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Quick Screen to Detect Current Substance Use Disorder in Adolescents and the Likelihood of Future Disorder*

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Abstract

AIMS—A brief screen requiring 3–4 minutes administration time was developed to detect adolescents qualifying for current substance use disorder (SUD) and those who will subsequently manifest SUD by early adulthood.

METHODS—The revised Drug Use Screening Inventory (DUSI-R; Tarter, 1990) was administered to 329 boys on three occasions (ages 12–14, 15–17 and 18–19 years of age). Principal components analysis yielded a core set of items to form three age-specific versions of the DUSI-R Quick Screen (DQS), consisting of the *Substance Involvement Index* and *Problems Severity Index*

RESULTS—Construct, concurrent and predictive validity of the DQS were in the good to excellent range. Sensitivity of the DQS at ages 12–14, 15–17 and 18–19 for detecting current SUD was 100%, 93% and 93%. The DQS at these ages predicted SUD by age 22 with 73%, 77% and 83% accuracy. Replication in another sample revealed sensitivity of 71% and 75% in 15–17 and 18–20 year old males.

CONCLUSIONS—The true positive rate of detecting current and future SUD suggests that the DQS is an efficient screen for identifying youths requiring treatment or secondary prevention.

Keywords

(3–6) Assessment; drug abuse; adolescence; addiction; substance use disorder; Drug Use Screening Inventory; Drug Use Screening Inventory-Revised; DUSI

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1. INTRODUCTION

Risk for developing substance use disorder (SUD) largely subsides by the third postnatal decade. Accordingly, it is sufficient that screening instruments designed to detect SUD in adults accurately distinguish affected from non-affected individuals. Youths, however, have not yet passed through the main period of risk. Accordingly, screening instruments should not only detect the presence of current SUD but also identify youths whose substance use is prodromal to later SUD. By satisfying these two criteria, SUD screening parallels biochemical (e.g., cholesterol) and physiological (e.g., blood pressure) screening to inform the presence of current medical disease as well as the likelihood of developing a disorder in the future. Devising an SUD screen for youths having predictive validity is, however, challenged by the relatively small portion of substance users who subsequently develop SUD. For example, lifetime consumption prevalence of alcohol and illegal drugs is 51.5% and 34.7% among high school seniors (Johnston, 2012) whereas lifetime prevalence of any SUD is only 14.6% (Kessler et al., 2005).

An SUD screen for youths having both concurrent and predictive validity must foremost take into account the characteristics of the prodrome, namely substance use behavior. Notably, the different abusable substances are facets of a unidimensional trait (Derringer et al., 2010; Kirisci et al., 2002). It is also noteworthy that age at the time of first substance consumption covaries negatively with risk for developing SUD (Breslau et al., 1993; Clark et al., 2006; Grant and Dawson, 1997; Hingson et al., 2006). Moreover, pattern of use (quantity, frequency, context, etc.) changes markedly during adolescence. Hence, a screening tool for adolescents must be tailored to chronological age and related pattern of substance consumption taking into account the spectrum of abusable compounds.

In addition, age at the time of alcohol use onset mediates the association between transmissible risk in childhood and cannabis use disorder in adulthood, and age at the time of cannabis use onset mediates the association between transmissible risk in childhood and alcohol use disorder (Kirisci et al., 2012). These findings underscore the importance of taking into account chronological age in relation to liability that is congenious to all SUD categories in conjunction with severity of substance use. Significantly, 100% and 80% of the genetic and phenotypic portions of liability are congenious to all SUD categories (Tsuang et al., 1998) and the psychological characteristics associated with transmissible (intergenerational) risk for SUD in children and adolescents constitute a unidimensional trait, termed the transmissible liability index, in which 85% of variance is genetic (Vanyukov et al., 2009). The score on this trait predicts all DSM-IV categories of SUD in adults (Ridenour et al., 2011) and SUD outcome between childhood and adulthood (Kirisci et al., 2009). To date, SUD screens for adolescents have not been developed which incorporate both the prodrome (substance use) and predisposing liability.

Based on findings demonstrating that the Drug Use Screening Inventory (DUSI-R) summary score predicts SUD (Kirisci et al., 1995, 2007; Tarter, 1990), it was theorized that select items from this self-report accurately measures the liability for SUD and psychosocial correlates of current substance abuse. Accordingly, commensurate with the ontogenetic perspective of SUD etiology (Tarter et al., 1999), this study developed early, middle and late versions of the DUSI-R Quick Screen (DQS) for boys, consisting of a *Substance Involvement Index* and a *Problems Severity Index* for detecting current SUD and estimating the likelihood of future SUD. It was hypothesized that the DQS, requiring 3–4 minutes to self-administer, has both concurrent and predictive validity.

2. METHODS

2.1 Subjects

Boys between 10–12 years of age were recruited under aegis of the Center for Education and Drug Abuse Research (CEDAR). They were ascertained through their biological fathers who qualified either for lifetime SUD consequent to using an illegal drug ($N = 181$) or had no adult psychiatric disorder ($N=148$). Advertisement and random telephone calls were the main methods of identifying the proband fathers; however, approximately 25% of the SUD+ men were accrued from treatment facilities. In addition to the baseline evaluation, their sons were required to have completed four assessments scheduled at 12–14, 15–17, 18–19 and 22 years of age. To be admitted into this study the boys were also required to have a full scale IQ of 80 or higher and good health determined by physical examination and interview of the mother. Exclusionary variables included physical signs of teratogenic injury (substantiated by the mother's report of alcohol and/or drug use during the pregnancy), neurological injury requiring hospitalization, neurodevelopmental disability, and psychosis. As can be seen in Table 1, the sample is middle class and has average intelligence. Grade in school is commensurate with chronological age. In addition, the rate of childhood psychiatric disorders in this sample is similar to the general population.

2.2 Replication Sample

Generalizability of the results obtained on the CEDAR sample was explored by accessing data obtained from 153 15–17 year old and 178 18–20 year old male clients receiving outpatient treatment at Weber Human Services in Ogden Utah. Clinical evaluation revealed that 97 and 95 of the clients respectively qualified for SUD diagnosis. Most of the sample was referred for treatment by the court (85%) and two school districts (10%). The main intervention modality was family therapy, which lasted more than six months for the majority of the clients. This sample was selected for study because they all received the DUSI-R during their intake evaluation; hence, the DQS could be derived and submitted to cross-validation analysis.

2.3 Instrumentation

2.3.1 Drug Use Screening Inventory-Revised (DUSI-R; Tarter, 1990)—The DUSI-R was self-administered when the boys attained ages 12–14, 15–17 and 18–19. Classical and item response theory methods have previously documented the DUSI-R's reliability and validity (Kirisci et al., 1994, 1995; Kirisci and Tarter, 2001; Tarter et al., 1994; Tarter and Kirisci, 2001). In addition, investigations conducted on the DUSI-R has yielded research scales to delineate the etiological trajectories to SUD between childhood and young adulthood (Tarter et al., 2007) as well as clinical scales to forecast violence (Tarter et al., 2002) and several of the most common psychiatric disorders that precede or co-occur with SUD (Kirisci et al., 2007). The 149 items were accessed, therefore, to derive the *DUSI-R Quick Screen (DQS)* consisting of the *Substance Involvement Index* and *Problems Severity Index*.

2.3.2 Substance Involvement Index—Past month frequency of alcohol consumption is an accurate method of estimating the presence of alcohol use disorder in youths (Chung et al., 2012; Clark et al., 2006). This parameter of consumption topology also has the highest heritability (Dick et al., 2011). Accordingly, overall frequency of past month consumption of the most commonly ingested substances was used to derive the *Substance Involvement Index*.

The boys endorsed one of five options (0, 1–2, 3–9, 10–20, more than 20 times) to the question “How many times have you used each of the drugs in the past month?”. The list

included alcohol, amphetamines, LSD (and other hallucinogens), ecstasy, PCP, marijuana, glue, gasoline, smoke tobacco, chew tobacco, anabolic steroids, cocaine and crack, over-the-counter diet pills, heroin (and other opiates), methadone, and non-medical use of analgesics, barbiturates, and other prescription medications. Principal components analysis conducted on the responses yielded factors accounting for 22%, 26% and 25% of variance at respectively 12–14, 15–17 and 18–19 years of age. Table 2 presents the factors and their loadings. The factor scores were transformed to a T-scale ($M=50$, $SD = 10$) so that change over time and magnitude of difference between the individual's score and mean score of the cohort are readily determined.

2.3.3 Problems Severity Index—The boys answered “yes” or “no” to 149 questions denoting problems pertaining to substance use, mental health, physical health, behavior, family functioning, work, school, social skills, peer interactions, and leisure/recreation. The items comprising the *DUSI-R* can be found in Tarter (1990). Principal components analysis conducted on the responses when the boys were 12–14, 15–17, and 18–19 years of age revealed factors accounting for 33%, 38%, and 39% of variance. The ten problems having the highest loading on the factor, shown in Table 3, comprised the *Problems Severity Index*. Next, the factor scores were normalized to a T-scale to enable direct comparison of the individual's scores on the *Problems Severity Index* and the *Substance Involvement Index* using the same metric. In addition, normalizing the factor scores allowed quantifying the individual's severity of problems relative to their cohort during adolescent development.

The Substance Involvement Index and Problems Severity Index correlate .77, .34, and .48 at ages 12–14, 15–17, and 18–19. Whereas these correlations are significant ($p<.0001$), the large portion of non-overlapping variance indicates that each index contributes substantial unique information pertinent to detecting current SUD and for predicting future SUD.

2.3.4 Kiddie-Schedule for Affective Disorders and Schizophrenia (K-SADS; Orvaschel et al., 1982)—Trained master-level clinical associates administered the K-SADS to the boys when they attained 12–14 and 15–17 years of age. A committee consisting of two psychiatrists and the clinical associates who performed the interviews formulated current and lifetime diagnoses according to DSM-IV criteria. The outcome variable was any type of SUD (abuse or dependence) except nicotine dependence. Because nicotine does not have a diagnostic category of abuse, and consumption does not usually lead to psychosocial problems or interpersonal conflicts, it was not included in this study.

2.3.5 Structured Clinical Interview for Diagnosis (SCID; Spitzer et al., 1987)—The SCID was administered to the boys when they reached 18 years of age and repeated again at age 22. The procedure described above was also utilized to formulate SUD diagnoses at these follow-ups. The SUD rate in the sample was 0.8%, 6.3%, 24.2%, and 27.1% at ages 12–14, 15–17, 18–19, and 22. The most frequent SUDs at 22 years of age pertained to use of alcohol (28%), cannabis (26.9%), cocaine (4.6%), opioids (4%), and amphetamines (2.9%).

2.3.6 Drug Use Chart (CEDAR)—This self-report contains a list of 40 abusable substances. The number of different compounds consumed at least one time was tabulated. Concurrent validity of the *Substance Involvement Index* was evaluated by correlating this score with number of different substances used in lifetime.

2.3.7 Child Behavior Checklist (CBCL; Achenbach and Edelbrock, 1983), Youth Self-Report (YSR; Achenbach, 1991) and Young Adult Self-Report (YASR; Achenbach, 1997)—Externalizing behavior is the most ubiquitous

psychological disturbance preceding and co-occurring with substance use. The CBCL was completed by the mothers when their sons were 12–14 years of age. Subsequently, the boys self-administered the YSR and YASR. Concurrent validity of the *Problems Severity Index* was determined by correlating this score with the externalizing scale score.

2.4 Procedure

Parents provided informed consent until the participants attained 18 years of age. Subsequently, informed consent was obtained directly from the participants. Breath alcohol testing and a urine drug screen were performed at the outset of each session to ensure that the data were not biased by substance-induced altered physiological state. None of the participants tested positive. Upon concluding the session, the questionnaires were reviewed by a research assistant to ensure completeness. In addition, the score obtained on the DUSI-R's Validity Scale was inspected. None of the participants scored above the threshold implicating deceptive reporting. Prior to discharge from the laboratory the boys were debriefed and remunerated at the rate of \$10/hr.

2.5 Data Analysis

The questionnaires were scored by optical scanning and the data were automatically entered into the Oracle database. Unidimensionality of the *Substance Involvement Index* and *Problems Severity Index* was documented using confirmatory factor analysis. Concurrent validity was assessed using several procedures. The t-test for independent samples compared sons of SUD+ fathers and sons of SUD- fathers on the indexes, Product moment correlations documented the association between the *Substance Involvement Index* and number of different drugs tried in lifetime and the association between the *Problems Severity Index* and externalizing scale score. Logistic regression determined the odds ratio of each DQS index for classifying presence/absence of current SUD followed by receiver operating characteristic (ROC) curve analysis to quantify sensitivity, specificity and overall classification accuracy. Logistic regression and ROC analyses were also performed to evaluate the DQS's accuracy for predicting SUD in the future. All analyses were conducted using SAS software.

3. RESULTS

3.1 CEDAR Sample

3.1.1 Construct Validity—Confirmatory factor analysis revealed that the *Substance Involvement Index* and the *Problems Severity Index* are unidimensional constructs. The model data fit indices, shown in Table 4, are all in the excellent range.

3.1.2 Concurrent Validity—As shown in Table 5, sons of SUD+ fathers score significantly higher on the *Substance Involvement Index* measured at ages 12–14 and 18–19 but not at 15–17 years of age. The *Problems Severity Index* is higher in sons of SUD+ parents at ages 15–17 and 18–19 with a trend toward significance ($p=.09$) at ages 12–14.

The *Substance Involvement Index* correlates with number of different drugs used in lifetime at 12–14 ($r = .34$), 15–17 ($r = .29$), and 18–19 ($r = .56$) years of age. The *Problems Severity Index* and externalizing score are also correlated at 12–14 ($r = .37$), 15–17 ($r = .37$), and 18–19 ($r = .60$) years of age. All the correlations exceed the .001 significance level.

The *Substance Involvement Index* and *Problems Severity Index* alone do not detect current SUD. However in combination, as shown in Table 6, they classify youths according to presence/absence of current SUD with excellent accuracy. At age 12–14, The *DQS* has 88% accuracy of detecting presence/absence of SUD (sensitivity = 100%, specificity = 76%). At

age 15–17, the DQS's accuracy is 90% (sensitivity = 93%, specificity = 80%). Accuracy at age 18–19 is 91% (sensitivity = 93%, specificity = 68%).

3.1.3 Predictive Validity—The results presented in Table 6 (columns 2,4,6) indicate that the DQS has good to superior predictive validity. At age 12–14, the DQS predicts presence/absence of SUD manifest between ages 15–22 with 69% accuracy (sensitivity = 73%, specificity = 53%). The DQS at age 15–17 predicts SUD manifest between ages 18–22 with 76% accuracy (sensitivity = 77%, specificity = 67%). The DQS administered to the boys when they were 18–19 years of age predicts presence/absence of SUD between ages 20–22 with 81% accuracy (sensitivity = 83%, specificity = 63%). The complete 2 × 2 classification tables can be found in the Supplementary Materials.¹

3.2 Replication Sample

Table 7 presents the logistic regression and ROC analyses pertaining to the DQS's accuracy for detecting current SUD. At ages 15–17 and 18–20, the *Substance Involvement Index* did not detect clients according to presence/absence of SUD. The *Problems Severity Index* in contrast was significant for both age groups. Sensitivity was 71% and 75% and specificity was 52% and 60%. Whereas the DQS detects true positives at acceptable accuracy, the essential attribute of a quick screen, its detection of true negative cases is low.

4. DISCUSSION

Three versions of the *DUSI-R Quick Screen (DQS)* were designed to assess psychosocial problems and severity of substance use during early, middle and late stages of adolescence. Consistent with the common liability model (Vanyukov, 2003a,b), and supported by research documenting shared genetic and phenotypic vulnerability for all SUD categories (Kendler et al., 2003, 2007; Tsuang et al., 1998), the *Substance Involvement Index* and *Problems Severity Index* were derived and psychometrically confirmed as unidimensional continuous constructs. Joined together, they comprise the DQS, a screen requiring 3–4 minutes administration time designed to detect the presence of current SUD and estimate the likelihood of developing SUD in the future.

In addition to demonstrating that the DQS has sound psychometric properties, this study revealed that the problems presaging SUD are not constant during early, middle and late adolescence. Negative emotionality is the most salient feature measured in the early adolescent version of the DQS, thereby concurring with findings showing that dysregulation is a core predisposing component of SUD vulnerability (see Cheetham et al., 2010; Tarter et al., 2012 for reviews). By age 15–17, the most ubiquitous feature is maladjustment in school in conjunction with antisocial behavior. By age 18–19, antisociality in context of substance use characterizes the young men with current SUD and those who subsequently developed SUD. In effect, the three DQS versions capture different age-specific facets of psychosocial disruption.

As expected, but nevertheless important to note, this study found that prediction accuracy is lower the longer the interval between assessment and measurement of SUD outcome. Between ages 12–14 and 22, the prediction accuracy is 69% with sensitivity of 73%. These findings suggest that the DQS is an efficient screen considering that it can be administered via the Web in 3–4 minutes and requires no scoring time. Also, concurrent validity in the replication sample is lower than the primary sample, albeit still in the acceptable range. Sensitivity, the main parameter of interest in quick screening, was 93% in 15–17 and 18–19

¹Supplementary material can be found by accessing the online version of this paper at <http://dx.doi.org> and by entering doi:...

year old boys in the CEDAR sample compared to 71% and 75% in the replication sample drawn from Weber Human Services. Whether the lower sensitivity in the replication sample is due to difference in staff training, greater defensiveness due to court-ordered assessment, or demographic characteristics cannot be determined at this juncture. Additional replication studies involving more formalized procedures may yield validity estimates that more closely align with the CEDAR sample.

Several limitations of this study warrant mention. Whereas administration of the *DQS* is expeditious, computing the two indexes is time consuming. Accordingly, an on-line computer-administered *DQS* was developed which automatically scores the responses and immediately displays the results (www.dusi.com). Furthermore, the Web-based *DQS* links to related tools for 1) more in-depth assessment and reporting, 2) automatic tracking and population surveillance, 3) monitoring changes during intervention and aftercare, and 4) aggregating data for program evaluation taking into account the client's clinical presentation, type and intensity of intervention, demographic context, and family environment (www.yourhealthcheckup.org). Finally, because the on-line version of the *DQS* is freely available in twelve languages, it is a heuristic protocol for cross-national and cross-cultural research. These advantages notwithstanding, the *DQS* is limited to situations where individualized assessment can be conducted such as in clinical, forensic or social service settings. Its usefulness for screening youths in groups (e.g., schools) is contingent on access to a device (e.g., smart phone) that is connected to the Web.

It is also important to emphasize that the *DQS* was designed to detect current and future SUD in boys only. The findings cannot, therefore, be assumed to generalize to girls. The rationale guiding development of the *DQS* specifically for boys is based on many reports in the empirical literature documenting qualitative differences between the genders. Accordingly, one brief instrument cannot encompass the content required to assess both genders. Presently, we are developing parallel age-specific versions of the *DQS* for girls.

The *DQS* is the first screening protocol designed specifically to gauge the likelihood of future SUD anchored to chronological age during adolescent development. It is important to note, however, that chronological age may be a less informative benchmark than biological maturation for capturing developmentally-specific characteristics pertinent to SUD. Numerous studies have shown, for example, that early onset puberty amplifies risk for substance use and SUD consequent to having a physical appearance suggesting more advanced chronological age. In boys, facial hair, visible musculature and above-average height facilitate opportunities to affiliate with older peers who engage in "adult" behaviors, including substance use (Costello et al., 2007; Hayatbakhsh et al., 2009; Horner et al., in press). Concomitantly, endocrinological changes, especially increasing concentration of androgens, including testosterone, potentiates behaviors that predispose to substance use and SUD (Archer, 2006; Daitzman and Zuckerman, 1980; Olweus et al., 1980; Udry, 1990). Indeed, disruptive behavior and aggressive social dominance motivation during mid-adolescence mediate the association between testosterone level in early adolescence and SUD in adulthood (Reynolds et al., 2007; Tarter et al., 2007). Lastly, it should be noted that profound neuromaturational changes also occur during adolescence, including progressive integration of the limbic system and frontal cortex (see Casey and Jones, 2010 for review). These changes not only bear on risk for substance abuse and SUD but also have direct ramifications for prevention and treatment (Perry et al., 2011; Spear, 2000). Thus, whereas the three versions of the *DQS* were derived according to chronological age and shown herein to have predictive validity, it may be possible to enhance prediction accuracy upon additionally taking into account maturation status.

In summary, the present study underscores the importance of joining the behavioral correlates of SUD vulnerability and substance use severity geared to the chronological age of adolescents. Although additional refinements such as including contextual variables in the screen or taking into account maturational status may enhance concurrent and predictive validity, this study demonstrated that the DQS efficiently and accurately identifies youths currently manifesting SUD as well as those who are likely to develop SUD by young adulthood.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Characteristics of the sample at time of enrollment (age 10–12)

	M (SD)
Full Scale WISC-III IQ	112.1 (14.75)
Grade in School	6.6 (1.18)
Family Socioeconomic Status	43.7 (13.0)
Ethnicity	
European American	79.2%
African American	17.5
Other	3.3
Psychiatric Disorders	
Conduct Disorder	5.8%
Attention Deficit Hyperactivity Disorder	6.7
Oppositional Defiant Disorder	6.7
Depression Disorder	2.9
Anxiety Spectrum Disorder	2.9

¹ Socioeconomic status derived using Hollingshead four factor index>

Table 2Factor loadings and composition of the *Substance Involvement Index*¹

<u>Age 12–14</u>	
Alcohol	72
Smoking tobacco	71
Marijuana	66
LSD/hallucinogens	63
Cocaine/crack	63
Chewing tobacco	58
<u>Age 15–17</u>	
Barbiturates	83
PCP	83
Cocaine/crack	79
LSD/hallucinogens	72
Tranquilizer pills	67
Prescription pain killer pills	57
Amphetamine/stimulants	47
Marijuana	41
Alcohol	41
<u>Age 18–19</u>	
LSD/hallucinogens	84
Ecstasy	79
Amphetamines/stimulants	71
Tranquilizer pills	67
Gasoline	64
Cocaine/crack	61
Prescription pain killer pills	55
Glue	54
Marijuana	50
Alcohol	48
PCP	45
Smoking tobacco	41

¹Decimal point is not shown

Table 3Factor loadings and composition of the *Problems Severity Index*¹

<u>Age 12–14</u>	
Did you feel irritable and upset when in school?	54
Did your friends cut school or work?	53
Did you feel sad a lot?	52
Did you generally feel angry	51
Did you have frequent arguments with your parents which involved yelling or screaming?	50
which involved yelling or screaming?	50
Did you have trouble getting your mind off things?	50
Have your friends stolen anything from a store or damaged property on purpose?	50
Did your parents dislike your friends?	48
Did your friends get bored at parties when there was no alcohol served?	48
Have you stolen things?	47
<u>Age 15–17</u>	
Did you not do your school assignments?	58
Have you made money doing something that was against the law?	57
Did you usually stay out late on nights when you had to go to school or work the next morning	56
Did you feel irritable and upset when in school?	55
Did your friends cut school or work?	55
Did you have trouble concentrating in school or when studying?	55
Were you late for class?	54
Have any of your friends been in trouble with the law?	54
Were your grades below average?	54
Have you had a problem remembering what you had done while you were under the effects of drugs or alcohol?	53
<u>Age 18–19</u>	
Have you made money doing something that was against the law?	57
Did any of your friends lie a lot?	56
Have your friends stolen anything from a store or damaged property on purpose?	56
Did you feel irritable and upset when in school?	55
Did you do things a lot without first thinking about the consequences	55
Did any of your friends sell or give drugs away?	54
Have alcohol or drugs interfered with your homework or school assignments?	54
Have you ever missed or been late to school because of alcohol or drugs?	54
Have you intentionally damaged someone else's property?	54
Did you get tired very quickly when you exerted yourself?	54

¹Decimal point is not shown

Table 4

Results of confirmatory factor analysis

	Age 12–14	Age 15–17	Age 18–19
<i>Substance Involvement Index</i>			
χ^2 (df), p-value	3.93 (6), .68	22.87 (23), .47	7.27 (9), .61
Root Mean Square Error Approximation	<.001	<.001	<.001
Tucker-Lewis Index	.99	.99	.99
Comparative Fit Index	.99	.99	.99
<i>Problems Severity Index'</i>			
χ^2 (df), p-value	35.20 (33), .36	23.57 (26), .60	32.14 (29), .31
Root Mean Square Error Approximation	.013	<.001	.018
Tucker-Lewis Index	.99	.99	.99
Comparative Fit Index	.99	.99	.99

Table 5

Comparison of sons of SUD+ and SUD– fathers on the DQS indexes

	Age 12–14				Age 15–17				Age 18–19			
	SUD+ M(SD)	SUD– M(SD)	t	p<	SUD+ M(SD)	SUD– M(SD)	t	p<	SUD+ M(SD)	SUD– M(SD)	t	p<
<i>Substance Involvement Index</i>	51.5(10.6)	48.6 (9.1)	2.28	.02	49.6(3.1)	50.3(13.33)	–.55	.58	51.9(13.50)	48.2(4.85)	2.75	.01
<i>Problems Severity Index</i>	51.1(10.3)	48.9 (9.6)	1.72	.09	51.4 (9.9)	48.7 (9.88)	2.11	.04	52.4(11.20)	47.9(8.32)	3.50	.001

Table 6

Concurrent and predictive validity of the DQS

	Age 12–14	Age 16–22	Age 15–17	Age 19–22	Age 18–19	Age 22
Outcome Age	Current SUD+/- OR (p) (95% CI)	Future SUD+/- OR (p) (95% CI)	Current SUD+/- OR (p) (95% CI)	Future SUD+/- OR (p) (95% CI)	Current SUD+/- OR (p) (95% CI)	Future SUD+/- OR (p) (95% CI)
<i>Substance Involvement Index</i>	1.09 (.29) (.93, 1.27)	1.09 (.001) (1.04, 1.14)	1.03 (.50) (.95, 1.12)	1.17 (.02) (1.02, 1.33)	1.19 (.001) (1.07, 1.32)	1.05 (.36) (.95, 1.16)
<i>Problems Severity Index</i>	1.04 (.45) (.93, 1.17)	.98 (.350) (.94, 1.02)	1.14 (.001) (1.07, 1.21)	1.07 (.001) (1.03, 1.11)	1.14 (.001) (1.09, 1.20)	1.12 (.001) (1.07, 1.18)
Overall Accuracy ^I	88%	69%	90%	76%	91%	81%
Sensitivity ^I	100%	73%	93%	77%	93%	83%
Specificity ^I	76%	53%	80%	67%	68%	63%

^I Area under the curve

Table 7

Replication of concurrent validity of the DQS

	15–17 years of age	18–20 years of age
	OR (p) (95% CI)	OR (p) (95% CI)
<i>Substance Involvement Index</i>	1.08 (.20) (.96, 1.21)	1.00 (.88) (.96, 1.05)
<i>Problems Severity Index</i>	1.06 (.01) (1.01, 1.12)	1.06 (.01) (1.01, 1.10)
Overall Accuracy	68%	67%
Sensitivity	71%	75%
Specificity	52%	60%