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A Psychometric Assessment of the GAIN General Individual Severity Scale (GAIN-GISS) and Short Screeners (GAIN-SS) Among Adolescents in Outpatient Treatment Programs

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Abstract

The Global Appraisal of Individual Needs (GAIN) - General Individual Severity Scale (GAIN-GISS), and GAIN-Short Screener (GAIN-SS) are widely used diagnostic measures of internalizing disorders, externalizing disorders, substance abuse, and criminal and violent behavior. Though prevalent in clinical and research settings, there is only limited psychometric evidence of the dimensional structure of these scales. Our investigation used intake data from 6,909 adolescents presenting to outpatient substance abuse treatment facilities in the United States. Our analytic approach used exploratory and item factor analyses to evaluate the underlying factor structure. Multi- and unidimensional item response theory models were employed to evaluate the utility of the scales at providing precise score estimates at various locations of severity. Most scales were confirmed as unidimensional; scales with evidence of multidimensionality, identified as having a weak general dimension and strong specific dimensions using a bifactor IRT model, include the Crime Violence Scale and the GAIN-SS.

Keywords

psychometrics; item response theory; substance use measurement

1. Introduction

The Global Appraisal of Individual Needs (GAIN; Dennis, White, Titus, and Unsicker, 2008) is an assessment of substance use, mental illness, and crime and violent behavior widely used by the clinical and research community in over 1,700 agencies (Conrad, Conrad, Mazza, Riley, Funk, Stein, and Dennis, 2012). GAIN items serve as a map to diagnostic criteria and symptoms in the DSM-IV (APA, 1994) and DSM-IV-TR (APA, 2000); intended for clinical and research use, subscales of the GAIN may be used to produce dimensional counts or profiles of diagnostic disorders. While clinicians and researchers commonly use the GAIN scales for patient assessment, to date there has been little research regarding the properties of the GAIN scales using modern psychometric methods. The goal of the present work is to provide an evaluation of the dimensional structure and

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psychometric properties of the diagnostic scales that make up the GAIN General Individual Severity Scale (GAIN-GISS) and the GAIN-Short Screener (GAIN-SS; Dennis, Chan, and Funk, 2006).

GAIN-GISS overview

The GAIN-GISS is designed to provide four diagnostic assessments: 1) internalizing disorders (i.e., with the Internal Mental Distress Scale, IMDS); 2) externalizing disorders (i.e., with the Behavioral Complexity Scale, BCS); 3) substance use disorders (i.e., with the Substance Problems Scale, SPS); and 4) crime and violence (i.e., with the Crime and Violence Scale, CVS). The GAIN-GISS was developed to provide a cost-efficient method of assessment aimed at assisting clinicians and researchers with diagnosis, interpretation, placement, treatment planning, outcome monitoring and documentation (Dennis et al., 2008). The 123-item GAIN-GISS often serves as a measure of outcomes related to co-occurring mental, behavioral, and substance use problems in adolescent substance use outpatient treatment settings (Smith, Hall, Williams, Hyonggin, and Gotman, 2006; Chan, Godley, Godley, and Dennis, 2009; Griffin et al., 2011; Riley, Srikanth, Choi, and McCarty, 2012). Research findings from the GAIN-GISS among substance dependent adolescent populations cover a range of topics including patterns of mental health problems (Chan, Dennis, and Funk, 2008; Hussey, Drinkard, Falletta, and Flannery, 2008), frequency of delinquent behaviors (D'Amico, Edelen, Miles, and Morral, 2008), and educational and economic outcomes (Griffin, Ramchand, Edelen, McCaffery, and Morral, 2011).

GAIN-SS Overview

As a subset of the GAIN-GISS, the 20-item GAIN-Short Screener is meant to provide a quick and accurate screener of multiple behavior disorders and to aid in patient triage and clinical referral, treatment planning, and program evaluation (Dennis et al., 2006). The GAIN-SS is one of the few available screeners that addresses both mental health and substance abuse problems (Voss, Comtais, Morgan, McBride, Peterson, and Ries, 2006) and has been validated in multiple patient populations (e.g., general healthcare settings, individuals in the criminal justice system, and homeless populations; Shinn, Gottlieb, Wett, Bahl, Cohen, and Ellis, 2007; Sacks et al., 2007a). The GAIN-SS has been used to screen for various mental health disorders including major depression, schizophrenia, and bipolar disorder (Peters et al., 2008; Rush, Castel, Brand, Toneatto, and Veldhuizen, 2013).

Existing Psychometric Evidence

Given the widespread use of the GAIN in clinical and research settings, there is surprisingly little psychometric information available that describes the properties of these scales. The majority of prior psychometric evaluation of the GAIN-GISS was conducted with Rasch-based models that make strong assumptions of the relationship between the item responses, namely that a scale's items have equal discrimination parameters (i.e., that the strength of the relationship between the item and the underlying scale is the same for all items) (Conrad, Riley, Conrad, Chan, and Dennis, 2010; Conrad et al., 2012). Findings from these investigations are available as a series of technical reports at http://www.chestnut.org/li/gain/psychometric_reports. These reports include Rasch model evaluations of measurement invariance across subgroups (e.g., Conrad, Dennis, Bezruczko, Funk, and Riley, 2007), item and person fit assessments (Conrad, Bezruczko, Chan, Riley, Diamond, and Dennis, 2010), the performance of Rasch-based computer adaptive tests (Riley, Dennis, and Conrad, 2010; Riley, Conrad, Bezruczko, and Dennis, 2007) and reliabilities for individual GAIN-GISS scales. Highlighted across these reports is the general appropriateness of the items, strong evidence for score reliability, and only isolated indications of item misfit. Psychometric investigations of the GAIN-SS mostly involve analyses using receiver operating characteristic (ROC) curves aimed at identifying appropriate diagnostic cut-off scores based

on sensitivity and specificity findings (e.g., McDonnell et al., 2009; Dennis et al., 2006; Voss et al., 2006; Sacks et al., 2007b).

While these previous evaluations serve as important initial presentations of the scales and item properties, the growth in utilization of the GAIN-GISS and GAIN-SS calls for some degree of closer evaluation. We begin that process here by presenting results from a series of confirmatory and exploratory factor analytic (CFA; EFA) and item response theory (IRT) models. Such evaluations can provide a better understanding of the dimensional structure of the scales included in the GAIN-GISS and GAIN-SS and the properties of their items as they relate to the underlying construct being measured. Notably, our factor analytic process is focused on critically evaluating the dimensional structure of the various GAIN-GISS and GAIN-SS scales. In practice, researchers and clinicians assume that each of the GAIN scales measures a single construct (i.e., unidimensionality) by using summed GAIN scale items to create a single score. Thus, through closer psychometric evaluation our goals include (1) assessing the extent to which obtaining a single score is appropriate for each GAIN-GISS and GAIN-SS scale, (2) identifying the substantive content assessed by the scales, and (3) how well that content is measured across the continuum of severity. To our knowledge this is the first comprehensive evaluation of the GAIN-GISS and GAIN-SS scales' dimensionality using hierarchical factor analytic modeling and non-Rasch IRT modeling, which allows differences in the relationship between the item and the underlying scale to emerge.

2. Materials and methods

Sample

For this analysis, we used baseline (i.e., intake) GAIN data collected by the Centers for Substance Abuse Treatment at the Substance Abuse and Mental Health Services Administration. Specifically, the GAIN was administered to adolescent clients entering outpatient treatment under three separate funding mechanisms (N = 6909; see Table 1 for demographic information). In the Cannabis Youth Treatment cooperative agreement (CYT), conducted in 1997, 12–18 year-old recent cannabis users who reported at least one symptom of cannabis abuse or dependence were randomized to one of five different outpatient treatment interventions offered at one of four treatment sites (N=569; see Dennis et al., 2004). The Adolescent Treatment Model program was an observational study in 1998–99 that funded 10 treatment centers to collect information on their clients at baseline and at follow-up (see N=501; Stevens and Morral, 2003). Finally, the Effective Adolescent Treatment program launched in 2003 provided support to 37 adolescent treatment programs to adopt one of the treatments tested in the CYT (N=5839; Hunter et al., 2011).

Measures

The GAIN-GISS instruments were used in this study (including the Internal Mental Distress Scale (IMDS), Behavioral Complexity Scale (BCS), Substance Problem Scale (SPS), and the Crime Violence Scale (CVS)). Each measure utilizes a 4-point response scale assessing the most recent time a problem has occurred (0=*never*, 1=*1+ year ago*, 2=*2 to 12 months ago*, 3=*past month*). To obtain adequate item response coverage for these analyses, the *1+ year ago to past month* response categories were collapsed to a value of 1 and compared to the *never* category. Separate analyses were conducted for each of the four GAIN-GISS scales, their four corresponding short screeners, and the combined 20-item GAIN-SS referred to as the Total Disorder Screener (TDSr; Dennis, et al., 2006), for a total of 9 sets of analyses.

Substance Problem Scale (SPS)—The SPS ($\alpha = 0.90$; 5-item screener $\alpha = .76$; Dennis et al., 2006) is a 16-item scale comprised of three substance use subscales: the 7-item Substance Dependence Scale, 4-item Substance Abuse Index, and 5-item Substance Issues Index. These items collectively query the presence of symptoms related to alcohol and drug use disorders (e.g., hiding drug use, being unable to reduce drug use, spending time obtaining drugs, etc.).

Behavioral Complexity Scale (BCS)—The BCS ($\alpha = 0.94$; 5-item screener $\alpha = .76$; Dennis et al., 2006) is a 33-item assessment of problem behavior symptoms comprised of the 18-item ADHD Scale and the 15-item Conduct Disorder Scale. These items measure content that relates to inattention, hyperactivity and impulsivity, and bullying behaviors.

Internal Mental Disorder Scale (IMDS)—The IMDS ($\alpha = 0.94$; 5-item screener $\alpha = .74$; Dennis et al., 2006) is a 43-item measure comprised of five subscales: the 4-item Somatic Symptom Index, 9-item Depressive Symptom Scale, 5-item Homicidal Suicidal Thought Scale, 12-item Anxiety/Fear Symptom Scale, and the 13-item Traumatic Stress Scale. Items from these scales measure somatic complaints, depressive symptoms, homicidal and suicidal thoughts, anxiety and fear, and traumatic stress.

Crime Violence Scale (CVS)—The CVS ($\alpha = 0.90$; 5-item screener $\alpha = .72$; Dennis et al., 2006) is a 31-item assessment with four subscales: the 12-item General Conflict Tactic Scale, 7-item Property Crime Scale, 7-item Interpersonal Crime Scale, and 5-item Drug Crime Scale. Items from these scales depict various aspects of crime and conflict, including getting into arguments, fighting, using weapons, and participating in illegal activity.

GAIN Short-Screener (GAIN-SS)—The GAIN-SS is a brief 20-item measure comprised of five items each from the *SPS*, *IMDS*, *BCS*, and *CVS*. The 20-item instrument may be used as a conjoint instrument yielding a single continuous score via the *Total Disorder Screener* (TDS_{cr}; adolescent $\alpha = 0.87$; Dennis et al., 2006), or as a set of four brief 5-item screeners using score cutoffs to identify individuals scoring high on one or more of the behavioral health disorders (Friedmann, Melnick, Jiang, and Hamilton, 2008; Sacks, et al., 2007b).

Statistical and Psychometric Methods

Item Factor Analytic Approach—To assess the dimensionality of each of the 9 scales commonly derived from the GAIN-GISS, we fit factor analytic models that take into account the categorical nature of the items using the inter-item polychoric correlations with mean and variance adjusted weighted least squares as implemented in the Mplus software (Muthen & Muthen, 1998–2010). Initially 1-factor confirmatory factor analyses (CFA) were used for each scale to test the assumption of unidimensionality. Tests of unidimensionality reveal the extent to which it is appropriate to compute a single score from a given scale. Evidence of unidimensionality was evaluated based on widely used model fit index criteria (RMSEA (Root Mean Square Error of Approximation) $.08$, TLI (Tucker-Lewis Index) $.95$, CFI (Confirmatory Fit Index) $.95$; Hu & Bentler, 1999; Browne & Cudeck, 1993).

After inspecting the 1-factor model's modification indices, and using substantive judgment, if misfit was detected, the data were refit with revised models that account for multidimensionality with minor subfactors or correlated residuals in a CFA framework (e.g., bifactor models). In situations in which the violations of unidimensionality were more problematic, exploratory factor analysis (EFA) was used with Crawford-Ferguson rotation and oblique factor extraction (Crawford & Ferguson, 1970) to help identify the contents of

each dimension. When multi-factor models, such as those from EFA models, most appropriately fit the data, the general recommendation is to extract multiple scores according to the identified dimensions.

Item Response Theory—After conducting CFA and identifying unidimensional item sets for each GAIN-GISS scale, we used item response theory (IRT) and fit the items to a 2-parameter logistic model (2-PL) using the software IRTPRO (Cai, du Toit, and Thissen, 2011). For each item, the 2-PL estimates a unique *slope* or *discrimination* parameter (*a*), indicating the magnitude of association between the item response and the latent construct being measured, and a *threshold* parameter (*b*), that indicates the level on the latent construct at which a response becomes probable. Because each item is allowed a unique discrimination parameter, the 2-PL is a more highly parameterized model than the Rasch model and is appropriate for situations in which items vary in the strength of their relation to the underlying construct, unlike the Rasch model where the relationship between the item the underlying dimension is not estimated and assumed to be equal across items.

Following the IRT analyses, score precision was computed within each scale using the parameters from the 2-PL model. IRT represents reliability as a function of the latent variable that varies according to the location on the scale where the items provide information. Statistical information reflects the degree to which an item response contributes to score precision along the continuum of measurement. Because reliability is on a metric more common to most than information, we generated plots of scale reliability for each of the unidimensional GAIN scales, which is one less the inverse of information. These plots indicate the locations on the continuum where the measure is most useful in discriminating between levels of the trait (where reliability is high) and locations on the continuum where the scale lacks power to detect score differences (where reliability is low).

3. Results

The results are arranged according to model fit and dimensionality. Scales for which a unidimensional model fits reasonably well are presented first followed by scales for which modifications were required to achieve satisfactory fit (i.e., multidimensional scales). A presentation of the IRT score reliability follows the dimensionality report.

Unidimensional Scales

Substance Problems Scale—The 16-item SPS scale was initially fit with a unidimensional CFA. The fit indices provided in Table 2 indicate that the SPS items are strongly unidimensional, suggesting that obtaining a single score from these items is appropriate. Comparisons of factor loadings (Table 3) suggest that the SPS latent construct is most strongly represented by the content of 7 items from the Substance Use Disorders subscale (factor loading range = .73 to .81; mean = .77) and less so of items from the Substance Issue Index and Substance Abuse Index (factor loading range = .52 to .77; mean = .64), indicating that the scale most strongly reflects severity of addiction and the impact of that addiction on one's daily life (SU Disorders scale content) However, based on the fit of the 1-factor model, there was no evidence of the uniqueness of the three subscales to warrant separate subscores.

Behavioral Complexity Scale—The 33-item BCS was fit with a one-factor CFA model. Model fit indices in Table 2 suggest the scale closely corresponds to a unidimensional construct. Though the BCS is unidimensional, comparisons of factor loadings inform the underlying content being measured (see Table 4). For example, loadings from the 1-factor model tend to be highest for the 9 items from the Inattentive Disorder Scale (factor loading

range: .91 to .76, mean = .85), followed by the 9 items from the Hyperactive Impulsivity Scale (factor loading range: .77 to .64, mean = .71), with the BCS being only weakly representative of the 15-item Conduct Disorder Scale (factor loading range = .77 to .38, mean = .59).

Internal Mental Distress Scale—A 1-factor CFA model was found to closely fit the 43-item IMDS (see Table 2). The content of the IMDS broadly captures aspects of mental distress (e.g., scale content includes depressive symptoms, lack of energy, somatic complaints, anxiety, helplessness, suicidal thoughts, etc.) (see Table 5). Findings from the unidimensional model indicate that the scale is closely representative of items that assess severe levels of mental distress, namely items from the Traumatic Stress Scale (13 items) and the Homicidal/Suicidal Thoughts Scale (5 items; average loadings = .83 and .79, respectively), and to a lesser degree are representative of items measuring less severe levels of mental distress from the Somatic, Depressive, and Anxiety/Fear scales (average loadings range from .62-.67).

GAIN-SS 5-item subscales—The 5-item GAIN-SS screeners are used as quick screeners to identify individuals with potential diagnoses. One-factor CFA models were initially used for all screeners to ensure that a single score is appropriate for each screener. The fit indices reported in Table 2, with a single exception, show the appropriateness of the unidimensionality assumption and marginal reliabilities (ranging from .61 to .70). While the initial model fit for the BCS screener indicated severe misfit (i.e., based on the RMSEA of .17) due to local dependence, a revised model that accounted for two LD item pairs (*listening and attention difficulties* and *bullying or fighting behaviors*) with correlated residuals was found to closely fit the data (see Table 2).

Multidimensional Scales

Crime Violence Scale—Initially fitting the 31-item CVS to a one-factor model indicated the strong presence of multidimensionality (RMSEA = .084, CFI = .835, TLI = .824). An EFA was next used to better identify the underlying factor structure. Using substantive judgment and fit indices to guide factor extraction, a 2-factor model was determined to reasonably explain the item response associations. The 2-factor model presented in Table 6 clearly identifies an Interpersonal Conflict dimension among the General Conflict Scale items (e.g., arguing or fighting with someone), and an Illegal Activity dimension among the remaining items from the Property, Interpersonal, and Drug Crimes scales. When modeled with the corresponding 2-factor simple structure CFA the model demonstrates reasonably close fit (RMSEA = .059, CFI = .920, TLI = .914) with a moderate correlation between the two factors ($r = 0.58$). Thus, obtaining a single score using all the CVS items likely leads to biased standard error estimates and misleading indications of high score reliability. A reasonable alternative indicated by these results is to obtain separate Interpersonal Conflict and Illegal Activities scores.

GAIN- Short Screeners and the Total Disorder Screener—Though the GAIN-SS contains four separate scales that were evaluated separately above, it is often used as a 20-item Total Disorder Screener (TDS_{Scr}) from which a single score can be generated (e.g., Dennis et al., 2006; McDonnell, Comtois, Boss, Morgan, and Ries, 2009). To test the appropriateness of using the TDS_{Scr} as a general measure of the co-occurrence of substance use problems, crime and violence, and mental health disorder, initially a 1-factor model was fit. Taken together the resulting indices suggested poor fit (CFI=.793, TLI=.769, RMSEA=.109).

In order to better represent the relations among the item responses, we characterized the TDSr as being comprised of a single underlying “general” factor, in addition to separate unique factors that correspond to each of the four GAIN-SS 5-item subscales. A bifactor model was used to represent this structure such that each item received a single loading on a general dimension, and a second loading on the dimension specific to the item’s originating GAIN-SS subscale. Factor loadings in Table 7 indicate that the items for the GAIN-SS are highly multidimensional, which is confirmed by the relative close fit of the more highly parameterized bifactor model (CFI=.947, TLI=.932, RMSEA=.059). The explained common variance (ECV; the proportion of the item variance accounted for by the general factor; Reise, Moore, and Haviland, 2010; Stucky, Thissen, and Edelen, 2013) of 54% indicates that 46% of the variance is accounted for by the items’ subscales (this percentage would be zero for a perfectly unidimensional model). A comparison of factor loadings indicates that the general factor is largely dominated by the BCS items, with items from the remaining factors being only moderately associated with the general factor. Finally, although still acceptable, score reliability is greatly reduced when the multidimensionality across the GAIN-SS is accounted for (from .83 for a unidimensional model that ignores multidimensionality to .70 for the general factor from the bifactor model). The magnitude of the subscale specific-factor loadings in Table 7 along with the large reduction in reliability when the multidimensionality is accounted for gives confirmation that the individual screeners represent unique content with very little overlap that can be represented as a *general* dimension. These results indicate that it would be inappropriate to treat the GAIN-SS as a single dimension in an IRT model or to use the TDSr to represent the collection of screeners.

GAIN-GISS and GAIN-SS Score Precision

Unidimensional 2-PL IRT models were fit to each of the identified unidimensional item sets from the SPS, IMDS, BCS, and CVS and their screener counterparts to evaluate score reliabilities. Figure 1, upper left panel, provides a graphical display of the reliability SPS scores. Generally, SPS score reliability is greater than 0.80 from one standard deviation below the mean to nearly two standard deviations above the mean, indicating that the SPS is appropriate for individuals with a wide-range of substance problems (marginal reliability = 0.85). Compared to the full scale, the shift in the precision indicates the SPS screener includes slightly less severe items and a corresponding loss in precision across the entire continuum (marginal reliability = 0.70).

Figure 1, lower right panel, illustrates that BCS scores are highly reliable (greater than .80) from one standard deviation below the mean to three standard deviations above the mean, which corresponds to a range of BCS summed scores (summed scores of about 3 to 28). Notably, 25% of the present sample (N=1728) did not endorse any behavioral items, which is reflected by the low levels of score precision at the low end of the construct (marginal reliability = 0.89) suggesting that the scale is best at identifying individuals with moderate to high levels of behavioral problems. While the BCS screener had strong evidence of LD item pairs, which indicates a violation of the IRT assumption of unidimensionality and likely leads to a spurious increase in score precision, we provide the score precision here to allow a comparison to the full-length BCS. Similar to the SPS screener, the BCS screener indicates a slight shift toward the mean in item reliability and a substantial loss to precision (marginal reliability = 0.67); however, unlike the SPS screener, the BCS screener maintains high reliability around the mean.

Similar to the BCS, Figure 1, upper right panel, illustrates that scores for the IMDS are highly reliable from approximately the mean to three standard deviations above the mean; however, because of sparse data counts (e.g., 20% of the sample, N=1357 did not report any mental distress symptoms), reliability is low for scores representative of low mental distress

(marginal reliability = 0.85), indicating that the scale's primary utility is in identifying individuals with moderate to high levels of mental distress. The IMDS screener indicates modest reliability from approximately the mean to one standard deviation above the mean (marginal reliability = 0.61).

Following the 2-factor CFA model, separate unidimensional calibrations were conducted to obtain IRT item parameters for the 10 Interpersonal Conflict items and 21 Illegal Activities items. Figure 1, lower left panel, illustrates clear differences in the severity indicated by the two content domains and their screener items. Fewer adolescents report illegal activities (44% of our sample, $N = 3044$, reported none), and strongly skewed response frequencies indicate that Illegal Activity is only informative for those experiencing at least a modest level of activity. Reliability levels for the Illegal Activities items greater than .8 occur from the mean to three standard deviations above the mean; however, less score precision is obtained at lower levels of severity and the marginal reliability is 0.68.

Unlike Illegal Activity, Interpersonal Conflict items represent less severe content, are more frequently endorsed, and less strongly skewed (only 23%, or $N=1560$, reported none). Figure 1, lower left panel, illustrates the shift in precision being available around the mean for the Interpersonal Conflict items, suggesting that these items address content more commonly endorsed (marginal reliability = 0.83). Finally, the CVS screener merges the Illegal Activity and Interpersonal Conflict reliability functions, a compromise between the severity of the two dimensions, with a modest overall reliability from the mean to one standard deviation above the mean (marginal reliability = 0.62).

4. Discussion

As the GAIN-GISS and GAIN-SS become increasingly used for both clinical and research purposes, it is important to confirm the dimensionality and evaluate the psychometric properties of the constructs they are intended to measure. This paper responds to this need by providing a dimensionality assessment of these widely used tools. Results indicate that unidimensional models closely fit the data for three of the four core GAIN-GISS scales (SPS, BCS, and IMDS) and three of four the corresponding GAIN-SS screeners. However, multidimensional models were needed to accurately characterize the Crime Violence Scale, Behavioral Complexity Screener, as well as the 20-item GAIN-SS. Additional key findings focus on the GAIN-GISS scales' varying levels of score reliability based on the IRT model, item content when evaluated with categorical factor analyses, and implications of the 5-item GAIN-SS subscales.

One of the more noteworthy set of findings reported here is that while three of the four GAIN-GISS scales do indeed measure a single dimension, the strength or relevance of the items within each scale tended to vary according to the content-specific subscales from which they are comprised. For example, the Behavior Complexity Scale is defined most saliently by items from the Inattentive Disorder Scale and much less so by items from the Conduct Disorder scale. This means that scores from the BCS are more indicative of adolescent's ability to pay attention in the classroom, at home, or at school (content represented by the inattentive subscale), than of more severe conduct behaviors contained in the conduct disorder subscale (e.g., animal cruelty, stealing, getting into fights). Similarly, the magnitudes of the factor loadings of the Internal Mental Distress Scale suggest that the construct being measured is representative of a more severe aspect of mental distress (e.g., suicide, homicide, and traumatic distress) rather than lower levels of distress measured by the Depressive Symptom and Anxiety/Fear Symptom subscales. This is supported by the scale reliability function indicating that score precision was higher for individuals with more severe (higher) IMDS scores. Finally, our factor evaluation of the Conflict/Violence Scale

suggests two clear dimensions: Interpersonal Conflict (e.g., insulting others, threatening others) and Illegal Activities (e.g., using a weapon to steal, distributing stolen goods). Though moderately correlated (McDonnell et al., 2009 report intercorrelations ranging from .25 to .40), there is very little evidence indicating that a single dimension or score is appropriate to generate from this set of items. We suggest that the CVS may be most usefully scored either based on results from the 2-factor solution, or by using the individual subscales (e.g., the General Conflict Tactic Scale, Drug Crime Scale, etc) that comprise the CVS.

The GAIN-SS psychometric performances are representative of their corresponding parent GAIN-GISS scales. The reduction in reliability, though expected, is more severe than desired (marginal reliabilities range from .61 to .70). The screeners are meant to produce reliable scores while reducing respondent and administrative burden. However, relative to their full-scale counterparts, the screeners' uniformly low score precision raises questions as to their utility. For example, it is likely that the screeners' low precision at high ranges of severity impacts their ability to effectively identify individuals needing additional services.

Regarding the use of the Total Disorder Screener (TDSr, a continuous count of the 20 GAIN-SS items), our recommendation is that it should not be routinely calculated, as its interpretation as a single score is not clear. Bifactor analyses indicated strong multidimensionality across the GAIN-SS items corresponding to the four component SS subscales. This is evidenced by general and specific-factor loadings shown in Table 7. The four specific factors correspond to the four component short screener subscales, and with the exception of the BCS specific factor, the specific factor loadings are fairly uniformly strong. The loadings on the general factor are low (average loading = .56) and indicate that there is very little shared content among the 20-items. The effect on score precision of ignoring the multidimensionality and obtaining a single score from the TDSr is evident when comparing the marginal reliability obtained from a 1-factor model (the traditional approach of scoring the TDSr) to the marginal reliability of general factor scores from the bifactor model. When the bifactor model is used to score the TDSr the marginal reliability for the 20 items is only .70; however, if the 20-items are treated as a single, unidimensional scale, the marginal reliability is .83. The implication is that when obtaining a single score from the TDSr, the score precision will be inflated by ignored multidimensionality.

The current study is not without limitations. Our particular sample, although large, included only adolescent individuals from outpatient substance abuse clients who tended to be less severe than clients from inpatient care settings where the GAIN is traditionally administered. This resulted in severely skewed item responses, and prior to conducting CFA and IRT analyses it was necessary to collapse several response categories. Thus the 2-PL IRT item parameters used to generate information plots in this paper may not necessarily be generalizable to other studies using the 4-point response scale and the graded response model (Samejima, 1969). For instance, adults or adolescent individuals receiving care in residential or inpatient treatment settings may endorse severe response categories more frequently, and thus could take advantage of the full response scale. On the other hand in non-specialty treatment settings (e.g., criminal justice) low endorsement rates could result in item parameters even more skewed than are reported here, and thus the dichotomous scale appears to be appropriate. While we would expect the dimensionality results to be generalizable, because outpatient clients tend to experience less severe mental and behavioral health problems relative to inpatients, the likely increase in rates of item endorsement for inpatients would shift the IRT model's threshold parameter estimates lower.

Despite this limitation, our findings add significantly to the current knowledge base regarding the dimensionality and psychometric properties of the GAIN-GISS and short screeners. Among our key findings, we note that because of the GAIN-SS screeners' relatively low levels of precision at low and high ranges of severity, there is the risk of misclassifying individuals for various substance or behavioral disorders. One worthwhile direction for future research may be to identify alternative screeners that have more acceptable levels of precision.

With respect to the full-length GAIN-GISS scales, although they provide adequate levels of reliability, they too underperform in extreme score locations (typically towards lower severity locations). Finally, three of the four GAIN-GISS scales are strongly unidimensional (with the exception of the Crime and Violence scale); however, our findings indicate that the each GAIN-GISS scale is disproportionately influenced by the content from one of its subscales, to the extent that these subscales dominate the content being assessed. These results provide insights for researchers and clinicians regarding the proper use and interpretation of the core GAIN-GISS scales and should offer users additional knowledge of the underlying psychometric properties of these widely used scales.

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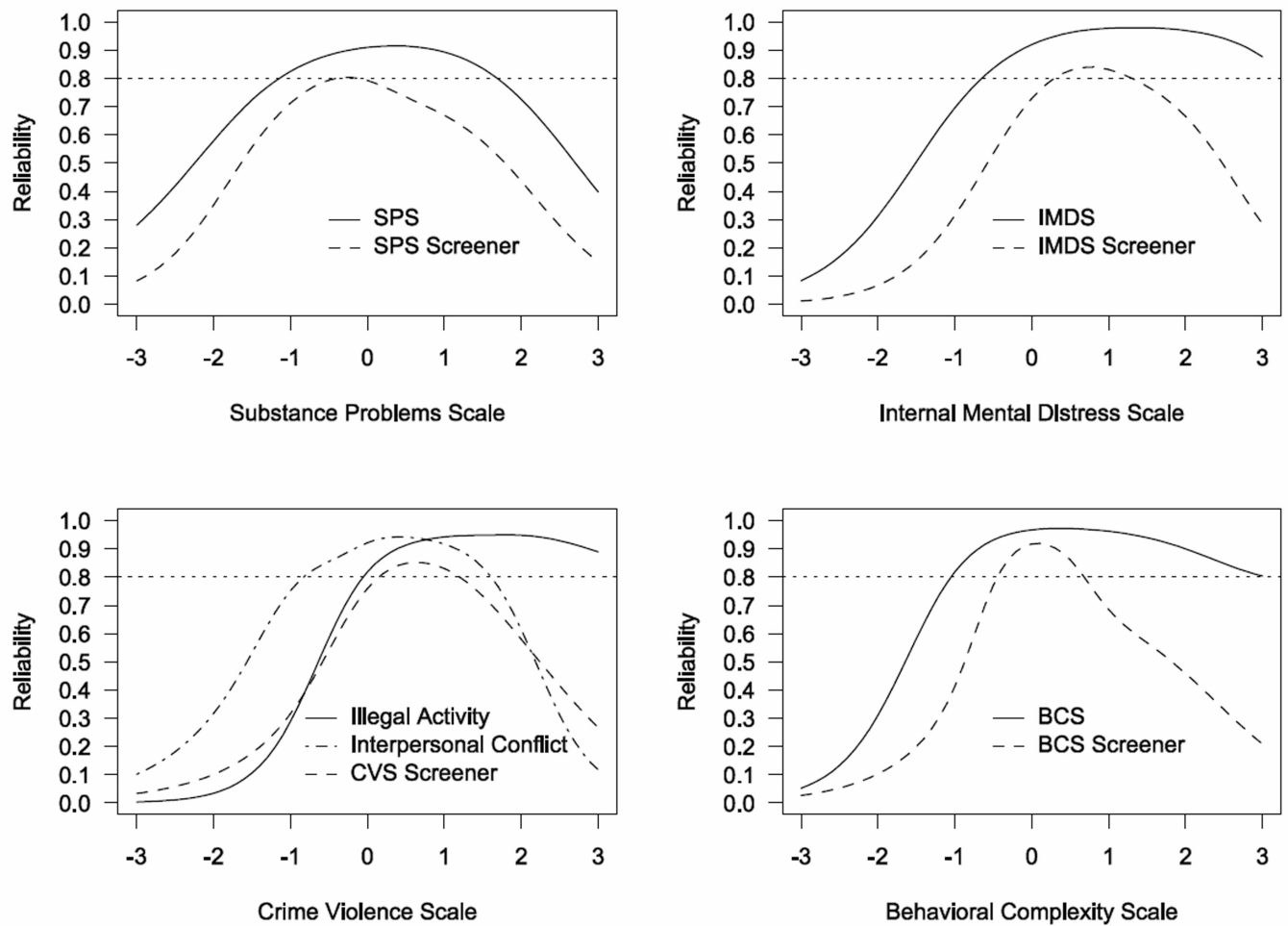


Figure 1.

The x-axis for these figures is in the metric of the IRT model, a normal distribution with mean=0 and standard deviation=1.

Table 1

Demographic characteristics of adolescent clients entering outpatient treatment.

Demographic characteristic	N = 6909
Age in years (%)	
11–12	1.8
13–14	20.6
15–16	52.3
17–18	25.3
Race/Ethnicity (%)	
White	52.8
Black	11.8
Hispanic	20.2
Other	15.2
Gender (%)	
Male	71.9
Female	28.1
Current living situation (%)	
House	88.4
Friend's House/Unsupervised	
Dorm	6.7
Other	4.9
Substance use (%)	
Does not recognize substance use as problem	13.2
Past receipt of treatment	21.5
Marijuana as primary substance use under treatment	45.0

Table 2

GAIN-GISS and GAIN-SS factor analysis fit indices and IRT marginal reliability.

Scale	CFI	TLI	Marginal Reliability	RMSEA
<i>GAIN-GISS</i>				
Substance Problems Scale	.965	.960	.85	.056
Behavioral Complexity Scale	.953	.950	.89	.056
Internal Mental Distress Scale	.933	.929	.85	.052
<i>GAIN-SS</i>				
Substance Problems Screener	.993	.986	.70	.045
Internal Mental Distress Screener	.995	.990	.61	.040
Crime and Violence Screener	.989	.978	.62	.059
Behavioral Complexity Screener	.965	.930	.67	.170
Behavioral Complexity Screener (2 correlated residuals)	1.00	.999	NA	.021

Table 3

Factor loadings for a 1-factor model of the Substance Problems Scale

Scales and abbreviated items	Factor loading
<i>Substance Issue Index</i>	
Used alcohol or other drugs weekly or more often?	0.76
Alcohol or other drug use caused you to feel depressed (etc.) or caused other psychological problems?	0.72
Alcohol or other drug use caused you to have numbness (etc.) or other health problems?	0.60
Parents, family, partner, co-workers, classmates or friends complained about your alcohol or other drug use?	0.59
Tried to hide that you were using alcohol or other drugs?	0.52
<i>Substance Abuse Index</i>	
Kept using alcohol or drugs even though you knew that it was keeping you from meeting your responsibilities (etc.)?	0.77
Kept using alcohol or other drugs even though it was causing social problems (etc.)?	0.65
Used alcohol or other drugs where it made the situation unsafe or dangerous for you (etc.)?	0.61
Alcohol or other drug use caused you to have repeated problems with the law?	0.52
<i>Substance Abuse Disorders</i>	
Spent a lot of time either getting alcohol or other drugs, using alcohol or other drugs, feeling the effects of alcohol or other drugs (high, sick)?	0.81
Use of alcohol or other drugs caused you to give up, reduce or have problems at important activities at work, school, home or social events?	0.80
Kept using alcohol or other drugs even though you knew it was causing or adding to medical, psychological or emotional problems you were having?	0.79
Used alcohol or other drugs in larger amounts, more often, or for a longer period of time than you meant to?	0.77
Needed more alcohol or other drugs to get the same high or found that the same amount did not get you as high as it used to?	0.76
Were unable to cut down or stop using alcohol or other drugs?	0.74
Had withdrawal problems from alcohol or other drugs like shaking hands (etc.)?	0.73

Table 4

Factor loadings for a 1-factor model of the Behavioral Complexity Scale

Scales and items	Factor loading
<i>Inattentive Disorder Scale</i>	
Had a hard time paying attention at school, work, or home.	0.91
Made mistakes because you were not paying attention	0.90
Had a hard time listening to instruction at school, work, or home.	0.88
Not following instructions or not finished your assignments?	0.88
Been unable to pay attention when other things were going on	0.85
Been forgetful or absentminded	0.84
Had a hard time staying organized or getting everything done.	0.82
Avoided things that took too much effort, like school work or paperwork.	0.82
Lost things that you needed for school, work, or home.	0.76
<i>Hyperactivity Impulsivity Scale</i>	
Fidgeted or had a hard time keeping your hands or feet still when you were supposed to.	0.77
Been unable to stay in a seat where you were supposed to stay.	0.76
Had a hard time waiting for your turn.	0.73
Gotten in trouble for being too loud when you were playing or relaxing.	0.73
Felt restless or the need to run around or climb on things.	0.72
Gave answers before the person finished asking the question.	0.72
Interrupted or butted into other people's conversations or games.	0.68
Felt like you were always on the go or driven by a motor.	0.66
Talked too much or had others complain that you talked too much.	0.64
<i>Conduct Disorder Scale</i>	
Stayed out at night later than your parents or partner wanted.	0.78
Lied or conned to get things you wanted or to avoid having to do something.	0.73
Been a bully or threatened other people.	0.69
Skipped work or school.	0.69
Started physical fights with other people.	0.65
Broken windows or destroyed property.	0.62
Been physically cruel to other people.	0.61
Taken money or things from a house, building, or car.	0.59
Taken things from a store or written bad checks to buy things.	0.58
Set fires.	0.56
Run away from home (partner) for at least one night.	0.55
Forced someone to have sex with you when they did not want to.	0.52
Used a weapon in fights.	0.50
Taken a purse, money, or other things from another person by force.	0.49
Been physically cruel to animals.	0.38

Table 5

Factor loadings for a 1-factor model of the Internal Mental Distress Scale

Scales and items	Factor Loading
<i>Somatic Symptom Scale</i>	
Sleep trouble, such as bad dreams, sleeping restlessly or falling asleep during the day?	0.72
Headaches, faintness, dizziness, tingling, numbness, sweating or hot or cold spells?	0.61
Pain or a heavy feeling in your heart, chest, lower back, arms, legs or other muscles?	0.60
Having dry mouth, loose bowel movements, constipation, trouble controlling your bladder or related itching?	0.53
Feeling very trapped, lonely, sad, blue, depressed, or hopeless about the future?	
Thoughts that other people did not understand you or appreciate your situation?	0.79
Feeling tired, having no energy or like you could not get things done?	0.71
Feeling easily annoyed, irritated, or having trouble controlling your temper?	0.71
Remembering, concentrating, making decisions, or having your mind go blank?	0.71
Losing interest or pleasure in work, school, friends, sex or other things you cared about?	0.69
Feeling very shy, self-conscious or uneasy about what people thought or were saying about you?	0.68
Moving and talking much slower than usual?	0.62
Losing or gaining 10 or more pounds when you were not trying to?	0.61
Sleep trouble, such as bad dreams, sleeping restlessly or falling asleep during the day?	0.53
<i>Homicidal/Suicidal Thought Scale</i>	
Had a plan to commit suicide?	0.91
Gotten a gun, pills or other things to carry out your plan?	0.89
Attempted to commit suicide?	0.82
Thought about ending your life or committing suicide?	0.79
Thought about killing or hurting someone else?	0.52
<i>Anxiety/Fear Symptoms Scale</i>	
Being unable or finding it difficult to control your worries?	0.78
Feeling very anxious, nervous, tense, fearful, scared, panicked or like something bad was going to happen?	0.76
Trembling, having your heart race or feeling so restless that you could not sit still?	0.74
Having to repeat an action over and over, or having thoughts that kept running over in your mind?	0.73
Having a lot of tension or muscle aches because you were worried?	0.71
Thoughts that other people were taking advantage of you, not giving you credit or causing you problems?	0.67
Getting into a lot of arguments and feeling the urge to shout, throw things, beat, injure or harm someone?	0.67
Thoughts that someone was watching you, following you or out to get you?	0.64
Seeing or hearing things that no one else could see or hear, or feeling that someone else could read or control your thoughts?	0.63
Feeling very afraid of open spaces, leaving your home, having to travel or being in a crowd?	0.61
Thoughts that you should be punished for thinking about sex or other things too much?	0.60
Avoiding snakes, the dark, being alone, elevators or other things because they frightened you?	0.45
<i>Traumatic Stress Scale</i>	
When something reminds you of the past, you became very distressed and upset?	0.91
You felt guilty about things that happened because you felt like you should have done something to prevent them?	0.90
You had a hard time expressing your feelings, even to the people you cared about?	0.90
You lost your cool and exploded over minor, everyday things?	0.86

Scales and items	Factor Loading
You felt like you could not go on?	0.86
Had any of the above problems for three or more months? (TSS items)	0.85
You were frightened by your urges?	0.83
Sometimes you used alcohol or other drugs to help yourself sleep or forget about things that happened in the past?	0.83
When you think of things you have done, you wish you were dead?	0.81
You had nightmares about things in your past that really happened?	0.78
Your dreams at night are so real that you awaken in a cold sweat and force yourself to stay awake?	0.78
It seemed as if you have no feelings?	0.77
You were afraid to go to sleep at night?	0.77

Table 6

Factor loadings for a 2-factor model of the Crime / Violence Scale

Items	Factor 1	Factor 2
Insulted, swore, or cursed at someone?	1.02	−0.15
Left the room or area rather than argue?	0.91	−0.38
Discussed it calmly and settled the disagreement?	0.86	−0.41
Pushed, grabbed, or shoved someone?	0.82	0.17
Threatened to hit or throw something at another person?	0.78	0.15
Kicked, bit, or hit someone?	0.76	0.26
Actually threw something at someone?	0.72	0.18
Slapped another person?	0.67	0.14
Beat up someone?	0.66	0.34
Hit or tried to hit anyone with something (an object)?	0.66	0.27
Threatened anyone with a knife or gun?	0.40	0.49
Used a knife or gun or some other thing (like a club) to get something from a person?	0.09	0.84
Used a weapon, force, or strong-arm methods to get money or things from a person?	0.09	0.82
Bought, received, possessed or sold any stolen goods?	0.10	0.78
Hit someone or got into a physical fight?	0.34	0.76
Sold, distributed or helped to make illegal drugs?	0.13	0.74
Other than from a store, taken money or property that didn't belong to you?	0.12	0.73
Hurt someone badly enough they needed bandages or a doctor?	0.30	0.73
Broken into a house or building to steal something or just to look around?	0.08	0.73
Purposely damaged or destroyed property that did not belong to you?	0.19	0.72
Taken something from a store without paying for it?	0.13	0.70
Made someone have sex with you by force when they did not want to have sex?	0.12	0.67
Taken a car that didn't belong to you?	0.10	0.66
Been involved in the death or murder of another person (including accidents)?	0.10	0.65
Driven a vehicle while under the influence of alcohol or illegal drugs?	0.08	0.65
Been a member of a gang?	0.18	0.65
Passed bad checks, forged (or altered) a prescription or took money from an employer?	0.02	0.64
Intentionally set a building, car or other property on fire?	0.11	0.63
Gambled illegally?	0.14	0.62
Traded sex for food, drugs, or money?	0.01	0.58
Actually used a knife or gun on another person?	0.32	0.52

Table 7

Bifactor loadings for the 20-item TDSr

TDSr items	General Factor	SPS	IMDS	BCS	CVS
Used alcohol or other drugs weekly or more often?	0.42	0.66			
Alcohol or other drug use caused you to have repeated problems with the law?	0.42	0.45			
Had withdrawal problems from alcohol or other drugs like shaking hands (etc.), or you used alcohol or any other drugs to stop being sick or avoid withdrawal problems?	0.58	0.41			
Spent a lot of time either getting alcohol or other drugs, using alcohol or other drugs, feeling the effects of alcohol or other drugs (high, sick)?	0.53	0.68			
Use of alcohol or other drugs caused you to give up, reduce or have problems at important activities at work, school, home or social events?	0.53	0.50			
Sleep trouble, such as bad dreams, sleeping restlessly or falling asleep during the day?	0.52		0.49		
Feeling very trapped, lonely, sad, blue, depressed, or hopeless about the future?	0.53		0.71		
Thought about ending your life or committing suicide?	0.45		0.61		
Feeling very anxious, nervous, tense, fearful, scared, panicked or like something bad was going to happen?	0.56		0.53		
When something reminds you of the past, you became very distressed and upset?	0.50		0.50		
Had a hard time paying attention at school, work, or home.	0.77			0.60	
Had a hard time listening to instruction at school, work, or home.	0.69			0.58	
Been a bully or threatened other people.	0.80			-0.20	
Lied or conned to get things you wanted or to avoid having to do something.	0.73			0.12	
Started physical fights with other people.	0.75			-0.22	
Pushed, grabbed, or shoved someone?	0.52				0.31
Driven a vehicle while under the influence of alcohol or illegal drugs?	0.48				0.43
Purposely damaged or destroyed property that did not belong to you?	0.50				0.69
Taken something from a store without paying for it?	0.49				0.60
Hit someone or got into a physical fight?	0.52				0.70

Note:

SPS: Substance Problems Scale
IMDS: Internal Mental Distress Scale
BCS: Behavioral Complexity Scale
CVS: Crime and Violence Scale