COMPARING THE MULTIDIMENSIONAL BEHAVIORAL HEALTH SCREEN TO THE PHQ-9 IN PREDICTING DEPRESSION-RELATED SYMPTOMATOLOGY IN A PRIMARY MEDICAL CARE SAMPLE

A thesis presented to the faculty of the Graduate School of Western Carolina University in partial fulfillment of the requirements for the degree of Master of Psychology, Clinical Concentration

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Kelsey,

Graduate school would be absolutely no fun without you.

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ABSTRACT

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Depression is the most common form of psychopathology affecting people in the US. It is commonly diagnosed and treated in primary medical care settings, creating a need for a reliable, quick self-report tool used for the assessment of depression in this context. There is a current shift in the way psychopathology is conceptualized, as the field transitions from a categorical, syndrome-based model to a dimensional model. This transition should be reflected in the assessment tool used within the primary care setting. The Multidimensional Behavioral Health Screen is being developed as a brief and efficient screening-level assessment tool for core psychopathology *components* (rather than *syndromes*), with a specific focus on depressive symptomatology. This study presents empirical evidence supporting the implementation of the MBHS as a reliable and valid mental health screener to be administered in primary care clinics.

INTRODUCTION

Assessment and Treatment of Depression

Depression is one of the most prevalent mental illnesses, with 6.7% of all U.S. adults experiencing at least one major depressive episode in their lifetime (NIMH, 2016). Women are particularly prone to experiencing depression, with roughly 8.5% of women in the US experiencing symptoms of depression (NIMH, 2016). Furthermore, depression is the leading cause of suicide, which accounts for 1.4% of all deaths worldwide, or 13.4 deaths per 100,000 people in the US. (WHO, 2017). The rate of suicide in the US has been increasing since 1999, creating a need for significant and immediate identification and interventions for people experiencing depressive symptoms (Kegler, Stone, & Holland, 2017).

Most people in the US who seek help for depression receive it from their primary care physician rather than a mental health professional (Magellen Healthcare, 2014). Depression is indicated as a reason for a visit to a primary care physician 10.3% of the time (CDC, 2017). In primary care settings, the Patient Health Questionnaire-9 (PHQ-9) is one of the most frequently used tools for assessing and diagnosing depression (Spitzer, Kroenke, & Williams, 1999). The PHQ-9 is a 9-item self-report questionnaire which mirrors the DSM-5 criteria for depression. For each item, participants answer on a scale of "0" (not at all) to "3" (nearly every day) how often they are bothered by the 9 symptoms of depression. See appendix B for a copy of the PHQ-9.

The PHQ-9 has been found to be psychometrically sound when comparing patient's scores to their eligibility for DSM-5 criteria for depression. One study which collected data on 580 participants found the internal reliability of the PHQ-9 to be excellent, with a Cronbach's α of 0.89 (Kroenke, Spitzer, Williams, 2001). The same study found the test-retest reliability of the

PHQ-9 to be very strong. The correlation between the results of the PHQ-9 and diagnosis arrived at after a structured clinical interview was 0.84, and the mean scores from each assessment were nearly identical (Kroenke, Spitzer, Williams, 2001).

While the PHQ-9 is a reliable and valid screening tool psychometrically, it still exhibits shortcomings when used in a clinical setting; specifically, it lumps many heterogeneous symptoms into a single syndrome. Furthermore, since a depression diagnosis requires presence of only five of the nine symptoms listed in the DSM-5, it is possible for two people diagnosed with clinical depression to share only one symptom. This is problematic as it does not identify and parse out people who will benefit from any one of the many different treatments for depressive symptoms.

Depression is commonly treated with a selective serotonin reuptake inhibitor (SSRI) medication, targeting a depletion of the neurotransmitter serotonin in the central nervous system (Delgado & Moreno, 2000). The use of SSRIs as a treatment option is based on the monoamine theory, which suggests that the pathophysiologic source of depression is an insufficient supply of serotonin, norepinephrine, and/or dopamine in the synapses of the brain (Coppen, 1967). SSRIs counteract this effect by blocking the reuptake of serotonin, thus increasing the neurotransmitter in the synapse.

Advancing beyond the monoamine theory, more recent clinical studies have provided evidence of neuronal atrophy in response to stress and depression. Prolonged exposure to stress results in the release of glucocorticoids, such as cortisol, in the synapses (Duman, Malberg, Nakagawa, D'Sa, 2000). The oversupply of cortisol may be sufficient to cause damage to brain cells. In addition to the detrimental effect of cortisol, stress is also found to diminish brain-

derived neurotrophic factor (BDNF) in the hippocampus (Smith et al., 1995). Decreased levels of BDNF are found to decrease the survival and function of neurons in the adult brain, as well as limit neural plasticity.

There is evidence to suggest that antidepressant treatment increases the expression of BDNF, which decreases the rates of cell death (Duman et al., 1999). Through stimulating BDNF antidepressant treatment may increase neurogenesis, facilitating the growth and development of neurons (Duman, Malberg, Nakagawa, & D'Sa, 2000). Recent studies demonstrate that chronic antidepressant treatment increases neurogenesis, which in turn increases the proliferation and survival of new neurons (Duman, Malberg, Nakagawa, & D'Sa, 2000).

Just as depression is most often diagnosed in a primary care setting, antidepressant medications are typically prescribed by a primary care physician rather than a psychiatrist. The rate of prescriptions being written for SSRI medications have increased dramatically in the last two decades. Presently 7% percent of all visits to a primary care physician end with a prescription for an SSRI medication. This is compared to 1997, when only 3% of primary care office visits resulted in a SSRI prescription. SSRI drugs are now the second most commonly prescribed drug in the US (Mojtabai & Olfson, 2011).

Despite the frequent prescription of SSRIs, their effectiveness is widely disputed. According to one meta-analysis utilizing FDA data, only 51% of studies examining antidepressants produced a positive result (Kirsch, 2008). For people with mild or moderate depression, one meta-analysis found SSRI treatment to have a nonexistent to minimal effect on depressive symptoms (Fournier et al., 2010). Another study, while finding SSRIs to be superior to placebo treatment, found that roughly 24% of people prescribed an SSRI did not respond to

treatment (Gueorguieva, 2011). Not only is non-response a possible downfall of taking an SSRI, but as many as 25% of people experience a worsening of symptoms while taking the drug compared to placebo (Juurlink, 2006; Kirsch, 2008).

The problem with prescribing an antidepressant to someone who will likely not benefit from it is that SSRIs are sometimes accompanied by detrimental side effects. The most common side effect is gastrointestinal (GI) disturbances (Goldstein & Goodnick, 1998). Other harmful side effects include sexual dysfunction, insomnia, skin rashes, headaches, joint and muscle pain, and nausea (Harvard Health, 2014). In some cases, particularly in adolescents and adults under the age of 25, antidepressant use can lead to suicidal thoughts or actions (Fergusson et al., 2005). Therefore, it is important for prescribers to be selective and cautious when deciding to place someone on an antidepressant.

What explains the lack of efficacy of SSRIs for a significant minority of patients? Perhaps people with certain types of depression may benefit from SSRIs while people with other types of depression may not. It may be that the monoamine theory is insufficient in explaining depressive symptoms for people who experience demoralization due to circumstances in life such as poor work and family relationships. Therefore, people with those depressive symptoms will likely benefit more from psychotherapy than an SSRI, which would only target chemical imbalances and perhaps not the source of the person's despair. In contrast, other depressive symptoms may have a more neurological basis; thus, people experiencing them may benefit the most from an SSRI medication. People suffering from anhedonia, a symptom of depression manifested by lack of pleasure and interest in previously enjoyable activities, may be an example of a group who would benefit from an SSRI.

There is substantial evidence to suggest that anhedonia is associated with a deficit in hedonic capacity, a specific neurological reward circuit (Pizzagalli, Iosifescu, Hallett, Ratner, & Fava, 2008). Furthermore, the neurobiological mechanisms which influence hedonic capacity are not necessarily involved in other reward deficits, such as those found in non-anhedonic people with depression (Der-Avakian & Markou, 2012). The μ-opioid and endocannabinoid receptors in the nucleus accumbens and ventral pallidum are the critical regions for hedonic capacity to occur (Der-Avakian & Markou, 2012). There are drugs which specifically target restoring hedonic capacity to control levels, specifically nonmonoamine antidepressants (Katzman & Sternat, 2016). When designing a successful depression inventory, a key feature will be identifying which of the differential core components of depression the patient is experiencing, and in turn using that information to create a successful treatment plan.

Current Paradigm Shifts within Psychology

An important shift in the current understanding of mental illness is the transition from categorical diagnoses to a dimensional understanding of pathological symptomology. Dimensions may be thought of as continua which reflect the adaptive and maladaptive characteristics of the entire population, with one end experiencing none of the symptoms and the other end presenting extreme prevalence of the symptoms (Kotov, 2017). This view is contrasted with the current mode of diagnostic thinking, in which mental illness is thought of as a fixed entity. The Diagnostic and Statistical Manual of Mental Disorders (DSM–5) utilizes a categorical approach of classifying mental illness.

Several limitations exist for the current classification system of mental illness. First, interrater reliability is very low, with 40% of DSM-5 based diagnoses not meeting adequate

interrater reliability levels (Regier et al., 2013). Secondly, comorbidity for mental disorders is highly prevalent, with 45% of people with one mental disorder meeting criteria for two or more other mental disorders. High levels of comorbidity in mental disorders suggests an extent to which the divisions between conditions are arbitrary. If an individual is experiencing two "comorbid disorders," it may be more accurate to conceptualize the individual's difficulties as a conglomeration of symptoms which are not distinct from each other. The imprecise current method of diagnosing mental illness both hinders proper treatment considerations and limits research. The solution to the shortfalls inherent within categorical diagnoses lies within the empirically-based dimensional understanding of mental symptomology.

Several models of psychopathology have adopted a dimensional conceptualization of syndromes. One such model is included as an emerging model in Section III of the DSM-5, which covers personality disorders. The proposed model for assessing personality disorders includes two criteria: criterion A: significant impairments in self identity or self-direction and interpersonal functioning and criterion B: one or more pathological personality trait domains, based on a dimensional understanding of personality traits (Few et al., 2013). Utilizing the DSM-5 Section III approach, clinicians rate individuals on 25 dimensional traits and four impairment domains. Research has provided evidence supporting the reliability and validity of the DSM-5 section III approach to personality disorders (Few et al., 2013).

The Research Domain Criteria (RDoC) project was created by the National Institute of Mental Health as a way of classifying mental pathology through dimensions of observable behavior and neurobiology (Cuthbert & Insel, 2010, 2013). RDoC employs the following 6 domains to classify pathology: cognitive, positive valence, negative valence, social processes,

arousal, and regulatory systems. The aim of RDoC is to create a framework for researchers to operate under which has eliminated the heterogeneity between mental disorders and focuses on individual dimensions (Cuthbert & Insel, 2010, 2013).

Most recently, the Hierarchical Taxonomy of Psychopathology (HiTOP) has been created as a dimensional alternative to categorical understandings of mental pathology (Kotov, et al., 2017). The HiTOP classification system proposes that mental traits occur as a continuum across multiple levels of a hierarchy. The hierarchical view allows clinicians to view pathology as graded, with symptoms ranging from broad to narrow in scope.

The Minnesota Multiphasic Personality Inventory-2-Restructured Form (MMPI-2-RF; Ben-Porath & Tellegen, 2008/2011) operates under a dimensional view of mental illness and is one of the most widely used instruments for assessing psychopathology worldwide (Drayton, 2009). The MMPI-2-RF consists of 338 self-report questions designed to conceptualize a person's psychological state and personality. Interpretation of the 338 questions is broken down into five content domains: Somatic/Cognitive, Emotional/Internalizing, Thought Dysfunction, Behavioral/Externalizing, and Interpersonal Functioning. Within the five domains exist three tiers: broad, mid-level, and narrow (see Figure 1). Within the Emotional/Internalizing dysfunctional domain are the two noteworthy mid-level scales of Demoralization (RCd) and Anhedonia (RC2). RC2 measures what is commonly described as anhedonia, with high levels on this scale indicating a lack of feelings of pleasure. RCd, in contrast, measures general distress and discontentment. In the DSM-5, there exists no distinction between RCd and RC2 symptoms when considering the diagnosis of depression. However, the segregation of depressed mood and anhedonia in the MMPI-2-RF is crucial for selecting the most appropriate treatment plan.

A 3-factor model of internalizing dysfunction has been proposed by Watson and has additional support by Sellbom, Ben-Porath, and Bagby (Sellbom, Ben-Porath & Bagby, 2008; Watson, Gamez, & Simms, 2005). Rather than focusing on traditional categorical disorders such as anxiety and depression, this method organizes the broad internalizing dysfunction domain into the three factors of anxious-misery, anhedonia, and fear. The MMPI-2-RF assesses these three factors separately through the scales RCd, RC2, and RC7, respectively.

Implications of the Dimensional Model for Behavioral Health Screening

As noted above, the PHQ-9, while used widely, is based on the traditional, categorical paradigm. The categorical model of pathology makes creating a short, accurate screening test very difficult. With the shift to a dimensional model of psychopathology, there is now an opportunity to create a more precise assessment tool. Benefits of a dimensional assessment tool include its precise estimation of a trait, as validated by the MMPI-2-RF, and its exclusion of heterogeneous symptoms.

Therefore, there is a pressing need to create a self-report measure which will quickly evaluate patients within primary care clinic for maladaptive psychological symptoms. The Multidimensional Behavioral Health Screen (MBHS) is an assessment tool currently being validated. It is designed to correlate highly with the following nine of the MMPI-2RF's mid-level and narrow constructs: Somatization (RC1), Demoralization (RCd), Anhedonia (RC2), Anxiety (RC7), Suicide/Death Ideation (SUI), Cognitive complaints (COG), Activation (ACT), Disconstraint (DISC-r), and Substance Abuse (SUB).

Table 1: Comparing MBHS and MMPI-2-RF terminology with description

MBHS Scale	MMPI-2-RF Target Scale	Brief Description
Somatization SOM^s	Somatic Complaints RC1	A variety of physical symptoms, including gastric, headache, neurological
Demoralization DEM^s	Demoralization RCd	General unhappiness, dissatisfaction with life
Anhedonia ANH^s	Anhedonia RC2	Low positive emotion, joylessness
Anxiety ANX^s	Dysfunctional Negative Emotions RC7	Fear, worry
Suicide/Death Ideation SUI^s	Suicide/Death Ideation SUI	Suicidal or death-oriented thoughts, tendencies, or attempts
Cognitive Complaints COG^s	Cognitive Complaints COG	Attention, concentration, focus and memory difficulties
Activation ACT^s	Activation ACT	Energy, restlessness
Disconstraint DSC^s	Disconstraint DISC-r	Impulsivity, low self-control
Substance Abuse SUB^s	Substance Abuse SUB	Drug abuse, including alcohol

Depressive symptomatology is the priority and primary focus of this assessment tool, as it is commonly seen in primary care offices. However, this tool may be used to assess for other

behavioral health problems, including anxiety-related problems and attention/cognitive problems. The scale also includes screening measures of two specific issues relevant to any healthcare provider, suicidal ideas and substance abuse.

Somatization estimates the extent to which psychological factors may be contributing to the patient's complaints of physical symptomatology. Demoralization measures general unhappiness and dissatisfaction with their life and may be most improved through psychotherapy. Anhedonia measures an overall lack of enjoyment in completing pleasurable activities and may be positively affected by the administration of medication. As noted above, the distinction between Demoralization and Anhedonia is important in the treatment of depression. It is separated in the MMPI-2-RF and thus will be screened for separately in the MBHS. The anxiety scale was chosen for screening purposes because of the common cooccurrence of anxiety with a host of other mental and physical problems. Suicide/death ideation assessment is crucial for assessing a patient's safety and will factor into treatment decisions for the patient. Cognitive complaints include memory and thinking difficulties often seen in a variety of mental and physical illnesses, such as dementia. Activation may be assessing for what is seen in a manic phase of bipolar disorder. Disconstraint is a factor of impulse control disorders, such as attention-deficit/hyperactivity disorder, and is a known correlate of adherence to medical regimens. Substance abuse is important to assess for as it may be impacting other aspects of a patient's physical health; it may also factor into a physician's decision to prescribe medications which are commonly abused.

The aim of the current study is to compare the MBHS's nine scales of behavioral health problems to the MMPI-2-RF's target scales and examine the correlations between each of the

scales**.** The second aim of the current study is to look at correlations between the PHQ-9 and the MMPI-2-RF's scales**.** The use of the MBHS will compete with the currently widespread use of the PHQ-9. The primary use of the MBHS will be for the assessment of depression, and the appropriateness of medication will be dependent on the specific depression-related symptomology which is reported on the MBHS. Strong correlations between the MBHS and the targeted MMPI-2-RF scales are expected to be found, with lower correlations between the MBHS and non-targeted MMPI-2-RF scales.

METHOD

Participants

Participants were adult volunteers from the waiting room of a family medicine clinic, Mountain Area Health Education Center (MAHEC). Participants were required to be at least 18 years old and able to read and understand English test materials prepared at approximately the 4th grade level. Participants were excluded from the study if they produced invalid MMPI-2-RF protocols using the standard cutoff scores of VRIN-r > 79, TRIN-r > 79, F-r = 120, or Fp >99. The goal of the study was to receive data from 450 participants. Participants were compensated for their time by receiving a $20 gift card to Walmart after completion of the study.

Materials and Measures

The Multidimensional Behavioral Health Screen (MBHS; McCord, Hickey, Mitchell, Warszawski, 2017) is an instrument currently being developed to be used to assess psychopathology constructs in primary medical care settings. The MBHS contains 27 short items which measure somatization, demoralization, anhedonia, anxiety, suicidal tendencies, activation, cognitive complaints, disconstraint, and substance misuse. Directions for each item read "Indicate your response to each item by circling the number. Please answer as accurately and honestly as you can." Participants circle their response from a scale of 0-3, with 0 indicating definitely false, 1 indicating somewhat false, 2 indicating somewhat true, and 3 indicating definitely true. Total scores for each of the 9 constructs are calculated by adding the scores for the 3 items which comprise the scale. T-scores for each of the possible values are calculated

(found in Appendix C). Scores in the shaded area (T > 66) suggest need for referral to behavioral health for comprehensive assessment. Scores greater than one for suicidal ideation require immediate assessment. Preliminary data for the MBHS suggests strong reliability and validity. Validity was calculated previously using correlations between the MBHS scales and the MMPI-2-RF target scales obtained from a college sample. Correlations between the MBHS scales and the MMPI-2-RF target scales for demoralization, anhedonia, and anxiety were .71, .57, and .66, respectively.

The Patient Health Questionnaire-9 (PHQ-9; Spitzer, Kroenke, Williams, 1999) is a commonly used tool to assess for depression. The PHQ-9 is a 9-item self-report questionnaire which reflects the DSM-5 criteria for depression. For each item, participants answer on a scale of "0" (not at all) to "3" (nearly every day) how often they experience the 9 symptoms of depression.

The Minnesota Multiphasic Personality Inventory-2-Restructured Form (MMPI-2-RF; Ben-Porath & Tellegen, 2008/2011) is a frequently used tool for assessing psychopathology (Drayton, 2009). The MMPI-2RF consists of 338 self-report questions designed to conceptualize a person's psychological state and personality. For the present study, the MMPI-2-RF's nine scales of Somatic Complaints, Demoralization, Anhedonia, Dysfunctional Negative Emotions, Suicide/Death Ideation, Cognitive Complaints, Activation, Disconstraint, and Substance Abuse will be used as target criteria in evaluating the corresponding scales of the MBHS.

Procedures

Data collection was completed at MAHEC, a primary care clinic for family medicine in the southeastern United States. The sample is composed of volunteers solicited in the waiting room of MAHEC. As noted above, volunteers must be 18 years of age, able to use a laptop, and proficient in English.

Patients who express interest were given a consent form to read and sign. Then, they completed the PHQ-9, MBHS, and MMPI-2-RF on a laptop provided to them by the research assistant. The PHQ-9 and MBHS were given first to half the participants, and the MMPI-2-RF was administered first to the other half. This was done so that any potential priming effects of each questionnaire was counterbalanced. Completion of the three questionnaires took approximately one hour. The $20 gift card was awarded upon completion of the tasks. Participants were asked to sign a log indicating they received the gift card. Participants were given a second copy of the Consent Form which contained contact information for the researchers and the IRB. In this phase of the study, questionnaires were not scored immediately. Thus, no feedback was provided to the participant or to the MAHEC clinician.

RESULTS

In the following sections we will present first the basic psychometrics findings for the MBHS, including reliability (Cronbach's alpha and mean inter-item correlation for each scale), convergent validity (correlation with the MMPI-2-RF target scale), and discriminant validity (correlations with non-target MMPI-2-RF scales). Following this will be ROC-Curves, quantifying the accuracy of the screening scale to predict clinical-range elevations on the targeted scale of the MMPI-2-RF. Finally, we will examine parallel findings using the PHQ-9 as the predictive screener of clinical elevations on the MMPI-2-RF.

Participants were excluded based on their Variable Response Inconsistency (VRIN) scale score on the MMPI-2-RF. The VRIN scale is indicative of random responses, with a score at or above 80 rendering the test uninterpretable. Similarly, the True Response Inconsistency (TRIN) scale score was used to exclude participants based on their propensity to always answer "true" or always answer "false" to questions. Scores at or above 80 on the TRIN scale indicate the participant was likely giving fixed responses. Consequently, 213 participants took part in the study, but only 134 participants remained once individuals with scores of 80 or higher on VRIN or TRIN were excluded.

Reliability

Table 2 presents the mean inter-item correlation for the three items which comprise each of the MBHS subscales. These correlations are compared to the mean inter-item correlations for the items on the MMPI-2-RF subscales as a point of reference. The MBHS performed similarly to or better than the MMPI-2-RF in terms of inter-item correlations, substantiating the utility of

the items chosen to compose the MBHS scales. In a similar way, Cronbach's alpha for the MBHS's scales and the MMPI-2-RF's scales are compared. Cronbach's alpha for the MBHS was comparable to that of the MMPI-2-RF, suggesting strong reliability for the MBHS's scales.

Table 2: Inter-item correlations and Cronbach's alpha for MBHS and MMPI-2-RF scales

	Mean Inter-Item Correlation		**Cronbach's Alpha**	
	MBHS Scale	**[MMPI-2-RF]**	**MBHS Scale**	**[MMPI-2-RF]**
SOMs [→ RC1]	.54	[.11]	.78	[.76]
DEMs [→ RCd]	.61	[.24]	.83	[.88]
ANHs [→ RC2]	.51	[.10]	.76	[.66]
ANXs [→ RC7]	.60	[.16]	.82	[.82]
SUIs [→ SUI]	.57	[.16]	.80	[.38]
COGs [→ COG]	.56	[.16]	.79	[.67]
ACTs [→ ACT]	.37	[.15]	.64	[.60]
DSCs [→ DISCr]	.52	[.14]	.76	[.71]
SUBs [→ SUB]	.43	[.20]	.69	[.62]

Some differences between the inter-item correlations within the MMPI-2-RF and MBHS may be attributable to structural differences, including the MBHS's 4-choice rubric and very short scale. Overall, our findings conclude that the MBHS performs as well as the MMPI-2-RF and that the MBHS has adequate internal reliability.

Validity

Table 3 presents correlations between the MBHS's 9 predictor scales and the MMPI-2-RF target scales. High convergent validity was found for each scale, with almost every MBHS scale correlating the most highly with its target scale on the MMPI-2-RF. The MBHS also demonstrated strong discriminant validity, with few scales correlating more highly with a non-target MMPI-2-RF scale than the target scale. Indeed, of the 81 correlations between the MBHS and the targeted MMPI-2-RF scales, 77 were in the predicted direction. The four exceptions were

largely based on actual correlations between underlying latent constructs and are quite distinguishable by item content. Higher convergent and discriminant validity was found for the MBHS than the PHQ-9. The PHQ-9 had high correlations with many MMPI-2-RF subscales and not only DEM, which is the most logical target scale for a depression screener. This demonstrates the diverse and heterogeneous constructs measured by the PHQ-9, evidencing further its lack of utility as a depression screener.

Table 3: Correlations between MBHS predictors and MMPI-2-RF targets

	RC1	**RCd**	**RC2**	**RC7**	**SUI**	**COG**	**ACT**	**DISCr**	**SUB**
SOMs	.725	.593	.606	.473	.347	.565	.168	.029	.028
DEMs	.585	.744	.628	.653	.288	.434	.168	.204	.142
ANHs	.649	.704	.684	.649	.341	.538	.303	.141	.080
ANXs	.541	.707	.561	.677	.286	.411	.321	.147	.129
SUIs	.299	.393	.344	.385	.655	.235	.320	.071	.117
COGs	.579	.713	.488	.615	.327	.730	.425	.232	.155
ACTs	.353	.559	.306	.526	.397	.446	.501	.419	.246
DSCs	.167	.493	.261	.357	.280	.327	.498	.530	.474
SUBs	-.092	.187	.179	.278	.109	.038	.080	.650	.799
PHQ-9	.60	.68	.56	.57	.39	.55	.28	.18	.14

Area Under the Curve (AUC) Receiver Operating Characteristics (ROC) Curves

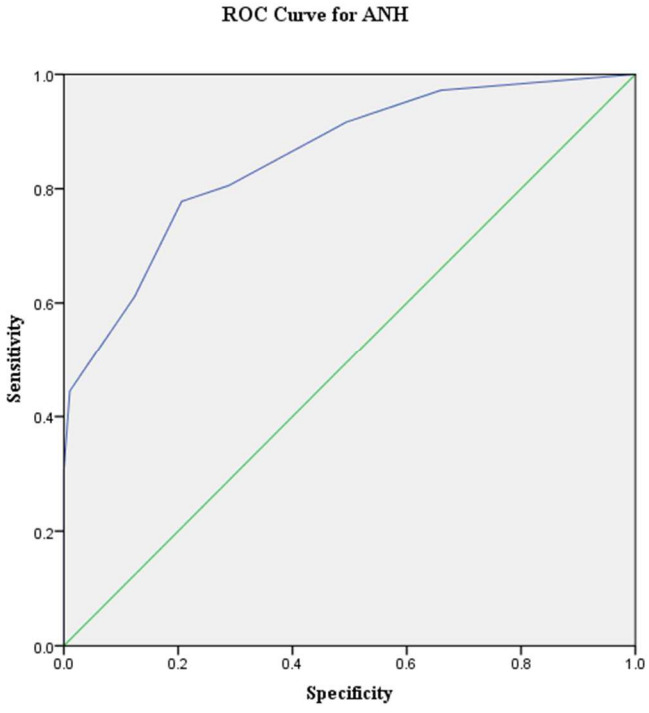
ROC curves were created to determine the accuracy of the MBHS in differentiating clinical-range elevations and non-clinical scores on the target scale of the MMPI-2-RF. The ROC is a curve of probability, with the AUC measuring the degree to which the screener is able to distinguish between positive and negative classes. In the case of the MBHS, this describes clinical and non-clinical elevations on the MMPI-2-RF. The higher the AUC to 1, the greater ability of the screener to accurately predict the accurate outcome. An AUC of 0 describes a screener with no ability to distinguish between positive and negative classes, and an AUC of .5 designates a screener with a random chance of distinguishing accurately. The closer to the upper-left corner of the ROC the AUC line is, the higher the rate of true positives, indicating high sensitivity, and higher rates of true negatives, indicating high specificity.

Because the MBHS is to function as a screening tool, it is imperative for it to be capable of accurately detecting clinical elevations. Table 4 presents the ROC curve for the ANH scale. The ANH scale of the MBHS had .86 AUC, indicating high likelihood of placing participants in the same category the MMPI-2-RF placed them in. A ROC Curve was completed for each of the MBHS scales, with classification accuracies ranging from an AUC value of .73 to .90.

Table 4: AUC values for the MBHS classification of MMPI-2-RF scores

MBHS Scale	AUC	Probability Level
SOMs	.79	.000
DEMs	.89	.000
ANHs	.86	.000
ANXs	.80	.000
SUIs	.73	.000
COGs	.90	.000
ACTs	.74	.000
DSCs	.82	.000
SUBs	.85	.000

Table 5: ROC Curve between the MBHS and MMPI-2-RF classification of ANH



DISCUSSION

The purpose of this study was to establish the MBHS as a viable alternative to the PHQ-9 as a screening tool to be implemented within primary medical care facilities. The MBHS's scales correlated highly with the MMPI-2-RF's target scales, demonstrating high convergent validity. Furthermore, the MBHS demonstrated high discriminant validity as its scales correlated the most highly with its MMPI-2-RF target scale, and no other scale. Our findings substantiate the claim that the MBHS is accurately screening for the target constructs in the MMPI-2-RF.

Our results indicated that the PHQ-9 does not have high discriminant or convergent validity with any of the nine constructs of the MMPI-2-RF. Thus, the PHQ-9 does not screen for any one construct, rather a muddle of symptomatology which is attributed to the construct of depression. The PHQ-9 does accurately predict depression diagnoses; however, the current paradigm shift provides ample evidence suggesting that current heterogeneous diagnoses have no meaningful implications for treatment or research. Furthermore, the reason mental illness prevention and treatment has remained stagnant may be attributable to the faulty labels which we are basing our diagnoses on.

When looking at the implementation of the MBHS as part of a long-term study, a relationship between high ANH scores and the effectiveness of SSRIs is expected to be found. The ANH scale of the MBHS is linked to low positive emotions and a lack of joy, which may particularly improve through SSRI usage. Conversely, DEM, the MBHS scale which the PHQ-9 correlates most highly with, may be predictive of low improvement of depressive symptoms following SSRI treatment. DEM may be less treatable through SSRIs since it is based more on

circumstantial variables, and less on neurochemistry. As SSRI effectiveness is highly variable, an effective method to screen for patients who would benefit the most from SSRIs would be greatly beneficial. Further research should explore if ANH is predictive of less depressive symptoms following SSRI treatment.

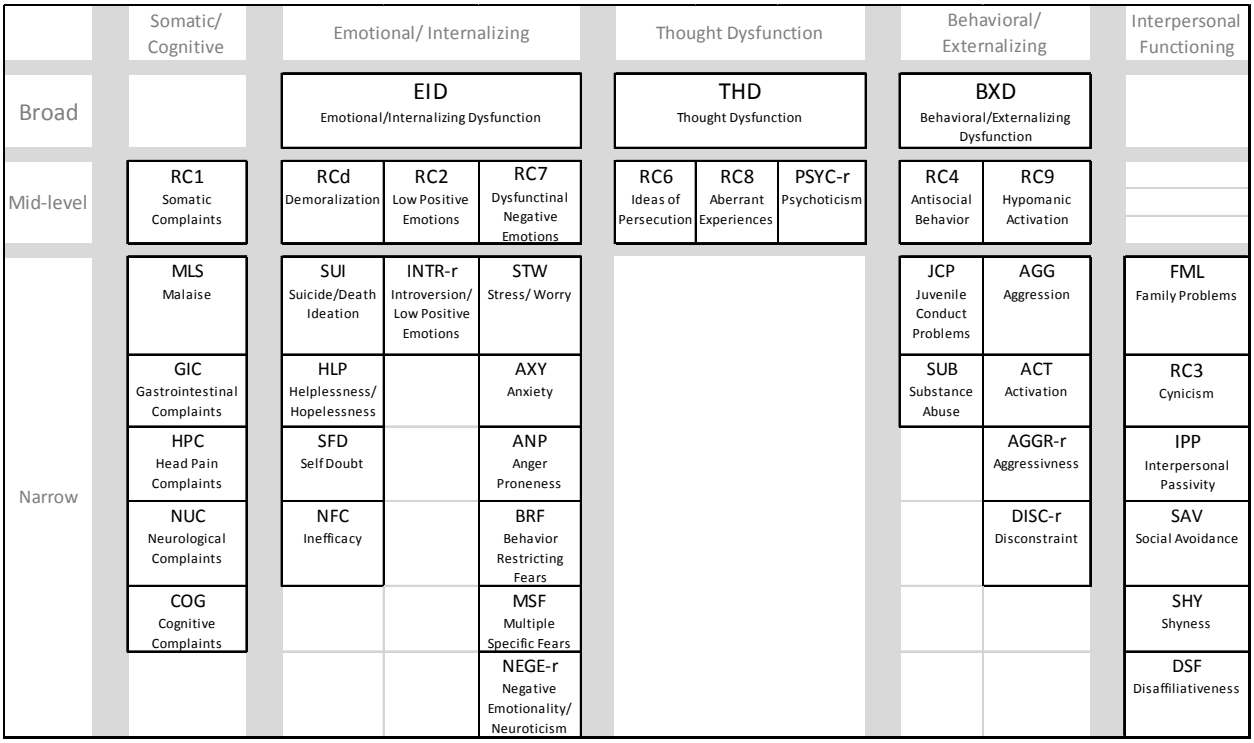
One potential limit to the study was sample size. While data collection providing psychometric qualities for the MBHS will continue until a sample of 300 is reached, only 191 participants were included for the present study. Of the 191 participants who partook in the study, usable data were collected on only 134 individuals. Researchers observed a notable portion of participants who finished the questionnaires improbably quickly given that most individuals take an hour to complete the three surveys. Participants were given a $20 incentive for completion of the study, which may have contributed to individuals completing the study who did not have the time or desire to do so accurately. Accordingly, data collection should continue increasing the sample size of usable data and consequently the power of the study.

Another possible limitation of this study was the sample population. This study was conducted using English-speaking adults in a primary medical care setting. Further data should be collected on a more diverse sample. One limitation of collecting data in a primary care setting is that genuine, severe psychopathology is an outlier in the data set. However, a primary care setting is the target population for implementation of the MBHS.

Despite the aforementioned limitations of the study, the MBHS has established itself to be a viable alternative to the PHQ-9. It is fitting that the mental health screeners administered in primary care settings reflect the growing propensity of psychologists to understand mental symptomatology as a dimension. Unlike other health screeners, the MBHS measures 9 core

constructs commonly presented in primary care settings, allowing physicians to have an accurate comprehensive depiction of psychological areas of concern for each patient. Hence, the MBHS can be recommended as a novel dimensional and homogenous mental health screener to be administered in primary care clinics.

Figure 1: The hierarchical dimensions within the MMPI-2-RF.



REFERENCES

Coppen A. (1967). The biochemistry of affective disorders. *British Journal of Psychiatry*; 113:1237–64

Cuthbert, B. N., & Insel, T. R. (2010). Toward new approaches to psychotic disorders: The NIMH Research Domain Criteria project. *Schizophrenia Bulletin*, 36, 1061–1062. http://dx.doi.org/10.1093/schbul/sbq108

Cuthbert, B. N., & Kozak, M. J. (2013). Constructing constructs for psychopathology: The NIMH research domain criteria. *Journal of Abnormal Psychology*, 122, 928 –937. http://dx.doi.org/10.1037/a0034028

Delgado, P., & Moreno, F. (2000). The role of norepinephrine in depression. *Journal of Clinical Psychiatry*, 61(1), 5-12.

Der-Avakian, A., & Markou, A. (2012). The neurobiology of anhedonia and other reward-related deficits. *Trends in Neurosciences,* 35(1), 68-77. doi:10.1016/j.tins.2011.11.005

Drayton M. (2009). *Occupational Medicine*, 59:135–136 doi:10.1093/occmed/kqn182

Duman, R.S., Malberg, J., Nakagawa, S. & D'Sa, C. (2000). Neuronal plasticity and survival in mood disorders. *Biological Psychiatry*, 48, 732-739.

Duman, S., Malberg J., Thome, J. (1999). Neural plasticity to stress and antidepressant treatment. *Biological Psychiatry,* 46:1181–1191.

Fergusson, D., et al. (2005). Association between suicide attempts and selective serotonin reuptake inhibitors: systematic review of randomized controlled trials. *British Medical Journal,* Vol. 330, pp. 396–99.

Few, L., et al., (2013). Supplemental Material for Examination of the Section III DSM-5 Diagnostic System for Personality Disorders in an Outpatient Clinical Sample. *Journal of Abnormal Psychology.* doi:10.1037/a0034878.supp

Fournier, J. C., Derubeis, R. J., Hollon, S. D., Dimidjian, S., Amsterdam, J. D., Shelton, R. C., & Fawcett, J. (2010). Antidepressant drug effects and depression severity. *Jama*, 303(1), 47. doi:10.1001/jama.2009.1943

Goldstein, B. J., & Goodnick, P. J. (1998). Selective serotonin reuptake inhibitors in the treatment of affective disorders- III. Tolerability, Safety and Pharmacoeconomics. *Journal of Psychopharmacology*, 12(4).

Gueorguieva, R. (2011). Trajectories of depression severity in clinical trials of duloxetine. *Archives of General Psychiatry*, 68(12), 1227.

Harvard Health Publishing. (2018). What are the real risks of antidepressants? https://www.health.harvard.edu/newsletter_article/what-are-the-real-risks-of-antidepressants

Katzman, M., & Sternat, T. (2016). Neurobiology of hedonic tone: The relationship between treatment-resistant depression, attention-deficit hyperactivity disorder, and substance abuse. *Neuropsychiatric Disease and Treatment*, Volume 12, 2149-2164. doi:10.2147/ndt.s111818

Kegler, S. R., Stone, D. M., & Holland, K. M. (2017). Trends in suicide by level of urbanization-United States, 1999–2015. MMWR. *Morbidity and Mortality Weekly Report*, 66(10), 270-273.

Kirsch, I. (2008). Antidepressants and the placebo response. *Public Library of Science Medicine*, 18(04), 318-322.

Kroenke, K., Spitzer, R. L., & Williams, J. B. (2001). The PHQ-9. *Journal of General Internal Medicine*, 16(9), 606-613. doi:10.1046/j.1525-1497.2001.016009606.x

Kotov, R., Ruggero, C. J., Krueger, R. F., Watson, D., Yuan, Q., & Zimmerman, M. (2011). New dimensions in the quantitative classification of mental illness. *Archives of general psychiatry*, 68(10), 1003-1011.

Kotov, R., et al., (2017). Supplemental Material for The Hierarchical Taxonomy of Psychopathology (HiTOP): A Dimensional Alternative to Traditional Nosologies. *Journal of Abnormal Psychology*. doi:10.1037/abn0000258.supp

Magellan Healthcare (2014). Treating Depression in the primary care setting. Retrieved March 12, 2018, from https://www.magellanprovider.com/media/11790/f-pce10-pcp-dep.pdf

McCord, D. M., Haugh, S., & Hutchinson, K. (2017, March). Preliminary development of a multi-band behavioral health screen. Paper presented at the annual meeting of the Southeastern Psychological Association, Atlanta, GA.

McCord, D. M., Hickey, H., Mitchell, H., Warszawski, J. (2017, March). Update on the development of the Minnesota Behavioral Health Screen. Paper presented at the annual meeting of the Southeastern Psychological Association, Atlanta, GA.

McCord, D. M., Provost, R. P., Scales, W. D., & McCord, J. T. (2015, June). *Mapping the PHQ-9 depression screening tool onto the construct-relevant scales of the MMPI-2-RF*. Poster session presented at the 50th Annual Symposium on Recent Research with the MMPI-2-RF, MMPI-2, and MMPI-A, Minneapolis, MN.

Mojtabai, R., & Olfson, M. (2011). Proportion of antidepressants prescribed without a psychiatric diagnosis is growing. *Health Affairs*, 30(8), 1434-1442.

National Institute of Mental Health (2018). Major Depression. Retrieved March 12, 2018, from https://www.nimh.nih.gov/health/statistics/major-depression.shtml

Pizzagalli, D. A., Iosifescu, D., Hallett, L. A., Ratner, K. G., & Fava, M. (2008). Reduced hedonic capacity in major depressive disorder: Evidence from a probabilistic reward task. *Journal of Psychiatric Research*, 43(1), 76-87. doi:10.1016/j.jpsychires.2008.03.001

Regier D., Narrow W., Clarke D., Kraemer H., Kuramoto S., Kuhl E., Kupfer D., (2013). DSM-5 field trials in the United States and Canada, Part II: test-retest reliability of selected categorical diagnoses. *The American Journal of Psychiatry*; 170(1):59–70.

Sellbom, M., Ben-Porath, Y. S., & Bagby, R. M. (2008). On the hierarchical structure of mood and anxiety disorders: confirmatory evidence and elaboration of a model of temperament markers. *Journal of Abnormal Psychology*, 117(3), 576.

Spitzer R., Kroenke, K., Williams, J. (1999). Validation and utility of a self-report version of PRIME-MD: the PHQ primary care study. *Journal of the American Medical Association*, 282, 1737-1744.

Smith MA, Makino S, Kvetnansky R. (1995). Stress alters the expression of brain-derived neurotrophic factor and neurotrophin-3 mRNAs in the hippocampus. *Journal of Neuroscience*, 15:1768–1777.

Watson, D., Gamez, W., & Simms, L. J. (2005). Basic dimensions of temperament and their relation to anxiety and depression: A symptom-based perspective. *Journal of Research in Personality*, 39, 46–66.doi:10.1016/j.jrp.2004.09.006

World Health Organization (2018). Suicide Data. Retrieved March 12, 2018, from http://www.who.int/mental_health/prevention/suicide/suicideprevent/en/

Appendix A

Multidimensional Behavioral Health Screen (beta 8)

ID: _____ Age: _____ Gender: _____ Date: _____

Indicate your response to each item by circling the number. Please answer as accurately and honestly as you can.	**Definitely False**	**Somewhat False**	**Somewhat True**	**Definitely True**
1. I have pains.	0	1	2	3
2. I feel useless.	0	1	2	3
3. There is little joy in my life.	0	1	2	3
4. I worry a lot.	0	1	2	3
5. I have thought about killing myself.	0	1	2	3
6. I have trouble concentrating.	0	1	2	3
7. I get bored easily.	0	1	2	3
8. I often make impulsive decisions.	0	1	2	3
9. I sometimes drink too much alcohol.	0	1	2	3
	Definitely False	**Somewhat False**	**Somewhat True**	**Definitely True**
10. I feel weak.	0	1	2	3
11. I am dissatisfied with my life.	0	1	2	3
12. I have little motivation.	0	1	2	3
13. Nervousness interferes with my daily functioning.	0	1	2	3
14. I have tried to kill myself.	0	1	2	3
15. I get distracted easily.	0	1	2	3
16. My thoughts race through my head very fast.	0	1	2	3
17. I often break rules, regardless of the consequences.	0	1	2	3
18. I currently use drugs/alcohol.	0	1	2	3
	Definitely False	**Somewhat False**	**Somewhat True**	**Definitely True**
19. I get nauseous.	0	1	2	3
20. I feel generally discouraged.	0	1	2	3
21. I tend to avoid social activities.	0	1	2	3
22. I obsess about things I can't control.	0	1	2	3
23. I want to die.	0	1	2	3

24. I can't remember things.	0	1	2	3
25. I do dangerous things for thrills.	0	1	2	3
26. I don't think before I act.	0	1	2	3
27. I have used drugs/alcohol in the past.	0	1	2	3

Appendix B

Patient Health Questionnaire-9

Name _____ Date _____

Over the *last 2 weeks*, how often have you been bothered by any of the following problems?	Not at all	Several days	More than half the days	Nearly every day
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
3. Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself—or that you are a failure or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed? Or the opposite—being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3

9. Thoughts that you would be better off dead or of hurting yourself in some way	0	1	2	3

(For office coding: Total Score ____ = ____ + ____ + ____)

If you checked off *any* problems, how *difficult* have these problems made it for you to do your work, take care of things at home, or get along with other people?

Not difficult at all	Somewhat difficult	Very difficult	Extremely difficult
□	□	□	□

Appendix C

Name/ID: _____

Multidimensional Behavioral Health Screen Profile Sheet (beta 8)

T-score	SOM	DEM	ANH	ANX	SUI	COG	ACT	DSC	SUB	%ile
≥ 90										
88										
86					9					
84										
82										
80		9			8			9	9	
78										
76		8	9		7					
74							9		8	
72	9		8		6			8		≥99
70		7		9			8		7	98
68	8		7		5	9		7		96
66		6		8		8	7		6	95
64	7		6					6		92
62		5		7	4	7	6		5	88
60	6		5					5		84
58		4		6	3	6	5		4	79
56	5		4	5				4		73
54		3			2	5	4		3	66
52	4		3					3		58
50				4		4	3			50
48	3	2	2	3	1	3		2	2	42
46							2			34
44	2	1	1	2	0	2		1	1	27
42							1			21
40	1	0	0	1		1		0	0	16
38				0			0			12
≤ 36	0					0				≤ 8
Raw Score										
	SOM	**DEM**	**ANH**	**ANX**	**SUI**	**COG**	**ACT**	**DSC**	**SUB**	
	1+10+19	2+11+20	3+12+21	4+13+22	5+14+23	6+15+24	7+16+25	8+17+26	9+18+27	

T score of 50 is general population mean. T-score of 63 or greater is clinical range (top 10% of medical outpatients). **Scores in shaded areas suggest need for referral to Behavioral Health for comprehensive assessment. Score > 0 on SUI should be queried, and score > 4 requires formal assessment.**

SOMatization, malaise, physical complaints	
DEMoralization, unhappiness, dissatisfaction	**COG**nitive issues, attention, memory, focus
ANHedonia, inability to experience pleasure	**ACT**ivation, energy, restlessness
ANXiety, fear, worry	**DiSC**onstraint, impulsivity, low self-control
SUIcidal Tendencies, thoughts, attempts	**SUB**stance Misuse - drug and/or alchohol