Validation and performance of the Alcohol, Smoking, and Substance Involvement Screening Test (ASSIST) among adolescent primary care patients

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Abstract

Background and aims—The World Health Organization's Alcohol, Smoking, and Substance Involvement Screening Test (ASSIST) has strong support as a clinical screening tool and research instrument, but has only been validated with adults. This study evaluated the ASSIST and ASSIST-Lite in an adolescent population.

Design—Internal consistency, concurrent validity, discriminant validity, and diagnostic accuracy were examined for tobacco, alcohol, and cannabis ASSIST scores. An abbreviated version (the ASSIST-Lite) was evaluated for cannabis.

Setting—Three community health centers in Baltimore, Maryland, USA.

Participants—525 primary care patients, ages 12-17.

Measurements—Measures included the ASSIST, the CRAFFT screening tool, and items from the Composite International Diagnostic Interview (CIDI) corresponding to substance use disorder criteria in the Diagnostic and Statistical Manual of Mental Disorders, 5th edition.

Findings—The ASSIST had good internal consistency ($\alpha s=.68-.88$), good concurrent validity with the CRAFFT ($r=.41-.76$; $ps<.001$), and was able to discriminate between gradations of cannabis problem severity. In receiver operating characteristics analysis of optimal clinical cut-points, the ASSIST accurately identified tobacco, alcohol, and cannabis use disorders (sensitivities=95%-100%; specificities=79%-93%; area under the curve [AUC]=.90-.94), but did so at minimally low cut-points (indicative of any use in the past 3 months). The ASSIST-Lite performed similarly to the ASSIST in identifying cannabis use disorders (sensitivity=96%; specificity=88%; AUC=.92), also at a minimally low cut-point. However, confirmatory factor analysis of the ASSIST indicated poor model fit.

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Conclusions—The Alcohol, Smoking, and Substance Involvement Screening Test (ASSIST) is promising as a research and screening/brief assessment tool with adolescents, but revisions to clinical risk thresholds are warranted. The ASSIST-Lite is sufficiently informative for rapid clinical screening of adolescents for cannabis use disorders.

Keywords

ASSIST; adolescents; psychometrics; screening; validation; alcohol; tobacco; cannabis

Introduction

Tobacco, alcohol, and illicit drug use contribute to morbidity, mortality, and social problems worldwide (1-3). In the last decade, the World Health Organization (WHO) supported the development and validation of the Alcohol, Smoking, and Substance Involvement Screening Test (ASSIST), which classifies patients into low, moderate, and high risk categories to guide clinical intervention. The instrument provides substance-specific risk scores for tobacco, alcohol, cannabis, cocaine, amphetamine-type stimulants, inhalants, sedatives, hallucinogens, and opioids based on responses to several questions about substance use and associated problems.

In the initial research on the ASSIST, researchers recruited 236 adults from addiction treatment, general medical, and psychiatric settings across nine countries/territories. This study used test-retest strategies to establish reliability and mixed methods to determine feasibility, leading to a revision from 12 to 8 items (4). In a subsequent validation of the ASSIST 2.0 with 150 adults in Australia (1/3 recruited from addiction treatment, the remainder from primary care), researchers established the concurrent validity of the ASSIST based on correlations with established instruments, construct validity via correlations with known risk factors for substance abuse, discriminant validity in the ASSIST's ability to distinguish between use, abuse, and dependence as defined by the dominant diagnostic criteria at the time, and stability of scores across 3 months (5).

In the largest validation study of the ASSIST to date, the instrument was evaluated with 1,047 participants (~1/3 from addiction treatment, the remainder from primary care). That study established the ASSIST's concurrent, construct, and discriminant validity in a large multinational sample, and determined weighted scoring using principal components analysis —leading to the ASSIST 3.0, the current version in use (6).

Subsequently, a brief intervention for illicit drug use tied to the ASSIST was tested with 731 adults in a four-nation randomized trial. Participants randomized to brief intervention reported significantly greater reductions in ASSIST scores at 3 month follow-up compared to a delayed intervention condition (7). That study demonstrated the utility of the ASSIST not only as a screening tool, but also as a research instrument for gauging changes in substance use risks following intervention.

Although the ASSIST has only 8 items, most are repeated for each substance that the individual endorses using. Competing priorities and time/resource constraints in healthcare settings have been barriers to adopting preventive services (8), including substance use

screening and intervention. Despite robust empirical support for alcohol misuse screening and intervention (9-13), it remains underutilized in the US compared to services with similar cost-effectiveness and clinical impact (14). Screening and intervention for tobacco smoking is effective but likewise underutilized (15). Recognizing that the ASSIST may be too lengthy for busy medical settings, researchers recently distilled the ASSIST into a "Lite" version comprised of just a few items. This "ultra-rapid screening" had high accuracy in identifying substance use disorders (16).

Adolescents are an important population for screening and intervention, as onset of substance use typically occurs during adolescence (17-18). Although evidence for the effectiveness of brief interventions with adolescents is somewhat mixed, a number of studies have shown promising results in reducing substance use and associated behaviors (19).

To date, all psychometric data on the ASSIST is derived from studies with adults. There have been efforts to adapt the ASSIST for adolescents, which included expert clinician panels and culminated in draft recommendations for revising the ASSIST for youth, including new cut-points, updated wording, and eliminating the low risk category (20-22). However, no empirical studies have been published examining the performance of the ASSIST with adolescents, either in its original form or in the draft youth version. To our knowledge, the current study is the first to examine the ASSIST in an adolescent sample. This study evaluates the ASSIST with respect to internal consistency, concurrent validity with an established screening tool, diagnostic accuracy against substance use disorder criteria (sensitivity, specificity, receiver operating characteristics area under the curve), and discriminant validity. The study also evaluates the "ASSIST-Lite" items for cannabis.

Methods

Participants

Participants were adolescent patients seeking medical services at health centers in Baltimore, USA (*N*= 525; 54% female), of whom 51% were ages 12-14 and 49% were ages 15-17. Participants were 93% African American, <1% White, and 6% reported another race. Hispanic ethnicity was reported by 3%. Most reported being enrolled in high school (60%), 37% were in middle school, and 3% were in college or not enrolled in school. To expedite recruitment, the study was conducted at three sites of a single local healthcare organization, with each site contributing ~1/3 of the sample. There were no significant differences across sites on any of the variables examined in this study. Thus, sites were pooled for analysis.

Procedure

Adolescent patients at the participating sites were approached by research staff in the waiting area. Research staff invited patients to participate in an anonymous health survey development study. The study was described verbally to adolescents and parents/guardians (if present). Adolescents were informed that their responses were anonymous and would not be shared with clinic staff or parents. Patients providing assent were taken to a private room and administered several questionnaires by a trained interviewer. Participants were given a $20USD gift card to a local sandwich shop chain. The only eligibility criteria were age

12-17 and ability to comprehend English. The study was approved by the Friends Research Institute IRB with a waiver of written informed consent/assent. Research staff gave youth and their parents an IRB-approved information sheet describing the study.

Measures

ASSIST—The ASSIST was developed by the WHO using a rigorous, research-driven process (4-6). It queries about 9 categories of psychoactive substances and contains 8 items (most of which are asked for each substance for which lifetime or past 3-month use is endorsed) and provides substance-specific risk scores that can be categorized into low, moderate, or high risk to guide intervention. Substance-specific scores were calculated using standard ASSIST scoring procedures. ASSIST-Lite scores for cannabis were calculated using the three relevant ASSIST items (16). We could not evaluate the ASSIST-Lite for tobacco or alcohol because they incorporate items from other instruments not included in the ASSIST.

CRAFFT—The CRAFFT is a substance use screening instrument for adolescents that has substantial empirical support (23-25). This 6-item questionnaire (plus 3 pre-screening questions establishing past year use of alcohol, cannabis, or other drugs) asks youth yes/no questions about risk indicators from substance use (e.g., "Do you ever use alcohol or drugs when you are by yourself, Alone?"). The CRAFFT has emerged as the dominant screening instrument for adolescent substance use (25, 26), and is included to establish concurrent validity of the ASSIST.

CIDI-2 Items—A subset of items from the Composite International Diagnostic Interview, 2nd edition (CIDI-2) (27) were used to determine substance use disorders (SUDs). These items map to SUD diagnostic criteria delineated in the Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-5) (28). The items were asked for each substance the participant reported using in the past year. The CIDI-2 has been validated and widely used in epidemiological and clinical research (27, 29-32) to assess SUDs based on the previous version of the DSM. We calculated criteria based on the DSM-5 SUD classifications, which entailed a scoring modification that drops the item on legal problems and includes an item on craving (28).

DSM-5 SUDs were considered the "gold standard" criterion measure. Because the ASSIST provides a tiered risk categorization (low, moderate, high), we defined risk categories based on the DSM-5 criteria. "Non-problem use" was defined as substance use without the endorsement of any DSM-5 criteria. "Problem use" was defined as past year use with the endorsement of 1 DSM criterion, consistent with previous screening development studies for adolescents (23, 33). SUDs were defined using the standard diagnostic threshold of 2 criteria.

The DSM-5 contains SUD severity specifiers, whereby 2-3 criteria indicate mild severity, 4-5 criteria indicate moderate severity, and 6 or more criteria indicate high severity. Although adolescents meeting SUD criteria can be considered high risk clinically, these specifiers provide an opportunity to evaluate the ASSIST's ability to discriminate between gradations of problem severity among substance-using youth.

Statistical Analysis

This study focuses on substance-specific ASSIST scores for tobacco, alcohol, and cannabis, as use of other substances was rare (<2% for all other drugs combined). Cronbach's α was used to assess internal consistency of the items comprising each substance-specific ASSIST score. Concurrent validity of ASSIST scores was examined via correlations with the CRAFFT. These correlations were examined only for alcohol and cannabis scores, as the CRAFFT does not screen for tobacco. For discriminant validity, mean ASSIST scores were compared using independent-sample t-tests for those who met vs. did not meet DSM-5 SUD criteria. These analyses were conducted both in the full sample, and in subsamples reporting past year use of each substance. [Higher values in the total sample are driven by participants reporting abstinence, as they receive zero-scores on the ASSIST, which matches to absence of DSM criteria]. In addition, discriminant validity was assessed based on the ASSIST's ability to distinguish gradations of problem severity, comparing discrimination between non-problem use vs. problem use/mild use disorder (i.e., use with no DSM criteria vs. 1-3 criteria, or "low risk" vs. "moderate risk"), and problem use/mild use disorder vs. moderate/high severity use disorder (i.e., 1-3 criteria vs. 4 criteria, or "moderate risk" vs. "high risk"). Because of small cell sizes, this analysis was limited to alcohol and cannabis for "low" vs. "moderate" risk, and cannabis only for "moderate" vs. "high" risk.

In recognition that the primary clinical purpose of screening is to efficiently identify patients needing further assessment/intervention, we evaluated ASSIST cut-points for problem use and SUDs in the full sample. The performance of the ASSIST at various cut-points was examined with respect to sensitivity, specificity, and receiver operating characteristics (ROC) area under the curve (AUC) (34), with optimal cut-points determined by the Youden Index (35). Sensitivity, specificity, and AUC statistics were also examined for the "ASSIST-Lite" cannabis items.

We also conducted a confirmatory factor analysis (CFA) with the items from the tobacco, alcohol, and cannabis scales, postulating three latent factors corresponding to "risk" for each substance. Based on those findings, we conducted an exploratory iterated principal factor analysis to further probe the ASSIST's structure.

Results

Participant Substance Use

Forty-seven youth reported past year tobacco use (9%), while 124 (24%) reported past year alcohol use and 110 (21%) reported past year cannabis use on the CIDI. The mean (*SD*) substance-specific ASSIST scores in the total sample (*N*=525, including those reporting abstinence who scored zero) were 1.03 (3.89) for tobacco, 1.19 (3.12) for alcohol, and 2.59 (6.66) for cannabis. Among those reporting past-year use of each substance, the mean (*SD*) substance-specific ASSIST scores were 10.34 (8.27) for tobacco (*n*=47), 4.19 (4.98) for alcohol (*n*=124), and 11.81 (10.08) for cannabis (*n*=110). Overall prevalence of SUD was 4% for tobacco, 5% for alcohol, and 11% for cannabis (Table 1).

Internal Consistency

Cronbach's α values for each substance-specific ASSIST score were good-to-excellent in the total sample, with α of .87 for tobacco, .72 for alcohol, and .88 for cannabis. Restricting the sample to past-year users of these substances yielded slightly lower α values of .78, .68, and .81 for tobacco, alcohol, and cannabis, respectively.

Concurrent Validity

Pearson correlations between substance-specific ASSIST scores and scores on the CRAFFT were all statistically significant at *p*<.001, both in the total sample and those reporting past-year use, with *r*=.55 for alcohol and .76 for cannabis (total sample) and *r*=.41 for alcohol and .64 for cannabis (past-year users).

Discriminant Validity

Table 2 shows mean ASSIST scores by DSM-5 SUD status, both for the total sample and for those reporting past-year use. In the total sample, ASSIST scores were many-fold higher among adolescents who met SUD criteria than for those who did not (30.0-, 12.9-, and 26.3-fold higher for tobacco, alcohol, and cannabis, respectively; *ps*<.001). Among those reporting past-year use, mean ASSIST scores were higher for participants who met SUD criteria than for participants with sub-diagnostic use by a factor of 2.3 for tobacco, 3.8 for alcohol, and 3.7 for cannabis (all *ps*<.001).

Discrimination between non-problem use vs. problem use/mild use disorder (0 DSM criteria vs. 1-3 criteria) was poor for alcohol at an optimal score cut-point of 4 (sensitivity=51%, specificity=80%, AUC=.66), and acceptable for cannabis at an optimal score cut-point of 8, although sensitivity was relatively low (sensitivity=67%, specificity=100%, AUC=.83).

With respect to discriminating between problem/mild cannabis use disorder (1-3 DSM criteria) vs. moderate-to-high severity cannabis use disorder (4 criteria), a range of cut-points performed similarly when weighting sensitivity and specificity equally. At a cut-point of 14, the ASSIST had sensitivity=90%, specificity=73%, and AUC=.81, whereas at a cut-point of 20, the ASSIST had sensitivity=69%, specificity=94%, and AUC=.82.

Clinical Cut-Points Analysis

Sensitivity, specificity, and AUC for the optimal cut-points identifying youth at the clinical thresholds of "problem use" or higher (1 SUD criteria) and DSM-5 SUD (2 SUD criteria) are shown in Table 3. For all three substances, sensitivities and specificities were good-to-excellent. Sensitivities for identifying DSM-5 SUD exceeded 95% for all three substances, with specificities of 93% for tobacco, 79% for alcohol, and 87% for cannabis. AUC values for identifying DSM-5 SUDs were .94 for tobacco, .90 for alcohol, and .93 for cannabis. For identifying problem use or higher, sensitivity was 97% for tobacco, 90% for alcohol, and 98% for cannabis, while specificities were 95%, 82%, and 91% for these substances, respectively. In the full sample, the optimal ASSIST cut-point for identifying moderate-to-high severity cannabis use disorders (4 criteria) was 7 (sensitivity=100%, specificity=92%, AUC=.96). Despite the seemingly excellent performance of the ASSIST, it is important to note that identification of clinically-relevant substance use problems occurs at an optimal

cut-point of 2 for all three substances, whether the threshold is "problem use" or DSM-5 SUD. This is *the lowest possible cut-point* for those who report recent use (corresponding to using a substance "once or twice" in the past 3 months).

ASSIST-Lite

Although the "ASSIST-Lite" cannabis items had acceptable performance at the recommended cut-point of 2 for adults (sensitivity=79%; specificity=95%; AUC=.87), a cut-point of 1 was optimal in the present sample of adolescents (sensitivity=96%; specificity=88%; AUC=.92). We confirmed that the cut-point of 1 was superior even under the diagnostic thresholds of abuse, dependence, and abuse *or* dependence from the previous version of the DSM (DSM-IV), which was used in the development of the ASSIST-Lite (16).

Performance of CRAFFT

For comparative purposes, the CRAFFT at its standard cut-point of 2 yielded sensitivities, specificities, and AUC values of 93%, 91%, and .92 for DSM-5 cannabis use disorder, and 88%, 86%, and .87 for DSM-5 alcohol use disorder, respectively. Thus, the ASSIST, ASSIST-Lite, and CRAFFT performed very favorably—and comparably—on these metrics.

Factor Analysis

Items from the three substance-specific scales were examined in a CFA positing three latent factors for tobacco, alcohol, and cannabis risk. All paths from the latent factors to their respective items were significant (all ps<.001). However, the model did not perform well against a saturated model [χ^2(116)=1116.04; p<.001], and fit indices were likewise disappointing (e.g., CFI=.80). In order to better understand these findings, we conducted an exploratory iterated principal factor analysis to probe the ASSIST's structure. An eigenvalue cut-off of 1.0 suggested a three-factor structure. Table 4 shows normalized loadings from a promax rotation of this three-factor structure. Items from each substance-specific ASSIST scale generally loaded together onto their respective factor (bolded). However, there were several items for which loadings "crossed" onto another factor (italics). There was less ambiguity when the analysis was restricted to participants reporting use of any of these three substances on the ASSIST, although one cannabis item (Q4c) continued to group with the tobacco items (loading=.48).

Discussion

The ASSIST is a widely used screening/research instrument for adults, but there is little data on its utility with youth. The present study, conducted among adolescent primary care patients in the US, found that substance-specific ASSIST scores for tobacco, alcohol, and cannabis had good internal consistency and good concurrent validity. Discriminant validity for distinguishing gradations of problem severity among substance users, to the extent that we could examine it in this sample, was acceptable for cannabis but less so for alcohol.

The findings that ASSIST scores were able to identify problem use and DSM-5 SUDs with a high degree of accuracy are encouraging. However, it is important to consider the practical

implications of the cut-points. This optimal cut-point of 2 for all substances corresponds to the lowest possible score someone could get if they used the substance within the past 3 months. This level of use is considered "low-risk" category for adults, yet in this adolescent sample it was highly sensitive and specific for identifying SUDs. While recent use is not necessarily problematic, it warrants further discussion with a provider. Hence, for rapid triage, the CRAFFT or a single question about recent use could save valuable time and yield similar accuracy. The ASSIST-Lite items also performed very well in this regard, yielding high sensitivity and specificity for cannabis use disorders (also at a lower cut-point than for adults) (16).

The ASSIST, ASSIST-Lite, and CRAFFT each have their strengths and weaknesses. The CRAFFT is brief, asks uniquely about being in a car with an impaired driver, and has excellent psychometrics, but does not include tobacco or distinguish between substances in problem attribution. In contrast, the ASSIST offers more detailed response options and substance-specific appraisal of use and problems, but takes longer to administer. The CRAFFT or ASSIST-Lite may best serve as brief clinical screening tools, where rapid triage is needed to identify patients requiring greater attention, The ASSIST may be useful when more detailed information is needed (e.g., as a brief assessment following initial identification of patients with potential substance misuse). Additionally, the ASSIST may have useful research applications.

It is important to note that this study evaluated the standard adult version of the ASSIST 3.0, and not the draft version for youth developed by the Drug and Alcohol Service of South Australia (DASSA) (20-22). That version used expert panels to guide suggested revision of the ASSIST, including recommendations to eliminate the low risk category altogether (based on the premise that any substance use among adolescents is problematic), eliminate or revise certain items, and revise prompts and wording. It is possible that implementing these recommendations will yield a better instrument for adolescents than the standard version, and this is ultimately an empirical question. The finding that low cut-points were optimal for identifying problem use and SUDs is quite consistent with the DASSA-developed version's recommended cut-point of 2 for moderate risk (20, 21).

Despite support for criterion validity against DSM criteria, factor analytic findings suggested some room for improvement. An oblique 3-factor structure for tobacco, alcohol, and cannabis risk was insufficient to capture the full complexity of item responding, calling into question strict unidimensionality of the substance-specific scales (at least under standard scoring practices). Nevertheless, an exploratory factor analysis did suggest a three-factor structure that generally reflected these substance-specific scales. The current study provides new data on the performance of the standard version of the ASSIST with adolescents, and could serve as a benchmark against which to examine subsequent tailoring of the instrument.

For the current study, sensitivity and specificity were given equal weight in determining optimal ASSIST cut-points. The ideal trade-off between sensitivity and specificity may vary based on clinical setting, population, base rate of substance use, clinical priorities, and costs of treatment vs. failure to treat. As with any screening study conducted in a real-world

healthcare environment, it is to be expected that a large segment of the sample would report abstinence from substance use. Previous studies of the ASSIST addressed this issue by oversampling adults with SUDs by recruiting at addiction treatment clinics (4-6). In contrast, the current study was conducted solely in primary care. While this reflects the clinical settings for which the ASSIST was designed, a consequence is that most participants reported abstinence. Whether those who report abstinence provide useful information about a screening or research instrument is a matter of perspective. If the purpose is to determine the instrument's ability to discriminate between levels of problem severity among individuals who use substances, those who are abstinent can be viewed as noise drowning out signal. On the other hand, a screening tool's overarching purpose is to distinguish patients who require intervention from those that do not. Thus, from the standpoint of clinical utility and relevance, individuals who report abstinence are a critical group. Most results in the current study were reported for the full sample. However, where appropriate, we also reported findings for participants reporting use of each substance.

Limitations

This study has several limitations. It was conducted with a mostly African-American sample in a single city. Replication in diverse samples is warranted. Prevalence of past year substance use in our sample reflects that of U.S. African American youth nationally, but cannabis rates were somewhat higher in our sample (sample vs. national rates=9.9% vs. 9.7% for tobacco; 23.6% vs. 20.8% for alcohol; 20.9% vs. 13.5% for cannabis) (36). All study measures were self-report, and administered in the same session. SUD criteria were not assessed by a clinician, but determined using established items mapping directly to the diagnostic criteria (27), and administered by experienced research interviewers under conditions of strict confidentiality from parents and medical staff. Although this sample is not small by most standards, a larger sample would have allowed for subgroup analyses (e.g., age, gender, poly-substance use). We were only able to examine the ASSIST for tobacco, alcohol, and cannabis. Although these substances are most likely to be encountered in primary care, other substances also present risks for adolescents. More research is needed examining the ASSIST with youth that use other substances. Such research will likely require oversampling of substance-using youth (e.g., from SUD treatment settings), as done in the adult ASSIST studies. Despite these limitations, this study provides new data to guide future use and refinement of the ASSIST with adolescents. This study supports the potential value of the ASSIST as a research and clinical instrument in this population, although some revisions in scoring and/or cut-points that trigger intervention may be warranted to further optimize its utility.

Acknowledgments

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Table 1

Substance use characteristics with DSM-5 criteria (*N*= 525).

	No use (abstinent)	Non-Problem Use (0 DSM criteria)	Problem Use (1 DSM criterion)	DSM-5 Disorder (2 or more criteria)
	n (%)	*n (%)*	*n (%)*	*n (%)*
Tobacco	478 (91.0%)	15 (2.9%)	11 (2.1%)	21 (4.0%)
Alcohol	401 (76.4%)	75 (14.3%)	25 (4.8%)	24 (4.6%)
Cannabis	415 (79.0%)	30 (5.7%)	24 (4.6%)	56 (10.7%)

Table 2

Means (standard deviations) of substance-specific ASSIST scores by DSM-5 Substance Use Disorder diagnostic criteria.

	Full sample (*N* = 525)			Past-year users[1]		
	DSM-5 Criteria met	DSM-5 Criteria not met	p-value	DSM-5 Criteria met	DSM-5 Criteria not met	p-value
Tobacco	15.0 (8.9)	.5 (2.0)	< .001	15.0 (8.9)	6.6 (5.5)	< .001
Alcohol	10.3 (7.2)	.8 (1.9)	< .001	10.3 (7.2)	2.7 (2.7)	< .001
Cannabis	18.4 (9.8)	.7 (2.2)	< .001	18.4 (9.8)	5.0 (3.9)	< .001

[1] tobacco: *n* = 47 ; alcohol: *n* = 124; cannabis: *n* = 110. P-values are from independent samples t-tests.

Table 3

Performance of optimal ASSIST cut-points in identifying problem use and DSM-5 substance use disorders (*N*=525).

	Sensitivity	Specificity	AUC
Tobacco			
Problem Use (optimal ASSIST cut-point= 2)	96.9%	95.3%	.96
DSM-5 SUD (optimal ASSIST cut-point= 2)	95.2%	93.3%	.94
Alcohol			
Problem Use (optimal ASSIST cut-point= 2)	89.8%	82.1%	.86
DSM-5 SUD (optimal ASSIST cut-point= 2)	100.0%	79.0%	.90
Cannabis			
Problem Use (optimal ASSIST cut-point= 2)	97.5%	91.2%	.94
DSM-5 SUD (optimal ASSIST cut-point= 2)	98.2%	86.8%	.93

Note: Problem Use is defined as 1 or more DSM-5 criteria. DSM-5 SUD is defined as 2 or more criteria.

Table 4

ASSIST factor loadings.

	Factor 1 (tobacco risk)	Factor 2 (alcohol risk)	Factor 3 (cannabis risk)	*Uniqueness*
ASSIST Tobacco Items				
Q2a (frequency of use)	**.63**	−.03	*.31*	.31
Q3a (craving)	**.86**	.08	.06	.15
Q4a (problems)	**.67**	−.03	−.12	.64
Q6a (others' concern)	**.51**	.04	.18	.59
Q7a (inability to control use)	**.81**	.04	−.03	.35
ASSIST Alcohol Items				
Q2b (frequency of use)	<−.01	**.33**	*.40*	.63
Q3b (craving)	−.05	**.54**	.23	.59
Q4b (problems)	.03	**.52**	−.02	.73
Q5b (failed to fulfill obligations)	.05	**.67**	−.04	.54
Q6b (others' concern)	−.11	**.45**	.29	.67
Q7b (inability to control use)	.03	**.60**	−.12	.67
ASSIST Cannabis Items				
Q2c (frequency of use)	−.11	−.08	**1.0**	.10
Q3c (craving)	.16	.02	**.74**	.29
Q4c (problems)	*.52*	−.12	.27	.55
Q5c (failed to fulfill obligations)	*.31*	.05	**.44**	.53
Q6c (others' concern)	.08	.08	**.67**	.44
Q7c (inability to control use)	.23	−.05	**.58**	.48
Variance	4.99	2.87	5.25	
Proportion	.57	.33	.60	

Note: Iterated principal factor analysis. Values are normalized loadings from promax rotation. Loadings above .30 for ASSIST substance-specific scale items that load onto the respective factor are bolded. Loadings above .30 for ASSIST substance-specific scale items that cross onto another factor are italicized.