

# Conversion and Validation of the Teen-Addiction Severity Index (T-ASI) for Internet and Automated-Telephone Self-Report Administration

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This study converted the Teen-Addiction Severity Index (T-ASI) into self-report formats using Internet (Net) and interactive voice response (IVR) automated-telephone technologies. Reliability and convergent validity were assessed among 95 inpatient adolescent participants. Current functioning scores obtained by clinician interview correlated well with self-report Net (mean  $r = .74$ ,  $SD = .14$ ) and IVR (mean  $r = .72$ ,  $SD = .16$ ). Lifetime history items obtained by clinicians were consistent with self-report Net (mean  $r = .60$ ,  $SD = .32$ ; mean  $\kappa = .67$ ,  $SD = .24$ ) and IVR formats (mean  $r = .60$ ,  $SD = .30$ ; mean  $\kappa = .64$ ,  $SD = .26$ ). Participants rated “ease of use” as being high for both Net and IVR formats. These findings suggest that automated T-ASI administration is a valid and potentially less expensive alternative to clinician-administered T-ASI interviews.

Although the assessment of adult substance abuse problems has a well-tested vehicle in the Addiction Severity Index (ASI; McLellan et al., 1992; McLellan et al., 1985; McLellan, Luborsky, Woody, & O'Brien, 1980), no equivalent “gold-standard” instrument presently exists for adolescent substance abuse assessment. Some states have mandated using the ASI for adolescent populations. This development has occurred despite the fact that adult-oriented assessments are ill-suited for use with teenage populations because of developmental differences between adolescents and adults (Tarter et al., 1995). Other states have mandated use of the

ASI for adults but have temporarily abandoned attempts to create a similar assessment standard for adolescents. Although the Problem-Oriented Screening Instrument for Teenagers (POSIT; Rahdert, 1991) and the Drug Use Screening Inventory (DUSI-R; Tarter, Laird, Bukstein, & Kaminer, 1992) have achieved prominence as screening instruments, no national standard for adolescents has emerged that offers a solution for the dual needs of comprehensive, problem-focused assessment prior to treatment and outcomes-tracking during and after treatment.

Written in consultation with McLellan, Kaminer's Teen Addiction Severity Index (T-ASI)—a semistructured interview with 154 questions containing 227 individual items—was designed to include the same domains as its adult counterpart, with the exceptions that it has (a) no medical domain, given that adolescents have fewer medical problems; (b) age-appropriate language for teenagers; (c) a combined alcohol and drug use assessment condensed into a single chemical domain; (d) a school status domain to reflect the importance of school in teenagers' lives; and (e) a peer/social domain to assess the impact of friends and personal relationships (Kaminer, Bukstein, & Tarter, 1991). Including domains on employment, family relations, legal status, and psychiatric status, the T-ASI is a seven-domain instrument. The T-ASI is a viable candidate for reliable, multidomain adolescent substance abuse assessments that (a) are sensitive to the needs of adolescent inpatients and outpatients, (b) contain quantitatively oriented questions for automated interpretation, (c) are less than 30 min in length to qualify as clinically useful and practical, (d) have separable lifetime and current sections to facilitate both intake and follow-up assessments, and (e) possess scoring algorithms that do not require clinical ratings and lessen the clinician time required for administration. The T-ASI is widely used by many criminal justice sys-

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tems, state and county governments, state psychiatric hospitals, and a variety of community treatment centers.

Although the standard T-ASI covers highly relevant content for its intended purpose and is associated with favorable psychometric properties, it does possess a number of disadvantages. First, like the related ASI, the T-ASI is expensive to administer, especially for underfunded substance abuse agencies. Although no exact data have been found on the cost of administering the T-ASI, the figures from the ASI are informative, given that the two are of similar length: Butler et al. (2001) estimated that the typical clinician-administered (CA) ASI costs \$75–125 per administration (25–40 min for the clinician interview itself and another 10–20 min for scoring). If a self-report (SR) version was available, this valuable time could otherwise be devoted to clinical treatment. Second, both the ASI and T-ASI require training to be administered properly, creating the potential for widespread interrater bias (Butler et al., 2001). Unfortunately, many clinics do not have the resources for ASI or T-ASI clinician training. Third, the factors mentioned above may hamper the T-ASI's use as a research tool.

Converting the CA T-ASI into a SR format and validating Internet (Net) and interactive voice response (IVR) automated-telephone versions of the T-ASI offer the potential to create an ideal substance abuse instrument for assessing and tracking adolescents. First, creating an SR format would save clinician time and reduce the associated costs of both implementing and scoring the survey. Second, widespread access to the telephone and the Internet makes these technologies well-suited for reaching wide audiences, inside or outside clinical settings. In 2002, 95.5% of all U.S. households and 89.1% of low-income families had access to a touch-tone phone at home (U.S. Census Bureau, 2003). In 2000, 66% of U.S. households with school-age children possessed a computer, 53% of U.S. households with children had access to the Internet at home, and 89.4% had access to the Internet either at home or school (Newburger, 2001). Third, instantaneous communication enables timely reports. Clinicians and patients can have access to T-ASI reports within minutes of completing the automated survey. Fourth, the use of centralized databases inherent in Internet and IVR technologies makes assembling large databases of patient responses feasible for research purposes. Fifth, despite some limitations, SR has proven to be a valid method for assessing substance use and other medical disorders (Babor et al., 1987; Darke, 1998; Midanik, 1988), and validity has also been demonstrated for both IVR (Piette, 2000) and Internet formats (Cunningham, Humphreys, & Koski, 2000). Last, IVR and Internet technology have received positive responses from youth populations (Mundt, 2001).

The central focus of this study was to adapt the T-ASI into self-report Internet (T-ASI SR Net) and self-report IVR (T-ASI SR IVR) formats and to evaluate and compare their psychometric properties (internal consistency, temporal stability, and convergent validity). Ease of use was also evaluated. If the new SR versions of the T-ASI are associated with favorable psychometrics and high user acceptability, they may prove to be a quick, cost-effective, and unbiased assessment vehicle.

## Method

### Sample

The study recruited adolescent inpatient participants at a large, free-standing residential youth chemical dependency facility in eastern Washington State. Adolescent participants were American Society of Addiction Medicine Treatment Level III.5, under the refined adolescent guidelines, and all met criteria for the *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV*; American Psychiatric Association, 1994) substance use disorder. Inpatient participants were recruited into the study if they were 12–19 (inclusive) years old at the beginning of the study, not pregnant, not suicidal, able to understand simple spoken and written statements, and willing to provide informed consent in conjunction with their parents or guardians. Participants were compensated with coupons for participation, although they did not need to complete individual surveys or the full administration sequence to receive compensation.

### Survey Development

The study made several alterations to Kaminer et al.'s (1991) original CA T-ASI. First, the researchers converted the T-ASI into an SR format appropriate for adolescents. This was accomplished by removing the potential ambiguity of certain technical terms. For example, "In the past year, have you been in a controlled environment?" was changed to "In the past year, have you spent the night in a detention center, a hospital, or a treatment program?" and "How important to you now is counseling or referral for these legal problems?" was altered to "How important to you now is getting help for these legal problems?" The survey language was also simplified so that it could be understood at a fifth-grade reading level. A fifth-grade reading level was chosen as the minimum necessary to read a survey and understand it, and it was deemed appropriate for the intended 12–19-year-old respondents who might have difficulties in school and might not read at their attained grade level. For instance, "How satisfied were you with your job performance?" was changed to "Were you happy with how well you did your job?" and "Have you had a significant period in which you experienced hallucinations?" was altered to "Have you ever heard or seen things that were not real?" In addition, the researchers clarified potentially ambiguous wording. For example, the more specific "last 30 days" was substituted for "last month," as a clarification for participants who might be taking the survey in the middle of a month.

Second, the researchers made several changes to make the instrument appropriate for automated SR mechanisms. Small wording changes were performed to make more answers suitable for quantitative responses. In addition, some general questions and branching logic were added, enabling a participant's answers to determine whether or not related questions should be administered. For example, a general question was asked regarding whether adolescent respondents had ever used opiates in order to determine whether more specific follow-up questions should be pursued about particular opiate use and problems in the past 30 days. Although the original clinician interview administered by paper and pencil contained 227 individual items, the T-ASI SR Net and the T-ASI SR IVR were modified using branching logic to have a range of 68–215 items. Included in the 68–215 items were 39 items that tracked current activity only (i.e., the past 30 days), making them a suitable mechanism for follow-up outcomes-tracking.

Third, the researchers developed a Net version of the clinician-administered T-ASI (CA T-ASI Net) in order to facilitate data gathering using the clinician interview. Instead of writing patient responses on paper, the study clinician entered them by clicking on responses or keying numbers using a computer with a mouse.

Finally, we developed composite scores to summarize items related to current functioning (typically functioning in the past 30 days) in six domains: chemical use, psychiatric problems, legal problems, family functioning, peer relationships, and school functioning. Calculation composite

scores followed the same basic approach as in the adult ASI. All item responses were first transformed by dividing them by their maximum possible value; for example, ratings of subjective distress on a 0–4 scale were divided by 4, whereas the number of days in the past month when a problem occurred were divided by 30. Transformed items in each domain were then averaged to yield a composite score from 0 (*absence of problems on all of the subscale items*) to 1 (*most severe possible response to all subscale items*).

The *chemical use composite* is similar to the combined alcohol and drug composites in the adult ASI and includes the numbers of days patients used alcohol, tobacco, cannabis, opiates, hallucinogens, stimulants, barbiturates, sedatives, inhalants, and multiple substances; misused over-the-counter medications; had alcohol-related problems; and had drug-related problems, as well as participants' subjective distress from alcohol and drug problems and their desire for alcohol and drug treatment. The *psychiatric composite* is nearly identical to the adult ASI and includes presence of serious depression, anxiety, strange untrue beliefs, auditory hallucinations, memory or concentration problems, violent urges, suicidal ideation, suicide attempts, ingestion of psychiatric medications, the number of days of psychiatric problems in the past month, subjective psychological distress, and desire for mental health treatment. The *legal domain* addresses whether patients were on parole, were awaiting charges, and had done something illegal to get money in the past month, as well as participants' distress with legal problems and desire for legal counseling.

The T-ASI *family composite* includes more items than the adult ASI, as family functioning is assessed more extensively in the T-ASI. These items include number of serious conflicts with family members in the past month, subjective distress with family problems, desire for help or counseling for family problems, and teens' perception of the degree to which their family is supportive, fights, has shared activities, has set rules, is trustworthy, and hears them. Items on recent physical or sexual abuse were not included in the overall composite scores so that the T-ASI could be used with or without including these items that trigger mandated reporting. The *peer relationship composite* included items on satisfaction with friendships, arguments with friends, distress over problems with peers, desire for help or counseling for peer problems, and (if teens are involved in a romantic relationship) satisfaction with that relationship and arguments with their boyfriend or girlfriend. Finally, the *school composite* included the number of times in the past month the participant missed school, skipped classes, was late, got into trouble, was suspended, participated in extracurricular activities, and attended after-school events, as well as participants' subjective distress and desire for counseling for school problems.

### Study Implementation Procedure

To compare the responses to the T-ASI SR Net and the T-ASI SR IVR with the CA T-ASI Net, the researchers recruited patients to take the T-ASI repeatedly during four sessions over a 10–12 day period. Most administrations occurred at 2–3 day intervals, with the exception of a 6-day interval, which was used to assess test–retest reliability within a single technology. The study rotated the order of administration in a four-cell design, in which participants alternated between taking the CA T-ASI Net, the T-ASI SR Net, and the T-ASI SR IVR.

In addition, participants completed three established screening instruments to compare the correlation of the T-ASI SR composite scores with corresponding domain scores in these instruments. Participants took the Personal Experience Screening Questionnaire (PESQ), a widely used, 10-min screening tool used to assess the need for a comprehensive drug-use evaluation and to screen briefly for select psychosocial problems and “faking good” and “faking bad” tendencies (Winters, 1998); the Personal Experience Inventory (PEI), a 40–60 min comprehensive assessment instrument that covers substance abuse and summarizes problems relevant for planning the level of treatment intervention (Winters & Henly, 1989); and the Problem-Oriented Screening Instrument for Teenagers (POSIT), a 20-min screening tool designed to identify potential problem areas that require further in-depth assessment (Rahdert, 1991; see Table 1).

In addition, adolescent participants answered questions about their access to technology. Participants also completed a satisfaction survey at Time 4 to determine the acceptability of the SR formats. Participants were asked the following questions for each of the three modes of administration: “How easy was it for you to use [the technology]?” “How much did you like [the technology]?” and “How likely would you be to provide honest answers using [the technology]?”

All CA T-ASI interviews were conducted by a single chemical-dependency mental health professional, who read the training manual for the T-ASI, performed mock assessments, and reviewed questions with the principal investigator and a consultant.

### Data Analysis

Several analytical techniques compared T-ASI domain scores obtained by Net and IVR with corresponding domain scores obtained by clinician interview. First, the internal consistencies of T-ASI composite scores (Cronbach's alphas) were compared for scores obtained by clinician interview, SR Net, and SR IVR formats. Second, the researchers compared

Table 1  
Survey Instruments and Implementation Sequence

Session no.	Main Cell 1 (n = 27)	Main Cell 2 (n = 26)	Main Cell 3 (n = 29)	Main Cell 4 (n = 26)
T1 (N = 108)	CA T-ASI Net, PEI, technol. survey	CA T-ASI Net, PEI, technol. survey	T-ASI SR Net, PESQ, technol. survey	T-ASI SR IVR, PESQ, technol. survey
T2 (N = 105)	SR T-ASI Net, PESQ	SR T-ASI IVR, PESQ	T-ASI SR Net, PESQ <sup>a</sup>	T-ASI SR IVR, PESQ <sup>a</sup>
T3 (N = 100)	T-ASI SR Net, PESQ <sup>a</sup>	T-ASI SR IVR, PESQ <sup>a</sup>	CA T-ASI Net, PEI	CA T-ASI Net, PEI
T4 (N = 95)	T-ASI SR IVR, POSIT user survey	T-ASI SR Net, POSIT, user survey	T-ASI SR IVR, POSIT user survey	T-ASI SR Net, POSIT user survey

*Note.* T1 occurred 8 days after intake. Follow-up sessions occurred 2–3 days after the previous survey administration, except for the noted 6-day interval for test–retest. Thus, the total sequence lasted 10–12 days. CA T-ASI Net = Clinician-Administered Teen-Addiction Severity Index by Internet; T-ASI SR Net = Self-Report Teen-Addiction Severity Index by automated Internet; T-ASI SR IVR = Self-Report Teen-Addiction Severity Index by interactive voice response telephone; PEI = Personal Experience Inventory; PESQ = Personal Experience Screening Questionnaire; POSIT = Problem-Oriented Screening Instrument for Teenagers; Technol. = technology; T = Time.

<sup>a</sup> 6-day waiting period.

test-retest reliability of composite scores obtained by clinician interview, SR Net, and SR IVR. Third, the convergent validity of the SR measures with the clinical interview was assessed by correlating T-ASI SR Net and T-ASI SR IVR composite scores with corresponding CA T-ASI Net composite scores.

The fourth analysis examined the correspondence between CA T-ASI Net, T-ASI SR Net, and T-ASI SR IVR formats for all of the lifetime history items. Correspondence across formats was assessed by computing the mean correlation (for continuous items) and mean kappa coefficient (for dichotomous items) obtained across the three formats. The fifth analysis further assessed convergent validity of the SR formats of the T-ASI with other established measures: Composite scores from the T-ASI SR Net and T-ASI SR IVR were compared for correlation with corresponding domain scores from the PESQ, the PEI, and the POSIT. The sixth analysis examined whether the Net and IVR formats had any significant mean differences in their strength of correlation with CA T-ASI Net composite scores.

The final analysis concerned the general acceptability of the SR formats. The time required to complete the three instruments was recorded, and participant ratings for ease of use, liking, and likelihood of answering honestly were calculated using repeated measures analysis of variance, with planned contrasts comparing both Net and IVR with clinical interview.

## Results

### Participant Recruitment and Demographics

A total of 108 participants agreed to participate in the study, constituting 84% of the 128 eligible patients admitted to the adolescent substance abuse facility during the study period. Ninety-five of the 108 participants (88%) completed all four administrations; 5 (5%) completed only three sessions; 5 (5%) completed only two sessions; and 3 (3%) completed only one session. Nine of the 13 participants who did not complete all rounds of interviews dropped out from the study because of their clinical discharge. The other 4 chose not to continue for personal reasons.

Demographically, the participant sample was 49% female. The average age was 16 with a range of 14–19 years old ( $SD = 1.214$  years). No 12- or 13-year-olds were admitted to the clinic during

the 13 weeks of study recruitment. Seventy-nine percent of participants reported being in school that year. Of those who were not in school, 13% reported working full-time prior to entering treatment, 17% worked part-time with regular hours, 22% worked part-time with irregular hours, and 48% were unemployed. In addition, the group of those employed reported that they had completed, on average, 10 years of school (with a range of 6–13 years of school). For primary drug of abuse, 28% of participants reported alcohol, 30% indicated cannabis, and 31% stated stimulants, with smaller percentages reporting opiates, hallucinogens, inhalants, and over-the-counter drugs. For ethnicity, 10% described themselves as being Hispanic or Latino. In their SRs of race, 80% selected White, 11% selected American Indian/Alaska Native, 3% selected Black/African American, 1% selected Native Hawaiian/Pacific Islander, 0% selected Asian, and 6% selected "Other."

### Internal Consistency and Test-Retest Reliability of Composite Scores

Because the great majority of adolescents in our sample were not employed (89%), most of the employment domain items were inapplicable. Employment composite scores were, therefore, not computed, and only individual items were analyzed. For the remaining six domains, the SR Net and IVR instruments exhibited internal consistencies commensurate with or superior to the CA T-ASI (see Table 2). Cronbach's alphas obtained by T-ASI SR Net ( $M = .61$ ,  $SD = .18$ , range = .34–.83) and T-ASI SR IVR ( $M = .55$ ,  $SD = .22$ , range = .19–.80) were comparable with those obtained by interview ( $M = .53$ ,  $SD = .15$ , range = .28–.65). Moreover, all domains except the peer domain showed good test-retest reliability ( $r > .75$ ) within the Net and IVR formats.

### Convergent Validity of SR Composite Scores With Clinical Interview

As shown in Table 2, T-ASI composite scores obtained by clinician interview were well correlated with composite scores

Table 2  
Internal Consistency, Test-Retest, and Correlation of IVR and Net T-ASI Domain Scores With Clinician-Administered T-ASI

Domain <sup>a</sup>	Internal consistency (Cronbach's $\alpha$ )			Test-retest reliability		$r$ with CA T-ASI	
	CA	SR Net	SR IVR	SR Net	SR IVR	SR Net	SR IVR
Chemical	.65	.75	.76	.83	.58	.60**	.65**
Psychiatric	.65	.83	.80	.88	.86	.63**	.74**
Legal	.45	.47	.50	.95	.90	.94**	.94**
Peer	.28	.34	.19	.62	.39	.56*	.46*
Family	.64	.62	.59	.77	.76	.79**	.70**
School	.52	.62	.47	.86	.87	.64**	.56**

Note. CA = Clinician-Administered Teen-Addiction Severity Index by Internet; SR Net = Self-Report Teen-Addiction Severity Index by automated internet; SR IVR = Self-Report Teen-Addiction Severity Index by interactive voice response telephone.

<sup>a</sup>Employment composite scores could not be analyzed in this sample as very few participants were either employed or seeking employment.

\* Correlates significantly greater than 0 ( $p < .05$ ).

\*\* Correlates significantly greater than 0 ( $p < .01$ ).



obtained by T-ASI SR Net (mean  $r = .74$ ,  $SD = .14$ , range =  $.56$ – $1.00$ ) and by T-ASI SR IVR (mean  $r = .72$ ,  $SD = .16$ , range =  $.46$ – $.99$ ). There were no significant differences between the Net and IVR formats in their correlations with clinician interview for the chemical, legal, and employment domains. The Net possessed a higher correlation for the peer, family, and school domains, whereas the IVR format exhibited a higher correlation for the chemical and psychiatric domains.

#### *Convergent Validity of Lifetime History Obtained by CA T-ASI SR Net, T-ASI SR Net, and T-ASI SR IVR*

The convergent validity of lifetime history items that were not included in the T-ASI SR composites was assessed by comparing responses to the clinician interview with the SR Net and SR IVR formats. Both SR formats displayed very positive correlations in the lifetime history sections with the CA T-ASI SR. For the SR Net, the mean correlation of the 88 continuous variables between CA T-ASI SR Net and T-ASI SR Net was  $.60$  ( $SD = .32$ , range =  $-.50$ – $1.00$ ). For the 38 categorical variables on the Net, the mean kappa coefficient between CA and T-ASI SR Net formats was  $.67$  ( $SD = .24$ , range =  $-.03$ – $1.00$ ).

In parallel for SR IVR and its 88 continuous variables, the mean correlation between responses obtained by CA T-ASI SR Net and T-ASI SR IVR was  $.60$  ( $SD = .30$ , range =  $-.11$ – $1.00$ ). For the 38 categorical variables, the mean kappa coefficient between CA T-ASI SR and T-ASI SR IVR formats was  $.64$  ( $SD = .26$ , range =  $-.02$ – $1.00$ ).

#### *Correlation of CA T-ASI Net, T-ASI SR Net, and T-ASI SR IVR Domain Scores With the PESQ, PEI, and POSIT*

We used two criteria to assess convergent validity of the automated SR versions of the T-ASI with other established measures. First, we considered whether the T-ASI SR Net and the T-ASI SR IVR composite scores correlated significantly with other measures. Next, we considered whether correlations between these other measures and the SR versions of the T-ASI were *not* significantly different from the correlations between those measures and the clinical interview format of the T-ASI. The T-ASI SR Net and T-ASI SR IVR correlated significantly with other measures in 13 of 17 comparisons (81%) and had correlation coefficients comparable with those of the CA T-ASI for 12 (IVR) or 13 (Net) of those 17 comparisons (see Table 3). The SR versions of the T-ASI exhibited convergent validity for summary scores in the chemical (5 of 5 comparisons), psychiatric (4 of 4 comparisons), family (2 [IVR] or 3 [Net] of 3 comparisons), and legal (1 of 2 comparisons) domains. The T-ASI showed poor convergence with the POSIT and PEI for the school (0 of 1) and peer (0 of 2) domains, respectively.

#### *Mean Differences Between Composite Scores Across Formats*

Repeated measures analysis of variance and follow-up  $t$  tests indicated significant mean differences for three of the seven domain scores (see Table 4). Psychiatric domain problem scores obtained by Net were higher than those obtained by clinical interview. Peer domain problem scores obtained by IVR were

Table 3  
*Correlation of Clinician, Net, and IVR T-ASI Domain Scores With PESQ, PEI, and POSIT Criterion Measures*

Criterion measure	CA	SR Net	SR IVR
Chemical domain			
PESQ PS	.20*	.29**	.18**
PESQ Last 3 months drug use	.28*	.25**	.28**
PEI Personal Involvement	.25*	.33**	.27**
PEI Drug Use	.47*	.32**	.23**
POSIT Substance Use/Abuse	.41*	.48**	.32**
Psychiatric domain			
PESQ PP	.57*	.70**	.63**
PEI Psychological Disturbance	.44*	.50**	.43**
PEI Negative Self-Image	.32*	.33**	.35**
POSIT Mental Health	.50*	.49**	.42**
Legal domain			
PEI Deviant Behavior	.47*	.45**	.45**
POSIT Aggressive Behavior	.06	.06	.04
Peer domain			
PEI Social Isolation	.02	.07	.16
Family Domain			
PEI Family Pathology	.43*	.39**	.29**
PEI Family Estrangement	.56*	.57**	.49**
POSIT Family Relationships	.32*	.35**	.22**
School domain			
POSIT Educational Status	.04	-.02	.01

*Note.* CA = Clinician-Administered Teen-Addiction Severity Index by Internet; SR Net = Self-Report Teen-Addiction Severity Index by automated internet; SR IVR = Self-Report Teen-Addiction Severity Index by interactive voice response telephone; PESQ = Personal Experience Screening Questionnaire; PEI = Personal Experience Inventory; POSIT = Problem-Oriented Screening Instrument for Teenagers; PS = problem severity; PP = psychological problems.

\* Correlates significantly greater than 0 ( $p < .05$ ).

\*\* Correlates significantly greater than 0 ( $p < .05$ ) and not significantly less than correlation of CA T-ASI with same measure ( $p < .05$ ).

significantly higher than those obtained by clinical interview. Conversely, family domain problem scores obtained by IVR were significantly lower than those obtained by T-ASI interview.

#### *SR Survey Acceptability*

The SR surveys were completed in a quick and timely manner. The average administration time for the paper-and-pencil clinician interview is 25–40 min. In our study, the average time for the CA T-ASI Net was 20.05 min (range = 14–39 min,  $SD = 6.05$  min), whereas the average time to complete the T-ASI SR Net was 25.05 min (range = 14–42 min,  $SD = 7.06$  min) and the average time to complete the T-ASI SR IVR was 18.63 min (range = 10–28 min,  $SD = 10.04$  min). Therefore, both the Net and IVR SRs showed themselves to be viable alternatives to the CA T-ASI.

The survey questioning participants' access to technology showed high percentages of participants with access to touch-tone telephone technology (97%) and to computers (96%), and a large majority reported actually using the Internet (84%).

In determining acceptability, both the Internet and IVR SR formats received positive evaluations from adolescent participants, with the SR Net receiving the highest marks, the CA interview ranking second, and IVR placing a close third. Over 50% of adolescent respondents gave the T-ASI SR Net high ratings for ease of use, general likeability, and likelihood to answer honestly

Table 4  
Mean and SD T-ASI Domain Scores Obtained by Clinical Interview, Net, and IVR

Domain <sup>a</sup>	CA		SR Net		SR IVR		F(df)	p
	M	SD	M	SD	M	SD		
Chemical	0.19	.07	0.18	.08	0.19	.08	1.1(2, 169)	.32
Psychiatric	0.21	.17	0.25**	.24	0.21	.20	4.0(2, 172)	.03
Legal	0.29	.27	0.29	.26	0.29	.27	0.3(2, 170)	.73
Peers	0.32	.12	0.32	.13	0.37*	.12	7.1(2, 172)	.01
Family	0.41	.12	0.41	.13	0.39*	.12	3.4(2, 170)	.04
School	0.45	.13	0.47	.16	0.48	.13	1.5(2, 110)	.23

Note. CA = clinician administered; SR Net = self-report Internet; SR IVR = self-report interactive voice response (automated telephone); T-ASI = Teen-Addiction Severity Index.

<sup>a</sup> Employment composite scores could not be computed in this sample as very few participants were either employed or seeking employment.

\* Significantly different ( $p < .05$ ) from mean score obtain by clinician-administered T-ASI. \*\* Significantly different ( $p < .01$ ) from mean score obtained by clinician-administered T-ASI.

(see Table 5 and Table 6). Moreover, SR Net consistently received significantly higher ratings than the CA interview. Over 50% of participants gave T-ASI SR IVR high ratings on “ease of use” and “likely to answer honestly,” and IVR was rated similarly to clinical interview in these areas. IVR received lower ratings for likeability than did the CA and Net formats.

In addition to quantitative questions, participants were also given an opportunity to provide open-ended qualitative responses, which helped clarify the reasons behind survey responses. There were no complaints about the Net technology but rather many words of praise. The main benefits cited were (a) pleasure (“I like working on computers”); (b) perceived speed (“I think working on the computer is a good way to go faster”); (c) perceived accuracy (“I found [it easier] to give more accurate answers on the computer—maybe because I am a visual learner”); and (d) comfort (“my generation feels most comfortable with a computer because we use it a lot”). Some participants also expressed preference for IVR on the basis of having “bad handwriting,” “not having to click the mouse,” or appreciating the additional privacy that IVR affords: “I liked that the telephone survey was easy to concentrate on. It spoke for you, and it was the most private.” Unfavorable comments regarding IVR involved (a) perceived delay (waiting for the system to ask or repeat questions); (b) perceived length (“I did not like the phone survey because it took a long time”); and (c) perceived redundancy (the desire to eliminate repetitive questions).

Comments about the instruments contributing to self-knowledge and providing a sense of anonymity proved particularly enlightening. Regarding self-knowledge, respondents wrote the following: “I like how it helps us kids learn more about ourselves”; “It makes me realize my problem”; “It lets me get some stuff out that I needed to get out—It made me realize that I’m a full-blown addict”; “It makes you think about stuff your drug use has caused, such as missing school and stuff”; and “Some of the questions were really accurate to my old lifestyle—it was interesting.” Regarding a feeling of anonymity, respondents said the following: “It is easier to tell the truth to a computer”; “I liked that you can do this from home”; “I liked that you’ll be able to try it at your home someday”; and “I like it more than talking face to face to a counselor.”

### Discussion

This study assessed the reliability and convergent validity of Internet and automated-telephone SR versions of the T-ASI. This process entailed three changes to the original T-ASI: (a) use of an SR rather than interview format; (b) automation of the SR administration by means of Internet and IVR; and (c) calculation of composite scores to summarize current functioning. Overall, the automated SR Net and IVR formats of the T-ASI appear to represent reliable and valid alternatives to the CA version of the

Table 5  
Comparison of Instrument Satisfaction

Instrument questions (N = 95)	Mean score (1–5)			% rating 4 or 5		
	CA	SR Net	SR IVR	CA	SR Net	SR IVR
How easy to use?	3.95	4.22*	3.77	66%	77%	62%
How much liked?	3.36	3.45**	2.70*	46%	70%	33%
How likely to answer honestly?	4.14	4.42*	4.27	78%	91%	85%

Note. CA = Clinician-Administered Teen-Addiction Severity Index by Internet; SR Net = Self-Report Teen-Addiction Severity Index by automated Internet; SR IVR = Self-Report Teen-Addiction Severity Index by interactive voice response telephone.

\* Significantly different from clinician administered (two-tailed,  $p < .05$ ).

\*\* Net significantly different from IVR (two-tailed,  $p < .05$ ).

Table 6  
*Comparison of Access to Technology*

Access to technology questions ( <i>N</i> = 108)	%		
	Yes	No	No answer
Do you have access to a computer?	96	3	1
Do you use the Internet or Web?	84	15	1
Do you have access to a touch-tone telephone?	97	1	2

T-ASI, particularly for assessment of chemical use, psychiatric, legal, family, and school problems.

The internal consistency and test–retest reliability of T-ASI SR for current functioning composite scores obtained by SR Net and IVR were equal or superior to those obtained by interview. Likewise, the automated SR versions of the T-ASI demonstrated reasonable convergent validity with the clinician-rated version of the T-ASI for chemical use, psychiatric, legal, family, and school composite scores. The automated SR administrations of the T-ASI also showed good convergence with the CA T-ASI for lifetime history items in both the Net (mean  $r = .60$ ,  $SD = .32$ ; mean  $\kappa = .67$ ,  $SD = .24$ ) and IVR (mean  $r = .60$ ,  $SD = .30$ ; mean  $\kappa = .64$ ,  $SD = .26$ ) formats.

In addition, the T-ASI SR showed generally good convergent validity with the PESQ, PEI, and POSIT for assessment of problems with chemical use, psychiatric, legal, and family problems. Comparison of the T-ASI with the PESQ, PEI, and POSIT is limited by the fact that their domains are only partially overlapping. Differences in domain constructs across instruments do not necessarily indicate that any given instrument is superior, merely more or less useful for a given purpose. Poor convergent validity between the T-ASI legal domain and the POSIT Aggressive Behavior subscale is likely due to differences in content: the T-ASI assesses severe legal consequences (e.g., arrests, incarceration), whereas the POSIT subscale includes both severe and mild behavior problems (e.g., “brag,” “swear or use dirty language,” “louder than other kids,” etc.). Poor convergence between the T-ASI school domain score and the POSIT Educational Status score also likely reflects differences in content: the T-ASI focuses on more severe behavior problems (e.g., “late to school,” “skipped classes,” “suspended”), whereas the POSIT assesses a broad range of traits related to success in school (e.g., “good listener,” “get frustrated easily,” “good speller,” etc.). In general, these differences stem from the differing purposes of the POSIT (a screening tool) and the T-ASI (for assessment at intake and for follow-up during and after treatment). Poor convergent validity between the T-ASI Peer domain score and the PEI Social Isolation score and the POSIT Social Skills score may also reflect wide variability in the specific content of these measures. Notably, the PEI Social Isolation score and POSIT Social Skills score, both from well-developed measures, were also not significantly correlated with each other ( $r = .15$ , *ns*).

Results of this study indicate that we succeeded in developing assessment tools that are not only accurate but also usable by inpatients. The successful recruitment and high retention rates of our study suggest general acceptability. The T-ASI SR Net required an average of 25 min to complete, whereas the T-ASI SR

IVR required an average of 18.5 min to complete. These figures are particularly interesting, given that participants frequently expressed concern over the greater perceived length of the IVR survey. A 39-question “Current” section, asking questions about the past 30 days of activity, would require even less time, providing a solid, practical assessment instrument for follow-up outcomes-tracking.

As anticipated, technology-savvy adolescent participants preferred the SR Net assessment to the clinician interview. This finding supports previous research on participant preferences (Mundt et al., 2001). Although differences in mean scores showed little change across technologies and may be attributable to chance, the participant survey results support previous claims that respondents perceive that they will be more honest using automated systems than during face-to-face interviews (Cunningham et al., 2000; Piette, 2000). Also of note is the assertion that participants considered IVR to be very similar to the clinician interview in terms of ease of use. Although IVR is less popular than Net technology, it is important to note that it proved acceptable, as telephone remains the best technology for achieving nearly universal access for longitudinal follow-up reporting.

Participants also thought that both the IVR and Net surveys helped them learn about themselves and their substance abuse problem. This self-learning shows an active engagement on the part of participants and shows that surveys by themselves may help, to a small extent, patients confront their problems.

As noted above, this study assessed not only automated administration of the T-ASI but also new scoring procedures to generate T-ASI composite scores. This was particularly important for the peer and school domains, which have no counterparts in the adult ASI. Our T-ASI composites appear to work relatively well for the chemical use, psychiatric, legal, family, and school domains. However, the peer domain, which combines several potentially disparate constructs (friendships, romantic relationships, and friends’ substance abuse) had poor internal consistency ( $\alpha < .35$ ) and limited test–retest reliability in all three formats. Additional psychometric work is needed to refine this domain. The study was also unable to test the psychometric properties of a planned employment composite in this sample, which contained few teens who were working or seeking employment. Validation and refinement of this composite score should be addressed in future research with teens who are involved with paid work.

This study’s demonstration of SR’s moderate to high internal consistency and convergent validity relative to the CA T-ASI, as well as its very similar correlation pattern with PESQ, PEI, and POSIT domains may reflect the study population. The study sampled adolescent inpatients in a highly structured residential setting, so it is not known whether the SR format would work as well in a less structured outpatient environment. Also, the use of a single interviewer for the CA T-ASI is a limitation. Future research is planned with multiple clinician interviewers. In addition, because no 12- and 13-year olds were admitted into the clinical site, no participants in this age group could be recruited into the study. Caution should therefore be exercised in generalizing the results of this study to 12- and 13-year-old youth. Finally, participants received compensation to participate, so it remains to be seen if the SR instruments would perform similarly with unpaid respondents. Previous work with mental health patients suggests that unpaid

participants do respond well to IVR technology (Brodey et al., 2004).

In conclusion, this study validated the conversion of the T-ASI into an SR format and the adaptation of the SR format into automated Net and IVR survey technologies. This development marks an improvement in the mechanism for delivering the T-ASI survey widely, reliably, and cost-effectively. In addition, the availability of the Net and IVR SR technologies may open the door to using the T-ASI more widely in longitudinal outcomes-tracking. One of the challenges in tracking patient outcomes is obtaining data on patients who are no longer in treatment. Both Net and IVR technology are well-suited for reaching substance abuse patients remotely when they may be out of clinical care. The T-ASI SR Net and T-ASI SR IVR could therefore be used to track patient progress or relapse over time, providing an invaluable tool for clinical monitoring of patient status and treatment effectiveness. This research sets the stage for a larger study of an outcomes tracking system using the T-ASI SR to gather outcomes data from adolescent substance abuse clinics across North America. Such a system may facilitate identification of effective treatment modalities and the matching of adolescent patients with the most effective treatment modality suitable for their needs.

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