Assessing the Accuracy of the Substance Abuse Subtle Screening Inventory-3 Using *DSM-5* Criteria

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John M. Laux, Robin M. DuFresne, Allison K. Arnekrans, Sylvia Lindinger-Sternart, Christopher P. Roseman, Amy Wertenberger, Stephanie Calmes, Darren W. Love, Andrew M. Burck, Jim Schultz

This study examined the Substance Abuse Subtle Screening Inventory-3's (SASSI-3) ability to predict *Diagnostic and Statistical Manual of Mental Disorders* (5th ed., *DSM-5*) substance use disorder criteria. Various data sets were collected from college students, patients at a residential substance use disorder treatment center, and clients of a private, non-profit forensic and mental health treatment center (*N* = 241). Agreement between the SASSI-3 and *DSM-5* diagnosis was fair.

Keywords: **SASSI-3, *DSM-5*, substance use disorder, substance abuse, mental health treatment**

The Substance Abuse Subtle Screening Inventory-3 (SASSI-3; Miller & Lazowski, 1999) is a substance use screen that uses logically derived, or obvious questions, as well as subtle, or empirically derived questions. The SASSI-3 can be completed, scored and interpreted in 15 minutes. Side one consists of 67 true–false items selected for their ability to statistically differentiate between a criterion group of persons with substance dependence and a control group of non-substance dependent persons. The 67 empirically derived items are used in an effort to defeat dissimulation and are similar in nature and purpose to items found on the MacAndrew Alcoholism Scale-Revised (MAC-R; MacAndrew, 1965). As such, these empirically derived items are useful with individuals who are either intentionally or unintentionally denying a substance use disorder (Laux, Piazza, Salyers, & Roseman, 2012). These comprise the Symptoms scale (SYM), which assesses the symptoms and consequences of drug and alcohol use; the Obvious Attributes scale (OAT), a measure of the obvious symptoms of substance dependence; the Subtle Attributes scale (SAT), an indirect measure of substance use that employs items with non-substance-related content; the Defensiveness scale (DEF), which measures denial or minimization; the Supplemental Addiction Measure scale (SAM), which discriminates general defensiveness from defensiveness related to substance use; the Family Versus Control Subjects scale (FAM), which identifies those who are likely to focus on the thoughts and feelings of others to their own neglect; the Correctional scale (COR), used to detect response patterns similar to those produced by persons with a history of criminal behaviors; and the Random Answering Pattern scale (RAP), designed to identify haphazard answering. Side one also includes questions about respondents' marital status, employment status, education, ethnicity and income.

Side Two consists of 12 items specific to alcohol use and 14 items regarding use of other substances. Response options to these 26 items are *never*, *once or twice*, *several times*, and *repeatedly*. These 26 items comprise the Face Valid Alcohol (FVA) and Face Valid Other Drugs (FVOD) scales and

John M. Laux is a Professor at The University of Toledo. Robin M. DuFresne is a practicing clinical counselor at the Zepf Center in Toledo, Ohio. Allison K. Arnekrans is an Assistant Professor at Central Michigan University. Sylvia Lindinger-Sternart is an Assistant Professor at the University of Great Falls. Christopher P. Roseman is an Associate Professor at The University of Toledo. Amy Wertenberger is a doctoral candidate at The University of Toledo. Stephanie Calmes is a professional counselor at Harbor Behavioral Health in Toledo, Ohio. Darren W. Love is the Treatment Program Manager at Court Diagnostic and Treatment Center in Toledo, Ohio. Andrew M. Burck is an Assistant Professor at Marshall University. Jim Schultz is a mental health counselor at Harbor Behavioral Health in Toledo, Ohio. Correspondence may be addressed to John M. Laux, MS 119, 2801 W. Bancroft St., Toledo, Ohio, 43606, John.Laux@utoledo.edu.

are similar to items found on the Michigan Alcoholism Screening Test (MAST; Selzer, 1971) and the CAGE (Ewing, 1984). The SASSI-3 is interpreted using nine decision rules. The first five decision rules are based solely on the unique contributions of individual scales. The remaining four decision rules involve a combination of two or more scales. A decision rule is coded "yes" if the associated SASSI-3 scale or scales' raw score is equal to or greater than the decision rule's cut score. Otherwise, the decision rule is coded as "no." The respondent is determined to have a "high probability of having a substance dependence disorder" if any of the decision rules are met (Miller & Lazowski, 1999, p. 10).

Not only does the SASSI-3 do a better job of identifying alcohol use disorders than the MAST, CAGE and MAC-R (Laux, Perera-Diltz, Smirnoff, & Salyers, 2005; Laux, Salyers, & Kotova, 2005), it provides the added benefit of screening for drug use other than alcohol. The most recent inquiry into substance use screens indicated that the SASSI-3 is the substance use screen most frequently used by Master Addictions Counselors certified by the National Board for Certified Counselors (Juhnke, Vacc, Curtis, Coll, & Paredes, 2003).

The SASSI-3 Manual (Miller & Lazowski, 1999) reported a sensitivity (true positive) rate of 94.6% and specificity (true negative) rate of 93.2%. Subsequent field research produced results consistent with the psychometric claims made in the SASSI-3 Manual (Burck, Laux, Harper, & Ritchie, 2010; Burck, Laux, Ritchie, & Baker, 2008; Calmes et al., 2013; Hill, Stone, & Laux, 2013; Laux, Perera-Diltz, Smirnoff, & Salyers, 2005; Laux, Salyers, & Bandfield, 2007; Laux, Salyers, & Kotova, 2005; Wright, Piazza, & Laux, 2008). Further, Laux et al. (2012) demonstrated that the SASSI-3's empirical items and associated decision rules increased the instrument's screening accuracy. In addition, persons' willingness and ability to self-report having a substance use disorder as described in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision* (*DSM-IV-TR*; American Psychiatric Association [APA], 2000) did not negatively affect the instrument's sensitivity. Laux et al. (2012) found that the SASSI-3 produced high sensitivity rates across varying levels of motivation to change among persons who lost parental rights due to substance use.

APA published the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-5*) in 2013. This most current version of the *DSM* brought forward major and important changes to the way the substance use disorder (SUD) chapter is conceptualized (Dailey, Gill, Karl, & Barrio Minton, 2014). Notably, the former dichotomous substance abuse and substance dependence categories have been removed and replaced with a continuum under the heading of "Substance Use Disorders" (APA, 2013, p. 483). The criterion formerly associated with the substance abuse and substance dependence disorders have been merged onto one continuum, to which craving has been added. Clients are determined to have a mild SUD if two or three criteria are met, a moderate SUD when four to five symptoms are met, and a severe SUD when six or more symptoms are endorsed.

Because previous versions of the *DSM* criteria were frequently used as the gold standard against which SUD screens were compared (Ashman, Schwartz, Cantor, Hibbard, & Gordon, 2004; Lazowski, Miller, Boye, & Miller, 1998), it is of interest to investigate the degree to which the SASSI-3 accurately predicts the new *DSM-5* substance use diagnostic criteria. Our literature review produced two examples of empirical comparison between the SASSI-3, or its predecessors, and *DSM* criteria. The first (Lazowski et al., 1998) reported on the standardization efforts that produced the instrument's third version. This research team used the data from persons whose case files had a *DSM-III-R* (APA, 1987) or a *DSM-IV* (APA, 1994) substance use diagnosis and an administration of the SASSI-3. How the participants were diagnosed was not specified. The results of this investigation found that the SASSI-3's overall accuracy rating was 97%, the sensitivity rating was 97% and the specificity rating was 95%. A second study (Ashman et al., 2004) sought to determine the SASSI-3's ability to screen for

substance abuse among persons with traumatic brain injury. Ashman et al. (2004) used the Structured Clinical Interview for *DSM-IV* (First, Spitzer, Gibbon, & Williams, 1996) as the criterion variable against which the SASSI's results were compared. These authors concluded that while the SASSI's overall decision and FVA scale yielded "modest accuracy, sensitivity, and specificity rates" (p. 198), the FVOD scale had high sensitivity (95%) but only moderate accuracy (83%) and specificity (82%) among persons with traumatic brain injury.

The purpose of this study was to extend this line of research and examine the SASSI-3's ability to accurately assess the presence of an SUD using *DSM-5* criteria. Specifically, the authors calculated kappa statistics to estimate the degree of agreement between the SASSI-3's overall decision rules, its individual decision rules and counselors' *DSM-5* SUD diagnoses. This analysis is important because these decision rules directly affect the SASSI-3's final SUD classification (i.e., high probability of substance dependence disorder/low probability). Further, we examined the SASSI-3's specificity and sensitivity using receiver operating characteristics (ROC) curves. We hypothesized that we would find good agreement between the overall SASSI-3 score and the *DSM-5* SUD diagnosis. We further expected to find good agreement between the SASSI-3 face valid scales and the *DSM-5* SUD diagnosis. We expected to find a moderate to low agreement between the SASSI-3 subtle scales and the *DSM-5* SUD diagnosis. Additionally, we hypothesized that the ROC analysis would provide optimal cut-off scores for each of the SASSI-3 subscales that would improve those scales' sensitivity and specificity. Study participants were selected from an inpatient SUD treatment center, an urban university, and a community mental health center that provides court-ordered outpatient treatment for clients with substance use issues. These populations were selected in order to match the populations on which the SASSI-3 was standardized (Miller & Lazowski, 1999).

Method

Participants

This study included participants (N = 241) recruited between October 2013 and May 2014. There were 114 females (47.3%) and 127 males (52.7%). The participants' average age was 33.63 (SD = 6.83, range = 19–47). One hundred thirty-one (54.4%) were European American, 52 (21.6%) were African American, 7 (2.9%) were Hispanic, 12 (5.0%) were biracial, and 4 (1.7%) were Asian American. Thirty-five (14.5%) provided no ethnic background information. The average number of years of education completed was 12.48 (SD = 1.79, range = 7–18). Thirty-two (13.3%) were married, 156 (64.7%) were never married, 27 (11.2%) were divorced, 16 (6.6%) were separated, 4 (1.7%) were widowed, and 6 (2.5%) did not indicate a marital status. Thirty-three (13.7%) participants listed their employment as full-time, 22 (9.1%) as part-time, 91 (37.8%) as not employed, 65 (27.0%) as student, 9 (3.7%) as home maker, 13 (5.4%) were disabled, 2 (.8%) listed retired, and 6 (2.5%) listed no employment status. The sample features fewer employed, and more unemployed and student participants than the SASSI-3 normative sample (Miller & Lazowski, 1999).

Participants were recruited from three sites in Ohio. A total of 117 (48.5% of the total sample) participants were recruited from an adults-only comprehensive community mental health substance abuse treatment center. Another 61 subjects (25.3% of the total) were recruited from a private, non-profit organization specializing in court-ordered outpatient mental health treatment. Finally, 63 students (26.1% of the sample) enrolled at a large, public, urban university in Ohio were recruited to provide a sample of individuals who were less likely to be substance users. A one-way ANOVA [$F(2, 233) = 24.28$, $p = .000$, $\eta^2 = .172$] showed that the college students' mean age (M = 23.86, SD = 9.04) was significantly lower than the inpatient substance abuse clients' (M = 35.80, SD = 11.36) and the outpatient clients' (M = 32.80, SD = 10.88).

Procedure and Materials

The procedures involved here were approved by the sponsoring institution's Institutional Review Board and the data collection sites, and were consistent with the American Counseling Association's *Code of Ethics* (2014). Three licensed counselors who had completed two graduate courses in testing and assessment conducted standardized interviewing and administered SASSI-3s. All three counselors completed training in SUD interviewing and SASSI-3 administration and scoring prior to the study's beginning. All persons receiving treatment at sites 1 and 2 were asked to participate. A total of 117 of the 118 (99.2%) persons at site 1 and 61 of the 64 (95.3%) persons at site 2 agreed to participate. Sixty-three of 79 students (79.8%) enrolled in one of three separate undergraduate counseling courses agreed to participate.

Each participant met individually with a researcher who used the structured SUD questionnaire to conduct an interview and administered the SASSI-3. The SASSI-3s were scored and interpreted by a fourth researcher who had no knowledge of the interviewing researchers' diagnostic impressions. For quality control purposes, the senior author reviewed the SASSI-3 scoring and questionnaire results.

Instruments

Structured Substance Use Disorder Questionnaire. At present, no structured guide or screen exists that was developed and normed using the current *DSM-5* SUD criteria. To ensure that the counselors were uniform in their substance use interviews and that their interviews were consistent with the *DSM-5* criteria, we designed a 22-item questionnaire to determine whether participants would meet criteria for a *DSM-5* SUD. This questionnaire was based on the 11 criteria for an SUD from the *DSM-5* (APA, 2013). These items were yes/no questions corresponding to the criteria for an SUD and were divided into two sections. The first 11 items applied to alcohol use and the second 11 items applied to the use of other drugs. Consistent with the *DSM-5*'s SUD section, participants who responded "yes" to two or more items in either section met criteria for a *DSM-5* substance use disorder.

Endorsement of two items in the first section indicated the participant met criteria for an SUD involving alcohol use; endorsement of two items in the second section indicated the participant met criteria for an SUD involving other drugs. Severity of the SUD was based on decision rules provided in the *DSM-5*: 2–3 symptoms indicated a mild SUD, 4–5 symptoms indicated a moderate SUD, and 6 or more symptoms indicated a severe SUD (APA, 2013). Counselors clarified the meaning of items as needed. No distinction was made between different types of drug use (marijuana, cocaine, etc.) because the SASSI-3 does not do so. The internal consistency estimates for the alcohol and other drug use sections were high ($\alpha = .94$ and $\alpha = .97$, respectively).

Data Analysis

The authors used two methods of statistical analysis. Cohen's kappa was used to measure the agreement between the two dichotomous *DSM-5* SUD diagnosis variables (i.e., met criteria or not) and the overall score on the SASSI-3 (high probability of substance dependence disorder/ low probability). Cohen's kappa also was used to compare the *DSM-5* diagnosis of either an SUD involving alcohol or one involving other drug use to the score on the SASSI-3 subscale 1 (FVA) or subscale 2 (FVOD), respectively. It was then used to measure agreement between the *DSM-5* SUD diagnosis and the scores on subscales 3–9 on the SASSI-3. The value of the kappa is between 0 and 1 and is divided into 5 levels of agreement: .01 to .20 signifies slight agreement; .21 to .40 fair; .41 to .60 moderate; .61 to .80 substantial; and .81 to .99 near perfect agreement (Landis & Koch, 1977).

Unlike the kappa, ROC curve analysis is used with continuous variables. ROC analysis allows one

to measure a trade-off between specificity (true positives) and sensitivity (true negatives; Youngstrom, 2014). ROC allows the investigator to determine how specificity and sensitivity change when the cut-off value of the continuous variable is changed. ROC value is expressed as an area under the ROC curve (AUROC). ROC curves are graphically represented as the relationship between an instrument's specificity (horizontal axis) and sensitivity (vertical axis). ROC curves are interpreted by finding the point on the graph where a scale's sensitivity and specificity are balanced. To the naked eye, this optimal point is where the curve begins to flatten out at the top. ROC analyses are performed on individual scales, but not multiple scales. As such, ROC analyses can only be performed on those SASSI-3 decision rules that involve individual scales (decision rules 1–5). Decision rules 6–9 involve input from two or more SASSI-3 scales and are therefore not subject to ROC analysis. The ROC scores are categorized as follows: ≥ .90, excellent; ≥ .80, good; ≥ .70, fair; and < .70, poor (Youngstrom, 2014).

Results

A review of the participants' random answering profile (RAP) scores indicated that all profiles were valid. Of the 241 participants, the SASSI-3 classified 153 (63.5%) as having a high probability of having a substance dependence disorder. Raw SASSI-3 scale scores were converted to *t* scores using the SASSI-3 Manual's Appendix C (Miller & Lazowski, 1999).

Table 1

SASSI-3 Scale Descriptive Data and Internal Consistency Estimates

SASSI-3 Scale	Mean *t* score	Standard Deviation	Range	Alpha
FVA	55.67	15.86	41-110	0.93
FVOD	70.58	25	5-116	0.97
SYM	63.58	14.68	36-92	0.81
OAT	60.23	12.25	35-85	0.74
SAT	58.35	14.78	24-99	0.52
DEF	45.33	10.81	24-73	0.53
SAM	62.76	12.09	30-94	0.63
FAM	44.1	12.18	4-76	0.24
COR	61.21	13.74	36-88	0.63

Note. FVA = Face Valid Alcohol scale; FVOD = Face Valid Other Drugs scale; SYM = Symptoms scale; OAT = Obvious Attributes scale; SAT = Subtle Attributes scale; DEF = Defensiveness scale; SAM = Supplemental Addiction Measure scale; FAM = Family versus Control Subjects scale; COR = Correctional scale.

Table 1 represents each SASSI-3 scale's mean, standard deviation, range of scores and Cronbach's alpha. These internal consistency reliability estimates were comparable with previously reported alphas (Burck, Laux, Harper, & Ritchie, 2010; Burck et al., 2008). The counselor's interviews indicated that 188 (78.0%) of the participants met SUD criteria as specified in the *DSM-5*. Of these 188, 25 (13.3%) had a mild SUD, 13 (6.9%) were moderate, and 127 (67.6%) had a severe SUD. Of the 188

participants diagnosed with an SUD, 85 participants (45.2%) had an alcohol use disorder. Of these 85, 33 (38.8%) had a mild alcohol SUD, 13 (15.3%) were moderate, and 39 (45.9%) were severe. One hundred thirty-three participants (55.2%) were positive for an SUD other than alcohol. Of these 133, 10 (7.5%) had a mild disorder, 8 (6.0%) were moderate, and 115 (86.5%) were severe.

Cohen's kappa (κ) statistic was calculated to determine the agreement between the *DSM-5* diagnosis (i.e., met criteria or not) and the SASSI-3 overall score and each of the SASSI-3's decision rules. Table 2 presents the results of these analyses as well as the number of SASSI-3 true positive, true negative, false positive and false negative classifications. The overall SASSI-3's agreement with the counselors' diagnostic decisions was fair (κ = .423, p = .060). The SASSI-3 results concurred with counselors' diagnostic interviews on 182 cases and disagreed on 59 cases. The SASSI-3's sensitivity (true positives) and specificity (true negatives) rates were .75 and .77, respectively.

Table 2

Agreement Between Counselors' Diagnoses and SASSI-3 Individual and Total Decision Rules

Rule	True Positive	True Negative	False Positive	False Negative	Kappa
1[1]	31 (12.9%)	151 (62.7%)	5 (2.1%)	54 (22.4%)	0.383***
2[2]	105 (43.6%)	105 (43.6%)	3 (1.2%)	28 (11.6%)	0.745*****
3	91 (37.8%)	47 (19.5%)	6 (2.5%)	97 (40.2%)	0.229***
4	32 (13.3%)	53 (22.0%)	0 (0%)	156 (64.7%)	0.083**
5	38 (15.8%)	53 (22.0%)	0 (0%)	150 (62.2%)	0.100**
6	62 (25.7%)	50 (20.7%)	3 (1.2%)	126 (52.3%)	0.149**
7	107 (44.4%)	48 (19.9%)	5 (2.1%)	81 (34.0%)	0.313***
8	4 (1.7%)	52 (21.6%)	1 (0.4%)	184 (76.3%)	0.001*
9	59 (24.5%)	46 (19.1%)	7 (2.9%)	129 (53.5%)	0.100**
SASSI-3	141 (58.5%)	41 (17.0%)	12 (5.0%)	47 (19.5%)	0.423****

Note. 1 = Rule 1 kappa tested against positive for alcohol use disorder only. 2 = Rule 2 kappa tested against all substance use disorders but alcohol use. All other kappa values are calculated for each Decision Rule's agreement a clinical diagnosis of any substance use disorder. * = less than chance agreement, ** = slight agreement, *** = fair agreement, **** = moderate agreement and ***** = substantial agreement (Landis & Koch, 1977).

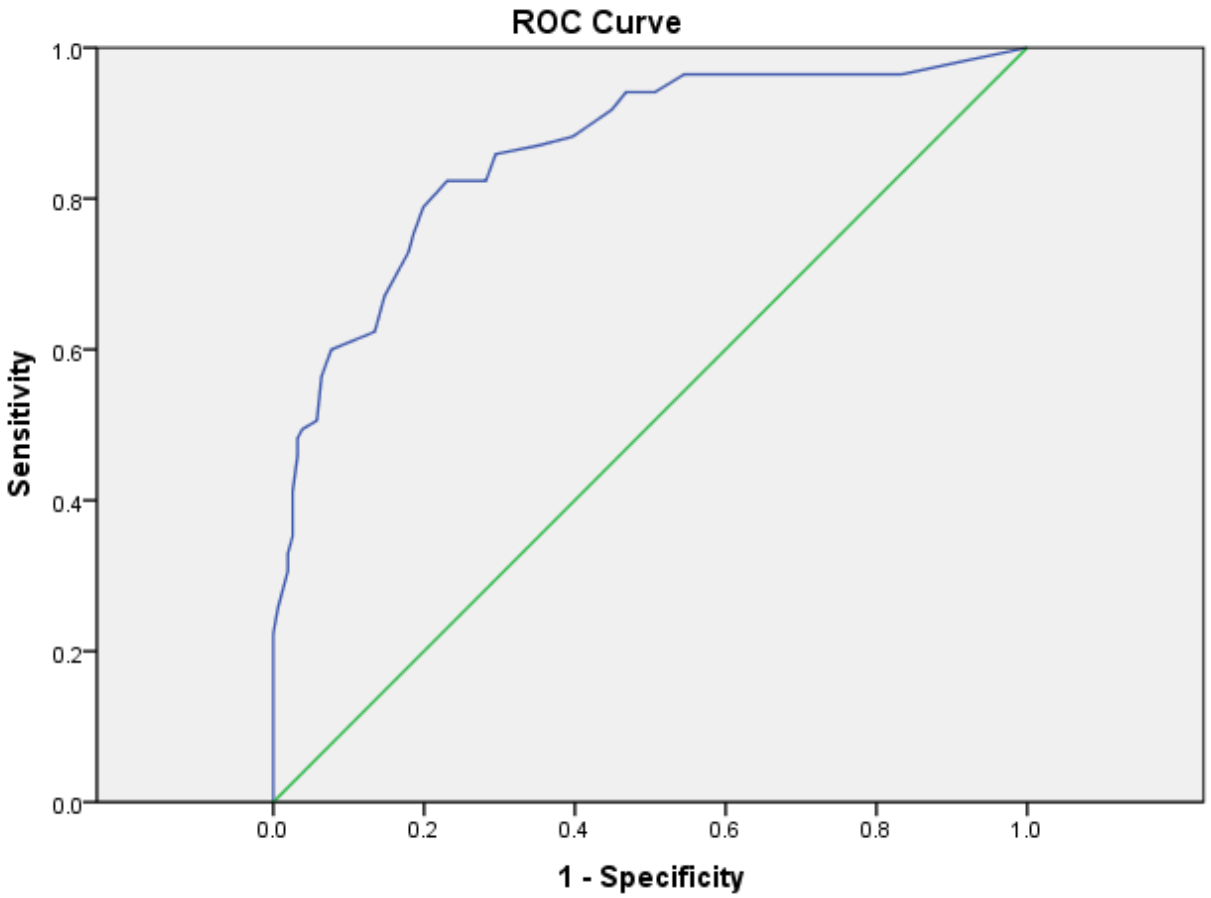
A closer examination of the kappa data indicates that the SASSI-3 and its subscales' areas of weakness were the false negative rates. That is, the SASSI-3 failed to identify persons as likely substance dependent that the counselors judged as substance dependent (i.e., met criteria or not). Based on the kappa data, the SASSI-3 overall score incorrectly categorized 47 (19.5%) of the sample

as not in need of further SUD assessment. This suggests that the decision rules' cut scores may be too high for this sample. To test this hypothesis, the researchers investigated the SASSI-3's FVA, FVOD, SYM, OAT and SAT scales' specificity and sensitivity using ROC analyses (Youngstrom, 2014).

The ROC analysis of the FVA scale produced an AUROC value of .861, p = .000, standard error = .026, with a 95% confidence interval range of .811 to .912. This indicates that there is a good agreement between the FVA scale and the counselors' alcohol use disorder diagnoses (Youngstrom, 2014). A review of the coordinates of the curve (Figure 1) demonstrates that an adjusted FVA t score cut-off of 53.5 would provide the optimal balance between sensitivity (.79) and specificity (.80). A t score of 53.5 translates into an FVA raw score of approximately 6 for both sexes. Rule 1 was recalculated using a raw score of 6 for both sexes and a kappa statistic was calculated to determine the agreement rate between this new FVA cut score and the counselors' alcohol use disorder diagnoses. The new kappa statistic was .551, p = .000. The new Rule 1 sensitivity and specificity rates were, respectively, .81 and .77. Rule 1's false positive rate was .19 and the false negative rate was .23. Lowering the Rule 1 cut score to 6 improved the kappa statistic by .168.

Figure 1.

ROC Curve for FVA t *Score Plotted Against Counselor Alcohol Use Disorder Diagnosis*

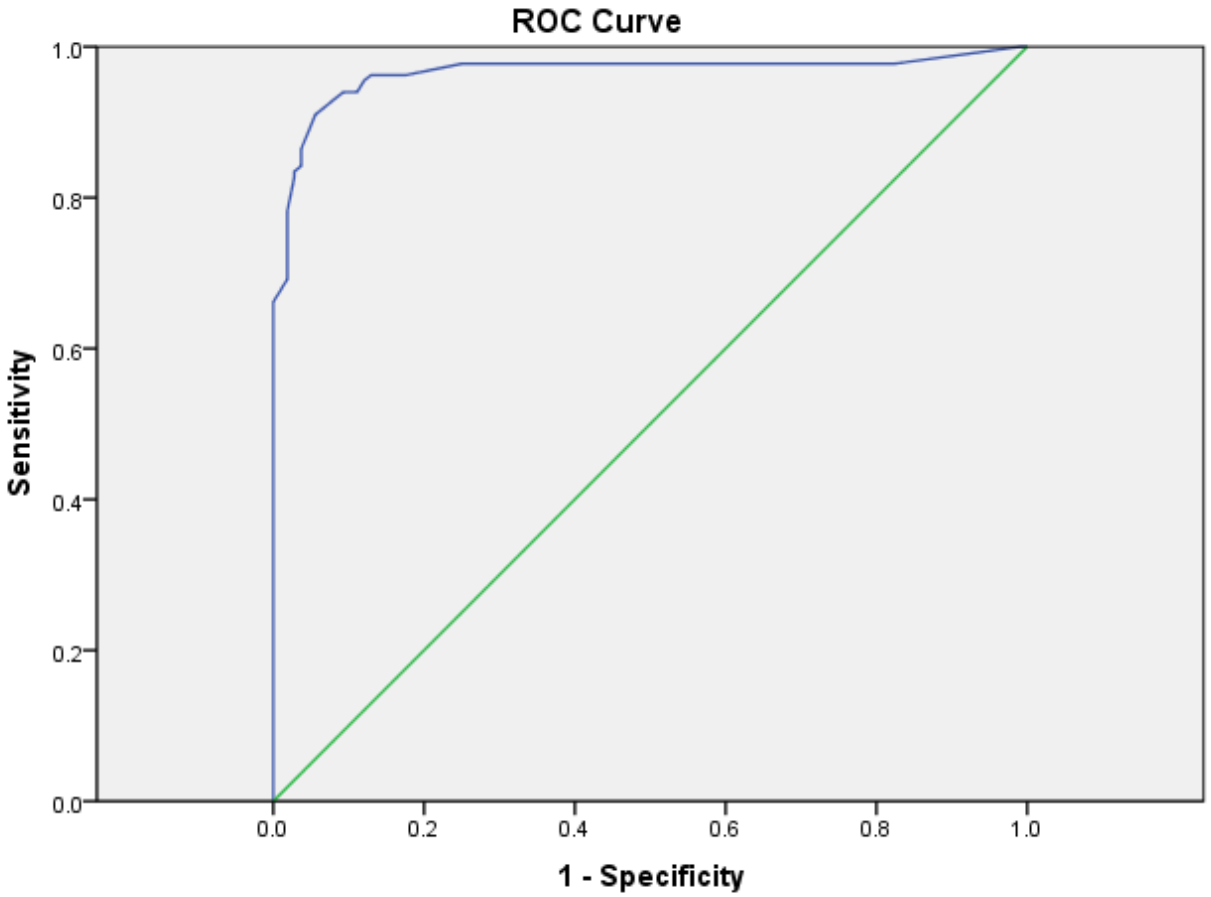


Note. Diagonal segments are produced by ties.

The ROC analysis of the FVOD scale produced an AUROC value of .965, p = .000, standard error = .013, with a 95% confidence interval range of .940 to .990. This indicates that there is an excellent agreement between the FVOD scale and the counselors' SUD other than alcohol dependence diagnoses (Youngstrom, 2014). A review of the coordinates of the curve (Figure 2) argued against making any adjustments to the current FVOD score cut-offs for Rule 2.

Figure 2.

ROC Curve for FVOD t *Score Plotted Against Counselor SUD Diagnosis*

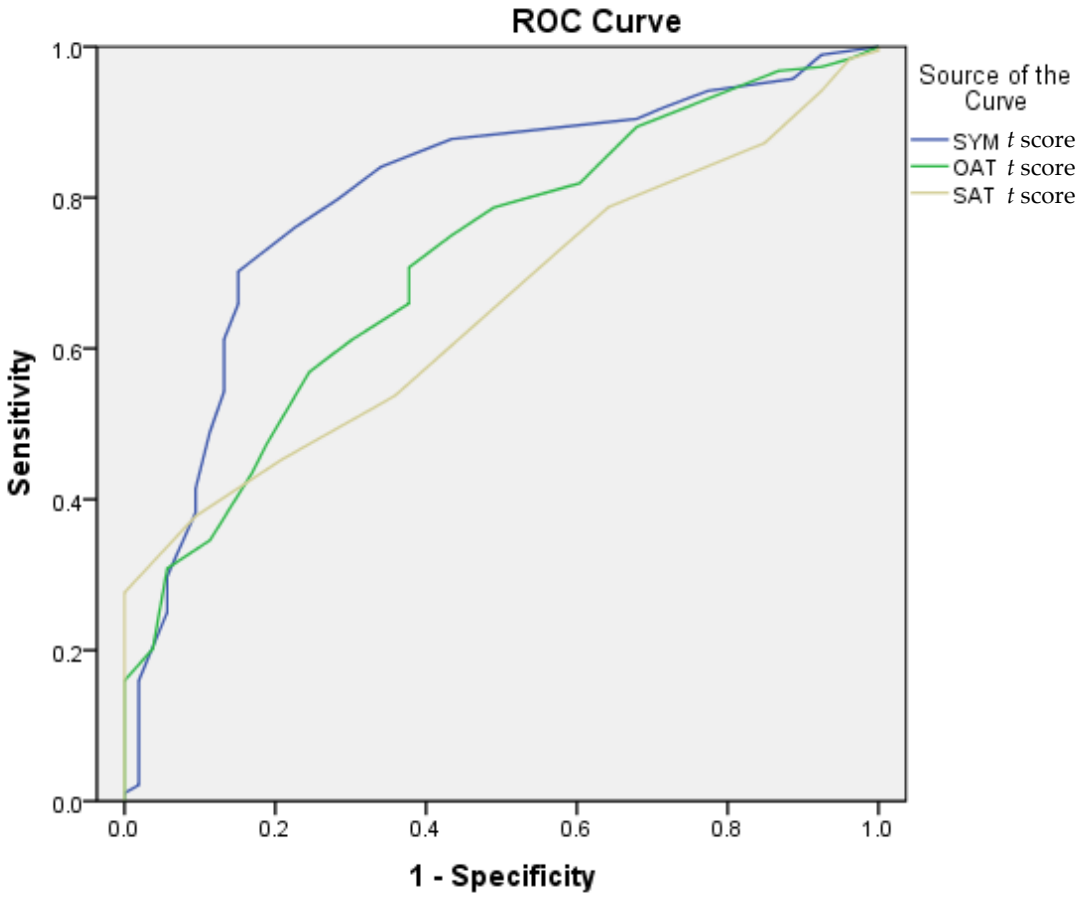


Note. Diagonal segments are produced by ties.

The ROC analysis of the SYM scale produced an AUROC value of .803, p = .000, standard error = .035, with a 95% confidence interval range of .735 to .871. This indicates that there is a good agreement between the SYM scale and the counselors' SUD diagnoses (Youngstrom, 2014). A review of the coordinates of the curve (Figure 3) demonstrates that an adjusted SYM t score cut-off of 56.5 would provide the optimal balance between sensitivity (.761) and specificity (.774). A t score of 56.5 translates into an SYM raw score of approximately 5 for males and 4 for females. Rule 3 was recalculated using these new raw scores and a kappa statistic was calculated to determine the agreement rate between this new SYM cut score and the counselors' overall SUD diagnoses. The kappa statistic was .437, p = .000. The new Rule 3 sensitivity and specificity rates were, respectively, .76 and .77. Rule 3's false positive rate was .23 and the false negative rate was .24. Lowering the Rule 3 cut score to 6 improved the kappa statistic by .208.

Figure 3.

ROC Curve for SYM, OAT and SAT t *Scores Plotted Against Counselor SUD Diagnosis*



Note. Diagonal segments are produced by ties.

The ROC analysis of the OAT scale produced an AUROC value of .717, p = .000, standard error = .038, with a 95% confidence interval range of .643 to .791 (Figure 3). This indicates that there is fair agreement between the OAT scale and the counselors' SUD diagnoses (Youngstrom, 2014). It was not possible to adjust the OAT *t* score to produce an optimal cut-off score such that a balance between sensitivity and specificity could be obtained. For example, to attain a sensitivity rating of .82, the *t* score cut-off would have to be lowered to 48.5, which would produce a specificity rating of .634.

The ROC analysis of the SAT scale produced an AUROC value of .654, p = .001, standard error = .037, with a 95% confidence interval range of .582 to .727 (Figure 3). This indicates that there is poor agreement between the SAT scale and the counselors' SUD diagnoses (Youngstrom, 2014). As with the OAT scale, no cut-off score could be determined that would provide an optimal balance between sensitivity and specificity.

The SASSI-3's overall decision was recalculated using the lowered Rule 1 and Rule 3 cut scores. This process resulted in a total of 188 persons being classified as likely dependent on the SASSI-3, or a change in the total number of classifications by 28. A follow-up analysis comparing the SASSI-3 final decision using the adjusted scores for Rules 1 and 3 and the original cut scores for Rules 2 and 4–9 with the counselors' decisions produced a kappa of .457 (p = .000). This kappa is slightly higher

than the kappa produced using unadjusted Rule 1 and 3 cut-offs (κ = .423). The adjusted process identified 161 of the 181 (sensitivity = .89) participants whom the counselors classified as having an SUD. However, this increased sensitivity came at the cost of decreased specificity. The adjusted process identified only 33 (specificity = .55) of those participants whom the counselors determined did not have an SUD. The false positive rate and the false negative rate for this adjusted process were, respectively .45 and .11. In sum, this process increased the number of true positives by 20, decreased the number of true negatives by 8, increased the number of false positives by 8, and decreased the number of false negatives by 20. As one might expect, lowering the cut scores on these two rules increased the instrument's ability to detect the presence of problems, but did so at the cost of possibly overdiagnosing 8 (3%) additional participants while reducing the false negative classifications by 20 (8.3%).

Discussion

The *DSM-5* section on SUDs includes significant changes. Chief among these changes is the movement away from an abuse/dependence dichotomy to an SUD continuum that includes all of the criteria previously unique to abuse and dependence disorders as well as the addition of a craving criterion. The present study examined the SASSI-3's utility in predicting counselors' diagnostic classifications using the new *DSM-5* SUD criteria. The results provided a mixed picture. The SASSI-3's agreement with the counselors' diagnoses was moderate. This finding prompted us to conduct a similar series of kappa analyses for each of the SASSI-3's decision rules and ROC analyses for the first five SASSI-3 decision rules. The last four decision rules could not be analyzed with the ROC as they are each composed of more than one scale of the SASSI-3. The decision rules' agreement with the counselors' diagnoses varied considerably. The kappa values presented in Table 1 are below what would be expected based on previously published agreement statistics using previous versions of the *DSM* (Miller & Lazowski, 1999). The SASSI-3 and its decision rules' false negative values suggested that the instrument's modest agreement with the counselors may have been a consequence of unnecessarily high raw score cut-off points. Consistent with Clements' (2002) findings related to adjusting cut scores, the ROC score analyses presented mixed results. The ROC analyses provided evidence that lowered FVA and SYM cut scores improved these scales' respective sensitivity and specificity estimates. The FVOD scale's current cut score produced high sensitivity and specificity and did not need to be improved. The OAT and SAT cut scores could not be adjusted without unwanted compromises to either scale's associated decision rules' sensitivity and specificity. The SASSI-3's overall decision was recalculated using the lowered Rule 1 and Rule 3 cut scores. This process resulted in an improvement in sensitivity with a slight decrease in specificity. The net result was an improvement in the SASSI-3's overall agreement with licensed counselors' SUD determinations. Our FVOD scale's sensitivity and specificity findings are consistent with those of First et al. (1997) and Lazowski et al. (1998), and suggest that the FVOD scale is useful in predicting *DSM-IV-TR* and *DSM-5* non-alcohol SUDs. Our FVA scale findings are consistent with those of First et al. (1997) but differ from those of Lazowski et al. (1998). There are no other SASSI-3 ROC analyses available for comparison.

These results elicit deliberation about whether SUD counselors would be better served by an SUD screening instrument that over- or under-predicts SUD diagnoses. In the case of a scoring method that produces higher sensitivity but lower specificity, resource allocation might be a concern. A counselor's diagnostic time might be unnecessarily spent ruling out clients, and clients might be unnecessarily inconvenienced by participating in a full SUD assessment. Alternatively, counselors using a scoring method with lower sensitivity but higher specificity would have fewer clients unnecessarily inconvenienced and spend less time assessing persons who do not need SUD

treatment. The unfortunate trade-off is that persons with an SUD who might benefit from assessment and treatment would otherwise be sent home without an appropriate recommendation.

The health, social, psychological and legal implications of misdiagnosing clients with SUDs have been documented (Brown, Suppes, Adinoff, & Thomas, 2001; Horrigan, Piazza, & Weinstein, 1996; McMillan et al., 2008). Therefore, SUD counselors would benefit from a screening instrument with high sensitivity and specificity (Tiet, Finney, & Moos, 2008). When that goal cannot be achieved, SUD counselors and agencies may want to consider which of these two is more important.

Counselors and their agencies might consider their patient population and setting. Among populations likely to have an SUD, specificity might be less important than sensitivity. Conversely, a counselor working at a community mental health agency or college counseling center may benefit from a highly sensitive instrument to identify clients with dual diagnosis treatment needs. In sum, this study represents the first investigation of the SASSI-3's agreement with the new *DSM-5* SUD criteria. Past research (e.g., Laux et al., 2012) has demonstrated that the SASSI-3's subtle scales improve the instrument's diagnostic accuracy over that which is obtained using face valid approaches only. As such, we are cautious about drawing strong conclusions about the SASSI-3's agreement with the *DSM-5* criteria until a larger sample of research is available.

Limitations and Suggestions for Future Research

ROC curve analysis allows for the examination of one scale at a time. Consequently, we were unable to use these methods to examine the SASSI-3 decision rules that use more than one scale (Rules 6, 7, 8 and 9). These decision rules include data from the instrument's subtle and obvious questions and are important contributors to the overall instrument's sensitivity and specificity. Thus, the inability to examine these decision rules excludes results that may impact the SASSI-3 sensitivity and specificity.

This study collected data from three different locations: a university campus, an inpatient SUD treatment center and an outpatient mental health counseling center. The participants from the college sample were significantly younger, by 9 and 11 years respectively, than those from the other collection sites. Because SUDs are progressive in nature, we recommend that subsequent researchers conduct sample-specific SASSI-3 analyses to determine whether or not population-specific, rather than universal, cut-offs would be useful. Additionally, because there were very few persons in this sample whose use of drugs other than alcohol was categorized as mild, it is not clear whether the FVOD's lower kappa value was due to the instrument itself or the sample's homogeneity.

Finally, the *DSM-5*'s SUD diagnosis is on a continuum and includes severity specifiers (mild, moderate or severe). It may be more diagnostically useful to expand the SASSI-3 to address these specifiers, rather than rely solely on the current dichotomous likely/not likely dependent conclusion. Future researchers are encouraged to determine what decision rule cut scores would be associated with each of the three levels of SUD severity.

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