

## Effectiveness of a low back pain classification system

Hamilton Hall, MD, FRCSC<sup>a,b</sup>, Greg McIntosh, MSc<sup>b,\*</sup>, Christina Boyle, PT<sup>b</sup>

<sup>a</sup>Department of Surgery, University of Toronto, Toronto, Ontario, Canada

<sup>b</sup>CBI Health Group Research Department, 900-3300 Bloor St W, Toronto, Ontario M8X 2X2, Canada

Received 5 November 2008; accepted 17 April 2009

### Abstract

**BACKGROUND CONTEXT:** One goal of low back pain (LBP) assessment is to direct clinicians to specific subgroups that benefit from particular treatment approaches.

**PURPOSE:** To compare outcomes in a nonoperative care setting between patients assessed and treated based on a diagnostic system of LBP classification with patients managed without a classification system.

**STUDY DESIGN/SETTING:** A prospective double-cohort study.

**PATIENT SAMPLE:** Mechanical LBP cases (n=2110) who started a rehabilitation program at 15 clinics across Canada between February 2006 and August 2007.

**OUTCOME MEASURES:** Subjective global pain rating at discharge; change in reported medication usage; Visual Analog Scale (VAS) pain rating from assessment to discharge; change in perceived function from assessment to discharge based on score change from a modified version of the Low Back Outcome Score; total number of treatment days.

**METHODS:** The two cohorts were a comparison group (n=754) and a classification group (n=1356). The comparison group consisted of consecutive, consenting patients attending treatment at eight clinics that provided generic, traditional, therapy including modalities and exercise and that emphasized reassurance of likely recovery, encouragement to remain active, and avoidance of bed rest. The classification group consisted of consenting patients attending seven clinics where the staff had been trained to use the LBP classification system. Patients were categorized into one of four classifications, each dictating a separate treatment approach.

**RESULTS:** For those reporting “no pain” posttreatment, odds ratios for those treated according to a Pattern classification ranged from 2 to 10 times the odds of the comparison group (p<.05). For “no medication use” posttreatment, odds ratios for the classification group ranged from 2 to 4 times the odds of the comparison group (p<.01). Odds ratios of a statistical and minimal clinically important difference (30% increase in functional score) for the classification group ranged from approximately 2 to 4 times the odds of the comparison group (p<.01). For VAS Pain Rating (0–10 scale), the odds ratios of a statistically and clinically significant pain reduction (2 points) for the classification group ranged from 30% to 60% higher than odds for the Comparison Group (p<.05). The comparison group had the highest number of treatment days, statistically significantly greater than for each pattern within the classification group (p<.001).

**CONCLUSIONS:** LBP is a heterogeneous condition and treatment results may significantly improve when clinically relevant syndromes are determined initially to guide treatment. Classifying LBP based on pattern recognition shows promise to help clarify future clinical trials and surgical referrals. © 2009 Elsevier Inc. All rights reserved.

### Keywords:

Subgroups; Mechanical back pain; Classification; Pattern of pain; Back pain syndromes; Nonpathoanatomic approach

Presented at: Canadian Spine Society, 8th Annual Meeting, March 12–15, 2008, Sun Peaks, British Columbia, Canada; International Society for the Study of the Lumbar Spine, 35th Annual Meeting, May 25–30, 2008, Geneva, Switzerland; North American Spine Society, 23rd Annual Meeting, October 14–18, 2008, Toronto, Canada; Society for Back Pain Research, Annual General Meeting, November 6–7, 2008, Staffordshire, England.

FDA device/drug status: not applicable.

Author disclosures: HH (medical director, CBI Health); GM (epidemiologist, CBI Health); CB (director of standards and accreditation, CBI Health).

\* Corresponding author. Tel.: (416) 428-1030, (800) 463-2225; fax: (416) 231-0091.

E-mail address: [gmcintosh@cbi.ca](mailto:gmcintosh@cbi.ca) (G. McIntosh)

## Introduction

Diagnosis is the foundation of appropriate management and should be based on clinical assessment [1] and appropriate investigation. Spratt states that ideally the fundamental element of initial patient assessment is to identify a diagnosis for which diagnosis-specific treatment exists that will resolve the problem [2]. This basic principle of clinical practice is difficult to apply to low back pain (LBP) because a definitive and relevant cause or diagnosis cannot be made in approximately 80% of LBP presentations [3,4]. Deyo and Diehl [5] found that the most frequent reason for patient dissatisfaction with medical care for a back complaint was failure to get an adequate explanation for their LBP.

The usual search for anatomical sites and structural causes of LBP can interfere with treatment [1]. Abnormal images do not always indicate symptoms [6–12]. Overutilization of diagnostic procedures is not cost-effective, can adversely affect outcomes, may increase the likelihood of iatrogenic complications [13], and can lead to potentially inappropriate treatment [14–16].

Identifying LBP subgroups based on patient characteristics—clinical presentations established by the history and physical examination—may be a reasonable alternative [17]. The Quebec Task Force [18], an international LBP consensus group [19], the Cochrane Back Review Group [20], and others [2,21–23] have all emphasized the need to classify LBP into meaningful clinically relevant subgroups.

The generic term “nonspecific low back pain” (NSLBP) has gained acceptance as a category for patients lacking a recognized anatomical or pathological cause [3]. LBP classifications frequently include a single NSLBP category despite the fact that LBP is heterogeneous [19,24–27]. Although it may serve as a diagnosis of exclusion for surgical indications, a nonspecific category offers no positive direction for nonsurgical management. One possibility for the failure to predict effective treatment is an inability to subgroup or classify patients with nonspecific LBP in a way that directs management decisions [28].

Waddell states that ordinary backache or NSLBP is mechanical pain of musculoskeletal origin in which symptoms vary with physical activities [1]. Because NSLBP includes a variety of mechanical conditions with varying responses to movement and posture, nonspecific seems to be an inappropriate label.

Effective LBP assessment should identify patient categories that lead clinicians to the most effective management. Previous research suggests that treating patients based on a classification approach results in better clinical outcomes than nonclassification-based treatment strategies [29–31]. However, these studies identify narrow putatively anatomic subsets applicable to some but not to most mechanical LBP patients [1]. A more robust and inclusive classification system is required. An appropriate starting point is recognition of the symptom clusters of back pain syndromes [1].

In the traditional medical paradigm, groups of signs and symptoms that appear together in a regular and predictable

## EVIDENCE & METHODS

### Context

For many low back pain patients without serious destructive disease or deformity, current diagnostic methods are of uncertain utility. Non-operative treatment of low back pain is often guided by a presumed underlying pathologic or structural disease entity, but can also be guided by an empirically classified presenting clinical syndrome. This article aims to compare these two approaches.

### Contribution

In this large, observational cohort, the authors have found that specific treatments guided by clinical syndrome correlated with apparent better outcomes.

### Implications

Observation cohort studies such as this can suggest clinic superiority, but usually cannot provide that conclusion with much certainty. Caution is indicated in interpreting this study's findings as inclusion, exclusion, recruitment, diagnostic criteria and data sets, practitioner skills, and baseline patient characteristics may vary impact outcomes. Nonetheless, the classic work by Drs. Ian Macnab and John McCulloch stressed the importance of considering the empirically described clinical syndrome when the pathologic diagnosis is uncertain. This study indicates this approach remains worthy of consideration and further study today.

—The Editors

fashion but lack a definitive etiology are labeled syndromes. A carefully constructed history suggests a syndrome or pattern that is then supported by a concordant structured physical examination. Final verification of correct syndrome selection comes from a predictable positive treatment response.

The classification system in the present study is based solely and deliberately on the recognition of syndromes or patterns of pain with no direct reference to anatomic site or pathological process. In this system, the essential elements are determined by the location of the dominant pain, whether that pain is constant or intermittent and the particular movements or postures that exacerbate or alleviate the symptoms [32]. These recognized similarities allow categorization and the generation of a theoretical prototype against which subsequent clinical patterns can be compared and tested [33]. The intertester reliability of this subgroup identification has been previously documented (agreement=79%, kappa=0.61) [34].

The purpose of this study was to assess the effectiveness of this LBP classification system in a clinical setting. It addresses the research question: do patients assessed and treated in accordance with this classification system have

superior outcomes to patients receiving more homogeneous generic care?

## Methods

This prospective double-cohort study investigated patients who started nonoperative care at 15 clinics (owned by the same Canadian rehabilitation provider) between February 2006 and August 2007. Patients in both cohorts were referred by family physicians, chiropractors, or medical specialists; the ratio of the referring professions in each cohort was the same. Both groups had an equal, very small proportion of patients who were self-referred. All clinics involved in this study are primary access rehabilitation facilities providing nonoperative care. Because this is a national network, both cohorts had geographic variation and included patients from clinics in urban centers in British Columbia, Alberta, and Ontario. There was a uniform mix of occupations with no predominant employer or industry. The referral patterns to both the cohorts were similar.

The two cohorts were a comparison group ( $n=754$ ) and a classification group ( $n=1469$ ). The discrepancy in group sizes reflects the time-based collection period. The classification clinics treated more patients than the comparison clinics in the same time frame. Intake was closed when the smaller group reached numbers sufficient to power the study.

All patients in both cohorts were referred for treatment with a diagnosis of mechanical LBP, defined as pain arising from physical structures within the spine that varied or fluctuated with movement and/or position [35]. Both cohorts contained patients with sciatica and neurogenic claudication as well as mechanical back dominant pain. Individuals who were subsequently diagnosed with specific medical conditions associated with LBP or those suspected of having back pain related to infection, malignancy, or major trauma were excluded and, when indicated, referred for appropriate management.

All patients provided a signed, written, informed consent for participation and release of information. No patient was contacted directly by the investigators. Patient names were removed to make the data anonymous; only identification numbers were used for recognition.

Ethics approval was obtained from the independent firm Institutional Review Board Services.

The comparison group consisted of 754 consecutive patients attending treatment at eight recently acquired clinics that did not use a classification-based system of assessment and treatment. The registered physical therapists at the comparison clinics provided generic, traditional therapy including modalities and exercise. They emphasized the likelihood of recovery, encouraged activity, and discouraged bed rest.

The classification group consisted of patients attending seven clinics where the staff had been trained to use the

LBP classification system. These clinics had the same basic facilities as those in the comparison group with equal access to modalities and exercise equipment. Registered physical therapists obtained the standardized history and performed the standardized physical examination. All the therapists had previously used the classification system but before the initiation of the study, the authors conducted a 2-hour review session at each clinic. A 1-hour follow-up session was provided 6 months later to insure compliance and accuracy.

The classification group consisted of 1,469 consecutive consenting patients referred with LBP. On initial physical examination, 113 patients (7.7%) were found to have an alternate source of mechanical pain—principally hip or sacroiliac joint pain—and were excluded. Because the basis of exclusion was the clinical presentation, imaging studies were not routinely obtained. Hip pain was identified based on gait testing and specific joint movements that reproduced patients' typical symptoms. Sacroiliac joint pain was assessed based on the techniques described by Laslett [36] and others [37–39]. The remaining patients were grouped into one of four mechanical syndromes, each of which directed a distinct treatment approach. The final sample size of the classification group was 1,356 patients.

The four patterns of mechanical pain are principally derived from the initial history and physical examination. History takes precedence. The essential questions are, “Where is your pain the worst?” and “Is that pain constant or intermittent?” The history elicits the aggravating and relieving movements and postures with particular attention to flexion and extension. Patients choose the movement/position that is “best” for pain relief and the one that is “worst” for pain production. The physical examination confirms the history and assesses neurological status [32,35].

Although a patient may possess elements of more than one pattern, the site of the dominant pain—back or leg—determines the initial categorization and therefore the first treatment. The back dominant categories are mutually exclusive. Although the leg dominant categories are equally specific, they can occasionally coexist. Most patients experience both back and leg pain but careful questioning almost invariably determines the area of chief concern. If any uncertainty remains, the leg dominant patterns take precedence over the back dominant ones [40].

Patterns 1 and 2 are back dominant. In this classification system, back pain includes pain that is most severe in the back, in the buttocks, over the greater trochanters, or in the groin. The pain is mechanical, that is, it responds to movement or position. Pattern 1 is always aggravated with flexion and is subdivided into fast and slow responders. Pattern 1 fast responders have a clear directional preference for extension posture or exercises. Pattern 1 slow responders lack directional preference and have pain with positioning or movement in both directions. The intensity of the pain is irrelevant. Pattern 1 may be constant or intermittent.

Pattern 2 is pain increased with extension only, usually improved but never aggravated with flexion and is always intermittent [35].

Pattern 3 is compatible with the designation of sciatica. It is constant, leg dominant pain with signs of root irritation and/or a conduction deficit. Leg dominant indicates that the most intense pain is anywhere in the leg below the gluteal fold. Pattern 4 corresponds to neurogenic claudication, defined as intermittent leg dominant pain produced by activity, typically walking and relieved with rest and posture change, usually flexion [41,42]. Although reduced walking distance was not considered a necessary criterion for inclusion in Pattern 4, walking distance was used as a measure of severity and indication of treatment progression. Appendix A summarizes the specific details of each pattern of pain.

This classification system was devised to be inclusive. It does not contain “nonspecific” or “other” categories. It is intended to describe all possible presentations of mechanical LBP with and without associated direct nerve root involvement. Patients who do not fit one of the four mechanical patterns or who fail to respond to the pattern-selected physical treatment are considered candidates for further investigation to locate an alternate underlying condition [40]. As a result, few exclusion criteria were necessary in the study. Age had no relevance to the categories. Those older than 65 years and those with neurological, reflex, or strength deficits were included. Neurological compromise is covered in Patterns 3 and 4. Only those with previous spine surgery or specific medical conditions were excluded.

The same range of treatments was available in both groups. Both cohorts received education, postural training, exercise, and modalities where indicated. The difference between the two groups was the specificity of the education, posture, and exercise to a particular subgroup of patients. In the comparison group, there was no distinction made for the presenting symptom complex and all treatments were applied more or less uniformly. Treatment in the classification group was tailored to the presenting pattern. The classification system was strongly linked to a subsequent management strategy. Appendix B provides a typical treatment algorithm for two patterns of back dominant pain.

Baseline information was obtained during the initial assessment in the clinics and came from clinical assessments, questionnaires, and patient self-reports. At discharge from the clinics, patients completed a standardized questionnaire to determine changes or improvements. The questionnaire is based on the Low Back Outcome Score [43] but has been modified and validated for use in these clinical settings [44,45]. Outcomes assessed were (1) subjective global pain rating at discharge (pain is gone, decreased, same, or increased), (2) change in reported medication usage from assessment to discharge, (3) change in an 11-point Visual Analog Scale (VAS) pain rating from assessment to discharge, (4) change in perceived function from assessment to discharge, and (5) total number of treatment days.

The comparison of global pain rating between the cohorts was between the numbers of patients who reported that their pain was gone. No attempt was made to quantify those who were still experiencing symptoms. Similarly, medication use was assessed by comparing only those who were not taking any drugs [46,47].

The days in treatment varied within both groups but treatment continued until a clinician believed that progress was unlikely, the patient decided that he or she had achieved sufficient improvement or the referral source or payer requested discharge. There were no dropouts; all patients in both cohorts completed a course of treatment and submitted intake and discharge information.

All analyses were conducted with SPSS for Windows release 15.0.1, November 22, 2006. An alpha level of 0.05 (two sided) was used as the criterion for statistical significance.

## Results

For both comparison and classification groups, the mean age was 44.7 years (SD=13.3, range=18–89,) with 55.1% males. The mean lag time from symptom onset to treatment was 110.7 days (SD=201.5). The average lag time was skewed by 13 patients with very long histories of back pain (symptom duration over 3 years). The median lag time was 32 days.

Table 1 shows the baseline characteristics for both groups; there were no baseline statistically significant differences in VAS pain rating, symptom duration, and percent not using medication. The classification group was significantly older (4 years), had more females, and had better perceived function. Statistically significant differences in baseline variables between groups were not deemed clinically significant and were likely an artifact of the large sample size. A four-point difference in baseline functional score was not clinically significant because this difference represented less than a 5% difference in score between groups, which is far less than the 30% documented as a minimal clinically important difference [48,49].

Table 2 displays the frequency distributions of each pattern of pain within the classification group. Pattern 1 fast

Table 1  
Baseline characteristics between groups

Characteristic	Comparison group	Classification group	SSD
Age, mean (SD)	41.7 (11.4)	45.8 (13.8)	*
VAS, mean (SD)	5.87 (2.19)	5.76 (2.29)	NS
Sex, % female	40.4	46.5	*
Questionnaire score, mean (SD)	37.6 (10.5)	41.6 (11.7)	*
Symptom duration, mean (SD)	118.3 (199.2)	107.1 (202.6)	NS
Medication usage, % never	10.9	14.2	NS

SD, standard deviation; SSD, statistically significant difference; VAS, Visual Analog (0–10) Scale; NS, not significant.

\* $p < .001$ .

Table 2  
Frequencies of each pattern of low back pain within the classification group

Classification	n	%
Pattern 1 fast	419	30.9
Pattern 1 slow	676	49.9
Pattern 2	106	7.8
Pattern 3	134	9.9
Pattern 4	21	1.5
Total	1356	100.0

and slow responders accounted for 81%. Pattern 4 was quite rare in this clinical setting; because of the small sample size of this pattern, it was not included in the analyses.

Posttreatment comparison of the classification and comparison groups revealed that the latter had poorer results for both qualitative (Table 3) and quantitative outcome measures (Table 4).

For global pain rating, the odds that patients categorized and treated as Pattern 1 fast responders reported that their pain was “gone” posttreatment were 10 times the odds for those in the comparison group ( $p < .001$ ). Odds ratios of pain relief for the subgroups whose treatment was directed by pattern classifications (Pattern 1 Slow, Pattern 2 and Pattern 3) ranged from 2 to 4 times the odds of the Comparison Group ( $p < .05$ ) (Table 3).

For medication use, the odds that Pattern 1 fast responders reported not using medication posttreatment were four times the odds for the comparison group ( $p < .001$ ). Odds ratios of no medication use for other subgroups using a pattern classification to deliver treatment were approximately two times the odds of the comparison group ( $p < .01$ ) (Table 3).

The outcome measures in Table 4 were quantitative variables. For functional improvement, Lauridsen et al. [48] and Ostelol et al. [49] suggest a 30% change between the pre- and the posttreatment scores on a function questionnaire to attain the minimal clinically important difference. In our study, Pattern 1 fast responders were 1.8 times more likely to report a 30% increase in functional score than were the comparison group ( $p = .001$ ). The remaining odds ratios for statistically and clinically relevant functional improvement in subgroups

managed on the basis of pain pattern classification range from approximately two to four times the odds of the comparison group ( $p < .001$ ). Overall, the comparison group had the smallest increase in function.

For VAS pain rating, previous studies have defined a clinically important difference as an 18% decrease (2-point change on an 11-point scale) [50,51]. The odds of a 2-point decrease in pain were 20% higher for Pattern 1 fast responders than the total comparison group ( $p = .014$ ). The odds ratios of a statistically and clinically significant pain reduction for the other groups managed on the basis of a pain pattern classification ranged from 30% to 60% higher than odds for the comparison group.

In the case of treatment days, receiving treatment based on a pattern classification significantly reduced the number of treatment days. The comparison group had the highest number of treatment days, statistically significantly greater than for every pattern ( $p < .05$ ).

**Discussion**

Riddle and Rothstein [52] concluded that there is very little published data on construct validity of LBP subgrouping systems. Emerging evidence, however, supports the hypothesis that classifying and managing patients based on the clinical picture produces better outcomes than nonspecific treatment [27,30,31,53,54].

In this study, the assignment of patients to the correct subgroup depended on the therapists’ ability to conduct a competent clinical assessment. Reliance on the history taking and physical examination skills of the clinician is a potential source of distortion in any clinically based classification system. For this reason, the method used in this study has been simplified as much as possible without losing its precision. The system requires no unique technical abilities. Using a standardized and carefully constructed interrogation, a clinician can deduce the site of the dominant pain and whether that pain is truly constant or intermittent. With close questioning, it is not difficult to determine what movements or postures increase, decrease, or have no effect on the pain. This is usually enough information to hypothesize the most likely pattern of pain. The confirmatory

Table 3  
Posttreatment odds ratios (95% confidence intervals) for two qualitative outcome measures by classification category

Outcome	Comparison group*	Pattern 1 fast responder	Pattern 1 slow responder	Pattern 2	Pattern 3
Global pain rating (gone)					
OR	—	10.85	2.328	2.68	4.32
95% CI	—	(6.21–18.95)	(1.63–3.33)	(1.23–5.84)	(1.96–9.51)
p Value	—	<.001	<.001	.013	<.001
Medication use (not using)					
OR	—	4.09	1.92	2.49	1.97
95% CI	—	(3.11–5.37)	(1.53–2.42)	(1.54–4.05)	(1.29–2.99)
p Value	—	<.001	<.001	<.001	.001

Global pain rating (Is pain “gone,” “decreased,” “same,” or “increased”?); \*Reference category for odds ratio comparisons; OR, odds ratio; CI, confidence interval; Medication use (“not using,” “occasional,” or “daily”).

Table 4  
Odds ratios (95% confidence intervals) for three quantitative outcome measures by classification category

Outcome	Comparison group*	Pattern 1 fast responder	Pattern 1 slow responder	Pattern 2	Pattern 3
Function OR	—	1.03	1.03	1.01	1.05
95% CI	—	(1.02–1.04)	(1.02–1.04)	(0.98–1.04)	(1.03–1.07)
p Value	—	<.001	<.001	NS	<.001
MCID OR	—	1.79	1.76	1.05	3.95
95% CI	—	(1.27–2.55)	(1.29–2.38)	(0.48–2.32)	(2.14–7.29)
p Value	—	.001	<.001	NS	<.001
VAS OR	—	1.10	1.15	1.04	1.29
95% CI	—	(1.02–1.19)	(1.08–1.22)	(0.91–1.18)	(1.14–1.44)
p Value	—	.014	<.001	NS	<.001
Treatment (d)	21.5	10.3	16.5	9.9	14.3
p Value	—	<.001	<.001	<.001	<.001

VAS, Visual Analog Scale (0–10) pain rating; OR, odds ratio; Function, modified Low Back Outcome Score; MCID, minimal clinically important difference in functional score; \*Reference category; NS, not significant; Function OR, the odds ratio of 1.03 indicates that pattern 1 fast responders were 3% more likely to have a 1 point increase in functional score.

physical examination uses only basic and well-recognized examination techniques. In the reliability study conducted on this classification system, there were no statistically significant differences in the high agreement rates or kappa values between experienced and novice therapists [34]. This finding suggests that the system can be easily understood and readily applied regardless of the number of years of experience in practice or the ability to perform intricate manual maneuvers. Highly specialized or extensive training is not required for implementation and effective utilization.

Limitations of this study include the potential for bias [55]. Because almost all patients in both cohorts were referred, there may be centripetal bias; physicians do not refer all of their back pain patients to this clinic system. Because all the participating locations belonged to a company with a widely recognized reputation for a particular active therapeutic approach, only mechanical pain patients may have been selected for this type of treatment. Care providers may decide that for profoundly disabled or minimally restricted patients this form of management is not appropriate, thereby creating a referral filter bias. However, this bias applies equally to both the classification and comparison groups. The similarity of the referral patterns suggests a minimal selection bias between the cohorts.

Classification alone without subsequent influence on management provides little merit. A useful classification system for nonspecific LBP should lead to the formation of relevant subgroups of patients with specific clinical findings that respond to a particular approach [56,57]. We agree with Fritz et al. [58] that subgrouping is a worthy objective. In the present study, patients were classified into one of four categories, each with its own associated treatment approach. The classification-based method of assessment and treatment resulted in better short-term outcomes for pain rating, medication use, function, and treatment days compared with those treated with a more generic approach.

This classification system is based on pattern recognition, not anatomic site or pathological process. If patients

in a nonsurgical, physical rehabilitation setting can ameliorate or abolish their pain and resume their normal activities of daily living, it should not matter that the specific anatomic pain generator was neither sought nor identified. In nonoperative care, it is not always necessary to know exactly what produces the pain to manage it. Only when surgery is considered does unequivocal identification of the anatomical source of the pain gain paramount importance.

Classification system validation is a multistep process [57]. Future randomized trials are required but the importance of cohort studies should not be minimized. Validated subgroups are an important step toward avoiding inappropriate subgroup sampling in unexpectedly heterogeneous cohorts [2,18,28,31,56,59]. For this study, those categorized as Patterns 1 and 2 comprise a high percentage of the patients who, in other studies, might have been labeled NSLBP and treated without specific direction.

A substantial limitation of some subgroup studies is the narrow range of subjects to which the classifications apply [53,54]. A large proportion remains unclassified. An advantage of the current system is widespread applicability; it is almost totally inclusive regardless of work status, disability level, symptom duration, or initial perceived diagnosis. The system can also be applied to those with the specific labels of sciatica and neurogenic claudication. Both of these diagnoses are usually regarded as separate from NSLBP and are therefore not considered when attempting further subgroup identification. In both sciatica and neurogenic claudication, however, a lack of diagnostic precision can relegate some of these patients to the “other” category [4]. By including the clinical features of both these spinal conditions within this classification without the necessity of establishing and locating a specific anatomic abnormality, all members of both groups are categorized and assigned suitable initial nonoperative management. The third component of subgroup validation, after definitive history and concordant physical examination, is the requirement to obtain a predictable, positive, and timely treatment outcome. This final step ensures that patients with acute sciatica or disabling

neurogenic claudication who fail to respond are rapidly triaged to more aggressive management.

Assessing patients and subgrouping them by pattern recognition cannot only identify the appropriate treatment direction, it may help screen those who require additional care and redirect those who do not. The overwhelming majority of patients with Patterns 1 and 2 are not surgical candidates. Their identification at a primary care level can ease the burden of unnecessary specialist referral while providing a direction for suitable, effective, and accessible therapeutic alternatives.

## Conclusions

In this cohort study, the identification of clinical syndromes directed treatment; there was no reference to specific pathology. This approach had a strong positive effect on outcomes for pain relief, reduced medication use, improved function, and shortened length of treatment. Further validation requires prospective controlled trials.

LBP is a heterogeneous condition. Treatment results may significantly improve with the initial determination of clinically relevant syndromes that are then used to guide therapy. Classifying LBP based on pattern recognition shows promise to help clarify future clinical trials and surgical referrals.

## Acknowledgments

The authors thank the CBI Health Physiotherapy & Rehabilitation clinics in the cities of: Barrie, Brampton, Etobicoke, Mississauga, Ottawa, and Woodbridge.

## References

- Waddell G. The back pain revolution. 2nd ed. Edinburgh, Scotland: Churchill Livingstone, 2004.
- Spratt K. Statistical relevance. In: Fardon DF, editor. Orthopaedic knowledge update: spine 2. Rosemont, IL: The American Academy of Orthopaedic Surgeons, 2002:497–505.
- Kent P, Keating J. Do primary-care clinicians think that nonspecific low back pain is one condition? *Spine* 2004;29:1022–31.
- Chou R, Qaseem A, Snow V, et al. Clinical efficacy diagnosis and treatment of low back pain: a joint clinical practice guideline from the American College of Physicians and the American Pain Society. *Ann Intern Med* 2007;147:478–91.
- Deyo RA, Diehl AK. Patient satisfaction with medical care for low-back pain. *Spine* 1986;11:28–30.
- Boos N, Hodler J. What help and what confusion can imaging provide? *Baillieres Clin Rheum* 1998;12:115–39.
- Yelland M. Diagnostic imaging for back pain. *Aust Fam Physician* 2004;33:415–9.
- Kikuchi S. Values and problems in MR imaging for the evaluation of low back pain (orthopedic surgeon's view). *Semin Musculoskelet Radiol* 2001;5:127–8.
- Hollingsworth W, Dixon AK, Todd CJ, et al. Self reported health status and magnetic resonance imaging findings in patients with low back pain. *Eur Spine J* 1998;7:369–75.
- Savage RA, Whitehouse GH, Roberts N. The relationship between the magnetic resonance imaging appearance of the lumbar spine and low back pain, age and occupation in males. *Eur Spine J* 1997;6:106–14.
- Borenstein DG, O'Mara JW, Boden SD, et al. The value of magnetic resonance imaging of the lumbar spine to predict low-back pain in asymptomatic subjects: a seven-year follow-up study. *J Bone Joint Surg* 2001;83-A:1306–11.
- Fukuda K, Kawakami G. Proper use of MR imaging for evaluation of low back pain (radiologist' view). *Semin Musculoskelet Radiol* 2001;5:133–6.
- Tacci JA, Webster BS, Hashemi L, Christiani DC. Clinical practices in the management of new-onset, uncomplicated, low back workers' compensation disability claims. *J Occup Environ Med* 1999;41:397–404.
- Breslau J, Seidenwurm D. Socioeconomic aspects of spinal imaging: impact of radiological diagnosis on lumbar spine-related disability. *Top Magn Reson Imaging* 2001;11:218–23.
- Modic MT. Degenerative disc disease and back pain. *Magn Reson Imaging Clin N Am* 1999;7:481–91.
- Chou R, Fu R, Carrino JA, Deyo RA. Imaging strategies for low-back pain: systematic review and meta-analysis. *Lancet* 2009;373:463–72.
- Donelson R. Rapidly Reversible Low Back Pain, Hanover NH, USA: SelfCare First LLC, 2007.
- Spitzer WO, Leblanc FE, Dupuis M, et al. Quebec Task Force on spinal disorders. Scientific approach to the assessment and management of activity-related spinal disorders: a monograph for clinicians. *Spine* 1987;12:1–59.
- Borkan JM, Koes B, Reis S, Cherkin DC. A report from the Second International Forum for primary care research on low back pain. Re-examining priorities. *Spine* 1998;23:1992–6.
- Bouter LM, Pennick V, Bombardier C. Editorial Board of the Back Review Group. Cochrane back review group. *Spine* 2003;28:1215–8.
- Leboeuf-Yde C, Lauritsen JM, Lauritzen T. Why has the search for causes of low back pain largely been nonconclusive? *Spine* 1997;22:877–81.
- Delitto A. Research in low back pain: time to stop seeking the elusive "magic bullet". *Phys Ther* 2005;85:206–8.
- Abraham I, Killackey-Jones B, Deyo R. Controversies in internal medicine. (Specific-v-non-specific diagnosis in low back pain.). *Arch Intern Med* 2002;162:1442–8.
- McKenzie R. Mechanical diagnosis and therapy for low back pain: toward a better understanding. In: Twomey L, Taylor J, editors. *Physical therapy of the low back*. New York: Churchill Livingstone, 1987:157–73.
- Coste J, Paolaggi JB, Spira A. Classification of nonspecific low back pain: II. Clinical diversity of organic forms. *Spine* 1992;17:1038–42.
- Delitto A, Erhard RE, Bowling RW. A treatment-based classification approach to low back syndrome: identifying and staging patients for conservative treatment. *Phys Ther* 1995;75:470–89.
- Leboeuf-Yde C. Low back pain: time to get off the treadmill. *J Manipulative Physiol Ther* 2001;24:63–6.
- Bouter LM, van Tulder MW, Koes BW. Methodologic issues in low back pain research in primary care. *Spine* 1998;23:2014–20.
- Delitto A, Cibulka MT, Erhard RE, et al. Evidence for use of an extension-mobilization category in acute low back syndrome: a prescriptive validation pilot study. *Phys Ther* 1993;73:216–28.
- Erhard RE, Delitto A, Cibulka MT. Relative effectiveness of an extension program and a combined program of manipulation and flexion and extension exercises in patients with acute low back syndrome. *Phys Ther* 1994;74:1093–100.
- Fritz JM, Delitto A, Erhard RE. Comparison of a classification-based approach to physical therapy and therapy based on clinical practice guidelines for patients with acute low back pain: a randomized clinical trial. *Spine* 2003;28:1363–72.
- Hall, H. Acute care: non traumatic low back pain Chapter 18, IN: *Orthopaedic Knowledge Update: Spine 2*, AAOS, 153–66, 2002.
- Higgs J, Jones M. Clinical reasoning in the health professions. In: Higgs J, Jones M, editors. *Clinical reasoning in the health professions*. Oxford: Butterworth-Heinemann, 2000:3–14.

- [34] Wilson L, Hall H, McIntosh G, Melles T. Inter-tester reliability of a low back pain classification system. *Spine* 1999;24:248–54.
- [35] Hall H, McIntosh G, Melles T. A different approach to back pain diagnosis: identifying a pattern of pain. *Can J Contin Med Educ* 1994;6:31–42.
- [36] Laslett M. Pain provocation tests for diagnosis of sacroiliac joint pain. *Aust J Physiother* 2006;52:229.
- [37] Vleeming A, Albert HB, Ostgaard HC, Sturesson B, Stuge B. European guidelines for the diagnosis and treatment of pelvic girdle pain. *Eur Spine J* 2008;17:794–819.
- [38] Hancock MJ, Maher CG, Latimer J, et al. Systematic review of tests to identify the disc, SIJ or facet joint as the source of low back pain. *Eur Spine J* 2007;16:1539–50.
- [39] Laslett M, Aprill CN, McDonald B, Young SB. Diagnosis of sacroiliac joint pain: validity of individual provocation tests and composites of tests. *Man Ther* 2005;10:207–18.
- [40] Hall HA. Consultation with the back doctor. Toronto, Canada: McClelland & Stewart Ltd, 2003. Chapter 14.
- [41] Suda Y, Saitou M, Shibasaki K, et al. Gait analysis of patients with neurogenic intermittent claudication. *Spine* 2002;27:2509–13.
- [42] Porter RW. Spinal stenosis and neurogenic claudication. *Spine* 1996;21:2046–52.
- [43] Greenough CG, Fraser RD. Assessment of outcome in patients with low back pain. *Spine* 1992;17:36–41.
- [44] McIntosh G. Back pain prognostic factors: a cohort study of 1,752 patients of a national rehabilitation clinic system. Masters of Science thesis in Epidemiology. Toronto, Canada: University of Toronto Press, 1999.
- [45] McIntosh G, Frank JW, Hogg-Johnson S, et al. Prognostic factors for time receiving workers' compensation benefits in a cohort of patients with low back pain. *Spine* 2000;25:147–57.
- [46] Long A, Donelson R, Fung T. Does it matter which exercise? A randomized control trial of exercise for low back pain. *Spine* 2004;29:2593–602.
- [47] Manniche C, Asmussen K, Lauritsen B, et al. Low Back Pain Rating scale: validation of a tool for assessment of low back pain. *Pain* 1994;57:317–26.
- [48] Lauridsen HH, Hartvigsen J, Manniche C, et al. Responsiveness and minimal clinically important difference for pain and disability instruments in low back pain patients. *BMC Musculoskelet Disord* 2006;7:82.
- [49] Ostelol R, Deyo R, Stratford P, et al. Interpreting change scores for pain and functional status in low back pain: towards international consensus regarding minimal important change. Presented at: Palma International Forum IX, Primary Care Research on Low Back Pain; October 4–6, 2007; Palma de Mallorca, Spain.
- [50] Childs JD, Piva SR, Fritz JM. Responsiveness of the numeric pain rating scale in patients with low back pain. *Spine* 2005;30:1331–4.
- [51] Hagg O, Fritzell P, Nordwall A. The clinical importance of changes in outcome scores after treatment for chronic low back pain. *Eur Spine J* 2003;12:12–20.
- [52] Riddle DL, Rothstein JM. Interrater reliability of McKenzie's classifications of the syndrome types present in patients with low back pain. *Spine* 1993;18:1333–44.
- [53] Childs JD, Fritz JM, Flynn TW, et al. Validation of a clinical prediction rule to identify patients with low back pain likely to benefit from spinal manipulation. *Ann Intern Med* 2004;141:920–8.
- [54] Brennan GP, Fritz JM, Hunter SJ, et al. Identifying subgroups of patients with acute/subacute "nonspecific" low back pain: results of a randomized clinical trial. *Spine* 2006;31:623–31.
- [55] Sackett DL. Bias in analytical research. *J Chronic Dis* 1979;32:51–63.
- [56] Rose SJ. Physical therapy diagnosis: role and function. *Phys Ther* 1989;96:535–7.
- [57] Fritz JM, George S. The use of a classification approach to identify subgroups of patients with acute low back pain: inter-rater reliability and short-term treatment outcomes. *Spine* 2000;25:106–14.
- [58] Fritz JM, Brennan GP, Clifford SN, et al. An examination of the reliability of a classification algorithm for subgrouping patients with low back pain. *Spine* 2006;31:77–82.
- [59] van der Heijden GJ, Beurskens AJ, Koes BW, et al. The efficacy of traction for back and neck: a systematic, blinded review of randomized clinical trial methods. *Phys Ther* 1995;75:93–104.

## Appendix A

### Patterns of pain of LBP

#### Descriptive Symptoms

##### Pattern 1: Back dominant pain aggravated by flexion.

- Low back dominant pain: felt most intensely in the back, buttock, over the trochanter or in the groin.
- Pain is always intensified by forward bending or sustained flexion.
- Pain may be constant or intermittent
- No relevant neurological symptoms.

##### Pattern 2: Back dominant pain aggravated by extension.

- Low back dominant pain; felt most intensely in the back, buttock, over the trochanter or in the groin.
- Pain is never intensified with flexion.
- Pain is always intermittent.
- No relevant neurological symptoms.

##### Pattern 3: Leg dominant pain aggravated by back movement.

- Leg dominant pain: felt most intensely below the gluteal fold above or below the knee.
- Pain is always constant.
- Neurological symptoms must be present.

##### Pattern 4: Leg dominant pain aggravated by activity.

- Leg dominant pain: felt most intensely below the gluteal fold above or below the knee.
- Pain is brought on by activity and relieved by rest in flexion.
- Pain is always intermittent.
- Neurological symptoms usually absent at rest.

#### Findings on Objective Assessment

##### Pattern 1:

This pattern is divided into two groups:

- Fast responders: Increased pain on flexion and relief with lumbar extension.
- Slow responders: Increased pain on flexion and on extension.

The neurological examination is normal or non-contributory

##### Pattern 2:

The neurological examination is normal or non-contributory

##### Pattern 3:

Neurological examination must be positive for either an irritative test or a newly acquired focal conduction deficit.

##### Pattern 4:

Neurological examination at rest is normal or identifies an established focal conduction defect.

There are no acute irritative findings.

Appendix B

