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Compensable work disability management: a literature review of biopsychosocial perspectives

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ABSTRACT

Minimising work disability and facilitating work participation is a major focus of occupational therapy, and the specific brief of therapists working as case managers in the occupational injury arena. This paper reviews and discusses the empirically-supported critical factors in the development, maintenance and management of work disability, and outlines the essential components of multidisciplinary biopsychosocial rehabilitation. By implementing the biopsychosocial model as the framework in which work disability is conceptualised and occupational rehabilitation plans are developed, case managers can play a key role in promoting evidence-linked practice to reduce the cost and suffering associated with long-term work disability.

KEY WORDS: biopsychosocial, work disability, compensable injury, rehabilitation.

INTRODUCTION

Australian society, like other industrialised nations, is burdened by the ever-increasing socioeconomic costs of work-related injuries. In New South Wales, the most populous Australian state with approximately 2.8 million employees (AusStats, 2003), there are annually around 51,000 work-related injuries producing medical and rehabilitation costs of $526 million (WorkCover, 2005).

While legislative changes (Berreth, 1997) and better work and injury management practices have decreased the incidence and frequency rates of work-related injury (HSE, 2001), improved health outcomes (WorkCover, 2001), and increased return to work rates, the total cost of compensable injuries have continued to rise (WorkCover, 2002a). This is due to the ever-increasing expenses incurred by approximately 10% of injured workers who, although not diagnostically different to work resumers (Cohen, Nicholas, & Blanch, 2000), become long-term work disabled and produce 70% to 80% of the total costs of all workplace injury claims (WorkCover, 2005). Reducing the numbers and costs associated with this group is a major goal of workers' compensation authorities, and the present challenge for health professionals working in the occupational injury arena.

Research into the factors that mediate and maintain work disability has led to the conclusion that a shift in clinical reasoning and practices, away from those that focus on physical factors alone, and towards those informed by a more comprehensive theoretic framework, is required (BSRM, 2000). The purpose of

this paper is to review the currently known key issues in the development, maintenance and management of work-related disability. A brief overview of the two main theoretical models of illness, the biomedical and biopsychosocial models, is followed by a comparison of how each model informs the management of injury, pain and disability. The paper concludes with a description of the application of the biopsychosocial model to occupational rehabilitation practice.

THEORETICAL MODELS OF HUMAN ILLNESS

Two key models evident in the conceptualisation and treatment of illness are the traditional biomedical model and the more recent biopsychosocial model. The biomedical model proposes that an illness is caused by some identifiable physical pathology (Bernard & Krupat, 1994), and that symptoms of illness, such as pain and disability, are directly attributable and proportional to that underlying pathology (Waddell, 1992). Any psychological symptoms that may arise are considered to be a secondary effect that will remit after the pathology is remedied.

In the context of an occupational injury, the biomedical model posits that a work-related injury leads to physical pathology (i.e. either temporary tissue damage or permanent impairment), which causes pain and produces disability (Figure 1). Clinical reasoning informed by this model proposes that work disability will be resolved either by the relief of pain or the curing of the physical pathology. This model, while effective in application to diseases produced by a specific pathogen

(e.g. a spinal tumour), is insufficient to explain other conditions that lack clear physical pathology, such as chronic non-specific low back pain (Bernard & Krupat, 1994); (Waddell, 1992).

Studies evaluating the relationship between injury, pain and disability following musculoskeletal injury (e.g. (Cooper, Tate, Yassi, & Khokhar, 1996); (Fritz, George, & Delitto, 2001); (Waddell, Somerville, Henderson, & Newton, 1992) have demonstrated that, while moderately correlated, these elements do not share a linear relationship as proposed by the biomedical model. Accordingly, a six-country, two-year longitudinal study of 2,080 participants (age range 18-59 years) with low back pain of a minimum 90 days duration, found that although medical treatments (e.g. surgery, physical therapies, medications, aids and supports) produced an improvement in subject health, they did not result in a significant reduction in pain intensity or a change in work status (Bloch & Prins, 2001).

The biopsychosocial model of illness (Engel, 1977), which has emerged in reaction to the biomedical model's limitations, assumes illness, pain and disability to be the products of the interaction between psychological and physical variables, which together are set against a background of social and environmental influences (Figure 2) (Bernard & Krupat, 1994). In recognition of its validity, the biopsychosocial model has been adopted by the World Health Organisation (WHO) as the means of classifying the determinants of health, functioning and disability (*International Classification of Functioning, Disability*

and Health (ICF), (WHO: World Health Organisation, 2001). When applied to work-related injuries, this model accommodates for the clinical observation that injured workers diagnosed with similar physical pathology, can and do report differences in pain intensity and level of work disability (von Korff, Ormel, Keefe, & Dworkin, 1992), and implies that variability in disability when physical injury factors are equal, is due to the effects of psychological and/or social-environmental factors.

WORK RELATED INJURY

The vast majority (65%) of work-injuries are benign 'strains and sprains' of the soft tissues of the musculoskeletal system (WorkCover, 2005), and are deemed not to be serious medical conditions (Waddell, 2004). The signs and symptoms of a sprain or strain are pain, restricted movement and reduced functional ability (Australian Acute Musculoskeletal Pain Guidelines Group [AAMPGG], 2004). The bodily location most frequently involved, and totalling approximately 46% of all soft tissue injuries, is the back, followed by the knee (11%), the shoulder (10%), "other" locations (9%) and the ankle (6%) (HSE, 2001; WorkCover, 2005).

For more that 95% of sprains and strains it is not possible to specify the precise origin of pain (AAMPGG, 2004), but in 80% of cases it will settle sufficiently within three to four weeks of onset to allow the injured worker to resume employment (Burdorf, Naaktgeboren, & Post, 1998). Ten percent of workers will have a longer recovery period, and a further 10% will become long-term work disabled (WorkCover New South Wales, 2005).

Issues in the management of work related injuries

In order to maximise the likelihood of recovery and to control the costs associated with a sprain or strain, medical authorities have compiled biopsychosocially-based evidence-linked clinical guidelines, including protocols for diagnostic triaging (RCGP, 1999) and the management of soft-tissue injuries in general (AAMPGG, 2004), and back (Carter & Birrell, 2000) and neck injuries in particular (Motor Accidents Authority, 2001). However, despite the finding that adherence to standardised diagnostic and treatment protocols can reduce both time lost from work by up to 40%, and total claims costs by up to 60% (Wiesel, Boden, & Feffer, 1994), the insurance and medical records of long-term disabled workers show low application of evidence-linked guidelines (Cohen et al., 2000); (Grilli & Lomas, 1992).

The records of Australian (Cohen et al., 2000), Danish, German, Israeli, Dutch, Swedish and American (Bloch & Prins, 2001) injured workers, all reveal that in the majority of cases injury management remains in accordance with the biomedical model. Furthermore, the longer a person is off work the more somatically-focused treatments and investigations they receive, and despite "evidence of psychosocial disturbance" (Cohen et al., 2000) p.307), this is rarely addressed (Williams, Feuerstein, Durbin, & Pezzullo, 1998). Such practice is blamed for producing long-term work disability and its associated costs (Anema, van der Giezen, Buijs, & van Mechelen, 2002).

Causes and consequence of non-evidence-linked management

Why is it that injured workers are not receiving evidence-linked management if this could improve outcomes and reduce costs? The likely answers to this question are that either the treating clinician is unaware of the content of the relevant clinical guidelines, or is as yet unconvinced of the benefits of adhering to such guidelines (Grilli & Lomas, 1992). In a few cases, excessive investigation and/or intervention may reflect the practice of defensive medicine in a litigious climate (Studdert et al., 2005), but in the majority of cases it is believed to be the result of a perceived need to "do something" (Australasian Faculty of Occupational Medicine, 2001, p.24), when an injured worker's complaints of disabling pain continue beyond the period in which the condition was expected to resolve. Applying biomedical model reasoning, these complaints are interpreted as indicating the presence of some missed, or as-yet-undiagnosed physical pathology (Waddell, 2004), and thus trigger a search for a physical cause or cure. Consequently, the injured worker remains in a "medically intensive phase", exposed to potentially iatrogenic effects (Alliance of NSW Divisions [Alliance], 2002) while costs escalate and the possible psychosocial determinants of pain and work disability remain unaddressed.

PAIN

Pain is the main presenting symptom of a sprain or strain (AAMPGG, 2004) and the primary reason for an injured worker to cease duty and seek medical care (Bernard & Krupat, 1994). Pain is classified on a temporal basis according to its

duration post-injury: a*cute* - three to four weeks; *sub-acute* - four to 12 weeks; and, *chronic* - more than 12 weeks (Abenhaim et al., 2000).

Traditionally, and in accordance with the biomedical model, pain was viewed as a physical sensation arising solely from, and in proportion to, tissue damage (Main & Spanswick, 2000). The current biopsychosocial understanding of pain is that it is a complex physical and emotional experience resulting from the dynamic processing of pathophysiological (location and intensity), psychological (cognitive and emotional responses) and social-environmental (context and relational) inputs at multiple sites within the central nervous system (CNS)(Melzack, 1999; Nicholas & Wright, 2001). This multidimensional conceptualisation of pain is extensively supported by the findings of empirical studies examining the factors contributing to variability in intensity when pain is experienced at a range of bodily locations (Jamison, Rudy, Penzien, & Mosley, 1994; Klapow et al., 1995).

Chronic pain

Chronic pain is not ongoing acute pain (Waddell, 2004). While it has an initial physical cause the connection with injury is progressively lost; with time it becomes either disproportionate to the original physical problem or has no clear pathophysiological basis (Merskey & Bogduk, 1994).

Chronic pain develops as the result of an interaction between physiological and psychosocial factors. At the time of injury, chemical and morphological changes in the peripheral and central nervous systems up-regulate the sensitivity of pain

perception neural networks (Dubner, 1997; Wright, 2002) resulting in the phenomena of hyperalgesia and allodynia; adaptive responses designed to promote rest and healing. These states typically remit as recovery occurs, but may be maintained, becoming the neurophysiologic basis of chronic pain, if negative cognitive and emotional states (e.g. fear, anxiety and catastrophic thinking) (Sullivan et al., 2001) are concurrently experienced with acute physical pain sensations. These psychological responses amplify physical pain signals (Price, 1999) and heighten the stimulation of pain perception neural networks (Melzack, 1999), thereby consolidating the normally temporary neuroplastic adaptations (Dubner, 1997).

Changed neuronal connections are also responsible for innocuous stimuli acquiring the ability to trigger pain sensations. Through the repeated pairing of pain with certain movements, activities, emotions, and so on, neutral stimuli can acquire the capacity to produce pain long after the noxious input from damaged tissues has ceased (Flor, 2000). Chronic pain therefore will fluctuate, being exacerbated by stimuli such as: negative emotional states, including anger (Bruehl, Chung, Burns, & Biridepalli, 2003) and depression (Dickens, McGowan, Clark-Carter, & Creed, 2002); fear-provoking thoughts and beliefs (Smith, Gracely, & Safer, 1998); poor coping responses (Sullivan, Stanish, Waite, Sullivan, & Tripp, 1998); solicitous spousal behaviours (Flor, 2000); and, social stressors (Feuerstein, Sult, & Houle, 1985); as well as physical work or activity (Hoogendoorn, van Poppel, Bongers, Koes, & Bouter, 1999). Exacerbations, however, do not represent further physical damage or re-injury (Waddell, 2004).

Chronic pain is also maintained through the influence of multiple reinforcers: attention and empathy (Kerns, 1999); participation in passive physical treatments and investigations (von Korff, Barlow, Cherkin, & Deyo, 1994); the avoidance of feared behaviours or activities (Vlaeyen & Linton, 2000); release from usual responsibilities (particularly unsatisfying work) (Hoogendoorn et al., 2002); and, the payment of wage-commensurate sickness benefits (Mayer, Gatchel, & Polatin, 2000).

Treatments that provide symptomatic relief of acute pain are inappropriate for chronic pain as they are ineffective in extinguishing such pain (Merskey & Bogduk, 1994) or reducing pain-related work disability (Hansson & Hansson, 2000). Furthermore, because of their role in the development and maintenance of chronic pain and disability (Gasma, 1994) acute pain treatments are considered potentially harmful in the chronic phase (Alliance, 2002).

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WORK DISABILITY

Work disability refers to a specific aspect of pain-related disability evidenced by limitations in the capacity to meet occupational demands (Waddell, 2004).

The development of work disability

From the epidemiological study of low back injury, {Frank, Brooker, et al. 1996 #1090} et al. (1996) found that the risk of long-term disability rises exponentially post-injury, and that three phases of risk, paralleling the temporal divisions of

pain, can be identified: (1) The *acute phase* (up to four weeks post injury). In this phase, the main causes of disability are physical or clinical factors (Cooper et al., 1996); the return to work rate is high (80%) (Burdorf et al., 1998) and the risk of long-term work disability is low (1-10% chance). (2) The *sub-acute phase* (between four and 12 weeks post injury). In this phase, disability is associated with both physical and emerging psychological factors (e.g. maladaptive attitudes and beliefs, passive coping responses and emotional distress) (Turk, 1997). Only 11% of injured workers in this phase are likely to resume employment (Burdorf et al., 1998) and the risk of long-term work disability is moderate (10-20% chance). (3) The *chronic phase* (beyond 12 weeks post injury). In this phase, the main causes of ongoing disability are psychological and social-occupational factors (Turk, 1997); the return to work rate tapers to negligible levels (Burdorf et al., 1998) while the risk of long-term work disability commences at 50%, but rises to 98% by two years post injury (Watson, 2001).

The determinants of work disability

To identify the most potent determinates of work disability, (Waddell, Burton A. Kim, & Main, 2003) synthesised the findings of 28 reviews and 31 individual studies of the predictors of long-term work disability in populations with varying sites of soft tissue injury. The predictors were rated in terms of their strength of effect (i.e. having a weak, moderate or strong relationship with work disability) and the consistency with which this relationship was demonstrated in the studies reviewed (i.e. high, moderate or low).

The strongest group of predictors were psychological factors, (such as emotional distress, depression, fear-avoidance beliefs, catastrophic thinking/poor coping, pain behaviours, negative expectations of returning to work, and perceived poor general health), attracting the highest overall ratings for both predictive strength and consistency of findings. These were also classed as the most clinically relevant predictors because they are potentially modifiable. Other strong and consistent predictors of work disability were: demographic factors, including older age (>55 years), occupation (unskilled), work history, employment status (unemployed) and length of time off; social-environmental factors, such as pre-injury job dissatisfaction, local unemployment rate, and financial incentives (i.e. benefit rates and participation in litigation); and, biological factors, such as previous history of a similar injury (this applied to back injuries only), generalised functional disability and pain intensity. In contrast, the findings from clinical examination, a proxy for physical impairment, were only a weak and inconsistent (low) predictor of work disability.

Managing work disability

In line with the findings on predictors of work disability, the WHO ICF (WHO, 2001) indicates that a broad range of biopsychosocial factors are potential targets of intervention, and these are identified in evidence-linked clinical guidelines (e.g. (AAMPGG, 2004; Carter & Birrell, 2000).

Acute phase

The recommended strategies for managing an acute musculoskeletal injury are: the relief of pain (“bio-“); reassurance and explanation about the non-serious nature of the injury (“psycho-“); and, advice to avoid rest and to remain active, that is to participate in everyday activities, including remaining at or returning to work, as soon as possible (“-social”) (AAMPGG, 2004). Occupational health guidelines extend these recommendations to include: establishing a return to work goal, facilitating communication between all parties (“social-occupational”) (Carter & Birrell, 2000); and, the avoidance of diagnostic imaging (e.g. X-rays and magnetic resonance imaging [MRI]) of non-serious conditions (Alliance, 2002).

While no studies could be found that compare the combined use of these recommendations to some alternate form of care, they are under-girded by the collective findings of empirical research and clinical practice. For example, (von Korff, 1999) reports the qualitative finding that patients in acute pain want three things: pain relief; information about their condition; and, reassurance and advice. Adequate pain relief is considered essential for promoting early activity and preventing disability (Waddell, 2004).

The benefit of reassurance and advice to remain active was demonstrated in a large randomised controlled trial (RCT) conducted by (Indahl, Velund, & Reikeraas, 1995), involving 975 injured workers sick-listed with low back pain for between eight and 12 weeks (i.e. sub-acute cases). Usual care was compared to a supportive clinical intervention involving a detailed explanation of the nature of

the injury, reassurance and encouragement to remain active, and ergonomic advice. The intervention produced a 50% reduction in sickness absence at 200 days follow-up (30% versus 60% still off work) and a 15% improvement in long-term (five year) outcomes (19% versus 34% still off work) (Indahl, Haldorsen, Holm, Reikeras, & Ursin, 1998). Similarly, the non-clinical stakeholders in the workplace injury arena have identified teamwork, trust, and credibility among all parties as key facilitators of work resumption, and ineffective communication and delays in the processing or delivery of information or treatment, as key barriers to return to work (Frank et al., 1998; Friesen, Yassi, & Cooper, 2001).

The effects of activity versus rest was examined by (Abenhaim et al., 2000), who conducted a systematic review of 150 RCTs comparing combinations of rest, participation in activities of daily living, occupational activity and active exercise, for the management of acute low back pain. They concluded that better outcomes are achieved when patients are encouraged to progressively resume their normal activities, including work “as tolerated” (p.6), rather than rest.

A number of studies indicate the non-beneficence of diagnostic imaging in the management of sprains and strains of the back. (Jensen et al., 1994) studied the MRI scans of the lumbar spine of 98 normal adults (age range 20-80 years) who were asymptomatic for back pain. Sixty four percent (64%) had some abnormality of the discs or facet joints. Similarly, (van Tulder, Assendelft, Koes, & Bouter, 1997), in a systematic review of 35 studies of the relationship between radiographic (X-ray) findings and non-specific low back pain, found no significant

association between structural abnormalities of the back (e.g. transverse vertebra) and only a weak association (odds ratios ranging from 1.2 to 3.3), between degenerative changes (e.g. disc space narrowing) and pain. Hence clinical guidelines caution against the use of diagnostic imaging in the management of a stain or sprain because of the risk of misinterpretation of normal age-related incidental findings, which may lead to anxiety and the provision of "unnecessary" or "potentially harmful" treatments (Alliance, 2002, p.17).

In summary, the empirical findings support the use of reassurance, encouragement to resume normal activities, communication between relevant parties and the avoidance of over-investigation and passive treatment in the management of an acute sprain or strain.

Sub-acute phase

If work-resumption does not occur by 4 weeks post-injury, clinical guidelines (e.g. (Alliance, 2005; Carter & Birrell, 2000) provide a dual option algorithm, involving either strategies to facilitate the slow-to-date recovery of some workers or mechanisms for identifying others at high risk of long-term disability and for whom secondary prevention should be initiated (Linton, 1999).

In all cases, the first recommendation is a medical review to confirm the absence of serious physical pathology ("Red Flags"). If, as is likely, none is found, the next step is to screen for the presence of "Yellow Flags" (psychosocial factors

known to increase the risk of long-term disability e.g. attitudes, beliefs and avoidance of activity) (Kendall, Linton, & Main, 1997), using a tool such as the Örebro Musculoskeletal Pain Questionnaire (Dunstan, Covic, Tyson, & Lennie, 2005; Linton & Haldén, 1998). If no serious physical condition or psychosocial risk factors are identified, then the guidelines suggest similar strategies to those recommended for the acute phase; but in particular the cessation of passive treatments and the certification of fitness for modified duties (WorkCover, 2003). The benefit of this latter strategy was demonstrated by (Krause, Dasinger, & Neuhauser, 1998), who reviewed 29 empirical studies of modified work programs and found that the provision of modified duties doubled the return to work rate of both temporarily and permanently impaired workers, compared to similarly injured workers who were not offered such modifications.

If significant levels of psychosocial risk factors are identified, the guidelines recommend biopsychosocial rehabilitation (Karjalainen et al., 2001). To identify the essential components of such rehabilitation, (Staal et al., 2002) reviewed 14 RCTs evaluating the effects of 19 return-to-work interventions. They concluded that a sufficient sub-acute or chronic phase biopsychosocial rehabilitation program should include the following elements: (i) an exercise component, including graded participation in everyday activities (including work activities); (ii) a psychological component, involving the use of cognitive-behavioural (CBT) strategies to modify maladaptive beliefs, emotions and behaviours; and (iii) an occupational component, giving the intervention a work focus and being aimed at facilitating work resumption.

In a systematic review of multidisciplinary rehabilitation for sub-acute low back pain, (Karjalainen et al., 2001) reported that biopsychosocial interventions produced a 30%-50% reduction in time lost from work when compared to usual care. Of particular interest was a study by (Loisel et al., 1997) which, in contrast to the findings of Indahl et al., (1995) reported in the *Acute Phase* section above, found that a clinical intervention alone was insufficient to reduce work disability in injured workers with sub-acute low back pain. Using an RCT, Loisel et al. compared usual care (n=26), a clinical intervention (n=31), an occupational intervention (n= 22) and a combined clinical-plus-occupational intervention (n=25). The clinical intervention involved a visit to a back specialist and participation in a back school: the occupational intervention involved assessment by an occupational health physician, the prescription of modified duties, and a Workplace Assessment plus recommendations, by an ergonomist. At one year follow-up the clinical-plus-occupational intervention group had returned to work 2.41 times faster than the usual care group, but the clinical-intervention-only group had no significant effect on outcomes. At six years follow–up the combined intervention was the most cost-beneficial (Loisel et al., 2002).

While Loisel et al. (1997) and Indahl et al. (1995) appear to have produced conflicting results; this may be due to differences in the content of the “clinical-only” intervention. Indahl et al.’s optimistic medical reassurance and encouragement to resume activity is likely to have introduced a significant psychological component that may not have been present in the clinical arm of

the Loisel et al. (1997) study. In sum, while there is evidence to suggest that multi-disciplinary intervention is effective in the sub-acute phase, Karjalainen et al. (2001) recommend that more large-scale studies are conducted.

Chronic phase

If a worker's injury, pain and disability progresses to the chronic phase, then clinical guidelines recommend that all workers receive intensive, specialist-clinic-based multidisciplinary biopsychosocial rehabilitation (WorkCover New South Wales, 2003) to address the expected impairments in physical, social, familial and occupational functioning. Although established interventions for chronic pain-related disability, such as medical care (the relief of symptoms) (Hansson & Hansson, 2000), functional restoration (the re-establishing of physical performance) (Sinclair, Hogg-Johnson, Mondloch, & Shields, 1997) and pain management (improving quality of life by addressing beliefs and behaviour) (Morley, Eccleston, & Williams, 1999), deliver varying improvements in physical and psychological functioning, only multidisciplinary biopsychosocial rehabilitation shows positive effects on work resumption (Bendix et al., 1996; Kendall & Thompson, 1998).

The findings of a systematic review by (Guzman, Esmail, Karjalainen, Malmivaara, & Irvin, 2001) assessing vocational outcomes following multidisciplinary biopsychosocial rehabilitation, indicate that a chronic phase intervention can be effective, but it will need to be intensive (Bendix, Bendix, Ostenfeld, Bush, & Andersen, 1995), thus it will be more expensive ($US5000

compared to $US500 per patient, (Bendix et al., 1996) yet less effective than a lighter sub-acute phase secondary prevention intervention (Marhold, Linton, & Melin, 2001).

Of the four studies on chronic phase interventions reviewed by Guzmán et al. (2001), only two (Bendix et al., 1995; 1996) reported a significant (30%-50%) improvement in employment status post-intervention. Bendix et al. (1995) (n=126 injured workers with chronic low back pain) and Bendix et al. (1996) (n=106 similarly injured workers) compared an intensive three-week functional restoration program using a behavioural approach, plus a three-hour course in job seeking skills training, to a less intensive program (Bendix et al., 1995) and usual care (Bendix et al., 1996) and reported a significant benefit from both interventions.

The other two studies (Alaranta et al., 1994) and (Mitchell & Carmen, 1994) reported no improvement in vocational outcomes following multidisciplinary biopsychosocial rehabilitation. Alaranta et al. (n=293 injured workers with chronic low back pain) trialled a three week functional restoration program, using a cognitive-behavioural approach, plus “individual consultations for work problems” (p.1340) and found no significant impact on “occupational handicap” (p.1341), when compared to usual care at 12 months follow-up. Similarly, Mitchell and Carmen (n=420 workers with mixed sites of chronic pain) compared usual care to an intensive eight-week functional restoration program with

behavioural support and “individual and group counselling” (p. 634), and found no significant differences in employment status at 12 months follow-up.

While all four studies used a functional restoration program with a cognitive and/or behavioural approach and a work focus, those reporting a positive effect on work disability utilised a detailed “social-occupational” component, in balance with the “physical” and “psychological” components. Thus, rather than demonstrating equivocal effectiveness of multidisciplinary biopsychosocial rehabilitation for chronic work-disability, or the ineffectiveness of a less intensive intervention, the studies reviewed by Guzmán et al. (2001) indicate that an effective intervention is one that includes both necessary and sufficient elements; the latter involving specific skills training to facilitate work resumption.

This conclusion is further evident in two other studies. Using a quasi-experimental design involving chronic pain patients (n=81) with a mean duration of symptom of 5.54 years, Kendall and Thompson (1998) found that a light CBT pain management intervention, inclusive of a graded exercise component plus job seeking skills training, raised employment rates from 17.2% to 24.7%, while the waiting list comparison group (n=102) showed no change in employment rate (9.8%) across the six-month follow-up period. Similarly, (Watson, 2001) conducted an uncontrolled pilot study evaluating a light biopsychosocial intervention with a group of 84 chronic, work-disabled social security beneficiaries (mean time off work = 3.16 years). At six months follow-up, 39.5% of the participants had returned to work, compared to the usual 2% spontaneous

work resumption rate of non-treated persons work disabled for more than two years (Waddell, 2004). While the limitations of these non-controlled studies are acknowledged, they do support the notion that a specific and structured "social-occupational" intervention is a necessary and success-promoting component of biopsychosocial rehabilitation for the long-term work disabled.

In summary, the limited number of studies available on biopsychosocial rehabilitation for the chronic work disabled indicate that such interventions are essential to facilitate return to work, but are faced with limitations if the social-occupational obstacles to work-resumption are not addressed comprehensively.

Applying the biopsychosocial model to workplace injury management

Occupational therapists working as rehabilitation consultants or case managers are charged with facilitating the resolution of injury-related work disability, as evidenced by the worker's return to safe and suitable duties (Chinnery, 1990). Based on the understanding of the biopsychosocial nature of work disability, an Australian worker's compensation authority, WorkCover NSW, have produce guidelines suggesting interventions for integration in workplace-based injury management programs (WorkCover, 2003). By incorporating these interventions into their client's return to work plans, rehabilitation case managers can exercise evidence-linked practice.

Consistent with current practice, the WorkCover recommendation for the acute injury phase is the early return to progressively up-grading, goal focused and

collaboratively determined suitable (modified) duties. In the sub-acute or chronic phases, the recommendations vary according to: (i) the duration of the worker's disability, and, (ii) the severity of the worker's psychosocial risk factors for long-term disability ("Yellow Flags"). The options are: (1) therapeutic exercise and activities, designed to meet the assessed critical demands of identified duties and delivered using a CBT approach. This is recommended for sub-acute phase injured workers with low level Yellow Flags; (2) a community-based light CBT multidisciplinary group intervention (part-time for a total of 16 hours) involving therapeutic exercise and activities, plus education and other strategies designed to improve psychological functioning, establish pain self-management and decrease pain-related disability. This intervention is recommended for injured workers in the sub-acute and "early chronic" (<6 months) phases exhibiting moderate levels of Yellow Flags; and, (3) an intensive CBT multidisciplinary group intervention (full- or part-time for a minimum of 100 hours) recommended for injured workers in the chronic phase and with high levels of Yellow Flags (WorkCover, 2003).

Support for the WorkCover guidelines has been shown in a study by Dunstan and Covic (2006). Based on these guidelines, the first author (DD) developed, manualised and delivered a community-based light CBT intervention, using a clinical psychologist and physiotherapist from separate practices, working in liaison with the injured worker's occupational rehabilitation provider and treating doctor, to create a multidisciplinary team. This low-cost group program (approximately $A1,400 per participant), with population-wide application, was

associated with significant gains in perceived pain intensity, physical and psychological functioning, and readiness to return to work in a group (n=30) of chronic pain-disabled workers. However, while clearly demonstrating that a multidisciplinary approach is effective in improving physical and psychological functioning, this study also showed that these gains alone are insufficient to produce a return to work when co-morbid unemployment is present. As other studies (e.g. Bendix et al., 1996; Kendall & Thompson, 1998) have suggested, additional strategies, such as those designed to facilitate work resumption, are necessary to form a comprehensive biopsychosocial intervention when co-morbid work disability and unemployment are present, and should be recognised within the WorkCover guidelines.

Beyond this limitation, occupational therapists should be aware of the following barriers to the current application of the WorkCover recommendations: only a limited number of physical therapists are trained in the use of a CBT approach to exercise and activity programs; programs incorporating the recommended elements of the light CBT multidisciplinary group intervention remain in the developmental and evaluation stages (Dunstan & Covic, 2006); the necessary community-based multidisciplinary teams capable of delivering the light CBT intervention do not currently exist and a model of delivery has only recently been tested (Dunstan & Covic, 2006); pain clinics suitable for providing an intensive program are few in number and not available population wide (Pain World, 2005); (Sullivan, 2003); and, many stakeholders trained in the biomedical model

continue to favour somatic treatments and are yet to be educated in the need for biopsychosocial intervention (Frank et al., 1998; WorkCover, 2002b).

So how can occupational therapists deliver biopsychosocial occupational rehabilitation interventions within the existing clinical environment? The first and most vital step is to recognise the need to assess, and if necessary address, psychological and social-occupational-environmental issues, as well as physical factors, in the rehabilitation of all physically injured workers. At initial interview, injured workers can be screened for the presence of psychosocial risk factors for long-term disability using an instrument such as the Örebro Musculoskeletal Pain Questionnaire (ÖMPQ) (Dunstan et al., 2005). If the total score is in the high risk range (>130), then this risk can be communicated to all relevant parties and referral for psychological intervention, from a clinician skilled in CBT for pain and disability management, can be made. The treating physical therapist and psychologist can be advised of the critical physical demands of suitable duties (identified through Workplace Assessment) and a collaborative goal, with graded steps for active treatment, can be established. Communication between all parties can be facilitated, workplace issues addressed, and the provision of modified duties arranged. If the worker has become unemployed, then referral for training in labour market re-entry skills can be made. Finally, through modelling or direct education, occupational therapists can communicate to all stakeholders and treatment providers, the importance of a biopsychosocial approach to physical injury management, thereby becoming the catalysts for evidence-based practice in occupational rehabilitation.

SUMMARY AND CONCLUSIONS

Only a small percentage of injured workers become long-term work disabled, but they account for the majority of compensation costs and pose multiple challenges for occupational rehabilitation. As the injured worker progresses from the acute to sub-acute and finally the chronic phases of injury, pain and disability, traditional interventions become increasingly ineffective in facilitating work resumption. In contrast, comprehensive biopsychosocial rehabilitation programs are delivering promising results. Based on evidence-linked clinical guidelines, programs applicable to workplace-based rehabilitation have been developed and are gaining support with growing research; however they remain infrequently integrated into injury management plans (Frank et al., 1998). While further research is required to identify the specific components of comprehensive interventions, occupational therapists and other health professionals functioning as occupational rehabilitation consultants, are in a position to forge the way in reducing work disability, by embracing the biopsychosocial model as the over-aching conceptual framework for understanding and managing all aspects of work-related injury, and driving the inclusion of evidence-linked interventions into occupational rehabilitation plans.

REFERENCES

1. AAMPGG: Australian Acute Musculoskeletal Pain Guidelines Group. (2004). *Evidence-based management of acute musculoskeletal Pain. A Guide for Clinicians* . Brisbane: Australian Academic Press.

2. Abenhaim, L., Rossignol, M., Valat, J.-P., Nordin, M., Avouac, B., Blotman, F. et al. (2000). The role of activity in the therapeutic management of back pain: Report of the International Paris Task Force on back pain. *Spine, 25 (4S) Supplement*, 1S-33S.

3. Alaranta, H., Rytökoski, M. B., Rissanen, A., Talo, S., Rönnemaa, T., Puukka, P. et al. (1994). Intensive physical and psychosocial training program for patients with chronic low back pain. *Spine, 19*(12), 1339-1349.

4. Alliance of NSW Divisions. (2002). *Work-related acute low back pain clinical guidelines information for general practitioners*. Sydney, Australia: WorkCover NSW.

5. Alliance of NSW Divisions. (2005). Management of work-related sub-acute and chronic low back pain: Guide for general practitioners Version 1.0. Sydney, Australia: WorkCover NSW.

6. Anema, J. R., van der Giezen, A. M., Buijs, P. C., & van Mechelen, W. (2002). Ineffective disability management by doctors is an obstacle for return-to-work: a cohort study on low back pain patients sicklisted for 3-4 months. *Occupational and Environmental Medicine, 59*, 729-733.

7. AusStats. (2003). *Census of population and housing: selected education and labour force characteristics for statistical local areas, New South Wales and Jervis Bay territory.* Retrieved October 2005, from http://www.abs.gov.au/Ausstats.

8. Australasian Faculty of Occupational Medicine. (2001). *Compensable Injuries and Health Outcomes.* Sydney, Australia: The Royal Australasian College of Physicians.

9. Bendix, A. F., Bendix, T., Ostenfeld, S., Bush, E., & Andersen, A. (1995). Active treatment programs for patients with chronic low back pain: a prospective, randomized, observer-blinded study. *European Spine Journal, 4*, 148-152.

10. Bendix, A. F., Bendix, T., Vaegter, K., Lund, C., Frolund, L., & Holm, L. (1996). Multidisciplinary intensive treatment for chronic low back pain: a randomized, prospective study. *Cleveland Clinical Journal of Medicine, 63*(1), 62-69.

11. Bernard, L. C., & Krupat, E. (1994). *Health psychology: biopsychosocial factors in health and illness*. Philadelphia: Harcourt Brace College Publishers.

12. Berreth, C. A. (1997). State workers' compensation legislation enacted in 1996. *Monthly Labor Review,* Vol. 120(1), 1-2.

13. Bloch, F. S., & Prins, R. (2001). *Who returns to work & why? A six-country study on work incapacity & reintegration*. New Brunswick (USA): Transaction Publishers.

14. Bruehl, S., Chung, O. Y., Burns, J. W., & Biridepalli, S. (2003). The association between anger expression and chronic pain intensity: evidence for partial mediation by endogenous opioid dysfunction. *Pain, 106*, 317-324.

15. BSRM. (2000). *Vocational rehabilitation: the way forward*. London: British Society of Rehabilitation Medicine.

16. Burdorf, A., Naaktgeboren, B., & Post, W. (1998). Prognostic factors for musculoskeletal sickness absence and return to work among welders and metal workers. *Occupational and Environmental Medicine, 55*(7), 490-495.

17. Carter, J. T., & Birrell, L. N. (2000). *Occupational Health Guidelines for the Management of Low Back Pain at Work - Principal Recommendations.* London: Faculty of Occupational Medicine.

18. Chinnery, D. (1990). *The Australian Occupational Rehabilitation Guide* (2nd ed.). Chippendale, Australia: Corporate Impacts Publications Pty Ltd.

19. Cohen, M., Nicholas, M., & Blanch, A. (2000). Medical assessment and management of work-related low back or neck/arm pain. *Journal of Occupational Health and Safety, 16*(4), 307-317.

20. Cooper, J. E., Tate, R. B., Yassi, A., & Khokhar, J. (1996). Effect of an early intervention program on the relationship between subjective pain and disability measures in nurses with low back injury. *Spine, 21*(20), 2329-2336.

21. Dickens, C. M., McGowan, L., Clark-Carter, D., & Creed, F. H. (2002). Depression in rheumatoid arthritis: a systematic review of the literature with meta-analysis. *Psychosomatic Medicine, 64*, 52-60.

22. Dubner, R. (1997). Neural basis of persistent pain: sensory specialisation, sensory modulation and neuronal plasticity. In T. S. Jensen, J. A. Turner, & Z. Wiesenfeld-Hallin (Editors), *Progress in pain research and management (proceedings of the 8th World Congress on*

Pain) (Vol. 8 pp. 243-257). Seattle: IASP Press.

23. Dunstan, D.A. & Covic, T. (2006). Can a rural community-based work-related activity program make a difference for chronic pain-disabled injured workers? (manuscript submitted for publication).

24. Dunstan, D. A., Covic, T., Tyson, G. A., & Lennie, I. G. (2005). Does the Örebro Musculoskeletal Pain Questionnaire (ÖMPQ) predict outcomes following a work-related compensable injury? *International Journal of Rehabilitation Research, 28*(4), 369-370.

25. Engel, G. L. (1977). The need for a new medical model: a challenge for biomedicine. *Science, 196*(4286), 129-136.

26. Feuerstein, M., Sult, S., & Houle, M. (1985). Environmental stressors and chronic low back pain: life events, family and work environment. *Pain,* Vol. 22, 295-307.

27. Flor, H. (2000). The functional organization of the brain in chronic pain. In J. Sandkuhler, B. Bromm, & G.F. Gebhart (Editors), *Progress in Brain Research* (Vol. 129 pp. 313-322). Germany: Elsevier Science B.V.

28. Frank, J., Sinclair, S., Hogg-Johnson, S., Shannon, H., Bombardier, C., Beaton, D. et al. (1998). Preventing disability from work-related low-back pain: new evidence gives new hope--if we can just get all the players onside. *Canadian Medical Association Journal, 158*(12), 1625-1631.

29. Friesen, M. N., Yassi, A., & Cooper, J. (2001). Return-to-work: the importance of human interactions and organizational structures. *Work, 17*, 11-22.

30. Fritz, J. M., George, S. Z., & Delitto, A. (2001). The role of fear-avoidance beliefs in acute low back pain: relationships with current and future disability and work status. *Pain, 94*, 7015.

31. Gasma, A. (1994). The role of psychological factors in chronic pain. *Pain, 57*, 5-15.

32. Grilli, R., & Lomas, J. (1992). *Evaluating the message: the relationship between compliance rate and the subject of a practice guideline*. Hamilton, Ontario: McMaster University.

33. Guzman, J., Esmail, R., Karjalainen, K., Malmivaara, A., & Irvin, E. B. C. (2001). Multidisciplinary rehabilitation for chronic low back pain: systematic review. *British Medical Journal,* Vol. 322(7301), 1511-1516.

34. Hansson, T. H., & Hansson, E. K. (2000). The effects of common medical interventions in pain, back function, and work resumption in patients with chronic low back pain: a prospective 2-year cohort study in

six countries. *Spine,* Vol. 25(23), 3055-3064.

35. Hoogendoorn, W. E., Bongers, P. M., de Vet, H. C. W., Ariëns, G. A. M., van Mechelen, W., & Bouter, L. M. (2002). High physical work load and low job satisfaction increase the risk of sickness absence due to low back pain: results of a prospective cohort study. *Occupational Environmental Medicine, 59*, 323-328.

36. Hoogendoorn, W. E., van Poppel, M. N., Bongers, P. M., Koes, B. W., & Bouter, L. M. (1999). Physical load during work and leisure time as risk factors for back pain. *Scandinavian Journal of Work and Environmental Health, 25*, 387-403.

37. HSE. (2001). *Health and safety statistics 2000/01.* Retrieved October, 2005, from http://www.hse.gov.uk/statistics.

38. Indahl, A., Haldorsen, E. M. H., Holm, S., Reikeras, O., & Ursin, H. (1998). Five-year follow-up study of a controlled clinical trial using light mobilization and an informative approach to low back pain. *Spine, 23*(23), 2625-2630.

39. Indahl, A., Velund, L., & Reikeraas, O. (1995). Good prognosis for low back pain when left untampered: a randomized clinical trial. *Spine, 20*(4), 473-477.

40. Jamison, R. N., Rudy, T. E., Penzien, D. B., & Mosley, T. H. (1994). Cognitive-behavioral classifications of chronic pain: replication and extension of empirically derived patient profiles. *Pain, 57*, 277-292.

41. Jensen, M. C., Brant-Zawadzki, M. N., Obuchowski, N., Modic, M. T., Malkasian, D., & Ross, J. S. (1994). Magnetic resonance imaging of the lumbar spine in people without back pain. *The New England Journal of Medicine, 331*(2), 69-73.

42. Karjalainen, K. , Malmivaara, A., van Tulder, M., Roine, R., Jauhiainen Merja, Hurri, H. et al. (2001). Multidisciplinary biopsychosocial rehabilitation for subacute low back pain in working-age adults: a systematic review within the framework of the Cochrane Collaboration Back Review Group. *Spine, 26*(3), 262-269.

43. Kendall, N., Linton, S., & Main, C. (1997). *Guide to assessing psychosocial yellow flags in acute low back pain*. Wellington, NZ: Accident Rehabilitation and Compensation Insurance Corporation and National Advisory Committee on Health and Disability.

44. Kendall, N. A., & Thompson, B. F. (1998). A pilot program for dealing with the co-morbidity of chronic pain and long-term unemployment. *Journal of Occupational Rehabilitation, 8*, 5-26.

45. Kerns, R. D. (1999). Family therapy for adults with chronic pain. In R. J. Gatchel, & D. C. Turk (Editors), *Psychosocial factors in pain: critical perspectives* (pp. 445-456). New York: Guilford Press.

46. Klapow, J. C., Slater, M. A., Patteron, T. L., Atkinson, H. J., Weichgenant, A. L., Grant, I. et al. (1995). Psychosocial factors differentiate multidimensional clinical groups of chronic low back pain patients. *Pain, 62*, 349-355.

47. Krause, N., Dasinger, K., & Neuhauser, F. (1998). Modified work and return to work: a review of the literature. *Journal of Occupational Rehabilitation,* Vol. 8(2), 113-139.

48. Linton, S. J. (1999). The prevention of disability due to chronic musculoskeletal pain. In P.D. Wall, & R. Melzack (Editors), *The Textbook of Pain* (pp. 1535-1548). London: Churchill-Livingstone.

49. Linton, S. J., & Haldén, K. (1998). Can we screen for problematic pain? A screening questionnaire for predicting outcome in acute and subacute back pain. *Clinical Journal of Pain, 14*(3), 209-215.

50. Loisel, P., Abenhaim, L., Durand, P., Esdaile, J. M., Suissa, S., Gosselin, L. et al. (1997). A population-based, randomized clinical trial on back pain management. *Spine, 22*(24), 2911-2918.

51. Loisel, P., Lemaire, J., Poitras, S., Durand, M.-J., Champagne, F., Stock, S. et al. (2002). Cost-benefit and cost-effectiveness analysis of a disability prevention model for back pain management: a six year follow up study. *Occupational and Environmental Medicine, 59*(12), 807-815.

52. Main, C. J., & Spanswick, C. C. (2000). Models of pain. In H. Parker, & P. Watson (Associated Editors), *Pain management: an interdisciplinary approach* (pp. 3-18). London: Churchill Livingstone.

53. Marhold, C., Linton, S. J., & Melin, L. (2001). A cognitive-behavioral return-to-work program: effects on pain patients with a history of long-term versus short-term sick leave. *Pain, 91*, 155-163.

54. Mayer, T. G., Gatchel, R. J., & Polatin, P. B. (2000). *Occupational musculoskeletal disorders: function, outcomes and evidence*. New York: Lippincott Williams & Wilkins.

55. Melzack, R. (1999). From the gate to the neuromatrix. *Pain, 6 (supplement)*, S121-S126.

56. Merskey, H., & Bogduk, N. (1994). *Classification of chronic pain: descriptions of chronic pain syndromes and definitions of pain terms* (2nd ed.). Seattle, USA: IASP Press.

57. Mitchell, R. I., & Carmen, G. M. (1994). The functional restoration approach to the treatment of chronic pain in patients with soft tissue and back injuries. *Spine, 19*(6), 633-642.

58. Morley, S., Eccleston, C., & Williams, A. (1999). Systematic review and meta-analysis of randomized controlled trials of cognitive behaviour therapy and behaviour therapy for chronic pain in adults, excluding headache. *Pain, 80*, 1-13.

59. Motor Accidents Authority. (2001). *MAA guidelines for the management of whiplash-associated disorders*. Sydney, Australia: Motor Accidents Authority.

60. Nicholas, M. K., & Wright, M. (2001). Management of acute and chronic pain. In J. Milgrom, & G. D. Burrow (Editors), *Psychology and Psychiatry: Integrating Medical Practice* (pp. 127-153). Chichester, UK: John Wiley & Sons, Ltd.

61. *Pain World: Australian Pain Clinics.* Retrieved October, 2005, from http://www.painworld.zip.com.au/clinics.html#NSW

62. Price, D. (1999). Psychological mechanisms of pain and analgesia. (Vol. 15). Seattle: IASP Press.

63. RCGP: Royal College of General Practitioners. (1999). *Clinical guidelines for the management of acute low back pain*. London, UK: Royal College of General Practitioners.

64. Sinclair, S., Hogg-Johnson, S., Mondloch, M. W., & Shields, S. A. (1997). Evaluation of effectiveness of any early, action intervention program for workers with soft tissue injuries. *Spine, 22*, 2919-2931.

65. Smith, W. B., Gracely, R. H., & Safer, M. A. (1998). The meaning of pain: cancer patients' rating recall of pain intensity and affect. *Pain, 78*, 123-9.

66. Staal, J. B., Hlobil, H., van Tulder, M. W., Köke, A. J. A., Smid, T., & van Mechelen, W. (2002). Return-to-work interventions for low back pain: a descriptive review of contents and concepts of working mechanisms. *Sports Medicine, 32*(4), 251-267.

67. Studdert, D. M., Mello, M. M., Sage, W. M., DesRoches, C. M., Peugh, J., Zapert, K. et al. (2005). Defensive medicine among high-risk specialist physicians in a volatile malpractice environment. *JAMA,* Vol. 293(21), 2609-17.

68. Sullivan, M. J. L. (2003). Introduction: Emerging trends in secondary prevention of back pain disability [Special Topic Series: Secondary prevention of low back disability]. *Clinical Journal of Pain,* Vol. 19(2), 77-

79.

69. Sullivan, M. J. L., Stanish, W., Waite, H., Sullivan, M., & Tripp, D. A. (1998). Catastrophizing, pain, and disability in patients with soft-tissue injuries. *Pain, 77*, 253-260.

70. Sullivan, M. J. L., Thorn, B., Haythornthwaite, J. A., Keefe, F., Martin, M., Bradley, L. A. et al. (2001). Theoretical perspectives on the relation between catastrophizing and pain. *The Clinical Journal of Pain, 17*, 52-64.

71. Turk, D. C. (1997). The role of demographic and psychosocial factors in transition from acute to chronic pain. In T. S. Jensen, J. A. Turner, & Z. Wiesenfeld-Hallin (Editors), *Proceedings of the 8th World Congress on Pain, Progress in Pain Research and Management* (Vol. 8 pp. 185-213). Seattle: IASP Press.

72. van Tulder, M. W., Assendelft, W. J. J., Koes, B. W., & Bouter, L. M. (1997). Spinal radiographic findings and nonspecific low back pain: a systematic review of observational studies. *Spine, 22*(4), 427-434.

73. Vlaeyen, J. W. S., & Linton, S. J. (2000). Fear-avoidance and its consequences in chronic musculoskeletal pain: a state of the art. *Pain, 85*, 317-332.

74. von Korff, M. (1999). Pain management in primary care: an individualized stepped-care approach. In D. J. Gatchel, & D. C. Turk (Editors), *Psychosocial factors in pain* (pp. 360-373). New York: Guildford Press.

75. von Korff, M., Barlow, W., Cherkin, D., & Deyo, R. A. (1994). Effects of practice style in managing back pain. *Annals of Internal Medicine, 121*(3), 187-195.

76. von Korff, M., Ormel, J., Keefe, F., & Dworkin, S. F. (1992). Grading the severity of chronic pain. *Pain, 50*(2), 133-149.

77. Waddell, G. (1992). Biopsychosocial analysis of low back pain. *Bailliére's Clinical Rheumatology, 6*(3), 523-557.

78. Waddell, G. (2004). *The Back Pain Revolution*. London: Churchill Livingstone.

79. Waddell, G., Burton A. Kim, & Main, C. J. (2003). *Screening to identify people at risk of long-term incapacity for work: a conceptual and scientific review*. London, UK: Royal Society of Medicine Press Ltd.

80. Waddell, G., Somerville, D., Henderson, I., & Newton, M. (1992). Objective clinical evaluation of physical impairment in chronic low back

pain. *Spine, 17*(6), 617-628.

81. Watson, P. J. (2001). *From back pain to work: a collaborative initiative between the national disability development Initiative and the Department of Behavioural Medicine Salford Royal Hospitals Trust.* Manchester, UK: Salford Royal Hospitals NHS Trust.

82. WHO: World Health Organisation. (2001). *International classification of functioning, disability and health (ICF)*. Geneva: World Health Organization.

83. Wiesel, S. W., Boden, S. D., & Feffer, H. L. (1994). A quality-based protocol for management of musculoskeletal injuries. *Clinical Orthopaedics and Related Research, 301*, 164-176.

84. Williams, D. A., Feuerstein, M., Durbin, D., & Pezzullo, J. (1998). Health care and indemnity costs across the natural history of disability in occupational low back pain. *Spine, 23*(21), 2329-2336.

85. WorkCover NSW. (2002a). *Statistical Bulletin 2000/2001, WorkCover NSW Workers Compensation Statistical Bulletin.* Sydney Australia: WorkCover NSW.

86. WorkCover NSW. (2002b). WorkCover News. Sydney Australia: WorkCover NSW.

87. WorkCover NSW. (2003). *Work related activity programs for the prevention of long-term disability in workers with musculoskeletal Injuries (non Red Flag conditions). Health care provider guidance material. discussion paper.* Sydney, Australia: WorkCover NSW.

88. WorkCover NSW. (2005). *Statistical Bulletin 2002/2003: WorkCover NSW Workers Compensation Statistical Bulletin.* Sydney, Australia: WorkCover NSW.

89. WorkCover NSW. (2001). *Health, return to work, social and financial outcomes associated with different compensation pathways in NSW.* Sydney, Australia: Price Waterhouse Coopers.

90. Wright, A. (2002). Neurophysiology of pain and pain modulation. In J. Strong, A. M. Unruh, A. Wright, & G. D. Baxter (Editors), *Pain: a textbook for therapists* (pp. 43-64). Edinburgh: Churchill Livingstone.

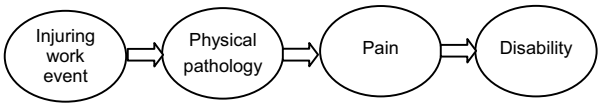

Figure 1 Relationship between injury, pain and disability according to the biomedical model of human illness

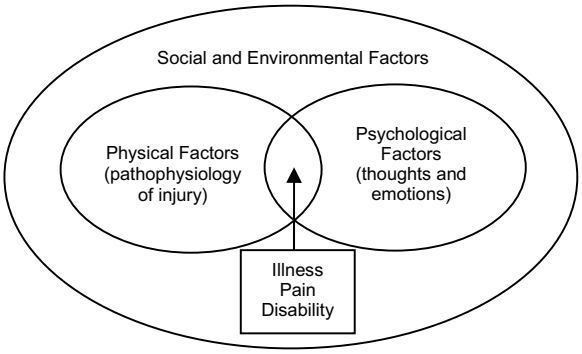

Figure 2 Relationship between injury, pain and disability according to the biopsychosocial model of human illness

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