 18 tested allergens, and no reaction to the negative control. Patients were asked to stop their antihistamine medication 48 hours before allergy testing.

2.2.2 | NAR patients

Nonallergic rhinitis (NAR) was defined as clinically relevant symptoms of chronic rhinitis without positive skin prick test results and no other reason for rhinitis symptoms (see Exclusion Criteria). Intermittent or persistent rhinitis was defined in the same way as in AR (according to ARIA classification).

2.2.3 | Controls

To validate the mini-RQLQ for use in NAR patients, 49 healthy controls were included. Healthy controls were employees from the AMC and were randomly recruited between December 2012 and January 2013. Healthy controls had to be free of rhinitis symptoms.

2.3 | Exclusion criteria

Patients with anatomical deformities or other forms of nasal obstruction, such as septal deviation, septal perforation, choanal atresia and/or nasal valve collapse or dysfunction being responsible for nasal obstruction, were excluded. Also, patients with signs of infectious rhinitis (purulent/discholoured discharge, fever) and/or chronic rhinosinusitis (CRS) with or without nasal polyposis based on nasal endoscopy (purulent/discholoured discharge, nasal polyps) and/or CT scan were excluded, as were pregnant patients, patients with nasal/sinus surgery within the previous 3 months, a serious and/or

unstable disease affecting nasal function, unilateral nasal symptoms and/or patients with a history of immunotherapy.

2.4 | Questionnaires

Both the mini Rhinconjunctivitis Quality-of-Life Questionnaire (mini-RQLQ) and a questionnaire assessing use and success rate of nasal medication were sent to patients' home address.

2.4.1 | Mini-RQLQ questionnaire

The mini-RQLQ was used to assess quality of life in AR and NAR patients and healthy controls. This questionnaire was primarily developed to assess QoL in AR and includes 14 questions divided into 5 subdomains assessing daily activities, practical issues, complaints of nose and eyes.

2.5 | Validation of the RQLQ for NAR

The psychometric properties of the questionnaire, reliability, validity, responsiveness and clinically significant change have been described for AR.²²

Because symptomatology of NAR and AR is quite similar, we expected the content of the mini-RQLQ to be valid for NAR patients. Internal reliability was measured estimated by calculating Cronbach's α . Test-retest reliability was not measured because we did not expect it to be different from AR patients.

We determined convergent construct validity by comparing the outcomes of the mini-RQLQ in NAR patients to the ARIA classification. The discriminant construct validity was determined by comparing the NAR patients group to healthy controls. The clinically significant change was expected to be comparable to AR and not evaluated separately for the NAR group.¹³

2.5.1 | Nasal medication questionnaire

To assess the use of nasal medication in NAR and AR, patients completed a questionnaire concerning present and past medication in the last 2 years, assessing number and type of medication used, rate of improvement of different treatment modalities and overall treatment satisfaction with current treatment. Patients were asked if they were on medication at the moment of filling in the questionnaire and/or in the previous years. Subsequently, they filled in the name of (a) currently used medicament(s) and—if applicable—the name(s) of medicaments they used in the past. As a supplement, we attached a list of allergy and nasal drugs in case patients forgot the name of their medicament. We included space for "description in own words." Per medicament patients had to tick a box for "duration of use" and "rate of improvement." Duration of use was classified as: incidentally, less than 4 weeks, 1-6 months and more than 6 months. Rate of improvement was classified as: no improvement, small improvement, large improvement and no more symptoms.

Finally, patients had to tick a box whether they were satisfied or unsatisfied with their treatment.

2.6 | Statistics

The Kolmogorov-Smirnov test showed that data of the mini-RQLQ results were not normally distributed. Therefore, a Mann-Whitney *U* test was used to compare mini-RQLQ results between AR and NAR patients and between NAR and healthy controls. A general linear model (GLM) analysis was performed to assess the influence of patient characteristics age and sex on outcome results of QoL. Chi-square test was used to compare AR and NAR nonresponders and responders according to ARIA classification. Fisher's exact test was performed to compare type and rate of improvement of treatment modalities between AR and NAR.

3 | RESULTS

3.1 | Validation of mini-RQLQ in NAR

Because symptomatology of NAR and AR is quite similar, we expected the content of the mini-RQLQ to be valid for NAR patients. Nonallergic rhinitis (NAR) patients indeed had comparable outcomes to AR in the different domains of the questionnaire. The Cronbach's α of 0.883 indicated high internal consistency between mini-RQLQ outcomes within the NAR patient group. A test-retest analysis in 36 patients demonstrated a Pearson's correlation coefficient of 0.717 with a significance level of $P < .0001$. Previously performed language validation of the (mini-)RQLQ showed that its Dutch translation is adequately adapted to be used in the Dutch population.²³

The convergent construct validity showed higher values in the mini-RQLQ in patients with moderate to severe symptoms as defined by the ARIA classification than with patients with mild symptoms. On all subdomains of the mini-RQLQ, NAR patients had significantly higher outcomes compared to healthy controls (Table 1).

3.2 | Response rate

We selected AR and NAR patients who fulfilled the inclusion and exclusion criteria based on ENT history and examination from our database of patients who visited our outpatient clinic with symptoms of rhinitis and/or allergy and who received a skin prick test. This resulted in 556 allergic rhinitis patients and 329 nonallergic rhinitis patients. The questionnaires were sent to these patients home address followed by a reminder a month later. Patients who did not return the questionnaire after the first postal reminder were repeatedly tried to be reached by postal mail, telephone and/or email. Thirty-one AR and 19 NAR patients were untraceable ("sample loss") because of changed address, telephone number and/or email. In AR 216 and in NAR, 108 patients did not respond (not to the postal questionnaire nor to postal, email, or telephone reminders). Twenty-two AR and 42 NAR patients refused to participate.

TABLE 1 Mini-rhinoconjunctivitis quality of life questionnaire (Mini-RQLQ) in nonallergic rhinitis (NAR) vs healthy controls

Mini-RQLQ domains	NAR, n = 160		Healthy, n = 49		NAR vs Healthy Mann-Whitney U test (P)
	Median (range)	Mean (SD)	Median (range)	Mean (SD)	
Activities	2.67 (0.00-6.00)	2.63 (1.58)	0.00 (0.00-3.33)	0.46 (0.84)	<.0001
Practical problems	3.00 (0.50-6.00)	3.04 (1.50)	0.00 (0.00-4.50)	0.67 (1.01)	<.0001
Nose symptoms	2.67 (0.33-6.00)	2.84 (1.28)	0.33 (0.00-3.00)	0.49 (0.76)	<.0001
Eye symptoms	1.00 (0.00-6.00)	1.52 (1.70)	0.00 (0.00-4.33)	0.35 (0.76)	<.0001
Other symptoms	2.17 (0.00-6.00)	2.47 (1.72)	0.67 (0.00-2.67)	0.71 (0.79)	<.0001
Overall	2.36 (0.29-5.64)	2.46 (1.20)	0.43 (0.00-2.57)	0.53 (0.62)	<.0001

Finally, completed questionnaires of 287 AR (response rate 54.7%) and 160 NAR (response rate 51.6%) patients were analysed.

3.3 | Patient characteristics

Table 2 shows the patient characteristics of both patient groups. Patients with AR and NAR had a comparable mean age. Distribution by ARIA (Allergic Rhinitis and its Impact on Asthma) classification concerning duration and severity of symptoms was also comparable between the two groups. In the NAR group, a significant higher proportion of patients smoked (21.3% vs 13.9%, $P = .046$, chi-square test, without Yates correction). In the AR group, there was a higher proportion of patients with asthma than in the NAR group (16.4% vs 7.5%, $P = .008$, chi-square test, without Yates correction).

TABLE 2 Patient characteristics

	NAR, n = 160	AR, n = 287
Male: female	1: 2.1	1: 1.2
Mean age	47.4	42.4
Smoking (%)	34 (21.3%)	40 (13.9%)
Asthma (%)	12 (7.5%)	47 (16.4%)
ARIA grading	Moderate to severe persistent 115/151 (76.2%)	Moderate to severe persistent 204/279 (73.1%)
Perennial sensitization	Not applicable	218
House dust mite	Not applicable	156
Strictly seasonal sensitization	Not applicable	69

3.4 | Questionnaire outcomes

3.4.1 | Mini-RQLQ outcome

Table 3 shows the results of impairment of QoL as assessed by means of the mini-RQLQ questionnaire. A higher score means a higher level of impairment indicating a lower QoL. Nonallergic rhinitis (NAR) patients had an overall trend of having higher mini-RQLQ scores than AR ($P = .053$). Nonallergic rhinitis (NAR) patients were significantly more bothered by nasal complaints. Other complaints such as tiredness and lack of sleep were also more prominent in NAR patients.

A general linear model (GLM) analysis did not show a significant influence of age and gender on QoL results in both patient groups.

A separate analysis per mini-RQLQ domain comparing NAR and AR patients is shown in Table 4. Nonallergic rhinitis (NAR) patients have significantly higher scores for blocked and running nose compared to AR patients.

3.4.2 | Medication questionnaire outcome

Table 5 shows the proportion of AR and NAR patients using medication now or in the past. Nonallergic rhinitis (NAR) patients used significantly less medication than AR patients. In NAR, 71.6% used only one medicament, 20.9% used two medicaments, and 7.5% used three medicaments. In AR, 60.3% used only one medicament, 27.8% used two medicaments, and 11.9% used three medicaments. Table 6 shows the four most frequent used nasal drugs at the moment of filling in the questionnaire for both AR and NAR. Corticosteroid

TABLE 3 Mini-rhinoconjunctivitis quality of life questionnaire (Mini-RQLQ) scores nonallergic rhinitis (NAR) vs allergic rhinitis (AR)

Mini-RQLQ domains	NAR, n = 160		AR, n = 287		NAR vs AR Mann-Whitney U test (P)
	Median (range)	Mean (SD)	Median (range)	Mean (SD)	
Activities	2.67 (0.00-6.00)	2.63 (1.58)	2.33 (0.00-6.00)	2.39 (1.68)	.116
Practical problems	3.00 (0.50-6.00)	3.04 (1.50)	2.50 (0.00-6.00)	2.71 (1.67)	.056
Nose symptoms	2.67 (0.33-6.00)	2.84 (1.28)	2.33 (0.00-6.00)	2.49 (1.52)	.005
Eye symptoms	1.00 (0.00-6.00)	1.52 (1.70)	1.33 (0.00-6.00)	1.70 (1.62)	.095
Other symptoms	2.17 (0.00-6.00)	2.47 (1.72)	1.67 (0.00-6.00)	1.91 (1.55)	.001
Overall	2.36 (0.29-5.64)	2.46 (1.20)	2.07 (0.00-5.50)	2.21 (1.24)	.053

TABLE 4 Mini-rhinoconjunctivitis quality of life questionnaire (Mini-RQLQ) domain scores nonallergic rhinitis (NAR) vs allergic rhinitis (AR)

Mini-RQLQ domains	NAR, n = 160		AR, n = 287		NAR vs AR Mann-Whitney U test (P)
	Median (range)	Mean (SD)	Median (range)	Mean (SD)	
1. Activities	2.67 (0.00-6.00)	2.63 (1.58)	2.33 (0.00-6.00)	2.39 (1.68)	.116
Regular activities at home and at work	3.00 (0.00-6.00)	2.71 (1.74)	3.00 (0.00-6.00)	2.64 (1.91)	.631
Recreational activities	3.00 (0.00-6.00)	2.68 (1.81)	2.00 (0.00-6.00)	2.47 (1.93)	.232
Sleep	3.00 (0.00-6.00)	2.50 (2.01)	2.00 (0.00-6.00)	2.06 (2.08)	.023
2. Practical problems	3.00 (0.50-6.00)	3.04 (1.50)	2.50 (0.00-6.00)	2.71 (1.66)	.056
Need to rub nose/eyes	3.00 (0.00-6.00)	2.66 (1.88)	3.00 (0.00-6.00)	2.76 (1.99)	.622
Need to blow nose repeatedly	3.50 (0.00-6.00)	3.42 (1.65)	3.00 (0.00-6.00)	2.67 (1.87)	<.001
3. Nose symptoms	2.67 (0.33-6.00)	2.84 (1.28)	2.33 (0.00-6.00)	2.49 (1.52)	.005
Sneezing	2.00 (0.00-6.00)	2.43 (1.75)	2.00 (0.00-6.00)	2.50 (1.84)	.802
Stuffy blocked nose	3.00 (0.00-6.00)	3.50 (1.78)	3.00 (0.00-6.00)	2.80 (2.04)	<.001
Runny nose	3.00 (0.00-6.00)	2.58 (1.94)	2.00 (0.00-6.00)	2.14 (1.93)	.022
4. Eye symptoms	1.00 (0.00-6.00)	1.52 (1.70)	1.33 (0.00-6.00)	1.70 (1.61)	.095
Itchy eyes	1.00 (0.00-6.00)	1.59 (1.81)	2.00 (0.00-6.00)	2.09 (2.00)	.008
Sore eyes	0.00 (0.00-6.00)	1.36 (1.85)	0.00 (0.00-6.00)	1.42 (1.89)	.561
Watery eyes	1.00 (0.00-6.00)	1.58 (2.04)	1.00 (0.00-6.00)	1.57 (1.85)	.577
5. Other symptoms	2.17 (0.00-6.00)	2.47 (1.72)	1.67 (0.00-6.00)	1.91 (1.55)	.001
Tiredness and/or fatigue	3.00 (0.00-6.00)	2.99 (2.00)	2.00 (0.00-6.00)	2.55 (1.97)	.022
Thirst	2.00 (0.00-6.00)	2.19 (2.06)	1.00 (0.00-6.00)	1.50 (1.81)	.001
Feeling irritable	2.00 (0.00-6.00)	2.23 (2.07)	1.00 (0.00-6.00)	1.70 (1.89)	.009

TABLE 5 Use of medication

Use of medication	NAR, n = 160 Number of patients (%)	AR, n = 287 Number of patients (%)	Fisher's exact test (P)
Current use	67 (41.9%)	151 (52.6%)	.0305
No current use but use of medication last 2 y	43 (26.9%)	82 (28.6%)	.7423
Only use of medication >2 y ago	23 (14.4%)	25 (8.7%)	.0791
Never used medication	27 (16.9%)	29 (10.1%)	.0518

TABLE 6 Type of medication

Type of medication	NAR n (% of patients currently on medication) ^a	AR n (% of patients currently on medication) ^a	Fisher's exact test (P)
Corticosteroid nasal spray	57 (85.1%)	107 (70.9%)	.0273
Xylometazoline	16 (23.9%)	22 (14.6%)	.1210
Antihistamine tablet	6 (9.0%)	67 (44.4%)	.0001
Antihistamine nasal spray	2 (3.0%)	4 (2.6%)	1.0000
Other	10 (14.9%)	29 (19.2%)	.5663

^aA proportion of patients used more than one medicament.

nasal spray and antihistamine tablets were the most frequent used drugs in AR, compared to corticosteroid nasal spray and xylometazoline in NAR. A significant higher proportion of AR patients used antihistamine tablets compared to NAR ($P = .0001$).

Treatment satisfaction was not significantly different (Fisher's exact test, $P = .6588$) between AR and NAR. Both AR and NAR patients were not very satisfied with their current treatment with a treatment satisfaction rate of 43.3% in NAR and 47.0% in AR.

4 | DISCUSSION

There have been a substantial number of studies assessing several social-economic aspects, including QoL in AR, in contrast to NAR.²⁴ This is the first study assessing QoL in NAR patients with a validated questionnaire. Until now, there was no validated questionnaire to assess QoL in NAR patients. In this study, we performed a validation of the mini-RQLQ in NAR patients, showing a high discriminant construct validity (strongly significant higher outcomes in the NAR group compared to healthy controls), a Cronbach's alpha indicating strong internal consistency and a high convergent construct validity by comparing the mini-RQLQ in NAR to the ARIA classification.

Use of the (now validated for NAR) mini-RQLQ questionnaire showed that the QoL in NAR patients is equally—and for some aspects even more—impaired compared to AR, emphasizing the need for adequate treatment in NAR.

For the mini-RQLQ subdomains “nasal complaints” and “other complaints” (ie, tiredness), NAR scored significantly higher compared to AR. The subdomain “practical problems” nearly reached significance with a higher burden in NAR. Only, for the subdomain “eye complaints,” AR scored slightly higher compared to NAR, as expected.

One might explain the higher impairment of nasal symptoms, practical problems, etc. in NAR by the lack of effective treatment options in this patient group, because of lack of knowledge of underlying pathophysiology. The higher impairment of eye symptoms in AR can be explained by the fact that allergic conjunctivitis is an intrinsic feature of AR.¹⁹

Interpretation of these QoL results seems complicated by the fact that not all AR patients were allergen exposed during the time of completion of the questionnaire. Unfortunately, this was inevitable because some patients did not respond directly but after several reminders. However, assessment of mini-RQLQ scores in AR patients with and without allergen exposure surprisingly did not show significant differences between the two, not even in strictly seasonal AR patients. This might be influenced by the fact that around half of patients were using medication at time of filling in the questionnaire, independent of allergen exposure. Whether patients were not using medication because of mild symptoms or because of severe symptoms unresponsive to treatment remains an almost impossible question to answer.

This study was combined with an assessment of the use of numbers and types of (nasal) medication and the (subjective) efficacy of these medications in the different patient groups.

The “use of medication” questionnaire showed that a smaller proportion of NAR patients use medication for their symptoms compared to AR. This is likely to be the result of a lack of effective treatment options in this difficult to treat patient group, also shown in a treatment satisfaction rate of 43.3%. Also, AR patients have a less than 50% treatment satisfaction. Looking at these results, it is necessary to keep in mind that we are assessing an academic (third-line) patient group, with a risk of selecting more treatment-resistant AR patients. For NAR patients, it is possible that referral to an ENT clinic will happen sooner when atopy cannot be demonstrated by the GP and nasal (corticosteroid) spray is unsuccessful. One can speculate that comparing AR and NAR in a general population, the difference in QoL and treatment satisfaction will be even larger.

Assessing the numbers of patients using different types of medication, one notices that most NAR patients end up with the long-term use of a corticosteroid nasal spray. A proportion of 23.9% of NAR patients admits to use xylometazoline (Table 6). Unknown is the duration and frequency of use of this medicament in these individuals and thereby whether one can define these patients as actual “rhinitis medicamentosa.” Moreover, for some patients, there was a (small) time gap between this ENT assessment at the outpatient clinic and the completion of the questionnaire, allowing a change in use of medication to take place.

Concluding, these results demonstrate a clinically relevant impairment in both AR and NAR patients in their QoL combined with a

low treatment satisfaction, emphasizing the need for adequate treatment. This is especially of importance in the NAR patient group where lack of understanding of its underlying mechanism hampers finding adequate treatment solutions.

CONFLICT OF INTERESTS

The authors declare that they have no conflict of interests.

AUTHOR CONTRIBUTIONS

CLS performed the study, analysed the data and wrote the manuscript. IT supervised, read and commented the manuscript. AG read and commented the manuscript. PWH read and commented the manuscript. CMvD supervised, read and commented the manuscript. WJF supervised, analysed data, wrote, read and commented the manuscript.

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REFERENCES

1. Papadopoulos NG, Bernstein JA, Demoly P, et al. Phenotypes and endotypes of rhinitis and their impact on management: a PRACTALL report. *Allergy*. 2015;70:474-494.
2. Bousquet J, Fokkens W, Burney P, et al. Important research questions in allergy and related diseases: nonallergic rhinitis: a GA2LEN paper. *Allergy*. 2008;63:842-853.
3. Bousquet J, Bachert C, Canonica GW, et al. Unmet needs in severe chronic upper airway disease (SCUAD). *J Allergy Clin Immunol*. 2009;124:428-433.
4. Molgaard E, Thomsen SF, Lund T, Pedersen L, Nolte H, Backer V. Differences between allergic and nonallergic rhinitis in a large sample of adolescents and adults. *Allergy*. 2007;62:1033-1037.
5. Van Gerven L, Boeckxstaens G, Hellings P. Up-date on neuro-immune mechanisms involved in allergic and non-allergic rhinitis. *Rhinology*. 2012;50:227-235.
6. Segboer CL, Holland CT, Reinartz SM, et al. Nasal hyper-reactivity is a common feature in both allergic and nonallergic rhinitis. *Allergy*. 2013;68:1427-1434.
7. Chawes BL, Bonnelykke K, Kreiner-Moller E, Bisgaard H. Children with allergic and nonallergic rhinitis have a similar risk of asthma. *J Allergy Clin Immunol*. 2010;126:567-573.
8. Hakansson K, von Buchwald C, Thomsen SF, Thyssen JP, Backer V, Linneberg A. Nonallergic rhinitis and its association with smoking and lower airway disease: a general population study. *Am J Rhinol Allergy*. 2011;25:25-29.
9. Kim SW, Han DH, Lee SJ, Lee CH, Rhee CS. Bronchial hyperresponsiveness in pediatric rhinitis patients: the difference between allergic and nonallergic rhinitis. *Am J Rhinol Allergy*. 2013; 27:63-8.
10. Rondon C, Bogas G, Barrionuevo E, Blanca M, Torres MJ, Campo P. Nonallergic rhinitis and lower airway disease. *Allergy*. 2017;72: 24-34.
11. Hellings PW, Klimek L, Cingi C, et al. Non-allergic rhinitis: position paper of the European Academy of Allergy and Clinical Immunology. *Allergy*. 2017;72:1657-1665.

12. Gevorgyan A, Segboer C, Gorissen R, van Drunen CM, Fokkens W. Capsaicin for non-allergic rhinitis. *Cochrane Database Syst Rev*. 2015;7:CD010591.
13. van Oene CM, van Reij E, Sprangers MA, Fokkens WJ. Quality-assessment of disease-specific quality of life questionnaires for rhinitis and rhinosinusitis: a systematic review. *Allergy*. 2007;62:1359-1371.
14. Canonica GW, Bousquet J, Mullol J, Scadding GK, Virchow JC. A survey of the burden of allergic rhinitis in Europe. *Allergy*. 2007;62 (suppl 85):17-25.
15. Baiardini I, Braido F, Tarantini F, et al. ARIA-suggested drugs for allergic rhinitis: what impact on quality of life? A GA2LEN review. *Allergy*. 2008;63:660-669.
16. Droessaert V, Timmermans M, Dekimpe E, et al. Real-life study showing better control of allergic rhinitis by immunotherapy than regular pharmacotherapy. *Rhinology*. 2016;54:214-220.
17. Fokkens WJ. Rhinitis, not to sniff at. *Rhinology*. 2016;54:193-194.
18. Gelardi M, Maselli Del Giudice A, Fiorella ML, et al. Quality of life in non-allergic rhinitis depends on the predominant inflammatory cell type. *J Biol Regul Homeost Agents*. 2008;22:73-81.
19. Kalpaklioglu AF, Kavut AB. Allergic and nonallergic rhinitis: can we find the differences/similarities between the two pictures? *J Asthma*. 2009;46:481-485.
20. Juniper EF, Thompson AK, Ferrie PJ, Roberts JN. Validation of the standardized version of the rhinoconjunctivitis quality of life questionnaire. *J Allergy Clin Immunol*. 1999;104:364-369.
21. Heinzerling L, Frew AJ, Bindslev-Jensen C, et al. Standard skin prick testing and sensitization to inhalant allergens across Europe—a survey from the GALEN network. *Allergy*. 2005;60:1287-1300.
22. Juniper EF, Thompson AK, Ferrie PJ, Roberts JN. Development and validation of the mini rhinoconjunctivitis quality of life questionnaire. *Clin Exp Allergy*. 2000;30:132-140.
23. <https://eprovide.mapi-trust.org/instruments/mini-rhinoconjunctivitis-quality-of-life-questionnaire>
24. Del Cuvillo A, Santos V, Montoro J, et al. Allergic rhinitis severity can be assessed using a visual analogue scale in mild, moderate and severe. *Rhinology*. 2017;55:34-38.

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