Quick screen to detect current substance use disorder in adolescents and the likelihood of future disorder☆

Levent Kirisci [a,*], Maureen Reynolds [a], Darin Carver [b], Ralph Tarter [a]

[a] Center for Education and Drug Abuse Research, Department of Pharmaceutical Sciences, University of Pittsburgh, School of Pharmacy, United States
[b] Weber Human Services, Ogden, UT, United States

ARTICLE INFO

ABSTRACT

Aims: A brief screen requiring 3–4 min 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.

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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 et al., 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., 2006a,b; 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 congenerous to all SUD categories in conjunction with severity of substance use. Significantly, 100% and 80% of the genetic and phenotypic portions of liability are congenerous to all SUD categories (Tsuang et al., 1998) and the

psychological characteristics associated with transmissible (inter-generational) 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 min to self-administer, has both concurrent and predictive validity.

2. Methods

2.1. Subjects

Boys between 10 years and 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.

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

[a]Socioeconomic status derived using Hollingshead four factor index.

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 less 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 have yielded research scales to delineate the etiological trajectories to SUD between childhood and young adulthood (Tarter et al., 2007a,b) 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., 2006a,b). 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