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## Adaptation of the Medical Research Council Dyspnea Scale and the Oxygen Cost Diagram for its use in Puerto Rico

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**Introduction:** Dyspnea is a common and disabling symptom for patients with chronic lung diseases. The Medical Research Council Dyspnea Scale (MRC) and the Oxygen Cost Diagram (OCD) are widely used instruments validated in English to measure breathlessness.

**Objective:** To translate and culturally adapt the MRC and the OCD for its use in Puerto Rico.

**Method:** The scales were translated to Spanish and back translated. They were tested in patients attending a pulmonary clinic to assess its relevance and comprehension. Subjects answered the instruments, had a structured clinical interview and provided feedback. A multidisciplinary committee analyzed the source of misunderstanding using the input of the subjects, the clinical physicians, and the evaluators; made adjustments, and retested the instruments until inconsistencies were not observed.

**Results:** Placing emphasis on time spent walking

instead of distance traveled improved the discrimination between grade two and three in the MRC. In the OCD, placing the activities to the right side eased the interpretation of the scale. Numerical symbols were eliminated to minimize discomfort in the severely impaired subjects reluctant to mark the line near zero. Reversing the order of both scales encouraged a thorough reading of the activities from minimal to high energy demanding eliciting a more fitting response compared to structured clinical interview especially in the severely ill patient.

**Conclusion:** Using cross-cultural research methodologies to translate the MRC and OCD allowed the identification of differences in conceptualization when assessing the severity of dyspnea in Puerto Rico. Further testing is needed to confirm psychometric properties.

*Key words:* Dyspnea scales, Cultural adaptation, MRC, OCD, Spanish translation.

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**D**yspnea is a common and disabling symptom for patients with chronic lung diseases affecting adversely their quality of life. It is known that the severity of lung disease can not be estimated by a single physiologic test and therefore dyspnea itself needs to be measured (1). Several instruments are available to assess dyspnea, including structured interviews, self-report questionnaires, visual analogs, and numerical scales. (2-

4) Nevertheless, in countries where economical resources are limited, self administered, paper based instruments are preferred.

The Medical Research Council Dyspnea Scale (MRC) and the Oxygen Cost Diagram (OCD) are standard instruments validated in English to measure breathlessness that are simple, self administered, and widely used. (5-6) The MRC is a five point scale grading the severity of dyspnea associated with activities of daily living. It ranges from grade 0, not troubled with breathlessness, to grade 4, very severe breathlessness (Figure 1). Patients are asked to decide on the level of activity that produces dyspnea.

The OCD is a 100mm vertically oriented visual analog scale with a list of daily activities placed along the line proportionately to their oxygen cost. The patient is asked to draw a line at the point above which their dyspnea would not allow them to continue the activity. The result is then expressed as the distance in millimeters from zero to the mark (Figure 2).

There is no cultural adaptation of these instruments for the Puerto Rican population, although Spanish versions of the MRC have been published. (7-8) Cross-cultural

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<u>A</u>	<u>B</u>
<ul style="list-style-type: none"> <li>• <u>Grade 0:</u> None. Not troubled with breathlessness except with strenuous exercise.</li> <li>• <u>Grade 1:</u> Slight. Troubled by shortness of breath when hurrying on the level or walking up a slight hill.</li> <li>• <u>Grade 2:</u> Moderate. Walks slower than people of the same age on the level because of breathlessness or has to stop for breath when walking at own pace on the level.</li> <li>• <u>Grade 3:</u> Severe. Stops for breath after walking about a 100 yards or after a few minutes on the level.</li> <li>• <u>Grade 4:</u> Very severe. Too breathless to leave the house or breathless when dressing or undressing.</li> </ul>	<p style="text-align: center;"><b>Escoja la oración que MEJOR describa su falta de aire en un día típico de la semana pasada. Marque sólo una.</b></p> <p>----- A. Me falta el aire al vestirme o desvestirme o la falta de aire no me deja salir de mi casa.</p> <p>----- B. Me detengo por la falta de aire cuando camino por varios minutos (aproximadamente 90 metros) en un lugar llano.</p> <p>----- C. Me detengo por la falta de aire cuando camino por más de quince minutos (aproximadamente una milla) o camino más lento que personas de mi edad en un lugar llano.</p> <p>----- D. Me molesta la falta de aire cuando camino rápido en un lugar llano o si subo una cuesta pequeña.</p> <p>----- E. No me falta el aire a menos que haga ejercicio intenso.</p>

**Figure 1.** Medical Research Council Dyspnea Scale, ATS, 1982. B) Culturally adapted Spanish version. Simple instructions were added, the order of items were reversed and the numbers were substituted by letters; letter A is grade 4, B is 3, C is 2, D is 1, and E is Zero.

research methodology has been extensively used for the translation of instruments in the social sciences. It is now becoming an essential tool for the translation and adaptation of health sciences related instruments. (9-12) It is known that cultural and linguistic differences may affect the interpretation of quantitative instruments. In addition, different versions of the same instrument in the same language may result in loss of standardization limiting comparison between populations.

The purpose of this study was to translate to Spanish and culturally adapt the MRC dyspnea scale and the OCD for its use in Puerto Rico.

### Methods

A translation method was developed using as reference Brislin's model of forward and back translation, a modified version of Jones' expert panel group discussion, and field tests to assess problems in comprehension (13-15). Content, semantic, and technical equivalence to the source instruments were evaluated. (9)

The study was approved by the Institutional Review Board for human studies.

Figure 3 describes the steps followed to obtain instruments sensitive to measure the impact of breathlessness during activities of daily living in Puerto Rico while maintaining semantic, content, and technical equivalence to the source language. The source instruments were translated to the target language by a bilingual translator and back translated to confirm semantic equivalence. The source and target instruments were

reviewed by a committee comprised of two pulmonary and one internal medicine physicians, one epidemiologist, one statistician, three nurses, and two community members. All members were native Spanish speakers, seven of them bilingual.

The committee evaluated if each item of the instrument was relevant to our culture when measuring dyspnea, if the meaning of each item was the same in the English and the Spanish version, and if the method of data collection may affect the results differently in our population compared to the original culture. The Spanish instruments were then tested on individual patients at the pulmonary clinics of the University of Puerto Rico School of Medicine.

Each subject agreed to the following tasks: a) to answer the MRC, b) to answer the OCD, c) to answer a standardized written clinical interview developed by the investigators based on the three characteristic of dyspnea described by Mahler (4), and d) to provide feedback of the instruments. Any inconsistency was discussed with the subject allowing him (her) to explain the source of confusion. Direct verbal, non verbal and written response from a subject were recorded and reported to the committee. Adaptations were made if the committee considered that the source of confusion may interfere with the measurement properties of the instruments

### Results

Minimal errors in translation were corrected by the committee before field test. The committee also observed that instructions in the source instruments were not

standardized and written instructions were added to both instruments keeping the intention of the source language (SL). This was considered a necessary technical change to strengthen the self administered nature of the scales. Also there was agreement to use the first person on the items in order to ease the comprehension of the instruments.

The Spanish versions of both instruments were field tested in groups of ten individual interviews. The committee analyzed the input of the patients, the clinical physicians, and the evaluators looking for source of misunderstanding; made adjustments, and retested the instruments until inconsistencies were not observed.

Forty subjects participated during field testing, 20 of them were women, mean age was 58 years (range 31 to 75). Their educational background included: no education 7.5%, elementary school 2.5%, junior high school 10%, high school 42.5%, undergraduate education 17.5%, and unknown 20%. Eighty percent of participants had evidence of respiratory illness.

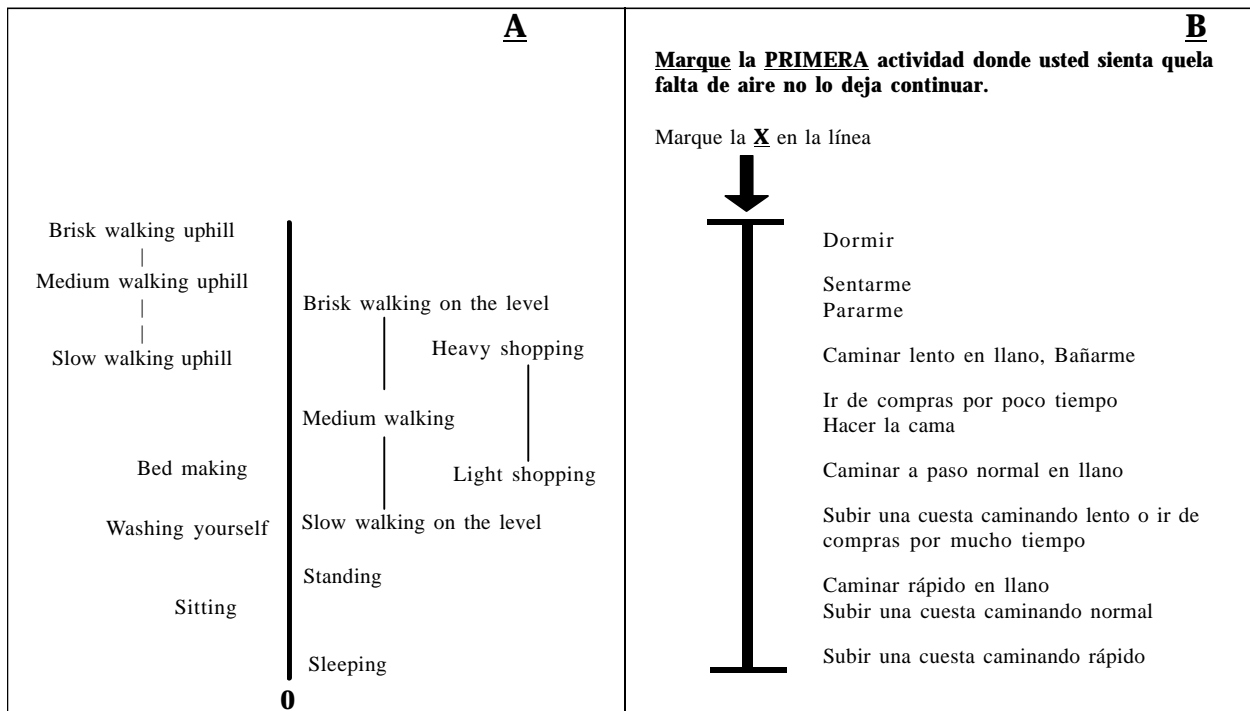
### MRC

Figure 1 show the source language MRC and its final Spanish adaptation.

During the assessment of content equivalence the

sentence describing grade 3 was initially translated to “me paro a coger aire cuando camino aproximadamente 100 yardas o cuando camino por varios minutos en llano”. The concept of distance walked (100 yards, 90 meters, or 300 feet) caused confusion during the field test. An equivalent measure with numbers of cars in a parking lot was unsuccessful. The concept of time walked was placed preceding the concept of length; “Me detengo por la falta de aire cuando camino por varios minutos (aproximadamente 100 yardas) en un lugar llano”. Emphasis on measured time instead of measured length was relevant to our culture without loss of meaning.

In Grade 2 moderate impairment is described using the subject’s own comparison with people of the same age walking on leveled ground or awareness of breathlessness walking at their own pace (Figure 1A). The source MRC does not include the concept of time in this item. Subjects were dubious in choosing between grades 2 and 3 because for them, becoming short of breath while walking on leveled ground after a few minutes (grade 3) was similar to breathlessness when walking at their own pace (grade 2). The MRC developed by Fletcher in 1959, ranging from grades 1 to 5 instead of 0 to 4, includes both time and distance traveled in the classification the grade, depicting a time of 15 minutes or a distance of approximately one mile (16). Adding these items to the grade description



**Figure 2.** Oxygen Cost Diagram, source language. B) Culturally adapted Spanish version. Simple instructions were added, all items are right sided, and the order of items was reversed. The bar (0 to 100mm) remains without marks to the participant but is calibrated for subsequent use by the researcher.

minimized ambiguity between the two grades (Figure 1B).

To preserve semantic equivalence, some phrases required modification. In grade 1, the words used as equivalents for “strenuous” such as “arduo”, “laborioso” and “vigorous” resulted in subject’s repeated request for clarification. Using intense as a descriptor of exercise (“ejercicio intenso”) did not cause confusion in the subsequent field test.

Important technical changes were necessary to correct grading inconsistencies brought up by the clinical interview. It was observed that the severely ill subjects were selecting a lower severity score than suggested by the standardized clinical interview. When faced about, it was apparent that they were choosing the first positive answer without reading subsequent options. Reversing the severity order of the MRC from severe impairment down to normal yielded a consistent response on subsequent field tests. Also, distractions were observed in several subjects trying to understand the meaning of the numbers in the scale. Substituting numbers by letters (A to E) resulted in less questioning about the intent of the instrument. The five point score of the scale was not changed; letter A is grade 4, to letter E grade 0.

The sequence of activities in grade 4 were modified since subjects ignored the second activities of dressing and undressing and assumed that traveling with assistance disqualified them for this grade. This resulted in the selection of grade 3 instead of grade 4. Once the sequence was reversed, it was much easier for subjects to understand the intent of the grade.

## OCD

*Figure 2 shows the source language OCD and its final Spanish adaptation.*

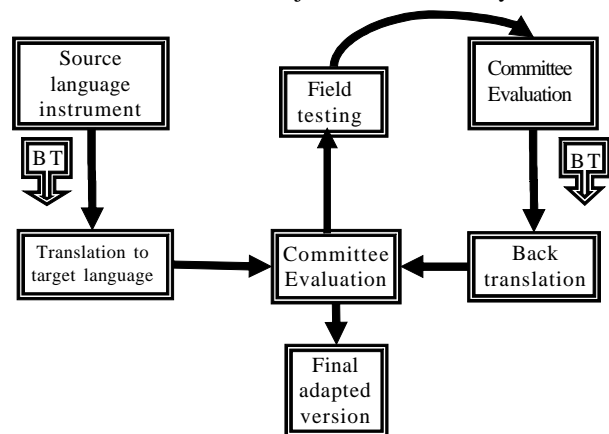
During the evaluation of content equivalence, the translation of the words: “medium”, “light” or “heavy” used to describe intensities of shopping were perceived as a notion of weight causing confusion. For our participants it was easier to understand intensity of shopping in terms of time spent. The phrase “heavy shopping” was adapted to “ir de compras por mucho tiempo” (shopping for a long time) and the phrase “light shopping” was adapted to “ir de compras por poco tiempo” (shopping for a short time).

When evaluating semantic equivalence, the descriptors of walking speed were slow, medium and brisk. The word medium has no equivalent Spanish translation. Using normal as a substitute: “Caminar a paso normal” (walking at a normal pace) maintains semantic equivalence and cultural relevance.

The phrase “walking uphill” could be translated as

“caminar subiendo una cuesta” (“walking uphill”) or “subir una cuesta caminando” (“uphill walking”). Subjects ignored the level of incline with the former, but became aware of the level of incline in the latter.

The visual format of the OCD caused confusion to most of the subjects. Placing all the activities on the right side of the scale improved visual comprehension. Another source of confusion was having activities of high oxygen consumption at the beginning of the scale. Subjects selected the first activity on the list, even when breathlessness impeded them to do other activities of lower oxygen consumption. When placed in a reversed order, understanding of the instructions and compliance with the objective of the scale improved. The number zero at the bottom of the scale caused concern due to its implied severity. Severely ill subjects were reluctant to mark near zero because as they expressed it: “I am not zero”. After substituting by an arrow, activities were better appreciated. Simple instructions were added specifying the subject to mark an “X” on the line adjacent to the activity selected.



**Figure 3.** Flow chart illustrates the process used for translation and cultural adaptation of the MRC and OCD. The evaluation committee was composed of both scientific and community members. BT= bilingual translator.

## Discussion

The multidisciplinary evaluation committee was an essential tool during the cultural adaptation process. The feedback of monolingual (Spanish) members in the committee gave an insight in the conceptual meaning of the translated version without the bias of a global bilingual interpretation. The participation of experts in measurement instruments eased the development of strategies used to correct observed sources of misinterpretation. The concurrent administration of a standardized written clinical interview while administering the scales alerted the committee about potential invalid selection of a grade by some subjects. The concept of field testing using private

and individual interview made subjects feel at ease to discuss feelings interfering with the measure especially in subjects having a very poor health.

Considering cultural aspects during the translation of the MRC and OCD, allowed for the recognition of different scenarios that led to a subject's misinterpretation of the instruments which may result in a loss of validity if not corrected.

On the MRC, the concept of distance traveled to assess the severity of breathlessness was ineffective. Our population uses more frequently the time it takes to reach a particular distance rather than the actual distance. This difference in conceptualization caused confusion to discriminate between grade 2 and 3. Placing the time spent walking preceding the distance walked increased subject's awareness of the meaning of grade 3. On the other side, time equivalence was not included in the 1982 ATS position statement for the MRC dyspnea scale for grade 2; therefore it was not included in the initial translation. The original MRC dyspnea scale developed by Fletcher et al. included time equivalence for the grade (16). Adding it to our instrument facilitated the discrimination between the two grades. Distance walked, as described by Fletcher et al., was maintained in parenthesis to allow its use in another culture.

Differences in conceptualization of how things can and should be quantified among Latinos and Anglos have been described by Matías et al. (17). They observed that Latinos had great difficulty responding to items in the Family Burden Scale that required them to indicate specific amounts of money spent. Adaptations of their instruments were necessary. Further studies need to evaluate if the observed preference for time spent over distance traveled to assess severity of impairment occurs in other Latino population.

In the OCD, a time reference was used to describe the intensity of shopping in the target language. The descriptors in the source language (light and heavy) were interpreted as carried weight during shopping leading to subject's confusion. Substituting with relative time spent during shopping was more relevant to our culture. Nevertheless, it is observed that both in the source and target language the descriptors are vague.

Finding expressions in Spanish that maintained semantic equivalence, was a challenge. On the MRC, "strenuous exercise" underwent several translations equivalent in back-translation but unable to produce the corresponding interpretation by our population. When substituted by "ejercicio intenso", the emphasis was transferred back to the intensity of the activity as in the source instrument.

In the OCD, the phrase "medium walking" ("caminar mediano") does not have a correlate in the target language.

A suitable alternative was "caminar a paso normal" (walk at a normal pace). During testing, it was interpreted as the mid-range walking speed which is the intent of the phrase in the source language.

The structure of the sentences or syntax influenced the maintenance of semantic equivalence. The Spanish translation of "walking uphill" in the OCD contains two verb forms ("caminar" and "subir"), used either as the active verb or as a modifier adverb phrase. When walking was selected as the active verb ("**caminar** subiendo una cuesta") subjects ignored the incline level because they assumed walking was on the level. When "subir" was chosen as the active verb ("**subir** una cuesta caminando"), it was easier for the subjects to distinguish walking intensity based on incline levels.

Subjects' tendency to glimpse through documents without reading them thoroughly made necessary to redesign the order of the scales. In the source instruments, the activities were described from no impairment to severe impairment. Subjects were inclined to select the first applicable answer without reading the document in its entirety. This caused the measurement to be biased toward less impairment, specially among the severely ill. Reversing the order yielded a more fitting response. The possibility of having subjects choosing a more severe level of impairment was not observed. It could be that our population copes with adversity by minimizing its severity.

This tendency was also observed when participants associated numerical symbols to levels of impairment. This was prominent in the OCD were severely impaired subjects associated the number zero with a sense of impending doom and were reluctant to mark the line near the number zero. The absolute value of the number appears to be a stronger stimuli in the selection process than the verbal descriptor of the impairment. Once numerical symbols were eliminated, subjects' discomfort was minimized.

The OCD, displaying the technical challenges of a visual analog scale, has been criticized for its need of repeated instructions. Placing all the items on the right side of the scale after reversing their order allowed subjects to read them in a top to bottom, right to left format, facilitating its interpretation and subsequent marking of the line. Changes in visual appearance resulted in a strengthening of its self-administered nature.

Finally, the sentences on both instruments were adapted to use the first person form. Different grammatical forms have been previously used in the MRC. The American Thoracic Society (ATS) used a third person, Fletcher used a second person, and Bestall used a first person form. (5-16, 18) The Spanish Society of Pneumology and Thoracic Surgery (SEPAR) uses third person form in a Spanish translation (8). The reason for these variations has not

been described or explained on the current literature. In our experience, the first person approach allowed subjects to become active participants of the activities described in a culturally appropriate context and reinforced the self-administered focus of the scale.

## Conclusion

The MRC and OCD were translated to Spanish and adapted for its use in Puerto Rico. In the MRC, placing emphasis on time spent walking instead of distance traveled eased discrimination between grade two and three. In the OCD, placing the activities to the right side improved visual appearance of the scale and eased its interpretation. Reversing the order of both scales from severely impaired down to normal improved grading selection when compared with clinical interview, especially in the severely impaired. Further testing is the next step to confirm psychometric properties.

## Resumen

**Introducción:** Disnea es un síntoma común e incapacitante en pacientes con enfermedades pulmonares. La escala de disnea del Concilio de Investigación Médica y el Diagrama de Consumo de Oxígeno (MRC y OCD) son instrumentos ampliamente usados y validados en inglés para medir su severidad. **Objetivo:** Traducir y adaptar culturalmente el MRC y OCD para su uso en Puerto Rico. **Método:** Las escalas se tradujeron al español y luego se retro-tradujeron al inglés. Estas fueron probadas en sujetos de una clínica de pulmonar para evaluar su relevancia y comprensión. Los sujetos contestaron los instrumentos así como una entrevista clínica y dieron sus sugerencias. El comité multidisciplinario analizó las fuentes de confusión, realizó ajustes en los instrumentos y los probó nuevamente hasta no observar inconsistencias. **Resultados:** En el MRC, el enfatizar el tiempo transcurrido, en vez de la distancia recorrida, mejoró la discriminación entre grado 2 y 3. En el OCD ubicar las actividades al lado derecho de la escala facilitó su interpretación. Los números del OCD se eliminaron para minimizar la molestia causada a aquellos severamente enfermos que se negaban a marcar cerca del cero. En ambas escalas, el invertir el orden de las actividades para leerlas de menor a mayor esfuerzo estimuló una respuesta más afín con la entrevista clínica. **Conclusión:** El uso de la metodología investigativa transcultural para traducir el MRC y el OCD permitió identificar las diferencias en la percepción de la disnea en Puerto Rico. Se necesitan pruebas adicionales para confirmar las propiedades psicométricas.

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