Discriminative Properties and Validity of a Health Status Questionnaire in Obstructive Airway Disease Patients: The Airways Questionnaire 20

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OBJECTIVE: To evaluate the discriminative properties and validity of the Airways Questionnaire 20 (AQ20) in a sample of airway obstructed patients and to compare its properties with those of the St George's Respiratory Questionnaire (SGRQ) and the Short Form 36 (SF-36).

PATIENTS AND METHODS: A convenience sample of 47 subjects was recruited from among 61 consecutive patients referred to an outpatient clinic specialized in airway obstructive diseases. All subjects completed the AQ20, SGRQ, and SF-36. Other measures were the baseline dyspnea index (BDI), 6-minute walk test (6MWT) distance, spirometry, results of arterial blood gas analysis, and body mass index.

RESULTS: The AQ20 showed very good correlation with the SGRQ total score (ρ=0.84, *P*<.001) and moderate correlation with all SF-36 domains (physical capacity, ρ=–0.53; physical functioning, ρ=–0.61; bodily pain, ρ=–0.55; general health, ρ=–0.59; vitality, ρ=– 0.55; social functioning, ρ=–0.57 ; emotional role functioning, ρ=–0.51; mental health, ρ=–0.61; all *P*<.001). The BDI and the 6MWT were the best predictors of AQ20 score (r^2=0.31) in the regression model. An area under the receiver operating characteristic curve of 0.91 (*P*<.001) indicated a high level of accuracy for the AQ20, using the SGRQ as the gold standard.

CONCLUSION: This study shows that the AQ20 is an accurate health status questionnaire in patients with moderate-to-severe airway obstruction. It could be an alternative to longer, traditional questionnaires such as the SGRQ.

Key words: *Questionnaires. Quality of life. Health Status. Statistics. Dyspnea. Chronic obstructive pulmonary disease.*

Propiedades discriminativas y validez de un cuestionario de salud en pacientes con enfermedad obstructiva de la vía respiratoria: el Airways Questionnaire 20 (AQ20)

OBJETIVO: Evaluar las propiedades discriminativas y la validez del cuestionario Airways Questionnaire 20 (AQ20) en un grupo de pacientes con cuadros de obstrucción de la vía respiratoria, y comparar sus propiedades con las de los cuestionarios St. George's Respiratory Questionnaire (SGRQ) y Short Form 36 (SF-36).

PACIENTES Y MÉTODOS: De un grupo de 61 pacientes consecutivos, remitidos a una consulta ambulatoria especializada en enfermedades obstructivas de la vía respiratoria, se seleccionó una muestra de conveniencia constituida por 47 pacientes. Todos los pacientes completaron los cuestionarios AQ20, SGRQ y SF-36. Otros parámetros evaluados fueron el índice de disnea basal, la distancia recorrida en la prueba de la marcha de 6 min, los resultados de la gasometría en sangre arterial y el índice de masa corporal.

RESULTADOS: El cuestionario AQ20 presentó una correlación estrecha con la puntuación del SGRQ total (ρ = 0,84; p < 0,001) y una correlación moderada con todos los dominios del SF-36 (capacidad física, ρ = –0,53; actividad física, ρ = –0,61; dolor corporal, ρ = –0,55; salud general, ρ = –0,59; vitalidad, ρ = –0,55; actividad social, ρ = –0,57; actividad de rol emocional, ρ = –0,51; salud mental, ρ = –0,61; en todos los casos, p < 0,001). El índice de disnea basal y la distancia recorrida en la prueba de la marcha de 6 min fueron los mejores elementos predictivos de la puntuación del AQ20 (r^2 = 0,31) en el modelo de regresión. El área bajo la curva de eficacia diagnóstica, que fue de 0,91 (p < 0,001), indicó un elevado grado de precisión del cuestionario AQ20, utilizando como prueba de referencia el SGRQ.

CONCLUSIONES: Los resultados obtenidos en este estudio demuestran que el AQ20 es un cuestionario preciso de salud en los pacientes con obstrucción de la vía respiratoria de grado moderado a intenso. Podría constituir una alternativa a los cuestionarios tradicionales más complejos, como el SGRQ.

Palabras clave: *Cuestionarios. Calidad de vida. Nivel de salud. Estadística. Disnea. EPOC.*

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Introduction

The study of health and quality-of-life factors in chronic respiratory diseases and their association with a high degree of disability is considered an important issue.[1] Quality-of-life questionnaires enable an evaluation of treatment benefits that is objective but holistic and patient oriented, permitting the comparison of different types of training and interventions. Generic quality-of-life questionnaires, such as the Short Form 36 (SF-36), can be used to compare the relative burden of different diseases and the relative benefits of different treatments.[2] Disease-specific questionnaires, however, focus on domains most relevant to certain diseases in order to describe the impairment in a patient's quality of life. The St George's Respiratory Questionnaire (SGRQ) is one of the most commonly used disease-specific health-status questionnaires for patients with airway obstruction. It contains 76 items and takes up to 15 minutes to answer in the Brazilian setting.[3] Shorter health status questionnaires, however, would be highly desirable in order to simplify evaluation, especially if they demonstrate good correlation with longer, validated tools.[4]

The Airways Questionnaire 20 (AQ20) is a short obstructive-airway-disease–specific questionnaire developed by Quirk and Jones.[5] It consists of 20 simple questions with yes/no answers. The validation process in Brazil has demonstrated good reproducibility (intraclass correlation coefficient for intraobserver variability, α=0.90; interobserver analysis of variance, α=0.92; P<.001).[3] Less than 5 minutes is needed to obtain answers and calculate the AQ20 score, but only a few studies have evaluated the performance of the AQ20 despite its being an extremely fast, simple tool for assessing health status.[5-10] While both generic and specific instruments can measure health status, they have different strengths, and the relationships among the AQ20, SGRQ, and SF-36 have not yet been fully described in the literature. The objectives of this study were to evaluate the discriminative properties and validity of the AQ20 in a sample of airway obstructed patients; to compare its properties with those of the SGRQ and SF-36; and to observe whether lung function, dyspnea sensation, gas exchange parameters, and exercise tolerance influences the AQ20 scores.

Patients and Methods

Patients

A convenience sample of 47 subjects was recruited. This sample size had an 80% power to detect a correlation coefficient of 0.40 or higher between the AQ20 and 2 other health status questionnaires, the SGRQ and the SF-36, with an α level of .05.

The outpatient clinic of the Federal University of São Paulo, Brazil, receives patients referred by pulmonary physicians for evaluation before they enter the university's pulmonary rehabilitation program. An average of 200 appointments with new patients are scheduled each year. Three quarters of the referred patients have chronic airway obstruction. From August 2001 to December 2002, all the obstructive airway disease patients (n=61) were approached in consecutive referral order, and 47 were enrolled in the study. The 14 (23%) patients who were initially considered but were excluded during the recruitment process included 2 who did not return for subsequent visits, 2 who had a positive exercise test for myocardial ischemia, and 10 who were hospitalized for pulmonary disease exacerbation within the last 4 weeks and had the appointment rescheduled). The protocol was approved by the ethics committee of the university and consent was obtained from all patients.

The inclusion criteria were: *a)* a diagnosis of a disease involving chronic airway obstruction, specifically chronic obstructive pulmonary disease (COPD) diagnosed in accordance with the criteria of the Global Initiative for Chronic Obstructive Lung Disease (GOLD),[11] bronchiectasis, bronchiolitis,[12] or asthma in accordance with the criteria of the Global Initiative for Asthma[13]; *b)* absence of exacerbations or hospitalizations during the preceding 4 weeks; *c)* limitation in activities of daily living, despite optimal medical therapy; *d)* no changes in the treatment during the preceding 4 weeks; and *e)* current smoking or smoking within the last 2 months in the case of an ex-smoker. Patients with significant, uncontrolled comorbidity such as severe joint disease or cardiovascular disease were excluded to avoid the influence of nonpulmonary diseases.

Measurements

All measurements were taken as part of the initial evaluation protocol of the university's outpatient clinic. First, the 3 health status questionnaires were self-administered in a quiet room. The patients were left to fill out the questionnaires without any intervention on the part of the investigators. In order to avoid any missing answers, a researcher checked all questionnaires after they were returned by the patients. If any data were missing, the questionnaire was returned so the patient could respond. All health status questionnaires used in this protocol were previously validated in Brazilian Portuguese (AQ20,[3] SF-36,[14] and SGRQ[15]), by means of formal translation and back translation procedures to obtain the final local language version; then the construct validation method was applied as previously described by the International Quality of Life Assessment Project Group[16] and as used in other validation studies.[17] The baseline dyspnea index (BDI) was used to assess shortness of breath.[18] Lung function assessment was performed in accordance with American Thoracic Society criteria.[19,20] Blood gas analysis was performed in all patients after they had been breathing room air while seated for 15 minutes. The 6-minute walk test (6MWT) was performed twice on different days in a 30-meter corridor, and the best distance walked was recorded.[20] Oxygen supplementation (through nasal prongs or a Venturi mask) was offered to the patients when it was needed to maintain a level of oxygen saturation (SpO_2) of more than 88% during the 6MWT. The body mass index was calculated by dividing weight in kilograms by height in centimeters squared.

Statistical Analysis

All results are presented as mean (SD) and range. The Kolmogorov–Smirnov test was performed to confirm data distribution. Relationships between 2 sets of nonparametric data were analyzed with the Spearman rank correlation coefficient (ρ). A subsample of patients with moderate-to-severe disease ($FEV_1 \leq 50\%$) was compared to the whole group to determine the effect of flow limitation on the health status correlations. Stepwise multiple regression analysis was performed to identify the variables that could best predict the AQ20 scores.[21] Independent variables were those that are important in the evaluation of respiratory rehabilitation candidates. Thus, the variables selected were forced expiratory volume in 1 second (FEV_1, % predicted), forced vital capacity (FVC), SpO_2, the

BDI, and the distance walked in the 6MWT. Dependent variables for the regression model were the AQ20 and SGRQ total scores, each expressed as a percentage of the maximum possible score. The area under a receiver operating characteristic (ROC) curve constructed for each test was calculated to determine the cutoffs that would give the optimal combination of sensitivity and specificity for various SGRQ and AQ20 case definitions. A level of significance of *P* less than .05 was adopted. Statistical analyses were performed with SPSS, version 10.0 (Chicago, Illinois, USA).[22]

Results

BDI, physical function and health status scores on all 3 questionnaires are shown in Table 1 for the 47 consecutive patients with chronic airway obstruction. Forty (85.1%) were classified as COPD patients and 7 (14.9%) as non-COPD patients. Of the non-COPD patients, 4 (8.5%) were diagnosed with bronchiectasis as a sequela of pulmonary tuberculosis, 2 (4.3%) with severe asthma, and 1 (2.1%) with bronchiolitis secondary to systemic sclerosis. Nineteen patients (40.4%) were female and the mean FEV_1 (% predicted) was 46.4% (18.4%). All patients were able to read, understand, and answer the questions alone. The average health status scores for the sample showed impairment, yet some patients showed normal or near-normal heath status even though they had been referred to the clinic for consideration for a respiratory rehabilitation program. Both AQ20 and SGRQ total scores were normally distributed according to the Kolmogorov–Smirnov test, as shown in Figure 1 (AQ20, *P*=.82; SGRQ, *P*=.92).

The significant Spearman correlation coefficients in Table 2 show that both the AQ20 and SGRQ were moderately correlated with all domains of the SF-36. The AQ20 showed an excellent correlation with the SGRQ total score (ρ=0.84, *P*<.001). The results of a separate analysis performed for patients with moderate-to-severe disease (FEV_1 ≤50%) is also shown in Table 2. The correlation between the AQ20 and the SGRQ total scores increased to ρ=0.91 (*P*<.001) in this subsample of patients. In order to evaluate the accuracy of the AQ20 in predicting quality-of-life scores on the SGRQ, a ROC curve was constructed taking into consideration the SRGQ as the gold standard, with a total score cutoff point of 50% of the maximum possible total as the threshold between moderate and severe disease. The area under the curve was 0.91 (95% confidence interval, 0.82-0.99; *P*<.001) and a score of 52.5% of the maximum possible score on the AQ20 was identified as the best predictor of a SGRQ score of 50% (Figure 2).

Significant Spearman correlation coefficients were calculated between the AQ20 total score and FVC (% predicted) (ρ=–0.35, *P*<.05) and BDI (ρ=–0.46, *P*<.01). The SGRQ total score was correlated only with the BDI (ρ=–0.62, *P*<.001). Significant correlations between SF-36 domain scores and clinical and physiologic measures were found for body mass index and SF-36 general health perception, ρ=0.35 (*P*<.02); FVC (% predicted) and SF-36 physical functioning, ρ=0.29 (*P*<.05); and the 6MWT and SF-36 physical functioning, ρ=0.35 (*P*<.02). The significant correlations between the BDI and SF-36 domains are shown in Table 3; no significant correlation was observed between the BDI and the SF-36 emotional role or mental health domains. All other correlations between SF-36 and clinical or physiologic factors were not significant.

TABLE 1
Patient Characteristics and Health Status in 47 Consecutive Patients With Airway Obstructive Diseases*

	Mean (SD)	Range
Age, y	65.3 (11.0	33-84
FEV_1, % predicted	46.4 (18.4)	13.0-90.8
FVC, % predicted	76.4 (23.87)	13.1-142.0
FEV_1/FVC, % predicted	44.7 (14.7)	0.33-73.0
PaO_2, mm Hg	66.3 (10.30)	41.7-87.0
$PaCO_2$, mm Hg	39.3 (5.89)	31.0-60.6
Body mass index, kg/m^2	25.56 (5.54)	15.5-39.5
Baseline dyspnea index	6.64 (1.96)	3-11
6MWT, m	521.3 (92.9)	224-630
AQ20, % of maximum possible score	51.3 (25.9)	0-100
SGRQ, % of maximum possible score		
Symptoms	58.3 (23.1)	17.8-91.0
Activity	64.5 (17.6)	30.8-100.0
Impact	43.2 (19.4)	4.7-79.0
Total	51.8 (147.0)	17.4-79.6
SF-36, % of maximum possible score		
Role physical	47.1 (25.5)	0.0-95.00
Physical functioning	49.3 (42.1)	0.0-100.0
Bodily pain	66.1 (28.5)	10.0-100.0
General health perceptions	56.7 (23.4)	10.0-94.00
Vitality	58.2 (23.1)	5.0-100.0
Social functioning	69.8 (29.7)	0.0-100.0
Role emotional	54.6 (42.0)	0.0-100.0
Mental health	62.5 (22.3)	8.0-100.0

* FEV_1 indicates forced expiratory volume in 1 second; FVC, forced vital capacity; 6MWT, 6-minute walk test; AQ20, Airways Questionnaire 20; SGRQ, St George's Respiratory Questionnaire; SF-36, Short Form 36.

Stepwise multiple regression analysis was used to identify variables that could best predict the AQ20 and SGRQ scores. Independent variables were FEV_1 (% predicted), FVC (% predicted) and SpO_2. After adjusting for 6MWT, the best predictor was the BDI, which was 5.97 times more predictive of lower AQ20 scores. The BDI accounted for 31% of the variance in the AQ20 total score (r^2=0.31, *P*<.01). In the SGRQ model, the only independent variable entered was the BDI, which accounted for 37% of the variance in the SGRQ total score (r^2=0.37, *P*<.01). Results are shown in Table 4.

Discussion

The AQ20 was developed to be an obstructive-airway-disease–specific health status questionnaire, its main features being that it is short and takes little time to complete (less than 5 minutes to answer and calculate a score according to previous experience in COPD patients[6]). One of the objectives of this study was to evaluate the validity

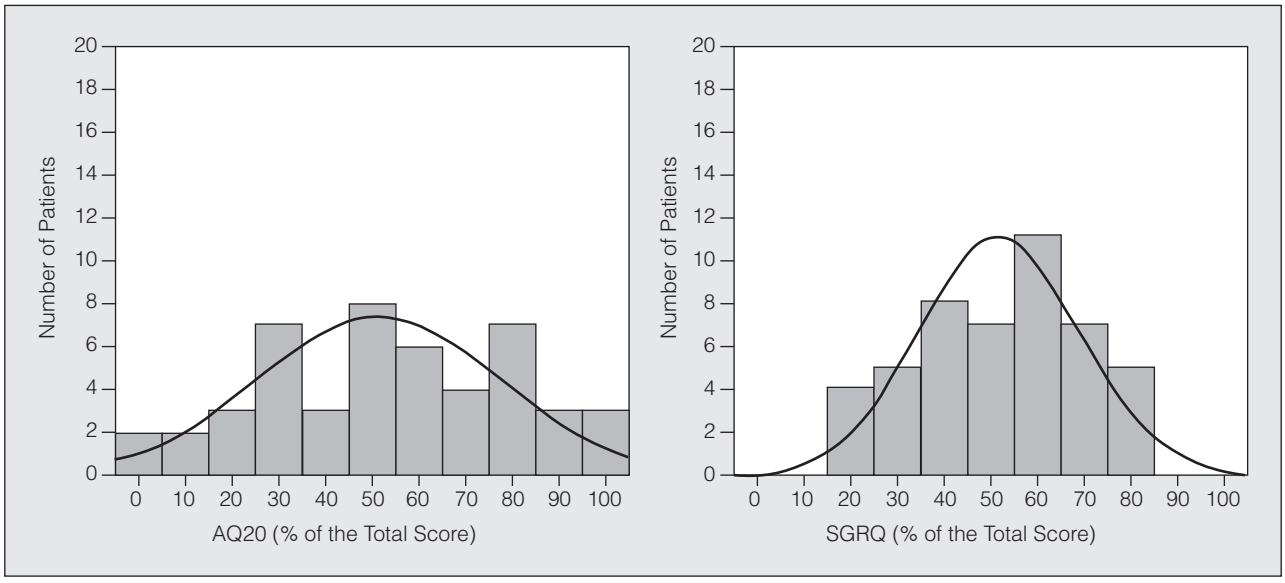

Figure 1. Frequency distribution histograms of the specific health status questionnaire total scores, each expressed as a percentage of the maximum possible score. AQ20 indicates Airways Questionnaire 20; SGRQ, St George's Respiratory Questionnaire.
Kolmogarov-Smirnov test. SGRQ (% of the total score): *P*=.82 (AQ20) and *P*=.92 (SGRQ).

of the AQ20 in all chronic airway obstructed patients referred to a university outpatient clinic. No patient who was enrolled was excluded from the analysis. On average, all patients had moderate-to-severe obstruction, dyspnea in the performance of daily activities, and physical limitation as evaluated by the 6MWT. Most of the patients had impaired health status when evaluated by both disease-specific questionnaires (the SGRQ and the AQ20). The generic health status questionnaire (the SF-36) also revealed impairment for all 8 domains in this study. In all but 2 SF-36 domains (physical role and general health perceptions), however, some patients had maximum health status scores (Table 1, ranges). The correlation between the AQ20 and the SGRQ was high in this study (ρ=0.84), as has been seen in the literature in other studies in patients with COPD (r=0.76[6] and r=0.86[7]) and asthma (r=0.80[5]). The higher the correlation coefficient, the more precisely the dependent variable can be predicted from the independent variable, but such data must be used with caution because a high correlation coefficient may not assess the clinical relevance of the variable.

The AQ20 has been said to display a ceiling effect, meaning that patients with mild disease according to spirometry will tend to have normal heath status scores.[7] This was not observed in our study, as the distributions of both SGRQ and AQ20 scores were normal in our study population of patients referred as candidates for respiratory rehabilitation, demonstrating that the AQ20, like the SGRQ, has good discriminating properties in patients with moderate-to-severe obstruction. The distribution of mean health status scores in our sample may not reflect the condition of the general outpatient population, however,

TABLE 2
Significant Spearman Rank Correlation Coefficients Between the Short Form 36 (SF-36) and the Airways Questionnaire 20 and the SF-36 and the St George's Respiratory Questionnaire for the 47 Patients With Airway Obstruction and for the Subsample With Forced Expiratory Volume ≤50% of Predicted*

SF-36 Domain	AQ20		SGRQ Total	
	Total Sample	FEV_1≤50%	Total Sample	FEV_1≤50%
Role physical	–0.61	–0.7	–0.67	–0.73
Physical functioning	–0.53	–0.66	–0.6	–0.62
Pain	–0.55	–0.6	–0.55	–0.61
Health perceptions	–0.59	–0.68	–0.58	–0.52
Vitality	–0.55	–0.64	–0.56	–0.57
Social functioning	–0.57	–0.57	–0.58	–0.55
Role emotional	–0.51	–0.62	–0.5	–0.61
Mental health	–0.61	–0.64	–0.55	–0.63

*AQ20 indicates Airways Questionnaire 20; SGRQ, St George's Respiratory Questionnaire; FEV_1, forced expiratory volume in 1 second. Scores were expressed as percentages of the maximum possible total for the study of correlations between them. All correlations are significant at P<.001.

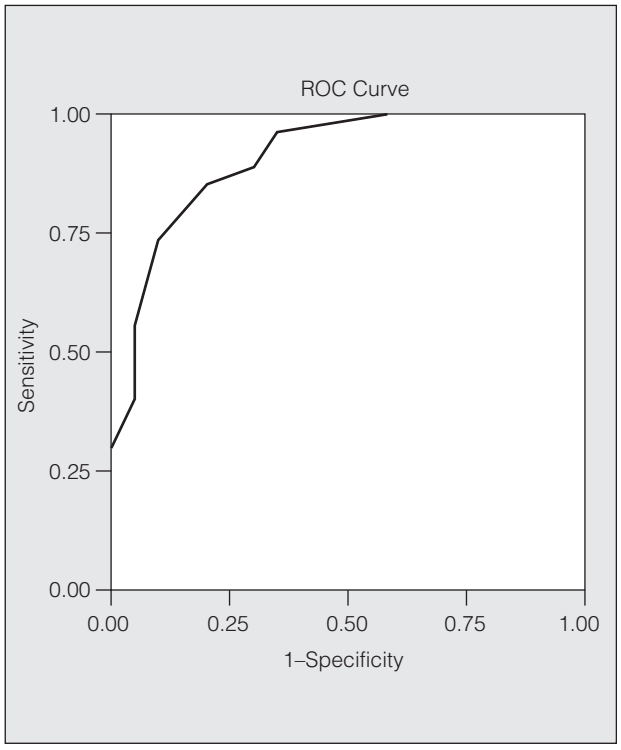

Figure 2. Receiver operating characteristic curve (ROC) showing the diagnostic sensitivity and specificity of the Airways Questionnaire 20 (AQ20) for distinguishing degree of quality-of-life impairment as defined by a St George's Respiratory Questionnaire (SGRQ) score as the gold standard (ie, mild-to-moderate quality of life impairment [SGRQ total score <50%] vs severe-to-very-severe impairment [SGRQ total score >50%]).

because a symptom or condition that limits the patient's lifestyle was already present, as it was one of the criteria for entering the program. These findings suggest the need for either modification of the AQ20 to permit the discrimination of heath status in mild cases, or its restriction to use in cases of moderate-to-severe obstruction. The cutoff point of 50% for the SGRQ total score was chosen for the analysis of the area under the ROC curve because this point discriminates mild-to-moderate from severe and very severe COPD disease according to the GOLD classification.[22] In this analysis, the area under the ROC curve of 0.91 indicated excellent accuracy for the AQ20

TABLE 3
Significant Spearman Rank Correlation Coefficients Between Short Form 36 (SF-36) Domain Scores and the Baseline Dyspnea Index (BDI)

SF-36 Domain	Correlation With the BDI
Role physical	0.49*
Physical functioning	0.37†
Pain	0.39‡
Health perceptions	0.33‡
Vitality	0.44†
Social activity	0.55*

*P<.001. †P<.01. ‡P<.05.

TABLE 4
Results of the Stepwise Multiple Regression Analysis of Predictors Assessed by the Airways Questionnaire 20 and the St George's Respiratory Questionnaire*

Model	Unstandardized Coefficient, β (SE)	95% Confidence Interval
AQ20, % of maximum score		
Constant	48.75 (20.85)†	6.43 to 91.08
BDI	–5.58 (1.71)‡	–9.06 to –2.11
6MWT, m	–0.10 (0.04)†	–0.29 to –0.10
SGRQ, % of maximum score		
Constant	85.98 (7.06)§	71.69 to 100.27
BDI	–5.30 (1.01)§	–7.35 to –3.26

*AQ20 indicates Airways Questionnaire 20; SGRQ, St George's Respiratory Questionnaire; BDI, baseline dyspnea index; 6MWT, 6-minute walk test.
†P<.05. ‡P<.01. §P<.001.

in the sample studied, and the AQ20 score that best predicted the designated SGRQ score of 50% was 52.5%.

Some association was found between the AQ20 and the SF-36 in this study, as confirmed by the statistically significant correlation coefficients with all domains, although lower sensitivity in discriminating health status is a known disadvantage of generic questionnaires.[23] However, following construct validation procedures, as in a similar comparison of the SF-36 and other specific and generic scales,[24] we saw correlations between the AQ20 and the SF-36 that were very similar to those found with the SGRQ. This observation supports the validity of this short questionnaire. The correlations among the AQ20, the SGRQ, and the SF-36 were found to be higher when the scores of patients with moderate-to-severe disease (FEV_1 ≤50%) were analyzed, showing further evidence supporting the validity of the AQ20. To our knowledge, this is the first report of a comparison of the AQ20 to the SF-36 and the SGRQ.

When pulmonary function parameters were evaluated, only the FVC (% predicted) was weakly correlated with the AQ20 total score. The physical function domain of the SF-36 questionnaire was also weakly correlated with the both FVC and the 6MWT distance. Despite the fact that nutritional status is an important issue in COPD patients, only the health perceptions domain of the SF-36 was associated with body mass index. However, only 3 patients in our sample had a body mass index less than 18 kg/m^2, so this aspect should be further analyzed with a larger sample including more undernourished patients. These observations reinforce the importance of using a generic questionnaire associated with a specific one when evaluating health status in pulmonary rehabilitation candidates with airway obstruction. Of course, the nonsignificant values found in this study must undergo careful analysis, as this study was not powered to detect weak correlations fact, only weak correlations have been found between the AQ20 and lung function tests in the literature.[5,6,7,9,10]

Dyspnea is one of the most important limiting symptoms in obstructive diseases, and it has usually been evaluated with the BDI. In our study, the BDI correlated with the AQ20 and SGRQ scores and with 6 of the 8 SF-36 domains (not with the emotional role and mental health domains). This finding shows the importance of this index and the real association of dyspnea with health status as measured by the AQ20, SF-36, and SGRQ questionnaires. Similarly, in the multiple regression analysis, the BDI was considered the best predictor of the AQ20 and SGRQ scores. In the model constructed for the SGRQ, the BDI accounted for 37% of the variance in total SGRQ score. In the AQ20 model, the BDI and distance walked in the 6MWT together were responsible for 32% of the variance, and this can be considered a partial confirmation of the validity of the AQ20. As mentioned above, dyspnea was unrelated to only 2 domains of the SF-36 (emotional role and mental health), and the influence of the BDI on the AQ20 score and on other SF-36 domains was similar as reflected by correlation statistics. These findings suggest that these 2 questionnaires have somewhat similar measurement properties, even though previously published data comparing the AQ20 and oxygen consumption found only a weak correlation.[7]

The 6MWT is commonly used to assess outcomes in rehabilitation candidates, as walking is an easy activity, and this makes it possible to integrate the emotional, psychological, and physical abilities of such patients. The finding of a significant correlation between distance walked and the AQ20 total score in the regression models of this study, supports the good measurement properties of these tools.

The limitations of this study would appear to be the use of a single setting (the pulmonary rehabilitation clinic) and an unbalanced proportion of the diseases included when recruiting patients. Although the university's outpatient clinic represented a "real life situation," such a setting may compromise the generalizability of our results to a certain degree, without invalidating the conclusions. Another limitation was the small sample size studied to explore secondary objectives. It is also known that pulmonary rehabilitation candidates have substantial disability and symptoms, despite optimal therapy. This sample may therefore not have reflected the whole outpatient population of patients with chronic obstructive airway disease and may have defined a better performance of the AQ20 in this subset of patients.

In summary, the AQ20 is an accurate health status questionnaire for use in moderate-to-severe airway obstructed patients. It shows a moderate correlation with the generic SF-36 and the concomitant use of these 2 questionnaires could be an alternative to traditional, longer questionnaires when a complete evaluation of health status is desirable but time is limited.

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