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Psychometric Validation of the Leeds Dependence Questionnaire (LDQ) in a Young Adult Clinical Sample

John F. Kelly, Ph.D.[a], **Molly Magill, Ph.D.**[b], **Valerie Slaymaker, Ph.D.**[c], and **Christopher Kahler, Ph.D.**[b]

[a]Center for Addiction Medicine, Department of Psychiatry, Massachusetts General Hospital; Harvard Medical School

[b]Center for Alcohol and Addiction Studies; Brown University

[c]Hazelden Butler Center for Research, Hazelden Foundation, Center City MN

Abstract

Objective—Measures of substance dependence severity that are both clinically efficient and sensitive to change can facilitate assessment of clinical innovation necessary for improving current evidence-based practices. The Leeds Dependence Questionnaire (LDQ) is a 10-item, continuous, self-report measure of dependence that is not specific to any particular substance and has shown promise in preliminary psychometric research. The present study investigates its psychometric properties in a large clinical sample of young adults.

Method—Emerging adults (N = 300) were enrolled in a naturalistic treatment process and outcome study of residential substance dependence treatment (mean age 20.4 [1.6], range 18–25; 27% female; 95% White). Dependence severity by demographic and diagnostic groupings, factor structure and internal consistency, and criterion- and construct-related validity were examined.

Results—Dependence severity in this cohort of youth overall was high (M = 18.65 [8.65]). LDQ scores were highest among opiate and stimulant users, and there was a trend for higher scores among women compared to men (t = 1.869, p = .063). Factor analysis using a robust alpha factoring extraction revealed a single factor accounting for 63% of the variance in reported dependence severity. The internal consistency was also very high (alpha = .93). Concurrent and convergent validity with dependence criteria, substance use frequency, and general symptom severity, respectively, were also acceptable.

Conclusions—The LDQ shows considerable promise as a brief, psychometrically sound, measure of substance dependence useful across a variety of substances, that has clinical and research utility. This study supports its use among emerging adults.

Keywords

Assessment; Substance Abuse or Dependence; Psychometric; Young or Emerging Adults

Clinically efficient measures of substance dependence severity that are sensitive to change can help with individual- and program-level treatment evaluations, and therefore facilitate assessment of clinical innovation necessary for improving current evidence-based practices. The Leeds Dependence Questionnaire (LDQ) is a brief, 10-item, self-report measure of substance dependence intended to capture the essential elements of the dependence

Corresponding Author: John F. Kelly; (617) 643-1980; F: (617) 643-1998; jkelly11@partners.org; 60 Staniford Street, Boston, MA 02114.

syndrome (Edwards & Gross, 1976; Edwards, 1986) across all substance classes. Initial psychometric data show promise for the use of the instrument as a robust, unidimensional, measure of substance dependence severity (Heather et al., 2001; Raistrick et al., 1994). Its brevity, ease of administration and scoring, high content validity, and demonstrated patient acceptability further suggest it has excellent potential as a clinical and program evaluation tool. It has demonstrated utility as a measure sensitive to change in response to substance use disorder treatment among adults treated for alcohol and opiate dependence (Tober et al., 2000).

The LDQ can provide clinicians and researchers with a unitary, continuous, measure of dependence that is not specific to any particular substance. It provides a range of scores from 0–30 intended to capture the "graded intensity" of the dependence syndrome (Edwards, 1986). The original study describing the development and initial validation of the LDQ with four sub-samples (Raistrick et al., 1994; N = 174) and a subsequent larger, purely clinical validation study (Heather et al., 2001; N = 1,681; LDQ M = 19.70), were based primarily on adult alcohol or opiate users (M age = 34). Both studies yielded an internally consistent, single principal component from the 10-item measure that accounted for the majority of the variance. A subsequent study with young adults (Lennings, 1999) tested the instrument on two samples: the first was conducted with a low dependence severity sample of college students (M LDQ = 6.2) enrolled in a drug and alcohol education program (ages 17–48; M age = 25; N = 203). Evidence was found for two factors, "craving" and "positive reasons for use". The second of these two studies examined the measure in a smaller sample of primarily male "juvenile delinquents" (ages 11–18 M; age = 16; N = 118) with higher average levels of dependence (LDQ M =15.3)[1] and found stronger evidence for a single factor. A more recent study with a web-based/online, low severity sample (LDQ M = 4.3) of adolescent and young adult alcohol users (ages 16–24) revealed high internal consistency and a single principal component accounting for the majority of the variance (Thomas & McCambridge, 2008). Finally, a sample of low severity (LDQ M=7.3) untreated heavy drinkers (N = 500, M age 37) yielded a two factor solution, a "drinking ideation" factor, and a "achieving and maintaining intoxication" factor (Hartney et al., 2003).

The pattern of findings in previous research broadly suggests that as the sample increases in dependence severity, as measured by the LDQ (and other corroborative measures, such as the AUDIT), the number of extracted factors or principal components is reduced from two to one. This may reflect the fact that as dependence progresses, neurobiological change processes produce a syndrome of increasing consistency, as alluded to by Edwards (1986): "Not all elements need be present, or present in the same degree, but with mounting intensity the syndrome is likely to show increasing coherence". If this pattern generally holds true, then we would predict that factor analyses with *clinical* samples should yield an internally consistent, single factor that accounts for the majority of the variability in scores. To test this possibility, and to validate and extend prior psychometric findings, we sought to examine the psychometric properties of the LDQ in a large clinical sample of emerging adults (N = 300; 18–25 years old) treated in a residential facility in the mid-western United States. Compared to older treated adults, treated adolescents and emerging adults are characterized by more marked heterogeneity in their patterns and intensity of substance use, typically use a greater number of substances simultaneously, and have a higher density of psychiatric problems and psychological distress (Stewart & Brown, 1995; Pollock & Martin, 1999; Tims et al, 2002; Brown, Vik & Creamer, 1989; Chan et al, 2008; Kelly et al, 2008 Brown, 1993; SAMHSA, 2008). Their experience with, and motivation to change, substance use differs also (Kelly et al, 2008). Such clinically important differences necessitate further

[1]The range given in the original paper was incorrectly reported as "10–40" when the correct range of scores on the instrument should be from 0–30. Thus, the mean reported in the original paper as "25.3", is adjusted and reported herein as "15.3".

LDQ validation across this critical developmental period. The present sample also reflects a much broader array of substance use disorders than has been reported in previous research with youth (Lennings, 1999; Thomas & McCambridge, 2008).

Given the potential clinical and research utility of the LDQ, we investigate its psychometric properties, including factor structure and factorial invariance across gender and patients' primary substance of misuse, as well as criterion- and construct-related validity at treatment intake. Our primary aims were first to examine dependence severity scores by gender, age, and primary substance. Then, to examine factor structure and internal consistency overall and within demographic (i.e., gender) and clinical (i.e., primary substance of misuse) sub-groups. Finally, we sought to assess the concurrent and convergent validity (i.e., using DSM-IV dependence symptoms, percent days abstinent, general psychiatric symptom severity) of the LDQ.

Method

Study Population and Protocol

The study population consisted of 300 young adult patients (18–25 years old) undergoing residential treatment and enrolled in a naturalistic study of treatment process and outcome. Of possible participants, 83% of those approached were enrolled. They were 20.37 years old on average (SD = 1.58). The majority were Caucasian (95%), male (73%), and single (95%). Length of stay in the residential program was a mean of 25.29 days (SD = 6.15), and the majority of patients were discharged with staff approval (82%). The study was conducted in accordance with the Institutional Review Board at Schulmann Associates IRB, an independent review board, and all participants signed informed consent documents.

Regarding the respresentativeness of our clinical sample, we compared our private treatment sample with available public residential programs in this age-range using the Treatment Episode Data Set [TEDS]), and across a sample of private adult outpatient and residential programs (Roman et al., 2004) We found that compared to same-age, public sector, residential patients our participants are comparable in terms of gender (33% vs. 34% female), marital status (95% vs 92% never married), education (51% vs 53% did not complete high school), unemployment (30% vs 32%), and not being in labor force (e.g., student; 53% vs 54%), but we have a higher Caucasian majority (95% vs 76%). Primary substance at treatment entry was similar with the highest for alcohol (28% vs 21%) marijuana (27% vs 31%), cocaine (12% vs 14%) and opiates (21% vs 18%). Compared to *all* adults across *all* types of programs treated in *private* programs our sample was similar across these indices except for a greater Caucasian majority (95% vs. 71%), which is a limitation. However, we anticipate that results here will be broadly generalizeable to youth treated for SUD.

Measures

The LDQ—Alcohol or drug dependence severity was measured with the Leeds Dependence Questionnaire (LDQ; Raistrick et al., 1994). The LDQ is a 10-item self-report instrument sensitive to mild, moderate, and severe levels of dependence on alcohol and other drugs. The instrument was originally developed in eight pilot stages with groups of patients ranging from 5 to 50. The 10 items map onto the ICD-10 and DSM-IV criteria for substance dependence: Pre-occupation, salience, compulsion to start, planning, maximizing effect, narrowing of repertoire, compulsion to continue, primacy of effect, constancy of state, and cognitive set. The measure has established psychometric properties with adult alcohol or opiate using samples (Hartney et al., 2003; Heather et al., 2001; Raistrick et al., 1994),

primarily alcohol using young adults (Lennings, 1999; Thomas & McCambridge, 2008), and substance using adolescents (Lennings, 1999).

Criterion measures: Substance dependence and use frequency—The Structured Clinical Interview for DSM-IV-TR (SCID; First et al., 2002) was used to capture substance-related symptoms and diagnoses. To ensure inter-rater reliability, audio-taped interviews were reviewed for all assessments in the first month of data collection and for two randomly chosen interviews each week thereafter. The SCID-assessed DSM symptoms were chosen as the criterion for assessment of the concurrent validity of the LDQ. Given that the LDQ is a continuous measure of dependence assessing severity combined for alcohol and all other substances used by an individual, we calculated the total sum of DSM symptoms meeting threshold across all substance classes.

Alcohol and other drug use frequency were captured with a modified version of the Form 90 (Project MATCH Research Group, 1993). The Form 90 has been tested with adult and adolescent samples and has demonstrated test-retest reliability and validity (Slesnick & Tonigan, 2004; Tonigan, Miller, & Brown, 1997). Participant percent days abstinent (PDA) was chosen as a second criterion for assessment of the LDQ's concurrent validity.

Construct measure: General psychiatric symptom severity—The Brief Symptom Inventory-18 (BSI-18; Derogatis, 2001) captures depression, anxiety, and somatization symptoms, and provides sub-scale and global measures of symptom severity. It has acceptable internal consistency and test-retest reliability, with coefficients ranging from .74 to .89 (Derogatis, 2001). The BSI was chosen for assessment of the convergent validity of the LDQ.

Statistical Analysis

We first examined LDQ measures of central tendency and dispersion by participant's primary substance of misuse and provide sample descriptive data within each drug category. Next, dependence severity across gender and primary substance was assessed using a series of independent samples t-tests. Subsequently, factor structure and internal consistency measures were examined overall and then within demographic and clinical sub-groups to assess factorial invariance. In keeping with best practices for exploratory factor analysis (Costello & Osborne, 2005), we evaluated the influence of any multivariate non-normal distribution of residuals, by running both maximum likelihood and principal axis factoring extractions. Both methods produced identical results regarding the item composition of the extracted factors, and the variance accounted for by each extraction method was virtually identical. Given the similarity, we present the results of the more robust principal axis factoring in Tables 3 and 4. Also, although orthogonal rotation of factors is common in the social sciences (e.g., Varimax rotation) due to ease of interpretation, this method assumes that the factors are uncorrelated. Given that most phenomena are correlated in the social sciences, oblique rotations are considered optimal (Costello & Osborne, 2005). Consequently, we chose an oblique Promax rotation. Finally, we assessed concurrent (DSM-IV dependence symptoms, PDA), and convergent (BSI), validity, using a series of bivariate correlations. All analyses were conducted using SPSS 17.0.

Results

LDQ Scores by Gender and Drug of Choice

Within this clinical sample of young adults, the highest proportion of participants identified alcohol (n = 84) as their primary substance of misuse followed by cannabis (n = 79), opiates (n = 68), and stimulants (n = 53), respectively (see Table 1). Table 1 shows that the highest

percentage of females was in the alcohol (36.9%) and then stimulant (35.8%) categories. Conversely, young women (13.9%) were less likely to report cannabis as their primary substance compared to young men (86.1%). The highest LDQ scores were among participants identifying opiates (M = 21.79[6.72]) followed by stimulants (M = 21.30[7.79]) as their primary substance.

Table 2 shows LDQ scores by gender and primary drug of choice. Overall, there was a trend for higher dependence severity scores among young women compared to young men ($t = 1.869$, $p = .063$). This was particularly true for the young women who identified cannabis as their primary substance (M =18.55[9.38] vs males, M = 13.40[7.94]), although this difference was of borderline statistical significance ($p = .055$). Females were also comparatively less represented in this drug of choice group.

LDQ Factor Structure and Factorial Invariance

The principal axis factoring extraction yielded a single interpretable factor accounting for 61.64% of the variance. Loadings were all of high magnitude, and ranged from a low of .58 (item 8) to a high of .89 (item 4; Afifi & Clark, 1996; Tabachnick & Fidell, 2001; see Table 3). The two lowest magnitude loadings were for item 8 (.58) and item 5 (.69). The internal consistency for a single factor within the full sample was also very high (alpha = .93).

Table 4 shows assessment of factorial invariance by gender and primary drug of choice. Given the smaller sample sizes for these sub-groups, drug classes were combined into “softer” (alcohol and cannabis) and “harder” (opiates and stimulants) categories. Except for female participants, a single factor emerged across sub-groups and the percent of variance explained was consistently high, ranging from 56.26% to 64.61%. Compared to males, factor structure for females produced a large initial factor and a second factor accounting for an additional 11.08% of the variance that was comprised of items 5 (.67), 7 (.92), and 9 (.58). The Cronbach’s alpha internal consistencies, however, within these four sub-groups were all high: .89 (young women), .94 (young men), alcohol/cannabis (.94), opiates/stimulants (.93).

LDQ Criterion- and Construct-Related Validity

The concurrent validity of the LDQ with the two criterion measures, DSM-IV dependence symptoms (totaled across substances) and percent days abstinent (PDA), were acceptable. Specifically, there was a moderate positive Spearman rank-order correlation between the LDQ and concurrent dependence symptoms ($r = .424$, $p < .0001$) and a lower negative correlation with PDA ($r = -.315$, $p < .0001$). Regarding construct validity, a moderate convergence with other psychiatric symptom-related distress was expected and demonstrated. BSI subscale and global index associations were positive and ranged from .44 for somatic symptoms to .51 for global severity ($p < .0001$; see Table 5).

Discussion

This study examined the psychometric properties of a brief, face valid, and easily administered and scored measure of substance dependence - the LDQ. In general, LDQ severity scores varied by patient sub-groups and showed a trend for higher severity among young women. Psychometric results revealed a high degree of internal consistency overall and by gender and primary substance of misuse. Factor analysis also supported a robust single factor, including high factor loadings for all LDQ items. This was apparent across classes of primary substance, but varied slightly by gender. Together with the results demonstrating acceptable concurrent and convergent validity, findings here indicate that the

LDQ is a reliable, valid, and clinically efficient measure of substance dependence severity suitable for use with emerging adults.

Analyses of LDQ scores by patient sub-group showed a trend for higher dependence severity among young women compared to young men. This was particularly true for women who identified cannabis as their primary substance of misuse. However, young women were comparatively less represented in this primary substance group. Compared to young men treated for SUD, cannabis as a primary substance appears much rarer among young women, but when it is primary, dependence may be more severe. Higher overall severity scores for women in this young treatment sample are noteworthy since higher rates of SUDs are observed among males in the general population (SAMHSA, 2008). This may reflect a tendency for young women to reach higher levels of severity before their behavior begins to cause the social problems that garner attention from concerned others. Because adolescent boys and young adult men tend to display greater externalizing behavior when using substances (e.g., alcohol), they may be more easily noticed and receive intervention or pressure to enter treatment at an earlier stage of dependence. Women tend to incur health consequence at a faster rate than men ("telescoping"; Greenfield, 2002; Hernandez-Avila et al.,, 2004; Schuckit et al., 1998) early detection through screening and appropriate intervention is therefore particularly important for young women (National Institute for Alcohol Abuse and Alcholism, 2005).

Similar to the clinical samples of Raistrick et al. (1994) and Heather et al., (2001), principal axis factoring extraction yielded a single interpretable factor accounting for a high proportion of the variance (i.e., 61.64%) in LDQ scores. This is also similar in magnitude to these prior clinical samples. Consistent with Raistrick's original validation study, items 5 ("Do you drink or take drugs in a particular way in order to increase the effect it gives you?") and 8 ("Is getting the effect you want more important than the particular drink or drug you use?") loaded relatively lower on the single factor, although these were still quite high in absolute terms. However, these items might benefit from rewording to better capture the experience of using substances to maximize effect.

Factorial invariance was demonstrated well across primary substance classes, but differed somewhat by gender. The variability in factor structure across gender should be viewed as preliminary due to the relatively small sample size of young women. Further research should examine the LDQ and other dependence measures by gender since differences in topography and patterns, types, and intensity of substance use as well as in treatment outcomes have been noted in prior research (Brady and Randall, 1999). However, consistent with Heather et al. (2001), who showed factorial invariance across opiate, alcohol, and "other drug" sub-samples, we found good overall evidence for a robust single factor underlying the measure in this clinical sample of emerging adults.

The concurrent validity of the LDQ with the two criterion measures, DSM-IV dependence symptoms and PDA, were acceptable, but lower than anticipated. There was only a moderate positive Spearman rank-order correlation between the LDQ and concurrent dependence symptoms, suggesting these may be capturing different aspects of the same construct. For example, the DSM-IV symptoms also capture tolerance and withdrawal, which are elements that are not captured directly on the LDQ. According to the measure's developers, tolerance and withdrawal are understood as sequelae of regular use and not aspects of "dependence" itself (Raistrick et al., 1994). Thus, the purely psychological aspects of the LDQ compared to the biobehavioral construct captured in DSM may help to explain the lower than expected concordance between these measures. Conversely, the moderate relationship with PDA may reflect a limitation of frequency of use as a measure of dependence severity. Specifically, individuals may use frequently, but not intensively. A

measure of days of heavy use could prove a more suitable criterion for assessment of concurrent validity. However, we did not find that a measure of heavy drinking days (number of days on which patients drank 6 or more drinks) correlated with the LDQ (r=.06, p=.63). We did not have a measure of "heavy" drug use days, but such a measure (e.g., on how many days were you high nearly all day or most of the day) may be a better criterion among young clinical samples who use multiple substances simultaneously. Finally, regarding construct validity, a moderately high convergence was observed with psychiatric symptoms on the BSI subscales and the global index. Because heavy substance use does affect brain systems associated with mood regulation and anxiety sensitivity as well as produce physical symptoms (e.g. gastrointestinal distress; Heinz et al, 1998; Harper, 2009), it is not surprising that these symptom levels are elevated among those with increasing dependence severity.

Limitations and Future Directions

Findings herein should be considered in light of several limitations. First, while our sample of young adults was broadly comparable to other national clinical samples in the same age range in the public sector treatment and to adult clinical samples in the private sector, generalizability to all emerging adults across all levels of clinical care is unknown. Second, while the overall sample size was clearly a strength, the relatively smaller sample of young women supports replication of the gender differences found here with further gender-based psychometric study. Finally, additional research with an expanded repertoire of criterion measures may better validate the concurrent validity of the LDQ.

Conclusions

The alcohol dependence syndrome has become well-established since its introduction as a "provisional clinical syndrome" by Edwards and Orford (1977). The LDQ provides a measure of the dependence syndrome, captures the essential elements of dependence on drugs other than alcohol, and can aid understanding of commonalities across various addictions. Brief, clinically useful, continuous, measures of substance dependence are rare in the field, but can prove useful for clinical and program evaluation purposes. The LDQ shows promise as reliable and valid dimensional measure of dependence. This study supports its use among emerging adults.

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Table 1

Sample Characteristics and LDQ Scores for each Primary Substance of Use

Primary Substance	*n*	Mean age (SD)	% Female	Mean LDQ (SD)	Median LDQ	LDQ Range
Alcohol	84	20.7 (1.7)	36.9%	16.55 (7.60)	17.0	1–30
Cannabis	79	20.1 (1.5)	13.9%	14.11 (8.29)	15.0	0–30
Opiates	68	20.6 (1.5)	22.1%	21.79 (6.72)	23.5	6–30
Stimulants	53	19.9 (1.5)	35.8%	21.30 (7.79)	23.0	5–30
Benzodiazepines	6	20.5 (0.8)	16.7%	19.50 (9.27)	20.5	3–28
Other	6	20.0 (2.0)	0.0%	16.33(10.09)	15.0	4–28
Total *	296	20.4 (1.6)	26.0%	18.01 (8.28)	19.0	0–30

* Four individuals did not report a primary substance

Table 2

Mean (SD) LDQ Scores by Gender and Patients' Primary Substance Category

Primary Substance	Male	Female	*t*	*p*-value
Alcohol	15.79 (8.34)	17.84 (6.06)	1.193	.236
Cannabis	13.40 (7.94)	18.55 (9.38)	1.945	.055
Opiates	21.51 (7.10)	22.80 (5.28)	0.653	.516
Stimulants	21.50 (8.02)	20.95 (7.58)	0.245	.807
Total	17.40 (8.59)	19.70 (7.03)	1.869	.063

Table 3

Individual LDQ Item Loadings on Factor 1

Item	Factor 1
1. Do you find yourself thinking about when you will next be able to have another drink or take more drugs?	.741
2. Is drinking or taking drugs more important than anything else you might do during the day?	.837
3. Do you feel that your need for drink or drugs is too strong to control?	.811
4. Do you plan your days around getting and taking drink or drugs?	.887
5. Do you drink or take drugs in a particular way in order to increase the effect it gives you?	.690
6. Do you take drink or other drugs morning, afternoon, and evening?	.709
7. Do you feel you have to carry on drinking or taking drugs once you have started?	.786
8. Is getting the effect you want more important than the particular drink or drug you use?	.579
9. Do you want to take more drink or drugs when the effect starts to wear off?	.780
10. Do you find it difficult to cope with life without drink or drugs?	.728

Table 4

LDQ Factor Structure by Gender and Primary Substance

	Factor 1 Eigenvalue	Factor 2 Eigenvalue	% of Variance Factor 1	% of Variance Factor 2	Total % Variance Accounted for
Males	6.46	---	64.61	---	64.61
Females	5.24	1.11	52.41	11.08	63.49
Alcohol & Cannabis	6.03	---	60.27	---	60.27
Opiates & Stimulants	5.63	---	56.26	---	56.26

Table 5

Means (SD) and Bivariate correlations showing the criterion-related validity of the LDQ

	Mean (SD)	1	2	3	4	5	6	7
1. DSM Symptoms[a]	11.85 (6.81)	-	.424**	−.235**	.275**	.285**	.305**	.331**
2. LDQ	18.05 (8.24)		-	−.315**	.437**	.472**	.398**	.512**
3. PDA	21.52 (25.33			-	−.291**	−.125	−.200**	−.216**
4. BSI Somatic	55.06 (11.34)				-	.502**	.684**	.795**
5. BSI Depression	64.19 (10.96)					-	.653**	.864**
6. BSI Anxiety	61.65 (10.94)						-	.891**
7. BSI Global Index	62.94 (10.31)							-

** p=<.001. Notes.

[a] Sum of symptoms met across substance classes. LDQ: Leeds Dependence Questionnaire; BSI: Brief Symptom Inventory.

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