Depression and anxiety associated with three pain conditions: results from a nationally representative sample

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Abstract

Investigations of the relationship between pain conditions and psychopathology have largely focused on depression and have been limited by the use of non-representative samples (e.g. clinical samples). The present study utilized data from the Midlife Development in the United States Survey (MIDUS) to investigate associations between three pain conditions and three common psychiatric disorders in a large sample ($N = 3032$) representative of adults aged 25–74 in the United States population. MIDUS participants provided reports regarding medical conditions experienced over the past year including arthritis, migraine, and back pain. Participants also completed several diagnostic-specific measures from the Composite International Diagnostic Interview-Short Form [Int. J. Methods Psychiatr. Res. 7 (1998) 171], which was based on the revised third edition of the *Diagnostic and Statistical Manual of Mental Disorders* [American Psychiatric Association 1987]. The diagnoses included were depression, panic attacks, and generalized anxiety disorder. Logistic regression analyses revealed significant positive associations between each pain condition and the psychiatric disorders (Odds Ratios ranged from 1.48 to 3.86). The majority of these associations remained statistically significant after adjusting for demographic variables, the other pain conditions, and other medical conditions. Given the emphasis on depression in the pain literature, it was noteworthy that the associations between the pain conditions and the anxiety disorders were generally larger than those between the pain conditions and depression. These findings add to a growing body of evidence indicating that anxiety disorders warrant further attention in relation to pain. The clinical and research implications of these findings are discussed.

1. Introduction

Numerous studies have found pain conditions to be associated with self-reports of psychological distress and psychiatric disorders. Several important clinical implications of these associations have been noted. For example, information regarding specific patterns of comorbidity could guide clinicians' efforts to detect psychiatric disorders in patients with pain. As well, psychopathology (i.e. depression) has been found to be associated with poor pain-related outcomes such as elevated pain intensity, functional limitations, and non-recovery (see Bair et al., 2003).

There are several important limitations with a majority of studies addressing the relationship between pain and psychopathology. First, they have typically utilized continuous self-report measures of psychopathology, which may assess transient symptoms or state-dependent negative affect, rather than enduring psychiatric disorders. Second, most have focused exclusively on depression, so there is a paucity of research regarding other forms of psychopathology. Third, the majority of studies in this area have utilized highly selected patients referred to specialty pain treatment centers and as a consequence the prevalence rates and associations found in these studies were likely biased. McWilliams et al. (2003) advocated the use of large community samples and diagnostic interviews in order to adequately investigate the associations between pain conditions and psychiatric disorders. These requirements are financially and logistically demanding, so several investigators (e.g. Wells et al., 1988) have taken advantage of data from large mental health surveys that included

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general health and disability questions. McWilliams et al. (2003) followed a similar strategy and used data from the National Comorbidity Survey (NCS; Kessler et al., 1994) in order to examine the associations between one long-term pain condition (i.e. arthritis) and common mood and anxiety disorders. The aforementioned limitations could be addressed because the NCS utilized a large nationally representative sample of the US civilian population and included a reliable and valid diagnostic interview to assess the presence of a wide range of psychiatric disorders.

McWilliams et al. (2003) found significant associations between arthritis and each of the mood and anxiety disorders considered. Given the lack of attention to anxiety disorders in the pain literature, it was particularly noteworthy that the associations between arthritis and several of the anxiety disorders (i.e. panic disorder and posttraumatic stress disorder) were stronger than the association between arthritis and depression. Evidence from other epidemiological studies indicates that migraine may also be more strongly associated with anxiety disorders, particularly panic disorder (e.g. Breslau and Davis, 1993; Swartz et al., 2000) and generalized anxiety disorder (GAD) (e.g. Merikangas et al., 1990), than with depression. The present study utilized data from another nationally representative sample, the Midlife Development in the United States Survey (MIDUS), in an attempt to replicate these earlier findings with arthritis and migraine and to extend this line of investigation to back pain. It was hypothesized that each of these pain conditions would be significantly associated with the psychiatric disorders included in the MIDUS and that each pain condition would be more strongly associated with the anxiety disorders than with depression.

2. Method

2.1. Subjects and procedures

Data from the MIDUS was used. The MIDUS was a large ($N = 3032$) nationally representative sample of persons 25–74 years of age in the non-institutionalized civilian population. The first stage of the survey had a response rate of 70% and involved a 30-min telephone interview. The second component of the survey involved two mailed questionnaires and had an 86.8% conditional response rate of telephone respondents leading to an overall response rate of 60.8%. A weighting procedure was used to adjust for differential probabilities of selection and non-response and to adjust the sample to approximate the US population. Further details of the MIDUS methodology are reported by Kessler et al. (1999) and Wang et al. (2000).

2.2. Diagnostic assessment

The MIDUS psychiatric diagnoses were based on the Composite International Diagnostic Interview-Short

Form (CIDI-SF) scales (Kessler et al., 1998), a series of diagnostic-specific measures developed from item-level analyses of the Composite International Diagnostic Interview (CIDI) questions in the NCS. The original CIDI (World Health Organization, 1990) was based on the revised third edition of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-III-R*; American Psychiatric Association, 1987). The CIDI-SF scales were designed to reproduce the full CIDI as exactly as possible with only a small subset of the original questions. Past-year diagnoses of major depression and GAD were made with the CIDI-SF. Comparison of the CIDI-SF classifications of depression and GAD with the full CIDI classifications in the NCS indicated high levels of sensitivity (89.6 and 96.6%, respectively), specificity (93.9 and 99.8%, respectively), and overall agreement (93.2 and 99.6%, respectively) for these psychiatric disorders (Kessler et al., 1998).

Past-year panic attacks were also assessed with the CIDI-SF. Panic attacks are discrete episodes of intense fear or discomfort that are unexpected (i.e. did not occur in situations that typically cause anxiety). Typical symptoms include heart pounding, sweating, and shaking. The *DSM-III-R* criteria for panic disorder require that either four panic attacks occur within a 4-week period or that one or more panic attacks are followed by a 4-week period of persistent fear of having another panic attack. These last two criteria could not be efficiently assessed within the time-frame intended for the CIDI-SF, so the less specific classification of panic attacks was included. Panic attacks were referred to as a psychiatric disorder in the present paper in order to be consistent with the terminology used when referring to the other forms of psychopathology considered (i.e. depression and GAD) and because they represent a severe anxiety response. Comparison of the CIDI-SF classification of panic attacks with the full CIDI classifications in the NCS (Kessler et al., 1998) indicated that it had high levels of sensitivity (90.0%), specificity (99.5%), and overall agreement of (98.4%).

2.3. Pain and other medical conditions

The MIDUS included questions regarding the presence of 27 health problems or medical conditions over the preceding 12 months. All these began with the same stem ('In the past 12 months, have you experienced or been treated for …?'). The questions concerning arthritis ('… Arthritis, rheumatism, or another bone or joint disease?'), migraine headaches ('… Migraine headaches?'), and back pain ('… Sciatica, lumbago, or recurring backache?') were used to create variables representing the presence or absence (presence = 1, absence = 0) of each of these pain conditions.

2.4. Demographic variables

Several demographic variables were used in order to statistically account for their possible influence on

psychopathology. These variables included gender, marital status (married vs. not married), race (Caucasian vs. other), and education level (high school diploma or less vs. college degree or higher). Age was treated as a continuous variable.

3. Results

The sample was 56.5% female. With regard to race, 82.0% were Caucasian, 11.2% were Black, and 6.8% belonged to other racial groups. The medical questions identified 588 individuals with arthritis (19.4%), 614 with back pain (20.3%), and 340 with migraine headaches (11.2%). Those with one or more pain conditions ($n = 1124$) were more likely to be female (63.0 vs. 52.8%; Chi-square = 29.8, df = 1, $P < 0.001$) and Caucasian (84.3 vs. 80.1%, Chi-square = 6.32, df = 1, $P = 0.012$) than those without one of the pain conditions. Those with one of the pain conditions were also less likely to have completed a college education (18.1 vs. 25.3%; Chi-square = 24.30, df = 1, $P < 0.001$) and were significantly older (Mean Age = 48.6, SD = 13.5) than those without one of the pain conditions (Mean Age = 43.4, SD = 13.1) [$F(1, 3030) = 108.6, P < 0.001$].

Differences in psychopathology between those with each of the pain conditions and those without it are reported in Table 1. Each psychiatric disorder was more common amongst those with each of the pain conditions relative to those reporting an absence of each of the respective pain conditions. For example, those with arthritis more frequently reported depression (18.2 vs. 13.1%), panic

attacks (11.2 vs. 5.8%), and GAD (5.6 vs. 2.7%), than those without arthritis. Separate bivariate logistic regression analyses with each of the pain conditions treated as potential predictors of the psychiatric disorders were used to examine whether these differences represent statistically significant associations. The findings of these analyses are also reported in Table 1 and indicate significant positive associations between each of the pain conditions and depression, panic attacks, and GAD.

In order to examine the associations between the pain conditions and the psychiatric disorders in a manner that accounted for other variables that may have independent effects on psychopathology, three series of multiple logistic regression analyses were used. The first series adjusted for (i.e. included as independent variables) demographic variables commonly used in epidemiological research (viz. gender, race, education level, and age). The second series adjusted for the demographic variables and comorbid pain conditions. Given that pain conditions are often comorbid with other medical conditions (e.g. Schellevis et al., 1993) and a wide range of medical conditions are associated with psychopathology (e.g. Wells et al., 1988), a third series of logistic regression analyses was conducted to examine whether the associations between the pain conditions and psychiatric disorders would remain significant after adjusting for other health/medical conditions. Similar to the method used by Currie and Wang (2004), a variable representing the number of other conditions was included as an independent variable along with the demographic variables and the other pain conditions. The most common health/medical conditions were (percentage in the total sample in parentheses) recurring stomach problems (20.4%), high blood pressure (18.0%), hay fever (15.7%), urinary or bladder problems (13.5%), chronic sleep problems (12.8%), asthma (12.6%), persistent foot trouble (11.6%), piles or hemorrhoids (11.4%), persistent skin trouble (10.5%), and persistent trouble with teeth (10.3%).

The multivariate associations between the pain conditions and psychiatric disorders are presented in Table 2. In the analyses that adjusted for the demographic variables (Model 1) and those adjusting for the demographic variables and pain conditions (Model 2), each association was statistically significant and positive. Each pain condition was more strongly associated with both of the anxiety disorders than with depression. The third series of analyses (Model 3) represents a very stringent test of the association between the pain conditions and the psychiatric disorders and investigated whether each pain condition could account for unique variance in the psychiatric variables beyond that accounted for by the demographic variables, the other pain conditions, and the number of other health/medical conditions present. Most of these associations remained statistically significant, but the arthritis–panic attack relationship and the back pain–GAD relationship were no longer statistically significant.

Table 1
Prevalence of psychiatric disorders[a] in three pain conditions

Psychiatric disorder	Pain condition		
	No arthritis	Arthritis	Odds ratio[b]
Depression	13.1%	18.2%	1.48 (1.16, 1.88)
Panic attacks	5.8%	11.2%	2.09 (1.54, 2.83)
Generalized anxiety disorder	2.7%	5.6%	2.17 (1.42, 3.33)
Psychiatric disorder	No migraine	Migraine	Odds ratio
Depression	12.3%	28.5%	2.84 (2.19, 3.70)
Panic attacks	5.5%	17.4%	3.58 (2.59, 4.97)
Generalized anxiety disorder	2.5%	9.1%	3.86 (2.48, 6.00)
Psychiatric disorder	No back pain	Back pain	Odds ratio
Depression	12.4%	21.0%	1.87 (1.49, 2.36)
Panic attacks	5.3%	13.0%	2.69 (2.00, 3.62)
Generalized anxiety disorder	2.5%	6.2%	2.54 (1.67, 3.85)

All findings were significant at $P < 0.001$.
[a] Diagnoses were made using the Composite International Diagnostic Interview-Short Form scales.
[b] 95% Confidence intervals in parentheses.

Table 2
Adjusted odds ratios[a] between chronic pain conditions and psychiatric disorders[b]

Pain condition	Model 1	Model 2	Model 3
	Depression		
Arthritis	2.07 (1.58, 2.70)***	1.65 (1.24, 2.20)***	1.39 (1.04, 1.87)*
Migraine	2.39 (1.83, 3.13)***	2.18 (1.66, 2.86)***	1.70 (1.28, 2.26)***
Back pain	2.06 (1.62, 2.61)***	1.70 (1.32, 2.19)***	1.40 (1.08, 1.82)**
	Panic attacks		
Arthritis	2.46 (1.75, 3.47)***	1.79 (1.24, 2.58)***	1.40 (.95, 2.05)
Migraine	3.07 (2.19, 4.29)***	2.69 (1.91, 3.78)***	1.98 (1.38, 2.84)***
Back pain	2.68 (1.98, 3.63) ***	2.10 (1.52, 2.91)***	1.62 (1.15, 2.28)**
	Generalized anxiety disorder		
Arthritis	3.20 (1.98,5.17)***	2.33 (1.41, 3.88)***	1.77 (.1.04, 3.02)*
Migraine	3.12 (1.99, 4.89)***	2.69 (1.70, 4.26)***	2.00 (1.23, 3.23)**
Back pain	2.82 (1.84, 4.32)***	2.04 (1.29, 3.71)**	1.52 (.94, 2.47)

Model 1 adjusted for demographic variables (i.e. gender, race, education, and age); Model 2 adjusted for demographic variables and the other pain conditions; Model 3 adjusted for demographic variables, pain conditions, and the presence of other medical conditions. *$P \leq 0.05$, **$P \leq 0.01$, ***$P \leq 0.001$.
[a] 95% Confidence intervals in parentheses.
[b] Diagnoses were made using the Composite International Diagnostic Interview-Short Form scales.

The variable representing the number of other conditions had significant positive associations with depression (Odds Ratio = 1.18, Confidence Interval = 1.13–1.24, $P < 0.001$), panic attacks (Odds Ratio = 1.23, Confidence Interval = 1.16–1.31, $P < 0.001$), and GAD (Odds Ratio = 1.21, Confidence Interval = 1.13–1.30, $P < 0.001$).

A substantial number of individuals reporting one of the pain conditions also reported a second or third pain condition (i.e. 33.5%). Several studies (e.g. Dworkin et al., 1990) have found psychopathology is more common amongst those with multiple physical complaints relative to those with one or no physical complaint. Three additional logistic regression analyses were conducted to examine the association between multiple pain conditions and the psychiatric disorders. These analyses utilized a categorical variable with five mutually exclusive levels. The levels of this variable were no pain ($n = 1908$), arthritis with no comorbid pain condition ($n = 274$), migraine with no comorbid pain condition ($n = 192$), back pain with no comorbid pain condition ($n = 280$), and two or more pain conditions ($n = 377$). Each analysis adjusted for the demographic variables and utilized those without one of the pain conditions as the reference group. These findings are presented in Table 3. The presence of multiple pain conditions was strongly associated with each psychiatric diagnosis (Odds Ratios ranged from 3.39 to 6.91). Arthritis was not significantly associated with panic attacks, but all the other associations were statistically significant and relatively large. It is important to note that this null finding concerns a select group of individuals with arthritis and no other pain conditions. The earlier findings that adjusted for the presence of other pain conditions more accurately reflect the association between arthritis and the psychiatric disorders because excluding those with other pain conditions eliminates a substantial portion of individuals with each pain condition and more importantly eliminates variance due to comorbid pain conditions,

Table 3
Associations between mutually exclusive pain groups and psychiatric disorders[a]

Pain category	Adjusted odds ratios[b] across psychiatric disorders		
	Depression	Panic attacks	Generalized anxiety disorder
No pain[c]	–	–	–
Arthritis	1.81 (1.21, 2.71)**	1.57 (.86, 2.87)	5.83 (2.93, 11.60)***
Migraine	2.14 (1.48, 3.10)***	2.37 (1.42, 3.99)***	3.13 (1.56, 6.30)***
Back pain	1.76 (1.24, 2.50)**	2.33 (1.45, 3.73)***	2.87 (1.41, 5.81)**
Multiple pain conditions	3.39 (2.52, 4.55)***	5.22 (3.61, 7.56)***	6.91 (4.01, 11.90)***

[a] Diagnoses were made using the Composite International Diagnostic Interview-Short Form scales. *$P \leq 0.05$, **$P \leq 0.01$, ***$P \leq 0.001$.
[b] Adjusted for demographic variables (i.e. gender, race, education, and age). 95% Confidence intervals in parentheses.
[c] Those without any of the three pain conditions were treated as the reference category. The other pain groups were mutually exclusive.

which is an inherent characteristic of membership in each of the pain groups (see Miller and Chapman, 2001).

4. Discussion

Data from the MIDUS yielded significant positive associations between three pain conditions (arthritis, migraine, and back pain) and common mood and anxiety disorders (depression, panic attacks, and GAD). Multivariate logistic regression analyses indicated that these associations remained after adjusting for a wide range of potential confounding variables including age, gender, education level, race, and the presence of another pain condition. These findings were noteworthy because previous epidemiological studies concerning psychopathology and both migraine (e.g. Merikangas et al., 1990; Stewart et al., 1994) and arthritis (e.g. McWilliams et al., 2003) have generally not adjusted for comorbid pain conditions.

Medical or health conditions that do not primarily involve pain are also associated with psychopathology (e.g. Wells et al., 1988). A third series of analyses examined whether each pain condition could account for unique variance in the psychiatric disorders beyond that accounted for by the number of other medical/health conditions present. The majority of the associations remained statistically significant, but the association between arthritis and panic attacks and the association between back pain and GAD did not. This pattern of findings raises the possibility that the association between arthritis and panic attacks and the association between back pain and GAD found in Models 1 and 2 reflect a more general association between health problems and psychopathology rather than more specific associations between these respective pain conditions and psychiatric disorders. Several of the other medical conditions included (e.g. recurring stomach problems) likely involved pain, so it is possible that the third set of analyses also adjusted for the presence of other forms of pain. Nonetheless, this procedure was used because the focus of the study was on three types of pain (rather than pain in general) and the goal of these analyses was to adjust for other medical and health conditions regardless of whether they involved some pain.

Consistent with previous studies, depression was significantly associated with each of the pain conditions. Based on previous research demonstrating substantial comorbidity between mood and anxiety disorders (e.g. Krueger, 1999; Vollebergh et al., 2001), it was expected that anxiety disorders would also be associated with the pain conditions. Furthermore, several studies (e.g. Breslau and Davis, 1993; McWilliams et al., 2003; Merikangas et al., 1990) have found pain conditions to be more strongly associated with several anxiety disorders than with depression. The present study replicated this pattern of findings and extended it to back pain. The bivariate odds

ratios clearly indicated that each pain condition was more strongly associated with the anxiety disorders than with depression. However, this pattern was less consistent in the analyses that adjusted for other medical/health conditions. Three additional logistic regression analyses were used to examine whether the association between multiple pain conditions and psychopathology would be greater than the associations between pure pain conditions (i.e. those with only one pain condition) and psychopathology. The overall pattern was consistent with previous research (e.g. Dworkin et al., 1990) indicating that those with multiple physical complaints have higher rates of psychopathology than those without a physical complaint or those with a single complaint.

There is a paucity of research or clinical literature concerning anxiety disorders in relation to pain conditions. The findings of this and earlier studies suggest that such attention is warranted. More sophisticated approaches to the assessment of anxiety are required in pain-related contexts. For example, a recent issue of *Arthritis Care and Research* focused on assessment issues included an article on depression (Smarr, 2003), but anxiety was only addressed in an article considering 'other measures of psychological well-being' (Schiaffino, 2003). Furthermore, the anxiety measure selected was the State-Trait Anxiety Inventory (Spielberger, 1983), which includes numerous depression-related items (see Bieling et al., 1998), and appears to be more accurately described as a measure of general distress. Several self-report measures designed to assess symptoms or constructs directly related to specific anxiety disorders are available. Examples include the Penn State Worry Questionnaire (Meyer et al., 1990) for GAD and the Mobility Inventory (Chambless et al., 1985) for agoraphobia. As well, the CIDI-SF could readily be incorporated into assessment procedures and represents a successful compromise between the need for diagnostic-specific assessment procedures and the time constraints found in many contexts.

Temporal relationships between pain conditions and depression have long been of interest (see Fishbain et al., 1997). However, the temporal relationships between pain conditions and anxiety disorders remains largely ignored. Breslau and Davis's (1993) longitudinal study of the association between migraine and psychopathology in a community sample of young adults provides a rare exception to this general rule. They found that individuals who reported having their last migraine a year or more prior to the baseline interview were at increased risk of experiencing first incidence depression and panic disorder at a 14-month follow up. These findings suggest that depression, panic, and migraine share common predispositions and that mood and anxiety disorders are not merely the psychological consequences of a pain condition. Causal relations between anxiety and most other pain conditions have not been investigated.

Theories regarding underlying factors involved in both pain and anxiety disorders have focused on neurochemical

mechanisms (e.g. Merikangas et al., 1990). Asmundson et al. (2002) reviewed several potential shared psychological vulnerabilities for posttraumatic stress disorder and pain and noted hyperarousal, hypervigilance, and attentional biases towards somatic cues may be involved in both conditions. These factors have also been implicated in other anxiety disorders, particularly panic disorder, and may be responsible for the associations observed in the present study. Recent conceptualizations of GAD have suggested that worry may be used to suppress somatic anxiety or the hyperarousal associated with perceptions of threat (Borkovec et al., 2004). It is possible that individuals with pain conditions may use worry as a strategy for reducing somatic arousal associated with pain, and as a result may become prone to developing GAD.

The treatment implications of the associations between pain and psychiatric disorders have focused on pharmacologic interventions (e.g. Stewart et al., 1994). However, in light of their possible shared psychological vulnerabilities, psychological interventions also hold potential for treating comorbid pain and psychiatric disorders. It is noteworthy that psychosocial interventions for psychiatric disorders and pain conditions share several common elements. For example, treatments for depression and pain both focus on increasing activity levels and treatments for anxiety and pain both include strategies for reducing arousal (i.e. relaxation training). It may be possible to develop integrated psychological treatments for both conditions. As well, evidence concerning the temporal relationships between disorders may provide direction in terms of prevention efforts. For example, the findings of Breslau and Davis (1993) suggest that those with a history of migraine would be an appropriate group at which to target anxiety disorder prevention efforts.

The present study has several strengths not commonly found in the pain literature. However, several limitations should be noted. First, psychopathology was assessed with a brief interview and included only three psychiatric disorders. McWilliams et al. (2003) found posttraumatic stress disorder more strongly associated with arthritis than any other mood or anxiety disorder, so the inclusion of a posttraumatic stress disorder interview would have been particularly desirable. Second, the pain conditions were assessed with single item self-report measures and this method would not have been as precise as well-validated interviews. This issue would be most salient to the case definition of migraine used in the present study as the term migraine is often used by the general public to describe severe headaches rather than migraine headaches as defined by specific criteria. Viewed in this light, the present findings regarding migraine may be more applicable to severe headaches than to migraine headaches per se. Third, the frequency and duration of the pain was not assessed, so it was not possible to determine whether those reporting pain experienced chronic or persistent pain. Arthritis and migraine/severe headaches are often chronic or have an intermittent course, so characterizing these conditions as long-term would be appropriate. The question concerning back pain included recurring pain in addition to pain conditions (e.g. sciatica and lumbago) that often resolve quickly, so the case definition of back pain used in the present study likely represents a mix of brief and more chronic back pain. While the procedure used to identify individuals with pain conditions represents a limitation, it should be noted that this approach is typical of large epidemiological studies. Finally, as noted earlier, the temporal relationships between the pain conditions and psychiatric disorders could not be investigated due to the cross-sectional nature of the study.

Despite the limitations of the current study, it adds to the growing literature regarding the associations between pain, depression, and anxiety disorders. Given that strong associations between these disorders have been consistently found across several studies, longitudinal studies involving more precise assessments of pain and psychiatric disorders are clearly warranted and have the potential to guide treatment and prevention strategies. Nonetheless, the present cross-sectional findings suggest that improved efforts at detecting and treating anxiety disorders are needed within pain treatment contexts.

Acknowledgements

References

American Psychiatric Association. Diagnostic and statistical manual of mental disorders 3rd ed revised. Washington, DC: American Psychiatric Association; 1987.

Asmundson GJG, Coons MJ, Taylor S, Katz J. PTSD and the experience of pain: research and clinical implications of shared vulnerability and mutual maintenance models. Can J Psychiatry 2002;47:930–7.

Bair MJ, Robinson RL, Katon W, Kroenke K. Depression and pain comorbidity: a literature review. Arch Intern Med 2003;163: 2433–45.

Bieling PJ, Antony MM, Swinson RP. The state-trait anxiety inventory, trait version: structure and content re-examined. Behav Res Ther 1998; 36:777–88.

Borkovec TD, Alcaine O, Behar E. Avoidance theory of worry and generalized anxiety disorder. In: Heimberg RG, Turk CL, Mennin DS, editors. Generalized anxiety disorder in research and practice. New York, NY: Guildford Press; 2004, pp. 77–108.

Breslau N, Davis GC. Migraine, physical health and psychiatric disorder: a prospective epidemiology study in young adults. J Psychiatr Res 1993; 27:211–21.

Chambless DL, Caputo GC, Jason SE, Graceley EJ, Williams C. The mobility inventory for agoraphobia. Behav Res Ther 1985;23: 35–44.

Currie SR, Wang J. Chronic back pain and major depression in the Canadian population. Pain 2004;107:54–60.

Dworkin SF, Von Korff M, LeResche L. Multiple pains and psychiatric disturbance: an epidemiologic investigation. Arch Gen Psychiatry 1990;47:239–44.

Fishbain DA, Cutler R, Rosomoff HL, Rosomoff RS. Chronic pain-associated depression: antecedent or consequence of chronic pain? A review. Clin J Pain 1997;13:116–37.

Kessler RC, McGonagle KA, Zhao S, Nelson CB, Hughes M, Eshleman S, Wittchen HU, Kendler KS. Lifetime and 12-month prevalence of DSM-III-R psychiatric disorders in the United States: results from the National Comorbidity Survey. Arch Gen Psychiatry 1994;51:8–19.

Kessler RC, Andrews G, Mroczek D, Ustun G, Wittchen HU. The world health organization composite international diagnostic interview short form (CIDI-SF). Int J Methods Psychiatr Res 1998;7:171–85.

Kessler RC, DuPont RL, Berglund P, Witchen HU. Impairment in pure and comorbid generalized anxiety and major depression at 12 months in 2 national surveys. Am J Psychiatry 1999;156:1915–23.

Krueger RF. The structure of common mental disorders. Arch Gen Psychiatry 1999;56:921–6.

McWilliams LA, Cox BJ, Enns MW. Mood and anxiety disorders associated with chronic pain: an examination in a nationally representative sample. Pain 2003;106:127–33.

Merikangas KR, Angst J, Isler H. Migraine and psychopathology: results of the Zurich cohort study of young adults. Arch Gen Psychiatry 1990;47: 849–53.

Meyer TH, Miller ML, Metzger RL, Borkovec TD. Development and validation of the Penn State Worry Questionnaire. Behav Res Ther 1990;28:487–95.

Miller GA, Chapman JP. Misunderstanding analysis of covariance. J Abnorm Psychol 2001;110:40–8.

Schellevis FG, van der Velden J, van de Lisdonk E, van Eijk JT, van Weel C. Comorbidity of chronic diseases in general practice. J Clin Epidemiol 1993;46:469–73.

Schiaffino KM. Other measures of psychological well-being. Arthritis Care Res 2003;49:S165–74.

Smarr KL. Measures of depression and depressive symptoms. Arthritis Care Res 2003;49:S134–46.

Spielberger CD. Manual for the state-trait anxiety inventory (Form V). Palo Alto, CA: Consulting Psychologists Press; 1983.

Stewart W, Breslau N, Keck PE. Comorbidity of mingraine and panic disorder. Neurology 1994;44(Suppl 7):S23–7.

Swartz KL, Pratt LA, Armenian HK, Lee LC, Eaton WW. Mental disorders and the incidence of migraine headaches in a community sample: results from the Baltimore epidemiologic catchment area follow-up study. Arch Gen Psychiatry 2000;57:945–50.

Vollebergh WAM, Iedema J, Bijl RV, de Graaf R, Smit F, Ormel J. The structure and stability of common mental disorders: the NEMESIS study. Arch Gen Psychiatry 2001;58:597–603.

Wang PS, Berglund P, Kessler RC. Recent care of common mental disorders in the United States: prevalence and conformance with evidence-based recommendations. J Gen Intern Med 2000;15:284–92.

Wells KB, Golding JM, Burnam M. Psychiatric disorder in a sample of the general population with and without medical conditions. Am J Psychiatry 1988;145:976–81.

World Health Organization. Composite international diagnostic interview. Geneva, Switzerland: World Health Organization; 1990.