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Interrater Reliability of a Movement Impairment-Based Classification System for Lumbar Spine Syndromes in Patients With Chronic Low Back Pain

Low back pain (LBP) is one of the most common reasons for visits to the physician's office and billions of dollars are spent for the cost of lost labor and related medical expenses.¹⁵ Of the people who experience LBP, approximately 8% will develop chronic symptoms. Although this is a small percentage of people who experience LBP, these individuals accrue large medical costs and frequently become disabled.² In spite of the high prevalence of LBP, effective treatment remains problematic.^{1,28,29} One of the greatest difficulties in determining treat-

ment and treatment efficacy lies in the diverse presentation of LBP, making it

difficult to classify patients into subgroups of those likely to respond to a specific intervention.

Although many physical therapists recognize the value of classification systems, the traditional medical model of classifying patients with LBP based on pathoanatomy has proven to be ineffective in this population.³¹ The lack of success in using the pathoanatomic model is likely due to the fact that a structural pathology cannot be identified in the majority of patients with LBP.² Waddell³¹ states that the majority of back pain can be described as "nonspecific LBP." He further defines nonspecific LBP as "common mechanical back pain of musculoskeletal origin in which symptoms vary with physical activity." Moreover, the pathoanatomy-based classification does not provide guidelines for physical therapy intervention. Several investigators have advocated for classifications that are based on signs and symptoms identified during the patient examination and a history that might direct clinicians to a specific treatment approach.^{4,7,24} Some of the better known classification systems that have been proposed and investigated include the treatment-based classification (TBC) by Delitto et al,⁴ McKenzie's movement-based classification,¹⁷ and the movement impairment-based classifica-

- **STUDY DESIGN:** A prospective methodological study of interrater reliability.
- **OBJECTIVES:** To examine the interrater reliability of a movement impairment-based classification system for patients with chronic low back pain (LBP).
- **BACKGROUND:** Movement impairment-based classification for the lumbar spine categorizes LBP based on the findings derived from a patient history and standardized examination. Though many presume this classification to be useful for directing treatment of individuals with LBP, agreement between examiners for assigning a lumbar spine category to a patient has not been studied thoroughly.
- **METHODS AND MEASURES:** Two physical therapists independently examined 24 patients (8 men, 16 women) with chronic LBP (pain duration greater than 12 weeks). All patients enrolled in the study had been diagnosed with LBP that was believed to be due to mechanical causes, and the duration of their symptoms ranged from 20

to 1040 weeks. The examiners used a standardized examination to assess patients and classify them into 1 of 5 lumbar spine categories. Percent agreement and kappa coefficients were calculated between the examiners for the lumbar movement impairment-based classifications.

- **RESULTS:** Percent agreement between examiners was 75% and the kappa coefficient was 0.61. The most prevalent lumbar spine categories identified by both examiners were lumbar extension rotation syndrome (41.7% of patients by examiner 1, 37.5% of patients by examiner 2) and lumbar rotation syndrome (41.7% of patients by both examiners).
- **CONCLUSIONS:** Interrater reliability between 2 physical therapists classifying patients with chronic LBP into 1 of 5 lumbar spine movement impairment categories had substantial agreement. *J Orthop Sports Phys Ther* 2008;38(6):371-376. doi:10.2519/jospt.2008.2760
- **KEY WORDS:** agreement, diagnostic categories, kappa statistic

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tion by Sahrman.²⁴ Several studies have demonstrated reliability^{8,10} and favorable outcomes using the TBC when treating patients with acute LBP.^{7,9,10,12} However, the TBC system has not been investigated for use in a chronic LBP population. The McKenzie movement-based classification has been shown to be reliable^{3,13,21} and highly correlated with MRI and discogram findings,^{5,20} but the system has been criticized for not being exhaustive.²² More specifically, McKenzie's system does not account for those patients whose symptoms do not improve (ie, centralize to the midline) with repeated movement.

When using Sahrman's classification, the clinician categorizes a patient with LBP into 1 of 5 different syndromes, based mainly on pain behavior (ie, does pain increase, decrease, or stay the same) during specific postures or movements.²⁴ The classification is based on the findings derived from a standardized examination that includes history and physical examination.²⁷ During the examination, the clinician attempts to identify spinal motions or alignment that provoke symptoms (ie, reproduce the patient's symptoms of pain or paresthesia).^{16,24} Once the classification has been identified, then treatment strategies can be implemented that restrict the symptom-provoking spinal motions or alignment during everyday activity.²⁷ Van Dillen et al²⁶ studied the reliability of physical examination items used to categorize the lumbar syndrome but did not address interrater reliability of the movement impairment-based classification system itself. Norton et al¹⁹ calculated percentage of agreement and a kappa value for pairs of examiners using the movement impairment-based classification system as part of a larger study examining lumbar curvature and LBP. Reliability of the movement impairment-based system for classifying patients with chronic LBP into categories used to guide treatment should be investigated further. Additionally, Heiss et al¹² states that, for a classification system to be practical for managing patients with LBP in today's hectic healthcare climate, clinicians must

TABLE 1	PATIENT DEMOGRAPHICS (N = 24)
Characteristic	Mean (SD)
Age (y)	43.8 (13.5)
Height (cm)	166.9 (9.9)
Mass (kg)	82.2 (18.0)
Body mass index (kg/m ²)	29.7 (7.7)
Duration of symptoms (mo)	288.0 (330.5)
Modified Low Back Pain Disability Questionnaire score (%)	37.4 (17.8)

be able to learn to use the system proficiently within a reasonable period. The purpose of our study was to determine the interrater reliability of the movement impairment-based system described by Sahrman²⁴ for classifying patients with chronic LBP when the system is used by clinicians with varying amounts of clinical experience and formal training.

METHODS

Patients

PATIENTS OF ANY AGE, RACE, OR SEX were recruited consecutively from patients referred to an outpatient pain clinic for treatment of chronic LBP and enrolled in a pain management program conducted by the clinic. Eligible patients had LBP for longer than 12 weeks. Twenty-four patients (8 men, 16 women) with a mean age \pm SD of 43.8 \pm 13.5 years participated in the study. All patients enrolled in the study had been diagnosed with LBP that was believed to be related to mechanical causes. Duration of symptoms ranged from 20 weeks to 1040 weeks, with a mean \pm SD duration of 288.0 \pm 330.5 weeks. A summary of participant characteristics is shown in **TABLE 1**.

Patients were excluded from the study if they demonstrated or reported any of the following: (1) pregnancy; (2) severe kyphosis, scoliosis, or spinal stenosis; (3) history of spinal surgery in previous 3 months, scheduled for surgery, or history of more than 1 surgical procedure on the spine; (4) cancer, rheumatoid arthritis, ankylosing spondylitis, or neurological disease other than nerve root involve-

ment at the lumbar spinal level; (5) inability to stand and walk without use of an assistive device; or (6) a Modified LBP Oswestry Disability Questionnaire score greater than 75. Delitto et al⁴ indicate that a score of greater than 75 on the Oswestry Disability Index (which is the original disability index on which the Modified LBP Disability Questionnaire was based) may be indicative of symptoms that are of a nonmovement nature and that, if the subject's score accurately represents his or her physical limitations and disability, there may be a severe underlying pathology. Patients who qualified for the study and volunteered to participate were read their rights as human participants and asked to sign a consent form in accordance with the guidelines established by The Institutional Review Board at the University of Texas Southwestern Medical Center at Dallas and Texas Woman's University.

Examiners

Two physical therapists served as examiners for the study. Both the examiners graduated from an accredited university in their respective countries and were licensed to practice. Examiner 1 had 2 years of clinical experience and examiner 2 had 9 years of clinical experience as a physical therapist. Although each of the examiners differed in academic background and clinical experience, they were similarly prepared in terms of amount of training and practice to evaluate patients using the standardized examination. Examiner 1 had taken a course at an affiliated university in which theory and practice of the

movement impairment-based classification system was presented. In this course, 1 to 2 hours of theory were followed by 3 hours of demonstration of test items used to categorize lumbar syndromes presented in Sahrman's textbook.²⁴ An additional 3 hours were spent practicing the examination on peers under the supervision of the course instructor. Examiner 2 had attended a continuing education course on diagnosis and treatment of movement impairment syndromes instructed by Sahrman and her associates. This weekend-long course included approximately 6 hours on the theory and practice of examination and classification of patients with LBP. Prior to beginning the study, the 2 examiners reviewed the operational definition of each test item in the standardized examination and practiced the procedure by performing the exam on 5 student subjects at their affiliated university. The actual practice time spent by the 2 examiners performing the standardized examination and making judgment on a classification was approximately a total of 8 hours over a 2-week period.

Instruments

A standardized examination developed by Sahrman²³ was used to assess and classify patients. The examination is designed to identify movement impairments of the lower quarter and to provide direction for the treatment of LBP. The examination items are related to (a) reports of symptoms associated with various positions and movements and (b) judgments by the examiner of alignment and movement in different positions.

The examination consists of 27 symptom-related test items. For each of these items, the subject either assumes a posture or performs a movement (spinal or lower extremity), then reports the status of his or her LBP symptoms relative to a specified posture or movement. For example, subjects are asked to indicate the status of their low back symptoms in their natural standing position. Next, they may be asked to move into a position of trunk

flexion. On completion of the test position, subjects are asked to report the status of their symptoms relative to what they were in the natural standing position. Response options are (a) symptoms increased, (b) symptoms decreased, or (c) symptoms remained the same. Operational definitions for these response options are published elsewhere.²⁷ Additionally, the examination has 25 alignment-related items that the examiner judges. For example, the examiner may observe the subject's sitting posture and judge the alignment of the lumbar spine to be primarily flexed, extended, or flat. At the completion of the examination, the examiner analyzes the results and makes a judgment to classify patients into 1 of 5 categories.

Assessment Procedures

In this study, patients were assessed and rated separately by each of the 2 examiners. Order of testing by either examiner 1 or examiner 2 was determined by a blind draw. If the patient randomly drew number "1," then examiner 1 performed the examination first. Examiner 1 then left the room and examiner 2 entered and performed the same examination on the patient. Each of the examiners administered all the items of the standardized examination in the same order to every patient. Each examiner recorded her findings on a data form and, at the end of the examination, used these findings to classify the patient into 1 of the 5 lumbar spine diagnostic categories. The examiners were not allowed to communicate with each other during the process of examination of each patient. They were also not allowed to discuss previously examined subjects or the classification system during the course of the study.

Data Analysis

The lumbar spine diagnostic category assigned by each of the 2 examiners was used for data analysis. The frequency of occurrence of each diagnostic category assigned by the 2 examiners was tabulated and agreement was calculated (number of exact agreements/number

of possible scores). Because some agreement between the raters is due to chance, a kappa statistic was calculated to determine percent agreement while accounting for chance.

RESULTS

BOTH EXAMINERS TESTED AND CLASSIFIED 24 patients with chronic LBP. Descriptive statistics calculated for patient demographics and characteristics are provided in **TABLE 1**. The distribution of lumbar spine diagnostic categories assigned by each examiner is presented in **TABLE 2**. Both examiners selected lumbar rotation with extension (41.7% of patients for examiner 1, 37.5% of patients for examiner 2) and lumbar rotation (41.7% of patients for both examiners) syndromes most frequently.

Lumbar rotation with flexion syndrome was selected for 16.7% and 20.8% of the patients by examiners 1 and 2, respectively. The lumbar extension and lumbar flexion syndrome categories were never selected by either of the examiners.

Percent agreement between the 2 examiners was 75%. The calculated kappa coefficient (κ) was 0.61 ($P < .001$). Based on the standard error of our obtained kappa, the resulting 2-sided 95% confidence interval was 0.33 to 0.89.

DISCUSSION

THE RESULTS OF OUR STUDY INDICATE that the 2 examiners agreed on the lumbar spine diagnostic category for 75% of the patients. The calculated kappa coefficient used to estimate interrater reliability when correcting for chance agreement between the examiners was 0.61, indicating good reproducibility²³ or a substantial level of agreement.¹⁴ Our calculated percent agreement and kappa value between examiners were similar to those reported by Norton et al.¹⁹ In the Norton et al.¹⁹ study, each subject was tested by a pair of examiners, but a total of 5 physical therapists served as examin-

TABLE 2

**AGREEMENT MATRIX FOR LUMBAR SPINE
DIAGNOSTIC CATEGORY CLASSIFICATION
FOR 24 PATIENTS BY 2 RATERS**

Syndrome		Rater 2					Total
		LERS	LES	LRS	LFRS	LFS	
Rater 1	LERS	7 (3.75)*	0	2 (3.75)	0	0	9
	LES	0	0	0	0	0	0
	LRS	3 (4.16)	0	7 (4.16)	0	0	10
	LFRS	0	0	1 (2.08)	4 (0.83)	0	5
	LFS	0	0	0	0	0	0
	Total	10	0	10	4	0	24

Abbreviations: LERS, lumbar extension rotation syndrome; LES, lumbar extension syndrome; LFRS, lumbar flexion rotation syndrome; LFS, lumbar flexion syndrome.; LRS, lumbar rotation syndrome.

* Values in parentheses represent chance frequencies.

20% of the men and women were classified into the lumbar extension diagnostic category. There are several possible explanations that none of our participants were classified into the lumbar extension category. Our 24 patients were recruited consecutively from a single pain management clinic. Consequently, our participants may not have been representative of all categories of chronic LBP. This skewed distribution across categories has the potential to lower the kappa value and could be viewed as a limitation of our study. Participants in the Norton et al¹⁹ study were recruited from 6 outpatient clinics and the target population was not necessarily patients with chronic pain. Although 72% of the participants in the Norton et al¹⁹ study were categorized as chronic, the authors defined *chronic* as having symptoms for more than 7 weeks, whereas we used a 12-week duration.^{1,6} Furthermore, participants in our study had been experiencing LBP for a mean of 5.5 years. Therefore, although both studies described their participants as having chronic LBP, the onset and duration of symptoms were very different in the 2 studies and could have contributed to the difference in distribution across lumbar spine diagnostic categories.

Our study demonstrated good reproducibility of the movement impairment-based classification system for categorizing patients with chronic LBP by 2 examiners. The examiners had varying levels of clinical experience and only 1 had received training by the developers of the system. It was also encouraging to note that our study demonstrated good reproducibility in a sample of patients who had a higher body mass index (BMI) than the general population. Seventy-five percent of the subjects in our sample were classified as being overweight, obese, or extremely obese according to standards set by the National Heart Lung and Blood Institute.¹⁸ In general, clinical measurements and observations are more difficult to perform in individuals who are overweight or obese, due to difficulty in palpation and visualization of body parts.

ers. After a pair of examiners tested each of the 95 subjects with LBP, each examiner independently classified the subject into a diagnostic category consistent with the preponderance of the examination results. Percentage of agreement between the examiners for categorization of lumbar pain was 78%. The kappa value was 0.57. The 5 therapists acting as examiners in the Norton et al¹⁹ study were also developers of the standardized examination and had worked together extensively. The fact that our study attained a similar percentage of agreement and kappa value as 5 more experienced examiners as reported by Norton et al¹⁹ is encouraging in terms of generalizability of both studies.

Studies examining the interrater reliability of a TBC system for LBP have yielded similar kappa values and percent agreement. Fritz and George¹⁰ examined the interrater reliability of the classification assignment between a pair of physical therapists who used the TBC system originally described by Delitto et al⁴ to assess 43 patients with acute LBP. Agreement between the therapists was 65.1% and the kappa coefficient was 0.56.¹⁰ Heiss et al¹² reported 31% agreement and a kappa coefficient of 0.14 between 4 randomly paired physical therapists who used the same TBC system to classify 45 patients with LBP. However, when 1 of the examiners was excluded from the analysis due to unusually low agreement

with the other examiners, percent agreement between the 3 remaining physical therapists was 55% and the kappa coefficient was 0.45.

In our study, the 2 most common lumbar spine diagnostic categories selected by both examiners was lumbar rotation with extension syndrome and lumbar rotation syndrome. Only 4 out of our 24 participants were classified as lumbar rotation with flexion syndrome. None of our participants were classified into the pure lumbar flexion or lumbar extension syndromes. We were not surprised that none of our participants fit the lumbar flexion syndrome category, as this syndrome is hypothesized to be more common in younger individuals who are experiencing an acute episode of LBP.²⁴ Our participants had a mean \pm SD age of 43.8 ± 13.5 years and met our inclusion criteria for having chronic LBP. Sahrman²⁴ states that the lumbar rotation with extension syndrome is most prevalent in patients with chronic LBP, especially in individuals over 55 years of age. Therefore, prevalence of the lumbar rotation with extension classification found in our study was in agreement with Sahrman's observation. Finding no participants in the lumbar extension category, however, was not as expected. Norton et al¹⁹ also found the lumbar rotation with extension category to be most prevalent (62%). However, in their study,

This represents another difference in our study that, compared to previous studies, may explain our different distribution of lumbar spine diagnostic categories.

Although this study provides additional data demonstrating usefulness of the movement impairment-based classification system, further studies need to assess whether the diagnostic categories are valid. Thus far, the only validity study related to the lumbar movement impairment-based classification system was a study published by Van Dillen et al.²⁷ That study provided support for partial construct validity of 3 of the lumbar spine diagnostic categories (lumbar rotation with extension, lumbar rotation with flexion, and lumbar extension). Additionally, Gombatto et al¹¹ and Van Dillen et al²⁵ have studied validity of the movement impairment-based classification system indirectly, examining whether the results of clinical tests used to classify patients are different between people in 2 LBP categories. For example, Gombatto et al¹¹ examined whether the lumbar movement patterns during a clinical test such as trunk lateral bending would be different between patients classified as lumbar rotation with extension and those classified as lumbar rotation. Using 3-dimensional motion analysis to assess kinematic measures of lumbar movement during trunk lateral bending, Gombatto et al¹¹ found the lumbar movement patterns to be different between the 2 groups. Based on these findings, the investigators concluded that their results provide data to validate the use of lumbar movement pattern observation as part of the standardized examination used to classify patients into LBP categories.¹¹ Van Dillen et al²⁵ conducted a similar study to assess whether lumbopelvic motion during a clinical test of active hip lateral rotation would differ between people in a LBP category of lumbar rotation with extension and those in a lumbar rotation category.²⁵ Studies by Gombatto et al¹¹ and Van Dillen et al²⁵ provide evidence for the validity of clinical tests used to select a diagnostic category.

The value of a classification system is

the ability to direct treatment. Ultimately, a classification system should lead to improvement in treatment. Sahrman²⁴ has proposed treatment corresponding to each diagnostic category, but there is no evidence to support the proposed treatment. Maluf et al¹⁶ used the movement impairment-based system to classify a patient with chronic LBP into the rotation-with-extension category. The corresponding treatment for rotation with extension proposed by Sahrman was then implemented resulting in improved Oswestry Disability Index scores. Although this was a case report, it provides preliminary support for the proposed treatment and underscores the need for clinical studies investigating the proposed treatment for each diagnostic category. This will be a long process, as there are 5 different diagnostic categories for the lumbar spine. But investigating the proposed treatment for the most commonly seen classification (lumbar rotation with extension syndrome) should be a priority.

There are several potential limitations in our study, the first of which is sample size. Our goal was to obtain a sample of 30 participants with chronic LBP. However, when 1 of the examiners had to leave the pain clinic where patients were recruited, data collection had to stop, which left us with a sample size of only 24. Although this was a smaller sample size than originally planned, we still had adequate power to detect a significant kappa statistic. Additionally, the skewed distribution of participants across lumbar spine categories in our study might have had an attenuating effect on the kappa value. Still, our calculated κ of 0.61, with a P value of less than .001 can be interpreted as substantial strength of agreement,¹⁴ with little chance that our calculated κ was due to chance rather than true agreement between our examiners.

A second potential limitation is that we did not monitor overt pain behaviors or clustered Waddell signs and symptoms³⁰ in our participants. Because these behaviors are more commonly observed in patients with chronic LBP, this could

have confounded the interpretation of physical findings in our study sample. More specifically, these patients would tend to display greater inconsistency in the standardized examination tests. Therefore, screening out patients who demonstrated overt pain behaviors or clustered Waddell's signs and symptoms would likely have resulted in a higher kappa value.

A third potential limitation in our study is the potential for participant learning. Participant learning is not an issue with the 25 alignment-related items in the standardized examination because these items require observation and judgment only by the examiner. Participant learning, however, may have confounded results of the 27 symptom-related items. For the symptom-related items, patients were asked by the first examiner to report on symptoms (increased, decreased, or same) associated with various positions and movements. Only after the first examiner completed the entire standardized examination and left the room did the second examiner enter the room and repeat the examination. Therefore, it is possible that the patient remembered his/her responses to the same tests conducted by the first examiner. There are 25 symptom-related test items, however, making it difficult to recall responses to each item.

To remove the issue of participant learning we would have needed to have the second examiner perform the examination several days later, making it more difficult for the patient to recall responses to the test items. This, however, would have introduced the potential for symptoms to change over the period.

CONCLUSIONS

INTERRATER RELIABILITY BETWEEN 2 physical therapists with varying clinical experience and training using a standardized examination to assess and classify patients with chronic LBP into lumbar movement impairment-based diagnostic categories revealed substantial agreement. Neither of the 2 physical ther-

apists in this study had extensive experience in using this classification system prior to this study, but they spent time practicing the system before beginning data collection. Time to learn and practice using any classification system should be expected. The substantial agreement between the 2 examiners with different experience and training improves the generalizability of our findings to other physical therapists using the movement impairment-based classification system for patients with chronic LBP. ●

KEY POINTS

FINDINGS: Two physical therapist with varying clinical experience and training classified patients with chronic LBP into the same diagnostic category 75% of the time when using a movement impairment-based classification system.

IMPLICATION: Clinicians can learn to use this classification system and use it effectively after a modest amount of training and practice.

CAUTION: The value of the movement impairment-based classification used in this study is ultimately to direct treatment based on the diagnostic category. However, the efficacy of the proposed treatment for each category has not been studied.

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