

RCAT reflects symptom control and quality of life in allergic rhinoconjunctivitis patients

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Abstract

Background: The Global Allergy and Asthma European Network (GA²LEN) Taskforce has requested more data on correlations between various Patient Reported Outcomes (PROs) in clinical trials on allergy. We compared three tools—the Rhinitis Control Assessment Test (RCAT), Rhinoconjunctivitis Quality of Life Questionnaire (RQLQ), and Rhinitis Total Symptom Score (RTSS)—to determine whether the RCAT alone is a sufficient primary outcome parameter in clinical trials on allergic rhinoconjunctivitis.

Methods: In two double-blind, placebo-controlled immunotherapy studies, 33 patients allergic to grass pollen and 94 to birch pollen completed two questionnaires (RCAT and RQLQ) and kept their own symptom diary from which the RTSS was calculated.

Results: Upon comparing RCAT and RQLQ results, we found strong correlations of $r = -0.871$ for grass pollen–allergic patients and $r = -0.795$ for birch pollen–allergic patients. The comparison between RCAT and RTSS results showed a strong correlation of $r = -0.811$ (grass pollen–allergic patients) and a moderate correlation of $r = -0.539$ (birch pollen–allergic patients). In the RCAT, 69.7% of grass pollen–allergic patients and 45.7% of birch pollen–allergic patients receiving guideline-concordant therapy were regarded as having insufficiently controlled symptoms.

Conclusion: The strong correlation suggests that the RCAT alone is equivalent to the RQLQ with respect to patients' symptom control and quality of life. Patients with uncontrolled symptoms can be identified using the RCAT. Hence, the physician can decide whether symptomatic therapy can be intensified or allergy immunotherapy should be administered.

Key words: Allergic rhinoconjunctivitis, PRO tool, quality of life, RCAT, symptom control

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Abbreviations

AR	Allergic rhinitis
CAP-RAST	Carrier polymer system – radioallergosorbent test
GA ² LEN	Global Allergy and Asthma European Network
CPT	Conjunctival provocation test
PRO	Patient-reported outcome
RCAT	Rhinitis Control Assessment Test
RQLQ	Rhinoconjunctivitis Quality of Life Questionnaire
RTSS	Rhinitis Total Symptom Score
SCUAD	Severe chronic upper airway disease
TRMS	Total Rescue Medication Score
VAS	Visual analogue scale

Introduction

Allergic rhinoconjunctivitis not only causes various symptoms, it also has a substantial impact on patients' quality of life. This influence is not measured by questionnaires that only enquire about symptoms (1). Furthermore, only moderate correlations between quality of life and objectifiable, clinical parameters, such as pulmonary function and nasal provocation tests, have been described (2,3). For many patients, the improvement in quality of life is an important target parameter of specific immunotherapy (4). This realisation led to the development of a questionnaire dealing specifically with patients' quality of life, the Rhinoconjunctivitis Quality of Life Questionnaire (RQLQ) (5). This questionnaire has since become the gold standard for determining quality of life in clinical studies involving rhinoconjunctivitis patients. A short version of the RQLQ, the so-called MiniRQLQ, was developed shortly thereafter (6).

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Another established possibility of determining illness-related impairments experienced by rhinitis patients is the Rhinitis Total Symptom Score (RTSS) (7). The daily survey of certain symptoms and medication use allows a longitudinal observation of symptom burden. Furthermore, the Rhinitis Control Assessment Test (RCAT) was developed, which can help distinguish between symptom-controlled and symptom-uncontrolled rhinitis patients (8). A generally valid definition of symptom control, however, does not yet exist for allergic rhinitis (AR) and is the subject of current scientific discussion (9).

Several studies have examined and compared various patient questionnaires. A correlation has been shown to exist between two of the above four tools, the MiniRQLQ and the RCAT. The information gained from these two questionnaires used together overlaps, making their simultaneous implementation in clinical studies unnecessary (10). So far, greater understanding of the connection between symptom control and quality of life exists in the area of allergic asthma, a comorbidity of AR. With the help of the Asthma Control Test and the Mini-Asthma Quality of Life Questionnaire, a correlation was determined between symptom control and quality of life (11).

It has been shown that severe AR symptoms are difficult to treat with pharmacotherapy. Only 33.4% of patients are considered completely or well controlled with respect to their nasal symptoms and 41.8% of patients with regard to ocular symptoms. Sufficient rhinitis control is dependent on multiple factors, such as socioeconomic status of the patient and coexisting bronchial asthma (12,13). However, the therapy scheme recommended by the International Consensus on Rhinitis is able to reduce the symptom score and improve quality of life (14). Furthermore, a real-life study showed a higher control after three years of immunotherapy in contrast to guideline-concordant symptomatic pharmacotherapy (15). Patients in the present study who did not experience adequate symptom control under guideline-concordant therapy comprise a subpopulation that is referred to as SCUAD patients. SCUAD stands for 'severe chronic upper airway disease' and, besides AR, also includes nonallergic rhinitis, chronic rhinosinusitis, and other diseases of the upper airways (16).

Better quality of life and symptom control are important therapy goals for many patients, both in clinical studies and in daily practice. A method must be available to evaluate those parameters quickly and precisely. The present study investigated whether the RCAT alone fulfils this task. Furthermore, our study explored the extent to which the RCAT can help with the problem of identifying and adequately treating SCUAD patients.

Methods

Study design

Two prospective, randomised, double-blind, placebo-controlled hyposensitisation trials provided the framework for this study. These trials are listed under the EudraCT numbers 2012-004916-79 and 2013-002129-43 in the EU Clinical Trials Register, and the results can be viewed on the homepage www.pharmnet-bund.de of the German Federal Ministry of Health. The studies were carried out in accordance with the Declaration of Helsinki and followed the Good Clinical Practice principles of the International Conference on Harmonisation. The study protocols were approved by the German Federal Ministry of Health (Paul-Ehrlich-Institut) and given a favourable opinion by the Ethics Committee of the North Rhine Medical Council (running numbers 2012420 and 2013322). Data protection was ensured in accordance with applicable German guidelines.

Patients participated in preseasonal treatment with study medication (LAIS® Grass sublingual tablets; LAIS® Birch/Alder sublingual tablets, Lofarma SpA, Milan, Italy) or with placebo and were observed during the pollen season and beyond. For the analysis of the investigation described here, only patients from the placebo arm were included to rule out any influence of immunotherapy. During the studies, the patients received antiallergic medication, so-called rescue medication, and were instructed to take it according to the latest Allergic Rhinitis and its Impact on Asthma (ARIA) update (17).

Peak pollen counts were determined using data from the German Weather Service (Deutscher Wetterdienst). The 30 days showing the highest grass pollen counts began at the end of May 2014; the peak birch pollen period was more intense and shorter, lasting 14 days beginning the end of March 2014.

Within the timeframes described above, patients visited their respective investigator and completed two questionnaires, the RCAT and the RQLQ on the same day. In addition, patients kept a symptom diary for the whole season. The RTSS was calculated for the 30-day grass pollen peak and the 14-day birch pollen peak, respectively.

Study population

Adults aged 18 to 75 years who had at least a 2-year history of allergic rhinoconjunctivitis were included in the tree and grass pollen studies. For patients in the grass pollen study, the retrospective RTSS with respect to the previous season was required to be ≥ 8 out of 18. This inclusion criterion did not apply to patients in the birch pollen study. In both study groups, the wheal diameter in the skin prick test had to be ≥ 3 mm and the negative control ≤ 2 mm.

The titrated conjunctival provocation test (CPT) was performed and evaluated according to the procedure described by Riechelmann et al (18). Patients who showed a positive reaction in two consecutive CPTs to a solution containing 100 SQ-E/ml, 1 000 SQ-E/ml or 10 000 SQ-E/ml were included in the studies. Allergen-specific IgE antibodies of major allergens were assessed to prevent the inclusion of cross-reactive patients. Major allergens are allergens that are recognised by $\geq 50\%$ of sensitised patients (19). For grass pollen-allergic patients, the CAP-RAST class was required to be ≥ 2 for the allergens Phl p 1 or Phl p 5b and, accordingly, ≥ 2 for Bet v1 for the birch pollen-allergic patients.

The main exclusion criteria were: predominant perennial allergy, partly controlled or uncontrolled asthma, other significant medical conditions, pregnancy, and breastfeeding. Participation in other clinical trials and ongoing treatment with immunotherapy led to exclusion as well. Predominant

perennial allergy in this case was defined by: anamnestic questions concerning the appearance of symptoms over the year, a higher CAP-RAST class for perennial allergens than for pollen allergens, and a stronger reaction in the skin prick test to perennial allergens than to pollen allergens.

Assessment criteria

The Rhinoconjunctivitis Quality of Life Questionnaire (RQLQ) consists of 28 questions in the following 7 domains: sleep problems, general symptoms, practical problems, nose symptoms, eye symptoms, activity limitation, and emotional function. Responses were marked on a 7-point Likert scale from '0 = not bothersome' to '6 = very bothersome'. The mean of all 28 responses formed the overall score between 0 and 6. The visit at the peak of the pollen season was designated as V6 for the grass pollen-allergic patients and as V5 for the birch pollen-allergic patients. The patients themselves completed the RQLQ in the investigators' offices at these respective visits.

The Rhinitis Total Symptom Score (RTSS) queries symptoms recorded daily by the patient in a diary. Four nasal and two ocular symptoms were documented. Symptoms (sneezing, rhinorrhoea, itchy nose, blocked nose, watery eyes, and itchy eyes) were rated from '0 = no symptoms' to '3 = severe symptoms'. The sum of the 6 symptom points yielded the RTSS per day and could range from 0 to 18. The daily RTSS value of all days of the peak of the pollen season (30 days for grass pollen and 14 days for birch pollen) was averaged over this period and used to make a comparison. Medication intake was also documented via a diary query, from which the Total Rescue Medication Score (TRMS) could be calculated. Medication intake followed a step-by-step schedule, beginning with antihistamine (Step 1), adding levocabastine eyedrops (Step 2), and then adding beclomethasone nasal spray (Step 3). Step 1 corresponded to a score of 6 points, Step 2 a score of 9 points, and Step 3 a score of 18 points. For asthma patients, the intake of long-acting β_2 -antagonists was assessed with an additional 9 points. Therefore, the patient could have a daily TRMS ranging from 0 to 18, and an asthma patient from 0 to 27.

The Rhinitis Control Assessment Test (RCAT) is a 6-item questionnaire that surveys the patient's impairments during the previous 7 days. The items are nasal congestion, sneezing, watery eyes, sleep problems, avoidance of certain activities, and self-perception of symptom control. Symptoms were assessed on a 5-point Likert scale from '1 = symptoms occur very frequently' to '5 = symptoms never occur'. The points for all 6 items were added together, yielding the overall score. Similar to the original validation study, all patients who reached 21 points or less were considered 'symptom-uncontrolled' (8). Patients having 22 points or more were regarded as 'symptom-controlled'. The RCAT was completed by the patients themselves in the investigators' offices at Visit (V) 5 (birch pollen trial) or V6 (grass pollen trial), respectively.

Statistical analysis

The data sets for both observation groups were analysed separately. Patient baseline characteristics were compiled. The quantitative variables were described in terms of mean and standard deviation, and the qualitative variables in terms of number and percentage. The proportions of symptom-controlled and symptom-uncontrolled patients were calculated in accordance with the RCAT validation study by Meltzer et al (8).

The analysis included the calculation of the Pearson correlation between the RCAT, RTSS, and RQLQ questionnaires. The level of significance was given in terms of Sig. (2-s). *P* values < 0.05 were considered statistically significant. Bland–Altman Plots were used to complete the analysis (20). The maximum of the accepted difference was set to 1.96 times the standard deviation, as commonly. It was necessary to transform the three questionnaires into a new scale ranging from 0 to 100. The RCAT had to be inverted to ensure that 0 points represented the least burden of disease.

The analysis of the data sets was performed using SPSS by IBM for Windows (Version 23, IBM Corp., Armonk, New York, USA).

Results

Baseline characteristics

In all, 127 patients were assessed for this study. Of these, 33 patients were from the placebo arm of the grass pollen study and 94 patients from the placebo arm of the birch pollen study. Fully completed questionnaires were returned for 29 of the 33 grass pollen–allergic patients and 76 of the 94 birch pollen–allergic patients. These 105 completed questionnaires could be analysed with respect to correlations. Besides age ($P = 0.001$), there were no significant differences between the study groups in terms of baseline characteristics (Table 1).

Correlations

Moderate to strong correlations between the questionnaires were seen in the analysis. Strong correlations could be found in the grass pollen cohort, and moderate to strong correlations in the birch pollen cohort (Figure 1). The strongest correlation of $r = -0.871$ was observed in the comparison between the RQLQ and the RCAT in the grass pollen–allergic patients. The negative correlation in this case means that the more the symptoms affect the patients' quality of life, the lower the symptom control is. The weakest correlation of $r = -0.539$ was observed between the RTSS and the RCAT in the birch pollen–allergic patients. If a high point value in one questionnaire can be matched to a high point value in another questionnaire, the correlation coefficient approaches the value of 1. However, if a high point value in one questionnaire corresponds to a low point value in another questionnaire, the correlation coefficient approaches the value of -1 . A P value of < 0.001 resulted for all correlations. The mean values from the questionnaires can be found in Table 2. We

cross checked the Pearson correlations using Bland–Altman plots (Figure 2). The large majority of the data points lie within the limits of agreement.

Upon comparing the RCAT and the 7 domains of the RQLQ, the strongest correlations ($r = -0.871$ and $r = -0.795$, respectively) were found between the RCAT and the total RQLQ score for both cohorts (Table 3). All correlation coefficients for the domains were within a similar range. For the grass pollen–allergic patients, the strongest correlation was observed between the RCAT and ‘activity’, followed by ‘general symptoms’ and ‘emotional function’. The weakest correlation resulted between the RCAT and the domain ‘practical problems’, the value $r = -0.647$ speaking in favour of a moderate correlation.

For the birch pollen–allergic patients, the strongest correlation—after the total score—was found for ‘practical problems’, followed by symptoms of the eye and the nose. The weakest correlation coefficient was $r = -0.559$ (‘activity’/ RCAT).

Symptom control

In analysing the RCAT, it became apparent that 23 of the 33 grass pollen–allergic patients provided with symptomatic medication in line with the latest guideline recommendations reached a score of ≤ 21 . Thus, 69.7% of grass pollen–allergic patients had symptoms that were not being controlled sufficiently by guideline-compliant symptomatic treatment. Scores ≤ 21 were also attained by 43 of 94 (45.7%) birch pollen–allergic patients (Table 4).

Total Rescue Medication Score

With respect to the analysis of the Total Rescue Medication Score (TRMS), a significant difference was observed between symptom-controlled and symptom-uncontrolled grass pollen–allergic patients ($P = 0.002$). The corresponding birch pollen–allergic patients showed a nonsignificant P value of 0.09. The TRMS corresponds to the 30- or 14-day peak of the respective pollen season (Table 5).

Discussion

Our results show a strong correlation between symptom control (RCAT) and quality of life (RQLQ). This strong correlation became particularly apparent in grass pollen–allergic patients, but also in the birch pollen–allergic patients ($r = -0.871$ and $r = -0.795$, respectively). The Bland–Altman plots showed only a minority of data points lying outside of the limits of agreement (Figure 2), more so in the birch pollen group than in the grass pollen group. This finding corresponds well with the Pearson correlations, with a smaller correlation for birch pollen than for grass pollen. Furthermore, we observed that the RCAT reflects all domains of the RQLQ properly. Thus, the RCAT can be regarded as the short alternative for the RQLQ.

General correlations

In addition, correlations were also found between symptom control/mean daily symptom burden (RTSS) and mean daily symptom burden/quality of life, each to a stronger extent in the grass pollen–allergic patients than in the birch pollen–allergic patients. This observation is particularly interesting, considering that the RQLQ deals only with the limitations in daily life as perceived by the patients and the RTSS only with symptom severity. On the other hand, the RCAT asks questions about both symptom severity and limitations in daily life. The correlations of the three questionnaires among themselves permit the conclusion that quality of life and symptom severity may not be evaluated separately from each other. A suitable questionnaire that is part of patient-relevant outcomes must measure both qualities accordingly. Consistent with our results, a highly significant correlation has been observed between the visual analogue scale (VAS)—a survey of the patient’s subjective perception of symptoms—and quality of life (RQLQ) (21,22). However, the GA²LEN Taskforce only recommends implementing a VAS for examining changes within individuals over time and not for comparing two study groups (23).

This study compared the results of three questionnaires that had been recorded within the framework of patient-relevant outcomes (patient-reported outcomes, PRO). Clinical studies have evaluated and tested a number of PRO questionnaires covering areas ranging from 'needs and benefit' to 'health-related quality of life' (5,24). However, the correlations and associations between the various PRO questionnaires are often unclear (25). Similar studies have already been conducted for bronchial asthma and were able to show a correlation between asthma control and disease-specific quality of life (11,26). In these studies, it became apparent that the domain 'activity' in quality of life correlated particularly strongly with asthma control, followed by 'emotional aspects' and 'environment'. The close relationship between bronchial asthma and AR led to the development of the RHINASTHMA questionnaire, which measures the quality of life in patients having both diseases and in its German version correlates with the RQLQ ($r = 0.705$) (27).

With respect to allergic rhinoconjunctivitis, only a few studies have been published that permit conclusions similar to ours. In particular, the Rhinitis Control Assessment Test (RCAT) has only been used in a few studies as an outcome parameter in the area of AR (28,29). Studies comparing PRO questionnaires examined symptom control and quality of life (30) or combined symptom-medication score and quality of life (31). However, the questionnaires employed in these studies are rarely used. A further indication of the close relationship between quality of life and symptom control in AR was shown in a study implementing the MiniRQLQ and the RCAT (10). By using the complete RQLQ in the present study, we aimed to add to the currently available data on comparisons between commonly used PRO questionnaires and to be able to identify the most effective method of measuring quality of life and symptom control.

Specific correlations: RQLQ domains and the RCAT

Relevant correlations could also be found between the RQLQ domains and the RCAT. Our results allow us to conclude that the RCAT correlates with all the domains of the RQLQ and thus captures the essential information contained in the RQLQ, comparable with the questionnaires on bronchial

asthma (11). Therefore, our results support the hypothesis formulated by Schatz, who stated that using both questionnaires, e.g. in clinical studies, resulted in the redundant gain of knowledge (10). The fact that the RQLQ is lengthy and time-consuming to complete speaks in favour of using the shorter RCAT in the future.

Symptom control

The subsequent analysis of the study revealed that 69.7% of the grass pollen–allergic patients and 45.7% of the birch pollen–allergic patients reached a RCAT score of ≤ 21 . Hence, according to a validation study, all of these patients are to be regarded as being insufficiently symptom-controlled (8). Since all patients enrolled in our studies had been provided with guideline-concordant medication, they can be classified as SCUAD patients (16). The proportions of SCUAD patients in the study presented here exceed those reported in some other studies by far. Using a VAS, Bousquet PJ et al. identified 18.9% SCUAD patients who had undergone a 2-week, guideline-concordant, antisymptomatic treatment (32). However, another study found that only 33.4% of the patients described their nasal symptoms as completely or well controlled (12). We are aware of the fact that our study participants had a level of distress high enough to motivate them to participate in an immunotherapy trial. Therefore, it is not clear whether this finding can be generalised for all pollen-allergic patients. According to a validation study, the RCAT is regarded as a sensitive tool for identifying patients with uncontrolled symptoms. Whether and how the RCAT can be utilised to manage therapy effectively must be investigated in a study having a study design similar to that used to assess the Allergic Rhinitis Control Test (33).

Total Rescue Medication Score

Furthermore, the present study also revealed a significant difference between symptom-controlled and symptom-uncontrolled grass pollen–allergic patients with regard to concomitant medication use (Table 5). Symptom-controlled patients took less concomitant medication (mean TRMS: 1.73) than did symptom-uncontrolled patients (mean TRMS: 6.33). It appears that patients who attain symptom

control using concomitant medication do not need to take much of such medicine. Patients who cannot achieve symptom control by taking concomitant medication also do not attain it by taking more of such medication, thereby resulting in a high TRMS. The *P* value of 0.09 for the birch pollen–allergic patients allows conclusions in a similar direction. At present, many different methods that intend to reflect the consumption of concomitant medication are being applied in clinical studies, which makes it difficult to compare the medication use in this study with that from other studies (34).

Limitations, strengths and conclusions

This study's limitation lies in the smaller correlations in the larger study arm of birch pollen–allergic patients compared to the smaller arm of grass pollen–allergic patients. This situation can possibly be attributed to the fact that the peak of the birch pollen season during the observation phase was limited to a very short time period. The mild winter of 2013/2014 led to a very early start of the birch pollen season; hence, the visit at which the RCAT and RQLQ were completed possibly did not take place at the peak of the birch pollen season as planned. The patients' responses could therefore relate to the phase of declining pollen counts and not to the peak. Patients completed the symptom diary (RTSS) on their own and over the course of the entire birch pollen season. Consequently, the questionnaires were decoupled temporally from the diaries, which explains in particular the difference in the correlation coefficients for RCAT/RTSS and for RQLQ/RTSS.

A clear strength of this investigation, however, is its design as a multicentre, randomised, prospective, double-blind, and placebo-controlled study. With 94 placebo-group patients, a total of 182 evaluated patients and 235 screened patients, this is one of the largest studies carried out on sublingual immunotherapy for birch pollen. The patient populations examined here correspond to those of other studies with respect to the mean RQLQ score at the peak of the season. Thus, the mean RQLQ score reported here and elsewhere can be regarded as typical for the disease (35,36).

In summary, the results of the present study suggest that the RCAT reflects both symptom control and the quality of life of patients. Using both the RQLQ and the RCAT in clinical studies and daily practice do not appear to provide more information than using the RCAT alone. Patients suffering from 'severe chronic upper airway disease (SCUAD)' can be identified with the help of the RCAT. This questionnaire makes it easier for the treating physician to decide whether to intensify or to change therapy. With this study, we have responded to the GA²LEN Taskforce's request for more data on correlations of various PROs (23,37).

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Author Contributions

RM and SA were responsible for the design and interpretation of the studies this manuscript is based on and for the interpretation of the data. JPL also interpreted the data, performed the research, took part in the acquisition of the data, and wrote the manuscript. AM, JC, JK and UP were responsible for the acquisition of the data. KS conducted the statistical analysis. All authors critically revised and approved the submitted version of the manuscript.

Conflicts of Interest

RM reports personal fees from ALK, grants from ASIT biotech, personal fees from allergopharma, personal fees from Allergy Therapeutics, grants and personal fees from Bencard, grants from Leti, grants, personal fees and non-financial support from Lofarma, non-financial support from Roxall, grants and personal fees from Stallergenes, grants from Optima, personal fees from Friulchem, personal fees from Hexal, personal fees from Servier, personal fees from Klosterfrau, non-financial support from Atmos, personal fees from

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Figure legends

Figure 1 Correlation graphs

These graphs show the correlations between each PRO questionnaire in the two study groups. All correlations were significant with a P value < 0.001 .

RCAT: Rhinitis Control Assessment Test; RQLQ: Rhinoconjunctivitis Quality of Life Questionnaire;

RTSS: Rhinitis Total Symptom Score; r : correlation coefficient.

Figure 2 Bland–Altman plots

These graphs show the Bland–Altman plots used to crosscheck the Pearson correlations.

RCAT: Rhinitis Control Assessment Test; RQLQ: Rhinoconjunctivitis Quality of Life Questionnaire;

RTSS: Rhinitis Total Symptom Score

Table 1 Baseline characteristics and sensitivities

		Grass pollen	Birch pollen
N		33	94
Age (Ø in years) [SD]		38.3 [12.96]	46.7 [11.97]
Sex	f	16 (48.5%)	60 (63.8%)
	m	17 (51.5%)	34 (36.2%)
Weight (Ø in kg) [SD]		75.5 [16.33]	77.4 [15.06]
Height (Ø in cm) [SD]		173.9 [9.06]	171.5 [9.64]
Duration of allergic rhinitis (Ø in years) [SD]		23.5 [12.39]	20.6 [12.42]
Retrospective RTSS (Ø) [SD]		13.3 [2.05]	Not documented
Seasonal, controlled asthma		4 (12.1%)	24 (25.5%)
CAP RAST (Ø) [SD]		3.3 (Phl p 1/Phl p 5) [1.19]	3.3 (Bet v 1) [1.07]
Prick test (Ø in mm) [SD]	Grass pollen	9.2 [3.21]	3.7 [3.64]
	Rye pollen	8.6 [3.54]	3.5 [3.71]
	Birch pollen	1.8 [1.94]	8.0 [3.46]

Bet v = Betula verrucosa; CAP-RAST = carrier polymer system – radioallergosorbent test; f = female; m = male; Phl p = Phleum pratense; SD = standard deviation; retrospective RTSS = retrospective Rhinitis Total Symptom Score

Table 2 Mean values from the questionnaires

	Grass pollen– allergic patients	Birch pollen– allergic patients
RQLQ Ø (preseasonal) [SD]	1.0 [1.26]	1.4 [1.34]
RQLQ Ø (seasonal) [SD]	1.8 [1.15]	1.6 [1.1]
RCAT Ø [SD]	19.2 [3.62]	21.7 [4.9]
RTSS Ø [SD]	4.9 [2.76]	6.6 [3.9]
Rhinitis Quality of Life Questionnaire (RQLQ preseasonal) = Visit 1; RQLQ (seasonal) = V5/V6; Rhinitis Control Assessment Test (RCAT) = V5/V6; Rhinitis Total Symptom Score (RTSS) = Peak pollen counts mean value for 30 (grass) and 14 (birch) days; SD = standard deviation		

Table 3 Correlation: 'RQLQ domains/RCAT'

	Grass pollen– allergic patients	Birch pollen– allergic patients
	<i>r</i> =	<i>r</i> =
RQLQ total		
	–0.871	–0.795
RQLQ domains		
Activity limitation	–0.787	–0.559
Sleep problems	–0.719	–0.688
General symptoms	–0.779	–0.666
Practical problems	–0.647	–0.701
Nose symptoms	–0.697	–0.694
Eye symptoms	–0.660	–0.698
Emotional function	–0.736	–0.651

P < 0.001
RQLQ, Rhinitis Quality of Life Questionnaire; RCAT, Rhinitis Control Assessment Test

Table 4 Distribution of patients receiving placebo and guideline-concordant rescue medication according to the RCAT score

RCAT Score	Grass pollen–allergic patients			Birch pollen–allergic patients		
	n Patients	%	Cumulative %	n Patients	%	Cumulative %
10	1	3.0	3.0	0	0	0
11	0	0.0	3.0	1	1.1	1.1
12	0	0.0	3.0	4	4.3	5.3
13	1	3.0	6.1	3	3.2	8.5
14	2	6.1	12.1	2	2.1	10.6
15	1	3.0	15.2	2	2.1	12.8
16	3	9.1	24.2	3	3.2	16.0
17	4	12.1	36.4	3	3.2	19.1
18	0	0.0	36.4	6	6.4	25.5
19	3	9.1	45.5	9	9.6	35.1
20	4	12.1	57.6	4	4.3	39.4
21	4	12.1	69.7	6	6.4	45.7
22	5	15.2	84.8	4	4.3	50.0
23	2	6.1	90.9	8	8.5	58.5
24	1	3.0	93.9	8	8.5	67.0
25	2	6.1	100.0	6	6.4	73.4
26				6	6.4	79.8
27				11	11.7	91.5
28				4	4.3	95.7
29				1	1.1	96.8
30				3	3.2	100.0

Symptom-uncontrolled patients: Rhinitis Control Assessment Test (RCAT) score 10–21; symptom-controlled patients: RCAT score 22–30

Table 5 Total Rescue Medication Score (TRMS)

	Grass pollen–allergic patients	Birch pollen–allergic patients
Mean [SD]	4.94 [4.31]	5.21 [5.24]
Mean ≤ 21 RCAT score [SD]	6.33 [4.05]	6.44 [5.83]
Mean > 21 RCAT score [SD]	1.73 [3.08]	4.16 [4.47]
<i>P</i> (≤ 21; > 21 RCAT score)	0.002	0.09

RCAT, Rhinitis Control Assessment Test; SD = standard deviation

Figure 1 Correlation graphs

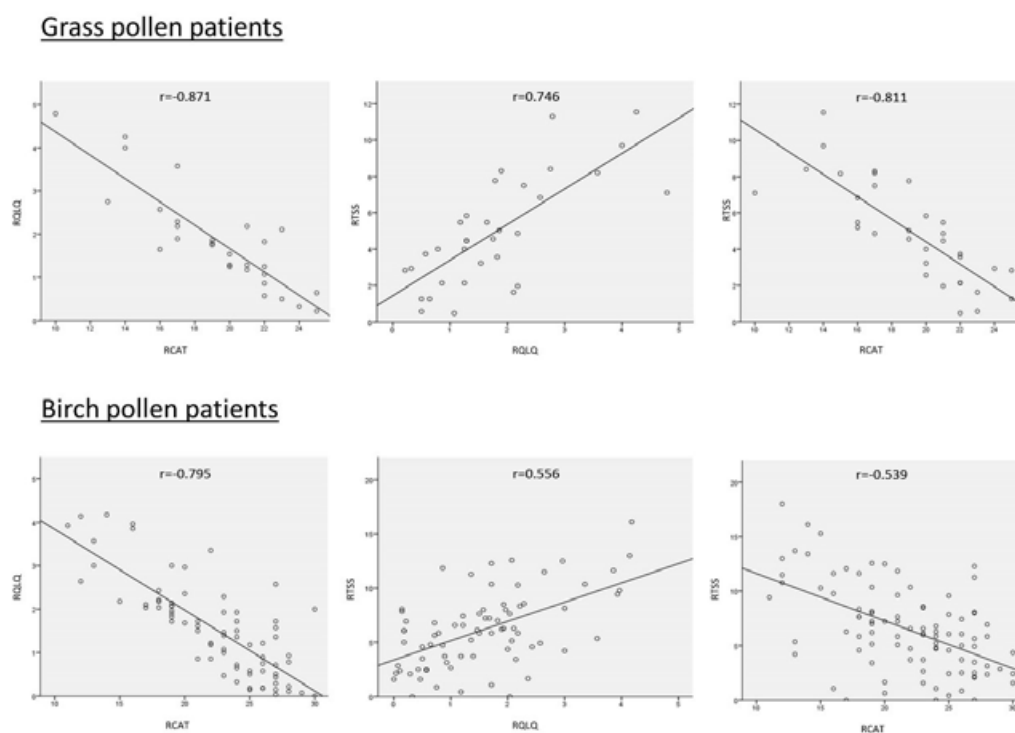


Figure 2 Bland–Altman plots

