

Variability in Walk Test Conditions at Pulmonary Rehabilitation Programs in Latin America and on the Iberian Peninsula

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OBJECTIVES: 1) To determine the frequency of use of the 6-minute walk test in pulmonary rehabilitation programs in Latin America and on the Iberian Peninsula; 2) to identify how the test is performed and possible variations from center to center.

MATERIAL AND METHODS: A questionnaire was sent to 55 pulmonary rehabilitation centers in Latin America, Portugal, and Spain.

RESULTS: Forty-nine (89.1%) centers answered the questionnaire. Forty-seven (95.9%) perform a walk test lasting 6 minutes; 22 (46.8%) take the longest distance of 2 tests as the real one; and 35 (74.5%) carry out the test in a corridor. The course distance ranged from 17 to 90 meters, but in 21 (44.7%) centers, the corridor was between 17 and 30 meters long. In 29 (61.7%) centers, the patients are routinely informed about the time that had elapsed during the test. Verbal encouragement is used in 44 (93.6%) centers. Thirty-eight (80.8%) use supplemental oxygen when a patient needs it. An increase in absolute values in the distance covered is used as a parameter indicating improvement at 21 (46.7%) sites while at 15 (33.3%) other centers the percentage increase is taken as a measure of improvement.

CONCLUSIONS: The 6-minute walk test is widely used for the evaluation of the exercise capacity at the pulmonary rehabilitation centers of Latin America and the Iberian Peninsula. However, there is great variability in the way the test is performed.

Key words: *Walk test. Rehabilitation outcome. Exercise test. Diagnostic techniques.*

Variabilidad en las condiciones de la prueba de la marcha realizada en el contexto de programas de rehabilitación pulmonar en América Latina y en la Península Ibérica

OBJETIVOS: Determinar la frecuencia de utilización de la prueba de la marcha de 6 min en el contexto de los programas de rehabilitación pulmonar que se llevan a cabo en América Latina y en la Península Ibérica. Definir la forma con la que se realiza esta prueba y las posibles variaciones que presenta en los distintos centros.

MATERIAL Y MÉTODOS: Se remitió un cuestionario a 55 centros de rehabilitación pulmonar localizados en América Latina, Portugal y España.

RESULTADOS: Respondieron al cuestionario 49 centros (89,1%); en 47 (95,9%) se realizó la prueba de la marcha con una duración de 6 min; en 22 (46,8%) se aceptó la mayor distancia recorrida por el paciente en 2 pruebas como el valor real de la prueba de la marcha; en 35 (74,5%) se realizó la prueba de la marcha en un pasillo; la distancia recorrida osciló entre 17 y 90 m, pero en 21 centros (44,7%) el pasillo tenía una longitud de 17 a 30 m. En 29 centros (61,7%) se informó sistemáticamente a los pacientes del tiempo transcurrido durante la prueba de la marcha; en 44 (93,6%) se animó verbalmente al paciente mientras realizaba la prueba; en 38 (80,8%) se utilizó oxígeno suplementario cuando el paciente lo necesitó. El incremento de los valores absolutos en la distancia recorrida se utilizó como parámetro para determinar la mejoría en 21 centros (46,7%), mientras que en otros 15 (33,3%) se utilizó como parámetro de mejoría el porcentaje de incremento en la distancia recorrida.

CONCLUSIONES: La prueba de la marcha de 6 min se utiliza con mucha frecuencia para la evaluación de la capacidad de ejercicio de los pacientes en los centros de rehabilitación pulmonar de América Latina y de la Península Ibérica. Sin embargo, hay grandes variaciones en la forma con la que se lleva a cabo la prueba.

Palabras clave: *Prueba de la marcha. Resultados de la rehabilitación. Prueba de esfuerzo. Técnicas diagnósticas.*

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Introduction

Walk tests have been widely used to assess exercise capacity in normal individuals or in patients with functional disorders, especially cardiopulmonary alterations. These tests are reproducible and inexpensive,

they resemble a familiar activity, and their use is guided by consensus.^{1,2} They have often been used to determine response to a clinical intervention, especially in pulmonary rehabilitation programs and for the prediction of maximal oxygen uptake.³⁻⁸ The 6-minute walk test has also been used to predict morbidity and mortality.⁹ Although such walk tests involve submaximal exercise, various studies have used them to assess exercise capacity in patients with chronic obstructive pulmonary disease (COPD)¹⁰⁻¹⁵ or pulmonary fibrosis.¹⁶

Several studies have determined the influence of test duration (2, 6, and 12 minutes),¹⁴ number of tests necessary to obtain the best performance,¹⁷ type of stimulus,^{18,19} and test surface (corridor, track, or treadmill).²⁰⁻²³ Elpern et al,²⁴ reported in 2000 that 94.7% of 75 pulmonary rehabilitation centers in the United States of America and Canada performed walk tests; 87% of them used a test duration of 6 minutes, 6% used 12 minutes, and 7% used both. Despite being so widely used, the walk test was not performed uniformly in the different centers according to the authors: 80% of the centers conducted only a single 6-minute test, most took place in a corridor, and pretest information and encouragement during the test were not standardized. Jardim et al²⁵ investigated the use of walk tests in 28 Latin American rehabilitation centers in 1999 (15 in Brazil, 3 in Argentina, 3 in Mexico, 2 in Uruguay, 2 in Colombia, 1 in Chile, 1 in Venezuela, and 1 in Peru) and found that the 6-minute walk test was carried out in 100% of the centers while the shuttle test was performed in only 5%. Those authors did not study the techniques used, however.

Recent guidelines on walk tests issued by the American Thoracic Society (ATS)²² and on exercise tests issued by the Spanish Society of Pulmonology and Thoracic Surgery (SEPAR)²⁶ emphasize various aspects related to indications for the tests and approaches to safety that had not been analyzed in the studies of either Elpern et al²⁴ or Jardim et al.²⁵ We should therefore be cautious when analyzing results coming from different rehabilitation centers as the techniques employed may vary.²⁷

No information is available regarding techniques used for walk tests in Latin America and on the Iberian Peninsula. Therefore, our aim was to survey pulmonary rehabilitation centers in those 2 geographic areas to investigate the frequency with which walk tests are used to measure exercise capacity and to determine the methods used. Our study was similar to one carried out in Canada and the USA.²⁴

Material and Methods

A questionnaire (Appendix) about the way a walk test is performed was sent to 55 public and private pulmonary rehabilitation centers in Latin America, Portugal, and Spain in 2002. In total there were 31 in Brazil, 5 in Argentina, 1 in Chile, 3 in Colombia, 3 in Spain, 4 in Portugal, 4 in Mexico, 1

in Peru, and 3 in Uruguay. Six centers did not respond, 1 in Brazil, 2 in Colombia, 1 in Portugal, 1 in Spain, and 1 in Mexico.

The questionnaire contained information concerning 5 aspects: *a*) the procedures and conditions of the walk test; *b*) patient instructions; *c*) the role of the walk test supervisor; *d*) parameters monitored before, during, and after the walk test; and *e*) use of supplementary oxygen and equipment (see Appendix).

Data Analysis

Only the questionnaires that were answered by the invited centers were analyzed. The central tendencies were calculated on numerical results. The results were then presented as percentages. Because a center could give an affirmative response to more than 1 item, the total of the percentages sometimes exceeds 100%.

Results

Forty-nine (89.1%) centers answered the questionnaire: 31 (63.2%) were from public university-affiliated hospitals and 18 (36.8%) were from non-teaching private institutions. Results from private and university/public centers were very similar, allowing us to study their responses together. Brazil had the largest numbers of centers but the procedures done there were not different from the centers in the other countries.

Two (4.1%) of the 49 pulmonary rehabilitation centers that responded to the questionnaires do not perform walk tests; thus, the results will be based on the 47 centers that in fact do them. All 47 (100%) centers perform the walk test in 6 minutes; of these, 42 (89.4%) carry out the test routinely with all patients and 5 (10.6%) do so only with some patients. Two centers (4.2%) administer the shuttle test in addition to the walk test in the same patient.

Walk Test Methods and Conditions

Number of tests performed during pre-pulmonary rehabilitation assessment: Eighteen (38.3%) centers base their assessment on a single walk test, 22 (46.8%) take the longest distance of 2 tests, and 7 (14.9%) perform 3 walk tests. Table 1 lists the time intervals between 2 tests.

Walking surface: Thirty-five (74.5%) of the centers perform the test in a corridor, 8 (17%) on a track, and 5 (10.6%) on a treadmill. Only 1 center (2.1%) uses a basketball court (as this question accepted more than one answer the sum of all percentages exceeded 100%). Three of the 5 centers that perform the walk test on a treadmill reported different initial speeds (1.5, 1.6, and 3.2 km/h). One center reported using 2 surfaces (corridor or track) for the walk test. Thirty-six (76.6%) reported never using a wheeled walker.

Distance: The distance walked in the corridor from the starting to the turning points ranged from 17 to 90 meters, with 21 (44.7%) of the centers using a corridor with a distance ranging from 17 to 30 meters (Table 2). The distance for tracks ranged from 6 to 400 meters.

Instructions to Patients

In 38 (80.8%) centers, the instructions were given to patients in a standardized manner. In 8 (17.1%) centers the instructions were informal and not standardized, and in only 1 (2.1%) center was a standardized instruction read by the test supervisor. During the walk test, 29 (61.7%) centers routinely informed the patients about elapsed time, 9 (19.1%) did so only when the patient asked for the information, and 9 (19.1%) provided no information. Patients were routinely informed of the distance walked in 9 (19.1%) centers, they were informed only if they asked in 9 (19.1%), and were not told the distance walked in 28 (59.6%) centers. One center did not respond to this question.

Verbal encouragement: Forty-four (93.6%) of the 47 pulmonary rehabilitation centers used verbal encouragement during the walk test, with 41 (93.2%) of them routinely using verbal encouragement while 3 (6.8%) centers used it sporadically. Verbal encouragement was provided by nonstandardized phrases in 25 (56.8%) centers and by standardized phrases in 19 (43.2%). Verbal encouragement was given according to the test supervisor's criteria in 27 (61.4%) centers, or the encouragement was given every minute in 10 (22.7%), every 30 seconds in 5 (11.4%), every first, third and fifth minute in 1 (2.3%). One center (2.3%) provided verbal encouragement every time the patient reached the end of the pathway.

Role of the Test Supervisor

The supervisors responsible for carrying out the walk tests are physiotherapists in 37 (80.4%) centers and/or physicians in 15 (32.6%) and nurses in 6 (13%). The walk test is supervised by 2 persons in 25 (54.3%) centers, by 1 person in 20 (43.5%) and by 3 to 4 persons (physiotherapy students) in one (2.2%) center. One center did not answer this question. During reassessment after rehabilitation, the test is supervised by the same person in 19 (41.3%) centers, by the same team (but not necessarily by the same person) in 24 (52.2%), and by whomever is available in 3 (6.5%). During the walk test, 28 (59.6%) centers allow the supervisor to instruct the patient to increase or reduce the rhythm or to rest, 17 (36.2%) centers do not permit it, 1 center reported that the test supervisor gives verbal encouragement to continue walking, and in 1 center the supervisor provides instructions according to the patient's performance. The position of the supervisor during the walk test and the presence or lack of verbal

TABLE 1
Time Interval Separating 2 Walk Tests Performed on the Same Day in 46 Pulmonary Rehabilitation Centers*

Interval	No. of Centers (%)
Recovery of resting cardiopulmonary profile	12 (26.1%)
20 min	1 (2.2%)
30 min	9 (19.6%)
1 h	1 (2.2%)
2 walk tests are not done on the same day	23 (50%)

*One of the 47 rehabilitation centers did not answer the question.

TABLE 2
Length of the Corridor Where the Walk Test Takes Place in 35 Pulmonary Rehabilitation Centers That Use That Test Setting

Length	No. of Centers (%)
≤20 m	11 (31.4%)
21-30 m	10 (28.6%)
31-40 m	5 (14.3%)
41-50 m	2 (5.7%)
51-60 m	3 (8.6%)
61-70 m	2 (5.7%)
71-80 m	1 (2.9%)
81-90 m	1 (2.9%)

TABLE 3
Position and Behavior of the Supervisor During the Walk Test in 46 Pulmonary Rehabilitation Centers*

Position and Encouraging Behavior	No. of Centers (%)
Keeps quiet, with only visual contact with the patient	2 (4.3%)
Keeps physically still, giving verbal encouragement to the patient	14 (30.4%)
Walking alongside the patient, with verbal encouragement	20 (43.5%)
Walking alongside the patient, setting the pace	0 (0%)
Walking alongside the patient, setting the pace and giving verbal encouragement	8 (17.4%)
Other	2 (4.3%)

*One of the 47 rehabilitation centers did not answer the question.

encouragement differed among centers, as shown in Table 3. One center did not answer this question.

Monitored Parameters

The main parameters monitored by the pulmonary rehabilitation centers before, during, and after the walk test and the frequency of monitoring are shown in Table 4. Since this item was a question for which multiple answers could be given, the sum of percentages exceeded 100%.

TABLE 4
Parameters Monitored Before, During, and on Completion of the Walk Test at 47 Pulmonary Rehabilitation Centers

	No. of Centers (%)		
	Before	During	On Completion
Peak flow rate	19 (40.4%)	4 (8.5%)	
Heart rate	45 (95.7%)	41 (87%)	2.45 (95.7%)
Spirometry	22 (46.8%)	0	
Electrocardiogram	11 (23.4%)	2 (4.3%)	2 (4.3%)
Blood pressure	42 (89.4%)	9 (19.1%)	37 (78.7%)
Respiratory rate	24 (51.1%)	16 (34%)	39 (83%)
Oxygen saturation	25 (53.2%)	44 (93.6%)	46 (97.9%)
Dyspnea score	16 (34%)	24 (51.1%)	40 (85.1%)
Lower limbs effort score	14 (29.8%)	15 (31.9%)	26 (55.3%)
Oxygen consumption	4 (8.5%)	3 (6.4%)	
Carbon dioxide output	4 (8.5%)	2 (4.3%)	
Distance walked	47 (100%)		
Number of rests	30 (63.8%)		
Duration of rests	22 (46.8%)		
Symptoms while walking	36 (76.6%)		

TABLE 5
Criteria for Defining Walk Test Improvement in 45 Pulmonary Rehabilitation Centers*

	No. of Centers (%)
Improvement, absolute distance	21 (46.7%)
Improvement, percentage of the previous test	15 (33.3%)
Do not perform the walk test to assess improved exercise capacity after rehabilitation	4 (8.9%)
No specific criteria	4 (8.9%)
Other	1 (2.2%)

*Two of the 47 rehabilitation centers did not answer the question.

Oxygen Supplementation

Thirty-eight (80.8%) centers supply oxygen in various situations. Oxygen supplementation is provided to the patients who have been using it in 30 (78.9%) centers, to patients who developed desaturation during a previous walk test in 21 (55.3%) centers, to patients during any test in 15 (39.5%) centers, or to patients who show desaturation at rest in 27 (71.0%) centers. Since this item was a question accepting multiple answers, the sum of percentages exceeded 100%. The minimum resting oxygen saturation levels for indicating a need for oxygen supplementation ranged from 85% to 90% by pulse oximetry (SpO₂).

If the patient starts the 6-minute walk test without oxygen and desaturation occurs during the test, 22 (84.6%) centers consider using oxygen when the SpO₂ falls below 88% to 90%, 18 (48.6%) discontinue the test and restart with oxygen supplementation, 6 (16.2%)

discontinue the test, 4 (10.8%) provide supplemental oxygen during the test without discontinuation, and 9 (24.3%) continue the test without oxygen. One center did not answer this question. Since this item was a question that allowed multiple answers, the sum of percentages exceeded 100%.

If oxygen supplementation is necessary, 24 (63.2%) centers choose an oxygen cylinder transported on a trolley, 11 (28.9%) use a small liquid oxygen cylinder transported in a bag, 8 (21%) use a large cylinder, and one (2.6%) uses an oxygen concentrator. The last 2 devices remain fixed and are equipped with a long extension tube. Since this item was a question that allowed multiple answers, the sum of percentages exceeded 100%. The device is transported by the supervisor in 17 (44.7%) centers, by a person other than the supervisor in 9 (23.7%), and by the patient in 4 (10.5%); 1 (2.6%) center reported no preference. The use of a catheter with a demand oxygen delivery system is not permitted in 24 (63.2%) centers. The SpO₂ limits most often reported by the 31 centers for indicating a need to discontinue the test were 85% by 10 (33.3%) centers, 80% by 8 (26.7%), and 88% by 6 (20%). One center did not specify the SpO₂ limit.

Assessment of Response to Rehabilitation by the 6-Minute Walk Test

Forty-two (91.3%) centers use the 6-minute walk test as an assessment of the response to their pulmonary rehabilitation programs, while 4 (8.7%) do not. One center did not answer this question. Table 5 shows how improvement in physical performance is defined in 45 centers (2 centers did not answer this question). The following additional criteria are used: walking the same distance with improvement in cardiopulmonary parameters; difference according to the predicted values of the equation of Enright and Sherrill²⁸; and improvement in heart rate, desaturation, dyspnea, and the number of interruptions. One (2.2%) center considers a decrease in dyspnea on the Borg scale as improvement, but no pre-established values were reported. The minimum increase in distance accepted as improvement (expressed in meters and as a percentage of the previous distance) and the frequency with which they were mentioned are shown in Figures 1 and 2, respectively.

Discussion

The 6-minute walk test has become a very popular test since it was proposed for the first time more than 20 years ago. Standardizing the execution of the test aims at facilitating its use, offering better information about the individual's exercise capacity, and allowing results from 2 different centers to be compared.

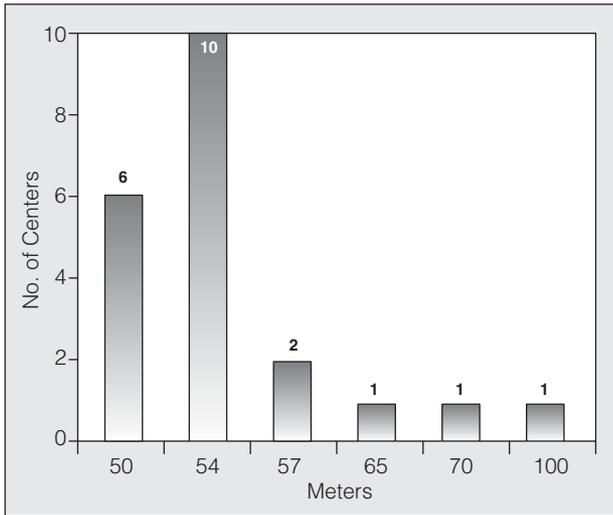


Figure 1. Distance used as a criterion to mark improvement in 6-minute walk test performance after pulmonary rehabilitation in 21 of the 47 centers.

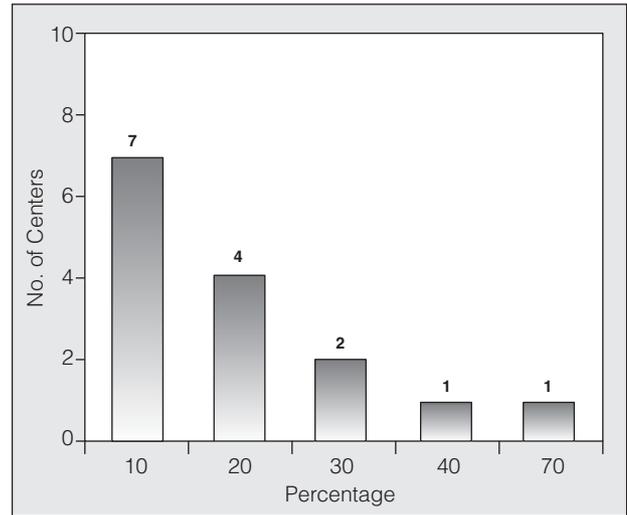


Figure 2. Minimum percentage increase in distance walked used to indicate improvement in walk test performance after pulmonary rehabilitation in 15 of the 47 pulmonary rehabilitation centers.

The aim of the present study was to determine the frequency with which the test is used to assess exercise capacity at pulmonary rehabilitation centers in Latin America and on the Iberian Peninsula and to identify how it is carried out. For this purpose, a modified questionnaire based on the research of Elpern et al²⁴ was sent to 55 rehabilitation centers, 6 of which did not respond. The authors observed great variation in the execution of walk tests among the pulmonary rehabilitation programs in the USA and Canada.

All centers in Latin America and on the Iberian Peninsula that responded to our questionnaire perform the 6-minute walk test, consistent with the rate of 94% reported by Elpern et al²⁴ for the North American pulmonary rehabilitation centers. However, there is great variation in the way the test is being performed with regard to *a)* test site and course length, *b)* number of tests performed, *c)* use of oxygen supplementation (level of desaturation that indicates need and the manner of transporting equipment), and *d)* the way the encouragement is given (words, time interval, and position of the test supervisor). Other sources of variation that could have been taken into consideration are age, gender, height, weight, lung, cardiovascular or musculoskeletal diseases, motivation, and the use of medication prior to the test.

Test Surface

The most often used test site or surface reported by the Latin American and Iberian Peninsula centers was similar to those reported elsewhere: a corridor was used by 74.5% of the centers in the USA and 73% of those in Canada.²⁴ The ATS recommends the test be performed in a corridor at least 30 meters long,² since a shorter

corridor requires the patient to change direction more often, spending time during that maneuver, and consequently, reducing the total distance walked. Although improved performance in longer corridors might theoretically be possible, there have been insufficient studies for drawing conclusions about the effect of this variable.

The present analysis showed that 44.7% of the centers use a corridor no longer than 30 meters. A different result was reported in the study of Elpern et al,²⁴ in which 85.2% of North American pulmonary rehabilitation centers reported using corridors longer than 30 meters. A recent multicenter study did not find significant variations in the results of the 6-minute test performed on straight courses ranging from 15 to 50 meters, but the patients walked, on average, 33 meters more when the test was performed on an oval track.²³

Learning Effect

With respect to the reproducibility of the test, Knox et al¹⁷ concluded that 3 walk tests lasting 6 minutes, with standard verbal encouragement and the test supervisor positioned at a certain distance from the patient, are conditions needed to achieve the best performance in patients with COPD. Cavalheiro et al¹⁹ demonstrated that when the supervisor imposes a rhythm during the test by walking ahead of the patient, the final distance covered is greater. In addition, there is no need to do more than two tests, suggesting that this monitoring method minimizes the influence of a learning effect and of motivation. However, there is insufficient evidence that the supervisor's position (in front of or behind a patient or to the side) can influence test performance.

In 43.5% of the pulmonary rehabilitation centers in Latin America and on the Iberian Peninsula the test supervisor walks alongside the patient, providing verbal encouragement but not imposing a rhythm. No information regarding this feature was available in the study by Elpern et al.²⁴

With respect to the number of tests performed, if more than 2 tests are done on the same day, the ATS recommends an interval of at least one hour before the next test and that the longest distance walked be recorded as the patient's basal level.² However, half of the centers in Latin America and on the Iberian Peninsula do not perform 2 walk tests on the same day, and the other half perform the 2 tests on the same day but consider different time intervals (Table 1).

A multicenter study involving 470 highly motivated patients with COPD who performed 2 such tests 1 day apart found that the distance walked was on the average longer (20 meters or 7%) on the second test day.²³ Other studies have reported a mean increase of 1% to 17% in the distance walked when a second test is performed 1 day after the first.^{17,29}

Although repeating a walk test may induce a learning effect and an improvement in coordination resulting in an increase in the distance walked, a large percentage of the pulmonary rehabilitation centers (38.3%) perform only one 6-minute test. Similarly, Elpern et al²⁴ showed that in the USA and Canada a percentage as high as 80% of the pulmonary rehabilitation centers perform only a single 6-minute walk test. Even though it has been shown that a second test may increase the distance walked, surprisingly, the ATS does not routinely recommend one.²

It seems logical that using the same supervisor in subsequent tests should contribute to better reproducibility of the test, but there is no available information on this feature in studies in the literature. Most of the pulmonary rehabilitation centers in Latin America and on the Iberian Peninsula use the same team of test supervisors, possibly explaining why less test variability is observed.

Oxygen Supplementation

Oxygen supplementation has been shown to improve patient performance during exercise and to increase the distance walked in 6 minutes.³⁰ A high rate of use of supplemental oxygen (80.8%) was observed in the present study.

Mak et al³¹ showed a significant but weak correlation between resting SpO₂ and the distance walked in 6 minutes. At all the pulmonary rehabilitation centers studied, SpO₂ is measured before, during, and after the test. The ATS recommends the administration of oxygen during the test for patients already on oxygen therapy.² Our results confirm that this orientation is followed by most centers in Latin America and on the Iberian Peninsula (78.9%).

Studies have demonstrated that oxygen supplementation, flow rate adjustment during the walk test, the type of equipment used, and the need for the patient to transport the equipment are some of the factors that can affect the distance walked during the test. Oxygen supplementation at flow rates of 2, 4, or 6 L/min increases the distance walked in the 6-minute walk test by 19.2%, 34.5%, and 36.3%, respectively, and a 14% reduction in the distance walked is observed when the patient transports the cylinder.³² Nevertheless, patients in 10.5% of the pulmonary rehabilitation centers in Latin America and on the Iberian Peninsula carry the oxygen supply equipment themselves. In centers in the USA and Canada, 38% do so. The possibility that the patient's performance is limited has not been taken into account.

Encouragement

Results on the 6-minute walk test depend on the effort, training, and especially the motivation of the patient. According to Guyatt et al,¹⁸ periodic verbal encouragement increases the distance walked compared to encouragement that is only provided when necessary. Informing the patient of the elapsed time and the distance walked might influence motivation and performance, but no study has yet tested this hypothesis.

Various studies have employed verbal encouragement every 30 seconds,^{13,17,18,31,33} every minute,¹⁹ or every 2 minutes.²⁰ The ATS guidelines recommend encouragement at intervals of 1 minute.² In most (61.4%) pulmonary rehabilitation centers in Latin America and on the Iberian Peninsula, verbal encouragement is provided according to the test supervisor's judgment and no standard interval is fixed. Some centers do not encourage their patients at all.

Another form of stimulation is to have the supervisor walk alongside the patient, giving encouragement. In a study carried out by our group, the mean distances walked by 53 unaccompanied and accompanied COPD patients were 436.3 and 525.8 meters, respectively ($P < .05$).¹⁹

Distance Walked as a Parameter Reflecting Improvement

The best way to express changes in test performance—whether as absolute values or as a percentage change in distance walked—remains to be established. The recommendation of the ATS² to use absolute values until new studies are available is followed by almost half (46.7%) of the centers that responded to our study. However, 33.3% of the centers take into consideration a percentage increase between 2 tests. Data concerning this aspect is not available in the study of Elpern et al.²⁴ Redelmeier et al¹³ considered a difference of 54 meters to be a significant improvement and this value has been widely applied to indicate improvement after an intervention.

Another approach cited in the survey for assessing walk test improvement after rehabilitation makes use of the equation of Enright and Sherrill.²⁸ That equation was developed to predict distance to be walked by normal individuals, however. Those authors observed that age, weight, height, and gender affect the distance walked in 6 minutes by healthy adults, but those variables might not have the same influence on the performance of patients with COPD. Trooster et al³³ have also looked at the variables that may interfere with walk test performance of healthy aging subjects, finding age, height, and sex to be the best predictors. Their model was able to explain 66% of the variability in the distance walked. Moreira et al³⁴ reported that their COPD patients performed in a way that was similar to what Enright and Sherrill predicted for normal individuals of the same age. Moreira and colleagues noted that the Enright and Sherrill equation is based on just one test and may not reflect the real exercise capacity of a normal individual. As far as we know there are no predictive models for the 6-minute walk test performance of COPD patients.

A limitation of this study is the fact that despite all efforts to reach the largest number of rehabilitation centers on the Iberian Peninsula through contacts with the local national respiratory societies and personal contacts with individuals who run rehabilitation centers, we are not sure we have in fact been able to reach all centers operating in Portugal and Spain in 2002.

We conclude that the 6-minute walk test is widely used in pulmonary rehabilitation centers in Latin America and on the Iberian Peninsula as a measure of exercise capacity. However, as there is great variability in the execution of the test among the different centers, the results obtained by different investigators should be compared only with caution.

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APPENDIX
Questionnaire on Walk Tests

Pulmonary Rehabilitation Center
City: Country:
Coordinator:

QUESTIONNAIRE ON HOW WALK TESTS ARE PERFORMED IN PULMONARY REHABILITATION PROGRAMS

Questions preceded by an asterisk (*) allow more than 1 answer.

1. In our pulmonary rehabilitation center for exercise capacity evaluation, we use:

- a. Just the walk test
- b. Just the shuttle walking test
- c. The walk test or shuttle walking test
- d. The walk test and shuttle walking test in the same patient
- e. Other (specify)

If you marked answer c to the first question, please specify the reasons for choosing one test or another.

.....
.....
.....

If you marked answer d to the first question, please explain your reason for performing both tests.

.....
.....
.....

2. In our pulmonary rehabilitation center the walk test:

- a. Is used routinely, with all patients
- b. Is used with only some patients
- c. Is not used

First Set

3. We perform a walk test with a duration of:

- a. 6 minutes
- b. 12 minutes
- c. Other (specify)

4. We evaluate the distance of the walk test based on:

- a. 1 walk test
- b. The best of 2 walk tests
- c. The best of 3 walk tests
- d. Other (specify)

5. *Our walk test is done:

- a. In a corridor (length
- b. On a track (length
- c. On a treadmill
- d. Other (specify)

6. If the walk test is done on a treadmill, what speed is set?

- a. We do not use the treadmill for walk test.
- b. The patient can speed up or slow down the treadmill during the test. (starting speed
- c. The supervisor can speed up or slow down the treadmill during the test. (starting speed
- d. Other (specify)

(Continued on the next page)

APPENDIX
Questionnaire on Walk Tests (Continued)

7. *Before the walk test the following measurements are recorded:

- a. Peak expiratory flow rate
- b. Heart rate
- c. Spirometry
- d. Electrocardiogram
- e. Blood pressure
- f. Respiratory rate
- g. Oxygen saturation by pulse oximetry (SpO₂)
- h. Dyspnea score (Borg scale)
- i. Lower limbs effort score (Borg scale)
- j. Oxygen consumption (VO₂)
- k. Carbon dioxide production (VCO₂)
- l. Other (specify)

8. *During the walk test the following parameters are measured:

- a. Heart rate
- b. EKG
- c. Blood pressure
- d. Respiratory rate
- e. SpO₂
- f. Dyspnea score (Borg)
- g. Lower limbs effort score (Borg)
- h. VO₂
- i. VCO₂
- j. Other (specify)

9. *At the end of the walk test the following parameters are measured:

- a. Heart rate
- b. Electrocardiogram
- c. Blood pressure
- d. Respiratory rate
- e. SpO₂
- f. Spirometry
- g. Peak expiratory flow rate
- h. Dyspnea score (Borg scale)
- i. Lower limbs effort score (Borg scale)
- j. VO₂
- k. VCO₂
- l. Distance walked
- m. Number of rests
- n. Duration of rests
- ñ. Symptoms during the test
- o. Other (specify)

Second Set: Information Given to Patients

10. How are the instructions given to the patients before the walk test?

- a. The supervisor reads a standardized script.
- b. The supervisor gives standardized instructions from memory.
- c. The supervisor gives nonstandardized instructions.
- d. Other (specify)

11. During the walk test, are the patients informed about the elapsed time?

- a. No
- b. Yes, routinely
- c. Yes, if they ask

12. During the walk test are the patients informed about the distance walked?

- a. No
- b. Yes, routinely
- c. Yes, if they ask

Third Set: Verbal Encouragement

If verbal encouragement is not given, go directly to question 16.

13. We use verbal encouragement during the walk test:

- a. Routinely
- b. Sometimes

(Continued on the next page)

APPENDIX
Questionnaire on Walk Tests (Continued)

14. Verbal encouragement is given by:
a. Standardized sentences
b. Nonstandardized sentences
c. Other (specify)
15. The verbal encouragement is given:
a. Every 30 seconds
b. Every minute
c. According to the supervisor's judgment
d. Other (specify)
- Fourth Set: Test Supervisor**
16. *The walk test is conducted by:
a. A doctor
b. A physical therapist/respiratory therapist
c. A nurse
d.
17. The walk test is conducted by:
a. 1 supervisor
b. 2 supervisors
c. Other (specify)
18. Supervision of the walk test is:
a. Always done by the same person
b. Always done by someone from the same team
c. Other (specify)
19. A follow-up walk test to evaluate a particular patient is supervised by:
a. The same supervisor who did the first walk test
b. Someone from the same team as those who did the first walk test
c. Other (specify)
20. Can the supervisor suggest that the patient increase or slow down the pace or rest during the test?
a. Yes, if the patient is walking very fast or very slowly
b. No
c. Other (specify)
21. During the walk test, the supervisor:
a. Remains stationary, with just visual contact with the patient
b. Remains stationary, giving verbal encouragement to the patient
c. Walks alongside the patient, giving verbal encouragement
d. Walks alongside the patient, setting the pace
e. Walks alongside the patient, setting the pace and giving verbal encouragement
f. Other (specify)
- Fifth Set: Supplemental Oxygen**
22. *Oxygen is supplied from the beginning of the walk test if:
a. The patient already uses oxygen
b. SpO₂, at rest, breathing room air, is under
- c. During a previous walk test, the patient presented desaturation
d. During any previous test of any type, the patient presented desaturation
e. Other (specify)
23. *In case the patient needs supplemental oxygen during the walk test, what equipment is used?
a. Oxygen cylinder carried on a wheeled trolley
b. Liquid oxygen cylinder carried in a bag
c. An oxygen concentrator with a long extension tube
d. Other (specify)
24. *In case the patient needs supplemental oxygen during the walk test, whose equipment is used?
a. Patient's own equipment
b. Equipment owned by the pulmonary rehabilitation center
c. No particular preference
d. Other (specify)
25. Can the patients breathe oxygen with a demand oxygen delivery system during the walk test?
a. Yes
b. No

(Continued on the next page)

APPENDIX
Questionnaire on Walk Tests (Continued)

26. Who pushes or carries the oxygen equipment during the walk test?
a. The patient
b. The supervisor
c. Other (specify)
d. No preference at all
e. The equipment remains fixed and is fitted with a long extension tube.
27. Is the oxygen flow adjusted during the walk test?
a. No
b. Yes, if the patient asks for a higher flow
c. Yes, enough to keep the SpO₂ above%
28. If the patient started the walk test without oxygen and desaturation occurs, is supplemental oxygen started during the test?
a. Yes
b. No
c. No, and the test is discontinued
d. No, the test is stopped for a while and reinitiated with the patient breathing oxygen

Final Set

29. Can a patient use a walker with wheels to rest arms on during the walk test?
a. Yes
b. No
c. The situation has never arisen.
30. *The walk test can be interrupted in case of:
a. SpO₂ less than.....
b. Severe dyspnea
c. Angina
d. Arrhythmia
e. Severe muscle pain
f. Other (specify)
31. Whenever a second test has to be done on the same day, what is the minimum time interval between them?
a. 30 minutes
b. 1 hour
c. Whatever is necessary for the vital signs to go back to the resting values
d. We do not perform two tests on the same day.
e. Other (specify)
32. What criteria do you use to determine that the patient's condition is stable enough for performing a second walk test to compare to one already finished?
a. We don't do a second walk test.
b. Symptoms
c. Cardiopulmonary parameters
d. Symptoms and cardiopulmonary parameters
e. We don't specify criteria related to stability of condition to determine if the patient can do a second walk test.
f. Other (specify)
33. We use the walk test to evaluate the response to a pulmonary rehabilitation program:
a. Yes
b. No
34. *We consider an increase in the walked distance to represent improved exercise capacity, as follows:
a. We do not use the walk test to evaluate response to a pulmonary rehabilitation program
b.meters/..... kilometers
c.% in relation to the pre-rehabilitation walk test
d. Other (specify)

Do you know of another pulmonary rehabilitation center in your country? Please give us the name of the coordinator, the address, and if possible the telephone, fax and e-mail contact information.

Center:
Coordinator:
Address: City:
Postal code: Telephone:
E-mail: Fax:

COMMENTS / SUGGESTIONS

.....
.....

THANK YOU