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The Relationship Between Pain and Depression

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Empirical results from epidemiological studies on pain–depression comorbidity in primary care and population samples have shown that: (a) pain is as strongly associated with anxiety as with depressive disorders; (b) characteristics that most strongly predict depression are diffuseness of pain and the extent to which pain interferes with activities; (c) certain psychological symptoms (low energy, disturbed sleep, worry) are prominent among pain patients, while others (guilt, loneliness) are not; (d) depression and pain dysfunction are evident early in the natural history of pain, but dysfunction and distress are often transient; and (e) among initially dysfunctional pain patients whose dysfunction is chronic, depression levels do not improve but neither do they increase over time with chronicity alone. These results seem consistent with these mechanisms of pain–depression comorbidity; (1) a trait of susceptibility to both dysphoric physical symptoms (including pain) and psychological symptoms (including depression), and a state of somatosensory amplification in which psychological distress amplifies dysphoric physical sensations (including pain); (2) psychological illness and behavioural dysfunction being interrelated features of a maladaptive response to pain evident early in the natural history of the condition, and often resolving during an early recovery phase; (3) pain constituting a significant physical and psychological stressor that may induce or exacerbate psychological distress. Thus, pain and psychological illness should be viewed as having reciprocal psychological and behavioural effects involving both processes of illness expression and adaption, as well as pain having specific effects on emotional state and behavioural function.

It is now well established that pain and depression are related (Romano & Turner, 1985; Katon, 1987), but the reasons for this association remain unclear. When chronic pain and depression co-occur, physical and psychological illness become enmeshed in ways that challenge conventional notions of the boundaries between physical disease and psychological disorder. Diverse explanatory concepts have been developed to explain the relationship between pain and psychological illness: a pain–prone disorder (Blumer & Heilbronn, 1982), somatisation (Kellner, 1985; Kleinman, 1988), psychogenic pain (Drossman, 1982; Feinmann, 1983; Haber *et al*, 1985), masked depression (Lesse, 1983), psychosomatic illness (Alexander, 1950; Webb, 1983), and a chronic pain syndrome (Addison, 1984; Black, 1975) being a few examples. Concepts come into fashion and are then discarded as overly simplistic, or not fully supported by data. This paper considers the comorbidity of pain and depression from a biobehavioural perspective that views the physical, mental and behavioural processes of chronic pain as integrated and interacting phenomena (Dworkin *et al*, 1992).

Our understanding of the psychology of pain remains inadequate, in part because most research on pain and depression has been carried out in highly atypical pain clinic populations late in the natural history of the pain problem (Fields, 1987). There is increasing recognition that an improved understanding of the psychology of pain requires studying representative samples of patients early in the natural history of the pain condition.

Objectives

This paper reviews a series of recent epidemiological studies of the pain–depression relationship, carried out in Seattle with population-based or primary care samples. New data from several of these studies are presented. The purpose of this review is to identify possible linkages between depressive illness and pain and potentially productive lines of investigation for future research. To this end, the following questions concerning the relationship between pain and depression are considered:

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(a) What characteristics of depression are associated with pain?
(b) What characteristics of pain are associated with depression?
(c) Is depression evident before the onset of a pain problem, early in its natural history, or only after pain has become chronic?
(d) How do depression levels change depending on short-term and long-term pain outcomes?

Theories of the pain–depression relationship

Pain and depression may be related at multiple levels: neurobiological, psychological and behavioural (Dworkin *et al*, 1992; Fields, 1987). At the neurobiological level, neurotransmitters (e.g. serotonin, norepinephrine) implicated in depressive illness have been found to play a critical role in pain modulation as well (Fields, 1987, 1991; Osterweis *et al*, 1987). This suggests that pain transmission may be altered by affective illness, while nociceptive input may also induce or exacerbate a dysphoric affective state. At the psychological level, it has been hypothesised that chronic pain is a particular form of somatisation in which negative emotions are expressed through bodily complaints, including pain (Osterweis *et al*, 1987). A related concept, somatosensory amplification, has been defined as an increased propensity to experience and report dysphoric symptoms including pain (Barsky, 1979, 1992; Barsky & Wyshak, 1990). It has been proposed that somatosensory amplification has both a trait component akin to neuroticism, and a state component in which amplification covaries with psychological distress. At the level of behaviour, it has been hypothesised that depression occurs secondary to impaired social role performance and reduced activity levels as a form of learned helplessness (Rudy *et al*, 1988; Fordyce, 1976). Bill Fordyce states:

> "the longer the history of the problem and the greater the interference in the premorbid behavioural repertoire, the greater the deprivation of reinforcement and the greater the amount of depression to be expected." (Fordyce, 1976)

These multiple levels of function have been integrated by a systems perspective, viewing pain and depression as having reciprocal psychological effects (Fields, 1987). Pain precipitates worry and pessimism, while depression impairs patients' abilities to cope with pain. The combined action of chronic pain and depression may induce progressive deterioration. Hopelessness, reduced energy, disturbed sleep, negative affect, and reduced social role performance may ultimately progress to profound disability and depression. Richard Sternbach described the severest forms of pain dysfunction as follows:

> "The chronic pain syndrome is characterized by the appearance of vegetative signs of depression... the patient adopts the sick role and the behaviors of chronic invalidism... these behaviors include decreased activity levels, polypharmacy, polysurgery, a reduction in income levels and disruption in family relationships. Interpersonal and mental conflicts become bound up in the pain complaint, which then becomes highly resistant to change." (Sternbach, 1978)

Each of these explanations of how pain and depression are related seems reasonable. This paper reviews prior results and presents new data from a series of epidemiological studies of the pain–depression relationship in order to bring empirical data to bear on the relative merits of alternative explanations, and to identify potentially productive avenues for future research.

Method

Sources of data

Relevant results are drawn from a series of population-based and primary care studies including: (a) the World Health Organization (WHO) Collaborative Project on Psychological Problems in General Health Care ($n=5438$ from 15 centres worldwide) (Sartorius *et al*, 1993); (b) a population survey of common pain symptoms ($n=1016$) (Von Korff *et al*, 1988); (c) a population-based, prospective study of pain and depression ($n=803$) (Von Korff *et al*, 1993*b*); (d) a short-term follow-up study of primary care back-pain patients ($n=195$) (Cherkin *et al*, 1993); and (e) a long-term follow-up of primary care back-pain, headache, and temporomandibular pain patients ($n=2389$) (Von Korff *et al*, 1992*b*, 1993*a*). The methods of these studies are described in detail elsewhere. Each of these studies was carried out in the enrolled population of the Group Health Cooperative of Puget Sound, a large Health Maintenance Organization in Seattle, Washington (except the WHO Collaborative Study, for which the Group Health Cooperative was one of the 15 participating centres).

Employing data from these studies, an initial approach to weighing evidence for and against alternative explanations of pain–depression comorbidity is to identify the characteristics of psychological illness that predict pain, and the characteristics of pain that predict psychological illness. Identifying the dimensions of pain and of

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psychological illness that are most strongly related may provide insight into the general nature of their relationship. Following consideration of cross-sectional data, the results of longitudinal studies of pain and depression are considered. Longitudinal data permit assessment of whether pain onset precedes depression (or *vice versa*), when depression becomes evident in the natural history of a pain condition, and how depression levels change in relation to the short-term and long-term outcomes of a pain condition.

Results

Cross-sectional analyses

Is pain specific to depression?

Over the last 20 years, attention has focused on the relationship between pain and depressive illness. However, there is evidence that chronic pain is not specific to depression (Merikangas *et al*, 1990; Breslau & Davis, 1992). For example, in Fig. 1 the prevalence of ICD–10 persistent somatoform pain disorder is shown by depression and anxiety disorder status. These data are drawn from the WHO Collaborative Study of Psychological Disorders in Primary Care (Sartorius *et al*, 1993). ICD–10 persistent somatoform pain disorder was operationally defined by current pain that was present most of the time over a six-month period in the prior year, and which bothered the patient a great deal. Persistent pain was most common among patients meeting criteria for both depressive and anxiety disorders, and least common among persons with neither. However, persistent pain was just as common among patients with an anxiety disorder not accompanied by depression as it was among patients with a depressive disorder not accompanied by anxiety. In this analysis, the depressive disorders included depression and dysthymia, and the anxiety disorders included generalised anxiety disorder, panic disorder and agoraphobia. These disorders were diagnosed according to the ICD–10 criteria as assessed by the Composite International Diagnostic Interview – Primary Care Version (CIDI; Üstün & Sartorius, 1995). Thus it appears that chronic pain is associated with a spectrum of psychological illness, rather than having a specific relationship with depression.

Are specific psychological symptoms related to pain?

Although the relationship between pain and psychological illness may not be specific to depression, there is evidence that certain psychological symptoms are more frequent among pain patients (Buckelew *et al*, 1986; Williams & Richardson, 1993). Figure 2 compares a profile of the psychological symptoms of primary care pain patients (including back pain, headache, and temporomandibular pain) to the same symptom profile for population controls. All score differences between the items on the two profiles were statistically significant after controlling for age and gender. However, the differences in symptom scores for guilt, self-blame, and feeling lonely or blue were quite small. Differences for feelings of worthlessness and hopelessness were somewhat larger, but were only moderate. In contrast, symptoms of psychological distress potentially induced or exacerbated by pain (feeling that everything is an effort, disturbed sleep, worry, and low energy) were the most pronounced differences between pain patients and population controls.

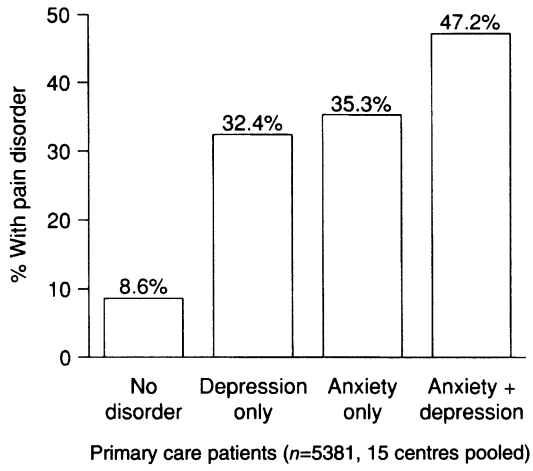


Fig. 1 Percentage of primary care patients with ICD–10 persistent somatoform pain disorder, by depressive and anxiety disorder status: WHO Collaborative Project on Psychological Problems in General Health Care. Weighted data pooled across 15 centres.

What dimensions of pain predict depression?

Although it is widely understood that chronic pain is a multidimensional phenomenon, it is sometimes assumed that all characteristics of chronic pain are strongly associated with depression. This is not necessarily so (Haythornthwaite *et al*, 1991). Figures 3(a) and (b) show the results of a multivariate

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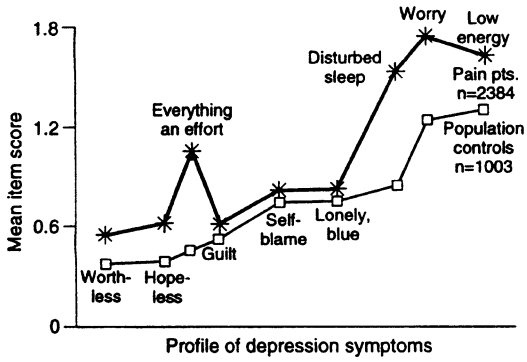


Fig. 2 Mean SCL–90 item scores for selected depressive symptoms: primary care pain patients *v.* population controls from the Group Health Cooperative of Puget Sound.

analysis examining depression levels as a function of different dimensions of chronic pain among primary care back-pain, headache, and temporomandibular pain patients (Von Korff *et al*, 1992*b*). The dimensions of pain examined in this analysis included intensity, interference with activities, pain days in the prior six months, and number of body sites in which a pain problem was reported. Interference with activities was a much stronger predictor of depression levels than pain intensity. In fact, the association of pain intensity with depression was not statistically significant (Fig. 3a). In the same analysis, both the number of pain days in the prior six months and the number of pain sites were significantly associated with depression symptom levels (Fig. 3b). However, the increments in depression levels with increasing pain days were inconsistent and relatively modest. In contrast, as pain became more diffuse, depressive symptoms showed pronounced increments in severity. This result is consistent with a large body of research showing that diffuse somatic symptoms are associated with increased psychological distress (Dworkin *et al*, 1990; Simon & Von Korff, 1991). The relationships of interference with activities and diffuse somatic symptoms (in this case pain) with depression are not specific to chronic pain. Both disability and diffuse somatic symptoms are associated with psychological distress among individuals with many different forms of physical and psychological illness. The pain–depression relationship may be due to processes that cause comorbidity of psychological and physical symptoms across many different types of physical illness, as well as processes that are specific to pain.

Longitudinal analyses

Does chronic depression increase pain onset rates or vice versa?

There has been one prospective study that has examined whether the presence of chronic depression is associated with increased first-onset rates of pain symptoms (Von Korff *et al*, 1993*b*), and one prospective study that has assessed whether the presence of a pain condition (migraine) is

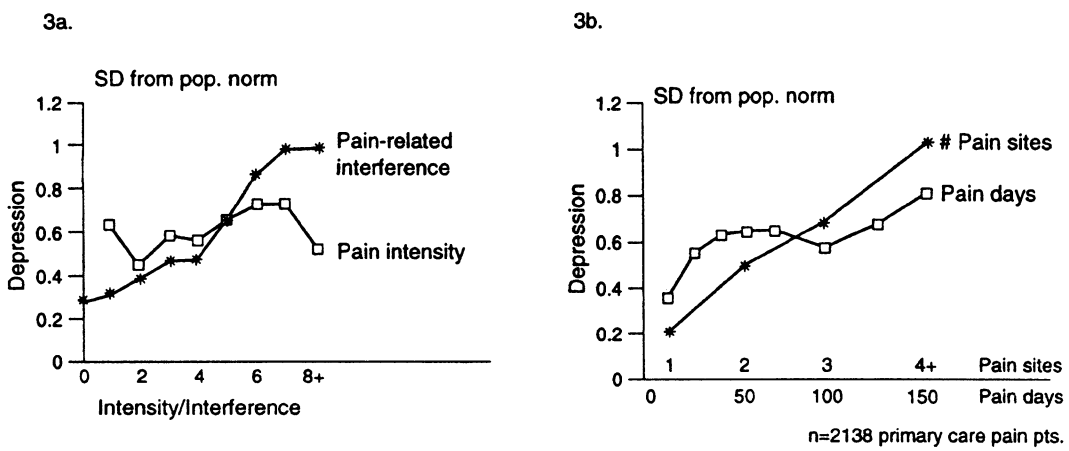


Fig. 3 SCL–90 depression scale standard deviation from population norms (age–sex adjusted). Least square adjusted means as a function of (a) pain intensity and interference with activities; and (b) number of anatomically defined pain sites and number of pain days in the prior six months. Primary care pain patients from the Group Health Cooperative of Puget Sound.

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associated with increased first-onset rates of depressive illness (Breslau & Davis, 1992). Both studies reached a similar conclusion. Von Korff *et al* (1993*b*) reported prospective data on first-onset rates of common pain symptoms among chronically depressed people relative to normal controls. It was found that chronic depression was inconsistently associated with pain onset. Depression predicted increased first-onset rates of severe headache and chest pain, but depressed individuals were not at increased risk of first onset of back pain, stomach pain, or temporomandibular pain. In contrast, people reporting at least one pain condition at baseline were consistently at increased risk of first onset of a new pain symptom, relative to people who were pain free at baseline. Based on these results, and prior cross-sectional research showing psychological distress to be strongly related to the presence of diffuse pain (Dworkin *et al*, 1990), it was suggested that susceptibility to dysphoric physical and psychological symptoms may be related features of a heightened responsiveness to both physical and psychological stressors.

Breslau & Davis (1992) reported a prospective study in which the effect of migraine on first-onset rates of psychological disorder was examined. People with either current or past migraine were more likely to develop depressive and anxiety disorders than people without a history of migraine. Past migraine was as strongly associated with onset of major depression and panic disorder as current migraine. They also found that patients with both current and past migraine were more likely to report diffuse physical symptoms. They concluded that the increased incidence of psychological disorder might be due to a common predisposition rather than a specific causal effect of migraine on onset of psychological disorder.

How does depression change in relation to pain outcomes?

Since depression may not be consistently present before the onset of a pain condition, how soon depression is evident after pain onset is a question of considerable significance. As shown earlier, a feature of chronic pain that is strongly associated with depression is the extent of interference with activities. This association is consistent with the hypothesis that pain induces depression over time through loss of social reinforcement and learned helplessness. If so, depression should increase in severity the longer pain dysfunction persists. We have evaluated whether this is the case in two longitudinal studies of primary care pain patients.

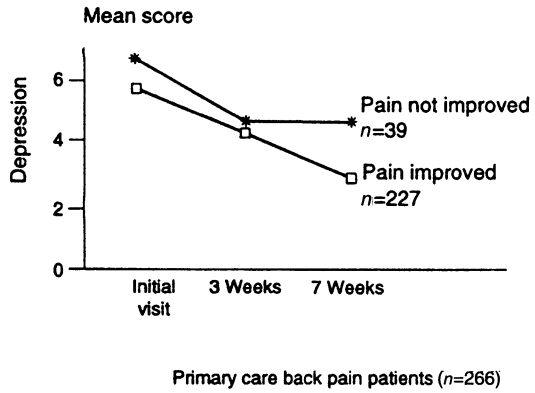


Fig. 4 Six-item depression screen (SCL–90 items) mean score assessed at the initial visit, three weeks, and seven weeks. Patients with improved *v.* unimproved back pain at seven weeks. Primary care back-pain patients from Group Health Cooperative of Puget Sound.

Figure 4 shows the course of depressive symptoms in relation to whether back pain was improved or unimproved, using a severity rating scale, over the first seven weeks following the primary care visit (Cherkin *et al*, 1993). Contrary to the behaviourist prediction, depression levels did not increase among patients who experienced chronic back pain. In fact, depression levels declined over time among patients with unimproved back pain as well as among patients whose back pain improved. Consistent with behavioural theory, the unimproved back pain patients were significantly more depressed at seven weeks than patients whose back pain did improve. This was because patients with chronic back pain did not achieve the same degree of resolution of psychological distress as patients whose back pain outcome was good. In other words, chronic depression was one manifestation of an incomplete recovery, rather than a psychological state that emerged only as pain became chronic.

In a 2-year follow-up study of primary care pain patients (Von Korff *et al*, 1992*b*, 1993*a*), we compared the long-term course of depressive symptoms among initially dysfunctional pain patients who continued to experience pain dysfunction at one and two years, with initially dysfunctional patients whose pain dysfunction was transient. Figure 5 shows depression levels measured one month, one year and two years after the pain patient's primary care visit. Patients with moderate to severe pain dysfunction that had not

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improved at long-term follow-up tended to remain chronically depressed. Again, their depression levels did not increase with continuing pain dysfunction. In contrast, initially dysfunctional pain patients whose pain dysfunction had improved at long-term follow-up showed markedly reduced depression levels. In fact, their depression levels were at population norms at long-term follow-up.

Psychological distress appears to be evident early in the natural history of a pain condition. There is no indication that depression emerges simply as a function of chronicity. Rather, patients who fail to restore normal functioning also tend to remain chronically depressed. Patients who decline in function over time may become more depressed, but increasing pain dysfunction is uncommon relative to failure to fully restore function.

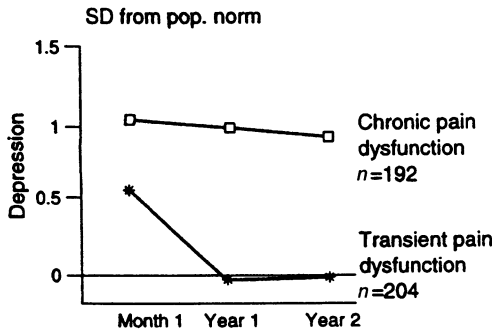


Fig. 5 SCL–90 depression scale standard deviation from population norms (age–sex adjusted) assessed at one month, one year and two years after the initial visit. Patients with moderate to severe pain dysfunction at the initial assessment, good *v.* poor pain outcome. Primary care back pain, headache, and temporomandibular pain patients from Group Health Cooperative of Puget Sound.

Discussion

Common explanations for the comorbidity of depression and chronic pain include: chronic pain is a somatised expression of unacknowledged depression; or depression is an understandable consequence of chronic pain. These truisms seem inadequate to explain fully the observed relationships between pain and depression. Based on the research reviewed in this paper, we offer the following inferences and observations concerning the relationships between pain and depression:

(a) Pain and negative emotions are, in part, related by a trait of vulnerability to dysphoric somatic and psychological symptoms and a state of heightened awareness of physical symptoms that covaries with psychological distress. These forms of somatosensory amplification are general psychophysiological processes not specific to pain or to pain patients.

(b) Psychological distress and withdrawal from activities are interrelated features of a poor adaptation to illness. This relationship between distress and disability is a general maladaptive response observed in physical illnesses other than those causing pain (Von Korff *et al*, 1992*a*; Ormel *et al*, 1993).

(c) Behavioural dysfunction and psychological distress are typically evident early in the course of a pain condition. However, highly dysfunctional and distressed patients often improve markedly over the first two months after onset. This suggests determining why some individuals respond immediately to severe pain with reduced activity levels and emotional distress, whereas others do not, and why some individuals who are intially distressed and dysfunctional manage to recover function and well-being, whereas others do not.

(d) Although much of the pain–depression relationship may be due to general illness processes not specific to pain, pain also has specific effects on manifestations and course of psychological distress. Specifically, pain may induce or exacerbate low energy, sleep disturbance and anxiety.

Those who believe that psychological illness plays an important role in the suffering of pain patients need to consider new ways of thinking about the relationships between pain and psychological illness. Past thinking has been too heavily based in the outdated distinction between "medically explained" pain and "psychogenic" pain (American Psychiatric Association, 1980). In place of these explanatory concepts, it may be productive to view psychological illness as both amplifying pain and impairing the capacity to adapt to severe pain. At the same time, chronic pain may be viewed as a potent physical and psychological stressor with potentially far-reaching effects on psychological and behavioural function.

There is a need for more focused and better designed research on the relationship between psychological illness and pain. Remarkably little

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is known about the psychological state immediately prior to pain onset, the effects of pain onset on psychological state, and the subsequent profound changes that often occur during the early phase of recovery. Many common pain conditions follow a recurrent course in which high rates of relapse are followed by an early recovery phase lasting one or two months. Because of these high relapse rates, it is feasible to conduct prospective studies of recurrent pain episodes, assessing patients before onset of a pain condition and during early recovery. (A small-scale example of this study design has been carried out by Feuerstein *et al*, 1987). At present, we are hampered by a lack of studies of the natural history of chronic pain in representative samples that incorporate adequate measurement of psychological and behavioural function before onset and during the early recovery phase.

Given the large burden of human suffering that occurs when pain and psychological illness coincide, there is a pressing need to understand the interplay of pain and psychological illness in representative samples studied early in the natural history of their comorbidity. Such research may help us better understand the neurobiological, psychological and behavioural mechanisms of both chronic pain and psychological illness among medical patients. Such research is needed to provide a scientific basis for prevention of the comorbidity of pain dysfunction and depression, and to increase the chances of full restitution of function and emotional health among those unfortunate individuals afflicted by both pain and depression.

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