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### SYSTEMATIC REVIEW

## Pain and Disability Rating Scale and Test for the Measurement of the Range of Motion in Low Back Pains

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### ABSTRACT

#### Keywords:

Low back pain;  
Disability examination;  
Validity scales of the trials;  
Range of joint motion.

**Objectives:** The purpose is to make a review of the validity of the pain and disability scales for the diagnosis of low back pain, as well as of the validity of the range of motion as a diagnostic criterion for low back pain in comparison to disability scales.

**Material and methods:** A bibliography research was carried out, according to the following database: Medline-PubMed and Pedro. There were included studies related with the trial. For this search, the following terms were used: "lowbackpain", "diagnosis", "validity", "disability scales", "range of motion". There were included a total number of 13 studies and were excluded 13.346.

**Results:** The consulted studies support the validity of the pain and disability scales for diagnosing low back pain (Roland Morris Disability Questionnaire, Oswestry Disability Index for Low Back Pain and VSA). Validity and high reproducibility of the test were observed to measure the range of low back pain motion [modified Schober, double inclinometer and fingertip-to-floor test (FTF)], obtaining a high correlation in comparison to an imaging test. On the other hand, the little relation between the range of motion and the functional disability indexes has been pointed out, which excludes it as diagnostic criterion for lumbar pathology.

**Conclusions:** Disability scales (Oswestry index and Roland Morris questionnaire) and pains (VSA) have proven their utility in diagnosing and in lumbar pathology's monitoring, and are the most recommended measurements of the scientific bibliography. We found internal validity and high reproducibility of the measurement tests for the lumbar range of motion (modified Schober test, double inclinometer, FTF test) in relation to the imaging test for measuring mobility. However, range of motion is not a valid criterion for diagnosing lumbar pathology, because of its little relation with the disability indexes.

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## INTRODUCTION

Epidemiologically speaking, "low back pain" is a very frequent pathology of medical consultation and work leave<sup>1</sup>. This pathology affects 70-85% of people at some point of their lives, from whom a 90% suffers recurrences. Great part of the back pathologies is due to low back pain, producing an important sanitary cost, direct and indirect<sup>2</sup>.

Among the multiple causes of low back pain, such as mechanical alterations of the spine, disc diseases and inflammatory or degenerative processes, we can include elasticity<sup>3</sup> and strength<sup>4-6</sup> alterations of the erector spinae muscles, psoas and abdominals.

Similarly, alterations of posture and postural control<sup>7-11</sup> are important for postural chains, of which diaphragm is part<sup>12, 13</sup>. Biomechanically speaking, it is common to find alterations in low back motion.<sup>14-16</sup>

Assessment is very important for rendering a good diagnosis of this pathology and for making possible a good monitoring of its evolution.

For this reason, in this article we suggest a review of the questionnaires and of the most used manual methods of diagnosis, in order to compare them.

## MATERIAL AND METHODS

### Search strategy

A systematic search was made between January and August of 2012, in the following database: Medline-PubMed and Pedro.

Search was limited to the following languages: English, Spanish and French. The preferred terms were the following: "low back pain", "diagnosis", "validity", "disability scales" and "range of motion".

Articles not related to the objectives of this trial were excluded.

Results were structured in two sections: in the first section, we made a review of the disability scales that are normally used for diagnosis and low back pain monitoring.

In the second section, we point out tests that measure the most used range of motion in the consulted bibliography and also, its validity as diagnostic criterion for low back pain.

## OBJECTIVES OF THE REVIEW

1. Verify the validity of the disability scales used for the diagnosis and assessment of low back pain.
2. Verify the internal validity of the tests that measure the range of motion and/or their relation regarding an imaging test.
3. Verify the validity of the range of motion as a diagnostic criterion for low back pain, when comparing it to the disability scales.

## SELECTION CRITERIA

Inclusion criteria: The subject matter of the article must include diagnostic validity for low back pain pathologies. From this point, there are three possibilities:

- Disability scales and questionnaires.
- Internal validity of manual tests that measure the range of motion and/or their comparison to the imaging tests.
- Relation between the range of motion and the disability scales and questionnaires as a validity criterion.

The included languages are English, Spanish and French.

Exclusion criteria: Subject matter of these trials is different to the one included in the inclusion criteria; the language of the trials is different from the ones of the inclusion criteria.

## REVIEW PROTOCOL

### Database selection

Selected database for performing this article were PubMed-Medline and Pedro, for including a great amount of articles related to the object of the trial.

### Identifying preferred terms

Preferred terms used for this matter were: "low back pain", "diagnosis", "validity", "disability scales" and "range of motion".

### Searching in database

- First, these keywords were combined: "low back pain", "diagnosis", "validity" and "disability scales".
- Secondly, "low back pain", "diagnosis", "validity" and "range of motion" were combined.
- Thirdly, all preferred terms were combined.

### Articles review and analysis

First, a review of the titles was performed and afterwards, of the articles overview, in order to exclude those that did not satisfy the inclusion criteria or those which are part of the exclusion criteria.

After performing the final selection, an analysis of the complete texts was carried out.

### Subject matter classification

Articles were classified in three different subject matters:

1. Validity of the disability scales.
2. Internal validity of the range of motion tests and/or relation with imaging tests in order to measure motion.
3. Validity of the range of motion as diagnostic criterion for low back pain in comparison to the disability scales.

### Characteristics of the selected trials

1. Trials that reveal the validity of the disability scales: to fulfill the first objective.
2. Trials that reveal the internal validity of the range of motion tests and/or their relation with the imaging tests: to fulfill the second objective.

3. Trials that relate the range of motion with disability scales: to fulfill the third objective and make sure these tests are valid for the diagnosis and monitoring of the lumbar pathology.

### Data analysis

A data collection was created of all articles, which included the following categories:

1. General aspects: number of authors, year of publication.
2. Responding to objective 1: yes/no (validity of disability scales for diagnosing low back pain).
3. Responding to objective 2: yes/no (internal validity of the range of motion tests and/or regarding imaging tests).
4. Responding to objective 3: yes/no (validity of the range of motion tests as diagnostic criterion of low back pain in comparison to disability scales).

## **RESULTS**

Statistical description of the sample size.

We found a total of 13,921 articles (n=13,921), from which 562 fulfilled the selection criteria (n=562).

After applying a classification by Title, Abstract and Keywords, we excluded 531 studies (n=531), thus including 31 articles in the end (n=31), which represents 0.22% of the initially founded articles.

Afterwards, we selected trials according to the content criteria (full text) and after the review, we excluded 18 (n=18), remaining our sample reduced to 13 articles (n=13).

Once we obtained the sample, we performed a secondary analysis of content and bibliographic references, from which we did not select any article (n=0); therefore, the final sample included 13 trials (n=13).

Authors	Year	Title
Honglei Yi., Xinran Ji, Xianzhao Wei, Ziqiang Chen, Xinhui Wang, Xiaodong Zhu, Wei Zhang, Jiayu Chen, Diqing Zhang, Ming Li <sup>22</sup>	2012	Reliability and validity of the simplified Chinese version of Roland Morris Questionnaire in evaluating rural and urban patients with low back pain.
Fritz, Irrqanq <sup>20</sup>	2011	A comparison of the Oswestry low back pain disability questionnaire and the Quebec back pain disability scale.
Hicks, Manal <sup>21</sup>	2009	Psychometric properties of commonly used low back disability questionnaires: are they useful for older adults with low back pain?
Van Nieuwenhuyse, Crombez, Burdorf, Verbeke, Masschelein, Moens, Mairiaux and the BelCoBack Study Group <sup>29</sup>	2009	Physical characteristics of the back are not predictive of low back pain in healthy workers: A prospective study.
Cuesta Vargas AI, Rodriguez Moya A <sup>17</sup>	2008	The frequency of the use of pain, disability and quality of life scales in the study of physiotherapy intervention on low back pain
Calmels, Bèthoux, Condemime, Fayolle <sup>23</sup>	2005	Low back pain disability assessment tools.
Rocchi, Sisti, Benedetti, Valentini, Bellagamba, Federici <sup>18</sup>	2005	Critical comparison of nine different self-administered questionnaires for the evaluation of disability caused by low back pain.
Bijur PE, Silver W, Gallagher PJ <sup>19</sup>	2001	Reliability of the visual analogue scale for measurement of acute pain.
Perret, Poiraudreau, Fermanian, Colau, Benhamou, Revel <sup>25</sup>	2001	Validity, reliability and responsiveness of the finger tip-to-floor test.
Postras, Loisisel, Prince, Lemaire <sup>28</sup>	2000	Disability measurement in persons with back pain: a validity study of range of motion and velocity.
Sullivan, Shoaf, Riddle <sup>27</sup>	2000	The relationship of lumbar flexion to disability in patients with low back pain.
Saur, Ensik, Frese, Seeger, Hildebrandt <sup>24</sup>	1996	Lumbar range of motion: reliability and validity of the inclinometer technique in the clinical measurement of trunk flexibility.
Williams R, Binkey J, Bloch R, Goldsmith CH, Minuk T <sup>26</sup>	1993	Reliability of the modified Schober and double inclinometer methods for measuring flexion and extension.

Figure 1. Included articles.

### Brief description of contents

General aspects: 46% of the articles have 5 or even more authors. 15% are publishings before 2000, 46% between 2000 and 2005, and 38% between 2006 and 2012.

Responding too bjective 1 of this review: 53% of the trials make possible responding to this objective; all authors agree in pointing out that pain and disability scales are valid for diagnosis and monitoring low back pain, and their use is recommended in the consulted scientific articles.

Cuesta Vargas<sup>17</sup> (2008) indicates that most used scales in scientific bibliography for evaluating low back pain are VAS, Roland Morris questionnaire and SF-36

to measure life quality. Rocchi<sup>18</sup> (2005) agrees and adds that questionnaires with most validity are Oswestry index, Roland Morris questionnaire and Quebec questionnaire.

Bijur<sup>19</sup> (2001) found good criteria of internal validity to measure pain from VAS. Fritz<sup>20</sup> (2011) points out that results of Oswestry index are better than those of Quebec questionnaire, and Hicks<sup>21</sup> (2009) states that both are valid to be used in elderly people.

Honglei<sup>22</sup> (2012) and Calmels<sup>23</sup> (2005) expose the validity of these questionnaires in their adaption to other languages and cultures. Honglei<sup>22</sup> (2012) adds that Roland Morris questionnaire has good correlation with Oswestry index and VAS.

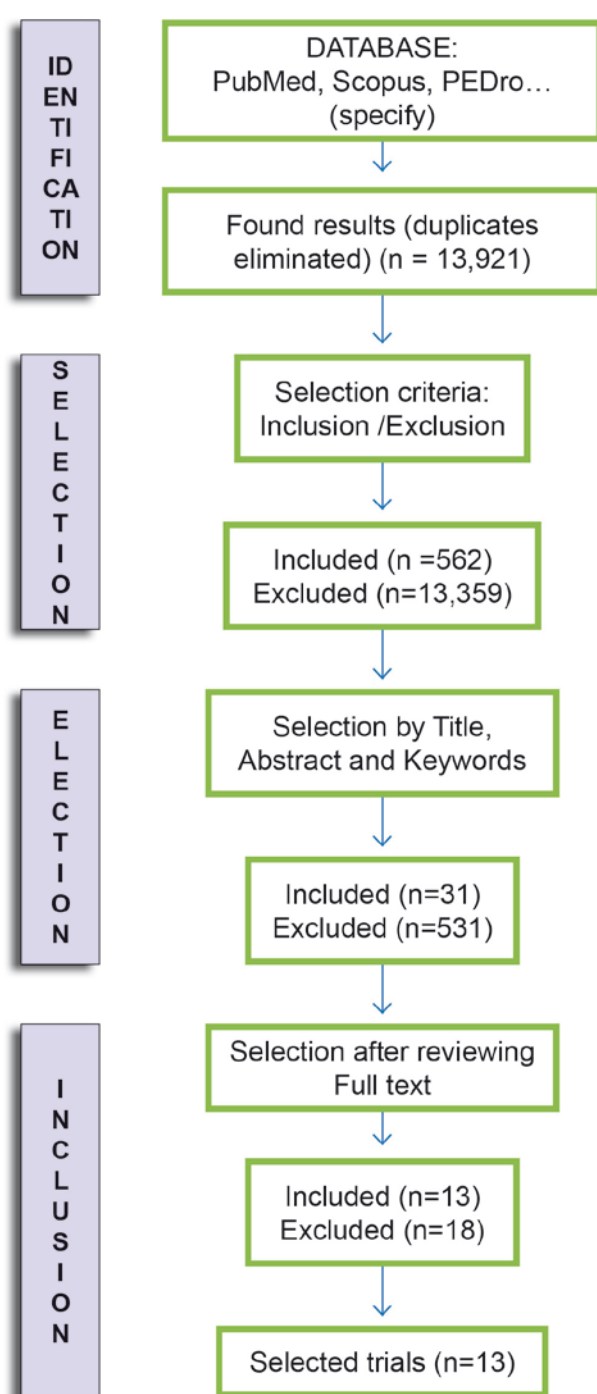


Figure 2. Flow chart of the articles selection, according to the PRISMA Declaration<sup>30, 31</sup> for reports of systematic review and meta-analysis in trials of health care.

Responding to objective 2 of this review: 23% of this trials allow responding to this objective; Saur<sup>24</sup> (1996) reveals a relation basically linear between the use of the double inclinometer and X-ray with an excellent correlation for total movement ( $r=0.97$ ;  $P<0.001$ ) and for the flexion movement ( $r=0.98$ ,

$p<0.001$ ) and less correlation for the extension movement ( $r=0.75$ ;  $p=0.001$ ). Perret<sup>25</sup> (2001) finds a good correlation between the trunk's flexion in the FTF test (FTF) and X-ray ( $r=0.96$ ;  $WHR=0.99$ ). Williams<sup>26</sup> (1993) compares the modified Schober's test and the inclinometer using internal validity criteria and finds a greater reproducibility in Schober's test (flx 0.72, ext 0.76) than in the inclinometer (flx 0.60, ext 0.48).

Responding to objective 3 of this review: 23% of the trials allow responding to this objective; all authors Sullivan<sup>27</sup> (2000), Poitras<sup>28</sup> (2000) and Van Nieuwenhuysen<sup>29</sup> (2009) agree in pointing out that the range of motion has a poor correlation with the disability scales and therefore, conclude that the range of motion is not a valid criterion for diagnosing this pathology.

## DISCUSSION

Lumbar pathology is one of the most common causes of medical consultation and work leave. Thus, it is important to have valid tools for its diagnosis and monitoring. The most common findings in the scientific bibliography are questionnaires and pain scales, to measure the range of motion and the imaging tests. In this trial, we carried out a review of the pain and disability scales and of the tests that measure the range of motion, due to its low economic cost, and the facility of using it during a consultation. Imaging and laboratory tests were excluded, since access to them is more difficult and economically more expensive.

The most mentioned scales in the consulted bibliography are VAS, Oswestry index and Roland Morris questionnaire<sup>17, 18</sup>. All these questionnaires are valid, reliable and of high reproducibility, validated in different countries and in different languages and cultures<sup>22, 23</sup>. These methods are used worldwide when performing scientific trials on lumbar pathology and their use is highly recommended<sup>17-23</sup>. The most frequently found tests for measuring the range of motion at the lumbar level in the consulted scientific bibliography are the FTF test; Schober's modified test and the inclinometer test. FTF is a simple test, of high reproducibility and that needs few material resources<sup>25</sup>. Schober's test has good reproducibility<sup>26</sup>. Inclinometer test has basically a linear correlation with the X-ray regarding the complete movements and trunk flexion, being less reliable for the extension movement<sup>24, 26</sup>.



Authors	Ob- jec- tive	Con- trol	Pa- tients/ Group	Variables	Procedure	Conclusions
Bijur PE, Silver W, Gallagher PJ <sup>19</sup>	1	No	96	VAS	Cohorts. Repeated measurements of VAS for 2h	Relation between vertical and horizontal VAS $r=0.99$ Total $r=0.97$ (CI 0.96-0.98)
Camels, Bèthoux, Condemime Fayolle <sup>23</sup>	1	No	-	Scales and diagnostic processes	Bibliographic review	DPO, RMQ, OSW, QUE showed validity, feasibility, linguistic adaptation and international use.
Cuesta Vargas AI, Rodriguez Moya A <sup>17</sup>	1	No	-	Assessment of the frequency rate of pain and disability scales in patients with low back pain	Bibliographic review	Most frequent methods for low back pain assessment were VAS, RMQ and SF-36
Fritz, Irrqanq <sup>20</sup>	1	No	67	OSW, QUE	Both scales were compared to the physical impairment index	Better levels of test-retest and reliability for OSW compared to QUE
Hicks, Manal <sup>21</sup>	1	No	107	OSW, QUE	Comparison with the psychometric properties	Reliability 0.92 OSW 0.94 QUE. Sensitivity $p<0.0001$ OSW; $p<0.001$ QUE Both questionnaires are valid for geriatric patients.
Honglei Yi., Xinran Ji, Xianzhao Wei, Ziqiang Chen, Xinhui Wang, Xiaodong Zhu, Wei Zhang, Jiayu Chen, Diqing Zhang, Ming Li <sup>22</sup>	1	No	187	RMQ, Chinese version	Comparison with the Chinese version of VAS and OSW	RMQ has high concordance with VAS and OSW and it is validated in intercultural adaption. WHR= 0.952-0.949 RMQ/VAS $r=0.685-0.666$ RMQ/OSW $r=0.841-0.818$ , $p<0.01$
Rocchi, Sisti, Benedetti, Valentini, Bellagamba, Federici <sup>18</sup>	1	No	No	Self-assessment questionnaires of disability from low back pain	Bibliographic review	The most valid are OSW, RMQ and QUE, with high correlation between them. OSW WHR 0.94 RMQ WHR 0.93 QUE WHR 0.92
Perret, Poiraudau, Fermanian, Colau, Benhamou, Revel <sup>25</sup>	2	No	114	FTF	Comparison with X-ray for reliability and validity	Good correlation between trunk flexion and X-ray ( $r=0.96$ ) Very good intra-inter observer reliability (WHR=0.99)
Saur, Ensik, Frese, Seeger, Hildebrandt <sup>24</sup>	2	Yes	54	LRM, inclinometer	Comparison between the inclinometer and radiologic measurements	Correlation between inclinometer and X-ray results almost linear in total movement ( $r=0.97$ ; $p<0.001$ ) and in flexion ( $r=0.98$ ; $p<0.001$ ) Better correlation in extension ( $r=0.75$ ; $p<0.001$ )
Williams R, Binkey J, Bloch R, Goldsmith CH, Minuk T <sup>26</sup>	2	No	15	Schober's modified test	Comparisons with inclinometer measuring. Searching for internal validity criteria	Schober's test has a 0.72 in flexion and 0.76 in extension. Inclinometer 0.60 in flexion; 0.48 in extension
Poitras, Loisel, Prince, Lemaire <sup>28</sup>	3	No	111	Range of motion in flexion and extension	Comparison with the kinematic results of OSW	No relation was found between the range of motion and disability tests.
Sullivan, Shoaf, Riddle <sup>27</sup>	3	No	34	Double inclinometer	Comparison of these results with RMQ	No relation was found between the measurement of range of motion and disability tests $r=0.35$ ; $p>0.1$
Van Nieuwenhuysse, Crombez, Burdorf, Verbeke, Masschelein, Moens, Mairiaux and the BelCoBack Study Group <sup>29</sup>	3	2 groups	692	Spinal aspects, range of motion test and questionnaires on low back disability	Cohorts study with annual measurement to find prognostic criteria for lumbar pathology	Disability tests represent an annual prognostic criterion. Spinal aspects and measurements of the range of motion are not related to the results of the disability scales; $p>0.05$
OSW Oswestry Index, RMQ Roland Morris Questionnaire, VSA Visual Analogue Scale, DPO Dallas Pain Questionnaire, QUE Quebec Questionnaire						

Figure 3. Results of the review.

Consulted bibliography indicates us that the correlation between the range of motion and the disability questionnaires is very low, and for this reason it is not recommended to be used as diagnostic criteria for low back pain. It is not considered valid for this purpose<sup>27-29</sup>.

### Study limitations

This trial could have been limited by the fact of excluding articles published in languages different from English, Spanish or French. Equally, there might be biases in the articles selection and limitations for using only two databases.

It would be interesting to find valid diagnostic tests useful for the diagnosis and prognosis of this pathology. It is suggested to follow the research line over valid and reliable diagnostic tests for the diagnosis and monitoring of the lumbar pathology.

### CONCLUSIONS

Pain and disability scales are valid, reliable and highly recommended tests in scientific bibliography for the diagnosis and monitoring of lumbar pathology<sup>17-23</sup>. They are translated and adapted to different languages and cultures<sup>22,23</sup>. These scales are also highly accepted to be used in scientific articles. Most used scales are Oswestry index, Roland Moris Questionnaire and VAS<sup>17, 18</sup>.

Measurement tests for the range of motion are valid and reliable when detecting variations in the range of movement; they have high reproducibility and low economic cost. They have a good correlation with the imaging tests; therefore, they can be used to perform the mentioned measurement.

The most used ones are: modified Schober's test<sup>26</sup>, double inclinometer<sup>24, 26</sup> and FTF test<sup>25</sup>. The range of motion is not a valid diagnostic criterion for lumbar pathology, since the relation between its results and the results of the disability scales is very poor<sup>27-29</sup>.

### CONFLICT OF INTEREST

Authors declare they had no conflicts of interest.

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