Headache and Depression: Confounding Effects of Transdiagnostic Symptoms

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SYNOPSIS

A link between headache and depression has been noted in the literature for over 30 years. To date, however, studies investigating this relationship *have* ignored the potential impact transdiagnostic symptoms (i.e., symptoms indicative of both depression and headache) may have on correlations between measures of depression and measures of headache activity. The present study examined this issue using the Beck Depression Inventory in a large sample of recurrent headache sufferers who had presented for treatment at one of two university-based clinics. Factor analysis identified two distinct, albeit correlated, factors reflecting cognitive/affective symptoms and somatic symptoms. Correlational analyses found consistent relationships between the somatic symptom factor and measures of headache activity, but not between the cognitive/affective factor and headache activity. We suggest that the BDI items comprising the somatic factor identified in this study may not be appropriate indicators of depression in recurrent headache samples.

Key words: headache, depression, diagnosis, measurement

Abbreviations: BDI Beck Depression Inventory

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INTRODUCTION

Although a large literature supports the existence of a link between chronic headache and depression,[1-16] studies have generally failed to address problems inherent when diagnosing depression in medical populations.[17-19] Somatic symptoms/concerns are an important component in many theoretical conceptualizations of depression.[18] The presence of this somatic component in our conceptualization of depressive syndromes complicates the task of diagnosing depression in pain populations as the overlapping symptoms of depression and pain must be disentangled. Thus, Beck, Steer, and Garbin[20] argue that it would be useful to have a scoring system that would enable one to exclude symptoms that are transdiagnostic (i.e., symptoms indicative of both depression and a given sample's medical disorder) when assessing specific medical populations such as headache.

At least three studies have found that cognitive/ affective symptoms are better indicators of depressive severity in medical populations than somatic/ vegetative symptoms.[17,21,22] For example, Cavanaugh and colleagues[17] reported that as depression increased for the medically-ill so did both the number and severity of cognitive/affective symptoms on the Beck Depression Inventory (BDI). The number of somatic symptoms, however, was not associated with depressive severity in this population. These studies suggest that in screening for depression with self-report instruments, such as the BDI, the presence of somatic symptoms alone is a poor predictor of depressive severity in the medically-ill.

Factor-analytic investigations have also supported distinguishing between subsets of BDI items (for a review of these studies see Beck et al.,[20]). Although the number of factors extracted has ranged from three to seven, recent studies suggest one general broad-band factor[21] that might be decomposed into three narrow-band factors: negative cognitions, negative self-concept, and motivational and physiological manifestations of depression.[23]

Several investigators have recently reported that higher scores on self-report depression inventories seem to be associated with poorer responses to behavioral interventions.[24-27] However, the BDI elevations noted in these studies have been relatively small. For example, two of the studies[24,26] reported that recurrent headache subjects with a

BDI score above 8 were less likely to benefit from behavioral treatment. A BDI score of 8 is unlikely to reflect even mild depression,[28] and raises the possibility that responses to specific BDI items may be more important than the total BDI depression score.

This study addressed the relationship between self-reports of depressive symptoms and headache activity. First, we attempted to determine if somatic symptoms cohere as a prominent factor in recurrent headache sufferers' responses to the BDI. Then we addressed the issue of whether previous findings linking recurrent headache and depression could, at least partially, be an artifact of the transdiagnostic nature of the BDI's somatic items.

METHOD

Subjects. Recurrent headache sufferers (N = 229) seeking treatment from two university-based treatment and research clinics participated in this study by completing the Beck Depression Inventory (BDI).[29] Eighty-five vascular (migraine and mixed) and 84 tension headache sufferers came from the Ohio University Stress and Health Clinic, while 36 vascular and 24 tension headache subjects came from the University of Mississippi Medical Center Headache Clinic. All subjects met criteria developed in accordance with descriptions provided by the Ad Hoc Committee on the Classification of Headache.[30] These criteria have been published previously in Holroyd et al.,[31] and Tobin, Holroyd, Baker, Reynolds, and Holm.[32] A subset of subjects (n = 136) also completed a month of daily headache monitoring in addition to the BDI. Some of these subjects (n = 63) went on to complete one of three psychological headache treatment programs and one month of headache monitoring posttreatment. The three treatment programs were each home-based and included relaxation strategies such as progressive relaxation and cue-controlled relaxation. In addition, one program included thermal biofeedback, while another included some cognitive therapy techniques. These programs have been described in detail elsewhere.[31,32] All subjects were treated in accordance with the Ethical Principles of the American Psychological Association.

Materials. The Beck Depression Inventory is a 21-item inventory developed to measure the extent of an individual's depressive symptoms.[29] The items of the BDI were chosen on the basis of their relationship to overt behavioral manifestations of depression and do not reflect any theory regarding the etiology or the underlying psychological processes in depression.[29] The items cover affective, cognitive, motivational, and somatic areas of depressive symptomatology. Evidence suggests that the BDI may be the most accurate inventory at representing the breadth of depressive symptoms.[33]

Subjects recorded headache activity four times daily using an 11-point scale (0 = no headache to 10 = incapacitating headache). Three measures were derived from the daily monitoring data: a) headache index (sum of the four daily headache activity recordings averaged over the month), b) headache peak (highest headache activity each week averaged over the month), and c) number of headache-free days each week averaged across the month.

Procedure, All subjects completed the BDI during their first assessment and interview visit to one of the two treatment clinics. A subset of subjects then completed one month of headache activity monitoring prior to entering one of three, two-month behavioral treatment programs. Subjects who completed their treatment program then completed the BDI again immediately posttreatment and then monitored their headache activity for a one-month follow-up period.

RESULTS

Factor Structure. A principal components analysis was conducted on the BDI and Kaiser's criterion and Cattell's scree test revealed the presence of three interpretable factors. Common factor analysis was then performed (with oblique rotation) and the multiple runs procedure was followed so that two, three, and four factor solutions were examined. The two-factor solution most closely approximated simple structure as the three and four factor solutions resulted in several items loading on more than one factor.

Examination of this two-factor structure revealed that all of the BDI items were represented (items loading at or above .30 were considered significant and thus represented). Furthermore, each item significantly loaded on only one of the two factors. Table 1 shows the two factors and each item's loading with each factor. Examination of these two factors suggests that factor 1 may reflect the cognitive and affective component of depression, while factor 2 appears to tap somatic manifestations of depression. However, because oblique rotation was used to arrive at the two-factor structure, the factors are not independent but instead appear strongly related (r = .68). Finally, reliability analyses were conducted on each factor, indicating that both factors demonstrated adequate internal consistency (alpha for factor 1 = .86 and for factor 2 = .68), and split-half reliability (Spearman-Brown

Table 1
Factor Pattern Loadings for the BDI's Two-Factor Structure

BDI items	Factor 1 Loadings	Factor 2 Loadings
2 - discouraged	.79	.03
3 - failure	.75	.07
7 - disappointment	.74	.03
5 - guilt	.61	.08
13 - decisions	.58	.20
1 - sad	.54	.08
9 - suicide	.54	.02
8 - self-blaming	.44	.09
4 - dissatisfaction	.42	.25
6 - punished	.37	.01
10 - crying	.36	.17
14 - body image	.33	.20
15 - work inhibition	.16	.63
18 - appetite	.00	.57
21 - sex drive	.02	.54
20 - health	.06	.48
17 - fatigue	.05	.40
12 - social withdrawal	.26	.37
19 - losing weight	.04	.34
16- insomnia	.05	.30
11 - irritability	.14	.30

Note: Correlation between the two factors (*r* = .68)

correlation for factor 1 = .85 and for factor 2 = .62).

Relationships Between the BDI and Headache Activity. Pearson correlations were used to determine the relationship between the pretreatment BDI and pretreatment headache activity in our sample. Correlations involving the total BDI score as well as scores for the two factors identified in the above analyses were examined. The measures of headache activity used in these analyses were the headache index (an overall measure incorporating frequency, intensity, and duration), headache peak, and number of headache-free days.

These analyses revealed significant correlations between the total BDI score and all three measures of headache activity. BDI factor 2 was also found to be significantly correlated with all three headache indices. However, no significant correlations were found between BDI factor one and any of the headache indices (though the correlation with headache peak approached significance). Table 2 contains the nine correlations and their significance levels. Although these correlations suggest relationships between headache activity and scores on the BDI, it appears that those BDI items comprising factor 2 (somatic symptoms) are most clearly related to the headache indices.

Predicting Reductions in Headache Activity with the BDI. Relationships between the BDI and changes in headache activity following treatment were examined by correlating the three pretreatment BDI measures (total, factor 1, and factor 2) with pre-post changes in the three headache activity indices. No significant correlations were found between any of the BDI measures and any of the headache activity change indices. In this sample of recurrent headache sufferers, it appears that scores on the BDI at preassessment were not predictive of reductions in headache activity following nonpharmacological treatment.

Relationships Between Changes on the BDI and Changes in Headache Activity. This set of analy-

Table 2
Correlations Between Depression Measures and Headache Measures

	Headache Index	Headache Peak	Headache-free days
BDI Total Score	.20*	.26**	-.23**
BDI Factor I (Cognitive/affective)	.10	.11	-.10
BDI Factor 2 (Somatic)	.24**	.32***	-.25**

* *P*< .05
** *P*<.01 *** *P*<.001

ses examined whether pre-post changes on the three BDI measures were significantly correlated with pre-post changes on any of the headache activity indices. As shown in Table 3, the total BDI score was significantly correlated with changes in headache peak and headache-free days but not with changes on the headache index. BDI factor 1 was significantly correlated with change in head-ache-free days, but not with the other two headache measures. BDI factor 2, however, was significantly correlated with changes seen in all three headache activity indices. These analyses suggest changes in headache activity are linked with changes on all three BDI measures. This link, however, appears strongest for the BDI items comprising factor 2.

Treatment Responders vs. Nonresponders: Comparing BDI Changes. Correlated or paired-sample t-tests were used to examine the statistical significance of pre-post changes seen in the three BDI measures. These analyses were performed separately for subjects categorized as treatment responders (50% or greater reduction in headache activity following treatment) and those categorized as nonresponders (less than 50% reduction in headache activity).

Analyses within the treatment responder group of subjects showed significant changes on BDI factor 2 [t(35) = 2.22, *P* < .05], a trend on the BDI total score [t(34) = 1.81, *P* < .10], and nonsignificant changes on BDI factor 1 it (35) = 1.55, *P* > .10]. In this sample of treatment responders, the mean score for BDI factor 2 dropped from 4.69 (SD = 4.19) at pretreatment to 3.05 (SD = 2.20) at posttreatment. Similarly, the trend for BDI total score revealed that subjects' scores at pretreatment (M = 8.31, SD = 6.07) were greater than their scores at posttreatment (M = 6.40, SD = 4.67).

Analyses within the treatment nonresponder group of subjects did not find significant changes on the BDI total score [t(26) = 1.13, *P* > .10], the BDI

Table 3
Correlations Between Changes on Depression Measures and Changes on Headache Measures Following Behavioral Intervention

	Headache Index	Headache Peak	Headache-free days
BDI Total Score	.14	.24*	.37**
BDI Factor 1 (Cognitive/affective)	.11	.14	.29*
BDI Factor 2 (Somatic)	.29*	.30**	.31**

* *P* < .05
** *P*<.01
*** *P*<.001

factor 1 score [t(27) = 1.38, *P* > .10], or the BDI factor 2 score [t(26) = .21, *P* > .10].

These t-tests provide additional evidence that changes in headache activity are related to changes on the BDI. Headache sufferers showing clinically substantial reductions in headache activity (50% or greater) following treatment also showed significant reductions on the BDI, though again mostly on those items comprising factor 2.

DISCUSSION

The results of our study suggest that the use of the BDI to assess depressive symptoms in recurrent headache sufferers may be improved by recognizing and using the two factors identified in this study. These two factors are differentially related to headache activity as well as to changes in headache activity following psychological intervention. In fact, results suggested that observed relationships between the BDI and headache activity are primarily due to the somatic items. The BDI total score does not appear to provide an unconfounded assessment of depressive symptoms in recurrent headache sufferers because the BDI likely includes items referred to by Steer, McElroy, and Beck[34] as transdiagnostic (i.e., symptoms that might reflect depression but might also reflect another disorder such as headache).†

The BDI's Factor Structure with Headache Patients. The factor structure identified in this study suggests the presence of two well-defined, albeit correlated, factors. The majority of BDI items had substantial loadings on only one of the two factors; only two items had loadings greater than .20 on both factors (see Table 1). These findings suggest that these two groups of items reflect clearly separable constructs; the first representing cognitive/affective characteristics of depression and the second reflecting somatic characteristics. The magnitude of the interfactor correlation (r = .68) suggests that, though distinct, these two factors may be thought of as tapping into an underlying general depression syndrome as suggested by Clark et al.,21 and Tanaka and Huba.[23]

The factor structure identified in this study is similar to those described in previous factor-analytic work with the BDI using other populations. For example, in a review of factor-analytic studies with nonmedical populations, Beck and Lester[35] concluded that despite various methods and populations three factors had been consistently identified. They labeled these three factors negative attitudes-suicide, performance difficulties, and physiological manifestations. More recently, using LISREL, Tanaka and Huba[23] have reported results consistent with Beck and Lester's[35] conclusions. Tanaka and Huba[23] found support for a model conceptualizing the BDI in a hierarchical fashion with one higher-order factor (depression) comprised of three primary factors, negative attitudes-suicide, performance difficulties, and physiological manifestations. Finally, in the only factor-analytic study we are aware of using only medical patients (male cardiac outpatients), Campbell, Burgess, and Finch[36] identified three factors they labeled negative self-attitudes, sadness, and physiological symptoms. Although only two factors were identified in the present study, this two-factor structure appears consistent with previous work since somatic items appeared to represent a subset of symptoms distinct from cognitive/affective items.

The factor structure identified in this study is also consistent with studies examining the use of the BDI in medical patient populations.[17,21,22] For example, Cavanaugh et al.[17] and Clark et al.[21] both report that cognitive/affective items generally provide a better indication of depressive severity in medical patients than somatic/vegetative items. Specifically, 6 of the 7 items described by Cavanaugh et al.[17] as the best predictors of depression in medical patients and 5 of the 6 items similarly identified by Clark et al.[21] were grouped on the cognitive/affective factor in this study. Extending these results to the present study clearly suggests that our cognitive/affective factor would be a much better measure of depression than our somatic factor with recurrent headache patients.

Headache and Depression Revisited. Correlations between the BDI factors identified in this study and headache activity suggest that somatic BDI items are primarily responsible for any general relationship between the BDI and headache activity. Of the two factors identified in this study, only the somatic factor was consistently related to headache activity and changes in headache activity.

These analyses suggest that using somatic items as indicators of depression in headache patient samples may confound the assessment of depression with headache symptoms and severity. This raises questions about previous studies that suggest relationships between headache and depression. As noted previously, to our knowledge no study examining the relationship between headache and depression has specifically considered the extent to which transdiagnostic symptoms might confound the assessment of each disorder.

Reports suggesting that depression may interfere with psychological treatments of headache may also be suspect.[24-27] These studies have generally found that relatively low BDI scores (e.g., 8)

can increase the likelihood that patients' will not respond to psychological interventions. Since scores such as these are unlikely to reflect even mild depression,[28] our results raise the possibility that the BDI's usefulness as a predictor of headache reduction following treatment may rest less on its validity as a measure of depression and more on its inclusion of transdiagnostic symptoms, In fact, several studies have found that headache activity itself is a good predictor of treatment success, with more frequent headaches being associated with poorer response to psychological interventions (see Blanchard and Andrasik,[24] Holroyd,[7] and Holroyd et al.,[31] for reviews of this literature).

While our inferences pertaining to a general relationship between headache and depression must be considered speculative, our results do suggest that when examining the relationship between headache and depression we could benefit by heeding the work done with general medical patients and paying attention to the presence of transdiagnostic symptoms. Our results suggest that at least some items from the BDI may be indicators of both depression and headache and as such may not be as useful for identifying depression in headache samples. Future studies might evaluate the differential effectiveness of the two BDI factors identified in this study as indicators of depression in recurrent headache patients.

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