Low Back Pain: Identifying Sub-Groups, Clinical Prediction Rules and Measuring Results

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Introduction

Low back pain is seldom one specific problem. At best, it is a set of problems, each contributing, to a greater or lesser degree, to the sufferer's pain experience. Unfortunately it is often very difficult to work out which set of problems is contributing most to that experience and thereby target (or even investigate) treatments. At worst, nobody knows what the problems are.

A breakthrough in back pain care happened in 1993, when the first International Forum on Primary Care Research on Low Back Pain generated an evidence review that resulted in a US national clinical practice guideline (A.H.C.P.R. 1994). This Forum of identified 'subgrouping' as the main priority for improving care further – a recommendation that endured (Borkan 1998). If we could divide patients into groups that would respond better to different treatment approaches, we could target care and get better results. For want of this, randomized controlled trials of treatments in undifferentiated back pain cohorts have so far shown only modest effects.

Narrow Models

Subsequent scientific discussion on 'subgrouping' began with attempts at classification, and speakers at various conferences presenting their individual systems based on syndrome recognition (Fairbank and Pynsent 1990; Nelson 1990; Porter 1990). Some of these systems (McKenzie and May 2003; O'Sullivan 2005) have attracted many followers and all, to a greater or lesser extent, have implied an explanation for the pain and a rationale for its management. Some however, have been based mainly on findings so subjective as to be unverifiable - although this did not necessarily dampen the enthusiasm of ardent followers!

Such was the lack of evidence surrounding back pain classification that no method has been universally adopted and subsequent attempts to achieve categories have not met with consensus. One example was hierarchical cluster analysis - based on symptom and sign variables that were intuitively thought to be important and amenable to being collected by computer interviews to avoid clinician bias (Pynsent and Fairbank 1990; Langworthy 1997). However, this experimental method of classification turned out not to offer sufficient diagnostic utility for clinicians and has not been pursued.

In response to a groundswell of interest in outcomes, efforts at subgrouping was diverted from explanatory models that could provide a rationale for intervention (albeit which then had to be tested for effectiveness) to ones that skipped the explanatory step and attempted to link the success of treatments to intuitively developed prediction rules. High positive likelihood ratios were found for some of these (Childs 2004; Cleland 2007). However, it was soon pointed out that prognostic factors (Bekkering 2005) had often not been accounted for in the analysis, thus invalidating the notion that it was mainly the treatment that was predicting the outcome.

A systematic review of 9 studies of clinical prediction rules in back pain research, (May 2009) found none whose findings had been replicated beyond the initial study. Furthermore, none of the clinical prediction studies of the success of manipulation alone met the evidence level set for validation, although 2 studies involving manipulation and/or exercises had been validated in another prospective sample. Of these, one (Brennan 2006) was an RCT that found that patients with acute and subacute non-specific back pain did better with manipulation, specific exercises or stabilization exercises if they met the intuitively determined prediction rules for success with each of these treatments. The other study (Teyhen 2007) found that the presence of inter-vertebral motion variables derived from quantitative fluoroscopy (angular and linear

displacement and attainment rates during lumbar flexion) was associated with conformity with an intuitively derived prediction rule for success with stabilization exercises. However, the authors did not test the treatment itself.

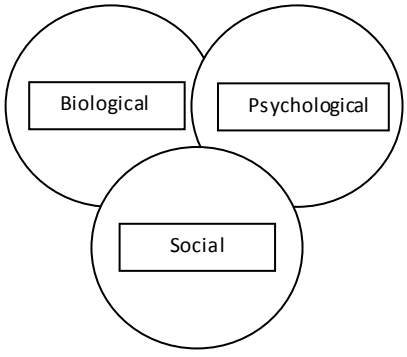
It is difficult to estimate the importance of these findings in terms of health impact. The Brennan study only examined patients with symptoms of less than 6 weeks duration, who generally improve regardless (Menezes Costa, Maher et al. 2012). The quantitative fluoroscopy study did not measure outcomes, but only addressed whether the kinematic variables identified patients who met the intuitively determined prediction rule itself. Additionally, the angular and linear displacement and attainment rates associated with the intuitive subgroups were sometimes smaller than the resolution of the fluoroscopic technique used (Teyhen 2005).

The extent of problems with identifying subgroups and classifications has been highlighted in a systematic review by (Fersum 2009). For example, the prone instability test (Wadsworth, DiFabio et al. 1988), although shown to have good repeatability and thought to indicate the need for stabilization exercises (Hicks 2003), has been found to be positive in nearly half of people with no back pain at all (Jorgensen 2010). Without a broader conceptual model for back pain than that of unverified mechanical subgroups, effect sizes are likely to remain low.

Broad Models

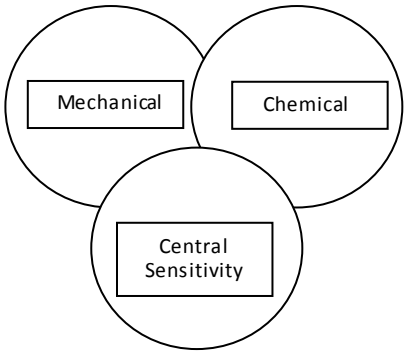
The broadest model for back pain available is the bio-psycho-social model (Waddell 1987) (Figure 1), where practitioners are encouraged to assess patients for prognostic factors based across a wide spectrum of health. This model however, has a narrow and unbalanced biological component (Hutchinson 1999), where the health and social impact of 'nonspecific' back pain grossly outweighs that of 'nerve root pain' or 'serious spinal pathology'. As discussed above, the biological component remains largely unclassified, while research into psychosocial factors, especially predictive research, has been energetically progressed. From inception cohort studies, psychological distress has been established as the main psychological predictor of chronic back pain (Pincus 2002) and negative attitudes to work the main social one (Truchon 2000). Assessing psychological and social risk factors and thereby stratifying back pain populations to intensive cognitive interventions versus non-intensive care has shown evidence of effectiveness (Hill, Whitehurst 2011). However, the effect sizes are small (0.04-0.33), indicating that such an approach, while important, is of limited relevance and that there is need for more work on the biological component.

Fig 1. The Bio-Psycho-Social Model



It is proposed that a biological classification for non-specific low back pain could follow the schema shown in Fig 2. This breaks down into mechanical, chemical and central sensitivity components, none of which are exclusive to the others and none of which so far have entirely satisfactory markers. Nevertheless, these may be on the way. The development of quantitative fluoroscopy at AECC (Breen 2012) is beginning to provide evidence for a mechanical subgroup in non-specific back pain patients and work is currently under way to provide a reference database from non-back pain populations against which to compare suspected inter-vertebral motion abnormalities in patients. Research using magnetic resonance imaging to detect vertebral endplate oedema is providing new understanding of the relationships between chemical changes in the spine and non specific back pain (Jensen 2008) - and more sophisticated uses of algometry (Nijs 2010) are providing us with reference information against which to identify central sensitization in such people.

Figure 2. A Model for the Biological Component of Non Specific Back Pain



Conclusion

The pursuit of useful back pain subgroups covers a number of classification models derived from screening, diagnosis and therapeutic expectations. They range from purely deterministic ones (e.g. statistical analysis of clinical findings) through explanatory models that provide a diagnostic basis for care, to intuitive groupings linked to individual treatments, and on to purely prognostic models devoid of any explanatory component. Whatever model is attempted, the main problems to be addressed will be contamination by undisclosed factors of prognostic importance, noise due to the presence of undetected factors that make no useful contribution (such as artifacts in the measurement system) and insufficient resolution in the measurement method. It is suggested that the psychosocial focus of clinical prediction work has claimed a disproportionate amount of our efforts to improve outcomes for most people with back pain (Breen 2011) and it is time to move 'closer to the bone'.

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