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Drug Use Disorder (DUD) Questionnaire: Scale Development and Validation

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Abstract

Background: Despite the ample interest in the measurement of substance abuse and dependence, obtaining biological samples from participants as a means to validate a scale is considered time and cost intensive and is, subsequently, largely overlooked.

Objectives: To report the psychometric properties of the drug use disorder (DUD) questionnaire including oral fluid and blood sample screening indicators measuring the three most commonly used illicit substances—marijuana, cocaine, and extramedicinal painkillers.

Subjects: Participants were a subset (N = 2,702) of the 2007 U.S. National Roadside Survey that was administered to daytime and nighttime weekend drivers in the 48 contiguous states to examine the prevalence of substance use and misuse.

Measures: Participants completed demographic and substance use questions as well as the DUD—a 12-item measure assessing substance abuse and dependence. Participants could potentially have completed the DUD three times for each of the three substances. Subscales of abuse and dependence were created using Diagnostic and Statistical Manual of Mental Disorders (Fourth Edition Text Revision [DSM-IV-TR]) criteria of these diagnoses.

Results: The DUD displayed adequate internal consistency on both subscales of substance abuse and dependence (Cronbach's α ranging from .71 to .84 and .83 to .92, respectively). The DUD also demonstrated construct validity in comparison to biological markers of each substance.

Conclusions: The DUD is a biologically validated instrument that is both easy to utilize and may have valuable implications as a research tool among both clinical and nonclinical populations.

Keywords

Measurement; methodology; survey methodology

The literature on substance use, abuse, and dependence is substantial. This interest, however, appears well warranted as an estimated 4.9% of the world's populations have used illicit

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drugs in the past 12 months, and0.6% of the world's populations have drug-related problems (United Nations Office on Drugs and Crime [UNODC] 2011). In fact, in an ongoing national survey of approximately 67,500 persons aged 12 years or older, the National Survey on Drug Use and Health (NSDUH) conducted in 2002 found that, excluding tobacco and alcohol, the most used drugs in the prior 12 months were marijuana (11%), cocaine (2.5%) and nonprescription pain-killers (4.7%; Substance Abuse and Mental Health Services Administration [SAMHSA] 2004). With such endemic substance use comes natural concerns of developing substance abuse and dependence. In other examinations of data collected in the NSDUH, previous research has found that young (less than 25 years) females were the most likely to develop cocaine dependence after onset of use (Chen and Kendal 2002; O'Brien and Anthony 2005). In another study of sex differences in opioid users, Back et al. (2010) found that male participants were more likely to obtain medicinal opioids without a prescription, through personal contacts or purchased from dealers. This may mean that men are in greater danger of abusing nonmedicinal opioids than are women, though women were more likely to become dependent on opioids as they were prone to using prescription opioids as a coping strategy (Back et al. 2011). In yet another study, Voas et al. (2013) found that among nighttime weekend drivers, female drivers were almost half as likely as male drivers to screen positive for illegal substance use, generally, or marijuana use, specifically. Further, Voas et al. also found that younger drivers (below 21 years) were significantly more likely to screen positive for marijuana use than all groups of older drivers but less likely to screen positive for cocaine and painkiller use (Voas et al. 2013), and Black drivers were over twice as likely as White drivers to screen positive for marijuana use. Given this widespread interest in substance use, abuse, and dependence, the need to properly assess these concepts is palpable and has been the focus of a great deal of scientific inquiry.

An examination of the empirical literature reveals that over the years numerous scales have been developed, assessing substance use, abuse, and dependence. Many of these scales are geared to specific substances (Baillie and Mattack 1996; Grant and Dawson 1997; González-Sáiz et al. 2009; Muñoz et al. 2010; Raistrick et al. 1994; Uddin, Maskrey, and Holland 2011), while others can be adapted to measure any number of substances of interest (Campbell et al. 2003; Flynn et al. 1997; McGovern and Morrison 1992; McLellan et al. 1992; Murphy and MacKillop 2011; Berney et al. 2002). Indeed, the number of scales that have been developed to measure substance use, abuse, and dependence demonstrates the interest and need in the subject as a whole.

Despite this interest, however, most instruments are self-report or semistructured interviews and validated on other self-report measures or semistructured interviews. Though these methods of instrument administration (particularly self-reporting) are cost and time effective —both of which are often necessary considerations in clinical and field research—self-report and semistructured interviews are vulnerable to subject biases via intentional or unintentional underreporting of substance use (McGovern and Morrison 1992). Essentially, then, such scales are attempting to validate personal recall instruments via self-report or semistructured interview—which may be biased information—with other personal recall instruments that would also suffer from the same potentially biased information.

Gathering physiological data (through blood, oral fluid, and/or urinalysis) on substance use from each participant to measure actual rates of current use allows for more detailed and accurate information on substance use; however, it is also enormously cost inefficient and time intensive sometimes, making it impractical in field research situations. One possible way to at least partially address this may be to utilize physiological measurements of substance use to validate an existing self-report measure. In this way, an instrument could have the benefit of brevity and convenience offered by a self-report measure, while simultaneously benefiting from the accuracy of its relationship to physiological data. Unfortunately, few instruments currently utilize this method of scale validation and rely largely on validation against other self-report measures.

Despite the scarcity of such data on existing scales, such an instrument would be a valuable tool for substance use, abuse, and dependence researchers. For this reason, we have developed an instrument that we hope can easily be utilized in clinical and real-world research settings as a self-report measure utilizing common clinical substance abuse and dependence diagnostic criteria. Simultaneously, we sought to utilize physiological measurement (via oral fluid and blood sample screening) in the validation of the scale to at least partially address the concerns around self-reported bias. The drug use disorder (DUD) questionnaire was the result of these efforts. In this article, we will first report on the validation of the DUD as a viable measurement of abuse and dependence criteria and then seek to use this newly validated instrument to examine differences in participant demographic variables on abuse and dependence criteria as measured by the DUD.

The current study will seek to establish the DUD as a viable measure of substance abuse and dependence as outlined in the Diagnostic and Statistical Manual of Mental Disorders (Fourth Edition Text Revision [DSM-IV-TR]). Further, due to the changes occurring to the DSM substance-related diagnostic criteria, we will also establish the DUD as a viable measure of substance use disorder as defined by the DSM-V. This will be done by conducting confirmatory factor analysis (CFA) to establish the DUD as a good fitting model of abuse and dependence (DSM-IV) and substance use disorder (DSM-V). Next, we will seek to demonstrate the reliability and validity of the DUD to the extent possible in a single study of a measurement. We will demonstrate construct validity by the screening of blood and oral fluid samples for indicators of marijuana, cocaine, and extramedicinal painkillers. As individuals with DUD scores meeting abuse and dependence criteria would be presumed to use substances to a greater extent than those who do not meet diagnostic criteria, those who meet diagnostic criteria would be more likely to be positive for biological traces of each of these substances. Finally, after establishing—to the extent possible—the reliability and validity of the instrument, we will examine differences between participants based on sex, age, and race regarding (1) the self-reported past year use of marijuana, cocaine, and painkiller and (2) meeting abuse or dependence criterion of any of those three substances as measured by the DUD and comparing these findings to the literature on the topic.

Method

Sample

The current study is a secondary analysis of the 2007 U.S. National Roadside Survey (NRS) that was administered to daytime and nighttime weekend drivers in the 48 contiguous states to examine the prevalence of substance use and misuse. Participants completed self-report measures and biological measures including breath tests as well as providing oral fluid and blood samples for drug analysis. For the current study, we used a subset (N = 2,702) of the total sample who provided demographic data and completed the DUD. Because the 2007 NRS is described in great detail elsewhere (Lacey et al. 2009a, 2011), it will be only outlined in the following section as it is directly relevant to the current research.

Participants of the 2007 NRS were randomly selected drivers at designated roadside survey stations (see Lacey et al. 2009a, 2011 for information on the sampling plan). Drivers were flagged down by police officers who directed them to the off-road study personnel. Participants were informed that their selection in the study was random, they had done nothing wrong, and participation in the survey was both anonymous and confidential. Recruiting and survey procedures were approved by the Pacific Institute's IRB. Drivers who provided informed consent were breath tested and participated in a 22-item interview, covering demographics, driving, and alcohol use. It is feasible, however, that many drivers who refused to participate at all in the current study were indeed under the influence of a substance and were subsequently reluctant to divulge information, despite assurances of confidentiality. Drivers who were randomly selected but refused to participate in the current study were offered an additional financial incentive of US$150 to provide at least a breath test. Of these participants, approximately 50% agreed to provide a breath sample before departing. Among those participants, however, no oral fluid or blood samples were collected nor were self-report measures (including the DUD) administered. As such, these participants were not included in the current study.

Participants who agreed to participate were offered the opportunity to earn US$5 for completing an alcohol use survey (not reported herein) and an additional US$10 to provide oral fluid samples and complete a drug use survey (including the DUD). Finally, they were offered an additional US$50 to provide a blood sample. Oral fluid and blood samples were used to screen for a variety of substances including—but not limited to—marijuana, cocaine, and painkillers. Of the 10,909 eligible drivers (commercial drivers and drivers under 16 were not interviewed) who entered the site, 9,094 agreed to participate in the basic interview, 7,719 provided an oral fluid sample, and 7,882 responded to the drug questionnaire (Lacey et al. 2009b). Of the 9,094 drivers who agreed to participate, 2,702 were eligible and completed the DUD. Analyses in the current study were conducted on these participants whether or not they endorsed using any of the three substances in question. Further, oral fluid and/or blood samples were gathered from all participants in the current study whether or not they reported use of any of the three substances of interest. Participants were between the age of 16 and 87 (M_{age} = 34.22, standard deviation [SD] 14.22) and the majority of the sample was male (60.8%) and identified=as White (55.8%). See Table 1 for descriptive statistics for the entire study sample.

Measures

General Demographics.—Participant self-reported demographic information including age, sex, race, and highest education level attained. Study personnel recorded the time of day when data were gathered. For the purposes of analysis, age was divided into groups to be congruent with previous work by Voas et al. (2013). These groups included those less than 21 years of age, those between 21 and 34 years, those between 35 and 44 years, and those above 45 years of age.

Substance Use Information.—Participants provided oral fluid and/or blood samples that were forwarded to the Immunalysis Corporation in Pomona California for screening using enzyme-linked immunoabsorbent assays (ELISA) followed by verification of positive samples with mass spectral detection using liquid chromatography–mass spectrometry (LC/MS). Approximately 50 substances were covered by this analysis (see Lacey et al. 2009b, 35 for detailed list), but in the current study the only substances examined were tetrahydrocannabinol (THC, the principal psychoactive constituent found in marijuana), cocaine, and extramedicinal painkillers (which was composed of butalbital, carisoprodol, codeine, hydrocodone, meperidine, morphine, oxycodone, propoxyphene, and tramadol).

DUD Questionnaire.—DUD is a self-report questionnaire developed to assess abuse and dependence criteria for marijuana, cocaine, and extramedicinal painkiller use among participants in the NRS. Participants were first queried about whether they engaged in use of any of the three substances of interest in the prior year, with a single item for each substance (screening item; see Table 2). If participants answered that they had not used that particular substance, they moved onto a query about the next substance. If participants denied having used marijuana, cocaine, or painkillers in the prior year, the DUD questionnaire was not administered, and these participants were not included in the factor analysis portion of the study. If the participant answered that they had used one or more of the three substances, they completed 12 items for each of the three substances of interest (i.e., marijuana, cocaine, and painkillers) they indicated using in the past year (see Table 2 for DUD items administered). Subsequently, the participants to whom the DUD was administered completed at least 12 items for having used one of the three substances, and at most 36 items if they reported using marijuana, cocaine, and painkillers in the prior year. Although conceivably any substance could be assessed with the DUD questionnaire, the current study only assessed marijuana, cocaine, and painkiller use, as these substances were deemed to be the most commonly misused substances among the general population with the exception of alcohol and tobacco. This also offered the opportunity to examine the performance of DUD questionnaire on a variety of substances and thereby increase the scale's external validity.

The DUD questionnaire was based on the Alcohol Use Disorders and Associated Disabilities Diagnostic Interview Schedule (AUDADIS; Cottler et al., 1997; Grant and Dawson 1997). Subsequently, the DUD questionnaire has a single item per symptom for substance abuse and substance dependence as listed in the DSM-IV-TR (American Psychiatric Association 1994). Participants answer each of the 12 items—the first 4 items assessing substance abuse and the second 8 items assessing substance dependence—with "yes" or "no" responses to indicate whether the statement is true of their experience with the

use of that particular substance (see Table 2). Similar to the DSM-IV-TR diagnostic criteria, participants were labeled as meeting the criteria for substance abuse if they answered “yes” to one or more of the 4 items used in this subscale. Participants were labeled as meeting the criteria for substance dependence if they answered “yes” to 3 or more of the 8 items used in this subscale. Furthermore, as is the case in the DSM-IV-TR, participants could not be placed into both abuse and dependence categories. If requirements were met for both abuse and dependence, participants were categorized as substance dependent.

At the time of this writing, the American Psychiatric Association was revising the DSM-IV-TR diagnostic criteria for substance abuse and dependence. The DSM-V revision involved collapsing the DSM-IV-TR diagnostic criteria of *substance abuse and substance dependence* into a single *substance use disorder* diagnosis. The only diagnostic criteria removed from the DSM-V substance use disorder diagnosis was the item concerning legal complications associated with substance use (Item 3 on the DUD questionnaire; see Table 2). As a result, the DUD questionnaire may also be utilized to assess for DSM-V substance use disorder diagnostic criteria. However, the manner in which the items are scored differs when the DUD questionnaire was utilized with DSM-V diagnostic criteria. To meet diagnostic criteria for substance use disorder, the DSM-V stipulates that participants must endorse two or more of the diagnostic criteria. Hence, if a participant answers “yes” to 2 or more of the items on the DUD questionnaire, they would meet diagnostic criteria for substance use disorder.

Face Validity

The DUD questionnaire was designed to be directly relevant to the diagnostic criteria utilized by the DSM-IV-TR. As such, the first considerations were to ensure that the DUD questionnaire (1) was an adequate replication of items stipulated in the DSM-IV-TR as diagnostic criteria for abuse and dependence (American Psychiatric Association 1994), and (2) allows for ease of data collection and interpretation for study personnel utilizing the instrument. DSM-IV-TR diagnostic items were adapted slightly to accommodate a nonclinical sample and to clearly stipulate a referent time period. For example, an item listed in the DSM-IV-TR stipulating tolerance to substance use as diagnostic criteria for substance dependence is listed as “A need for markedly increased amounts of the substance to achieve intoxication or desired effects” (p. 197). This item was reworded slightly for the DUD to read, “In the past year, have you found that you have to use more than you once did to get the effect you wanted?” (see Table 2 for item-by-item comparison of the DUD and DSM-IV-TR substance abuse and dependence criteria). In this way, the DUD items closely resemble actual clinical diagnostic criteria while accommodating a nonclinical sample. This method of item assemblage was based on the AUDADIS (Grant and Dawson 1997; Cottler et al. 1997; Pull et al. 1997), which is a structured assessment that has 1 item per symptom on the DSM-IV-TR.

Statistical Analyses

A series of logistic regression analyses were conducted to determine (a) differences between DUD subscales in positive indicators in blood or oral fluid for marijuana, cocaine, and extramedicinal painkillers and (b) participant sex, age, and race as a predictor abuse and dependence of all three substances. All regression analyses as well as demographic

information were conducted using SPSS v. 18.0 (SPSS Inc., Chicago, IL). A CFA was conducted to examine fit statistics of DUD subscales in the NRS for both the DSM-VI-TR diagnostic criteria for substance abuse and dependence and the DSM-V criteria for substance use disorder. CFAs were conducted using M-Plus v. 8.0.

The use of a CFA must first have a sound basis on which the factors are chosen. This is often done by first conducting an exploratory factor analysis (EFA) or by providing sufficient theoretical basis for the use of specified factorial loadings (Thompson 2004). In the current study, the factor loadings utilized in the DUD are drawn from the DSM-IV-TR and DSM-V diagnostic criteria for substance abuse and dependence and substance use disorder, respectively. Because the factor loading structure is clearly depicted in these manuals, and because the DUD is an instrument to be utilized as a tool for assessing for these substance-related disorders utilizing the definitions posited in the manuals, an EFA was deemed inappropriate and unnecessary.

Although numerous fit statistics may be appropriate to establish the ideal fit of a model, the current study utilizes the chi-square statistic, comparative fit index (CFI), the nonnormed Fit Index (NNFI), the root mean square error of approximation (RMSEA), and the Standardized Root Mean Square Residual (SRMR). Generally speaking, a nonsignificant chi-square statistic is generally regarded as acceptable (Barrett 2007); however, as is the case in the current research, the chi-square is often significant when large sample sizes are utilized and may result in inappropriate rejection of a model (Bentler and Bonnet 1980; Jöreskog and Sörbom 1993). Subsequently, though commonly reported, the chi-square statistic alone is insufficient to determine the fit of a model and a more robust determination of fit is necessary.

To this end, fit statistics were further examined by a CFI that may vary from 0 to 1, with higher scores indicating better fit. A minimum CFI of 0.90 has been posited to display adequate fit for a model (Bentler 1990). Although CFI is the most commonly reported fit statistic, as with chi-square it is also vulnerable to large sample sizes. It was employed in the current study only for its commonality in this research. Rather, the NNFI compares the proposed model with a null model of independent variables which may also vary from 0 to 1, with higher scores indicating better fit. The NNFI is generally perceived as a superior measure of fit compared to the CFI and NFI due to its capacity to accommodate large sample sizes (Bentler 1990) and as such was deemed appropriate for the current study. An NNFI minimum cutoff of 0.80 has been posited as an appropriate indicator of acceptable fit (Satorra and Bentler 1994).

In addition, the current study also examined the RMSEA and SRMR. Although these measures of fit may also vary from 0 to 1, lower scores indicate a better fitting model. The RMSEA examines how well the proposed model would fit the population covariance matrix (Byrne 1998) and is generally considered to be a particularly informative fit index (Diamantopoulos and Sigauw 2000) and was subsequently deemed appropriate for the current study. Although acceptable cutoff points vary in the literature from 0.05 to0.10, a cutoff rate of 0.08 has been selected for the current study as an indication of good fit (MacCallum, Browne, and Sugawara 1996). The SRMR is the square root of the difference

between residuals of the covariance matrix and the proposed model (Hooper, Coughlan, and Mullen 2008). An SRMR value of less than 0.05 has been posited to be well fitting; however, a value between 0.05 and 0.08 has been found to be acceptable (Hu and Bentler 1999).

Results

Of the 10,909 drivers who participated in the 2007 NRS, only 2,702 endorsed use of one or more of marijuana, cocaine, and extramedicinal painkillers and were eligible to complete the DUD. Therefore, 24.7% of participants of the original sample were utilized in the current research. Of those participants, 1,940 reported marijuana use in the past year, 1,266 reported cocaine use in the past year, and 2,017 reported painkiller use in the prior year. Of those reporting marijuana use, 12.3% ($n = 239$) met DUD criteria for abuse and 6.7% ($n = 130$) met criteria for dependence. Of those reporting cocaine use, 7.6% ($n = 97$) met DUD criteria for abuse and4.6% ($n = 59$) met criteria for dependence. Finally, of those reporting pain-killer use, 10.3% ($n = 209$) met DUD criteria for abuse and 4.8% ($n = 98$) met criteria for dependence.

The results of the CFA for each of the three substances are described in Table 3. Overall, DUD measurement of marijuana abuse and dependence demonstrated adequate fit, $\chi^2/df =$ 572.02 (53), $p < .001$; CFI 0.91; NNFI = 0.89; RMSEA 0.08; SRMR 0.04. Similar fit statistics were found for the 2007 NRS DUD measurement of cocaine, χ^2/df 606.87 (53), $p < .001$; CFI = 0.93; NNFI = 0.91; RMSEA = 0.11; SRMR = 0.04, and painkillers, $\chi^2/df =$ 834.88 (53), $p < .001$; CFI 0.91; NNFI = 0.89; RMSEA = 0.10; SRMR = 0.05. Thus, the DUD instrument demonstrated adequate fit for all substances measured, indicating some measure of external validity. Due to the upcoming DSM-V revisions to the substance use diagnostic criteria, a similar analysis was conducted using the DSM-V substance use disorder criteria. Although the CFAs yielded relatively poorer fit statistics for the DSM-V than for the DSM-IV-TR diagnostic criteria, they were still found to be largely adequate (see Table 3).

Sex, Age, and Racial Differences on Abuse and Dependence

Differences on DUD measurement of abuse and dependence of marijuana, cocaine, and painkiller use were examined both generally and specifically. Logistic regressions were conducted to determine differences between sex, age, and race on rates of abuse and dependence of all three substances (see Table 4). Women were significantly more likely than men to be either marijuana or cocaine dependent (odds ratio [OR]: 1.71, 95% confidence interval, CI: [1.09, 2.70] and OR: 3.87, 95% CI: [2.06, 7.27], respectively) but were half as likely as men to meet the criteria for painkiller abuse (OR: 0.58, 95% CI: [0.39, 0.86]). Also, participants who were under the age of 21 were significantly more likely to meet the criteria for marijuana abuse and dependence and cocaine dependence than groups who were older than 21. Finally, participants who identified as Black were significantly more likely to meet criteria for marijuana dependence (OR: 1.75, 95% CI: [1.05, 2.91]) but less than half as likely as those who identified as White to meet diagnostic criteria for cocaine dependence (OR: 0.36, 95% CI: [0.14, 0.92]).

Reliability

The Cronbach's α coefficient was used as an assessment of internal consistency for the overall scale and each of the two subscales (substance abuse and substance dependence) for each of the three substances of interest in the current study (marijuana, cocaine, and painkillers). Previous research has indicated that a Cronbach's α score of 0.60 or higher as an indicator of an acceptable scale (Cronbach, 1951). Cronbach's α scores ranged from0.88 to 0.95 for the complete scale and 0.71 to 0.84 and 0.83 to 0.92 for the substance abuse and substance dependence subscales, respectively, indicating adequate reliability for the DUD criteria on multiple substances.

Construct Validity

The current study attempted to validate constructs of abuse and dependence by means of comparison of DUD scores to physiological screening of marijuana, cocaine, and painkillers using ELISA. A series of logistic regressions were conducted to examine the predictive ability of the abuse and dependence subscales of the DUD to positive indicators measured in blood and/or oral fluid. Analyses were conducted three times, once for each of the three substances examined in the current study: marijuana, cocaine, and pain-killers. Participants who met DUD criteria for marijuana abuse and marijuana dependence were both over twice as likely as those who used marijuana but did not meet these criteria to have blood and/or oral fluid indicators for marijuana use (adjusted OR [AOR] = 2.37, 95% CI = [1.71, 3.30] and AOR = 2.54, 95% CI [1.71, 3.37], respectively). Those who met DUD criteria for cocaine abuse and cocaine dependence were, respectively, over twice as likely (AOR = 2.29, 95% CI = [1.14, 4.60]) and almost six times as likely (AOR = 5.88, 95% CI = [2.89, 11.96]) to screen positive for blood and/or oral fluid indicators for cocaine. Similarly, those who met DUD criteria for painkiller abuse and painkiller dependence were, respectively, almost two and a half times (AOR = 2.42, 95% CI [1.52, 3.86]) and almost three times (AOR = 2.93, 95% CI = [1.64, 5.22]) more likely to screen positive for blood and/or oral fluid indicators for painkiller use (see Table 5).

Discussion

The psychometric analyses of the DUD, coupled with utility of the instrument both as an easily administered and physiologically supported measure, suggest the value and practicality of the instrument as a substance abuse and dependence or substance use disorder assessment device. In the current study, we highlighted the continued need for instruments measuring substance abuse and dependence as described by the clinically relevant DSM-IV-TR or newly developed DSM-V. A device such as this should be economical, easily implemented, and make clinical criteria relatively easy to comprehend by a nonclinical sample of participants. To this end, the DUD questionnaire appears to be a potentially valuable instrument in measuring substance abuse and dependence and substance use disorders for clinical or research purposes.

The current study established adequate goodness-of-fit statistics for the DUD and the abuse and dependence subscales. The reliability of the DUD questionnaire has been established in the current study by examining the measure's internal consistency among three separate tests

of substances. The validity of the instrument has been supported by comparison of blood and/or oral fluid samples of participants for an accurate measurement of current substance use across multiple substances (marijuana, cocaine, and painkillers). Individual items in the DUD questionnaire were composed from items listed in the DSM-IV-TR, allowing it high levels of face validity and making it easily translatable to the DSM-V.

This study has several limitations that should be considered in interpreting its findings. First, the current study is a secondary analysis of the NRS data and, subsequently, has some limitations as a result. For example, the study is cross-sectional in nature. Although this is not uncommon in studies examining questions of scale validation, it would certainly be strengthened as a whole if temporal stability of the DUD could be established by reassessing participants after an interval of a few weeks or months. Second, the current study would also be notably improved with the concurrent administration of scales both similar and dissimilar to the DUD. This would allow for comparison of similar constructs and further establish concurrent and discriminant validity. The use of scales that measure similar constructs as a means of establishing construct validity is often considered the gold standard for establishing construct validity. The lack of such a scale in the current research is undoubtedly a limitation and must be addressed in future research. Third, although the use of biological criteria in the current study is both novel and informative, a limitation must be noted in their use. Primarily, different substances remain in the system for varying lengths of time. For example, as THC is a fat-soluble compound, it may leave traces of its use in the system for more than a week after use. Conversely, cocaine use may be undetectable in a matter of a few days. As such, this may result in the possibility of under- or overinflation in the use of a particular substance. Despite this, however, as those who meet diagnostic criteria for abuse or dependence of any of these substances are more likely to use them, these participants are also more likely to screen positive for them. Further, although the DUD could conceivably be used with any substance, in the current study it was used only with marijuana, cocaine, and painkiller. Although this was necessary for feasibility and practicality, it does not allow a detailed understanding of how it may perform with other substances. Similarly, the DUD was administered to a population of drivers in the United States and, as such, its externalization to populations outside of the United States would require further exploration.

Despite these limitations, however, the current study has notable strengths that must be considered as well. The use of blood and oral fluid samples as screening tools for marijuana, cocaine, and painkiller use is a valuable addition to the study and one oft not found in scale-validation studies. The use of biological markers of substance use may reduce reporting bias by participants and may also serve as a means to confirm participant self-report. Second, the assessment of substance abuse and dependence often involves an interviewer as well as self-report, making it both costly and time intensive. In research where reducing the burden on participants is both prudent and necessary for its success, a questionnaire that can adequately assess abuse and dependence without taking up a great deal of time can be extremely valuable. In addition, the DUD allows for easy interpretation of DSM-IV-TR- and DSM-V-related diagnostic criteria by those who do not have a clinical background giving it utility in field research with the general population. Although an instrument cannot be used to diagnose an individual, it can be used to determine whether further exploration in a clinical

setting may be warranted. Finally, the current study examines the versatility of the DUD as a tool for examining both DSM-IV-TR diagnostic criteria for substance abuse and substance dependence and DSM-V diagnostic criteria for substance use disorder. The ability of the DUD questionnaire to be used for both DSM-IV-TR and DSM-V diagnostic criteria will allow for easy transition for clinicians and researchers in their work with these populations.

Differences in Abuse and Dependence by Sex, Race, and Age Groups

Although an in-depth analysis of differences between males and females was beyond the scope of the current study and, as such, must be reserved for future analyses, a preliminary examination of DUD outcomes did indeed demonstrate differences between sexes, age groups, and races. Female drivers were found to be almost twice and four times more likely than male drivers to meet the diagnostic criteria for marijuana and cocaine dependence but just over half as likely to meet the criteria for painkiller abuse. This is consistent with previous research that compared rates of cocaine dependence between men and women as found in the National Household Surveys on Drug Use and Health (Chen and Kandel 2002; O'Brien and Anthony 2005). The finding that men were more likely than women to meet diagnostic criteria for painkiller abuse is likely the result of the ease and frequency by which men acquire nonmedicinal painkillers (Back et al. 2010). That is, by acquiring painkillers illegally, men are more likely to have legal problems associated with painkiller use (i.e., being arrested for possession), which is a criterion of painkiller abuse as measured by the DSM-IV. Also consistent with the previous literature, is the finding that participants in the under-21 age group were statistically more likely to meet the diagnostic criteria for marijuana abuse and dependence than all other age groups. Given the rampant increase in marijuana use among adolescents in recent years (i.e., SAMHSA 2004), this finding is not particularly surprising. Taken together, however, the fact that the DUD questionnaire found evidence for these common and well-documented phenomena may provide additional support for the validity of the DUD questionnaire as a measure of abuse and dependence.

Summary

The DUD questionnaire may have valuable implications as a research tool among both clinical and nonclinical populations. Its relative ease of use and cost-effectiveness make it readily deployable in a variety of settings and with a variety of populations. It may be of use in providing clinicians with quickly obtainable information to explore the possibility of substance abuse and dependence diagnoses, while allowing field researchers to quickly distinguish between casual substance use and use sufficient to cause serious concern in everyday activities. Further validation with various clinical and nonclinical populations will increase our understanding of its utility as a measure of substance-related diagnoses. Clearly the DUD questionnaire—or any other instrument—cannot and should not be used to diagnose someone with substance abuse, substance dependence, or substance use disorders as such diagnoses can only be made by an appropriately licensed and trained clinician in a therapeutic setting. It can, however, describe whether someone might be in danger of meeting those diagnostic criteria and whether further clinical assessment may be warranted. Future research will be needed to further validate the DUD questionnaire against other

scales and the diagnoses of mental health professionals as well as establish its utility with substances other than those listed in the current article.

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Table 1.

Demographic Characteristics of Study Participants.

	n	%
Sex		
Male	1,643	60.8
Female	1,054	39.0
Race		
White	1,509	55.8
Black	484	17.9
Other	223	8.3
Age		
<21 years	512	19.0
21–34 years	1,254	46.5
35–44 years	469	17.4
45+ years	461	17.1
Education		
Less than high school	289	10.7
Graduated high school	730	27.0
Some college	1,020	37.7
Graduated college	499	18.5
Beyond college	140	5.2
Substance use		
Marijuana use	1,940	71.8
Marijuana abuse	239	8.9
Marijuana dependence	130	4.8
Cocaine use	1,266	46.9
Cocaine abuse	97	3.6
Cocaine dependence	59	2.2
Painkiller use	2,017	74.7
Painkiller abuse	209	7.7
Painkiller dependence	98	3.6

Table 2.

A Comparison of Drug Use Disorder (DUD) Questionnaire Items to DSM-IV-TR Diagnostic Criteria.

Subscale		DUD questionnaire	DSM-IV-TR
	(Screening item)	Have you used this substance in the past year? (If yes, continue to substance specific items. If no, stop here)	
Abuse	1	In the past year, did your use interfere with taking care of your home or family or cause you problems at work or school?	Recurrent substance use resulting in a failure to fulfill major role obligations at work, school, or home
	2	In the past year, did you more than once get into a situation while using or after using that increased your chances of getting hurt—like driving a car or other vehicle or using heavy machinery?	Recurrent substance use in situations where it is physical hazardous
	3	In the past year, did you get arrested, held at a police station or have legal problems because of your use?	Recurrent substance-related legal problems
	4	In the past year, did you continue to use even though it was causing you trouble with your family or friends?	Continued substance use despite having persistent or recurrent social or interpersonal problems caused or exacerbated by the effects of the substance
Dependence			Tolerance, as defined by either of the following:
	5	In the past year, have you found that you have to use more than you once did to get the effect you wanted?	A need for markedly increased amounts of the substance to achieve intoxication or desired effects
	6	In the past year, did you find that your usual amount had less effect on you than it once did?	Markedly diminished effect with continued use of the same amount of the substance Withdrawal, as manifested by either of the following:
	7	In the past year, when the medication/drug effects were wearing off, did you experience some of the bad aftereffects—like trouble sleeping, feeling nervous, restless, anxious, sweating, or shaking, or did you have seizures or sense things that were not really there?	The characteristic withdrawal syndrome for the substance. The same substance is taken to relieve or avoid withdrawal symptoms
	8	In the past year, did you end up using more or using for a longer period than you intended?	The substance is taken in larger amounts or over a longer period than intended
	9	In the past year, did you more than once want to try to stop or cut down on your use, but could not do it?	There is a persistent desire or unsuccessful efforts to cut down or control substance use
	10	In the past year, did you spend a lot of time using or getting over the bad after effects of use?	A great deal of time is spent in activities necessary to obtain the substance, use the substance, or recover from its effects
	11	In the past year, did you give up or cut down on activities that were important to you or gave you pleasure in order to use?	Important social, occupational or recreational activities are given up or reduced because of substance use
	12	In the past year, did you continue to use even though it was causing you to feel depressed or anxious or causing a health problem or making one worse?	The substance use is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by the substance

Note. DUD = drug use disorder; DSM-IV-TR = Diagnostic and Statistical Manual of Mental Disorders (Fourth Edition Text Revision).

Table 3.

Confirmatory Factor Analysis Goodness-of-Fit Statistics for Drug Use Disorder Questionnaire by DSM-IV-TR and DSM-V Diagnostic Criteria.

	Marijuana Scale		Cocaine Scale		Painkiller Scale	
	DSM-IV-TR	**DSM-V**	**DSM-IV-TR**	**DSM-V**	**DSM-IV-TR**	**DSM-V**
χ^2 Statistic (*df*)	572.02 (53) ***	1016.78 (55) ***	606.87 (53) ***	926.70 (55) ***	834.88 (53) ***	1545.96 (55) ***
CFI	0.912	0.838	0.930	0.890	0.909	0.826
NNFI	0.891	0.805	0.913	0.868	0.887	0.792
RMSEA	0.083	0.110	0.109	0.135	0.097	0.132
SRMR	0.042	0.122	0.036	0.146	0.047	0.140

Note. DSM-IV-TR = Diagnostic and Statistical Manual of Mental Disorders (Fourth Edition Text Revision); CFI = comparative fit index; NNFI = nonnormed fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual.

*** $p < .001$.

Table 4.

Multiple Regression Analysis of Age, Sex, and Race as Predictors of Marijuana, Cocaine, and Painkiller Abuse and Dependence.

	Marijuana		Cocaine		Painkiller	
	Abuse AOR (95% CI)	**Dependence AOR (95% CI)**	**Abuse AOR (95% CI)**	**Dependence AOR (95% CI)**	**Abuse AOR (95% CI)**	**Dependence AOR (95% CI)**
Sex						
Female	0.93 [0.64, 1.35]	1.71 * [1.09, 2.70]	1.61 [0.99, 1.66]	3.87 *** [2.06, 7.28]	0.58 ** [0.39, 0.86]	0.85 [0.54, 1.34]
Male	Referent	Referent	Referent	Referent	Referent	Referent
Age						
<21	Referent	Referent	Referent	Referent	Referent	Referent
21–34	0.45 *** [0.30, 0.68]	0.52 * [0.31, 0.86]	0.71 [0.37, 1.37]	0.25 ** [0.11, 0.55]	2.12 [0.99, 4.48]	0.45 ** [0.25, 0.81]
35–44	0.16 *** [0.07, 0.35]	0.16 ** [0.06, 0.48]	0.50 [0.21, 1.22]	0.42 [0.16, 1.10]	4.01 *** [1.86, 8.63]	1.39 [0.77, 2.49]
Over 45	0.23 *** [0.13, 0.44]	0.03 ** [0.01,0.22]	0.81 [0.40, 1.66]	0.37 * [0.16, 0.83]	3.42 ** [1.59, 7.35]	0.32 ** [0.15, 0.68]
Race						
Black	1.19 [0.79, 1.79]	1.75 * [1.05, 2.91]	0.72 [0.04, 1.30]	0.36 * [0.14, 0.92]	1.24 [0.84, 1.83]	0.58 [0.34, 1.00]
White	Referent	Referent	Referent	Referent	Referent	Referent

Note. AOR = adjusted odds ratio; CI = confidence interval.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Table 5.

Summary of Logistic Regression Odds Ratios With Drug Use Disorder Questionnaire (DUD) as a Predictor of Positive Screening for Substance.[a]

	Blood/Oral Fluid Positive for THC		Blood/Oral fluid Positive for Cocaine		Blood/Oral Fluid Positive for Painkillers	
	AOR	**(95% CI)**	**AOR**	**(95% CI)**	**AOR**	**(95% CI)**
Marijuana subscales						
Abuse	2.37***	[1.71,3.30]	—	—	—	—
Dependence	2.54***	[1.71, 3.37]	—	—	—	—
Cocaine subscales						
Abuse	—	—	2.29*	[1.14, 4.60]	—	—
Dependence	—	—	5.88***	[2.89, 11.96]	—	—
Painkiller subscales						
Abuse	—	—	—	—	2.42***	[1.52, 3.86]
Dependence	—	—	—	—	2 93***	[1.64, 5.22]

Note. AOR = adjusted odds ratio; CI = confidence interval.

[a]Controlling for age, sex and race.

*$p < .05$.

***$p < .001$.