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# Pathoanatomy and classification of low back disorders

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ABSTRACT

Over the past decade research into the effectiveness of low back disorders (LBDs) has focused on the classification of subgroups more likely to respond to specific treatment. Much of this research has explicitly excluded a focus on pathoanatomical factors based on a questionable interpretation of the biopsychosocial model. Common justifications and potential issues with this approach are explored with recommendations made for future clinical and research practice.



## 1. Introduction

Identifying homogenous subgroups of low back disorders (LBDs) has been postulated as a means of increasing the likelihood of larger effect sizes in randomised controlled trials (RCTs) that evaluate treatment effectiveness (Ford et al., 2007; Fritz et al., 2007; Foster et al., 2011). The classification of LBDs has also been identified as a high research priority (Foster et al., 2009). The biopsychosocial model emphasises classification based on biomedical, psychological and social factors (Waddell, 1987) and has become the recommended approach for clinicians and researchers dealing with LBDs (Weiner, 2008a). The model purports that all factors, not just biomedical, should be considered in order to consistently achieve positive patient outcomes (Waddell, 1987; Gatchel and Turk, 2008). Despite some methodological issues in the literature (Kent and Keating, 2008; Hayden et al., 2009), the validity of the biopsychosocial premise is well accepted (Borkan et al., 2002). A range of biomedical and psychosocial factors have also demonstrated relevant associations with clinical presentation and outcome (O'Sullivan, 2005; Gatchel and Turk, 2008; Nicholas and George, 2011).

Seemingly in parallel with the adoption of a biopsychosocial approach to LBDs has been the evolution of an assumption by some clinicians and researchers that pathoanatomical factors are of low importance in clinical decision making (Weiner, 2008b). Evidence of this assumption is present in clinical guidelines that fail to recommend classification or specific management based on pathoanatomical principles apart from exclusion of red flags (Dagenais et al., 2010; Kamper et al., 2010). Within the physiotherapy profession this assumption has been taken a step further with perspective papers (Rose, 1989; Guccione, 1991; Di Fabio, 1999; Zimmy, 2004; Nicholas and George, 2011) and professional guidelines (American Physical Therapy Association, 2001) explicitly stating that a pathoanatomical approach to the classification and treatment of LBDs is neither appropriate or useful. These recommendations have been adopted by clinical protocols (McKenzie and May, 2003) and researchers (Van Dillen et al., 1998; Fritz et al., 2007; Foster et al., 2011). This paper explores the pathoanatomical approach to the classification and treatment of LBDs within the context of the current literature and with the aim of guiding future clinical and research practice.

## 2. Common rationale against a pathoanatomical approach

The classification of LBDs has traditionally been based on pathoanatomical principles (Weiner, 2008a). However, since the advent of the biopsychosocial model a number of rationale have been published in an attempt to justify a shift away from a pathoanatomical approach.

The identification of pathoanatomical LBD subgroups is commonly described as being possible in only a small proportion of cases (Deyo et al., 1992; O'Sullivan, 2005; Fritz et al., 2007; Raspe et al., 2008; Wand and O'Connell, 2008; Fersum et al., 2010;

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Fourney et al., 2011; Nicholas and George, 2011). However, this assertion is predominantly supported by citation of other reviews or studies with potentially obsolete data (Raspe et al., 2008). One cited study described the low percentage of pathoanatomical diagnoses made by physicians in patients with work related compensation due to a LBD (Abenhaim et al., 1995). However, this study was retrospective in nature and the diagnosis was made within the first seven days of injury, most likely without information from investigations and response to specific treatment. Another cited paper published three decades ago was based on the findings of a multi-disciplinary expert panel. However, on inspection this paper in fact concluded that the proportion of LBDs unable to be classified into a pathoanatomical subgroup could potentially range from 20 to 85% (White and Gordon, 1982).

Justifications based on limited clinical utility are also commonly used in support of a shift away from pathoanatomical classification and treatment. The failure of a pathoanatomical approach to positively impact on treatment response (i.e. demonstrate that treatment accounting for pathoanatomical factors is more effective) is one such justification (Van Dillen et al., 2003; Chou et al., 2007; Deyo et al., 2009; Pransky et al., 2010). Another common criticism has been the limited validity of clinical methods in diagnosing pathoanatomical subgroups (Van Dillen et al., 2003; Chou et al., 2007; Nicholas and George, 2011) particularly when using radiological findings (O'Sullivan, 2005; Chou et al., 2007; Pransky et al., 2010; Nicholas and George, 2011). However, issues with clinical utility are not unique to pathoanatomical based classification (Weiner, 2008b). There is still a large knowledge gap regarding psychosocial factors as a means of identifying valid subgroups that are more responsive to targeted treatment (Hayden et al., 2009; Kamper et al., 2010; Pincus et al., 2010; Simmonds et al., 2010). In addition, reviewers of the literature agree that further research is required across *all* the dimensions of LBP to enable the development of appropriate classification systems (Ford et al., 2007; Fairbank et al., 2011). A pathoanatomical approach can therefore not be discounted clinically or in research on the basis of poor clinical utility.

The shift away from pathoanatomical factors has been informed by assumptions made for people with chronic LBDs. One such assumption is that pathoanatomical mechanisms are of lesser importance in chronic compared to acute LBDs (Rainville et al., 2007). However, evidence exits to the contrary with laboratory and clinical research showing tissue healing (an important pathoanatomical factor) can continue well into the chronic phase of injury (Adams et al., 2010). A further assumption is that for chronic LBDs patient deconditioning rather than pathoanatomical factors is the primary barrier to recovery (Mayer et al., 1985; Rainville et al., 2007). However, recent evaluations of the validity and mechanisms underpinning the "decondition syndrome" have found conflicting evidence (Smeets and Wittink, 2007; Verbunt et al., 2010). Finally, the assumption around relative importance of psychosocial factors over pathoanatomical factors in chronic LBDs is not supported by a recent systematic review showing the amount of variance in outcome explained by psychosocial factors to be less than 25% (Wessels et al., 2006). It is a reasonable extrapolation that the reminder of the variance would be in part due to pathoanatomical factors.

The results of an early study on diagnostic injection has been reported as evidence of an inability to classify reliably based on pathoanatomical principles such as symptom location (Nicholas and George, 2011). In this early study it was shown that infiltration of the lumbar facet joints during spinal injection resulted in nociceptive provocation with variable symptom distribution (Marks, 1989). However, it is an insufficient argument to suggest that variable symptom distribution in response to provocation of a single anatomical source renders pathoanatomical classification based on a thorough clinical assessment as futile.

Published papers including evidence-based guidelines (Dagenais et al., 2010) have hypothesised that providing the LBD patient with a pathoanatomical diagnosis may be counterproductive via mechanisms such as the reinforcement of an excessive somatic focus (Deyo et al., 2009; Fourney et al., 2011; Nicholas and George, 2011). However, studies that have empirically tested this theory have found no evidence of adverse outcomes among participants who are given a pathoanatomical diagnosis (Kleinstuck et al., 2006; Ash et al., 2008).

It is clear that psychosocial factors are critical in the classification and treatment of LBDs. However, the above justifications for excluding pathoanatomical factors from clinical and research endeavour are not supported by the current literature.

## 3. The pathoanatomical approach in clinical and research practice

In spite of the above described assumptions a strong pathoanatomical emphasis remains prevalent in primary care physiotherapy (Daykin and Richardson, 2004; Kent and Keating, 2005; Spoto and Collins, 2008) and is recommended by expert physiotherapists (Smart and Doody, 2007; Wilde et al., 2007; Spoto and Collins, 2008) as well as researchers with expertise in LBD classification (Petersen et al., 2003; O'Sullivan, 2005; Paatelma et al., 2009). In addition, treatment protocols commonly evaluated in RCTs have been conceptualised within the context of a pathoanatomical model (McKenzie, 1981; Delitto et al., 1995; Flynn et al., 2002; Petersen et al., 2004; Donelson, 2007; Ford et al., 2011a, 2011b, 2012). Finally, understanding proven and hypothesised mechanisms of cause and effect is a critical part of clinical and research practice and pathoanatomical factors are self evidently important to consider in this regard (Ford et al., 2007; Helmhout et al., 2008; Weiner, 2008a; Stanton et al., 2010). Despite this groundswell of clinical and research support for the importance of pathoanatomical factors within a biopsychosocial framework, RCTs continue to be published with insufficient consideration of pathoanatomy.

The Flynn clinical prediction rule identifies people with LBDs who respond more positively to a manipulative technique described as affecting the sacro-iliac joint (Flynn et al., 2002). The rule has been extensively used to recruit participants for RCTs on the effectiveness of specific manual therapy (Childs et al., 2004; Hancock et al., 2008; Cleland et al., 2009; Hallegraeff et al., 2009; Sutlive et al., 2009). Three of these trials have investigated the "generalizability" of the Flynn prediction rule by evaluating relative effectiveness of lumbar mobilisation and sacro-iliac based manipulation techniques to people positive on the rule (Hancock et al., 2008; Cleland et al., 2009; Sutlive et al., 2009). There has been vigorous debate on the veracity of the findings of these studies (Hancock and Maher, 2010) and indeed the ability of clinicians to manipulate the sacro-iliac joint (O'Sullivan and Beales, 2007). However, little has been published on the potentially flawed clinical expectation of a sacro-iliac based clinical prediction rule to generalise to the specific, but "non-matched" treatment method of lumbar mobilisation. This is despite the developers describing clear pathoanatomical mechanisms relating the clinical prediction rule to manipulation targeting the sacro-iliac joint (Flynn et al., 2002). It is not surprising that the Flynn prediction rule has not been adopted by clinicians in the field (Spoto and Collins, 2008) given the recent research that fails to sufficiently explore pathoanatomical mechanisms.

Graded activity is another treatment approach where recent RCTs and systematic reviews (Macedo et al., 2010) insufficiently

consider pathoanatomical mechanisms. Graded activity involves the identification of functional goals, development of goal related specific exercise, and prescription of an exercise program in progressive increments until the functional goals are achieved. Importantly increases in exercise dosage are time rather than pain contingent and patient reports indicative of fear avoidance are addressed by the practitioner challenging presumed counter-productive beliefs regarding the rate and degree of the increment (Macedo et al., 2010). The provision of such a program may be appropriate in certain people with LBDs. However, the concept of a time contingent progression in exercise dosage is underpinned by the premise that genuine aggravation of symptomatic pathology is unlikely. Unfortunately, there is a lack of convincing evidence supporting the absence of significant pathoantomical injury in chronic LBDs. It is therefore theoretically possible, and in our clinical experience common, that time contingent exercise progression for *all* patients with chronic LBDs results in high rates of treatment drop out due to unacceptable exacerbation. This theory is supported by a recent systematic review showing that approximately 30% of participants undertaking graded activity treatment in RCTs fail to complete the program (Macedo et al., 2010). A more reasonable approach would be to select patients for graded activity programs based on high levels of fear avoidance *and* a low likelihood of significant pathology based on currently accepted clinical methods.

These examples illustrate the potential risks of insufficient consideration of pathoanatomical factors in RCTs on LBDs. By failing to sufficiently consider pathoanatomical issues, the treatment of LBDs has the potential for no effect or symptom exacerbation.

## 4. Methodological considerations

There is considerable variability in currently proposed LBD classification systems as well as in methods used for the development and validation of such systems (Kent and Keating, 2005; Ford et al., 2007; Fairbank et al., 2011). In our opinion this variability is likely to be due to insufficient consideration of methodological issues. Studies of concurrent validity/diagnostic accuracy compare the ability of a proposed classification system to predict the results of a gold or reference standard (Ford et al., 2007). However, acceptable reference standards in LBDs are elusive and therefore the relevance of concurrent validity studies in validating a classification system is limited (Carragee and Hannibal, 2004; Ford et al., 2007). Statistical approaches (Feinstein, 1987) have been used as a supposedly "empirical" method of developing LBD classification systems with a common example illustrated in the clinical prediction rule literature (Stanton et al., 2010). However, statistical methods can result in "artificial" classifications of limited clinical utility (Ford et al., 2007). In addition, the feasibility of research designs using a statistical approach is questionable, because of the complexity of LBDs, the number of factors needing evaluation and the likelihood of studies being under-powered (Ford et al., 2011b).

Given the limitations of concurrent validity and statistical methods for classification, authorities have discussed the importance of expert clinical opinion in resolving complex classification issues (Feinstein, 1987; Spoto and Collins, 2008). In domains of medicine outside of LBDs, including headache and non-Hodgkin's lymphoma, expert clinical opinion has been incorporated into sophisticated classification systems that result in improved clinical outcomes (Ford et al., 2007). However, such methodology has been slow to penetrate the literature on LBD classification (Ford et al., 2007).

Given the limitations of standard research methodologies, George and Delitto (2005) recommended "convergence of validity" as a useful concept in developing LBD classification systems for clinical and research purposes. They defined this as:

> "…evidence supporting or refuting the system (being) gathered from different sources and from the use of different methods. In the best case scenario, these sources converge and indicate similar meanings of the underlying constructs being studied." (George and Delitto, 2005, p. 312)

The convergence of validity concept is consistent with the original definitions of evidence-based practice that emphasise the constructive interaction between the research literature and clinical perspectives (Sackett et al., 2000) as well as more recent guidelines on developing classification systems (Ford et al., 2007; Reitsma et al., 2009). Such an approach is also congruent with developing a truly biopsychosocial based classification system that incorporates all relevant factors including the pathoanatomical.

## 5. The way forward

There is a pressing need to develop an evidence-based LBD classification system that incorporates biomedical *and* psychosocial factors (Ford et al., 2007; Weiner, 2008b). Treatment methods in widespread clinical use such as the McKenzie (McKenzie & May, 2003) and Maitland (Maitland et al., 2005) approaches as well as contemporary practices in motor control (Hodges and Moseley, 2003) already integrate these factors using sophisticated clinical reasoning methods (Higgs et al., 2008). Researchers and clinicians providing specific treatment for LBDs need to be cognizant of pathoanatomical factors and not erroneously disregard their relevance. Evidence-based research outcomes remain the hope for people with LBDs and clinicians in the field, and this potential is more likely to be realised if appropriate research methods are used that incorporate a pathoanatomical approach.

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