An Exploration of Maitland's Concept of Pain Irritability in Patients with Low Back Pain

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Musculoskeletal pain irritability is a clinical construct described by Maitland¹⁻³. Irritability judgments are commonly used by physical therapists in the clinical decision-making process⁴⁻⁶. Although widely used, irritability has not been defined to the ex-

tent that its measurement properties can clearly be tested, and no published investigations exploring the measurement characteristics of irritability were found by the authors of this paper. This study was designed to explore the measurement characteristics of irritability.

Pain severity/irritability as defined by Maitland was identified by Smart and Doody³ as one of five pain models that experienced physical therapists used when making clinical decisions for patients' musculoskeletal problems. Other pain models that therapists have used during the clinical reasoning process include biomedical, psychosocial, pain mechanisms, and chronicity models³. The following is an example of how a therapist might use clinical reasoning from each of the pain models to describe a single patient's pain. A patient reports subacute (chronicity) mechanical pain (biomedical) that is likely associated with a resolving inflammatory process (pain mechanisms). The patient displays no evidence of fear avoidance behaviors (psychological). The patient's symptoms are not severe or irritable so examination/treatment can be provided without fear of exacerbating symptoms (severity/irritability).

When evaluating a patient's musculoskeletal problem, Maitland not only considered the patient's pain severity and irritability but also the nature of the disorder¹. The interaction of these characteristics contributes to guiding

ABSTRACT: Maitland's construct of musculoskeletal pain irritability is widely used by physical therapists for making decisions about the vigor of examination and treatment, but this construct has not been defined to the extent that its measurement properties can be tested. The purposes of this study were to 1) determine if physical therapists utilize low back pain (LBP) irritability judgments to make treatment decisions, 2) identify LBP characteristics appropriate for an LBP irritability construct, and 3) develop a measurement construct of LBP irritability. Physical therapists evaluated and treated 183 subjects with LBP. The therapists judged the subjects' LBP as *irritable* or *non-irritable*, and recorded treatments provided at the initial visit. A principal-components analysis (PCA) was performed on 14 patient-reported LBP characteristics to identify potential components of a measurement construct of LBP irritability. The therapists' irritability judgments were found to be associated with the types of treatments prescribed. Five dimensions of LBP irritability were identified by the PCA from the 14 LBP characteristics considered. Four of these dimensions were associated with the therapists' LBP irritability judgments. The Roland-Morris Disability Questionnaire, presence of distal symptoms, and forward bending tolerance were found to have a stronger association with the irritability judgments than the dimensions of irritability identified in this study. Validated measures of LBP characteristics in current clinical use may adequately capture Maitland's concept of irritability.

KEYWORDS: Evaluation, Low Back Pain, Low Back Pain Irritability, Lumbar Spine, Maitland

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Financial support provided by the Sutter Institute for Medical Research and the California Physical Therapy Fund, Inc.

In-kind support provided by Jamba Juice Corporation, California State University, Sacramento College of Health and Human Services, and UC Davis Medical Center Physical Therapy Department.

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therapists' examination and treatment decisions. Pain is considered severe if the intensity is sufficient to interrupt a patient's activity. Pain severity is used as a consideration in determining pain irritability. The nature of a disorder, analogous to a number of pain model items identified by Smart and Doody, includes characteristics such as stability of the problem (worsening, improving, stabilized), stage of healing, known pathologic processes, and/or fear-avoidance behaviors.

Irritability is assessed by judging 1) the vigor of activity required to provoke a patient's symptoms, 2) the severity of those symptoms, and 3) the time it takes for the symptoms to subside once aggravated (i.e., pain persistence)¹⁻³. Maitland recommended that therapists who judge a patient's pain as irritable should limit the vigor of the physical examination and exercises initially prescribed to the patient¹. The rationale for limiting the vigor of examination and initial treatment is to avoid exacerbating the patient's pain complaints while maximizing the patient's mobility. The benefit of judging low back pain (LBP) irritability over a course of treatment has not been demonstrated to improve patient outcomes. However, maximizing the mobility of a patient with LBP has been shown to improve outcomes⁷⁻¹⁵. Therapists use a patient's LBP irritability status as a tool to gauge how vigorous initial exercise prescription should be.

Maitland judged a patient to have irritable LBP when the pain is easily aggravated, severe, and persistent for a prolonged period of time following a cessation of the aggravating activities^{1,2}. A primary hypothesis of the extent of LBP irritability is made by the therapist following the medical history and is modified based on findings in the examination.

Maitland's instructions on how to make irritability judgments are not clearly defined but rather are illustrated using brief vignettes of patients' descriptions of pain-provoking activities. Maitland provided us with an example of making an irritability judgment using the low vigor activity of ironing clothes¹. Suppose ironing clothes for half an hour elicits LBP to the degree that the patient

must stop the activity. If the pain subsides within a half an hour allowing the patient to iron for another half an hour, Maitland would judge the patient's disorder to have *minor irritability*. However, if the patient cannot iron again until after sleeping through the night, Maitland would consider the disorder to be *irritable*. An example given by Koury and Scarpelli² of an irritable shoulder condition illustrates consideration of the same variables. Koury and Scarpelli² described a patient who flexes his or her shoulder once or twice resulting in an increase in symptoms that persist for 30 minutes as having *irritable pain*. If the symptoms dissipate immediately on return from flexion, the pain is considered *non-irritable*.

Since a measurement construct of irritability has not been operationally defined, therapists' assessments of irritability are likely to contain a substantial amount of variability. A companion study¹⁶ to this investigation assessed the reliability of LBP irritability judgments of physical therapists as currently assessed. The reliability of these irritability judgments was found to be moderate (kappa statistic = .44, prevalence adjusted kappa = .50). This level of reliability may be improved upon with a clearly defined operational definition of irritability for patients with LBP. More importantly, the construct validity of irritability judgments may be improved by using a psychometric approach to define and test an irritability construct from Maitland's descriptions.

The purposes of this study were to 1) determine if physical therapists modify the vigor of treatment prescription based on their irritability judgment, 2) identify LBP characteristics appropriate for consideration in an irritability construct for LBP, and 3) develop a psychometrically sound construct of irritability.

Methods

Physical Therapists

Twenty-seven physical therapists, all who were treating patients with LBP at three participating physical therapy clinics, participated in this investiga-

tion. The therapists had practiced an average 6.1 years (range *new graduate* to 21 years) and had received an average 98 hours of advanced training in the evaluation and treatment of patients with LBP in the form of short- and long-term continuing education courses. None of the participating therapists was certified as an Orthopedic Clinical Specialist by the *American Physical Therapy Association*, was a fellow in the *American Academy of Orthopedic Manual Physical Therapists*, or had received an Australian Master's or Graduate Diploma in Manipulative Physiotherapy at the time of the study.

Pre-Study Training

The participating physical therapists all attended an orientation prior to beginning data collection that covered the purposes and procedures of this investigation. Maitland's definition of LBP irritability was reviewed by identifying the characteristics that guide classification: 1) time and vigor of activity required to aggravate pain, 2) severity of pain, and 3) persistence of pain after aggravating activities are stopped. All therapists were told that *irritable LBP* is easily aggravated, of moderate to severe intensity, and persistent after the aggravating symptoms are stopped (though no specific time guideline for pain persistence was provided). *Non-irritable LBP* was described as not easily aggravated, usually not severe, and not persistent after the aggravating activity is stopped. Therapists were told that the treatment for patients with irritable LBP may include manual techniques, pain relieving agents, and/or exercises designed to decrease or avoid aggravation of symptoms. Treatment for non-irritable LBP may include flexibility, strengthening, and/or conditioning exercises with minimal concern for aggravating pain complaints. Specific guidelines for deciding irritability status based on the interaction between ease of aggravation, pain severity, and pain persistence were not provided to therapists because none are known to exist. Treatment prescriptions were left to the therapists' judgment based on their evaluations. No assessment of therapists' concept of irritability

was administered prior to data collection.

Patient Sample

Data for this investigation were gathered from 183 subjects consecutively recruited from three physical therapy clinics: two in Sacramento, California and one in Davis, California. Patients were admitted to the study if they were a) at least 18 years of age, b) able to speak and read the English language fluently (no interpreters were available), and c) available to be contacted by phone for a one-year period (for research purposes not covered in this report). Patients were excluded from the study if they a) had undergone back or neck surgery, b) were diagnosed with a vertebral or hip frac-

ture, c) had plans for surgery in a hospital within six months of recruitment, d) were unable to walk one city block for a reason other than LBP, e) were pregnant, or f) reported progressive lower limb weakness or recent incontinence. Demographic, anthropometric, and clinical characteristics of the sample are described in Table 1.

Experimental Protocol

This study employed an exploratory cross-sectional design. Prior to data collection, the procedures and the subject informed-consent forms were approved by the California State University, Sacramento Committee for the Protection of Human Subjects, the Sutter Health Central Area Institutional Review Commit-

tee, and the University of California, Davis Institutional Review Board.

When a patient first contacted the clinic, he or she was recruited to participate in the study. If tentative agreement was obtained, eligibility was determined and, if eligible, demographic and anthropometric information was obtained. LBP characteristics were obtained from subjects by phone the day of or the day prior to the initial evaluation. These characteristics are listed in Table 2.

At the initial visit, all subjects signed an informed consent, completed a Roland-Morris Disability Questionnaire (RMDQ), a Fear Avoidance Beliefs Questionnaire (FABQ), a pain drawing, and three pain-intensity numeric rating scales. The pain-intensity numeric rating scales asked subjects to rate their

TABLE 1. Subjects' characteristics.

	Clinic #1 n=120	Clinic #2 n=57	Clinic #3 n=6	Total n=183
% male/female	34.2 / 65.8	33.3 / 66.7	66.7 / 33.3	35.0 / 65.0
Age (SD*)	42.3 (12.8)	47.0 (13.6)	44.8 (14.3)	43.9 (13.2)
Body Mass Index (SD)	26.2 (5.4)	27.9 (6.2)	28.3 (3.5)	26.8 (5.6)
Years Education (SD)	16.4 (2.9)	15.2 (2.9)	17.3 (2.7)	16.1 (2.9)
Race				
White	98 (81.7%)	37 (64.9%)	5 (83.3%)	140 (76.5%)
Hispanic†	14 (11.7%)	5 (8.7%)	0	19 (10.4%)
Other	8 (6.6%)	15 (26.4%)	1 (16.7%)	24 (13.1%)
% with Chronic LBP‡	20.8%§	50.9%	33.3%	30.6%
Initial RMDQ¶ score	9.9 (5.4)	10.9 (6.0)	8.8 (6.4)	10.2 (5.7)
Initial Composite Pain-Intensity Score§	71.6 (17.8)	70.8 (20.8)	59.4 (14.5)	70.9 (18.7)
Insurance types	n=120	n=56	n=6	n=182
HMO	92 (77%)	44 (79%)		136 (75%)
PPO	14 (12%)	5 (9%)	3 (50%)	22 (12%)
Medicare/Medicaid	5 (4%)	7 (12%)		12 (6%)
Other	9 (7%)		3 (50%)	12 (7%)
Diagnoses				
Nonspecific LBP#	110 (92%)	51 (91%)	5 (83%)	166 (91%)
Herniated disc/stenosis/sciatica	10 (7%)	5 (9%)	1 (17%)	16 (9%)

*SD = Standard Deviation.

†Hispanic is an ethnic group, not a race.

‡Chronic LBP defined as greater than 6 months duration.

¶RMDQ = Roland-Morris LBP Disability Questionnaire (0 to 24 range, 24=maximum disability).

§Composite Pain Score = 10 times the average of the three numeric pain-intensity rating scales (Appendix 1).

§Significant difference found between Clinic #1 and Clinic #2 at the $p < .001$ using a chi-square test of independence or the Fisher's exact test.

#Nonspecific LBP included the diagnoses of LBP, chronic LBP, lumbago, low back sprains/strains, degenerative disc disease, degenerative joint disease, sacroiliac sprains/strains, acute back spasms, unspecified injury to the back, unspecified back ache.

TABLE 2. Low back pain characteristics reported by phone prior to the initial examination.

- *Sitting time to aggravate LBP
- *Standing time to aggravate LBP
- *Walking time to aggravate LBP
- *Forward bending time to aggravate LBP
- *Sitting time tolerated
- *Standing time tolerated
- *Walking time tolerated
- *Forward bending time tolerated
- †LBP persistence after sitting
- †LBP persistence after standing
- †LBP persistence after walking
- †LBP persistence after forward bending
- Increase LBP with lifting < 10 lbs (Yes/No)
- Increase LBP with lifting > 10 lbs (Yes/No)

*Maximum time 4 hours, if LBP not increased with activity maximum time assigned

†Minimum time 0 hours, if LBP not increased with activity minimum time assigned; maximum time of 8 hours

TABLE 3. Treatment categories as identified by Sullivan et al¹⁸ with minor modifications.

Category	Treatments included within the category
McKenzie Approach*	Centralization exercises, posture-correction exercises, manual correction of postural deviations, one-on-one general back education/instruction in posture correction exercises
Manual Therapy	Lumbar/sacroiliac mobilization technique, lumbar muscle energy technique, sacroiliac muscle energy technique, massage/soft tissue mobilization
Exercise With Equipment	Trunk stretching, resistive exercise with equipment, aerobic exercise/work conditioning
Active and Stretching Exercise	Therapist-assisted stretching of the trunk, therapist-assisted stretching of the lower extremities, unassisted stretching of lower extremities, resistive exercises without equipment, isometric trunk exercises.
Physical Agents	Moist hot packs, ultrasound, ice/cold packs/ice massage, transcutaneous electrical stimulation
Aerobics and Walking†	Any aerobic exercise
Ergonomic Activities‡	Any instruction in posture, body mechanics, ergonomics

*Sullivan et al¹⁸ also included in this category 1) lumbar support pillow/roll, 2) individualized instruction in home exercises, and 3) separated one-on-one general back education and individualized instruction in posture correction.

†Sullivan et al¹⁸ delineated 1) individualized instruction in home walking program and 2) individualized instruction in non-walking aerobic exercise program.

‡Sullivan et al¹⁸ delineated 1) work conditioning without job simulation, 2) simulate activities of daily living primarily performed in the home, 3) physical demonstration of ergonomic principles.

current pain intensity and their worst and average LBP intensity over the previous two weeks. The scale ranged from 0 to 10 with 0 being no pain and 10 being extremely severe pain. A composite pain-intensity score was computed as the average of the three pain intensity numeric rating scales¹⁷.

Subjects then received an evaluation by the physical therapist and were provided with treatments consistent with the standard of practice at the participating clinic. Treatments were recorded in a fashion that allowed categorization as described by Sullivan et al (Table 3)¹⁸. This treatment categorization system allowed inference of vigor of treatment based on descriptions of the treatments included in each category. The therapist then recorded his or her irritability judgment of the subject's LBP.

Low Back Pain Characteristics

Fourteen LBP characteristics that reflect Maitland's irritability definition were considered in this study (Table 2). Four of these characteristics address *ease of aggravation* by determining how long the subject had to perform each activity before LBP symptoms increased (time to onset with sitting, standing, walking, and forward bending). Four characteristics addressed *severity* by determining how long a subject could perform the activity without stopping due to LBP (time tolerated with sitting, standing, walking, and forward bending). Four characteristics addressed *pain persistence* by determining how long a subject's symptoms persisted after the aggravating activity was stopped (LBP persistence following sitting, standing, walking, and forward bending). Times to aggravate and activity tolerance values were capped at 4 hours, and pain persistence values were capped at 8 hours to avoid outliers skewing the data. If an activity did not aggravate a subject's LBP, then the time to aggravate and activity tolerance variables were assigned the 4-hour maximum and pain persistence was assigned a value of zero.

Two characteristics, lifting less than 10 pounds and lifting more than 10 pounds, were only rated *yes* (symptoms were aggravated) or *no* (symptoms were not aggravated).

Analysis

The association of the therapists' LBP irritability judgments and category of treatment provided was evaluated using the Fisher Exact test^{18,19}. To statistically generate a construct for the measurement of LBP irritability, a principal-components analysis with varimax rotation was performed on variables listed in Table 2. The principal components analysis identified factors not correlated with each other and generated factor loadings that identified the variables within each factor most correlated with the factor²⁰. The group of variables most correlated with a factor is said to identify the *dimension* of the factor. An eigenvalue is a statistic that reflects how much variance in the entire data set each factor accounts for. Dimensions with eigenvalues greater than 1.00 were retained for evaluation in a LBP irritability construct²⁰. A factor loading score of greater than .50 was used for factor *dimension* interpretation²⁰. Principal-components analyses using quartermax and equimax rotations, and on subjects stratified by chronicity were also performed.

To assess one aspect of the content validity of the dimensions identified in the principal-components analysis as being appropriate for inclusion in an irritability construct for LBP, a posteriori analysis was performed to determine if a relationship existed between the dimensions and the treating physical therapists' irritability judgments. Logistic regression was first used to determine if a bivariate relationship existed between the therapists' irritability judgments and the five dimensions identified in the principal-components factor analysis. A dimension's value was the sum of the values of the variables included in the dimension. Additionally, we evaluated other characteristics that have been identified as being associated with LBP outcomes to determine if they were associated with irritability judgments as well. These variables included the initial

RMDQ score²¹, the initial numeric pain intensity score¹⁷, the subject's gender^{21,22}, if the subject had distal symptoms^{21,23}, if the subject's symptoms centralized²⁴⁻²⁶, if the subject was currently or had a history of receiving disability due to LBP²⁰, the subject's FABQ score for both physical activity and work activity^{27,28}, the subject's LBP acuity (acute < 6 months versus chronic ≥ 6 months)^{23,29}, and whether the subject's LBP was transient, recurrent, or chronic as defined by Von Korff et al¹⁷. Then, by stepwise addition of the variables found to be bivariate significant in a logistic model, we found the combination of variables that was most associated with the irritability judgments. This process was performed independently for the dimensions created by the factor analysis, and then for all variables considered.

For continuous variables included in the logistic regression analysis, odds ratios found to be significantly less than 1.0 ($p < .05$) suggested that the lower the variable value, the more likely the physical therapist judged the subject to have irritable LBP; odds ratios found to be significantly greater than 1.0 suggested that the greater the value of the variable, the more likely the physical therapist judged the subject to have irritable LBP. The c-statistic, which is equivalent to the area under a receiver operating characteristic curve, was used to assess how well the predictor variable(s) discriminated between subjects judged to have irritable versus non-irritable LBP³⁰.

Version 8.1 of SAS (SAS Institute Inc., PO Box 8000, Cary, NC 27511) was used to compute descriptive statistics, the chi-square test of independence, the Fisher Exact test, the principal components analysis, and logistic regression.

Results

Association of Therapists' LBP Irritability Judgment and Treatment Prescription

Treatment categories described by Sullivan et al¹⁸, slightly modified, were used to determine if associations occurred between the LBP irritability judgments and the treatments the therapists prescribed (Table 3). All associations were

considered with and without subjects stratified by chronicity (acute = < 6 months since onset, chronic = ≥ 6 months since onset). These findings are listed in Table 4. Subjects with acute LBP who were judged to have irritable LBP were more likely to receive a greater number of McKenzie treatments and physical agents, while subjects with both acute and chronic LBP that was judged irritable were more likely to receive manual therapy treatments and fewer active and stretching exercises.

Characteristics to Be Considered for a Measurement Construct of LBP Irritability

The frequency of activities that aggravated subjects' LBP are as follows: sitting 74%, standing 54%, walking 39%, forward bending 61%, lifting <10 pounds 30%, and lifting >10 pounds 78%. Thirty-eight of the 183 subjects (21%) were excluded from the principal-components analysis due to missing values for the variables analyzed. Missing values resulted from subjects not knowing the response to a question. For example, if a subject did not know the duration of his or her sitting tolerance time, the value was left blank. No significant differences between the groups of subjects included in and excluded from the principal-components analysis were found for the characteristics of age (t -test, $p = .17$), gender (χ^2 , $p = .62$), chronicity status (χ^2 , $p = .59$), initial disability score (t -test, $p = .71$), or initial numeric pain intensity rating (t -test, $p = .17$).

Seventy-three percent of the variance in the analyzed variables was accounted for by five dimensions identified by the principal-components procedure as having eigenvalues greater than 1.00 (Table 5). The factor loadings are listed in Table 5. The dimensions identified were *standing*, *walking*, *pain persistence*, *forward bending*, and *sitting* (Table 6). Three variables, pain persistence with forward bend, lifting < 10 pounds, and lifting > 10 pounds loaded on a sixth factor but the eigenvalue associated with this factor was < 1.00 so the factor was discarded.

Quartermax and equimax rotations were also performed on the factors iden-

TABLE 4. Association of treatment categories with therapists' irritability judgments.

Treatment Category	% subjects that received at least one treatment in this category	Significant association between category and therapists' irritability judgments using the Fisher's Exact Test
McKenzie Approach	92%	Subjects with acute irritable LBP were more likely to receive a greater number of McKenzie treatments ($p<.005$) ($n=123$)
Manual Therapy	15%	Subjects with both acute and chronic irritable LBP were more likely to receive manual therapy treatments ($p<.001$) ($n=183$)
Exercise with Equipment	93%	No association ($n=183$)
Active and Stretching Exercise	84%	Subjects with both acute and chronic irritable LBP were likely to receive fewer active and stretching exercises ($p<.01$) ($n=180$)
Physical Agents	39%	Subjects with acute irritable LBP were more likely to receive a greater number of physical agents ($p<.02$) ($n=123$)
Aerobics and Walking	48%	No association ($n=183$)
Ergonomic Activities	85%	No association ($n=183$)

TABLE 5. Factor loadings of low back pain characteristics included in the principal-components analysis with varimax rotation.

Variable	Factor	Factor loadings					
		1	2	3	4	5	6
Standing time to onset		.94	.15	-.04	.02	.03	.05
Standing time tolerated		.92	.19	-.03	.03	.04	-.12
Walking time to onset		.15	.91	-.12	.12	-.04	-.09
Walking time tolerated		.20	.91	-.11	.10	-.01	-.13
Pain persistence sitting		.15	.10	.67	.16	-.28	.12
Pain persistence standing		-.19	-.07	.91	.00	.01	-.05
Pain persistence walking		-.02	-.35	.80	-.03	.13	.00
Forward bending time to onset		.01	.10	.07	.96	.07	-.03
Forward bending time tolerated		.05	.10	.04	.94	.12	-.16
Sitting time to onset		-.06	.00	-.02	.09	.92	.01
Sitting time tolerated		.14	-.03	-.04	.08	.89	-.13
Pain with lifting < 10 lbs		.05	-.01	.16	-.27	.16	.54
Pain with lifting ≥ 10lbs		-.11	-.34	-.02	.06	-.24	.61
Pain persistence forward bending		-.26	-.04	-.05	-.06	-.08	.77
Proportion of total variance explained		24%	16%	13%	12%	8%	7%
Eigenvalue of factor		3.31	2.20	1.84	1.73	1.14	0.96

TABLE 6. Dimensions of LBP irritability identified by the principal-components factor analysis.

Dimension	Variables
Standing dimension (Factor 1)	Standing time to onset Standing time tolerated
Walking dimension (Factor 2)	Walking time to onset Walking time tolerated
Pain persistence dimension (Factor 3)	Pain persistence sitting Pain persistence standing Pain persistence walking
Forward bend dimension (Factor 4)	Forward bending time to onset Forward bending time tolerated
Sitting dimension (Factor 5)	Sitting time to onset Sitting time tolerated

tified by the principal-components analysis without substantial change noted in the resulting dimensions. Principal-components analysis performed separately on subjects with chronic (≥ 6 months duration) and acute LBP also resulted in very similar compositions of the dimensions.

Content Validity of the Dimensions Identified by the Principal-Components Analysis

The logistic regression analysis identified significant relationships between the therapists' irritability judgments and four out of the five dimensions (Table 7). For the *standing*, *walking*, *sitting*, and *forward bending* dimensions, the lower

the score of the dimension, the more likely the subject was judged to have irritable LBP. Considering only the dimensions, the combination of the standing and forward bending dimension scores was found to be most predictive of the therapists' irritability judgments (c-statistic = 0.70; Table 7).

Significant associations with the irritability judgments were also found for initial RMDQ score, initial pain-intensity score, presence of distal symptoms, FABQ physical activity and work activity scores, and if the subject was currently or had a history of receiving disability benefits (Table 7). Considering all variables, the combination that was most associated with the therapists' irritability judgments included initial RMDQ score, the presence of distal symptoms, and the *forward bending* dimension score (c-statistic = .78; Table 7).

Discussion

A therapist's judgment of a patient's irritability can change during an examination. The initial judgment is made following the medical history. This judg-

TABLE 7. Logistic regression models examining the relationship of statistically identified dimensions and other LBP characteristics with therapists' irritability judgments.

Model	ORs	95% CI of OR	p-value	c-statistic
Standing dimension (n=174)	0.87	0.78–0.96	<.005	0.62
Walking dimension (n=173)	0.89	0.81–0.99	<.05	0.60
Sitting dimension (n=175)	0.88	0.79–0.98	<.05	0.62
Forward bending dimension (n=164)	0.87	0.79–0.95	<.005	0.66
Pain persistence dimension (n=170)	1.05	0.97–1.13	.22	0.58
Forward bending dimension +	0.85	0.78–0.94	<.005	
Standing dimension (n=159)	0.87	0.79–0.97	<.05	0.70
Initial RMDQ* Score (n=183)	1.15	1.08–1.22	<.0001	0.71
Initial pain-intensity numeric rating score (n=179)	1.03	1.01–1.05	<.005	0.64
Presence of distal symptoms (n=183)	0.37	0.14–0.51	<.0001	0.66
Currently or history of receiving disability (n=183)	0.20	0.06–0.68	<.02	0.56
FABQ† physical activity section (n=183)	1.08	1.02–1.14	<.02	0.61
FABQ work activity section (n=178)	1.04	1.01–1.07	<.005	0.63
Initial RMDQ score +	1.12	1.04–1.20	<.005	
Presence of distal symptoms +	0.27	0.13–0.57	<.001	0.78
Forward bending dimension	0.89	0.81–0.99	<.03	

*RMDQ = Roland-Morris Disability Questionnaire

†FABQ = Fear & Avoidance Belief Questionnaire

ment can be modified depending on the patient's pain behavior during the objective examination. The initial irritability judgment affects the vigor of the objective examination that the therapist performs on the patient. The final irritability judgment affects the vigor of the treatment prescribed to the patient. Because the final irritability decisions can affect treatment prescription, and treatment prescription will most likely affect patient outcomes, this study explored measurement characteristics of therapists' final irritability judgments.

Therapists' Utilization of Irritability Judgments

The association between physical therapists' irritability judgments and the type of treatment provided was included in this study to support the use of therapists' irritability judgments as a criterion by which to judge appropriateness of LBP characteristics for use in an operational definition of irritability. The relationship between LBP irritability judgments and the category of treatment provided supports the assertion that therapists have understood and appropriately implemented Maitland's irritability concept. Application of Maitland's concept was dependent, in some cases, on the acuity of subjects' LBP. Sullivan et al's¹⁸ category of McKenzie Approach contains treatments (centralizing exercises) suggesting that subjects being treated had what McKenzie labels a derangement³¹. Since McKenzie's definition of a patient having a derangement includes the patient experiencing persistent pain following repeated movements in a single direction, it is likely this patient would be considered by Maitland to have irritable LBP. Centralizing exercises generally are low vigor exercises meant to control pain complaints, avoiding exacerbation of symptoms. These inferences support the finding that patients judged to have irritable LBP were more likely to receive a greater number of treatments in the McKenzie Approach category.

Though only a small percentage of subjects received manual therapy techniques (15%), subjects judged to have

irritable LBP were more likely to receive these techniques whether or not the subject had acute or chronic LBP. While 84% of subjects received at least one treatment in the *active stretching* category, if a subject's LBP was judged irritable, he or she was likely to receive fewer treatments in this category, minimizing vigorous treatment as Maitland advised. Finally, subjects with acute irritable LBP were more likely to receive a greater number of physical agents, reflecting therapists' attempts to help subjects control their intense pain complaints. All associations found between the therapists' irritability judgments and treatment decisions support the contention that therapists' treatment decisions are influenced by their irritability judgments in a fashion that agrees with Maitland's approach.

Statistically Generated Criteria for a Construct of LBP Irritability

The variables used in the principal-components analysis reflected Maitland's three aspects of LBP irritability. A grouping of these variables into three dimensions representing the three aspects of Maitland's concept of LBP irritability (ease of aggravation, severity, and pain persistence) would have supported consideration of these three independent characteristics in an operational definition of irritability.

Ease of aggravation and severity of LBP were not found to be independent characteristics but were grouped into a single dimension for each activity evaluated. This finding suggests that subjects with easily aggravated LBP are likely to have a lower activity tolerance due to LBP and that this relationship is activity-specific. The pain persistence dimension, which grouped subjects' pain persistence behavior following sitting, standing, and walking, is a dimension that is consistent with Maitland's irritability concept. Pain persistence following forward bending was not included in this dimension possibly because this activity is easy to avoid, making it a less common experience for people with LBP and less associated with the pain persistence of other activities.

The components of the statistically generated construct take into consideration the subjects' LBP behaviors in the common daily activities of sitting, standing, walking, forward bending, and lifting. These self-reported activities are subject to patients' perceptions of their capabilities, which do not always match their true capabilities^{32,33}. Therapists make two irritability judgments during an initial examination: the first, following the medical history (subjective examination) directs the vigor of the physical examination; the second, following the physical examination, influences the vigor of treatment prescribed. The first irritability judgment is based primarily on the patient's self-reporting of LBP behavior and functional limitations, and the second is influenced by physical examination findings. Including physical examination findings in an irritability construct, which was not addressed in this study, may mediate errors made by patients' self-reporting of activity limitations.

Content Validity of the Statistically Generated Criteria

Since no other standard for comparison of irritability judgments exists, we used the association of the therapists' judgments of LBP irritability with the dimensions identified by the principal-components analysis as evidence of the content validity for the identified dimensions in a LBP irritability measurement construct. Using the therapists' irritability judgments as a criterion for including LBP characteristics in an operational definition for LBP irritability judgments is supported by the therapists demonstrating moderate reliability in irritability judgments and making treatment decisions based on irritability judgments as Maitland intended³⁴. We would not expect an exceedingly strong relationship between the therapists' irritability judgments and dimensions of a construct to occur because of the limited reliability of the therapists' judgments.

A combination of two dimensions (forward bending and standing) was found to be the best predictor of the therapists' irritability judgments among

the statistically generated dimensions. Future investigations may find that the sum of the values that make up these dimensions serve as an indicator for a patient's irritability. For example, if the subject can forward bend and stand for a long period of time prior to aggravation of LBP symptoms and if he or she can tolerate these activities for long periods of time, the subject's LBP will be considered non-irritable or of low irritability. The sum of the dimensions, being a continuous variable, would have advantages over the dichotomous judgment of LBP irritability (irritable versus non-irritable). Identifying multiple levels along an irritability spectrum could allow a number of different "mobility starting levels" for patients with varied clinical presentations of LBP.

This investigation also revealed that the RMDQ alone was just as predictive of the therapists' irritability judgments as the statistically identified dimensions. Given the activity-related nature of the dimensions, it is not surprising that a measure of disability due to LBP was found to capture Maitland's irritability concept as well as the dimensions created in this study. Further development of a measurement construct of irritability should carefully consider use of previously validated measures of LBP disability. Such an approach could facilitate blending Maitland's widely used treatment paradigm with current evidence-based practices.

Limitations and Suggestions for Future Research

In this study, only patient-reported measures of pain behavior and functional limitations were included for consideration in the development of the LBP irritability construct. Since therapists consider pain behavior and movement impairments during the objective examination, future studies exploring irritability judgments should consider these findings in addition to the LBP characteristics identified in this investigation.

This study also limited therapists to dichotomous irritability judgments. Future studies should allow therapists to

make irritability judgments on an ordinal scale. This will provide a reference to explore multiple levels of an irritability spectrum, perhaps identifying different levels of exercise vigor at which to initiate treatment for patients with varied clinical presentations of LBP.

The anticipated value of using an LBP irritability construct is that it will empirically guide therapists to prescribe exercise programs at an appropriate level of vigor and possibly guide other treatment decisions as well. Additional investigations are needed to refine an operational definition of LBP irritability and explore the construct validity of an LBP irritability measurement construct by comparing treatment outcomes when therapists use the construct to guide treatment decisions as compared to providing patients with a protocol-driven program regardless of initial LBP presentations.

Conclusion

Only one of three pain behaviors identified by Maitland as appropriate for consideration in judging irritability was grouped statistically: pain persistence. Groupings were not found to be related to ease of pain aggravation and pain severity but were related to the aggravating activity. Some statistically identified groupings were associated with the therapists' irritability judgments of LBP. Alternative LBP characteristics, most notably disability due to LBP as measured by the RMDQ, were also found to be associated with the physical therapists' judgments of LBP irritability. Future studies should consider these LBP characteristics in testing the value of an irritability construct, a construct that should guide a therapist's treatment choices in a way that affects the patient's outcomes.

Acknowledgments

The authors wish to acknowledge Kathy Bechtold, PT, MS; Janet Retke, PT, GCS; Lois Boulgarides, PT, DPT; Janet Yamada Soto, PT; Clare Lewis, PT, DPsy; and all the physical therapists and physical therapy students who were in-

involved in data collection and management.

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