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The Kreek–McHugh–Schluger–Kellogg scale: a new, rapid method for quantifying substance abuse and its possible applications

Scott H. Kellogg, Pauline F. McHugh, Kathy Bell, James H. Schluger, Rosemary P. Schluger, K. Steven LaForge, Ann Ho, Mary Jeanne Kreek *

The Laboratory of the Biology of Addictive Diseases, The Rockefeller University, 1230 York Avenue, New York, NY 10021-6399, USA

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Abstract

The new Kreek–McHugh–Schluger–Kellogg scale ('KMSK scale') is designed to quantify self-exposure to opiates, cocaine, alcohol, and/or tobacco. Each section of the KMSK scale assesses the frequency, amount, and duration of use of a particular substance during the individual's period of greatest consumption. The scale also assesses the mode of use, whether the substance use is current or past, and whether each substance is the substance of choice. The administration time is under 5 min. In an initial validation study of this scale, 100 human subjects were administered the KMSK scale concurrently with the Structured Clinical Interview for DSM-IV (SCID-I DSM-IV version). The sensitivity and specificity were very good for opiates, cocaine, and alcohol use. In addition, the correlations between KMSK scores and the number of SCID-I criteria items met were excellent for opiates and cocaine and good for alcohol use. Nicotine dependence was not assessed in this study as there is no SCID-I nicotine criteria. These preliminary results show that the KMSK scale may have both construct validity similar to that of other established self-report measures and the potential to be an effective screening instrument for the assessment of a lifetime diagnosis of alcohol, opiate, or cocaine dependence.

Keywords: Tests and measures; Assessment; Cocaine; Opiate; Alcohol; Nicotine; Nosology

1. Introduction

In both addiction and psychiatric research, there is an ongoing need for rapid and accessible tools that can not only quantify substance self-exposure, but also diagnose addiction. Instruments such as the Addiction Severity Index (ASI; McLellan et al., 1984) and the Structured Clinical Interview for DSM-IV (SCID-I; First et al., 1995, 1998; First, 1997) are commonly-used tools. Such measures are the 'gold standards' in the field of addiction research, and they have been validated in many studies and have been shown to have good inter-rater reliability in both adult and adolescent subjects (Langenbucher et al., 1994; Kranzler et al., 1996; Ustun et al., 1997; Martin et al., 2000). They are, however, training-, time-, and labor-intensive. A number of brief screening tools have been developed for both alcohol and drugs, and these include such instruments as the CAGE, the AUDIT, the BMAST, and the TWEAK (see Bradley et al., 1998) for alcohol use and the DAST-10 (Skinner, 1982) for drug use.

The Kreek–McHugh–Schluger–Kellogg scale (KMSK scale) was designed to be a brief assessment instrument that could be easily administered with little training. The scale has also been translated into French, Spanish, Italian, and Hebrew to facilitate research on its usefulness in other cultures. The scale is derived from the observation that substance addiction is directly correlated with the degree of self-exposure that an individual has to the drug (Kreek, 1973, 2000). 'Self-exposure' is a measure consisting of the frequency, duration, and amount of drug use at the period of time in an individual's life when he or she was using the drug the most.

* Corresponding author. Tel.: +1-212-327-8248; fax: +1-212-327-7023

E-mail address: kreek@rockvax.rockefeller.edu (M.J. Kreek).

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This approach is in marked contrast to the other commonly-used brief screening instruments. While the AUDIT does ask some questions about frequency and amount, the other commonly-used short inventories (CAGE, BMAST, TWEAK, and DAST-10) focus primarily on loss of control and the negative consequences of substance use. In developing the KMSK scale, it was hypothesized that the overall degree of self-exposure to a drug may be predictive of a diagnosis of dependence, and, possibly, neurobiological changes similar to those seen in our animal studies (e.g. Unterwald et al., 1994; Zhau et al., 1996). Our aim was to demonstrate that the quantification of drug self-exposure would be a useful tool for addiction research, while potentially serving as a valid method for drug-dependence screening in a clinical setting.

2. Methods

2.1. The development and scoring of the KMSK scale

Since methods and patterns of self-administration of different substances can vary greatly depending on drug type, it was decided to rate each substance separately. Questions about rate, duration, and quantity of drug use were tailored to the individual drug category where necessary, although the basic structure of the questions was kept the same for each drug scale. The range of answers was derived by agreement of the three physicians connected with the study (PFM, JHS, and MJK), and they reflected both clinical experience and the scientific perspective on exposure and addiction that has been championed by our group. An additional question, concerning whether a substance was the subject's 'drug of choice', was also included but not given a numerical value.

The scoring system for each of the four subscales follows the same pattern. Question 1 (see Appendix A) provides a range of possible patterns for the frequency of use. The interviewer chooses the most appropriate answer and then assigns the corresponding number of points to the Frequency Score. The questions concerning the age of heaviest use and the status of current use require no numerical scoring. Question 4 on the Alcohol, Tobacco, and Cocaine scales (and the equivalent question 5 on the Opiates scale) assesses the duration of the period of heaviest use. As it was felt that there needed to be a certain amount of exposure for a measure of duration to make sense, there is a threshold that must be met by the Frequency Score before the individual is given a Duration Score. In the case of alcohol, it must be a '3' or higher; in the case of cocaine and opiates, a '2' is sufficient. An Amount Score is then determined. (This is question 5 on the Alcohol and Tobacco scales, question 6 on the Cocaine scale, and question 7 on the Opiate scale.) For the Alcohol scale, the Amount Score can be assessed directly, while for cocaine and opiates, it may be necessary to take a preliminary step to convert the answer into a common denominator. The Total Score is then determined by summing the Frequency, Duration, and Amount Scores.

2.2. Study participants

As part of an ongoing molecular genetics project (Bond et al., 1998; LaForge et al., 2000a,b; Cigler et al. 2001; Chen et al., 2002), potential volunteers were recruited through print advertisements, posters, radio announcements, and methadone maintenance and abstinence-based outpatient treatment clinics. These included both normal healthy volunteers and individuals with defined addictive diseases. This study utilized the data of 100 out of 226 consecutive volunteers. The 126 subjects who were not part of this study were excluded for the following reasons: 17 were family members of other substance-using volunteers and they did not receive these diagnostic instruments, 16 did not receive the KMSK scale, ten received an earlier version of the scale, 13 did not have a completed SCID-I questionnaire, four presented with nonpsychotic psychiatric problems that may have jeopardized the validity of their answers, two did not complete the study, four had a history of polysubstance abuse which meant that specific diagnoses for opiate and cocaine dependence were unavailable and 60 were excluded because of the absence of one or more specific items within any scale.

Of the 100 who constituted the final sample, the demographic profile was 53% male, 47% Caucasian, 31% African-American, 19% Hispanic, 2% Asian, and 1% other. The mean age was 36.2 years (S.D. = 11.9 years). In terms of substance abuse treatment, 16% were currently attending a methadone program, 6% were either in other kinds of addiction treatment or were regularly attending self-help groups, 6% reported a past treatment history, and 72% reported no treatment history.

Subjects were initially screened over the telephone by a research nurse to determine eligibility for participation. The only criterion for exclusion from participation in the ongoing genetics study was the presence of an active psychotic disorder or any other problem that may have raised questions about the subject's ability to understand our IRB-approved informed consent (developed for sharing samples and data with the NIH-NIDA Human Genetics Consortium) and to be able to tolerate the administration of lengthy questionnaires. All eligible subjects were then assessed in The Rockefeller University Hospital Clinic by a research nurse, clinical psychologist, or psychiatrist over one or two sessions. All subjects gave written informed consent prior to the

evaluations. Subjects received a modest financial reimbursement for their time.

Out of the sample of 100 volunteers, 54 did not meet the criteria for any DSM-IV alcohol, cocaine, or opiate dependence diagnoses as ascertained by the SCID-I. One member of this group qualified for a marijuana dependence diagnosis while another met the criteria for marijuana abuse. Of the 46 who did receive an alcohol, opiate, or cocaine dependence diagnosis, 25 were dependent on one substance, 16 were dependent on two substances, and five were dependent on three substances at some point in their lives. The single diagnosis group ($n = 25$) was made up of 12 who qualified for cocaine dependence, seven who received a diagnosis of alcohol dependence, and six who met criteria for opiate dependence. The multiple diagnosis group ($n = 21$) included participants who met dependence criteria in the following patterns: eight for opiates and cocaine, six for alcohol and cocaine, five for opiates, cocaine, and alcohol and two for opiates and alcohol. (It should be noted that these were multiple lifetime diagnoses and did not necessarily mean that they had been dependent on more than one substance at the same time.) Eight members of this group also received additional dependence and/or abuse diagnoses for substances that were not under scrutiny in this study. There were no gender or ethnic differences in relation to the likelihood of receiving a cocaine, opiate, or alcohol dependence diagnosis.

For those who did not meet the criteria for substance dependence, but who had had some exposure to substances, it was possible to meet a diagnosis of alcohol or substance abuse. Eight patients received a diagnosis of alcohol abuse and three of these were found to be dependent on cocaine, one was dependent on opiates and one was dependent on cocaine and opiates. Only one patient met the criteria for opiate abuse, and none of the patients met criteria for cocaine abuse.

2.3. Assessment

All of the examiners were fully trained in the use of the SCID-I. For administration of the KMSK scale, examiners were instructed to simply read the questions and answers to the study subjects and to circle the best corresponding answer. Space on the scale was allotted for comments by examiners if any answers required clarification. The same research personnel administered both the KMSK scale and the SCID-I. This was typically done during a single assessment period, but it was occasionally done over two sessions.

Both the SCID-I and the KMSK scale assess drug and alcohol use during the period of greatest intensity. The time frame for the SCID-I questions on alcohol dependence is centered on the question, 'When in your life were you drinking the most' (First et al., 1998, p. E 1). The time frame for the non-alcohol use disorders is centered, for each particular substance, on the question, 'When were you using (DRUG) the most?' (First et al., 1998, p. E 10). The KMSK scale analyzes the time frame in a similar manner, 'At the time in your life when you were drinking the most alcohol…'; 'At the time in your life when you were using the most cocaine or crack cocaine…'; 'At the time in your life when you were using the most (a) heroin or (b) illicit (not prescribed) opiates….'.

2.4. Statistical analyses

The first evaluation of this new measure was a correlational analysis between the KMSK scale scores for opiates (range 0–13), cocaine (range 0–16) and alcohol (range 0–13) and the number of SCID-I diagnostic criteria met for each of the respective substances (range 0–7). A receiver operating characteristics (ROC) analysis (Baldessarini et al., 1983; Murphy et al., 1987; McFall and Treat, 1999) was done next to determine both the validity of the KMSK scales and to find the best cutoff score for alcohol, cocaine, and opiate problems (tobacco was not analyzed in this study because there is no SCID scale for nicotine dependence).

The ROC analysis provides several pieces of useful information about the relationship between a scale and a criterion measure. The area under the ROC curve (AUROC curve; Bradley et al., 1998) is an overall measure of the relationship between the scale and the criterion with a score of 0.5 reflecting a chance relationship and 1.0 representing a perfect relationship (scores lower than 0.5 reflect a predictive ability that is worse than chance). For this study, volunteers who received a SCID-I score of 3 or greater for alcohol, cocaine, or opiate dependence were give the criterion score of '1'. Those who received scores of 0, 1, or 2 were given a '0' score for that substance; this was also true for volunteers who never used the substance. The score of 3 was chosen because this is the minimum number of DSM-IV symptoms necessary to receive a diagnosis of alcohol or substance dependence. The nine patients who received an abuse but not a dependence diagnosis for a specific substance also received a '0' score for that dependence diagnosis.

One of the functions of the ROC approach is to provide a method for determining the 'best' cutoff score for a scale. This is achieved by examining the relative sensitivity and specificity levels that would accompany the choice of a specific cutoff score. The sensitivity of a scale answers the question, using a specific cutoff score, of how likely is it that the scale will correctly diagnose a condition if it is actually there. The specificity of a measure, in turn, reflects the ability of a scale to correctly diagnose the absence of a condition when it actually does not exist using a specific cutoff score. The

sensitivity and specificity will change as different cutoff scores are used. In this study, the goal was to find the KMSK cutoff score that best predicted which participants received a dependence diagnosis.

The determination of the best cut-off score was made through the use of a χ^2 analysis. Each KMSK score, for each of the three scales, was entered into a two-by-two χ^2 equation. While the choice of a cutoff score may be influenced by the specific intent of the scale and/or the characteristics of a given population, if those things are not an issue, the cutoff score with the highest χ^2 value may well be the best choice (Gavin et al., 1989).

Two other measures that are of interest, but which are also highly influenced by the prevalence of a disorder within a given sample, are the positive predictive potential (PPP) and the negative predictive potential (NPP). The PPP is a measure of how likely the categorization given by the test is to be correct if it says that a condition does exist using that cutoff score. The NPP, on the other hand, reflects how likely the test is to be correct if it categorizes a subject as not having a condition or diagnosis given a specific cutoff score. These proportions will also change as different cutoff scores are used.

The KMSK scales were also evaluated to see if they were able to not only assess the presence or absence of a dependence diagnosis, but also to see if they were able to predict the severity of the diagnosis among those who were drug or alcohol dependent (Allen et al., 1997). Correlational analyses were done between the KMSK and the SCID-I for this subsample. In addition, the relative number of diagnostic criteria met by each diagnostic subgroup was evaluated. All analyses were performed using the SPSS 10.0 software (SPSS, 2000).

3. Results

3.1. Overall results

The results from the overall analysis are presented in Table 1, the relative benefits of using a specific cutoff score are shown in Table 2, and the ROC graphs for opiates, cocaine, and alcohol are shown in Fig. 1. A cutoff score means that the participant received that score or a higher one. The mean scores for the KMSK scale and the number of SCID-I diagnostic criteria met are presented for opiates, cocaine, and alcohol. The means and standard deviations are presented for both the whole sample of 100 subjects and for the subgroup of subjects who received a diagnosis for opiate, cocaine, or alcohol dependence, respectively.

3.2. Opiate users

The correlation between the two scales was very strong when using the whole sample (see Table 1). When opiate-dependent subjects ($n = 21$) were examined, the correlation was not significant. In the opiate dependent group ($n = 21$), 52% met all seven SCID-I criteria and an additional 19% met six of the seven criteria. The fact that this was a highly dependent subsample may have led to a 'ceiling effect'. The overall strength of the scale is further demonstrated through the excellent AUROC, sensitivity, and specificity scores as well as through the PPP and NPP scores.

The complexity of choosing the best opiate dependence cutoff score is illustrated in Table 2. The cutoff score of two shows perfect sensitivity and very good specificity. The NPP for this cutoff score is 100% while the PPP is 78%. The use of a higher score, the one determined through a χ^2 analysis, would be a safer choice.

3.3. Cocaine users

The results of the KMSK Cocaine scale parallel those of the Opiate scale. The correlation between the KMSK and the SCID-I was excellent for the whole group, but insignificant for those who qualified for a diagnosis of cocaine dependence. As noted above, this means that the Cocaine scale may do an excellent job of predicting the likelihood of a cocaine dependence diagnosis, but it was not able, in this small sample, to predict levels of severity among those who have a cocaine dependence diagnosis. As was found in the Opiate scale analysis, many of the participants showed high levels of dependence. In this case, among the cocaine dependent group ($n = 31$), 48% met all seven criteria and an additional 23% met six of the seven criteria. Again, the data may be exhibiting a 'ceiling effect'. The ability of the scale to correctly categorize participants was supported by the AUROC, sensitivity, and specificity scores. The PPP and NPP were also very strong.

The χ^2-derived score of 11 yielded a PPP of 88% and an NPP of 99%. With this particular sample, using the χ^2-derived score of 11 is a better choice.

3.4. Alcohol users

The results of the Alcohol scale are somewhat more complicated. The data also differed from data for the other substances in that it was possible to evaluate subjects with alcohol abuse. Using a subsample of patients who did not receive an alcohol dependence diagnosis ($n = 80$), there was a significant difference on the KMSK Alcohol scale between the eight volunteers who received an alcohol abuse diagnosis ($m = 9.1$;

Table 1
Analysis of KMSK and SCID-I comparisons

KMSK subscale	Mean KMSK scale score	Mean SCID score	KMSK–SCID correlation	AUROC (95% CI)	Sensitivity	Specificity	PPP/NPP	Overall accuracy
Opiates whole sample ($n = 100$)	$m = 2.7$, $S.D. = 4.6$	$m = 1.3$, S.D. = 2.5	$r = 0.93$, $P < 0.0005$	0.996, (0.988–1.004)	100%, (Cutoff = 9)	99% (Cutoff = 9)	PPP = 95%, NPP = 100% (Cutoff = 9)	99%
Opiate dependent ($n = 21$)	$m = 11.0$, $S.D. = 1.5$	$m = 6.0$, S.D. = 1.3	n.s.					
Cocaine whole sample ($N = 100$)	$m = 5.6$, $S.D. = 6.7$	$m = 1.9$, S.D. = 2.8	$r = 0.87$, $P < 0.0005$	0.982, (0.960 – 1.003)	97%, (Cutoff = 11)	94%, (Cutoff = 11)	PPP = 88%, NPP = 99%, (Cutoff = 11)	95%
Cocaine dependent ($n = 31$)	$m = 14.3$, $S.D. = 1.9$	$m = 6.0$, S.D. = 1.3	n.s.					
Alcohol whole sample ($N = 100$)	$m = 7.1$, $S.D. = 4.3$	$m = 1.2$, S.D. = 2.2	$r = 0.59$, $P < 0.0005$	.933, (0.880–0.985)	90%, (Cutoff = 11)	90% (Cutoff = 11)	PPP = 69%, NPP = 97%, (Cutoff = 11)	90%
Alcohol dependent ($n = 20$)	$m = 11.8$, $S.D. = 1.3$	$m = 5.4$, S.D. = 1.2	$r = 0.56$, $P < 0.05$					

Table 2
KMSK cutoff scores: impact on sensitivity and specificity

KMSK scale cutoff score	Sensitivity (%)	Specificity (%)	χ^2-value	Significance
Opiate 2	100	92	71.9	$P < 0.0005$
Opiate 3	100	94	75.7	$P < 0.0005$
Opiate 4	100	95	79.8	$P < 0.0005$
Opiate 5	100	96	84.2	$P < 0.0005$
Opiate 6	100	96	84.2	$P < 0.0005$
Opiate 7	100	98	89.0	$P < 0.0005$
Opiate 8	100	98	89.0	$P < 0.0005$
Opiate 9	100	99	94.2	$P < 0.0005$[a]
Opiate 10	81	99	71.4	$P < 0.0005$
Cocaine 8	100	90	73.3	$P < 0.0005$
Cocaine 9	100	91	76.5	$P < 0.0005$
Cocaine 10	100	91	76.5	$P < 0.0005$
Cocaine 11	97	94	78.9	$P < 0.0005$[a]
Cocaine 12	90	96	73.9	$P < 0.0005$
Alcohol 8	100	55	19.6	$P < 0.0005$
Alcohol 9	95	68	25.3	$P < 0.0005$
Alcohol 10	95	76	34.5	$P < 0.0005$
Alcohol 11	90	90	53.2	$P < 0.0005$[a]
Alcohol 12	60	94	32.8	$P < 0.0005$

[a] Optimal cutoff score as determined by χ^2-value.

S.D. = 3.0) and the 72 who did not ($m = 5.6$; S.D. = 3.9), Mann–Whitney U, $P < 0.05$.

Using the entire sample, the overall correlation between the two scales was good, but not as strong as that for opiates and cocaine. In contrast to the other two scales, the Alcohol scale was also a moderate predictor of level of severity among the subgroup of participants who met the criteria for alcohol dependence, $r = 0.56$, $P < 0.05$. When those who received a diagnosis of alcohol dependence were separated from those who also received a cocaine and/or opiate diagnosis, the scale was significant for the alcohol-only group alone (this alcohol-only group was also free of diagnoses not under consideration in this study as only one subject met criteria for any other diagnoses and that was marijuana abuse). While a very small subsample ($n = 7$), the alcohol-only group showed a strong correlation between the two scales, $r = 0.79$, $P < 0.05$. There was no significant correlation between the two scales, however, among those who also received a cocaine and/or opiate dependence diagnosis ($n = 13$). There was somewhat less of a 'ceiling effect' for this group. For the alcohol dependent group as a whole ($n = 20$), only 15% met all seven SCID-I criteria and 40% met six out of the seven criteria.

The AUROC, sensitivity, and specificity were all very good for the Alcohol scale, although they were not quite as strong as they were for opiates and cocaine (see Table 1). χ^2 Analyses were performed for the KMSK Alcohol scale questions 1, 4, and 5 to see which pattern appeared to co-occur with alcohol dependence. These three separate analyses found that the alcohol-dependent participants: (a) were quite likely to have been involved in daily or near daily drinking (sensitivity, 85%; specificity, 90%); (b) had their period of heaviest drinking last for 6 months or more (sensitivity, 95%; specificity, 56%); and (c) typically consumed five or more drinks per sitting during their period of heaviest use (sensitivity, 85%; specificity, 77%).

The World Health Organization (WHO; World Health Organization, 1998, 2000) guidelines for alcohol consumption rate the use of more than three drinks per day and 21 drinks per week as 'high-risk' drinking for men, and more than two drinks per day and 14 drinks per week as 'high-risk' drinking for women. While the KMSK alcohol questions were not modeled on these guidelines, the data does provide an opportunity to examine the relationship between quantity consumed and the development of dependence. With these WHO guidelines in mind, additional analyses were performed to look at the relationship between consumption patterns, particularly amount, and the probability of receiving a dependence diagnosis. The first comparison was between those who scored from 0 to 2 points on the Alcohol Amount score of KMSK scale (Question 5; reflecting 0–3 drinks per sitting) and those who scored 3 or more points (reflecting four or more drinks per sitting). Of the subsample ($n = 53$) who drank three drinks or less, the correlation between the KMSK Alcohol scale and the SCID-I Alcohol Dependence scale was small but significant, $r = 0.36$, $P = 0.01$. The median and modal drinking frequency score for this group was 1. e. 'A few times a year, on special occasions' (see Appendix A). For the subsample that drank 4 or more drinks per sitting ($n = 47$), the correlation, $r =$

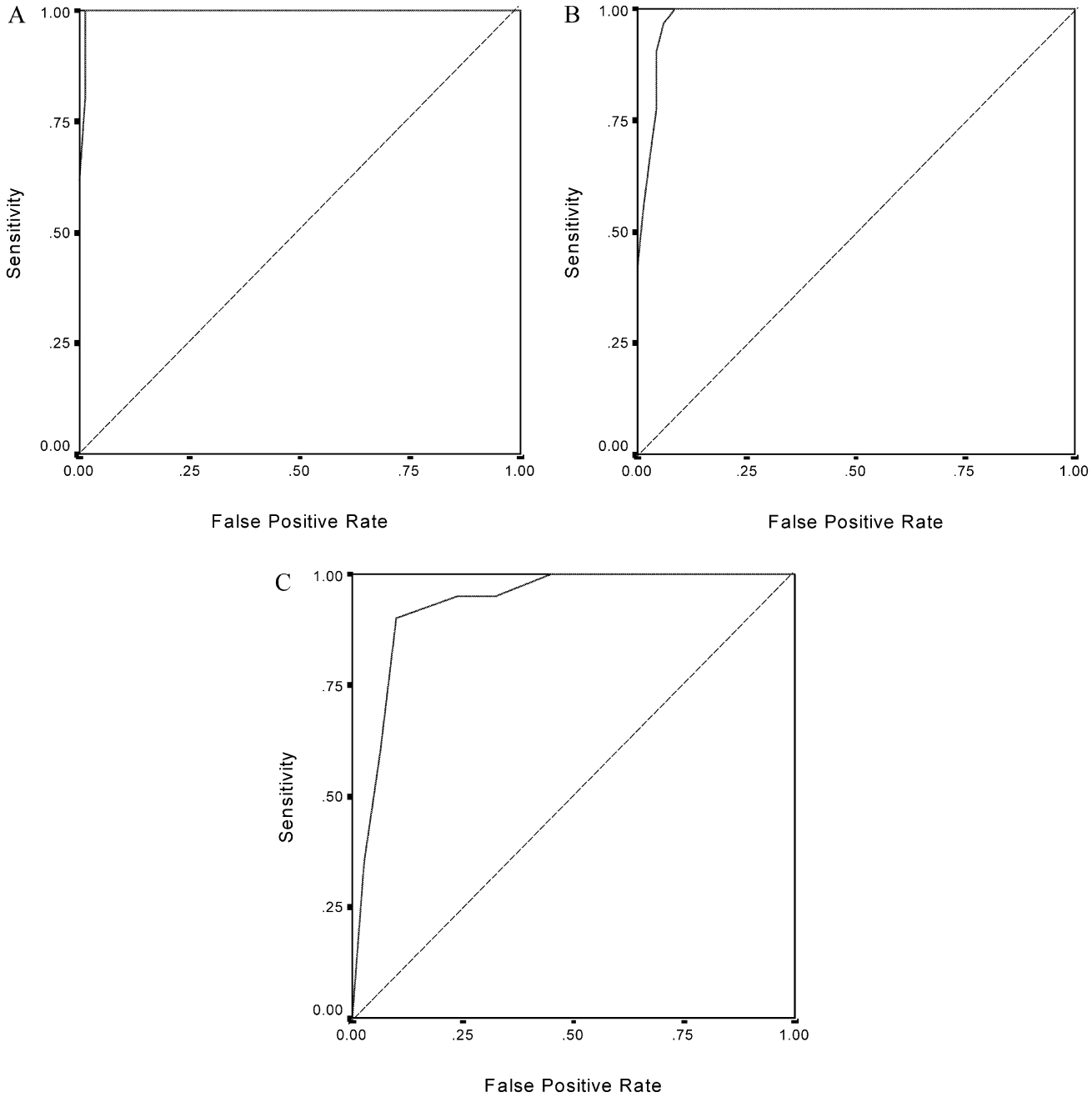

Fig. 1. The vertical axis is a measure of the sensitivity of the KMSK scale and the horizontal axis is a measure of the false positive rate for the same scale. The diagonal is a reflection of chance. The specific graphs are (A) the Opiate Dependence ROC graph; (B) the Cocaine Dependence ROC graph; and (C) the Alcohol Dependence ROC graph.

0.65, $P < 0.0005$, improved slightly over that for the whole sample (see Table 1). The median drinking frequency for this group was Alcohol scale answer 1. b. 'Three or more days a week', and the modal drinking frequency was Alcohol scale answer 1. a. 'Every day, or nearly every day'. The implication here is that there is a threshold exposure level that is necessary to reach before dependence symptomatology begins to appear. The range of KMSK Alcohol Scores was 0–10 for this low consumption group; however, only two of 53 participants in this group received any SCID-I Alcohol Dependence scores. Among those who received a diagnosis of alcohol dependence ($n = 20$), 90% typically drank four or more drinks at a sitting; among those who did not meet dependence criteria, 64% drank less than this at a sitting.

4. Discussion

4.1. Opiate dependence

The Opiate scale analyses revealed that even a relatively low level of exposure to opiates, as reflected in a cutoff score of 2, was sufficient to lead to a dependence diagnosis. However, if one wishes to reduce the likelihood of a false positive diagnosis, it would be better to use a cutoff score of 9, which is the score that had the best fit in the χ^2 analysis (see Table 2). The KMSK Opiate scale predicted the likelihood of a lifetime diagnosis; however, it did not predict the severity of the problem among those who met dependence criteria. There may have been a problem of restriction of range since out of the 21 volunteers who met SCID-I dependence criteria, 71% met six or seven of the seven opiate dependence criteria. Whether this is a reflection of the addictive nature of opiates is something that will need to be explored in future studies with other samples.

4.2. Cocaine dependence

The Cocaine scale also performed quite well. The correlation between the KMSK scale and the number of DSM-IV symptoms the person had experienced was quite strong. As was seen in the Opiates scale, the Cocaine scale scores reflected the probability of having met the criteria of dependence, but they were not a measure of severity among those who were dependent. Again, restriction of range may have been a problem as 71% again met six or seven of the seven criteria for cocaine dependence.

4.3. Alcohol dependence

The results for the KMSK Alcohol scale study were complex. Although there was a good correlation between the KMSK Alcohol scale and the SCID-I Alcohol Dependence scores, the fact that the correlation was somewhat weaker than that of the Opiate and Cocaine scales suggests that the development of alcohol dependence problems is not solely dependent upon exposure.

The results from the analysis of the relationship between exposure to alcohol and the development of dependence suggest several preliminary observations. The first is that there may be a threshold effect. In the analyses that were modeled after the WHO guidelines, it was found that moderate drinking (three drinks or less per sitting) was associated with not receiving a diagnosis of Alcohol Dependence 96% of the time. The second is that drinking greater amounts, or high levels of exposure, also may not be sufficient to predict a dependence diagnosis. On the one hand, of the 20 patients who received a diagnosis of alcohol dependence, 18 or 90% were drinking four drinks or more per sitting. On the otherhand, of the 47 patients who were drinking four or more drinks at a sitting, 29 or 62% of them did not qualify for an alcohol dependence diagnosis. As was noted above, the modal daily frequency in this group during their heaviest period of use was daily or nearly daily drinking.

This variability points to the possibility that exposure is only one factor in the development of an alcohol dependence problem—necessary, but not sufficient. Other factors could include genetic background (Tsuang et al., 1996, 1998; LaForge et al., 2000b), the presence or absence of polysubstance abuse, and the presence or absence of psychiatric or psychological problems or difficulties. Within this context, it is again interesting to note that, while the subsample was extremely small, the KMSK Alcohol scale predicted severity in those who were alcohol dependent only, but not in those who had also been dependent on opiates and/or cocaine. This suggests that there may be different subtypes of drug and alcohol dependent persons.

4.4. Comparisons with other measures

The overall results from this preliminary analysis of the KMSK scale shows that it may have detection properties that are comparable with other screening instruments such as the AUDIT. In a recent review article on the AUDIT, Reinert and Allen (2002) pointed out that, in a series of studies using various criteria, the median sensitivity was 0.86 and the median specificity was 0.89. Allen et al. (1997), in another review of the AUDIT, referred to a study using DSM-III-R criteria for current alcohol abuse or dependence that was done in a general medical clinic located in an inner city area. In that study, the sensitivity and specificity were both 0.96. All three of the KMSK scales evaluated here demonstrated sensitivity and specificity that are comparable with those results.

In a review article on the use of alcohol screening questionnaires, Bradley et al. (1998) referred to a series of studies done by Cherpitel. Using ICD-10 Alcohol Dependence criteria in a predominantly African-American sample, Cherpitel and colleagues found that the AUROC for the CAGE were 0.84 for both men and women; for the AUDIT, it was 0.87 for women and 0.88 for men; for the TWEAK ('hold' version), it was 0.90 for women and 0.89 for men; and for the BMAST, it was 0.75 for women and 0.64 for men. Again, the KMSK scale AUROC scores were equivalent or better than these (see Table 1).

4.5. Future directions and conclusions

This initial study of the KMSK scale raises some interesting questions for future research. The basic

premise of creating a screening measure for lifetime dependence based on exposure to substances has received preliminary support. Future efforts in this area should involve using larger sample sizes. To clarify some of the questions that have emerged in relation to the Alcohol scale, it might be particularly helpful to do further validity studies with a primarily alcohol-using sample.

Investigations that compare the relative utility of the KMSK scale as an interview instrument and as a self-report measure would be valuable as well. It would certainly increase the scale's utility if it could serve in both capacities. In addition, a test–retest reliability study would also be important in the further development of this tool.

The limitations of this study include: (a) the small number of subjects who fall into each diagnostic group; (b) the small number of people who achieve a diagnosis of abuse but not dependence; and (c) the fact that the same interviewers administered both forms. It would be helpful to be able to compare the results when the forms are administered by different researchers or clinicians.

In summary, the KMSK scale is a new, rapid screening instrument that can be used for the assessment of the extent of lifetime alcohol and drug use for the identification of dependence. While it was developed for use in research, further studies should examine the scale's utility in diverse clinical settings. Future versions of the KMSK scale will include sections on other drugs of abuse, including amphetamines, barbiturates, benzodiazepines, and cannabis, as well as sections on alcohol use throughout pregnancy. Lastly, the relationship between repeated self-exposure to a drug and the development of dependence is an intriguing question, one addressed here briefly, but one that warrants further study.

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Appendix A: KMSK scale (© The Rockefeller University 2001)*

KMSK Scale (© The Rockefeller University 2001) *

Alcohol

1. *At the time in your life when you were drinking the most alcohol, were you drinking it:*
   - a. Every day, or nearly every day *(5 points)*
   - *b.* Three or more days a week *(4 points)*
   - *c.* Every weekend, or most weekends and holidays *(3 points)*
   - *d.* Once a week or less *(2 points)*
   - e. A few times a year, on special occasions *(1 point)*
   - *f.* Never *(0 points)*

   Frequency Score _____

2. *When was this?*

3. *Are you using currently?*

4. *How long did this pattern of drinking last?*

   - a. More than a year *(3 points)*
   - b. Six months to one year *(2 points)*
   - c. Less than six months *(1 point)*

   Duration Score _____

   (If Frequency Score = 0, 1, or 2, Score Duration as 0)

5. *During this time when you were drinking the most, how many drinks at a sitting or in a day would you typically drink?*

   - a. Ten or more *(5 points)*
   - *b.* Five – ten *(4 points)*
   - c. Four – five *(3 points)*
   - d. Two – three *(2 points)*
   - e. One – two *(1 point)*
   - f. None *(0 points)*

   Amount Score _____

6. *Is alcohol your drug of choice?*

   - a. Yes
   - b. No

   Total Alcohol Score _____

Comments:

* Permission is given to use the KMSK Scale. Proper citation for this measure is appreciated.

Tobacco

1 *At the time in your life when you were smoking the most (a) cigarettes or (b) cigars, were you smoking:*

a. At regular intervals throughout the day, every day or most days *(5 points)*
b. In clusters, at specific times of day like coffee breaks or lunchtime, every day or most days *(4 points)*
c. Once a day, every day or most days *(3 points)*
d. 20 – 100 times in lifetime *(2 points)*
e. Fewer than 20 times in lifetime *(1 point)*
f. Never smoked *(0 points)*

Frequency Score _____

2. *When was this?*

3. *Are you using currently?*

4. *How long did this pattern of smoking last?*

a. More than a year *(3 points)*
b. Six months to one year *(2 points)*
c. Less than six months *(1 point)*

Duration Score _____
(If Frequency Score = 0, 1, or 2 Score Duration as 0)

5. *How many packs per day of cigarettes would you typically smoke, at your heaviest use?*

a. Two or more *(5 points)*
b. One – two *(4 points)*
c. One *(3 points)*
d. Half a pack *(2 points)*
e. Less than half a pack *(1 point)*
f. None *(0 points)*

Amount Score _____

6. *How many cigars per day would you typically smoke, at your heaviest use?* (Not scored)

a. Two or more
b. One – two
c. One
d. None

7. *Is tobacco your drug of choice?*

a. Yes b. No Total Tobacco Score _____

Comments:

Cocaine

1. *At the time in your life when you were using the most cocaine or crack cocaine, were you using it:*

   a. Several times a day, every day or most days, or continuous use as long as drug is available *(7 points)*
   b. Three or more times a day, three to five days a week *(6 points)*
   c. Three or more times a day, one to three days a week *(5 points)*
   d. Once a day, every day or most days *(4 points)*
   e. More than 100 times in lifetime *(3 points)*
   f. 20 – 100 times in lifetime *(2 points)*
   g. Fewer than 20 times in lifetime *(1 point)*
   h. Never used *(0 points)*

   Frequency Score _____

2. *When was this?*

3. *Are you currently using?*

4. *How long did this pattern of cocaine use last?*

   a. More than a year *(3 points)*
   b. Six months to one year *(2 points)*
   c. Less than six months *(1 point)* Duration Score _____

   (If Frequency Score = 0 or 1 Score Duration as 0)

5. *During this time when you were using the most cocaine, how much would you use/spend at one sitting? (Convert to Dollars)*

   a. Number of grams _____; Multiply by $80
   b. Number of vials or "rocks" _____; Multiply by $10
   c. Amount of money spent per day on cocaine: Total = $_____

6. Amount Scoring

$100 or more	*(6 points)*	$40-59	*(3 points)*	$0	*(0 points)*
$80-99	*(5 points)*	$20-39	*(2 points)*		
$60-79	*(4 points)*	$1-19	*(1 point)*		

Amount Score _____

7. *Is cocaine your drug of choice?* a. Yes b. No

Comments: Total Cocaine Score _____

Heroin/Opiates

1. *At the time in your life when you were using the most (a) heroin or (b) illicit (not prescribed) opiates, were you using it:*

   a. Several times a day, every day or most days *(4 points)*
   b. Once a day, every day or most days *(3 points)*
   c. 20 – 100 times in lifetime *(2 points)*
   d. Fewer than 20 times in lifetime *(1 point)*
   e. Never used *(0 points)*

   Frequency Score _____

2. *When was this?*

3. *Are you currently using?*

4. *If you were using illicit opiates, what were their names?*

5. *How long did this pattern of heroin and/or opiate use last?*

   a. More than a year *(3 points)*
   b. Six months to one year *(2 points)*
   c. Less than six months *(1 point)* Duration Score _____

   (If Frequency Score = 0 or 1 Score Duration as 0)

6. *During this time when you were using the most heroin or opiates, how much would you typically use/spend at one sitting?* (Score as doses)

   a. Number of bags/packets (1 bag = 1 dose)
   b. Number of pills/doses: (1 pill = 1 dose)
   c. Amount of money spent per day on heroin/opiates
   (Dose equals dollar amount divided by 10) (Dose = _____)

7. Amount Scoring

10 or more doses	*(6 points)*	4-5 doses	*(3 points)*	0 doses	*(0 points)*
8-9 doses	*(5 points)*	2-3 doses	*(2 points)*		
6-7 doses	*(4 points)*	<1-1 doses	*(1 point)*		

Amount Score _____

8. *Is heroin (opiates) your drug of choice?* a. Yes b. No

Total Heroin/Opiates Score _____

Comments:

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