

Regular Article

Validation of the Addiction Severity Index (ASI) for internet and automated telephone self-report administration

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Abstract

This study assesses the convergent validity of Internet (Net) and interactive voice response (IVR) automated telephone self-report versions of the Addiction Severity Index (ASI) relative to the established, clinician-administered (CA) ASI. Eighty-eight subjects were recruited from an addiction treatment program to complete three ASI assessments. The mean correlation between composite scores obtained by Net and IVR and those obtained via clinician interview was .91 (range .81–.95). For History items, the mean correlation was .77 (range .14–1.00) and the mean kappa coefficient was .75 (range .46–1.00). The results demonstrated the validity of these self-report Net and IVR versions of the ASI. Self-report Net and IVR were rated as “very satisfactory” or “extremely satisfactory” by a majority of respondents for ease of use. Automation can reduce the labor costs associated with ASI administration and may facilitate longitudinal tracking of subjects from home. © 2004 Elsevier Inc. All rights reserved.

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1. Introduction

The standard Addiction Severity Index (ASI) is a clinician-administered interview that measures a range of problem areas associated with alcohol and drug abuse. Composed of seven domains (Medical Status, Employment Status, Drug Use, Alcohol Use, Legal Status, Family/Social Relationships, and Psychiatric Status), the ASI is a well-established adult substance abuse assessment (McLellan et al., 1985, 1992). The Veterans Administration, many judicial systems, and several states mandate its use, resulting in an estimated 1–3 million ASI interviews per year (Budman, 2000).

Despite its established status, the clinician-administered ASI (CA ASI) possesses some disadvantages. First, the ASI is expensive to administer, especially for underfunded substance abuse agencies. We estimate that the typical CA ASI costs \$30–40 per administration, since it takes 30–60 min for the clinician interview itself and another 10–20 min for scoring. This valuable time could otherwise be devoted to clinical treatment or other duties. Second, the CA ASI requires extensive training to administer properly, creating the potential for inter-rater bias (Butler et al., 2001). Unfortunately, many clinics do not follow the recommendation for a 2-day training period and refresher courses, and many agencies have a high clinician turnover rate, making continuous training problematic and costly. Third, the factors mentioned above make “real-world” research difficult, because of low inter-rater reliability at many clinics and the high cost of multiple administrations to track patient progress over time.

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These problems with the CA ASI have compelled several researchers to pursue self-report versions of the ASI, in order to reduce both the costs and time needed for implementation (Block, Mather, & Hallett, 1997; McLellan et al., 1985; Rosen, Henson, Finney, & Moos, 2000). Paper-and-pencil self-report versions of the ASI substantially reduce clinician labor costs. Furthermore, CD-ROM computer versions have been designed to operate on a single PC and feature video interaction and automated scoring (Butler et al., 2001). These self-report mechanisms save time in administration and scoring, may increase patient substance use reporting by providing a greater sense of anonymity than CA, and eliminate problems with inter-rater reliability among untrained staff. However, these technologies still lack the ability to upload data from multiple sites quickly into a searchable database, as well as the ability to provide convenient followup administration from home or low-tech clinical sites.

As McLellan has argued in a recent editorial, research techniques that have proved successful in the lab need to be further refined to make their use effective in everyday clinical practice (McLellan, 2002). Interactive voice response (IVR) automated telephone technology and automated Internet (Net) technology offer the dual potential of harnessing the gains achieved in these previous self-report formats and of connecting them to a central database to provide nearly universal access from clinics or patients' homes. First, both Net and IVR technologies offer the low cost, fast scoring, and unbiased rating available with computer surveys. Second, wide access to telephone and the Internet make these technologies ideal for reaching wide audiences, inside or outside a clinical setting. In 2002, 95.5% of all U.S. households and 89.1% of low income families had access to a touch-tone telephone at home (U.S. Census, 2003), while, for the Internet, some 51% of U.S. households possessed a computer in 2000, and 42% of U.S. households used the Internet at home (Newburger, 2001). Third, instantaneous communication makes for timely reports. Clinicians and patients can have access to ASI scores within minutes of completing the self-report survey. Fourth, the use of a centralized database via telephone and internet technologies makes assembling large databases of patient responses feasible. Finally, IVR technology is well-suited for populations with low literacy who would otherwise have immense difficulties taking self-report surveys.

The central focus of this study was to adapt the ASI into self-report Net (SR ASI Net) and self-report IVR (SR ASI IVR) formats and to validate them for convergent validity, repeated ANOVA mean differences, as well as lifetime and continuous correlation. The study also sought to determine the level of a user satisfaction. If validation and user acceptability can be achieved using automated, self-report Net and IVR technologies, the ASI may prove to be a quick, cost-effective, unbiased assessment strategy, opening the possibility for large-scale intake assessments and followup longitudinal tracking. This, in turn, could open

new opportunities for identifying effective, “real-world” treatment strategies and matching those techniques with the individual patients who stand to most benefit from them.

2. Methods

2.1. Sample

The study recruited 88 subjects from a large private, non-profit, general hospital with an inpatient detoxification unit and an outpatient substance abuse clinic in the northwestern United States. Sequential inpatients (ASAM Treatment Level IV) and intensive outpatients (ASAM Treatment Level II) were recruited if they were (1) 18 years of age or older, (2) not pregnant, (3) not suicidal, and (4) were willing to provide informed consent. Subjects were tested for cognitive ability using the Mini-Mental Status Exam (Folstein, Folstein, & McHugh, 1975; Teng & Chui, 1987) at beginning and end of the study and for English-language reading ability (Bader, 2002) at the beginning of the study. Subjects were compensated for starting each portion of the survey sequence, although they did not need to complete individual surveys or the full administration sequence to receive payment.

2.2. Survey development

The study modified the self-report ASIs of Cacciola et al. (1998) and Rosen, Henson, Finney, and Moos (2000), which used 85–90% of the original ASI items and reorganized them into (a) a lifetime “History” section and (b) a “Current” section that concerned only the past 30 days and was sensitive to change. These latter “current status” items are reflected in ASI composite scores for current alcohol, drug, medical, psychiatric, family, legal, and employment status. The study adapted Cacciola's and Rosen's instruments into Net and IVR versions of the ASI. Because the History section is lengthy and would typically be administered only at intake, the study confined itself to developing the History section into a Net version only. The study developed both Net and IVR versions of the Current section to enable collection of followup outcomes data by either Internet or telephone. In addition, the study developed a Net version of the full CA ASI in order to facilitate data gathering and scoring using the clinician interview. This CA ASI Net was identical to the standard ASI, except that instead of writing patient responses on paper, clinicians entered them by clicking on responses or keying numbers using a computer with a mouse.

Although the ASI itself has always been in the public domain, both the Net and IVR software programs tested in this study are proprietary.¹ Software testing was

¹ Software may be obtained by emailing info@telesage.com.

accomplished using established test plans, and sample ASI score calculations were independently verified to assure that identical results would be obtained. Study data was stored in a SQL database (and can be stored in any standard database). Reports were not available for this study, but are presently available. While not used in this study, a web portal that enables clinic registration, intake, and followup assessments through the Internet and/or IVR technologies, and intake and followup clinician and client feedback is presently functioning in a multi-site, multi-state research project on substance abuse outcomes tracking, and the Net survey will be made available shortly for general use, free of charge.

2.3. Procedure

In order to compare the responses of the SR ASI IVR and SR ASI Net with the clinician-administered ASI, we recruited patients to take three administrations of the ASI during three sessions over a 7-day time span. The study rotated the order of administration in a four-cell design, in which subjects alternated between taking the clinician-administered ASI (History and Current), the SR ASI Net (History and Current), and the SR ASI IVR (Current only). The interval between administrations was 24–72 h, with a mean separation of 1.37 days between T1 and T2 and 1.89 days between T2 and T3. Assessments at T2 and T3 took place 24–48 h after the previous administration. The mean separation of CA-IVR was 1.96 days. The mean separation of CA-Net was 1.98 days. In addition, subjects completed a one-page written satisfaction survey at the end of the study. Subjects were asked for each of the three modes of administration: “How easy is 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 clinician-administered ASI interviews were conducted by a single Chemical Dependency Mental Health Professional with a Master’s degree in Psychology and many years’ experience working in the field of substance abuse treatment. The interviewer participated in a 2-day training session, read the training manual for the ASI, viewed videotapes on the ASI, performed mock assessments, and reviewed any questions with the principal investigator and two of the authors in two question-and-answer sessions.

2.4. Data analysis

Several analyses compared ASI composite scores (summary scores for current status items sensitive to change) obtained by Net and IVR to corresponding composite scores obtained by clinician interview.

First, convergent validity of the self-report measures with clinical interview was assessed by examining the correlations of SR ASI Net and SR ASI IVR composite scores

with corresponding CA ASI Net composite scores. We also used Cronbach’s alpha to examine internal consistency of ASI composite subscales in the CA, SR-Net, and SR-IVR formats. Second, mean differences in ASI composite scores obtained by CA, SR Net and SR IVR formats were assessed using repeated measures ANOVA with planned contrasts comparing both SR formats to CA. We also used repeated measures ANOVA to test whether differences in the order of survey administration contributed to any observed differences in mean scores across formats.

Third, because there are no overall summary scores for lifetime History items (other than interviewer-based severity ratings, which involve clinical judgment), we examined the correspondence between CA ASI and SR ASI Net formats for each lifetime History item. Correspondence across formats was assessed by computing the mean correlation (for continuous items) and mean kappa (for dichotomous items) obtained across the two formats. We also calculated the proportion of continuous items that correlated .50 or higher and the proportion of dichotomous items with kappa coefficients of .40 or higher, as Cacciola, McLellan, Alterman, Mulvaney, and Gairkh (1999) reported that 70% of ASI lifetime items met these convergence criteria when comparing responses to paper-and-pencil with CA administrations of the ASI. Mean differences in continuous item responses between the CA and Net formats were assessed using paired *t*-tests. Fourth, inpatient and outpatient subgroups were compared for correlation and mean difference to detect difference in formats for both sub-samples. Last, user satisfaction ratings for ease of use, liking, likelihood to use from home, and reported sincerity for the three different formats were compared using repeated measures ANOVA, with planned contrasts comparing both the self-report Net and self-report IVR to the clinical interview.

3. Results

3.1. Study retention and demographics

Seventy-four of the 88 subjects (84%) completed all three administrations (18 inpatients, 56 outpatients); eight (9%) completed only two sessions (4 inpatients, 4 outpatients); and six (7%) completed only one session (4 inpatients, 2 outpatients). Six of the subjects who did not complete all rounds of interviews dropped out from the study due to discharge. Two subjects experienced computer failures on their test dates. The other six decided not to complete their survey administrations for personal reasons. Eighty-four patients completed the CA ASI, 81 completed the SR ASI Net, and 78 completed the SR ASI IVR. Within each administration, subjects had a 89–90% completion rate (no questions missed) for the SR ASI Net and SR ASI IVR.

Demographically, the subject sample was 41% female and 70% outpatient. The average age of participants was 44

(13% age 60 or over); 12% of subjects were retired or disabled; and 20% received pensions, disability benefits, or Social Security. In terms of race, 88% identified themselves as White, 5% as American Indian/Alaska Native, 4% as African American, 1% as Asian, and 2% did not report race. Ethnically, 3% said they were Hispanic or Latino, and 1% did not report an ethnicity. All subjects tested were determined to possess an English-language reading ability at the fifth grade level or higher. No subjects were disqualified from participation due to their Mini-Mental Status Exam scores, though nine did demonstrate borderline scores (range 22–25, median 24) but completed the survey sequence with composite scores (SR Net=0.85; SR IVR=0.91).

3.2. Convergent validity of composite scores with clinical interview

As shown in Table 1, ASI composite scores obtained by clinical interview were very highly correlated with composite scores obtained by SR ASI Net (mean $r = .90$, range = .81 to .95) and by SR ASI IVR (mean $r = .91$, range = .82 to .95). There were no significant differences between the Net and IVR formats in their correlations with clinical interview for six of the seven ASI composites scores. The exception was the Legal composite, where the correlation with interview was higher for the SR ASI IVR format ($r = .95$) than for the SR ASI Net format ($r = .88$; Cohen's $q = .46$, $p < .05$).

Internal consistency of the ASI composite scales was comparable across all three formats. Cronbach's alphas obtained by SR ASI Net (mean = .81, range = .66 to .94) and SR ASI IVR (mean = .81, range = .66 to .87) were comparable to those obtained by CA ASI (mean = .84, range = .70 to .94).

Table 1
Correlation of ASI Composite Scores By Self-Report via Net and IVR with Scores from Clinician-Administered ASI

Problem domain	Correlation with CA ASI Net	
	SR Net	SR IVR
Alcohol	.93** (.46–.94)	.91** (.03–.93)
Drugs	.94** (–.02–1.00)	.94** (–.02–1.00)
Medical	.81** (.54–.74)	.82** (.63–.71)
Psychiatric	.91** (.59–.86)	.93** (.48–1.00)
Family	.91** (.69–.80)	.87** (.68–.73)
Legal	.88** (.44–1.00)	.95** (.63–1.00)
Employment	.95** (.79–1.00)	.94** (.76–1.00)

Note: Numbers outside parentheses are correlations of composite summary scores across formats; numbers in parentheses are range of correlations across formats of individual items used to calculate composite scores.

CA = Clinician-Administered Addiction Severity Index.

SR Net = Self-Report Addiction Severity Index via Automated Internet.

SR IVR = Self-Report Addiction Severity Index via Interactive Voice Response Telephone.

** Correlation significantly greater than zero, $p < 0.001$.

3.3. Mean differences in composite scores across formats

We found a significant difference in mean scores across formats for only one of the seven composite scores. As shown in Table 2, Drug composite scores obtained by SR ASI IVR were significantly ($p < 0.01$) higher than those obtained by CA ASI. ANOVAs for differences in mean scores approached significance ($p < 0.10$) for two other composites: Medical composite scores obtained by SR ASI Net were somewhat higher than those obtained by CA ASI ($p < 0.05$), whereas Legal composite scores were slightly higher in the SR ASI IVR administration than in the CA ASI format ($p < 0.01$).

To determine whether order effects might contribute to the observed differences across formats, additional post-hoc repeated measure ANOVAs were conducted for the Drug, Medical, and Legal composites, adding the order of rotation as a between-subjects variable. No significant order effect was detected, which suggests that order of presentation did not influence differences in response across ASI formats.

3.4. Convergent validity of lifetime history obtained by CA ASI Net and SR ASI Net

The convergent validity of lifetime history items not included in the ASI composites was assessed by comparing responses to the clinician-administered and self-report Net formats. (These items were not administered by IVR, as IVR was intended for use in collecting followup data on treatment outcomes, not intake information.)

For the 40 continuous variables, the mean correlation between responses obtained by CA ASI Net and SR ASI Net was .77 (range = .14 to 1.00). For the 29 categorical variables, the mean kappa coefficient across SR-Net and CA formats was 0.75 (range = .46 to 1.00), and mean percentage agreement was 88% (range = 75% to 100%). Over half (55%) of the lifetime history items showed excellent convergent validity ($r > .80$ or $\text{kappa} > .75$), 28% showed good convergent validity (r between .60 and .80 or kappa between .60 and .75), and 17% showed only moderate convergent validity across formats ($r < .60$ or $\text{kappa} < .60$).

The items showing only moderate convergence across formats included: number of driving violation arrests, number of assault arrests, number of months last incarcerated, number of delirium tremens (DT) episodes, number of drug overdoses, years of sedative use, number of years in current living arrangement, satisfaction with current living arrangement, whether ever had hallucinations, whether ever had trouble understanding or concentrating, whether ever had serious conflicts with friends, whether ever had serious conflicts with spouse, and whether ever had serious conflicts with family other than parents, siblings, or spouse. Correlations may be reduced as a result of a restriction effect due to homogeneity within the sample (a lack of variability in an item or the inclusion of a very large number of zeros). If

Table 2
Mean Differences in ASI Composite Scores by Self-Report Questionnaire and IVR Compared to Clinician Administered ASI

Problem domain	Mean composite scores			Mean difference from CA (5 th percentile, 95 th percentile) [#]		Repeated measures ANOVA	
	CA	SR Net	SR IVR	SR Net	SR IVR	F	p
Alcohol	.22	.21	.23	-.01 (-.11,+10)	+.01 (-.14,+19)	0.8	.47
Drugs	.03	.03	.04**	-.00 (-.06,+00)	+.01 (+.00,+09)	8.7	.001
Medical	.19	.22*	.18	+.03 (-.16,+33)	-.01 (-.34,+26)	2.6	.08
Psychiatric	.19	.20	.19	+.01 (-.17,+16)	-.00 (-.11,+17)	0.7	.52
Family	.13	.13	.14	-.00 (-.20,+13)	+.01 (-.15,+25)	0.8	.44
Legal	.05	.06	.07**	+.01 (+.00,+24)	+.02 (+.00,+17)	2.7	.08
Employment	.43	.42	.42	-.01 (-.07,+08)	-.01 (-.21,+06)	1.3	.26

CA = Clinician-Administered Addiction Severity Index.

SR Net = Self-Report Addiction Severity Index via Automated Internet.

SR IVR = Self-Report Addiction Severity Index via Interactive Voice Response Telephone.

* Planned contrast indicates $p < 0.05$ difference from mean score on CA ASI.

** Planned contrast indicates $p < 0.01$ difference from mean score on CA ASI.

[#] Figures in parentheses indicate the range of discrepancies between CA and SR scores. To remove extreme outliers, range is reported for 90% of subjects, from the 5th percentile (SR score less than CA score) to the 95th percentile (SR score greater than CA score).

present, this effect would tend to decrease correlations but would not alter actual agreement levels.

Paired *t*-tests comparing responses to continuous lifetime history items in the CA ASI and SR ASI Net formats showed significant ($p < 0.05$) mean differences for 10 of 49 continuous variables. On eight of those items, patients reported more severe problems in the clinical interview than in the Net survey: driving violation arrests, DWI arrests, years of cannabis use, years of cocaine use, years of drinking to intoxication, number of time treated for alcohol, number of times treated as a psychiatric outpatient, and (fewer) years in present living arrangement. Conversely, patients reported more overdoses and DTs in the Net survey than in the clinical interview.

3.5. Criterion validity with both inpatients and outpatients

To test whether criterion validity across ASI formats might be lower for inpatients ($n = 26$) than for outpatients ($n = 62$), we compared, in each sub-sample, the correlation coefficients and mean differences between formats obtained in both sub-samples. Correlations between the CA ASI and SR ASI IVR composite scores were similar for both inpatients (mean $r = .87$, range = .73 to 0.96) and outpatients (mean $r = .84$, range = .52 to .95). Correlations between the CA ASI and SR ASI Net formats were lower

among inpatients (mean $r = .85$, range = .66 to .94) than outpatients (mean $r = .93$, range = .88 to .999), yet still quite good.

3.6. Subject satisfaction

Overall, clinician interview received significantly higher ratings for ease of use, liking, and anticipated honesty than did the SR ASI Net and SR ASI IVR administrations (see Table 3). The CA ASI received higher mean scores for all three questions, while the self-report Net rated a close second, and the self-report IVR came in third. Similarly, the percentage of users rating the technologies “very satisfactory” (4) or “extremely satisfactory” (5) demonstrated the same order of placement. All of these findings were statistically significant. Of particular note, the perception of greater honesty with clinician interview came despite the fact that patients in actuality reported higher level of drug use via the self-report Net and IVR than with the clinician interview.

3.7. Survey duration

The CA ASI interviews lasted approximately 45 min. This included the time it took clinicians to enter the responses using a PC during the interview. Reports depicting

Table 3
Comparison of User Satisfaction Among Technologies

Instrument questions: ($N = 80$)	Mean Score (1–5)			Significant Differences ($p < 0.05$)	% Rating 4 or 5		
	CA	SR Net	SR IVR		CA	SR Net	SR IVR
How easy to use?	4.63	4.18	3.47	CA > Net > IVR	96%	83%	58%
How much liked?	4.34	3.96	2.57	CA > Net > IVR	85%	79%	21%
How likely to respond honestly?	4.47	4.17	3.86	CA > Net > IVR	95%	80%	70%

CA = Clinician-Administered Addiction Severity Index.

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the scored results of the ASI interviews were available as soon as the assessments were complete. SR ASI Net assessments were of similar length. The current section lasted approximately 20 min. The SR ASI IVR current section was 15 min in duration (range=8–23 min). IVR surveys were approximately 25% shorter in duration than CA or Net surveys.

4. Discussion

The self-report Net and IVR formats of the ASI appear to represent valid and reliable alternatives to the clinician-administered version of the ASI in a sample of volunteer inpatient and outpatient general substance-dependent adults. The mean correlation between composite scores obtained using automated administrations and those obtained from the standard ASI interview was .91, indicating excellent convergent validity. This correlation of composite scores across formats is similar to the 3-day test-retest reliability of the standard, clinician-administered ASI (McLellan et al., 1985).

Second, the correspondence of lifetime history items (mean $r=.77$, mean kappa=.75) was also good and compares favorably with results reported by Cacciola, McLellan, et al. (1999) for self-report administration of the ASI. Using criteria similar to those proposed by Cicchetti, Showalter, and Rosenheck (1997), correspondence across formats was “excellent” (56%) or “good” (24%) for 80% of the lifetime history items.

Third, use of automated IVR and Net technologies is not likely to result in under-reporting of problems related to substance use. The study’s use of Net and IVR self-report ASIs reinforces existing research finding that self-report surveys tend to increase reporting of substance use, most likely because subjects feel less judged than when conveying their substance use to a person (Babor, Stephens, & Marlatt, 1987; Darke, 1998; Midanik, 1988; Piette, 2000; Cunningham, Humphreys, & Koski, 2000).

Fourth, completion rates were very high. It appears that the subjects had no difficulty with using the technology, even for the relatively long initial SR ASI Net, lasting approximately 45 min. The 89–90% completion rate (no questions missed) is encouraging, especially considering that subjects did not need to complete the instrument in order to receive payment.

As anticipated, subjects preferred face-to-face interviews with clinicians in most if not all categories, particularly ease of use. Based on written comments by some subjects on the satisfaction sheet, many of the negative comments about IVR were aspects that could be improved. Users commented on the voice of the IVR system, the need for even more branching to avoid redundant questions, and the need for reminders for answer options. Despite the fact that the IVR system was not as popular as the Net software, it was still acceptable. This is important, as telephone may be the best

technology for achieving nearly universal access for longitudinal followup reporting, particularly from home.

For likelihood to answer honestly, the question related to subjects’ own anticipated sincerity, rather than actual sincerity. It was somewhat surprising that clients anticipated reporting more sincerity to clinicians than to the self-report Net and IVR. These results may be distorted by a “halo effect” of higher overall liking for clinical interview. As noted above, we found no evidence of underreporting of SR Net or SR IVR relative to clinician interview. In fact, subjects using SR Net and SR IVR reported higher levels of drug use than subjects receiving live interviews.

Finally, this study not only replicated other research demonstrating good convergent validity for self-report versions of the ASI, but we actually obtained significantly greater correlations between interview and self-report composite scores ($r=.91$) than the mean correlation reported in prior self-report research (mean $r=.74$; Butler et al., 2001; Cacciola et al., 1998, Rosen et al., 2000). This may partly be due to greater reliability in the CA ASI, as some prior studies (e.g. Rosen et al., 2000) used multiple clinicians who had not been extensively trained on the ASI. It may also reflect advantages of Net and IVR over paper-and-pencil questionnaires.

Our relatively high convergent validity relative to other studies may also reflect our study population. It is possible that patients in a private hospital treating both public-sector and privately insured patients may tend to be better educated and less cognitively impaired than patients in hospitals that were included in some previous studies (Cacciola, Koppenhaver, McKay, & Alterman, 1999; Rosen et al., 2000). This may contribute to more reliable reporting by our study subjects. Also, having more than one interviewer would have been preferable, but this was not possible within the context of the study. This is a limitation of our study; however, this limitation is mitigated by the highly structured nature of the ASI.

In conclusion, this study provides evidence supporting the validity of the self-report Net and self-report IVR survey formats. This development marks an improvement in the mechanism for administering the ASI widely, reliably, and cost-effectively. In addition, the availability of Net and IVR self-report technologies may open the door to using the ASI much more widely in longitudinal outcomes tracking. Both Net and IVR technology are ideal for reaching substance abuse patients remotely when they may be out of clinical care. The self-report ASI Net and self-report ASI 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. This research sets the stage for a national outcomes tracking database using the ASI to gather outcomes data from clinics across North America. Such a database may facilitate identification of effective treatment modalities and the matching of patients with the most effective treatment modality suitable for their needs.

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