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# The Utility of Depression Screening Measures After Traumatic Brain Injury

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**Abstract**

***Objectives:*** Identifying reliable, practical and easy to use tools to assess depression in patients with traumatic brain injury (TBI), is a necessary first step to addressing a high incidence problem. The intention of this study is to validate depression screening measures with a criterion-based structured interview among people with TBI. The final outcome will identify which measure is the best indicator of depression diagnosis in this population.

***Methods:*** 112 participants with TBI were administered the Beck Depression Inventory (BDI), Neurobehavioral Functioning Inventory (NFI), The Hamilton Rating Scale for Depression (Ham-D), and the Structured Clinical Interview for DSM-IV TR Axis I Disorders (SCID) in an outpatient neuropsychology clinic at a university medical center, outpatient physical medicine and rehabilitation clinics, and a long-term specialized living assistance program. Screening measure results were compared with SCID results to determine sensitivity, specificity, positive predictive value and negative predictive value of each screening measure.

***Results:*** The prevalence of depression as measured by the SCID was 31.53%. Depression was more likely among those who were unemployed, within 12 months of their injury, experienced a length of coma between 1-6 days following injury, and had an acute care stay between 2-6 days. The BDI showed sensitivity of 86% and specificity of 79%. Calculated sensitivity and specificity for the NFI was 62% and 92%, respectively. Based on specificity and sensitivity, the Ham-D missed the most cases in this sample, showing 46% sensitivity. However, the specificity for the Ham-D was highest of the three at 99%. The BDI had a positive predictive value (PPV) of 65%, highlighting the fact that 16 of the cases that the BDI identified as depressed were not actually depressed according to the SCID. The negative predictive value (NPV) for the BDI was 92%. The Ham-D showed the highest PPV at 94%, indicating that of those that tested positive on the Ham-D, 94% were rated as depressed on the SCID. NPV for the Ham-D was 80%. The NFI showed a PPV of 78% and NPV of 84%.

***Conclusions:*** Sensitivity was considered the most important aspect to evaluate, due to the need to minimize the number of cases of depression missed. From the results of the sensitivity and specificity calculations, the BDI appears to be the most appropriate screening measure for identifying cases needing further clinical evaluation.

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Approximately 5.3 million Americans are currently living with long-term disabilities due to a traumatic brain injury (TBI), and every year an estimated 1.4 million people sustain a TBI.[1] The Traumatic Brain Injury Model Systems of Care (TBIMS) has defined TBI as "damage to brain tissue caused by an external mechanical force, as evidenced by loss of consciousness due to brain trauma, posttraumatic amnesia, skull fracture, or objective neurologic findings that can be reasonably attributed to TBI on physical examination or mental status examination."[2] The cost of TBI in the US is estimated at $60 billion annually, which includes medical expenses as well as other indirect costs. [3] Disabilities associated with brain injuries are varied and can include cognitive difficulties, physical disabilities, and emotional changes and they may be short term, long-term or permanent. According to the CDC, the leading causes of TBI are falls (28%), motor vehicle accidents (20%), struck by/against incidents (19%), and assault (11%).[1] Men are twice as likely as women to suffer a TBI, and the very young (0-5 years) and teenagers (15-19 years) are at highest risk of TBI.[1]

While many of the physical wounds of TBI heal over time, behavioral issues often linger or worsen.[4, 5] Because many people go on to live for many years with the disabilities resulting from traumatic brain injury, an important area of research in TBI revolves around psychosocial outcomes. Research has shown that depression is more prevalent among those who have sustained a TBI than it is in the general population. TBI has been identified as a risk factor for depression, and depression has been identified as the most common Axis I diagnosis after brain injury.[6] Many studies have shown the negative impact of depression on psychosocial functioning.[5, 7-9]

Early brain injury research estimated the prevalence of depression among this population anywhere between 6% and 77%, with the wide range attributed to varying methods of

measurement, diagnosis, and sample characteristics. [10-14] When attempting to determine if a patient is depressed there are many tools to choose from, including structured interviews, self-administered rating scales, check lists, and rating scales administered by trained observers.[15] This is one factor that contributes to the wide range in estimates of the prevalence of depression. Different tools can lead to different results.[16] Additionally, an important limitation of many studies of depression is the lack of validation of screening test results using a structured clinical interview.

The most commonly used and widely accepted method for diagnosing depression is the criteria set forth in *The Diagnostic and Statistical Manual of Mental Disorders IV –text revision* (DSM-IV-TR), which relies on observable symptoms that cluster together to diagnose psychiatric disorders.[17] The DSM-IV criteria has been found to be reliable and valid for diagnosing depression in people who have suffered a TBI.[18-20] More recent studies of depression after TBI have identified a narrow range in prevalence rates of 26%-31% by using the criterion based DSM-IV as a framework for diagnosis.[5, 21-23] A structured clinical interview was created based on the DSM-IV to increase the reliability of psychiatric diagnosis by combining the consistency of the DSM-IV criteria with the increased reliability of a structured interview: The Structured Clinical Interview for DSM-IV Axis I Disorders (SCID).[24] While the SCID is a very reliable and accurate measure of psychiatric disorders, [25] it requires extensive training of clinicians and administration can be quite time consuming (as many as 3-4 hours) depending on the number of disorders evaluated.

For practical purposes, a wide variety of screening tools are more commonly used to measure depression in people after TBI. These include, the Hamilton Depression Rating Scale (Ham-D)[26], the Beck Depression Inventory (BDI)[27], the Neurobehavioral Functioning Inventory

(NFI)[28], the Patient Health Questionnaire 9 (PHQ-9)[29], and the Center for Epidemiologic Studies – D (CES-D)[30]. The CES-D has been judged to be reliable for assessing depression after TBI. [31] There is only one study to date validating its use with the SCID; however no other depression screening measures were used in that study for comparison. The PHQ-9 is a versatile depression screen that can be used to rate severity of symptoms or number of symptoms matching the DSM-IV criteria for diagnosing depression. It is designed for use with patients in primary care. One recent study validating it's use among people with TBI by comparison to SCID diagnosis[32], limited the sample population to those within one year of injury, precluding its applicability to patients many years post injury that may not have the same depressive symptoms. The Ham-D, and NFI are helpful in rating the severity of depression. The NFI has the added benefit of being self-administered and it is designed specifically for use among populations with neurological disabilities. The BDI is also self-administered.

One of the controversies surrounding depression diagnosis among those with TBI is the potential lack of self-awareness that may result from a brain injury. Some researchers have postulated that it may lead patients to under report depressive symptoms.[33, 34] Conversely, some symptoms generally associated with depression, such as sleep disturbance and changes in appetite, may occur in those with TBI as a consequence of their injury, rather than as a consequence of depression.[14] Therefore, an important step in assessing depression after TBI is identifying symptoms specifically related to depression in this population. Again, the DSM-IV-TR has been identified as the best guideline for depression diagnosis after TBI.[14]

**Objectives**

The necessity of a short, easy to use screening tool is obvious: it takes less time, training, and money to administer than a long structured interview. In addition to these facts, patients and

staff tend to have higher tolerance for a shorter, less tedious interview. By screening out all those who are clearly not depressed based on a short interview or questionnaire, the number of long structured interviews that must be administered diminishes. Another important factor is the need for a tool that can be used by many different kinds of professionals in many settings: from inpatient rehabilitation units; to family doctors offices; to social work settings; to military treatment facilities. If a tool is easy enough to use, and requires little training, more staff members will be qualified to administer it to more patients. Therefore, more people who have sustained a TBI and are suffering depression as a result will be identified and hopefully treated.

Diagnosis and treatment of depression among those with TBI is an important priority. Identifying reliable, practical and easy to use tools to assess depression in patients with brain injury is a necessary first step to addressing a high incidence problem. Further, improved assessment can lead to targeted interventions designed to meet the needs of individuals suffering depression after brain injury. The intention of this study is to evaluate three screening measures for depression (BDI, NFI, Ham-D) by comparison to a criterion-based structured interview, the SCID, among a population of people with TBI. The final outcome will identify which, if any, of the three measures is the most accurate predictor of depression diagnosis on the SCID.

## Methods

### Participants

Participants consisted of 112 men and women with TBI at least 3 months post injury with age ranging from 18 to 73 years (mean age 40.0, SD 12.8). Demographic data and injury characteristics for the sample are displayed in Table 1. Diagnosis of TBI was based on the TBIMS definition. The prevalence of depression in this study, based on SCID diagnosis of a current major depressive episode, was 31.53%. Injury severity was determined by Glasgow

Coma Scale (GCS) [35] score on admission to the emergency department, with 13-15 considered mild TBI, 9-12 moderate TBI, and scores of 8 and below indicating a severe injury. Of the 82 participants with injury severity reported, 35% had a mild injury, 17% had a moderate injury, and 48% had a severe injury. Females comprised 33% of participants with 67% male. The study population was 74% Caucasian, 23% African American, 1% Asian, 1% Hispanic and 1% "other". Seventy-four percent of injuries occurred in motor vehicle accidents (MVA), 8% were due to a fall, 11% were associated with assault, 2% were due to gunshot wounds (GSW), and the remaining 5% of injuries were categorized as "other". Participants were drawn from the Virginia Commonwealth University outpatient neuropsychology clinic (n = 40), an affiliated outpatient rehabilitation clinic (n = 28), local brain injury support groups (n = 7), a long-term specialized living assistance program (n = 9), and the TBIMS research participant pool (n = 28). The majority of the participants were referred to the study by clinicians. Others (current TBIMS research participants) were recruited via mailings, notifying them of the new study. Of those referred by clinicians, 79% agreed to be in the study. Response rate to the mail out was 22%. Informed consent was obtained from all participants.

Given the relatively low response rate of the TBIMS research participants, an effort was made to determine if the participants in this investigation were comparable to the overall TBIMS sample. No significant differences were found in Chi Square analysis for age, gender, length of coma, cohabitation (whether participant lived alone/with others), or marital status, ($p > .05$). A significant difference was noted between groups for ethnicity (Chi Square = 6.54, df = 1, p = .011) with the present investigation's sample having more Caucasians (74.1%) than the TBIMS sample (61.0%). In addition, the current sample had a longer acute care length of stay (mean = 25.9, SD = 35.1) than the TBIMS sample (mean = 19.2, SD = 18.9) ($F = 6.89$, df = 1, $p = .009$).

The TBIMS and this sample also had statistically significant differences in the number of those living a productive/non-productive lifestyle (Chi-square = 7.15, df = 1, p = .008). The percentage of those who were non-productive in the current sample was 69.7%, while in the TBIMS sample it was 50%.

**Depression Measures**

The screening measures chosen for this study were the BDI, Ham-D, and the NFI. All three were designed to measure the severity of depressive symptoms and are relatively short and easily administered. Additionally, each has characteristics making it appropriate to examine for use with brain injury populations. The NFI was designed specifically for use with patients with neurological disabilities, and encompasses six scales that provide useful symptom information to clinicians.[36] While past studies have questioned the usefulness of the BDI among a population of people with brain injury, [18] others have reported it to be reliable. [37] Further analysis of this screening instrument in this population would be helpful. The BDI targets mood symptoms more than somatic symptoms, which may be helpful and appropriate for use in a population of people with TBI. The Ham-D is considered by some as the gold standard when screening for depression in the general population. In treatment studies for depression, the Ham-D is the most commonly used instrument for selection of participants. [38, 39] In contrast to the BDI, the Ham-D is weighted more heavily towards the physical symptoms of depression; therefore, the Ham-D may be helpful in identifying cases that the BDI would conceivably miss. However in a review of 70 studies that evaluated the Ham-D, it has also been criticized as psychometrically inadequate.[40] Evaluating its usefulness in a sample of people with TBI by comparing it to SCID results would be beneficial. The SCID was chosen as the diagnostic instrument for this study because the depression module was designed to cover the criteria for depression diagnosis

designated by the DSM-IV. Additionally the instrument as a whole is currently considered the criterion standard for assessing psychopathology.[41, 42]

**The Structured Clinical Interview for DSM-IV Axis I Disorders, Clinician Version (SCID)[24]**

The SCID is a semi-structured interview designed to evaluate and diagnose psychiatric disorders. For this study the clinical version for assessing the major DSM-IV Axis-I disorders (including but not limited to Major Depressive Episode, major depressive disorder, Depressive Disorder NOS, Depressive Disorder due to a general medical condition, Depressive disorder due to substance use, Bipolar disorders I, II) was utilized. Diagnosis based on SCID results provides a DSM-IV diagnosis and associated code (i.e.: yes or no result for each category of psychopathology). Non-clinician research assistants can administer the SCID after extensive training. It can take from 1 to 3 or more hours to administer to patients. The SCID has been used in over 700 studies to diagnose psychiatric disorders and there are ample studies reporting on it's reliability and validity.[25, 43]

**The Hamilton Depression Rating Scale** and **The Structured Interview Guide for the Hamilton Depression Rating Scale** (Ham-D)[26]

The Ham-D is a very commonly used and effective measure for determining the severity of symptoms of depression. In general, the reliability and validity of the Ham-D has been determined to be good, but reliability can vary depending upon the circumstances of its use.[44] It can be used in clinical research by non-clinicians who have been trained. Correlation of the Ham-D with global measures of depression severity have ranged from .65-.90.[44] While internal consistency measured by Cronbach's Alpha ranges from .48-.92, [45-47] it improves upon implementation of the structured interview to >=.8. [48] The Structured interview Guide for the

Ham-D is a relatively short, semi-structured interview version of the Ham-D. [49] It uses the same rating scale as the Ham-d, but in a structured interview format. It requires some training but can ultimately be administered by staff other than trained clinicians in about 20 minutes. The commonly used threshold of a total score of 18 was utilized in this study to differentiate between depressed and non-depressed participants.[50]

The structured interview version of the Ham-D was administered to all participants in this study. It has proven validity and reliability that considers both the psychological and autonomic symptoms of depression.[48, 49] The intraclass correlation coefficient has been reported at .92. [44] Total score on the Ham-D can be calculated by adding up total points for all 17 items (between 0- 2 or 0-4 on each item) to describe severity of symptoms as follows: remission <=7; mild depression <= 17; moderate depression 18-24; severe depression >=25.

**The Beck Depression Inventory** (BDI) [51]

The BDI is a short screening measure for depression that is self-administered and contains 21 items. Participants rate each item on a four-point scale, ranging from 0-3. Total score on the BDI can be calculated to determine severity of depression as follows: 0-10 normal; 11-16 minimal depression; 17-20 borderline clinical depression; 21-30 moderate depression; 31-40 severe depression; and > 40 extreme depression.[51, 52]

The BDI has well documented reliability. As demonstrated in a review of 25 years of research, the measure shows high internal consistency, with Cronbach's Alpha ranging from .73-.90 depending on the participating population.[52] Test retest with the BDI-I has shown high correlation (r=.81-.83) among a student population. [44] Correlations (r) between the BDI and other common measures for determining severity of symptoms in depression (clinical ratings, Ham-D, Zung, Symptom Checklist-90, Multiphasic Personality Inventory Depression Scale (MMPI-D)

are relatively high, ranging between .55-.96. [44] For acceptable levels of sensitivity (66.88%) and specificity (58.8%) a cutoff score of 18 has been recommended for determining the presence or absence of a mood disorder (<18 is absence, >/= 18 mood disorder is present).[53]

**Neurobehavioral Functioning Inventory** (NFI) [28]

This 83-item inventory is self-administered and is designed to measure neurobehavioral functioning among patients with traumatic brain injury as well as other neurologic disorders. The NFI items can be divided into six scales: Depression, Somatic, Memory/Attention, Communication, Aggression, and Motor. Items are rated on a 5-point scale to determine the rate of occurrence of a problem. For example, an item "feel worthless" can be rated as Never, Rarely, Sometimes, Often, or Always. The 13-item depression scale can be used if a clinician wishes to assess patients' depression symptoms. The NFI is short, easy to use and requires no training to administer. Patients with scores above 43 on the NFI depression scale have been identified as showing the symptoms of clinical depression.[54]

The NFI has been shown to have high internal consistency, with Cronbach's Alpha for the depression subscale at .93. [55] Criterion-related validity has been demonstrated through correlation analyses with the MMPI and BDI.[4]

**Procedures**

Participants were either assessed in the outpatient neuropsychology clinic, in their residence at the long-term facility, or in outpatient rehabilitation facilities. Information on demographics, time since injury, injury severity, and current functioning was collected by patient interview and review of medical records.

Raters were trained in the administration of all measures with special attention focused on administration of the SCID. According to its creators, non-clinicians can administer the SCID

after extensive training.[43] The non-clinicians and clinicians in this study used all available training tools for SCID administration, including study of the SCID User's Guide, viewing and participating in the 11 hour video tape training program, and several practice sessions with clinical psychiatrists and psychologists. Additionally, joint interviews were administered in tandem with a psychiatrist, (kappa coefficient was .80). The SCID interview was completed based on an interview with the participant, medical record review, and information provided by family members as necessary. The Ham-D was completed by interview, and the person with TBI completed the BDI and NFI. All four measures were administered in random order during one interview.

**Results**

**Data Analysis**

Table 1 shows demographic characteristics of the sample and their risk of depression based on SCID diagnosis. Risk ratios and 95% confidence intervals were calculated using EpiInfo version 6. For the variable "productivity" participants were grouped as productive or non-productive based on their current employment/ school status. "Injury severity" was categorized as mild, moderate or severe based on a person's admission GCS score. On initial analysis "months post injury" and "length of coma" appeared to be associated with depression when considered as continuous variables. However, these two variables were not normally distributed. In order to evaluate their significance, participants were grouped, transforming the data into categorical variables. Variables that had large risk ratios with confidence intervals that indicated statistical significance were "productivity", "months post injury", and "length of coma", indicating some contribution to the likelihood of post TBI depression.

For purposes of comparison, the BDI, NFI and Ham-D were all measured against the SCID to assess the sensitivity and the specificity of the measures (tables 2-4). Sensitivity is the ability of a screening tool to detect and correctly classify a condition of interest (# of true positives). Specificity is a measure of the instrument's ability to correctly classify the absence of the condition of interest (# of true negatives). While all three screening measures performed well, the BDI was the most accurate. Using the recommended cutoff score of 18, the BDI showed sensitivity of 86% and specificity of 79%. Calculated sensitivity and specificity for the NFI was 62% and 92%, respectively. A cutoff score of 43 was used for the NFI. Based on specificity and sensitivity, the Ham-D missed the most cases in this sample, showing 46% sensitivity. However the specificity for the Ham-D was highest of the three at 99%, indicating only one false negative result when the SCID determined the case was positive (see Table 5).

Positive predictive value (PPV) is the proportion of patients with positive test screening results who were correctly classified for the condition of interest. Negative predictive value (NPV) is the proportion of patients with negative screening test results who were correctly classified for the condition of interest.[56] The BDI had a PPV of 65%, highlighting the fact that 16 of the cases that the BDI identified as depressed, were not actually depressed according to the SCID. The NPV for the BDI was the highest of the three at 92%, providing the percentage of cases classified as non-depressed by the BDI that were actually not depressed. This is an indication that those classified as not depressed by the BDI are likely not depressed according to the SCID, but some of those that are classified as depressed may not actually be depressed. The Ham-D showed the highest PPV at 96%, indicating that of those that tested positive on the Ham-D, 96% are actually depressed. The NFI showed a PPV of 78% and NPV of 84%, both values

falling in between the values of the Ham-D and the BDI. Table 5 shows the positive and negative predictive values for all three screening measures.

**Discussion**

The prevalence of depression revealed in this sample was 31.53%. This is similar to prevalence found in other studies that used DSM criteria for diagnosis, [5, 21-23] further supporting the use of comparable and reliable methods of diagnosis in order to produce more similar results among studies of depression after TBI.

Table 1 shows the risk ratios for different subdivisions of the sample. Males were 1.43 times likely than females to have a SCID diagnosis of depression, though the difference was not significant. "Length of coma" and "productivity" were both associated with post injury depression, based on risk ratios. The extremely wide confidence interval for "length of coma" highlights the necessity of using a larger sample in future investigations. Participants who were not working or in school had a depression risk 3.37 times the risk of those engaged in productive activities. The likelihood of depression varied depending on the number of days a person spent in acute care following their injury. Percentage of participants diagnosed as depressed on the SCID increased in accordance with the number of days, up to one week, after which time likelihood of depression was minimized. This is consistent with findings in some studies that depression decreases as injury severity increases.[57] However, a study using a larger sample size would be necessary to confirm these results. While injury severity (based on admission GCS) appeared to reveal a trend of decreasing depression in this sample, (prevalence of depression decreasing as injury severity increased), differences between groups were not significant.

From the results of the sensitivity and specificity calculations, the BDI appears to be the most appropriate screening measure for identifying cases needing further clinical evaluation. In spite of the 65% PPV for the BDI, indicating an overestimate of those who are depressed, its overall sensitivity provided the most valuable measure of it's usefulness for depression screening. The BDI's NPV of 92% is further confirmation of the utility of the measure, demonstrating that those who rate as not depressed on the BDI, are likely not depressed. A possibility for increasing the sensitivity and specificity might be to combine two measures; however, attempting this with the BDI and the NFI did not increase the sensitivity and actually decreased the specificity. Further investigation combining the BDI with different screening measures such as the PHQ-9 might yield improved results.

Another consideration for future research involves the NFI. Thirty-two items on the NFI have been identified as relevant and related to the DSM-IV criteria for diagnosing depression. While some of these items overlap with the 13-item scale, some do not. Furthermore, 14 of these 32 items have been analyzed and shown to differentiate between depressed and non-depressed patients with TBI.[58] The NFI could conceivably perform better by using items different than those found in the 13-item scale to help identify patients with symptoms of depression.

Representativeness of the sample was assessed by comparison to the Virginia Commonwealth University TBIMS population to determine similarities and differences. Many of the characteristics of the sample were similar to those of the VCU TBIMS database participants (age, gender, length of coma, marital status, and cohabitation). However, ethnicity, acute care length of stay, and productivity were significantly different. Because a shorter length of acute care stay (less than 21 days) appears to be associated with depression, and this sample had a longer mean length of stay than the TBIMS, depression prevalence of 31.53% could be an

underestimate for the general population. On the other hand, the percentage of those living a nonproductive lifestyle in our sample was higher than that of the TBIMS, possibly contributing to a higher estimation of depression prevalence than that which might be found in the general population of those with TBI.

Additionally, the present sample had less minority group members than the TBIMS sample, bringing into question the generalizability of the present findings. In the future, replication of this study should include enrollment of consecutive admissions to the inpatient rehabilitation program and multi-site data collection. These design changes would increase the generalizability of results.

**Conclusion**

The analysis in this study revealed that all three screening measures have some predictive ability for identifying patients with symptoms of depression that may result in a SCID diagnosis of depression. Sensitivity was considered the more important aspect to evaluate, because ideally staff would want to miss as few cases of possible depression as is feasible. Relying solely on the BDI to identify patients with a potential depression diagnosis would have resulted in missing 5 out of the 35 cases that were identified as depressed by SCID diagnosis. This would have caused an underestimate of the prevalence of depression in this sample of about 3.5%. Though it performed more accurately than the Ham-D or NFI, it remains clear that screening tools alone are not sufficient for diagnosing depression. However in situations where there is not enough time or money to provide a structured clinical interview for all patients, use of the BDI may prevent missing those cases that would never have had any type of evaluation for depression.

**Table 1: Demographic Characteristics and Risk of Depression After TBI**

| SAMPLE CHARACTERISTICS | N | % | % SCID Dx: YES | RR | 95% CI |
|---|---|---|---|---|---|
| **Gender** | | | | | |
| male | 75 | 67.0% | 34.7% | 1.43 | [0.75, 2.72] |
| female | 37 | 33.0% | 24.3% | 1.00 | |
| **Productivity** | | | | | |
| non-productive | 76 | 69.7% | 40.8% | 3.37 | [1.29, 8.77] |
| productive | 33 | 30.3% | 12.1% | 1.00 | |
| **Injury Severity** | | | | | |
| mild | 29 | 35.4% | 37.9% | 1.48 | [0.73, 3.01] |
| moderate | 14 | 17.1% | 35.7% | 1.39 | [0.58, 3.37] |
| severe | 39 | 47.6% | 25.6% | 1.00 | |
| **Cohabitation** | | | | | |
| lives alone | 25 | 22.3% | 36.0% | 1.20 | [0.65, 2.23] |
| lives w/ others | 87 | 77.7% | 29.9% | 1.00 | |
| **Months Post Injury** | | | | | |
| 3-12 | 28 | 25.5% | 50.0% | 3.63 | [1.36, 9.68] |
| 13-36 | 29 | 26.4% | 27.6% | 2.00 | [0.68, 5.91] |
| 37-72 | 13 | 11.8% | 30.8% | 2.23 | [0.66, 7.57] |
| 73-120 | 11 | 10.0% | 36.4% | 2.64 | [0.79, 8.75] |
| >/= 120 | 29 | 26.4% | 13.8% | 1.00 | |
| **Length of Coma** | | | | | |
| none | 39 | 39.8% | 35.9% | 5.38 | [1.32, 21.9] |
| up to 1 day | 15 | 15.3% | 46.7% | 7.00 | [1.65, 29.67] |
| 2-6 days | 14 | 14.3% | 50.0% | 7.50 | [1.78, 31.58] |
| >/= 7 days | 30 | 30.6% | 2.00% | 1.00 | |
| **Acute Care Stay** | | | | | |
| 0-7 days | 31 | 30.7% | 38.7% | 2.16 | [0.97, 4.82] |
| 8-21 days | 31 | 30.7% | 41.9% | 2.34 | [1.06, 5.14] |
| >/=22 days | 39 | 38.6% | 17.9% | 1.00 | |
| **Ethnicity** | | | | | |
| Other | 29 | 25.9% | 34.5% | 1.14 | [0.63, 2.08] |
| Caucasian | 83 | 74.1% | 30.1% | 1.00 | |
| **Marital Status** | | | | | |
| married | 29 | 25.9% | 37.9% | 1.31 | [0.74, 2.33] |
| Single | 83 | 74.1% | 28.9% | 1.00 | |

**Table 2. BDI vs. SCID Diagnosis of Depression**

| | SCID | | |
|---|---|---|---|
| **BDI (18)** | YES** | NO | Total |
| YES* | 30 | 16 | 46 |
| NO | 5 | 60 | 65 |
| Total | 35 | 76 | 111 |

*Yes on the BDI refers to a total score of 18 or greater, cutoff for presence of depression

**Yes on the SCID refers to a diagnosis of current major depressive episode or current major depressive episode due to a general medical condition

**Table 3. NFI vs. SCID Diagnosis of Depression**

| | SCID | | |
|---|---|---|---|
| **NFI (43)** | YES** | NO | Total |
| YES* | 21 | 6 | 27 |
| NO | 13 | 70 | 83 |
| Total | 34 | 76 | 110 |

*Yes on the NFI refers to a total score of 43 or greater, cutoff for presence of depression

**Yes on the SCID refers to a diagnosis of current major depressive episode or current major depressive episode due to a general medical condition

**Table 4. Ham-D vs. SCID Diagnosis of Depression**

| | SCID | | |
|---|---|---|---|
| **Ham-D (18)** | YES** | NO | Total |
| YES* | 16 | 1 | 17 |
| NO | 19 | 75 | 94 |
| Total | 35 | 76 | 111 |

*Yes on the Ham-D refers to a total score of 18 or greater, cutoff for presence of depression

**Yes on the SCID refers to a diagnosis of current major depressive episode or current major depressive episode due to a general medical condition

**Table 5. Sensitivity, Specificity, Positive Predictive Value (PPV) and Negative Predictive Value (NPV) of the BDI, NFI, and Ham-D Compared to the SCID**

| | **Sensitivity** | **Specificity** | **PPV** | **NPV** |
|---|---|---|---|---|
| **BDI** | 30/35 = 86% | 60/76 = 79% | 65% | 92% |
| **NFI** | 21/34 = 62% | 70/76 = 92% | 78% | 84% |
| **Ham-D** | 16/35 = 46% | 75/76 = 99% | 94% | 80% |

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