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Structural Models of Comorbid Anxiety and Depression in a Primary-Care Older Adult Sample: Effect of Medical Illness Severity, Threat, Chronicity, and Progressiveness on Model Fit

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Abstract

Recent research suggests that anxiety disorders may be more common in later life than previously thought. Among other factors, the presence of comorbid mood disorders and medical illness confounds accurate assessment and diagnosis of these conditions in the elderly. There have been few studies, however, examining the structural relationships between anxiety and depression with older-adult samples, and even fewer have considered the effect of medical illness on these relationships. This study examined three established structural models of anxiety and depression, using a clinical sample of older adults seeking treatment in a primary-care setting (N = 2,163). It was hypothesized that the presence of comorbid medical illness would act as a moderating variable in evaluating the fitness of these models. Results indicated that a hierarchical model represented the most parsimonious fit to the full sample. Tests of factorial invariance revealed variance in model fit as a function of illness severity and threat, and as a function of illness chronicity and progressiveness. Specifically, the relationship of somatic symptoms to anxiety varied by combined severity/threat, as well as by chronicity/progressiveness. These findings support previous conceptualizations of the relationship between anxiety and depression. Implications of these results for taxonomy, assessment, and intervention are discussed.

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This work is dedicated to the memory of my mother, Alice Jean Palmer (1942-2003), who was the first person to look at me and see a doctor.

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Structural Models of Comorbid Anxiety and Depression in a Primary-Care Older Adult Sample: Effect of Medical Illness Severity, Threat, Chronicity, and Progressiveness on Model Fit

In the literature regarding psychopathology in older adults, anxiety disorders have traditionally received less attention than have other disorder categories such as dementia and depression. Epidemiological studies based on currently accepted diagnostic criteria (i.e., recent revisions of the Diagnostic and Statistical Manual of Mental Disorders [DSM-III; DSM-III-R; DSM-IV; American Psychiatric Association, 1980/1987/1994) have generally found anxiety disorders to be less common among older adults (Regier et al., 1984/1990). Researchers of late, however, have identified higher rates of anxious symptomatology among the elderly, suggesting that anxiety among older adults may be more prevalent than previously thought (Lenze, Mulsant, Shear, Alexopoulous, & Reynolds, 2001; Lynch, Compton, Mendelson, Robins, & Krishnan, 2000; Wetherell, Gatz, & Pedersen, 2001). Anxiety in older adults is associated with higher utilization of healthcare services (Flint, 1999; Forsell and Winblad, 1998), greater physical disability (Lenze, Shear, Mulsant, & Reynolds, 2002), and increased risk of mortality from medical conditions such as heart disease (Blazer, 1997; Lenze et al., 2002).

Among older adults, recognition of both anxious symptoms and syndromes can be confounded by a number of factors. In the DSM, anxiety disorders (as well as many other mental disorders) are defined as discrete clusters of anxious symptoms (Maser & Cloninger, 1990). Many anxious symptoms are seen in a number of anxiety disorders, resulting in considerable overlap between the various anxiety disorders, as well as between anxiety and mood disorders, particularly unipolar depression. A number of

studies have established that comorbidity between anxiety and mood disorders is a relatively common presentation (Brown & Barlow, 1992; Brown, Campbell, Lehman, Grisham, & Mancill, 2001; Kessler, McGonagle, Zhao, Nelson, & Hughes, 1994; Sanderson, DiNardo, Rapee, & Barlow, 1990). Among older adults, anxiety disorders and depression co-occur with such frequency that some researchers consider the two to be virtually indistinct in this population (Rivas-Vasquez, Saffa-Biller, Ruiz, Blais, & Rivas-Vasquez, 2004; Stanley & Beck, 2001). Subsyndromal anxiety symptoms are also common in the presentation of major depression, particularly in the elderly. Studies of subthreshold anxiety and depression have indicated prevalence rates two to four times as high as that of specific anxiety or depressive disorders. Studies focusing specifically on the elderly have noted that these patients present with subsyndromal anxiety and depression in primary-care settings three to six times more frequently than with either condition reaching DSM threshold criteria (Rivas-Vasquez et al., 2004). Other researchers have noted that 'anxious depression' appears to be the most common presentation of anxious symptomatology observed in primary care settings (Flint, 1999; Sable and Jeste, 2001). This observation is particularly germane to our discussion of late-life anxiety, given the fact that older adults with anxious symptoms are more likely to present in a primary-care setting, attributing their somatic symptoms to medical etiologies (Stanley & Beck, 2001).

The presence of medical illness further obstructs accurate assessment and diagnosis of anxious syndromes in the elderly. Anxiety symptoms and disorders often present as comorbid with medical and physical syndromes, or they may arise in response to the onset of medical illness. In these cases, anxiety can impact the presentation and

course of the disease, as well as presenting challenges for treatment (Pontillo, Lang, & Stein, 2002; Roy-Byrne and Katon, 2000). Comorbid anxiety is observed most often in diseases whose physiological symptom presentations are similar to somatic symptoms of anxiety, such as cardiac illness, chronic obstructive pulmonary disease (COPD), asthma, and gastrointestinal disorders (Roy-Byrne and Katon, 2000). Also, many medical conditions produce anxiety symptoms in their own right, including cardiovascular disease, COPD, endocrine disorders, and neurological conditions such as strokes, Parkinson's disease, and neurodegenerative disorders (Cohen, 1990; Lauderdale & Sheikh, 2003; Sheikh, 2003). Physiological symptoms such as heart palpitations, tachycardia, headaches, stomachaches, etc., are among the most common manifestations of anxiety (Small, 1997). As a result, anxious symptoms, syndromes, and disorders are commonly observed in the context of treatment for medical illnesses. It has been estimated that approximately one in every five patients in the primary care setting has a diagnosable anxiety disorder, indicating that accurate assessment and diagnosis of these disorders plays a major role in both medical and psychological outcomes for a significant number of patients in this setting. Nevertheless, psychiatric disorders, including anxiety disorders, are missed in as many as half of primary-care patients, resulting in elevated morbidity and mortality in both the psychiatric and medical illnesses, and over-utilization of already limited healthcare resources (Zajecka, 1997). This becomes even more apparent when it is noted that the majority of patients presenting with somatic symptoms in primary care are not found to have a physiological etiology for their symptoms. Consequently, elevated rates of specific anxiety disorders, particularly GAD and panic disorder, are observed in these patients (Roy-Byrne and Katon, 2000).

The presence of anxiety disorders in the context of medical illness is associated with a number of negative outcomes. Particularly with comorbid depression, anxiety in medically ill patients is associated with increased disability, higher utilization of healthcare services, and increased mortality (Cohen, 1990; Lenze et al., 2002). The association between anxiety and increased mortality is particularly apparent in cardiovascular illness, although more research is needed to understand the mechanisms involved. Lenze and his colleagues (2001/2002) have noted the dearth of studies of anxiety in the medically ill elderly, despite evidence linking depression to increased mortality in physical illness, as well as substantial evidence linking anxiety and depression in this population.

Structural Models of Anxiety and Depression

As it was apparent that anxiety and depression frequently co-occur with one another, the need to understand the exact nature of their relationship with one another became increasingly salient to researchers. Theoretical perspectives on the relationship between depression and anxiety appear to converge with the evidence from genetic and neurobiological studies suggesting that both disorders share at least one common factor, while being differentiated by unique factors. Newer, more sophisticated psychometric approaches in the 80's and early 90's gave rise to structural models explaining the relationship of anxiety and depression. An early model, proposed by Tellegen (1985), posited that two related dimensions of affect, positive and negative, could be seen as an underlying framework for differentiating mood and anxiety disorders. Within Tellegen's model, positive affect was seen to be a specific factor in depression, while negative affect represented a general factor seen in both depression and anxiety. The model was

consistent with Beck's content-specificity theory of psychopathology, in which depression contains both negative attributions about the future and ruminations about past events (Beck & Emery, 1985).

Building on Tellegen's work and others, Clark and Watson (1991) conducted a review of factor analytic studies, which identified two specific factors in addition to the general distress factor; first, a factor consisting primarily of symptoms of autonomic arousal, relatively specific to anxiety, and an anhedonic (or low positive affect) factor which was unique to more severe depression. Consequently, the authors proposed a *tripartite* model of anxiety and depression that accounts for the generalized negative affect factor shared by both anxiety and depression, differentiating anxiety disorders by the presence of physiological arousal and depressive disorders by the lack of positive affect. In a series of tests, the authors built initial support for the validity of the model in student, adult, and patient clinical samples (Watson, Clark, et al., 1995).

Subsequent studies found support for the tripartite model in clinical samples of children and adolescents (Chorpita, Albano, and Barlow, 1997; Joiner, Catanzaro, and Laurent, 1996) as well as cross-cultural samples (Kiernan et al., 2001). Other studies have addressed the issue raised by Watson, Clark et al. (1995) regarding the validity of self-report measures, employing clinical interviews and psychophysiological studies (for a review, see Mineka et al., 1998) in addition to self-reports. However, Burns and Eidelson (1998) raised concerns about the validity of the tripartite model. In testing various structural equation models on student, substance-using, and adult outpatient samples, they found that a model containing two higher-order factors representing depression and anxiety provided the best fit for each sample group. As a result, Burns and

Eidelson argued that depression and anxiety were phenomenologically distinct constructs that could not be accounted for by a single distress factor. They acknowledged, however, that the high correlations between depression and anxiety could be the result of a single factor that would be undetectable to cross-sectional data. Earlier perspectives on the relationship between anxiety and depression also alluded to the temporal sequencing of the two disorders (see Alloy et al, 1990), further pointing out the need for longitudinal studies.

Applying evidence from previous diathesis-stress models of the development of anxiety disorders, Barlow and his colleagues (Barlow, 2002; Zinbarg et al., 1994, Zinbarg and Barlow, 1996) developed a three-factor model of anxiety disorders that had many similarities to the tripartite model. The most striking similarity between the two models was the appearance of a general factor, which Barlow labeled as 'anxious apprehension' that accounted for the shared variance among the anxiety disorders. Specifically, Barlow's model proposed that anxious apprehension was a precursor to the development of all anxiety disorders. Each individual disorder, in turn, was differentiated by various biopsychosocial factors unique to the disorder. Most of the differences between the Barlow model and Watson and Clark's model were, in fact, lexical differences. However, one important difference between the two was in the way the general distress/anxious apprehension factor was conceptualized. Although the shared and unique factors in the tripartite model were characterized as three first-order factors, Barlow's model posits that the anxious apprehension factor (which Barlow would describe as negative affect in later papers) is a higher-order trait factor, representing a common vulnerability to both mood and anxiety disorders (Zinbarg and Barlow, 1996). In a preliminary test of this model

using a sample group of outpatients seeking treatment for anxiety symptoms (N = 432), confirmatory factor analysis produced six lower-order orthogonal factors which roughly corresponded to the six DSM-IV disorders diagnosed in the sample group. Additionally, a single higher-order factor emerged, correspondent to the common negative affect factor seen in other three-factor models. Secondary analyses revealed that the general negative affect factor could not be entirely accounted for by shared variance among the lower-order factors or diagnostic overlap, lending further support to the validity of negative affect as a higher-order trait vulnerability (Barlow, 2002; Zinbarg and Barlow, 1996).

By now, it has become clear that the earlier models of anxiety and depression offered good explanations of some aspects of the relationships, while falling short in other areas (Mineka et al., 1997). The construct of negative affect as a common factor to both anxiety and depression, for example, has been supported in tests of both the tripartite and hierarchichal three-factor models (Watson et al., 1995; Zinbarg and Barlow, 1996). However, it is increasingly clear that the various anxiety disorders are differentially related to each other, as well as to depression. It is also apparent from the work of Barlow and his colleagues that the physiological arousal component of the tripartite model is not sufficient to discriminate all the anxiety disorders. In an exemplary study, Brown, Chorpita, and Barlow (1998) tested several structural models of anxiety and depression on a sample group of outpatients presenting with anxious and depressive symptoms (N = 350). They found that the DSM-IV disorders identified in the sample group exhibited good discriminant validity. They also found, in accordance with the tripartite model, that each of the disorder factors was highly correlated to the negative affect factor, and that depression was inversely correlated to positive affect. However, they also found that

social phobia was similarly correlated to positive affect. Even more compelling, they found that the autonomic arousal factor, which was hypothesized by the tripartite model to differentiate anxiety disorders *in general* from depressive disorders, was in fact differentially related to *each* of the anxious syndromes. It exhibited the strongest relationship to panic disorder (r = .67), and had an inverse correlation to GAD (r = -.22). In the final model, however, autonomic arousal exhibited virtually no relationship to either social phobia or OCD, supporting Barlow's view that each of the anxiety disorders has a unique component that differentiates it from the others.

In light of this evidence, Mineka and her colleagues (1998) proposed an integrative hierarchical model of anxiety and depression that incorporates empirically supported features of both the tripartite and hierarchical models proposed previously. This integrative model retains negative affect as a general distress factor common to anxiety and depression, and further posits that negative affect may play a pervasive role in a number of additional syndromes as well. The model goes on to recognize the heterogeneity of unique components of each disorder, calling for a better understanding of the nature of these factors. Finally, the integrative model points out that individual disorders may differ in the proportion of shared and unique factors observed in each syndrome. This observation has been noted in subsequent comorbidity research. For example, GAD and depression have been found to have a shared diathesis, while their environmental determinants are largely unique (Brown, Campbell, Lehman, Grisham, and Mancill, 2001).

Model Testing With Older Adult Samples

Although the existing models of anxiety and depression have been extensively researched in younger adult, child, and adolescent samples, there has been considerably less investigation of the validity of these models in older adults. A body of literature began to emerge in the 1990's suggesting that older adults may experience affect differently than their younger counterparts, drawn primarily from studies of late life depression (Gurian and Miner, 1991; Shapiro, Roberts, and Beck, 1999). For example, a comparative factor analysis conducted with young (n = 207), middle age (n = 231), and older adult (n = 828) samples revealed that experiencing positive affect was less salient to older adults that to their younger counterparts, while the experience of anxiety in older adults was more directly related to fear than to other factors (e.g. guilt, shame, worry) that were more salient in the younger samples (Lawton, Kleban, and Dean, 1993). Nevertheless, only recently have researchers begun to test the established models of anxiety and depression in older adult samples.

Previous research employing younger adult samples had indicated that consideration of both cognitive and affective symptoms of anxiety and depression improves discrimination of each disorder (Jolly, Dyck, Kramer, and Wherry, 1994). In an attempt to determine whether the same held true in the elderly, Shapiro, Roberts, and Beck (1999) undertook an initial investigation of cognitive and affective structure of depression and anxiety in a sample of community-dwelling older adults (N = 283). They chose to simultaneously test Beck's (1985) cognitive content-specificity hypothesis along with Watson, Clark, and Carey's (1988) positive and negative affective model The researchers first performed a series of factor analyses on measures of anxiety and

depression that were theoretically based on each model. For the cognitive content-specificity hypothesis, the Cognitions Checklist (CCL; Beck et al., 1987) was examined, and the Positive and Negative Affect Schedule (PANAS; Watson, Clark, and Tellegen, 1998) was evaluated for affective structure. Factor analyses of the CCL with younger adult samples had produced a two-factor solution corresponding to the Depressive- and Anxious- Cognitions subscales contained in the measure (Beck et al., 1987; Steer, Beck, Clark, and Beck, 1994). In the older adult sample, however, the measure separated into three factors; a health-anxiety factor derived from the original CCL Anxiety Scale, and two separate depression factors, representing cognitions about declining social functioning and thoughts of low self-worth. A similar analysis of the PANAS scales maintained a two-factor solution similar to that suggested by Watson et al., although some individual items were excluded for lack of specificity. However, it should be noted that the items loading on the Negative Affect subscale were primarily associated with anxiety (e.g., 'nervous,' 'jittery,' 'scared'), while items related to guilt and shame failed to load. This finding was consistent with those of Lawton et al. (1993) that ruminations about past events are less salient to elders than present concerns, particularly health-related anxiety.

In the second set of analyses, the revised CCL and PANAS subscales were correlated with symptom measures of depression and anxiety to determine if the same correlations observed in younger samples would hold true in the older adult sample group. Subsequently, hierarchical multiple regressions were conducted to see if the CCL and PANAS subscales independently predicted anxiety and depressive symptoms. These analyses revealed stark differences between the older adult sample and younger adults. In

terms of cognitions, they found that anxious cognitions in older adults related to both anxious and depressive symptomatology, in contrast to younger samples where anxious cognitions specified anxious symptoms. Cognitions of worthlessness were also related to both anxious and depressive symptoms, while thoughts of social loss generally were not associated with either anxious or depressive symptomatology in the elderly sample group. By comparison, thoughts of negative self-worth in younger samples tended to be associated differentially with depression (Roberts and Gotlib, 1997). With regard to affect, although the Negative Affect factor was associated with general distress in the elderly sample, lack of positive affect did not differentiate between depressive and anxious symptom presentations. This study was limited in that 1) it relied mainly on self-report measures, 2) the measures were completed in a group setting, which may have suppressed self-disclosure, and 3) the sample was relatively high-functioning, and generally asymptomatic. Nevertheless, the study suggested that older adults think differently about anxiety and depression than do their younger counterparts. Also, although the shared affective components of anxiety and depression may be similar across age groups, factors differentiating the disorders may vary as a function of advanced age.

Subsequent model tests of anxiety and depression in older adults have similarly failed to demonstrate invariance in factor structure between older and younger samples. Meeks, Woodruff-Borden, and Depp (2003) replicated Joiner's (1996) test of one, two, and three-factor models of anxiety and depression, using a large (N = 1,429) randomly generated sample of older adults, as well as a smaller (N = 210) convenience sample of participants recruited from various community sites. In both samples, the researchers

found that a two-factor model provided the best explanation of the data, suggesting that the general distress factor observed in younger samples is qualitatively different from the experience of older adults. Wetherell, Gatz, and Pedersen (2001) also obtained a two-factor solution in a longitudinal sample of middle-aged and older (M = 60.9 years) Swedish twins. Similar to Shapiro and her colleagues, these researchers found that general distress in older adults appeared to be more closely related to anxiety than to depression.

One of the key limitations of Shapiro's study, as well as many previous studies in this area, was the use of a relatively high-functioning, community-dwelling sample group. In their discussion, Shapiro and her colleagues rightly noted the possibility of a differential structure of anxiety and depression emerging in a sample of treatment-seeking elders. Addressing this issue, J.G. Beck and her colleagues (2003) replicated Shapiro's analysis of the CCL and PANAS with a sample of older adults presenting for a clinical trial of cognitive-behavioral therapy for GAD (N = 83). The researchers chose this relatively homogenous sample for two important reasons. First, they wished to avoid confounding their results through excessive variance in presentations, while still capturing a representative clinical sample. Citing earlier evidence of the wide prevalence of GAD in older adults, the authors argued that a sample group of GAD patients met this requirement. Second, the authors noted evidence that GAD itself may function as a higher-order factor in older adults, thus allowing them to extend the conceptualization of this syndrome in the elderly (Beck et al., 2003). The initial confirmatory factor analysis with the PANAS produced a three-factor solution, with negative affect separating into two factors. The two negative affect factors represented constructs similar to the findings

of Shapiro et al., with anxiety and anger loading on one factor and guilt and shame loading on the other. In Shapiro's analysis, however, the guilt/shame items were dropped, leaving a two-factor model; in the Beck analysis, retention of the guilt/shame factor proved a better fit to the data. Exploratory and confirmatory factor analyses of the CCL items with this sample produced a two-factor solution, although there were notable cross-loadings on several items. In contrast to Shapiro's results, a three-factor solution did not improve model fit. Intercorrelations between the CCL and PANAS subscales, as well as between these subscales and established measures of depression and anxiety, supported convergent validity of the depression measures, while the anxiety subscales were less clearly convergent. Likewise, a series of hierarchical regressions found that the measures of depression added predictive power to the regression equations for anxiety, but the anxiety measures did not produce the same effect in predicting depression. Of particular note, each of the subscales of the cognitive and affective measures added significant predictive power to both state and trait anxiety measures, suggesting that long-standing generalized anxiety plays an etiological role in the emergence of at least the anxious form of late-life depression (see Lynch et al., 2000, for a description). Overall, this study added to the growing evidence suggesting that older adults experience anxiety differently than their younger counterparts.

There has been at least one direct test of a tripartite structural model of anxiety and depression undertaken in a clinical sample of older adults (Cook, Orvaschel, Simco, Hersen, and Joiner, 2004). This test also extended the existing literature by employing a structured interview measure, in addition to self-reports, to test the convergence of the tripartite model in a clinical outpatient sample of older adults (N = 131). Although the

results of this study supported adequate fit of the tripartite model, the authors noted that the physiological arousal factor, which is posited to be anxiety-specific, was significantly correlated with a measure of depressive symptoms (i.e., the BDI; $r = .54$, $p = .001$), as well as with SCID-IV diagnoses of depression ($r = .47$, $p = .001$). Consistent with Beck et al., (2003), as well as earlier theoretical perspectives on the temporal relationship between anxiety and depression (Alloy et al., 1990), these results suggest that generalized anxiety plays a role in anxiety, depression, and comorbid states in older adults, perhaps as a higher-order factor (Mineka, Clark, and Watson, 1998; Zinbarg and Barlow, 1996).

Summary of the Present Literature

The shortcomings of our current categorical system for classifying mental disorders are perhaps most glaring when it comes to differentiating between anxiety and depression. The presence of a great number of symptoms that are common to both anxious and depressive syndromes seems to argue for a nosology based on something other than discrete symptom clusters. Ironically, these very shortcomings have served to illuminate the shared variance of anxiety and mood disorders, and have formed the basis for development of theoretical models to address these issues. Improving differential diagnosis of anxiety and depressive disorders will necessitate development of psychometrically-sound and theoretically-grounded measures that represent the experience of anxiety and depression across multiple populations. This becomes particularly important in the context of late-life, given mounting evidence that older adults experience anxiety and depression differently than their younger counterparts. In the elderly, symptom presentations become increasingly diffuse and somatic, giving rise to new dilemmas in diagnosis. Additionally, since most anxiety and mood disorders begin

earlier in life and increasing age is associated with declining recall, over-reliance on self-report measures becomes increasingly problematic with this population. Clinician-administered measures that are reliable and valid with older adults form an essential piece of the puzzle in understanding and recognizing anxiety disorders in older adults. These problems are often exacerbated in the elderly by the presence of medical illness.

Anxiety associated with medical illness is a particularly common occurrence among the elderly (Sheikh, 2003). Epidemiological studies, as well as longitudinal data, have indicated that a significant proportion of persons with chronic medical conditions also meet criteria for an anxiety disorder. Since the majority of older Americans suffer from chronic medical illness, we can expect an increased prevalence of comorbid anxiety symptoms and disorders in this group (Hybels and Blazer, 2003; Nguyen, Goldberg, & Sheikh, 1999; Small, 1997). Anxiety symptoms and discrete disorders, while relatively uncommon in community-dwelling older adults, are much more prevalent in medically ill elders. This increased prevalence is associated with increased morbidity and mortality, particularly in the context of comorbid depression (Lenze et al., 2000). There are several confounding issues encountered in recognizing anxiety in the context of medical illness that are of particular importance to older adults. Cognitive decline, comorbid depression, pharmaceuticals, substance use, and cohort effects can all serve to produce or mask anxious symptoms in the elderly patient (Nguyen et al., 1999; Small, 1997). Nevertheless, there have been no examinations of the structure of anxiety and depression conducted with medically ill older adults.

Hypotheses

Previous examinations of the relationship between anxiety and depression in older adults have usually relied on convenience samples taken from community or clinical settings. These samples have typically been relatively high-functioning, medically healthy older adults, with relative homogeneity regarding pre-existing psychiatric diagnoses. This study extends the current literature by employing a medically heterogenous sample of elders presenting in primary-care medical settings. This approach addresses concerns expressed by others in this research area (see Cook et al., 2004) regarding inclusion of medical comorbidity as a needed extension of the current literature in late-life anxiety and mood disorder comorbidity. To this end, information on comorbid medical conditions in this sample was used to provide a basis for generation of subsamples that varied in medical illness severity, threat, chronicity, and progressiveness.

The study tested three models of anxiety and depression comorbidity, based on models that have previously been examined in relatively healthy older-adult (Cook et al., 2004; Meeks et al., 2003) and wider age-range adult (Burns & Eidelson, 1998) samples. This study examined the fit of each model to the overall sample, before examining whether the best-fitting of these models would prove invariant in subsamples defined by varying levels of medical illness severity, threat, chronicity, and progressiveness. The following hypotheses were proposed:

1. A hierarchical model, with two first-order factors (representing depression and anxiety) subsumed under a higher-order, non-specific distress factor, will provide the best overall model fit.

2. The presence of medical illness is a moderating variable in the relationship between anxiety and depression in older adults. The structural model providing most parsimonious fit in the full sample (i.e., the hierarchical model) will prove non-invariant across subsamples representing various constructs of medical illness. Thus:

   (a) The hierarchical model will vary in fit between subsamples representing lower and higher levels of illness severity and threat. Severity is defined as the likelihood that participant medical conditions would require one or more days of hospitalization. Threat is defined as the likelihood that sequelae of present medical conditions would result in the death of the patient.

   (b) The model will vary in fit between subsamples representing lower and higher levels of illness chronicity and progressiveness. Chronicity is defined as the likelihood that participant medical illnesses will require medical treatment, beyond that which the participant could independently manage, for 6 months or longer. Progressiveness is defined as the likelihood that participant medical illnesses will increase in severity over time, regardless of treatment.

Methods

Participants

Participants for the study were derived from a sample group of older adults who originally participated in the Primary Care Research in Substance Abuse and Mental Health for the Elderly (PRISM-E; Levkoff, Chen, Coakley et al., 2004) multisite randomized trial of integrated behavioral healthcare for older adults. The sample group was derived from persons aged 65 years or older who originally presented at one of 34

primary care clinics across eleven sites participating in the PRISM-E study (N = 23,828). The study sites included six Department of Veterans' Affairs Medical Centers (VAMC), three community health centers, and two urban hospital networks (Levkoff et al., 2004). Each potential participant completed a brief screening procedure, consisting of the12-item General Health Questionnaire (GHQ-12; Goldberg & Williams, 1988) to assess symptoms of mental distress, two questions to assess suicidal thoughts (Spitzer et al., 1994), and three questions regarding alcohol consumption (Sobell, Sobell, Leo, & Cancilla, 1988).

A total of 6,430 participants met initial screening criteria for the presence of psychological distress, suicidal ideation, or at-risk drinking. These participants were then invited to participate in a baseline assessment that included sections of the MINI International Neuropsychiatric Interview (MINI; Sheehan et al., 1998), the Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1997), and the Beck Anxiety Inventory (BAI; Beck, Epstein, Brown, & Steer, 1988), as well as measures of alcohol consumption and a medication review. Of those invited to participate, 3,225 either declined to participate or were excluded because they were already receiving mental health or substance use treatment. Of the 3,205 participants who did participate in the baseline assessment, 992 did not meet baseline criteria for an anxiety, depressive, or substance use disorder, and were excluded on that basis. Additionally, 73 participants were excluded due to diagnoses of hypomanic or psychotic disorders, and 118 participants did not complete the baseline assessment. Of the remaining 2,244 cases, 87 were deleted listwise due to missing data on a MINI question about generalized anxiety that was to be used in the construction of the observed variables for the model. The remaining participants (N = 2,163) formed the sample group for the study. A frequency

comparison of key demographic variables between the excluded cases and those in the final sample revealed that the excluded participants were more likely to be black, between 65 and 74 years of age, never married, and more likely to report that they were just getting by financially (Table 1). Additionally, the final sample group was disproportionately male, which can probably be explained by the number of VAMC recruitment sites employed by the PRISM-E investigators. Comparison of the two groups on observed variables used in the models tested (Table 2) shows that the excluded participants generally reported higher levels of distress, although the groups were not statistically different from one another.

Measures

Mini International Neuropsychiatric Interview—The MINI International Psychiatric Interview (Sheehan, Lecrubier, Sheehan, et al. 1998) is a brief structured interview for diagnosis of DSM-IV and ICD-10 psychiatric disorders. The interview is organized in a series of 16 modules, representing various DSM-IV diagnostic categories (Table 3). Each module consists of a series of questions assessing current symptoms of each disorder that may be experienced by the patient. The MINI has displayed adequate inter-rater and test retest reliability, and demonstrates good convergent validity with more comprehensive structured interviews (Lecrubier et al., 1997; Antony & Barlow, 2002). For this study, items derived from the modules representing anxiety and mood disorders were summed to construct observed variables representing subgroups of interest. (Table 4)

Center for Epidemiological Studies Depression Scale (CES-D)—The CES-D (Radloff, 1977) is a 20-item self report measure designed for use in epidemiological studies to screen for the presence of depressive symptomatology. It possesses good internal consistency (= .85 [non-patients], .90 [patients]), and test-retest reliability (r > .54 at 6

months). Studies conducted with older-adult samples maintained similar numbers (Lewinsohn, Seeley, Roberts, & Allen, 1997). Radloff (1977) reported a consistent four-factor structure (dysphoria, well-being, somatic complaints, and interpersonal difficulties) in factor analyses of the measure; this structure has been replicated in other studies as well (see Antony & Barlow, 2002). The CES-D appears to be an adequate screening instrument for depression, with good sensitivity; however, it has been noted that the CES-D produces a high number of 'false positives,' limiting its diagnostic utility somewhat (Antony & Barlow, 2002). For this study, observed variables were constructed from the factors identified by Radloff (1977) as well as a summary of all measure items.

Beck Anxiety Inventory (BAI)—The BAI (Beck, Epstein, Brown, & Steer, 1988) is a 21-item self-report measure of anxiety severity. It displays adequate internal consistency (α = .60) and good test-retest reliability (r [one week] = .75). Correlations with clinician-administered anxiety scales were approximately .50, while correlations with clinician-administered depression scales were lower (approximately .25). Antony & Barlow (2002) reported that factor analysis of the BAI with an adult outpatient sample produced a two-factor solution (anxious cognitions and somatic arousal). This two-factor solution has also been observed in outpatient samples of older adults (Wetherell & Arean, 1997). These factors, as well as a summary variable, were employed to construct the observed BAI variables for this study.

Physical Health Indicators—The PRISM-E baseline interview also gathered information regarding medical comorbidity. Participants in the baseline interview had an average of 4.7 comorbid medical diagnoses (SD = 2.5; Levkoff et al., 2004). For purposes of invariance testing, the study employed self-reports from the PRISM-E baseline of medical diagnoses across 22 separate disease categories (Table 5). Each medical

diagnosis was assigned a separate weight for severity, threat, chronicity, and progressiveness based on mean ratings of each variable (Table 6) derived from a survey of nursing students enrolled in the MSN program at UM-St. Louis (N = 63). In this survey, the nursing students were asked to assign a rating to each of the 22 illness categories for each of the variables, using a 5-point Likert-type scale representing a percentage-range likelihood of each variable (see Appendix). Inter-rater agreement was adequate, with an intra-class correlation coefficient of 0.89 for the full survey. A series of Pearson product-moment correlations conducted between the four medical illnesses constructs on each category of medical illness revealed significant correlation between the severity and threat variables, as well as between the variables of chronicity and progressiveness. Combining the ratings of severity and threat produced high item consistency (Cronbach's ά = .917), with solid inter-rater reliability (Intraclass correlation coefficient = .917). Combining ratings for chronicity and progressiveness produced similar results (Cronbach's ά = .897; intraclass correlation = .897) Variables representing these combined categories were computed using a weight for each medical illness created by summing the means for severity and threat, and summing the means for chronicity and progressiveness. Each illness category was multiplied by the combined weights, and the resulting sum of weighted illnesses was used to represent the constructs of severity/threat and chronicity/progressiveness.

Descriptive Statistics

Correlational analysis of the observed variables for this study supported the utility of these variables in representing the latent variables of interest (Table 7). BAI factors

demonstrated the highest correlations with each other and with the MINI summed anxiety items. CES-D factor variables and MINI items representing factors associated with depression (summed depression, positive affect, negative affect) were also highly correlated with one another. Conversely, the BAI and MINI anxiety variables demonstrated clearly lower correlations with the CES-D and MINI depression variables. Compared to a community-dwelling sample of older adults (N = 281; Morin, Landreville, Colecchi, McDonald, Stone, & Ling, 1999), participants in this sample scored lower on the BAI subscales. This may reflect the fact that our sample group was predominantly (78.1%) male; older males have been shown to produce significantly lower BAI scores than older females (Owens, Hadjistavropoulos, & Asmundson, 2000). A recent validity study for the CES-D employing a sample of community-dwelling elders (N = 318; Haringsma, Engels, Beekman, & Spinhoven, 2004) recommended a cutoff score of 22 or above for diagnosing clinically significant symptoms of depression. In our study sample, 50.7% of participants scored 22 or above on the CES-D. Compared to large epidemiological studies (for example, Zung, Broadhead, & Roth, 1993), this sample reported higher levels of clinically significant depressive symptoms; however, the presence of psychiatric symptomatology was an inclusion criteria for the original study. Means and standard deviations for each of the observed variables appear in Table 8.

Data Analysis

To evaluate the question of whether medical illness would affect the structural relationship between anxiety and depression in this sample, an invariance-testing

approach was employed. To test invariance between the groups based on differences in medical illness severity and threat, the full sample was split into upper and lower thirds, using the summaries of medical comorbidities weighted by the combined severity/threat scores obtained from the nursing student survey. Factorial invariance was assessed by comparing model fit between the subgroups. A similar strategy was employed to test invariance between the groups based on chronicity/progressiveness.

For the tripartite model supported in the Cook et al. (2004) study, CES-D items loading on the 'somatic' factor and BAI items loading on the 'somatic arousal' factor were hypothesized to represent the latent 'physiological hyperarousal' variable. CES-D items loading on the 'well-being' factor and MINI items indicating positive affect were hypothesized to represent the latent 'positive affect' variable. The 'negative affect' latent variable was represented by CES-D items loading on the 'dysphoria' factor and BAI items loading on 'anxious cognitions.' The measurement/confirmatory model for the tripartite model appears in Figure 1.

For the hierarchical two-factor model from Burns & Eidelson's (1998) study, the first-order 'anhedonia' factor was represented by CES-D items loading on the 'anhedonia' and 'somatic factors, and MINI items indicating positive affect. The 'non-specific depression' factor was represented by CES-D 'dysphoria' items, and MINI items indicating summed depressive symptoms, as well as MINI negative affect items. The 'non-specific anxiety' factor was represented by BAI items loading on the 'anxious cognitions' factor, and MINI items indicating both summed and non-specific symptoms of anxiety. The 'somatic' factor was represented by BAI items loading on the 'somatic arousal' factor and MINI items indicating physiological arousal. The measurement model

for the Burns-Eidelson model appears in Figure 2, with the structural model appearing in Figure 4.

For the hierarchical three-factor model from Meeks et al. (2003), the first-order 'depression' factor was represented by CES-D well-being items and MINI items indicating depressive symptoms. The first-order 'anxiety' factor was represented by BAI and CES-D somatic subscales, BAI anxious cognitions, and the MINI items indicating anxious symptoms. The measurement model appears in Figure 3, with the structural model appearing in Figure 5.

Models were constructed and tested using AMOS (Analysis of Moment Structures) version 4.0 (Arbuckle, 1999). Chi-Square tests of model fit were employed as an initial assessment of model fit. Given the effect of large sample sizes on the chi-square distribution, additional fit indices were also examined. Absolute-fit indices, including the Goodness-of Fit Index (GFI; Hu & Bentler, 1995) and the Adjusted Goodness-of-Fit Index (AGFI; Hu & Bentler, 1995) were employed to address the sample size issue with the chi-square distribution, providing a comparison of fit between the hypothesized model and none at all. The AGFI provides an additional adjustment for degrees of freedom, affording a more specific test of model fit. The root-mean square error of approximation (RMSEA; Stieger & Lind, 1980) was also used to evaluate fit of these models. This measure of incremental fit provides a confidence interval around its point estimate, yielding further specificity of model fit (Smith & McMillan, 2001). Confirmatory factor analyses were conducted with each measurement model to evaluate adequate representation of each latent variable by the selected observed variables. The CFA model for the tripartite model, along with the structural Burns-Eidelson and

hierarchical models, were then tested and compared for fit to the full (N = 2,163) PRISM-E sample to test Hypothesis 1.

Based on the results of model testing with the full sample, the hierarchical model was selected for invariance testing with selected subgroups to evaluate Hypotheses 2(a and b). Model selection for this phase of analysis reflected adequate statistical model fit, as well as judgment of parsimony and theoretical congruence. The selected model was then tested for invariance, using the subsamples previously defined for each medical illness variable as well as the combination-weighted variables indicated by correlational analysis of the illness categories.

Power Analysis

Ullmann (2001) provided a general estimate that sample sizes of $\geq$ 200 are adequate for small to medium structural models. Based on this rough estimation, the proposed sample group appears to provide adequate power to test the proposed hypotheses. For a more exact analysis, we employed estimates provided by MacCallum, Browne, & Sugawara (1996) of sample size at $p = .80$ to detect an adequate root-mean square error of approximation (RMSEA). For the tripartite model, based on df = 25, a minimum sample size of N = 363 was estimated. For the Burns-Eidelson model, df = 10, requiring a minimum sample of N = 782. For the Meeks model, df = 15, and the recommended minimum sample (by extrapolation) is approximately N = 555. Given an overall sample of N = 2,163, employing upper and lower thirds produced subsamples with adequate sample size to evaluate each model with power exceeding 0.8.

Results

Confirmatory factor analysis of measurement models for each model revealed that the observed variables reliably measured the latent variables of interest (Table 9). All observed variables loaded significantly on their respective factors for each of the measurement models tested ($p \leq .01$). Testing of the full structural models revealed adequate statistical fit for both the tripartite and hierarchical (Meeks) models (tripartite model—χ^2 (3) = 10.4, p = .0015; hierarchical-- χ^2 (6) = 22.7, p $\leq$ .001). The Burns-Eidelson model did not demonstrate adequate fit to the full sample (see Table 10 for additional fit indices).

The hierarchical model was chosen for testing of invariance on the medical-illness variables of interest. Although the tripartite model could be judged as parsimonious on the basis of fewer overall parameters, the observed variables in the hierarchical model appear to better represent the hypothesized latent variables. Also, more of the paths from latent to observed variables were free to vary in the hierarchical model, providing greater construct validity for that model. Finally, the hierarchical model was believed to best represent the theoretical relationship between the three factors, as the most recent models in the literature suggest negative affect is a higher-order factor common to both anxiety and depression, while low positive affect is more specific to depression and physiological arousal is more specific to anxiety (Mineka et al., 1998; Teachman, Siedlecki, & Magee, 2007).

An invariance test using the combined severity-threat weighted summary of medical conditions revealed non-invariance between the low severity/threat (n = 705) and high severity/threat (n = 750) subsamples. Specifically, the BAI ‘somatic complaints’ items were differentially related to the anxiety variable between groups. An examination

of the regression paths revealed that the BAI somatic subscale was more highly correlated to the anxiety factor in the high severity/threat subsample (r = .57; Figure 6) than in the low severity/threat subsample (r = .25; Figure 7). A summary of the model-fitting sequence to the severity/threat groups appears in Table 11.

An invariance test using the combined chronicity/progressiveness weighted summary of medical conditions revealed non-invariance between the low chronicity/progressiveness (n = 716) and high chronicity/progressiveness (n = 733) subsamples. Again, the BAI somatic complaint subscale was found to vary between groups. Examination of regression paths revealed that the correlation of the BAI somatic subscale with the anxiety factor was higher for the high chronicity/progressiveness group (r = .58; Figure 8) than for the low chronicity/progressiveness group (r = .25; Figure 9). A summary of the model-fitting sequence to the chronicity/progressiveness groups appears in Table 12.

Discussion

The present study extends the current literature in several important ways. First, the study employed a sample group of older adults presenting in a primary-care setting. This corresponds to previous literature suggesting that older adults are more likely to present to primary-care providers with anxious and depressive symptoms than younger adults, who would be more apt to utilize specialty mental-health providers (e.g., Levkoff, Chen, Coakley et al., 2004; Bartels, Coakley, Zubritsky, et al., 2004). This approach, although technically a convenience sample, provides better external validity since it is selected on the basis of characteristics known to exist in the larger population. Further supporting the generalizability of these results, the sample group was drawn from a large

multisite clinical trial, with a range of both demographic characteristics and psychopathology generally reflective of a larger population. The large sample size provided adequate power to detect effects, both in the overall model-fit and in subsequent invariance testing. Most importantly, this sample included a range of comorbid medical conditions that allowed testing of factorial invariance on the basis of several important illness constructs.

In regard to the first hypothesis, the hierarchical model of comorbid anxiety and depression, with a second-order distress factor common to both conditions, provides adequate fit in the full sample. This extends the results found by Meeks et al. (2003) in probability and convenience samples to a larger, primary-care sample with information regarding a full range of comorbid medical illnesses. This study provides further support for the existence of a general-distress factor that underlies more specific expressions of psychopathology. Hierarchical models of this type have previously been fitted to discrete anxiety disorders (Zinbarg & Barlow, 1996) as well as anxiety and depression (Brown, Chorpita, & Barlow, 1998), and have been proposed to account for a wider range of psychopathology (Mineka, Watson, & Clark, 1998; Krueger, Markon, Chentsova-Dutton, Goldberg, & Ormel, 2003). Although the tripartite model adequately fit the sample as well, the hierarchical model was chosen for invariance testing on the basis of congruence with previous literature noting the differential relationship of negative affect to discrete anxiety disorders (Mineka, Watson, & Clark, 1998). Previous research has elucidated differences in the phenomenology of comorbid anxiety and depression in older adults; in particular, the prevalence of mixed anxiety-depressive states and subthreshold symptom presentations point to a common factor impacting both syndromes (Shapiro, Roberts, &

Beck, 1999; Rivas-Vasquez et al., 2004). A recent SEM examination of a tripartite model in a cross-sectional community sample of adults aged 18-93 (Teachman, Siedlecki, & Magee, 2007) posited a second-order negative-affect factor, similar to the models proposed earlier by Meeks et al. (2003), as well as by Zinbarg & Barlow (1996) and Mineka et al. (1998). This research suggests a continuing evolution toward conceptualization of negative affect as a higher-order factor common to anxiety and depression, and possibly to a number of other disorders as well.

The hierarchical model was found to vary between low and high-severity/threat subsamples, as well as between low and high-chronicity/progressiveness subsamples, in the relationship of somatic symptoms of anxiety to the latent anxiety variable. Specifically, somatic symptoms of anxiety were more strongly related to anxiety in the subsamples that were higher on each construct. This finding represents an important extension of the current literature, as it provides a better understanding of the impact of medical illness on the somatic expression of anxiety. Researchers have decried the lack of empirical data regarding this issue, arguing for the need of a better understanding of the presentation of anxiety in the context of medical illness (Farrell, 1997; House & Stark, 2002; Harter, Conway, & Merikangas, 2003).

Awareness of the direct relationship of somatic symptoms of anxiety to illness severity, threat, chronicity, and progressiveness has a number of important implications for assessment and treatment approaches in elderly patients. In spite of long-established data suggesting that anxiety disorders are common in the elderly, development of reliable and valid measures for anxiety in the medically ill elderly has traditionally lagged behind development of measures for other disorders, particularly depression (Hersen, van

Hasselt, & Gorenczy, 1993; Neal & Baldwin, 1994). In fact, there is still no universally accepted measure of late-life anxiety *in general* that has been sufficiently validated with a representative sample of elders (Ayers, Sorrell, Thorp, & Wetherell, 2007). The variations in responding to the BAI somatic-symptom questions noted in this study concur with other researchers who have pointed out its lack of specificity in older-adult samples, stemming from its reliance on somatic symptoms which are often elevated in the medically ill elderly (Wetherell & Gatz, 2004). These results underscore the need for increased specificity in assessments for anxiety in the medically ill elderly. Given the evidence linking anxiety to increased morbidity and mortality in the medically ill elderly, the development of reliable, valid, and accessible measures for use in clinical practice should be prioritized (Kim, Braun & Kunik, 2001; Ball, Goddard & Shekhar, 2002;.Stein, Sherbourne, Craske et al., 2004).

In terms of developing interventions germane to older adults with medical comorbidity, results of this study failed to indicate significant differences between healthy and ill adults in the relationship of anxious cognitions to anxiety. This suggests that interventions targeting anxious cognitions, which have been shown to be generally effective in older-adult samples (Ayers, Sorrell, Thorp, & Wetherell, 2007) should be effective in those with medical comorbidities as well. The increased presence of somatic symptoms in the medically ill suggests that behavioral interventions for anxiety should be offered routinely in the course of medical treatment of illnesses known to show a higher association with anxious symptoms, such as cardiac disease and COPD.

Factorial invariance testing of the selected model raised several issues that had to be addressed. First, it was necessary to develop a reliable and valid measure of medical

illness that would serve as the basis for dividing the full sample into the groups upon which the model would be evaluated. One of the considerations that influenced selection of the PRISM-E dataset for this study was the availability of sufficient data on medical illness to allow construction of such a measure. In fact, the screening and baseline surveys included information on a variety of medical questions, including healthcare utilization, pharmaceutical usage, self-perceptions of physical health, functional health status, and comorbid medical conditions (see Levkoff et al., 2004, for a full description).

A number of potential strategies were considered for utilizing the available data to develop the medical-illness measure. One strategy involved using individual medical-illness variables, such as the SF-36 Physical Health subscale, to increase power by allowing more of the sample group to be employed. However, each of the potential variables raised questions regarding its validity as a stand-alone indicator of medical illness. The SF-36 Physical Health subscale, for example, could be criticized for relying solely on self-reported perceptions of health. Reports of medication usage raised a similar issue of veracity as well as proving to be too heterogeneous to draw clear conclusions from. The Cornell Healthcare Utilization Scale measures hospital admissions and outpatient treatment utilization. This option would likely have produced a negatively skewed distribution of scores, given anecdotal reports that hospitalization generally implies an acute illness state (Lee, personal communication). This type of distribution would have failed to lend concurrent validity to the current approach, although the issue would have been a statistical one, rather than actual disconfirmation of the survey findings.

In an attempt to establish convergent validity, several strategies were explored that would combine the existing variables into a medical-illness severity or chronicity variable by employing an interaction or cross-tabulation strategy (for example, see Sheikh, Cassidy, Doriaswamy, et al. 2004). Unfortunately, employing such strategies with the study sample produced subsamples that lacked sufficient power to adequately test the proposed models. Therefore, the decision was made to utilize a single measure, the summed medical-illness checklist, to define the construct of interest. This strategy maximized statistical power by allowing use of the full sample. Simply summing the number of medical conditions present in participants, however, failed to provide information regarding the variables of interest in this study (i.e., illness severity, chronicity, progressiveness, and threat).

To address this issue, a weight was assigned to each medical condition in the sample, indicating the level of each variable of interest. A summary of each condition with the weights added would then allow assessment of severity, threat, chronicity, and/or progressiveness. It was suggested that these weights might be generated by obtaining a consensus rating of each illness category on the measures of interest by a sample of persons who could be considered to have authoritative knowledge regarding these medical conditions (Lee, personal communication, 2006). This strategy has been employed in similar studies where illness severity was a variable of interest (Farley & Hill, 2005; Chawistiak, Rosenheck, McEvoy et al.,2006). Physician rating of illness severity and chronicity forms the basis for well-established measures of illness severity and chronicity, such as the Cumulative Illness Rating Scale (Linn, Linn, & Gurel, 1968). A survey (see Appendix) was administered to a sample of masters-level nursing students,

who were considered to be familiar with both the disease categories in our checklist and the variables of interest. Tests of inter-rater reliability conducted with this sample indicated that the survey participants reached an acceptable level of agreement in rating the illness on each variable. However, the homogenous nature of the survey sample calls any statement of reliability into question. The nursing students surveyed primarily come from an acute-care hospital background. Nurses from other settings, such as long-term care or community practice, may produce very different ratings of these illnesses, based on their perspective (Steffen, personal communication). Healthcare professionals from other disciplines (e.g., medical doctors) and family caregivers may offer still more variation in ratings. Considering this variation in future studies would add external validity to our weights. This weighting system also limited the utility of our results in the sense that it rates levels of severity, threat, chronicity, and progressiveness by condition. However, this approach fails to account for individual differences between participants on the variables of interest. Cross-validation of this measure with SF-36 or Cornell Scale data would help to address this issue and lend a degree of concurrent validity to our assumptions regarding medical illness.

The decision to create variables based on combined constructs of severity/threat and chronicity/progressiveness was based on a series of Pearson product-moment correlations looking at the relationships between the four constructs within each illness category. Results of this analysis revealed high correlations between severity and threat ratings for each illness, as well as high correlation between chronicity and progressiveness ratings. One could conceptualize that the constructs of severity and threat might be related, as increases in severity of an illness would logically increase the threat

associated with the condition. Similarly, both chronicity and progressiveness refer to changes in the disease process over time. Diseases that are more likely to persist over time (chronic disease) could be expected to be more likely to increase in severity over time as well (progressive illness). Given the similarity of patterns of variance based on the combined weightings evaluated, it would be expected that invariance testing using weights based on each individual construct would yield similar results.

Although the nature of the sample group offers a number of advantages for the generalizability of our results, there are also several limiting factors to be noted. The sample group consisted of older adults who sought help at primary-care clinics, and who were willing to participate in the original study. While the literature suggests that primary care is a preferred point of contact for older adults, there may be qualitative differences between those elders who seek help in this manner and those who would present to other providers, such as mental health practitioners, clinics, and emergency rooms, as well as those who do not seek help for their symptoms. It is possible that those potential participants who declined to participate may also differ in important ways from those who did participate. Exclusion criteria for the final sample group limits the generalizability of the study at both ends of the spectrum of psychopathology. Participants who did not meet baseline criteria for anxiety, depressive, and substance use disorders were excluded from the original study. Thus, the study sample did not allow us to look at persons who exhibited subsyndromal anxiety and depressive symptoms. It is crucial to include these persons in future studies, given the prevalence of symptomatology in this population that falls short of DSM-IV diagnostic criteria, but nevertheless results in significant distress and impairment. Conversely, potential

participants who were already receiving treatment for an anxiety or mood disorder, or had diagnoses of hypomanic or psychotic disorders, were also excluded. This further restricted the range of psychopathology in the sample group. Additionally, the observed variables in our models were created by either employing existing factor analyses (in the case of the BAI and CES-D variables) or by summing MINI symptom questions associated with general anxiety and depression factors. This method does not provide information about the relationship of specific DSM disorders to the latent variables. Additionally, this method limits the validity of the latent variables to the reliability and validity of the observed measures. An important replication of this study would employ different measures to represent the latent variables. In particular, the measures selected should address some of the salient critiques of established symptom measures with older adults. For example, the BAI has often been criticized for its over-reliance on somatic symptoms of anxiety, which creates confounds when employed in chronically ill populations.

This study represents an important first step in elucidating the relationship between anxiety, depression, and comorbid medical conditions. It will be necessary, however, to replicate these findings in a sample that addresses the limitations of the current study. Also, these results are based on cross-sectional data. Examining these relationships in a longitudinal design is a needed extension of this research, to further clarify the nature of these relationships as medical illness persists and progresses. Future studies should employ observed variables that reflect specific factors and disorder criteria. Additionally, reliable and valid measures of the medical-illness constructs should be employed. Also, future studies should explore anxiety and depression comorbidity

within individual disease states. Finally, integrated models that specify the relationship between anxiety, depression, and medical illness should be posited and tested.

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Table 1. *Comparison of key demographic variables between final sample (N = 2,163) and participants excluded for missing data[1] (n = 87)*

	Final sample		Excluded cases	
	N	%	N	%
Gender[2]				
Male	1,622	76.0	68	78.1
Female	513	24.0	19	21.9
Age				
65-74	1,295	59.9	60	69.3
75 +	868	40.1	27	30.7
Ethnicity[3]				
White	1217	56.3	43	49.3
Black	512	23.7	28	32.5
Asian	107	4.9	6	6.5
Hispanic	292	13.5	8	9.1
Native American/Other/Refused	56	2.6	2	2.6
Marital Status[2]				
Married/partnered	1089	50.6	39	45.3
Separated/divorced	440	20.4	14	16.0
Widowed	510	23.7	23	26.7
Never married	115	5.3	11	12.0
Education[2]				
Less than high school	916	42.3	46	53.3
High school/GED	497	23.0	16	18.7
Some college or higher	740	34.2	23	26.6
Financial Status[2]				
Cannot make ends meet	436	20.2	22	25.3
Enough to get by	977	45.2	53	60.0
Comfortable	707	32.7	12	13.3

NOTE: 1- Exclusion based on missing responses to MINI question M1(" Have you worried excessively or been anxious about several things over the past six months?") 2- Totals less than 2,163 due to option to refuse question. 3- Total exceeds 2,163 because multiple responses were allowed.

Table 2. *Comparison of key variables of interest between final sample (N = 2,163) and participants excluded for missing data (n = 87).*

	Confidence Intervals (95 %)			
	Final sample		Excluded cases	
Variable name	Low	High	Low	High
CES-D well-being	1.03	15.03	-0-	13.08
CES-D somatic	-0-	12.78	0.31	21.51
CES-D anhedonia	-0-	10.99	-0-	12.63
CES-D dysphoria	-0-	16.77	-0-	21.14
BAI anxious cognitions	-0-	8.58	-0-	21.40
BAI somatic arousal	-0-	10.31	-0-	32.60
MINI summed anxiety items	-0-	12.19	2.82	13.84
MINI summed depression	-0-	9.89	1.72	10.62

NOTE: CES-D—Center for Epidemiological Studies-Depression Scale; BAI—Beck Anxiety Inventory; MINI—Mini International Neuropsychiatric Interview.

Table 3. *Mini International Neuropsychiatric Interview (MINI) diagnostic modules. (From Sheehan et al., 2002).*

Module	Time Frame	DSM-IV Code
Major Depressive Episode	Current (past two weeks)	296.20-296.26
With melancholic features		296.30-296.36
Dysthymia	Current (two years)	300.4
Suicidality	Current (past month)	
Manic Episode	Current/Past	296.00-296.06
Hypomanic Episode	Current/Past	296.80-296.89
Panic Disorder	Current/Lifetime	300.01-300.21
Agoraphobia	Current	300.22
Social Phobia	Current (past month)	300.23
Obsessive-Compulsive	Current (past month)	300.3
PTSD	Current (past month)	309.81
Alcohol Dependence	Past 12 months	303.9
Alcohol Abuse	Past 12 months	305.00
Substance Dependence	Past 12 months	304.00-.90/305.20-.90
Substance Abuse	Past 12 months	304.00-.90/305.20-.90
Psychotic Disorders	Lifetime/Current	295.10-295.90/297.1/ 297.3/293.81/293.82/ 293.89/298.8/298.9
Mood disorder w/Psychotic Features	Current	296.24
Anorexia Nervosa	Current (past 3 months)	307.1
Bulimia Nervosa	Current (past 3 months)	307.51
Generalized Anxiety Disorder	Current (past 6 months)	300.02
Antisocial PD	Lifetime	301.7

Table 4. *MINI item composition of observed variables.*

Variable	Items and descriptions
MINI Positive Affect (MP)	E 2. In the past two weeks, have you been less interested in most things, or less interested in things you used to enjoy most of the time? E 3 (d). Did you feel tired or without energy almost every day? F 3 (c). Did you feel tired or without energy? H 2 (d).Did you feel tired or without energy almost every day?
MINI Negative Affect (MN)	E 1. Have you been consistently depressed or down, most of the day, nearly every day, for the past two weeks? E 3 (e). Did you feel worthless or guilty almost every day? F 3 (d). Did you lose your self-confidence? H 2 (e). Did you feel worthless or guilty almost every day?
MINI Physiological Arousal (MPA)	L 4 (a). Skipping, racing, or pounding heart L 4 (b). Sweaty or clammy hands L 4 (c). Trembling or shaking L 4 (d). Shortness of breath L 4 (e). Choking or lump in throat L 4 (f). Chest pain L 4 (g). Nausea, stomach pain, diarrhea L 4 (h). Dizziness L 4 (l). Tingling or numbness in body parts L 4 (m). Hot or cold sensations
MINI Non-specific Anxiety (MNX)	L 4 (i). Feelings of unreality or detachment L 4 (j). Losing control or "going crazy" L 4 (k). Fear of dying M 1 Excessive worry M 2 Difficult to control worrying M 3 (a). Restless, keyed-up, on edge M 3 (b). Tense
MINI Depression (MD)	Sum of items in Modules E, F, H
MINI Anxiety (MX)	Sum of items in Modules L, M

NOTE: Module E—Major Depression and depression symptoms; Module F—Dysthymia; Module H—Depression history; Module L—Panic disorder; Module M—Generalized anxiety

Table 5. *Medical history checklist from PRISM-E baseline (N = 2,163).*

Disease category	n	%
Diabetes	546	25.2
Hypertension	1389	64.2
Heart trouble	756	35.0
Vascular disease or atherosclerosis	711	32.9
Any type of paralysis	93	4.3
Any effects of stroke	162	7.5
Arthritis	1385	65.1
Stomach ulcer	231	10.7
COPD, emphysema, asthma	385	17.8
Glaucoma	315	14.6
Liver disease	87	4.0
Gall bladder	78	3.6
Kidney disease	202	9.3
Bladder problem	430	19.9
Hip fracture	34	1.6
Other fractures	130	6.0
Anemia	155	7.2
Parkinson's disease	43	2.0
Sleep problems	1157	53.5
Skin disorders	573	26.5
Cancer	262	12.1

NOTE: Frequencies, percentages not cumulative.

Table 6. *Mean ratings of severity, threat, chronicity, and progressiveness for disease categories, from survey of MSN students (N = 63)*

Disease category	Severity		Threat		Chronicity		Progressiveness	
	M	SD	M	SD	M	SD	M	SD
Diabetes	2.98	1.33	2.15	1.07	4.78	0.55	3.53	1.13
Hypertension	2.37	1.09	2.50	1.20	4.50	0.87	3.02	1.20
Heart trouble	3.65	1.15	3.90	1.05	4.68	0.62	3.67	1.08
Vascular disease or atherosclerosis	3.03	1.10	2.97	1.10	4.22	0.96	3.55	1.08
Any type of paralysis	3.72	1.41	2.17	1.22	4.15	1.27	2.62	1.33
Any effects of stroke	4.23	0.96	3.35	1.15	4.05	0.98	2.70	1.20
Arthritis	1.72	1.07	1.38	0.90	4.18	1.12	3.78	1.19
Stomach ulcer	1.87	0.85	1.45	0.81	2.67	1.17	1.97	0.88
COPD, emphysema, asthma	3.78	1.03	3.75	1.07	4.50	0.81	4.12	0.98
Glaucoma	1.47	0.70	1.22	0.52	3.03	1.56	2.50	1.95
Liver disease	3.40	1.12	3.40	1.03	4.02	1.03	3.67	1.05
Gall bladder	2.93	1.29	1.68	0.83	2.10	1.02	2.07	1.07
Kidney disease	3.62	1.07	3.13	1.20	3.97	1.16	3.63	1.19
Bladder problem	2.13	1.05	1.55	0.81	2.53	1.08	2.30	1.10
Hip fracture	4.00	1.25	1.97	1.08	2.80	1.27	2.03	1.17
Other fractures	2.80	1.37	1.58	0.94	2.10	1.10	1.53	0.89
Anemia	2.27	1.23	1.77	0.90	2.95	1.37	2.03	1.12
Parkinson's disease	2.97	1.34	2.28	1.37	4.32	1.08	4.12	1.24
Sleep problems	1.63	0.92	1.27	0.63	2.55	1.38	2.03	1.06
Skin disorders	1.47	0.82	1.25	0.65	2.30	1.38	1.98	1.14
Cancer	4.30	1.01	4.18	0.92	4.45	0.93	3.68	1.14
Cataracts	1.40	0.74	1.21	0.64	2.50	1.35	2.42	1.38

NOTE: Severity ratings—1= 0-20 % likelihood of hospitalization, 2 = 21-40 % likelihood, 3 = 41-60 % likelihood, 4 = 61-80 % likelihood, 5 = 81-100% likelihood; Threat Ratings--1 = 0-20 % likelihood of death, 2 = 21-40% likelihood, 3 = 41-60 % likelihood, 4 = 61-80 % likelihood, 5 = 81-100% likelihood; Chronicity Ratings--1 = 0-20 % likelihood of continued illness, 2 = 21-40% likelihood, 3 = 41-60 % likelihood, 4 = 61-80 % likelihood, 5 = 81-100% likelihood; Progressiveness Ratings--1 = 0-20 % likelihood of increasing severity, 2 = 21-40% likelihood, 3 = 41-60 % likelihood, 4 = 61-80 % likelihood, 5 = 81-100% likelihood.

Table 7. *Intercorrelations for observed variables for all models.*

	1	2	3	4	5	6	7	8	9	10	11	12
1. BAC	--											
2. BS	.78	--										
3. MX	.65	.59	--									
4. MPA	.26	.27	.60	--								
5. MNX	.23	.20	.54	.55	--							
6. MD	.26	.24	.28	.12	.09	--						
7. MP	.18	.19	.19	.06	.05[1]	.79	--					
8. MN	.24	.22	.21	.06	.03[2]	.74	.50	--				
9. CS	.31	.30	.28	.12	.10	.71	.63	.55	--			
10. CA	.23	.22	.24	.08	.07	.61	.50	.55	.57	--		
11. CD	.31	.25	.27	.11	.11	.67	.54	.65	.73	.65	--	
12. CW	-.23	-.22	-.24	-.08	-.07	-.61	-.50	-.55	-.58	-1.00	-.65	--

NOTE: 1—$p \leq .05$; 2—Non-significant. All other correlations significant at $p \leq .01$. BAC—BAI anxious cognitions; BS—BAI somatic; MX—MINI summed anxiety; MPA—MINI physiological arousal; MNX—MINI non-specific anxiety; MD—MINI summed depression; MP—MINI positive affect; MN—MINI negative affect: CS—CES-D somatic; CA—CES-D anhedonia; CD—CES-D dysphoria; CW—CES-D well-being.

Table 8. *Descriptive statistics for study variables (N =2163).*

			Range	
Variable name	M	SD	Low	High
CES-D well-being	8.04	3.58	-0-	12.00
CES-D somatic	7.40	5.40	-0-	21.00
CES-D anhedonia	3.96	3.58	-0-	12.00
CES-D dysphoria	6.19	5.41	-0-	21.00
BAI anxious cognitions	1.90	3.42	-0-	20.00
BAI somatic arousal	3.80	6.53	-0-	31.00
MINI physiological arousal	0.36	1.52	-0-	10.00
MINI nonspecific anxiety	0.12	0.74	-0-	7.00
MINI positive affect	1.29	0.87	-0-	3.00
MINI negative affect	0.82	0.80	-0-	3.00
MINI summed anxiety items	2.45	3.72	-0-	22.00
MINI summed depression	4.44	2.78	-0-	17.00

NOTE: CES-D—Center for Epidemiological Studies-Depression Scale; BAI—Beck Anxiety Inventory; MINI—Mini International Neuropsychiatric Interview.

Table 9. *Fit indices for measurement models with full PRISM-E sample (N = 2,163).*

Model	χ^2	df	χ^2/df	GFI	AGFI	RMSEA
Tripartite	10.397*	3	3.466	0.998	0.989	0.034
Burns-Eidelson	588.542**	33	17.835	0.955	0.910	0.082
Hierarchical	21.255**	5	4.251	0.997	0.986	0.039

*NOTE: * $p < 0.05$; ** $p < 0.01$.*

Table 10. *Fit indices for structural models with full PRISM-E sample (N = 2,163).*

Model	χ^2	df	χ^2/df	GFI	AGFI	RMSEA
Tripartite[1]	10.397*	3	3.466	0.998	0.989	0.034
Burns-Eidelson	5489.248**	34	161.449	0.750	0.596	0.272
Hierarchical	22.737**	6	3.790	0.997	0.988	0.036

*NOTE: * $p < 0.05$; ** $p < 0.01$. [1]Statistics for this model are same as for measurement model, since all latent variables are first-order.*

Table 11. *Fit test summary for invariance between low and high medical illness severity/threat subsamples.*

Model description	χ^2	*df*	$\Delta\chi^2$	Δdf	*p*
1. Hypothesized baseline model	36.437	12	---	---	---
2. Factor loadings, variances and covariances constrained equal	260.308	21	223.871	9	0.0001
3. Factor loadings constrained equal	55.667	16	19.230	4	0.0007
4. Depression factor loadings constrained equal	36.474	13	0.037	1	NS
5. Depression factors, plus all anxiety factors *except BS* constrained equal	41.882	15	5.445	3	NS
6. Depression factors, plus all anxiety factors *except MX* constrained equal	54.924	15	18.487	3	0.0003
7. Depression factors, plus all anxiety factors *except BAC* constrained equal	51.153	15	14.716	3	0.0021

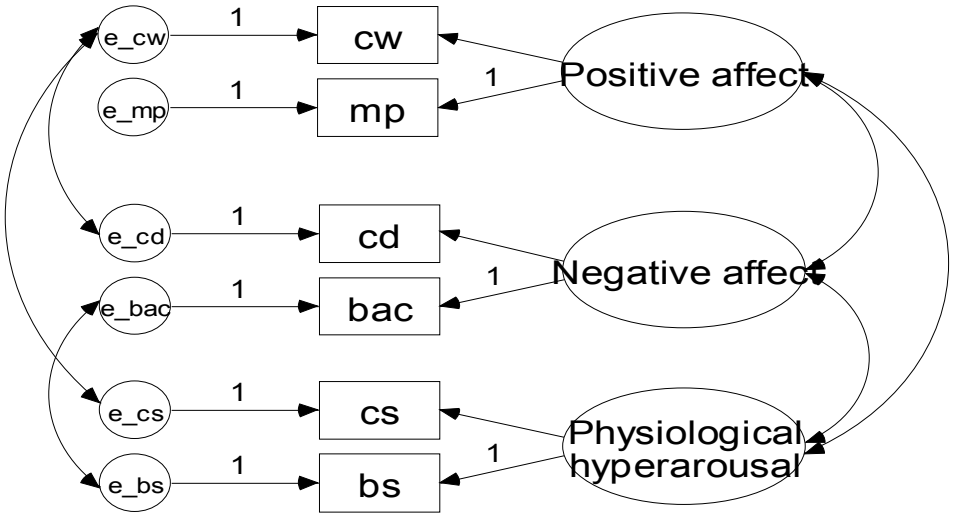
NOTE: $\Delta\chi^2$ *= difference in* χ^2 *values.* Δdf *= difference in degrees of freedom. All comparisons to Model 1.*

Table 12. *Fit test summary for invariance between low and high medical illness chronicity/progressiveness subsamples.*

Model description	χ^2	*df*	$\Delta\chi^2$	Δdf	*p*
1. Hypothesized baseline model	36.281	12	---	---	---
2. Factor loadings, variances and covariances constrained equal	278.582	21	242.300	9	0.0001
3. Factor loadings and latent paths constrained equal	98.143	18	61.862	6	0.0001
4. Anxiety factor loadings and latent paths constrained equal	76.409	17	40.128	1	0.0001
5. Depression factor loadings and latent paths constrained equal	41.882	15	5.445	3	0.0001
6. Depression factors only constrained equal	36.482	13	0.539	3	NS
7. Depression factors, plus all anxiety factors *except BAC* constrained equal	50.540	15	14.259	3	0.0026
8. Depression factors, plus all anxiety factors *except MX* constrained equal	55.023	15	18.742	3	0.003
9. Depression factors, plus all anxiety factors *except BS* constrained equal	39.946	15	3.665	3	NS

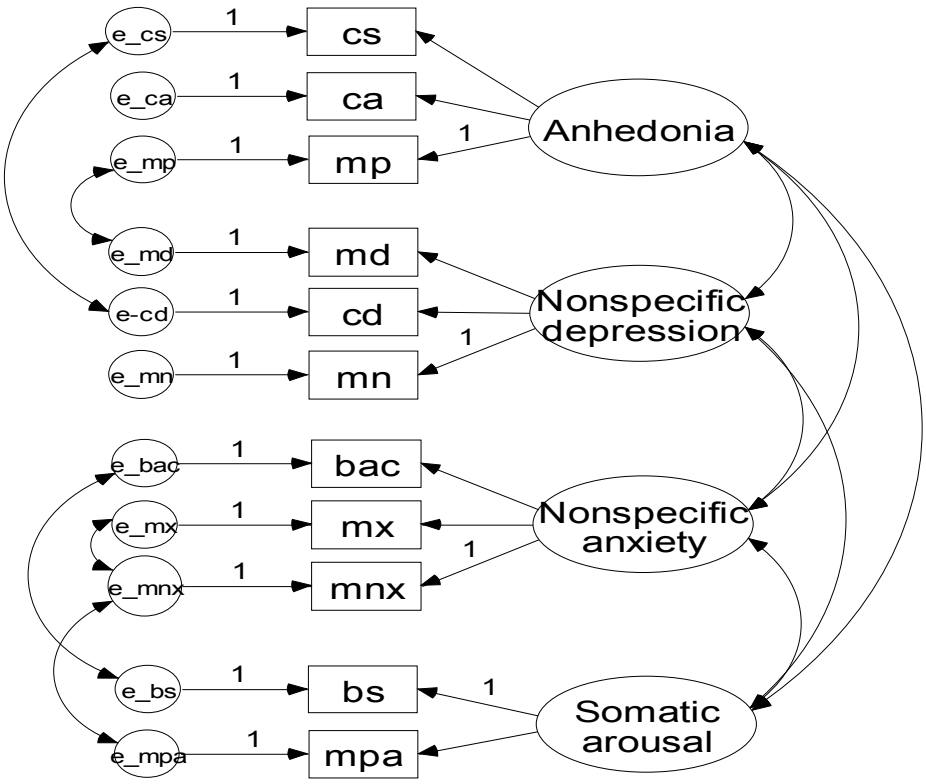
NOTE: $\Delta\chi^2$ *= difference in* χ^2 *values.* Δdf *= difference in degrees of freedom. All comparisons to Model 1.*

Figure 1. *Measurement model for the Cook et al. (2004) tripartite structural model.*



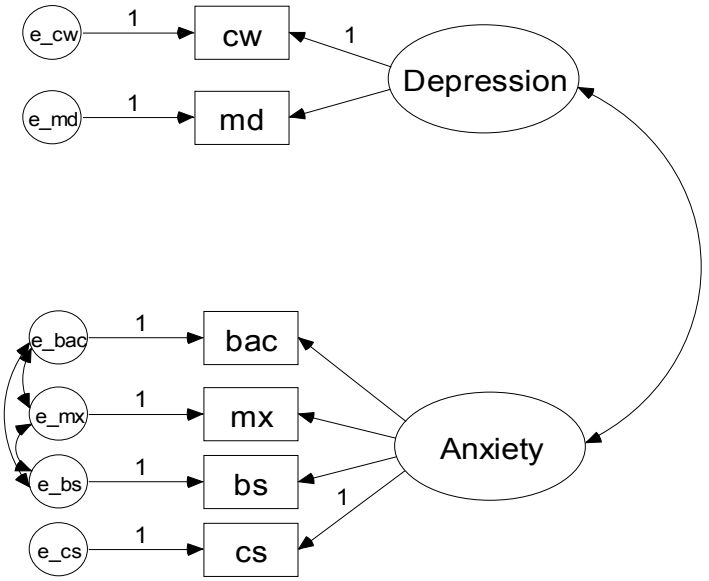
NOTE: All paths are significant $p \leq .01$. CW—CES-D 'well-being' items; MP—MINI 'positive affect' items; CD—CES-D 'dysphoria' items; BAC—BAI 'anxious cognition's items; CS—CES-D 'somatic' items; BS—BAI 'somatic arousal' items.

Figure 2. *Measurement model for Burns and Eidelson's (1998) two-factor model.*



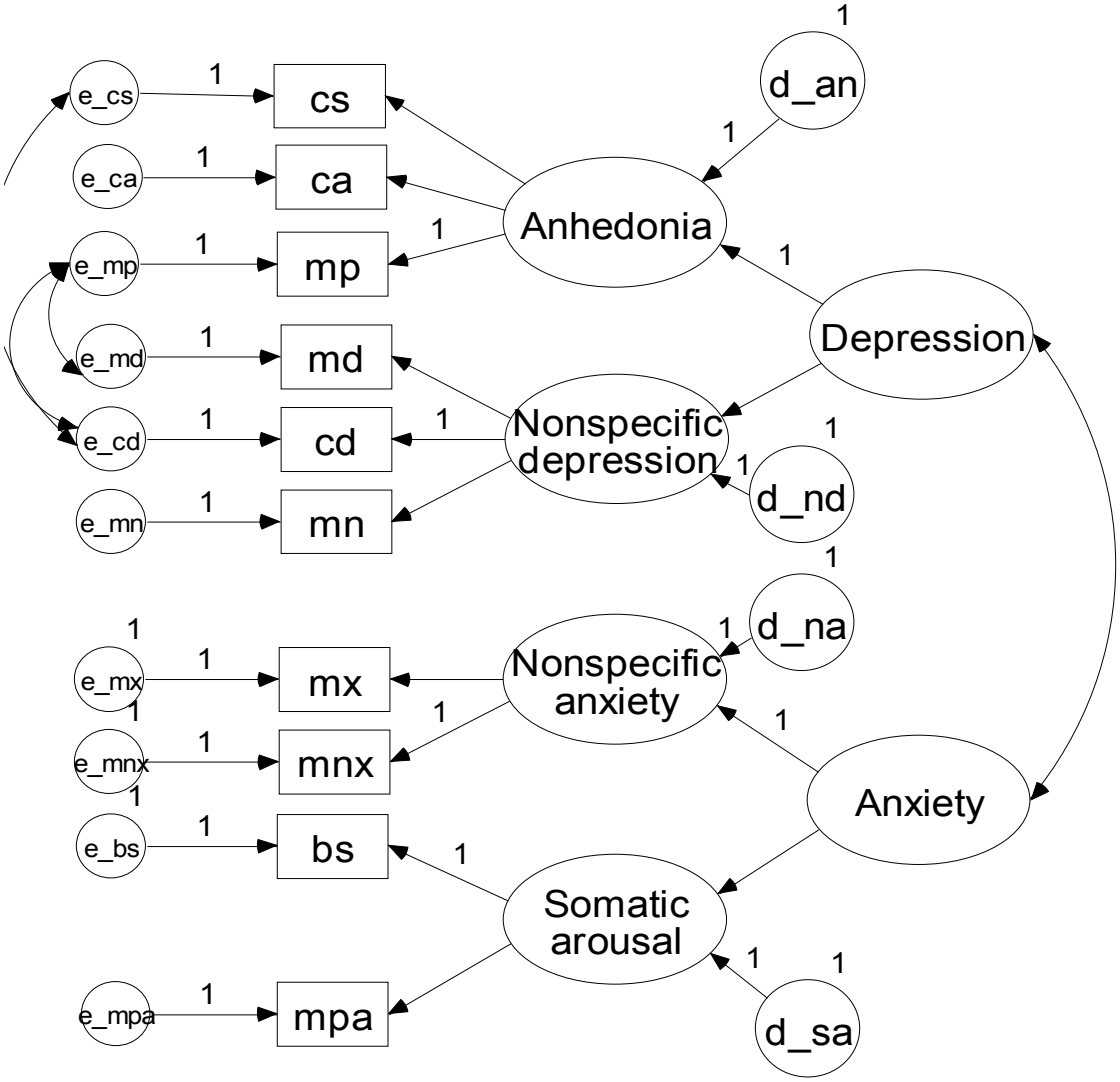
NOTE: All paths significant at p ≤ .01. CS—CES-D somatic items; CA—CES-D anhedonia items; MP—MINI items indicating positive affect; MD—MINI summed depression items; CD—CES-D dysphoria items; MN—MINI negative affect items; BAC—BAI anxious cognitions items; MX—MINI summed anxiety items; MNX—MINI non-specific anxiety items; BS—BAI somatic arousal items; MPA—MINI items indicating physiological arousal.

Figure 3. *Measurement model for Meeks et al. (2003) hierarchical three-factor model.*



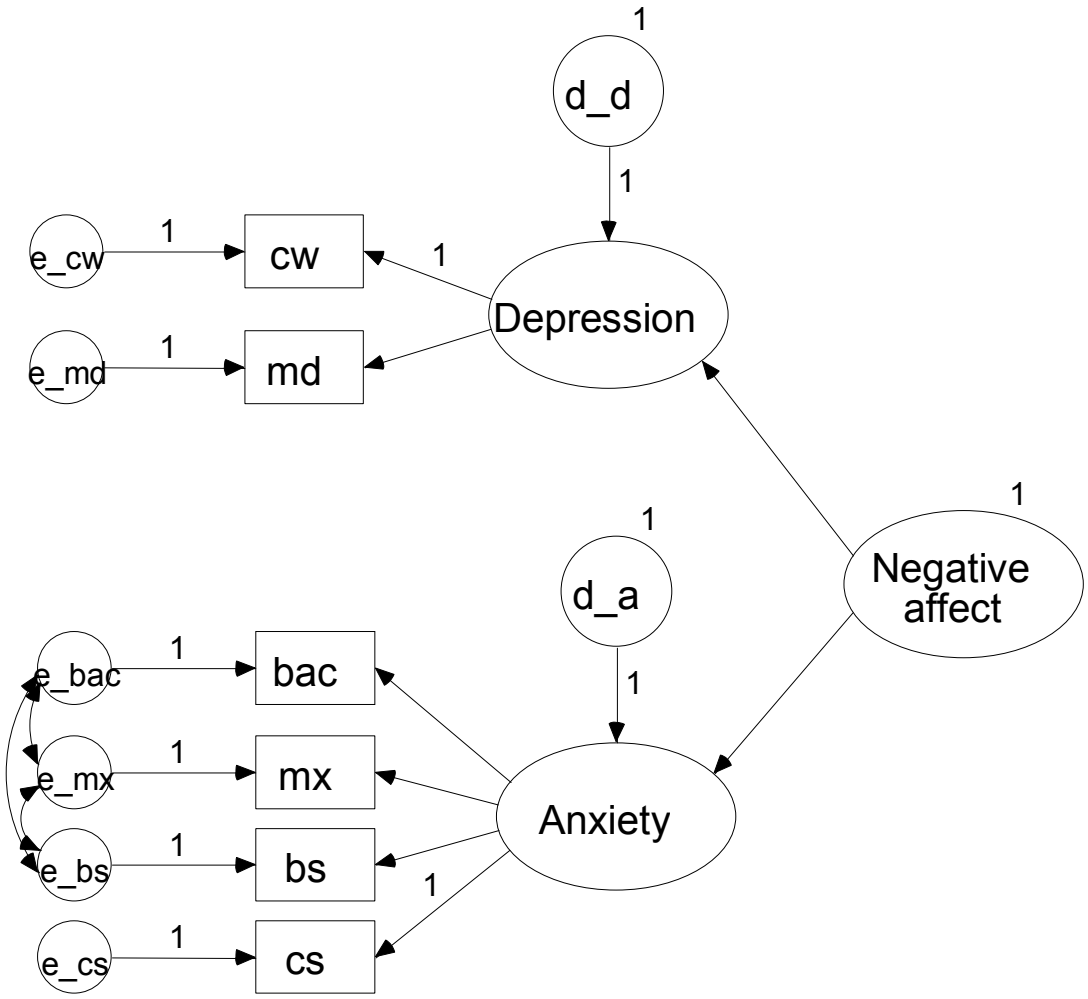
NOTE: All paths significant at p ≤ .01. CW—CES-D well-being; MD—MINI depression items; BAC—BAI anxious cognitions; MX—MINI anxiety items; BS-BAI somatic arousal; CS—CES-D somatic.

Figure 4. *Structural two-factor model from Burns and Eidelson (1998).*



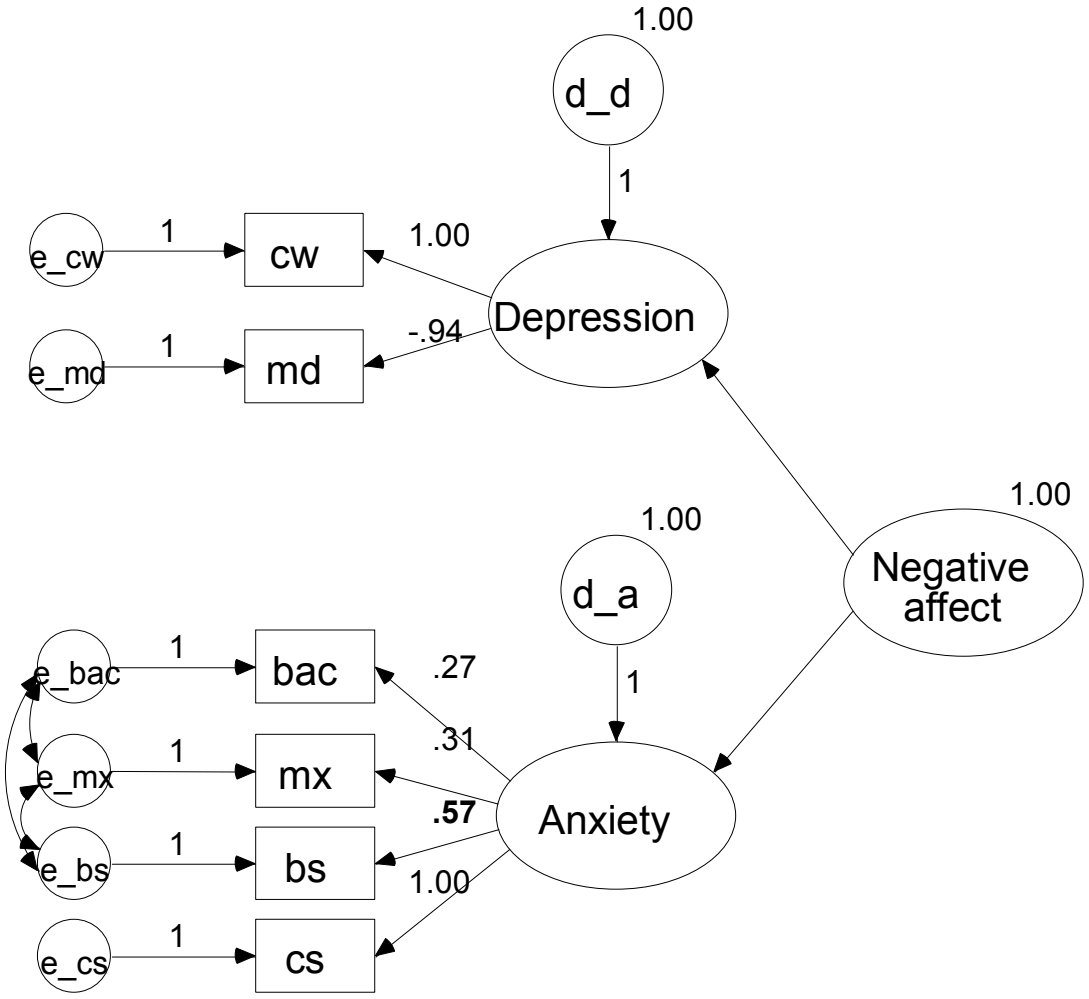
NOTE: All paths significant at $p \leq .01$. CS—CES-D somatic items; CA—CES-D anhedonia items; MP—MINI items indicating positive affect; MD—MINI summed depression items; CD—CES-D dysphoria items; MN—MINI negative affect items; BAC—BAI anxious cognitions items; MX—MINI summed anxiety items; MNX—MINI non-specific anxiety items; BS—BAI somatic arousal items; MPA—MINI items indicating physiological arousal.

Figure 5. *Structural model for hierarchical model (Meeks et al., 2003).*



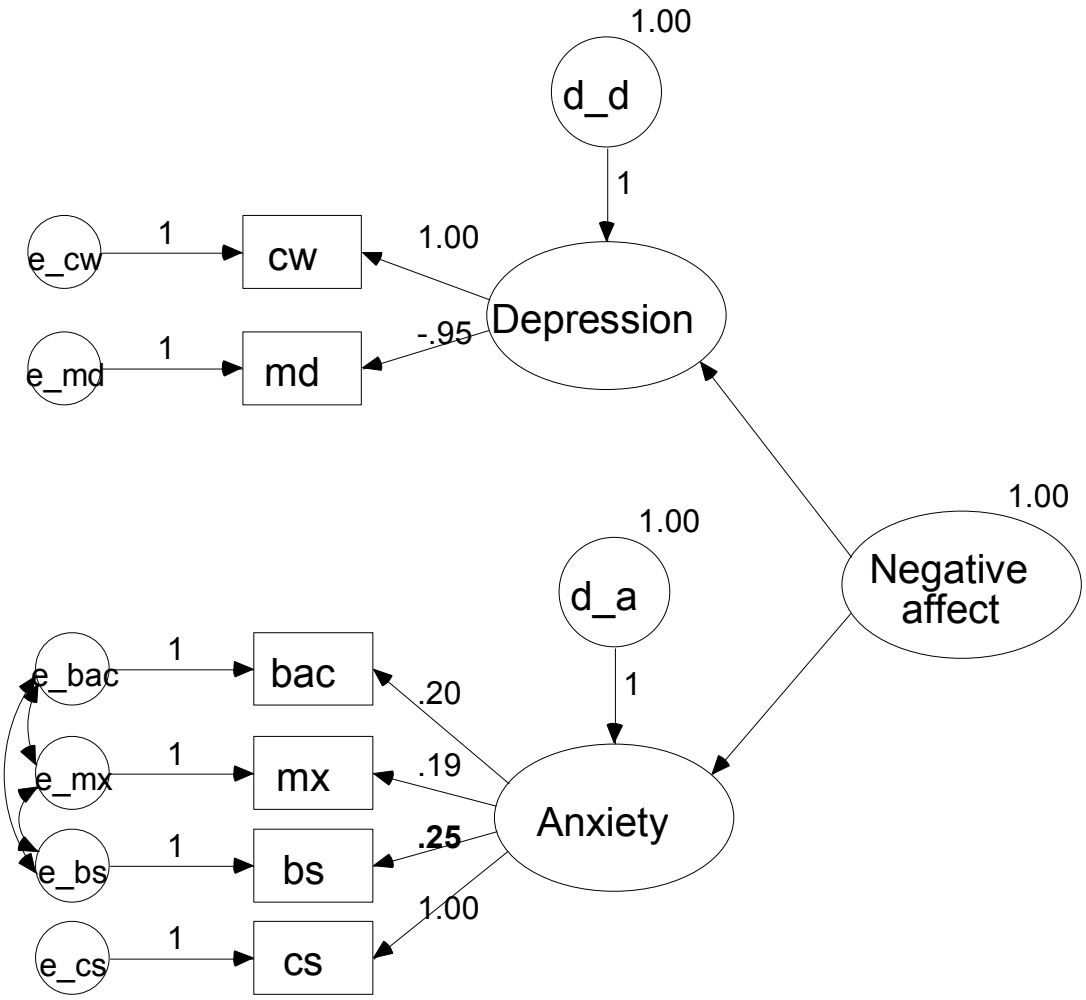
NOTE: All paths significant at p ≤ .01. CW—CES-D well-being; MD—MINI depression items; BAC—BAI anxious cognitions; MX—MINI anxiety items; BS-BAI somatic arousal; CS—CES-D somatic.

Figure 6. *Hierarchical model displaying correlations for regression paths-high severity/threat sample (n = 750).*



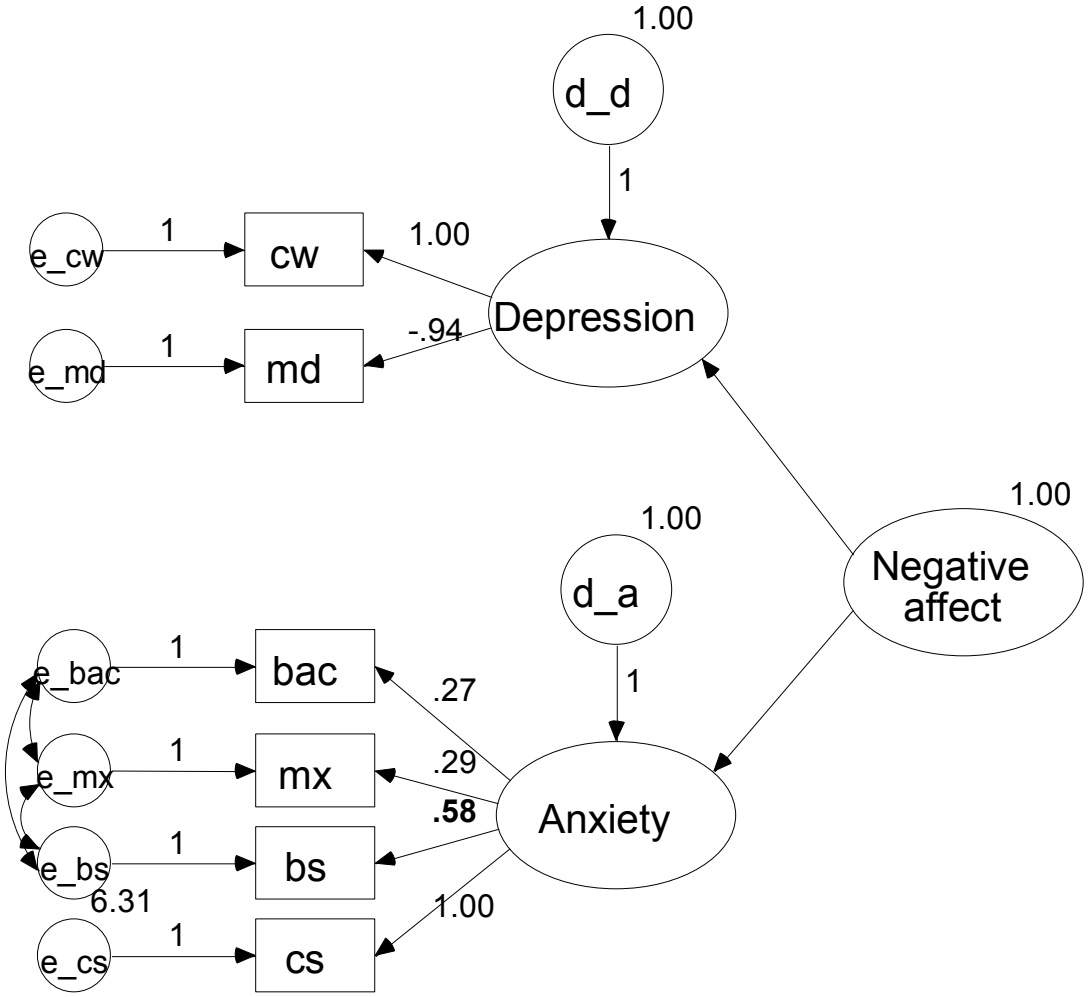
NOTE: All paths significant at p ≤ .01. CW—CES-D well-being; MD—MINI depression items; BAC—BAI anxious cognitions; MX—MINI anxiety items; BS-BAI somatic arousal; CS—CES-D somatic.

Figure 7. *Hierarchical model displaying correlations for regression paths-low severity/threat sample (n = 705).*



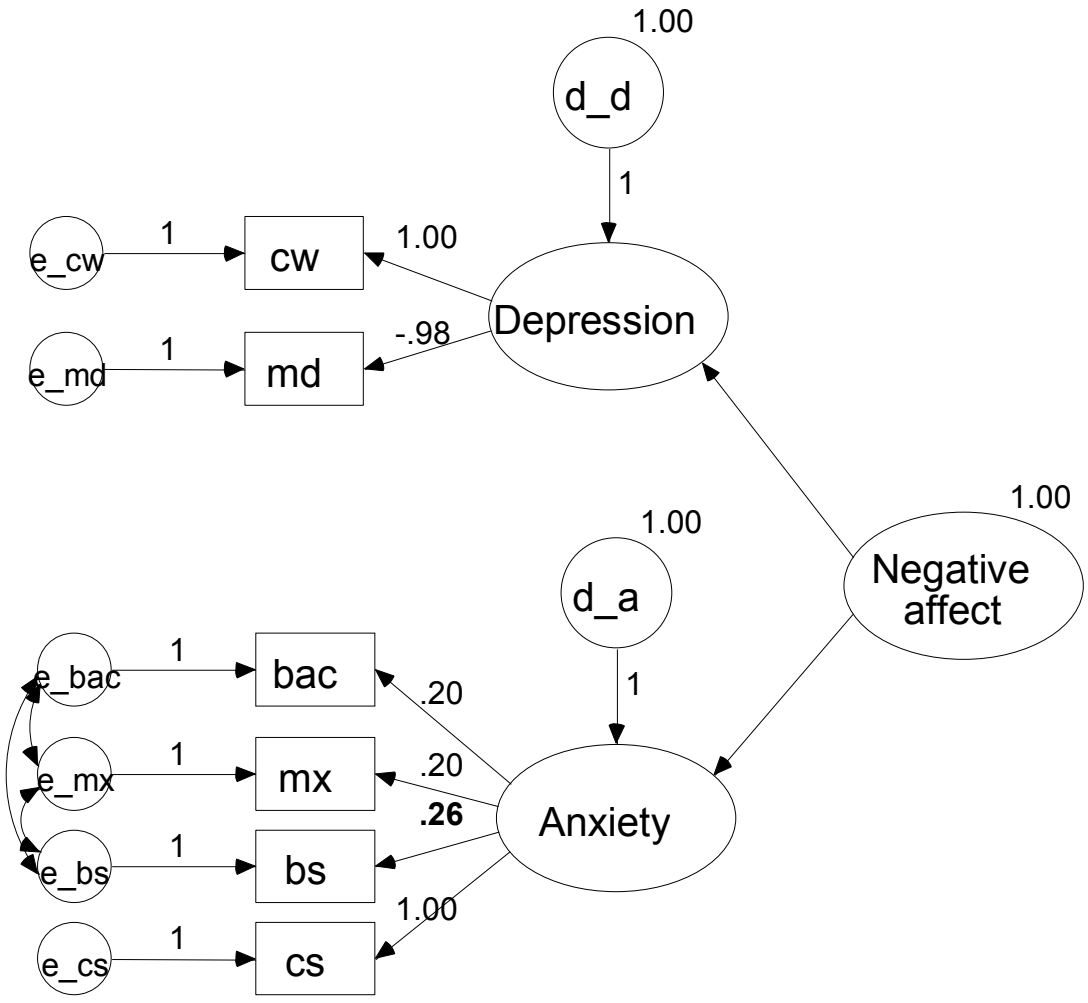
NOTE: All paths significant at p ≤ .01. CW—CES-D well-being; MD—MINI depression items; BAC—BAI anxious cognitions; MX—MINI anxiety items; BS-BAI somatic arousal; CS—CES-D somatic.

Figure 8. *Hierarchical model displaying correlations for regression paths-high chronicity/progressiveness sample (n = 733).*



NOTE: All paths significant at p ≤ .01. CW—CES-D well-being; MD—MINI depression items; BAC—BAI anxious cognitions; MX—MINI anxiety items; BS-BAI somatic arousal; CS—CES-D somatic.

Figure 9. *Hierarchical model displaying correlations for regression paths-low chronicity/progressiveness sample (n = 716).*



NOTE: All paths significant at p ≤ .01. CW—CES-D well-being; MD—MINI depression items; BAC—BAI anxious cognitions; MX—MINI anxiety items; BS-BAI somatic arousal; CS—CES-D somatic.

Appendix
ILLNESS PERCEPTIONS SURVEY

Thank you for participating in this survey. We are interested in your perceptions, as a healthcare provider, of the **severity, threat level, chronicity, and progressiveness** of a number of diagnostic categories commonly observed in older adults. For this survey, the term '**older adults**' will be defined as age 65 or older.

Severity is defined as the likelihood that a person suffering from this condition would require one or more days of hospitalization. For each category, use the following rating scale:

1 = 0-20 % likelihood of hospitalization
2 = 21-40 % likelihood
3 = 41-60 % likelihood
4 = 61-80 % likelihood
5 = 81-100% likelihood

Threat level is defined as the likelihood that sequelae of diseases in this category would result in the death of the patient. For each category, use the following scale:

1 = 0-20 % likelihood
2 = 21-40% likelihood
3 = 41-60 % likelihood
4 = 61-80 % likelihood
5 = 81-100% likelihood

Chronicity is defined as the likelihood that the disease will require medical treatment, beyond that which the patient could independently manage, for 6 months or longer.
For each category, use the following scale:

1 = 0-20 % likelihood
2 = 21-40% likelihood
3 = 41-60 % likelihood
4 = 61-80 % likelihood
5 = 81-100% likelihood

Progressiveness is defined as the likelihood that diseases in this category will increase in severity over time, regardless of treatment. For each category, use the following scale:

1 = 0-20 % likelihood
2 = 21-40% likelihood
3 = 41-60 % likelihood
4 = 61-80 % likelihood
5 = 81-100% likelihood

Disease category	Severity	Threat	Chronicity	Progressiveness
Diabetes	_____	_____	_____	_____
Hypertension	_____	_____	_____	_____
Heart disease	_____	_____	_____	_____
Vascular disease (peripheral or atherosclerosis)	_____	_____	_____	_____
Paralysis (any etiology)	_____	_____	_____	_____
Stroke	_____	_____	_____	_____
Arthritis	_____	_____	_____	_____
Stomach ulcer	_____	_____	_____	_____
COPD	_____	_____	_____	_____
Glaucoma	_____	_____	_____	_____
Cancer	_____	_____	_____	_____
Cataracts	_____	_____	_____	_____
Liver disease	_____	_____	_____	_____
Gall bladder	_____	_____	_____	_____
Kidney disease	_____	_____	_____	_____
Bladder problems	_____	_____	_____	_____
Hip fracture	_____	_____	_____	_____
Other fractures	_____	_____	_____	_____
Anemia	_____	_____	_____	_____
Parkinsons' disease	_____	_____	_____	_____
Sleep disorders	_____	_____	_____	_____
Skin conditions	_____	_____	_____	_____

Please answer the following demographic questions.

1. What is your age?

   1 = 18-30
   2 = 31-40
   3 = 41-50
   4 = 51-60
   5 = < 60 years

2. What is your level of clinical experience?

   1 = 0-1 years
   2 = 1-5 years
   3 = 5-10 years
   4 = 10-15 years
   5 = < 15 years

3. What is your identified race/ethnicity? (optional—for research purposes only)

   1 = African-American/Native African
   2 = Asian/Pacific Islander
   3 = Caucasian/European
   4 = Latin American/Hispanic
   5 = Native American/Alaskan
   6 = Biracial or multiracial

4. What is your identified gender? (optional—for research purposes only)

   1 = Male
   2 = Female