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COPD

Responsiveness of the cough and sputum assessment questionnaire in exacerbations of COPD and chronic bronchitis

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Summary
Background: To assess the responsiveness of the Cough and Sputum Assessment Questionnaire (CASA-Q) in COPD and chronic bronchitis patients recovering from an acute exacerbation. The 20-item questionnaire with a 7-day recall assesses the frequency and severity of cough and sputum and their impact on everyday life in clinical (trial) settings. The four domains (cough/sputum symptom and impact) use scales from 0 to 100, with lower scores indicating higher symptom/impact levels.
Methods: Outpatients were enrolled within 48 h of symptom onset of their exacerbation. Treatment was initiated at the discretion of the investigator, and patients observed for 6 weeks. During study visits, 59 eligible patients completed the CASA-Q at enrolment, week 1, 2 and 6. Responsiveness was assessed by calculating standardized effect sizes.
Results: Of the 19 male and 40 female patients with a mean (standard deviation, SD) age of 61.1 (10.5) years, all were classified by their physician to have improved or recovered after six weeks. The mean (SD) CASA-Q sores for the cough symptom, cough impact, sputum symptom and sputum impact domains increased from 32.6 (21.0), 40.7 (22.4), 37.4 (20.1), 47.1 (24.2) at enrolment to 54.0 (19.8), 63.7 (21.3), 55.1 (19.0), 65.5 (20.5) at week 6, respectively. Standardized effect sizes

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for patients improved or recovered from their exacerbation at week 6 were above 1.0 for the cough domains and at least 0.77 for the sputum domains.
Conclusions: The CASA-Q was responsive to symptom changes in patients recovering from an exacerbation.

Introduction

Current guidelines emphasize the role of symptom management in the treatment of stable Chronic Obstructive Pulmonary Disease (COPD).[1] However, instruments evaluating patient-reported sputum expectoration and cough, assessing their impact on everyday life in this patient population and consequently being responsiveness to treatment effects targeted at those symptoms are limited. We have developed and initially validated the Cough And Sputum Assessment Questionnaire (CASA-Q) for use in COPD and chronic (non obstructive) bronchitis patients.[2] This 20-item questionnaire assesses cough and sputum symptoms and their impact by calculating four domain scores. Although the questionnaire's intended use is in stable patients to assess the effects of maintenance treatment for the relief of cough and sputum expectoration (i.e. not symptom changes over the course of an exacerbations), the current study aimed to explore the 'maximal' responsiveness of the CASA-Q during symptom resolution in COPD and chronic bronchitis patients enrolled with an acute mild or moderate exacerbation. This setting was chosen as there are currently no available maintenance treatments that reliably reduce symptoms of cough and sputum in COPD and chronic bronchitis patients. During an exacerbation, those symptoms change as patients may recover with treatment (i.e. the underlying clinical construct being measured by the CASA-Q is known to change). The purpose of the study was therefore to evaluate the responsiveness of the CASA-Q under conditions of known change. Because exacerbations are defined as an acute worsening of the patients underlying condition, including cough and sputum, these events are suitable to evaluate changes in CASA-Q scores between the acute state, when these symptoms are more severe, and following recovery as determined by the clinician and other clinical parameters, when these symptoms should be less severe.

A failure to reflect the observed improvement in the clinical course of an exacerbation would therefore indicate that the CASA-Q may be unsuitable for maintenance treatment settings. The milder the exacerbation the more likely the symptom changes will resemble symptom improvements seen for stable patients receiving maintenance therapy, hence the selection of mild and moderate exacerbations as most relevant.

Exacerbations of COPD and chronic bronchitis are a major cause of morbidity, mortality, and reduced health-related quality of life.[3–5] During exacerbations patients suffer from increased respiratory symptoms such as dyspnea, cough and sputum expectoration.[3] During the clinical course of an exacerbation, symptoms increase, and, depending on severity, lead patients to intensify their respiratory medication or to seek care from a health care professional. Subsequent to treatment, symptoms decline and may resolve to previous levels or may remain permanently worse than before the event.[6,7] While several studies investigated the resolution of physiologic outcomes or dyspnea, there is only limited information about patient-reported resolution of cough and phlegm [7,8] and their associated impact on well-being during recovery from acute exacerbations of COPD or chronic bronchitis.[9]

Methods

Patients and setting

After IRB approval and written informed consent, female or male patients 40 years or older with an investigator diagnosis of COPD or chronic bronchitis were enrolled at the onset of a mild or moderate exacerbation (i.e. within $\leq$48 h of symptoms). Exacerbations were defined as an increase or new onset of at least two lower respiratory symptoms related to COPD/chronic bronchitis, with at least one symptom lasting for three or more days and requiring a change in treatment. Lower respiratory symptoms included: shortness of breath, sputum production (volume), sputum purulence, cough, wheezing, and chest tightness. A change in treatment required the prescription of antibiotics and/or systemic steroids (moderate exacerbation) or a significant change of prescribed respiratory medication (mild exacerbation). Investigators had to confirm the presence and time of onset of a mild or moderate exacerbation via a 'verification' case report form that queried all parts of the definition individually. Severe exacerbations were defined as those requiring hospitalisations and were an exclusion criterion. Other exclusion criteria were a history of asthma, cystic fibrosis, bronchiectasis, active pneumonia or tuberculosis. Patients had to be current or former smokers with a history of at least 10 pack-years.

Patients were followed for a total of 6 weeks, and had clinical visits at day 1 (visit 1), day 8 (visit 2), day 15 (visit 3), and day 43 (visit 4). At each clinical visit, the CASA-Q was administered and the investigator assessed the clinical course of the exacerbation. The patients received routine medical treatment for their exacerbation at the discretion of the investigator. Additionally, they were provided with albuterol rescue medication. Spirometry with post-bronchodilator measurement of both the Forced Expiratory Volume in 1 s (FEV-1) and Forced Vital Capacity (FVC) was performed according to ATS standards [10] at the last visit in order to characterize patients' lung function. Arterial oxygen saturation was assessed at every clinical visit via pulse oximetry.

The study was conducted in seven study sites in the United States, started in November 2007 and completed in March 2008.

Patient-administered questionnaires

The CASA-Q has been described in detail elsewhere.[2] Briefly, the questionnaire was developed and initially validated to assess the symptoms of cough and sputum based on the description of symptom frequency and severity, and their impact on daily activities. The cough and sputum domains have three items each, whereas the cough impact domain consists of eight items, and the sputum impact domain of six items (see appendix). Each item is answered on a scale from 'never' to 'always' (for frequency) or from 'not at all' to 'a lot/extremely' (for intensity), each type using five categories. All items are rescored from 1–5 to 0–4, and then reverse scored such that better responses have higher scores. Within each domain, items are summed and rescaled using the following algorithm: (sum rescored items)/(range of rescored item sum) × 100. This results in CASA-Q domain scores that range from 0 to 100, with higher scores associated with fewer symptoms/less impact due to cough or sputum. No overall score is being calculated. The CASA-Q is paper-administered and has a 7-day recall period. This recall period was selected because of the chronic nature of chronic bronchitis and COPD and the fact that important impacts in patients in the intended setting (i.e. maintenance treatment of cough and sputum symptoms) do not happen on a daily basis but will likely be covered within one week.

At the last visit, the patient-assessed symptom changes since the enrolment visit by answering the question '*Check the one number that best describes how your cough and phlegm symptoms are now, compared to the day you started in the study*' on a 7-item response scale from 'very much better' to 'very much worse' (Patient Global Impression of Change, PGI-C).

Patients completed a daily symptom diary (for the wording of the diary questions, please refer to footnote 2 under Table 2.), and documented their morning Peak Expiratory Flow (PEF) rate and their number of puffs/day of rescue medication during the entire study period. The diary was used to monitor symptoms over time, supplementing the physician's and patient's assessments of change in symptoms. This was done in order to demonstrate that the underlying clinical construct which the CASA-Q is supposed to measure would indeed change over time as expected. Additionally, the cough and sputum items of the diary were expected to correlate highly with the respective cough and sputum symptom domains of the CASA-Q (see below for analysis details), assessing the validity of the CASA-Q.

Clinician-administered questionnaires

The assessment of the clinical course of the exacerbation was recorded at each visit on a scale from 'worse', 'no improvement', 'improved' or 'recovered', based on the investigator's judgment of the presenting patient's respiratory symptoms compared to the enrolment visit (Clinical Assessment of Recovery, CAR). Similar to the PGI-C, the investigator recorded at the last visit the clinician's impression of change with a corresponding question (Clinician Global Impression of Change, CGI-C).

Statistical analysis

For an approximation of the sample size, previously observed standard deviations (SD) were utilized.[2] For a power of 90% to detect a within group difference in the CASA-Q domain scores between enrolment and the last study visit of 0.5 SD, 44 subjects were required. In order to account for the unknown SD in an exacerbation setting, the descriptive character of psychometric analyses and patients discontinuing the study early, 65 were enrolled.

The mean CASA-Q domain scores were calculated for each visit, overall and for patient subgroups of interest. Such subgroups were patients classified as 'improved', 'unchanged' or 'worse' by any of the three relevant measures (PGI-C, CGI-C, CAR). A minimum sample size for any subgroup analysis of 20 patients was pre-specified. The maximal CASA-Q score differences (i.e. change scores) were expected between day 1 and 43, or day 8 and 43. The rationale for using both differences, from day 1 *and* day 8 to day 43 is to ensure capturing the 'peak' of the exacerbation as the CASA-Q has a 7-day recall period. CASA-Q data collected at the first visit may partly reflect days where the patient was not (yet) in the exacerbation as the inclusion criterion required a symptom onset within 48 h of enrolment.

The primary analysis was pre-specified as assessing the responsiveness of the four CASA-Q domain scores using standardized effect sizes (SES), defined as the differences in relevant scores divided by their pooled standard deviation (SD). For this purpose, the mean change scores between assessments (i.e. day 1/8 and day 43) were calculated for each of the CASA-Q domains and patient subgroups (see above for definition of groups). Then, each mean change on the CASA-Q domain scores was converted to an SES. An effect size between 0.20 (0.2 SD) and 0.49 is considered as small, between 0.5 and 0.79 as medium, and above 0.79 as large.[11] P-values for SES were derived from paired t-tests, testing mean SES differences from zero (with $p < 0.05$ considered significant).

Mean changes in diary scores were calculated and tested for statistical significance using a generalized linear model for repeated measures for the morning PEF and rescue medication, i.e. the 'objective' measures of the clinical course of the exacerbation. Arterial oxygen saturation was assessed with the same statistical model, including baseline value as covariate.

Additionally, the CASA-Q cough symptom and sputum symptom domain scores were correlated to their respective diary item collected during the week corresponding to the CASA-Q recall period (Pearson correlation coefficients). For this purpose, 7-day means per patient were calculated for the relevant diary items. This mean response was correlated with the CASA-Q domains at days 8, 15, and 43. It was expected that the CASA-Q cough symptoms and sputum symptoms domains would correlate well with the diary items pertaining specifically to those symptoms ('*How often did you cough?*' and '*How often did you bring up phlegm?*).

In a post-hoc analysis, CASA-Q scores were exploratory stratified by smoking status (former vs. current). This analysis was performed expecting lower (i.e. worse) scores for smokers for all domain scores of the CASA-Q compared to former smokers. This additional analysis was supposed to support the

validity of the CASA-Q. All statistical analyses were performed using SAS version 9.1 (SAS Institute Inc., Cary, NC).

Results

Patient disposition

In total, 65 patients were enrolled into the study. Six patients were not eligible for analysis (study discontinuation ($n = 3$), hospitalisation ($n = 2$), concomitant lung cancer ($n = 1$)). Thus, 59 patients were analyzed (Table 1). Mean (standard deviation) disease duration was 5.5 (4.5) or 7.5 (5.0) years for patients with chronic bronchitis or COPD, respectively. By the trial exacerbation definition (see in 'methods'), all patients presented with a moderate exacerbation, receiving either oral steroids ($n = 53$, 90%), antibiotics ($n = 49$; 83%), or both. No patient presented with a mild exacerbation.

Clinical course

According to the physician's assessment (CAR), 17%, 66% and 17% of patients were 'worse/not improved', 'improved' or 'recovered', respectively, after eight days in the study. At day 43, this distribution changed to 83% in the 'recovered' and the remaining 17% in the 'improved' category. Six weeks after enrolment, the majority of patients were assessed as recovered from the exacerbation.

The course of the exacerbation according to patients' diary scores, morning PEF and rescue medication use is shown in Table 2. Mean weekly PEF increased from the week preceding day 8 to the week preceding day 43 by 10 L/min (not statistically significant); rescue medication use significantly decreased in the corresponding interval ($p = 0.0263$). Mean arterial oxygen saturation assessed by pulse oximetry increased from enrolment with 94.3% to 95.9% at day 43 ($p = 0.0397$).

CASA-Q responsiveness

Descriptively, in parallel with the clinical course of the exacerbation, the mean cough and sputum symptom and impact domain scores of the CASA-Q increased from day 1 to day 15 and remained then approximately the same until day 43 (Fig. 1).

All CASA-Q domain scores demonstrated responsiveness between day 1–43 and day 8–43 for all three assessment scales used to define 'improved' patient groups (i.e. using the PGI-C, CGI-C and the CAR). Table 3 demonstrates the SESs for CASA-Q change scores between initial presentation and the last visit above 1.0 for the cough domains, and between 0.77 and 0.92 for the sputum domains. Effect sizes calculated between day 8 and day 43 were lower, but still between 0.34 and 0.65. Both analyses used the PGI-C and CGI-C to define 'improved'. Results for the CAR were in the same order of magnitude (data not shown). There were not enough patients (i.e. <20) to allow for comparable analyses in patients classified as 'unchanged' or 'worse'.

Mean CASA-Q change scores between day 1 and 43 categorized by all PGI-C response options increased with improving categories (Table 4). For the 'a little better' category, changes in the cough domain scores were approximately twice as large as for the corresponding sputum domains scores.

CASA-Q validation

Pearson correlation coefficients between the cough and sputum diary items and the respective CASA-Q symptom domain scores were moderate to high, and ranged from |0.620| to |0.685| at day 8, |0.690| to |0.746| at day 15 and lastly, |0.599| to |0.801| at day 43. All correlations were statistically significant ($p < 0.0001$).

Table 1 Patient characteristics.

	Patient sample
At enrolment (*n*)	59
Investigator diagnosis of COPD/chronic bronchitis [*n*(%)]	54/5 (92/8)
Mean (SD) age [years]	61.1 (10.5)
Male/female gender [*n*(%)]	19/40 (32/68)
Caucasian origin [%]	95
Smoking history [*n*(%)]	
Former smoker	27 (46)
Smoker	32 (54)
Mean (SD) smoking history [pack-years]	60.14 (30.12)
Lung function at day 43 (*n*)[a]	57[b]
Mean FEV-1 (SD) [L]	1.47 (0.77)
FEV-1% predicted	56.4 (25.5)
Mean FVC (SD) [L]	2.41 (0.84)
COPD classification [*n*(%)][c]	
Not obstructed	19 (33)
Mild	2 (4)
Moderate	14 (25)
Severe	13 (23)
Very severe	9 (16)

[a] All post-bronchodilator values.
[b] Two patients with missing lung function measurements.
[c] May not add up to 100% due to rounding.

Table 2 Patient daily diary[a] parameters ($n = 59$).

	Day 8	Day 15	Day 43
Morning Peak Flow (L/min)	217.5 (82.99)	226.1 (81.41)	227.5 (95.26)
Rescue medication (number of puffs in 24 h)[b]	3.0 (2.89) /2.4	2.9 (2.92) /2.2	2.4 (2.43) /1.9
Breathlessness	3.2 (0.80)	2.9 (0.79)	2.9 (0.82)
Cough	3.3 (0.70)	3.0 (0.77)	2.9 (0.76)
Sputum	2.9 (0.86)	2.8 (0.94)	2.7 (0.90)

[a] All diary items: Weekly mean (SD) score for the 7 days preceding the clinical visit. Respective questions on breathlessness, cough and sputum for the preceding 24 h period were: 'How short of breath were you?', 'How often did you cough?', 'How often did you bring up phlegm?' on a scale from 1 to 5 ('not at all/never' to 'a lot/always').
[b] Mean (SD)/median.

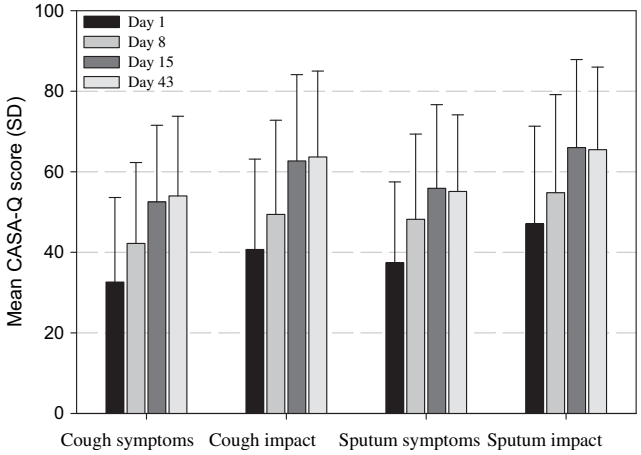

Figure 1 Mean CASA-Q domain scores by day. Higher CASA-Q domain scores are associated with fewer incidents/implications due to cough or sputum. Scores range from 0 to 100.

Descriptively, mean CASA-Q scores for current versus former smokers differed in the cough domains by at least 11 and up to 21 points, and in the sputum domains by at least 8 and up to 20 points (Fig. 2). Corresponding domain scores were always lower for current than for former smokers, indicating a higher symptom severity and impact of both cough and sputum. However, due to small sample sizes per stratum ($n = 27$ former smokers, $n = 32$ current smoker), those results have to be considered exploratory.

Discussion

This study assessed the responsiveness of the CASA-Q, a new 20-item questionnaire designed to measure the severity and impact of cough and sputum in patients with COPD and chronic bronchitis. The exacerbation setting was used as patients will present with cough and sputum symptoms (i.e. those symptoms are part of the definition of an exacerbation) that would decline over time, as the event resolves. Multiple clinical and patient-reported measures were used to confirm the presence of heightened symptoms on day 1 (enrollment) and that patient improvement had taken place at subsequent CASA-Q assessments (days 8, 15 and 43).

The CASA-Q was able to measure changes between the patient presentation and subsequent visits in all of its four domains. Patients' cough and sputum symptoms as well as their impact improved consistently during the first two weeks after initial presentation and initiation of treatment. Thereafter, however, patients generally did not report any additional improvements in cough and sputum symptoms or impact of those on the CASA-Q, possibly indicating their usual impairment level due to the underlying chronic respiratory disease.

This course of symptom resolution was consistent with earlier findings by Seemungal et al. who reported a median time to recovery of 7 (range 4–14) days for symptoms and of 6 (range 1–14) days for PEF.[12] The median PEF decrease of 6.6 L/min reported from another exacerbation study by these authors was comparable to what was obtained in the present study.[3] Recently, Vijayasaratha and Stockley described different symptom lengths for treated exacerbations of COPD ranging from a mean of 12 days for patients' subjective return to pre-exacerbation symptom levels, to 14 days for resolution of sputum color and volume.[13] Spencer et al. used the St George's Respiratory Questionnaire (SGRQ) to evaluate the health status of patients presenting with an acute exacerbation of chronic bronchitis and found the greatest improvement occurring within the first 4 weeks.[14] Since the SGRQ is measuring different concepts than the CASA-Q and is often administered with a recall period of four weeks, their findings are not inconsistent with ours. Another group has developed a daily measure, the breathlessness, cough, and sputum scale (BCSS), a brief, three-item, patient-reported outcome measure that has been developed to evaluate symptomatic improvement in patients with COPD but does not assess the impact of symptoms on patients' well-being.[7,8] They were able to document with the BCSS a symptom increase and decrease within seven days of the exacerbation. Score changes of the BCSS for moderate exacerbations were approximately 16% of the maximal score.

Table 3 Responsiveness: Mean change scores and Standardised Effect Sizes of the CASA-Q domains for patients 'Improved' at day 43 according to the Patient ($n = 57$) and Clinician Global Impression of Change ($n = 58$).

	Change scores between day 1 and 43				Change scores between day 8 and 43			
	Mean	SD	SES[a]	*P* value[b]	Mean	SD	SES[a]	*P* value[b]
Patient Global Impression of Change								
Cough symptoms	21.93	21.28	1.04	<0.0001	12.72	18.77	0.64	<0.0001
Cough impact	23.36	19.61	1.04	<0.0001	15.02	18.31	0.65	<0.0001
Sputum symptoms	17.98	20.82	0.88	<0.0001	7.89	15.06	0.38	0.0002
Sputum impact	18.86	19.21	0.77	<0.0001	11.33	18.78	0.47	<0.0001
Clinician Global Impression of Change								
Cough symptoms	21.70	21.29	1.03	<0.0001	11.93	19.57	0.59	<0.0001
Cough impact	23.44	19.30	1.04	<0.0001	14.60	18.69	0.62	<0.0001
Sputum symptoms	18.39	19.98	0.92	<0.0001	7.18	15.72	0.34	0.0010
Sputum impact	19.04	18.50	0.78	<0.0001	11.14	18.62	0.45	<0.0001

[a] Within group standardized effect sizes (SES) calculated as mean change score between two time points divided by standard deviation at first time point.
[b] *P*-values are derived from paired t-tests testing mean SES differences from zero.

Table 4 Mean CASA-Q change score by patient assessment of change category.

PGI-C Response	*n*	Mean change in CASA-Q domain score (SD) between day 1 and 43			
		Cough symptom	Cough impact	Sputum symptom	Sputum impact
Very much better	18	26.9 (21.30)	28.6 (21.28)	27.8 (18.96)	25.5 (22.41)
Much better	18	19.4 (22.51)	22.9 (19.41)	18.5 (22.06)	19.4 (14.92)
A little better	21	19.8 (20.49)	19.2 (18.09)	9.1 (18.05)	12.7 (18.37)
No change	1	—	—	—	—
A little worse	1	—	—	—	—
Much worse	0	—	—	—	—
Very much worse	0	—	—	—	—
Total	59	21.3 (21.29)	23.0 (19.44)	17.7 (20.59)	18.4 (19.06)

For the CASA-Q, all calculated standardized effect sizes were large. This is attributable to the clinical setting (maintenance treatment of relatively stable patients versus patients with an acute exacerbation), rather than necessarily a characteristic of the CASA-Q. The CASA-Q will need to be investigated in an interventional maintenance therapy setting to assess the responsiveness.[15] The change scores derived in this study could be considered the maximal responsiveness of the scale.

This study furthermore supported the validity of the CASA-Q by showing that active smokers reported a more intense severity of both cough and sputum and their impact than former smokers during an acute exacerbation and throughout its resolution. The Lung Health Study revealed a lower prevalence of chronic sputum expectoration and cough in sustained quitters from smoking, suggesting some reversibility of smoke-induced airway changes.[16] Accordingly, a reduction of bronchial epithelial mucin stores and

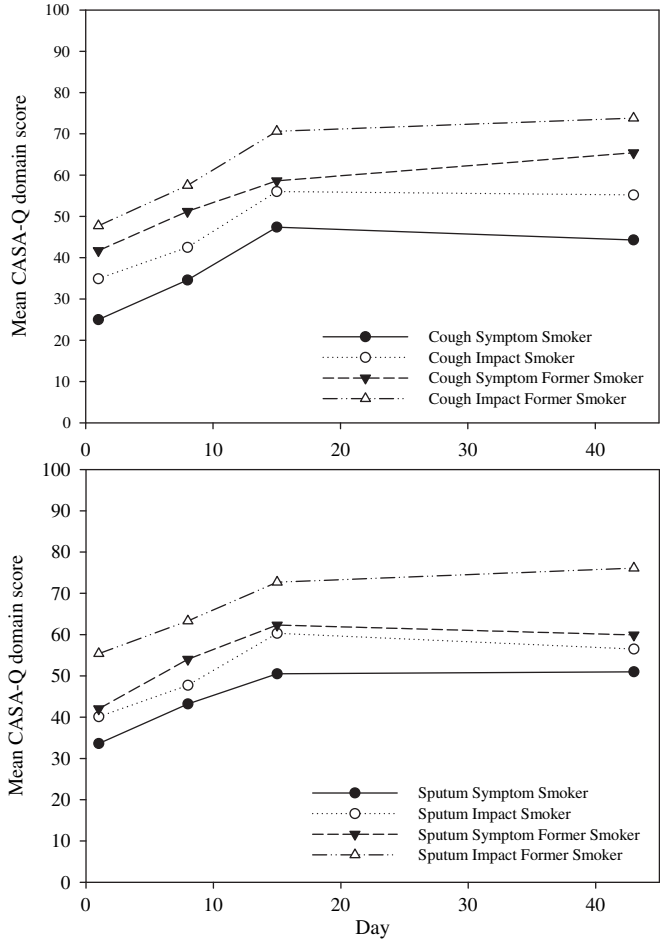

Figure 2 CASA-Q domain scores by day, stratified by smoking status. Upper panel: CASA-Q cough domains. Lower panel: CASA-Q sputum domains. Higher CASA-Q domain scores are associated with fewer incidents/implications due to cough or sputum. Scores range from 0 to 100.

squamous cell metaplasia in former smokers was obvious when compared to current smokers.[17] The present study indicated that patient-reported cough and sputum are distinct between smokers and former smokers even during acute exacerbations of COPD and chronic bronchitis.

A possible limitation of this study was the inherent inability to characterize patients by spirometry at study entry. Thus, we obtained some discordance between clinician diagnosis of COPD or chronic bronchitis at enrollment and post-bronchodilator spirometry at the study end. However, spirometry is still uncommonly used for the diagnosis of COPD in managed care plans in the US,[18] and some inaccuracy of COPD diagnosis has been reported from studies utilizing post-bronchodilator pulmonary function testing.[19,20] However, as the CASA-Q has been developed and validated in both patient groups, whether obstructed or not, this is not a limitation for assessing the responsiveness of the instrument. Another aspect that will need further investigation was the lack of discrimination of the CASA-Q cough domains between patient-assessed improvement where comparable change scores were observed for the 'a little better' and the 'much better' category. In a previous validation study, we could not find a strong correlation between cough measured via a unidirectional contact microphone and respiratory inductance plethysmography and the CASA-Q cough domains.[2] Both of these findings may indicate that cough could be particularly difficult to measure, possible due to patients getting used to their cough and adopting certain coping mechanisms.

In conclusion, the CASA-Q exhibited the ability to detect changes in cough and sputum symptoms and their impact in patients recovering from an exacerbation of COPD or chronic bronchitis. Based on these findings, the CASA-Q will need to be further evaluated in an interventional setting of relatively stable patients to establish its responsiveness in this patient population.

Conflict of interest statement

Brigitta Monz, Michael Nivens and Kay Tetzlaff are employees of Boehringer Ingelheim. Paul Sachs has received financial support for participation in speaker's boards and research activities. Recent industry sponsors with an interest in COPD were Boehringer Ingelheim, GlaxoSmithKline, Pfizer and AstraZeneca. Paul Sachs was the Coordinating Investigator for this study. Jeffrey McDonald and Bruce Crawford acted as paid consultants to Boehringer Ingelheim on this study.

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Boehringer Ingelheim funded this research. The study was designed by all authors, including those employed by the funding source. Data were collected by Boehringer Ingelheim, and the analyses performed by Mapi Values and Boehringer Ingelheim. All authors had unrestricted access to the data, participated in the interpretation of the findings, and vouch for the veracity and completeness of the data. The first draft of the manuscript was written by Drs. Tetzlaff and Monz with extensive review and revisions by all co-authors.

Appendix: Items of the CASA-Q (US English version)

Each item is answered ranging from ''never'' to ''always'' or from ''not at all'' to ''a lot/extremely'' as applicable; each type using five categories.
Over the last 7 days,

1. How much did you cough when you woke up in the morning?
2. How often did you cough during the day?
3. How often did you have coughing bouts?
4. How often were you tired after coughing?
5. How often did coughing make you short of breath?
6. How annoyed were you by your cough?
7. How often did you avoid going to public places because of your cough (for example, movie theaters, restaurants, etc)?
8. How often were your usual activities interrupted by your cough (for example, driving, hobbies, working around the house)?
9. How often did your cough interrupt your conversations with others (for example, phone conversations and face-to-face)?
10. How often did your cough wake you up, prevent you from falling asleep or falling back to sleep?
11. How often were you uncomfortable about bothering other people while coughing?
12. How thick was your phlegm?
13. How often did you bring up phlegm?
14. How often did your phlegm make it difficult for you to breathe?
15. How difficult was it for you to bring up phlegm?
16. How often did you feel uncomfortable about bothering other people while bringing up phlegm?
17. How annoyed were you by your phlegm?
18. How often did your phlegm interfere with your ability to speak?
19. How often did your phlegm prevent you from going to public places (for example, movie theaters, restaurants, etc)?
20. How often did you have to interrupt your usual activities to get rid of your phlegm (for example, driving, hobbies, working around the house)?

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