

BRIEF REPORT

Usefulness and validity of the modified Addiction Severity Index: A focus on alcohol, drugs, tobacco, and gambling

Cécile Denis, PhD^{a,b,c,d}, Mélina Fatséas, MD, PhD^{a,b,c}, Virginie Beltran, MSc^{a,b,c,e}, Fuschia Serre, PhD^{a,b,c}, Jean-Marc Alexandre, MSc^{a,b,c}, Romain Debrabant, MSc^{a,b,c}, Jean-Pierre Daulouède, MD^{a,b,e}, and Marc Auriacombe, MD^{a,b,c,d,e}

^aUniversity of Bordeaux, Bordeaux, France; ^bAddiction Psychiatry/SANPsy, CNRS USR 3413, Bordeaux, France; ^cDépartement (Pôle) Addictologie, Centre Hospitalier Charles Perrens and Centre Hospitalier Universitaire de Bordeaux, Bordeaux, France; ^dCenter for Studies of Addiction and Department of Psychiatry, Perelman School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania, USA; ^eBizia Addiction Clinic, Bayonne, France

ABSTRACT

Background: Individuals who seek treatment for an addictive disorder often exhibit comorbid substance use disorders and/or gambling disorder. The lack of a unique severity assessment instrument might be an obstacle for individuals to access integrated and comprehensive treatment. This paper aimed to examine the usefulness and validity of a modified version of the Addiction Severity Index (mASI) to assess all substance use disorders (including tobacco) and gambling. **Methods:** Participants ($N = 833$) were interviewed with the mASI and completed a validity battery questionnaire. The validity and the reliability of the mASI were examined. **Results:** The mASI was reliable, and its 9 assessed domains showed a relative independence, supporting its multidimensionality. **Conclusions:** The standardized properties of the mASI permit a comprehensive and systematic assessment of all addictive disorders independent of individuals' perceived problems and treatment settings, hence facilitating personalized treatment planning.

KEYWORDS

Addiction Severity Index; modification; reliability; usefulness; validity

Introduction

The *Diagnostic and Statistical Manual of Mental Disorders, 5th Edition* (DSM-5) has combined substance use disorders and gambling disorder into one new diagnostic category based on the many commonalities they share and has suggested that Internet gaming disorder be studied for inclusion in future revisions.^{1–4} Among individuals seeking treatment for one substance use disorder, polysubstance use is common,^{5–7} as are non-substance use problems, such as gambling disorder.^{8,9}

In 1980, the Addiction Severity Index (ASI) was introduced to assess impairments that commonly occur due to substance-related disorders and to help clinicians design more comprehensive and integrated treatments.¹⁰ The ASI has been translated into many languages, and it is the most widely used instrument for assessing the severity of substance-related disorders in different settings (addiction clinics, mental health settings, prison) and among different populations (substance users seeking treatment, homeless, substance users with co-occurring psychopathology).^{10,11} It produces relevant, reliable, and valid data for both clinical and research evaluation.¹² Developed 30 years ago, the ASI has also shown some shortcomings. The nature of substances used, the target population, and treatments provided have changed. To address these issues, the authors of the original ASI have undertaken a major revision and developed the 6th version of the ASI (ASI-6).^{10,11} Lesieur et al. designed a specific optional section in the ASI to

assess gambling and showed that it could be appropriate to assess gambling disorder.^{13,14} Among the changes, the ASI-6 included items that gather data on tobacco and gambling. However, most initial and recent studies with the ASI concerned individuals who endorsed opioid, cocaine, or alcohol use disorders.^{11,12,15} To date, no study has examined the usefulness and validity of the tobacco and gambling items of the ASI-6. As a consequence, little is known about the feasibility and the generalizability of the clinical dimensions of the ASI to other substance use and gambling.

Tobacco use disorder and gambling disorder have been excluded from major psychiatric epidemiological surveys and are poorly understood in comparison with other addictive and psychiatric disorders.^{5,6,8,16} A significant problem in understanding and managing these disorders may be related to the lack of standardized instruments for assessing problems or other aspects of life that are affected by such disorders. Some evidence suggests that treatments targeting single behaviors may not be as effective as those that are wider in scope,^{6,16} and treatment with a wider scope may even enhance treatment outcomes.¹⁷ These results provide a compelling incentive to develop an instrument that assesses a broad range of behaviors deemed to be addictive behaviors.

After 20 years of working with the ASI,^{18–23} and considering that it is the oldest and most well-known multidimensional

assessment tool, we chose to modify the ASI by adding some specific items to systematically gather data on tobacco use and gambling.²⁴ The objective of this paper was to bring some evidence of the validity of this modified version of the Addiction Severity Index (mASI) (see Supplemental Material) and its usefulness for individualized treatment planning for alcohol, drugs, tobacco, and gambling.

Methods

Sample recruitment

Subjects

The sample consisted of 833 individuals assessed at their entry into treatment for substance and/or non-substance use disorders in outpatient addiction clinics in Aquitaine, France. The study was reviewed and approved by the institutional review board of the University of Bordeaux, and all subjects provided informed consent to participate.

Procedure

As part of the standard intake assessment protocol, trained research interviewers, who were not involved in treatment, interviewed all subjects at their treatment entry. This intake assessment included the modified Addiction Severity Index (mASI) and the Mini International Diagnostic Interview (MINI).

Assessment and tools

Our group used the French Canadian translation of the 5th version of the ASI developed by Bergeron et al.^{25–27} and adapted it to the French European context.²¹ For this study, we used a modified version of the ASI (mASI) that included specific items assessing tobacco use, gambling, and other nonsubstance behavioral addictions.²⁴ All the other items remained unchanged from the original 5th version of the ASI.²⁸

We constructed items for tobacco following the same model as for other substances. The questions relevant to tobacco use were added within each section and grouped with related items to maximize the conversational nature of the interview. We placed the questions of frequency of use after the questions of other substances. This new section of the ASI generates tobacco severity scores: ASI tobacco Interviewer Severity Rating (tobacco ISR) ranging from 0 to 9, and ASI tobacco Composite Score (tobacco CS) ranging from 0 to 1. The formula to compute the tobacco CS was (no. of days used tobacco in the past 30 days \div 120) + (no. of days problems with tobacco in the past 30 days \div 120) + (how bothered by tobacco problems in the past 30 days \div 16) + (need for treatment for tobacco problems \div 16). The validity of these specific items was presented elsewhere.²⁹

We constructed items for gambling following the same model as for tobacco. This new section of the ASI generates gambling severity scores: ASI gambling ISR and ASI gambling CS. The formula to compute the gambling CS was (no. of days gambling in the past 30 days \div 150) + (no. of days problems with gambling in the past 30 days \div 150) + (how bothered by gambling problems in the past 30 days \div 20) + (need for

treatment for gambling problems \div 20) + (log (€ spent for gambling in the past 30 days + 1) \div 44). The validity of these specific items was presented elsewhere.³⁰

Substance use disorders and gambling disorder were assessed with the Mini International Neuropsychiatric Interview (MINI).^{31,32} Although the MINI was originally designed to elicit *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV) substance abuse and dependence criteria, the limited changes in criteria made it possible to also diagnose DSM-5 substance use disorders. DSM-5 criteria consist of the DSM-IV abuse and dependence criteria combined (excluding the “illegal acts” criterion from DSM-IV and introducing a new craving criterion).¹ For each substance, the craving criterion was assessed by the following question: “Have you ever had such a strong desire for (substance) or a craving for (substance)?”

Analyses

Cronbach’s alpha was calculated to evaluate the internal consistency of the items comprising each of the ASI composite scores (CSs). Eigenvalues of the items were used to examine whether the CSs were unidimensional. Principal component analyses and evaluated factor structure were performed using varimax rotation.

First, correlations between ASI ISRs and CSs were calculated. We expected high correlations between ISR and CS within the same domain and low or no correlation between different domains of the ASI. Then, we computed an intercorrelation matrix between the ASI CSs to evaluate their extent of independence. We expected low correlations between the scores. For all the correlation analyses, we used the nonparametric Spearman’s ρ correlation because of non-normal distribution of ASI scores based on Shapiro-Wilk test. To diminish the severity of the problem of the multiplicity of statistical tests, only the correlations nominally significant at the $P < .001$ level were considered statistically significant.

We defined groups according to ISR higher than 4 (indicating a need for additional treatment per ASI ISR definition) for alcohol, drugs (any drug except alcohol and tobacco), tobacco, and gambling. Similarly, we defined groups according to the ASI CSs. As CSs did not have a normal distribution, we split the groups according to the mean in the sample, i.e., higher than 0.21 for alcohol, higher than 0.17 for drugs, higher than 0.44 for tobacco, and higher than 0.03 for gambling. To evaluate the concurrent validity of the ASI items related to alcohol, drugs, tobacco, and gambling, we assessed the concordance between the alcohol, drugs, tobacco, and gambling ISRs higher than 4; alcohol, drugs, tobacco, and gambling CSs higher than the CS mean; the patient’s declaration about his/her major substance/behavior problem; and the DSM-5 substance use disorder and DSM-5 gambling disorder diagnoses using Kappa coefficients.³³ The DSM-5 diagnoses assessed by the MINI were used as external validity measures.

To evaluate some discriminant properties of the ASI CSs, we compared the mean CSs of 6 groups of individuals defined according to whether their major problem was alcohol, opiates, cannabis, tobacco, gambling, or polysubstance use (i.e., at least 2 drugs, excluding tobacco). These groups were chosen because of the differences regarding pharmacological properties of the

Table 1. Mean of the Composite Scores at baseline and internal consistency of the Composite Scores (CS) of the ASI among individuals seeking treatment in outpatient addiction clinics ($N = 833$).

Category	CS Mean (SD)	Cronbach's α	Eigenvalue	% of explained variance
Medical	0.26 (0.31)	.83	2.2	74.5
Employment/Support	0.52 (0.31)	.74	2.3	56.5
Alcohol	0.21 (0.26)	.84	3.5	59.1
Drug	0.19 (0.15)	.67	3.5	57.1
Tobacco	0.43 (0.30)	.78	2.6	65.7
Gambling	0.03 (0.12)	.87	3.4	67.6
Legal	0.07 (0.14)	.63	2.0	50.1
Family/Social	0.20 (0.21)	.64	3.2	53.2
Psychiatric	0.35 (0.23)	.79	3.9	56.2

substance, route of substance use, physiological effects, and legal status.

All the statistical analyses were performed using JMP 10.0 (SAS Institute, Cary, NC, USA).

Results

Sample characteristics

Among 939 individuals who sought treatment for at least one substance use disorder and/or gambling, 833 completed the intake mASI (88.7%) and gave their informed consent to participate. Among the 102 individuals for whom no baseline assessment was available, 86 individuals did not complete the baseline interview, and 20 refused to sign the informed consent form. The participants were mainly males (67.3%), and 36.4 years old on average ($SD = 11.2$; range: 19–78). They sought treatment for opiates (30.0%), alcohol (27.1%), tobacco (25.2%), cannabis (22.4%), cocaine (9.8%), sedatives (4.4%), and gambling (3.5%). Other drugs such as amphetamines, ecstasy, and hallucinogens were rarely used and were rarely reported as problem drug. There were 308 (37.0%) individuals who declared more than 1 substance as their major problem.

The mean length of the intake mASI interview was 58.7 minutes ($SD = 21.7$). The intake ASI interview was significantly longer for individuals who sought treatment for polysubstance use disorder (65.9 minutes, $SD = 22.8$) and significantly shorter for individuals who sought treatment for tobacco use disorder or gambling disorder (52.4 minutes, $SD = 18.5$).

The unidimensionality and the internal consistency of the items constituting the 9 CSs were evaluated with eigenvalue and Cronbach's alpha. The results are presented in Table 1. The items used to calculate each CS yielded a unidimensional scale with 1 factor and the eigenvalue ranged from 2.0 to 3.9

and explained from 50.1% to 74.5% of the variance. The Cronbach's alpha ranged from .63 to .87 and could be considered as good for medical, alcohol, and gambling domains; acceptable for employment/support, drug, tobacco, and psychiatric domains; and questionable for legal and family/social domains.

The bivariate correlations between ISR and CS are presented in Table 2. Each ISR was significantly correlated with its corresponding CS. The medical, alcohol, drug, tobacco, gambling, family/social, and psychiatric scales all had correlations higher or equal to 0.63, while the remaining scales had slightly modest correlation (i.e., employment $\rho = 0.43$, legal $\rho = 0.51$). There were also significant correlations between ISRs and noncorresponding CSs. However, the corresponding correlations were always greater than these noncorresponding correlations. The strongest was the psychiatric CS with family/social ISR ($\rho = 0.35$); no other noncorresponding correlation was higher than 0.28.

The intercorrelations among the 9 CSs were assessed by Spearman's ρ correlations. These correlations are presented in Table 3. As expected, the correlations were low. This finding supported the independence of the CSs. However, the drug CS was associated with medical CS ($\rho = 0.13$) and employment CS ($\rho = 0.14$). The legal CS was correlated with the employment CS ($\rho = 0.19$). The family/social CS was associated with medical CS ($\rho = 0.19$), tobacco CS ($\rho = 0.14$), and legal CS ($\rho = 0.17$). The psychiatric CS was correlated with most of the other CSs: medical ($\rho = 0.25$), alcohol ($\rho = 0.18$), drug ($\rho = 0.15$), legal ($\rho = 0.13$), and family/social ($\rho = 0.39$). These correlations were generally low (under 0.30), with only the correlation between the psychiatric CS and family/social CS reaching 0.39.

The concordant validity of the alcohol, drug, tobacco, and gambling ISRs was assessed with Kappa coefficients (Table 4). The concordance was excellent between drug ISR >4 and the individual's declaration of one drug (except alcohol and tobacco) causing the major problem ($\kappa = 0.80$). Similarly,

Table 2. Correlations (Spearman's ρ) between Addiction Severity Index Interview Severity Rating (ISR) and Composite Scores (CS) ($N = 833$).

ISR/CS	Medical	Employment	Alcohol	Drug	Tobacco	Gambling	Legal	Family/Social	Psychiatric
Medical	0.80	0.16	0.05	0.05	0.09	0.02	0.01	0.26	0.23
Employment	0.10	0.43	0.14	0.16	0.10	0.01	0.20	0.19	0.15
Alcohol	0.05	0.07	0.86	0.15	0.05	0.03	0.06	0.14	0.21
Drug	0.05	0.21	0.01	0.63	0.07	0.13	0.14	0.11	0.28
Tobacco	0.11	0.06	0.03	0.19	0.87	0.07	0.15	0.03	0.03
Gambling	0.02	0.03	0.01	0.06	0.06	0.85	0.06	0.02	0.05
Legal	0.04	0.09	0.08	0.14	0.03	0.09	0.51	0.08	0.03
Family/Social	0.22	0.18	0.12	0.05	0.11	0.04	0.03	0.63	0.35
Psychiatric	0.25	0.22	0.19	0.10	0.09	0.06	0.03	0.35	0.85

Note. Bold values indicate correlations that are significant at $P < .001$.

Table 3. Intercorrelations (Spearman's ρ) Matrix of Addiction Severity Index composite scores ($N = 833$).

	Medical	Employment	Alcohol	Drug	Tobacco	Gambling	Legal	Family/Social
Employment	0.06							
Alcohol	0.00	0.02						
Drug	0.13	0.14	0.00					
Tobacco	0.08	−0.09	0.04	−0.07				
Gambling	−0.01	−0.03	−0.00	−0.07	−0.07			
Legal	−0.03	0.19	−0.10	−0.05	0.05	0.02		
Family/Social	0.19	0.10	0.09	0.05	0.14	0.00	0.17	
Psychiatric	0.25	0.11	0.18	0.15	0.10	−0.04	0.13	0.39

Note. Bold values indicate correlations that are significant at $P < .001$.

concordance was excellent between gambling ISR >4 and the individual's declaration of gambling causing the major problem ($\kappa = 0.82$). The concordance was weaker but still good between alcohol ISR >4 and the individual's declaration of alcohol causing the major problem ($\kappa = 0.70$). The concordance was poor between tobacco ISR >4 and the individual's declaration of tobacco causing the major problem ($\kappa = 0.37$).

The concordance coefficients between a CS higher than the CS mean and the corresponding ISR higher than 4 were excellent for alcohol, tobacco, and gambling (κ ranged from 0.73 to 0.84), and good for drugs ($\kappa = 0.57$). The concordance coefficients between the CS higher than the mean CS and both the ASI declared main problem and the DSM-5 substance use disorder/gambling disorder diagnosis were in the same range as the concordance of the ISR higher than 4 and these 2 last variables, i.e., generally in a good range, except for tobacco, which exhibited lower concordance. However, the concordance between DSM-5 tobacco use disorder and tobacco CS was higher than with a tobacco ISR higher than 4 ($\kappa = 0.47$ versus 0.26).

Similar results were found by using DSM-5 diagnoses as an external validity measure. The correlation was excellent between alcohol ISR >4 and DSM-5 alcohol use disorder ($\kappa = 0.75$) and between drug ISR >4 and at least 1 drug use disorder diagnosis (except alcohol and tobacco) ($\kappa = 0.79$). The correlation was good between gambling ISR >4 and gambling disorder diagnosis ($\kappa = 0.72$). The correlation was poor between tobacco ISR >4 and DSM-5 tobacco use disorder diagnosis ($\kappa = 0.26$).

The concurrent validity of the item assessing the patient's major problem causing him/her to enter treatment was assessed with DSM-5 substance use disorder and DSM-5 gambling disorder diagnoses as an external validity measure by Kappa coefficient (Table 4). The concordance between individuals' major problem and DSM-5 substance use disorder and/or gambling disorder diagnoses was quite similar to the concordance between ISR >4 and DSM-5 substance use disorder and/or gambling disorder diagnoses. The concordance was excellent for gambling ($\kappa = 0.79$), good for alcohol ($\kappa = 0.80$) and drugs ($\kappa = 0.70$), and poor for tobacco ($\kappa = 0.09$). Among the drugs,

Table 4. Concordance between the ISR score higher than 4, CS higher than the mean CS, the substance(s) and/or behavior(s) problem declared by the individuals as their main problem, and DSM-5 use disorder diagnoses.

Problem	(a) ISR >4	(b) ASI CS > mean CS	(c) ASI declared main problem	(d) DSM-5 Use Disorder diagnosis	κ coeff. a \times b	κ coeff. a \times c	κ coeff. a \times d	κ coeff. b \times c	κ coeff. b \times d	κ coeff. c \times d
Alcohol n (%)	295 (35.4)	281 (33.7)	226 (27.1)	271 (32.5)	0.84	0.70	0.75	0.64	0.62	0.71
Drug (except alcohol and tobacco) n (%)	510 (61.2)	425 (51.1)	556 (66.7)	607 (67.7)	0.57	0.80	0.79	0.53	0.72	0.70
Opiates n (%)	NA	NA	250 (30.0)	218 (26.2)	NA	NA	NA	NA	NA	0.83
Cannabis n (%)	NA	NA	187 (22.4)	233 (27.9)	NA	NA	NA	NA	NA	0.64
Cocaine n (%)	NA	NA	82 (9.8)	75 (9.0)	NA	NA	NA	NA	NA	0.66
Sedatives n (%)	NA	NA	37 (4.4)	55 (6.6)	NA	NA	NA	NA	NA	0.53
Tobacco n (%)	364 (43.7)	333 (40.0)	210 (25.2)	618 (74.2)	0.83	0.37	0.26	0.58	0.47	0.09
Gambling n (%)	51 (6.1)	65 (7.8)	29 (3.5)	43 (5.2)	0.73	0.82	0.72	0.70	0.60	0.79

Note. The declared main problem correspond to the substance(s) and/or behavior(s) declared by the individual as causing the most difficulty and that have led to individual's entering treatment. ISR = Interviewer Severity Rating of the ASI. An ISR >4 indicates a need for additional treatment. NA = nonapplicable
 κ coeff. a \times b = concordance (Kappa coefficient) between an ISR score higher than 4 and the major problem declared by the individual and a CS higher than CS mean; κ coeff. a \times c = concordance (Kappa coefficient) between an ISR score higher than 4 and the major problem declared by the individual; κ coeff. a \times d = concordance (Kappa coefficient) between an ISR score higher than 4 and the DSM-5 Use Disorder diagnosis/DSM-5 Gambling Disorder diagnosis; κ coeff. b \times c = concordance (Kappa coefficient) between a CS higher than CS mean and the major problem declared by the individual; κ coeff. b \times d = concordance (Kappa coefficient) between CS higher than CS mean and the DSM-5 Use Disorder diagnosis/DSM-5 Gambling Disorder diagnosis; κ coeff. c \times d = concordance (Kappa coefficient) between the major problem declared by the individual and the DSM-5 Use Disorder diagnosis/DSM-5 Gambling Disorder diagnosis.

Table 5. Comparison of the ASI Composite Scores between 6 groups of individuals according to their substance(s) or behavior declared as major problem and have led to their entering treatment.

Category	<i>P</i>	Alcohol (<i>n</i> = 138)	Opiates (<i>n</i> = 177)	Cannabis (<i>n</i> = 100)	Tobacco (<i>n</i> = 142)	Gambling (<i>n</i> = 32)	Polysubstance (<i>n</i> = 188)
Medical CS Mean (SD)	0.03	0.28 (0.34) ^{a,b}	0.22 (0.31) ^b	0.21 (0.29) ^b	0.25 (0.29) ^{a,b}	0.26 (0.34) ^{a,b}	0.32 (0.33) ^a
Employment CS Mean (SD)	<.0001	0.59 (0.32) ^a	0.56 (0.31) ^{a,b}	0.49 (0.32) ^{a,b,c}	0.40 (0.5) ^c	0.42 (0.30) ^{b,c}	0.55 (0.31) ^{a,b}
Alcohol CS Mean (SD)	<.0001	0.58 (0.23) ^a	0.09 (0.15) ^c	0.12 (0.13) ^c	0.08 (0.09) ^c	0.06 (0.11) ^c	0.29 (0.29) ^b
Drug CS Mean (SD)	<.0001	0.10 (0.09) ^c	0.27 (0.15) ^a	0.23 (0.14) ^{a,b}	0.06 (0.06) ^{c,d}	0.03 (0.05) ^d	0.20 (0.15) ^b
Tobacco CS Mean (SD)	<.0001	0.38 (0.26) ^c	0.29 (0.16) ^d	0.40 (0.27) ^c	0.79 (0.19) ^a	0.16 (0.18) ^e	0.53 (0.31) ^b
Gambling CS Mean (SD)	<.0001	0.03 (0.07) ^b	0.02 (0.06) ^b	0.05 (0.08) ^b	0.02 (0.06) ^b	0.33 (0.30) ^a	0.05 (0.14) ^b
Legal CS Mean (SD)	NS	0.07 (0.13)	0.11 (0.15)	0.09 (0.14)	0.09 (0.07)	0.06 (0.12)	0.10 (0.12)
Family/Social CS Mean (SD)	0.04	0.25 (0.21) ^a	0.19 (0.17) ^b	0.21 (0.18) ^{a,b}	0.22 (0.12) ^{a,b}	0.19 (0.23) ^{a, b}	0.24 (0.19) ^{a,b}
Psychiatric CS Mean (SD)	<.0001	0.44 (0.24) ^{a,b}	0.33 (0.23) ^c	0.40 (0.22) ^{b,c}	0.43 (0.24) ^{a,b}	0.38 (0.23) ^{a, b, c}	0.51 (0.25) ^a

Note. The major problem reported by the individuals in the ASI was Alcohol for 138 patients, Opiates for 177 individuals, Cannabis for 100 individuals, Tobacco for 142 individuals, Gambling for 32 individuals, and Polysubstance (at least 2 drugs excluding tobacco) for 188 individuals.

CS = Composite Score of the ASI; SD = standard deviation, ASI domains are Medical Status (Medical), Employment/Support (Employment), Alcohol, Drug (excluding Alcohol and Tobacco), Tobacco, Gambling, Legal Situation (Legal), Family/Social Status (Family/Social), Psychiatric Status (Psychiatric).

ANOVA was performed to compare CSs between groups. When ANOVA was significant, Kruskal-Wallis post hoc test was performed. Mean CSs not connected by the same letter were significantly different between groups (Kruskal-Wallis test). Superscript labels with different letters reflect significant group difference (^{a,b,c}).

the concordance was excellent for opiates ($\kappa = 0.82$) and good for cannabis ($\kappa = 0.64$), cocaine ($\kappa = 0.66$), and sedatives ($\kappa = 0.53$). When individuals declared more than 1 drug (except tobacco) as the major problem, the correlation with several DSM-5 substance use disorder diagnoses was poor ($\kappa = 0.12$). The lower correlations were explained by the fact that individuals did not report substance and/or gambling as a problem whereas they met DSM-5 criteria for substance use disorder or gambling disorder.

Table 5 displays the comparison of the 9 CSs between 6 groups of individuals according to their major problem. There was no difference in the legal CS between the 6 groups, and this CS was low in all groups. There were only few differences between groups for the medical and family/social CSs, and the mean CS showed only moderate impairment in these 2 domains regardless of the group. The employment and psychiatric CSs showed high impairment for all groups. The 2 groups seeking treatment for tobacco and cannabis, i.e., the 2 more socially accepted drugs in addition to alcohol, presented lower impairment in the employment domain. Individuals seeking treatment for gambling also presented lower impairment in the employment domain. As expected, the alcohol group presented the highest alcohol CSs. Opiates, cannabis, and polysubstance groups had the highest drug CSs. Highest tobacco CS were found in the tobacco group. The polysubstance group presented the highest CSs in all the domains of the ASI. Finally, the gambling group presented the highest gambling CS. However, even if tobacco was not the major problem, the tobacco CS was not null in the other groups, consistent with the high prevalence of tobacco use among individuals with substance use disorders. Similarly, the gambling CS was not null in the other groups other than the gambling group.

Discussion

Our goal was to bring evidence for the validity of the mASI for assessing the severity of any substance use disorder, including tobacco, and also other addictive behavior, such as gambling

disorder, in treatment-seeking individuals regardless of types of treatment settings or individuals' perception of problems. Our modified version of the ASI assesses addictive behaviors regardless of the type of addiction. As with the other sections, it generates specific tobacco and gambling scores. Our findings support the reliability and the validity of this modified version of the ASI. Although the 6th version of the ASI added items related to tobacco use and gambling, these new items did not generate specific scores and were not taken into account in the computation of the scores of the ASI domains.¹¹ In its 6th version, the ASI is still focused on assessment of alcohol and/or drugs, with items related to tobacco and gambling only for assessing use in addition to the main alcohol and/or drug use. It is not suited for assessment of individuals with tobacco or gambling as their declared main problem.

The ISR, DSM-5 substance use disorder and gambling disorder diagnoses, and the individuals' perception of their major substance and/or gambling problem were linked. The CS reflected the level of impairment in every domain of the patient's life and allowed comparisons between the individuals according to their major addictive problem. The psychiatric CS showed that individuals exhibited psychological impairment regardless of the type of addiction (substance and nonsubstance). This was consistent with previous epidemiological studies that emphasized the high prevalence of psychiatric comorbidity among subjects with addictive disorders of all types.^{5,16,34–36}

The internal consistency of each domain of this mASI was comparable to results found in previous studies using earlier versions of the ASI in different settings^{37–39} and also in the 6th version of the ASI.¹⁵ The 9 assessed domains of our modified version of the ASI appeared to be relatively independent, supporting its multidimensionality. The relationships between some domains of the ASI were also found in previous versions of the ASI^{40,41} and also in the new 6th version of the ASI.¹¹ The psychometric properties of the items dedicated to tobacco and gambling in the 6th version of the ASI have not yet been established.^{11,15} We previously showed the validity of the added items in this modified version of the ASI specifically among tobacco users and gamblers.^{29,30} The multidimensional and

standardized properties of this mASI allow a comprehensive and systematic assessment independent of individuals' perceived problem and of treatment setting.

In our sample, we found that higher scores (ISR and CS) were concordant with substance use disorder diagnoses (alcohol and drugs) and gambling disorder diagnoses. Rikoon et al.⁴² showed that the ASI CS values could reasonably approximate current DSM-IV alcohol or drug dependence diagnosis. The ASI interview is better indicated to assess the individuals who have already been screened for a probable addictive disorder. Although the ASI should not be used independently to determine a diagnosis, it is a potentially useful screen for other substance use problems in individuals whose primary substance of abuse has already been established.

The poor concordance between both tobacco ISR and tobacco CS and the DSM-5 diagnosis of tobacco use disorder found in this sample may be explained by the fact that a high proportion of individuals meeting DSM-5 criteria for tobacco use disorder sought treatment for another substance use disorder or gambling disorder and that only a minority identified tobacco use as a problem of its own. There is some evidence showing that tobacco cessation treatment is not commonly integrated in addiction treatment programs.^{43–45} One reason could be a lack of systematic assessment of level of impairment and need for change regarding tobacco use. Another reason could be that among individuals in treatment for another substance-related use disorder, the clinical staff may believe that they are not interested in quitting smoking.⁴⁵ However, our results showed that the tobacco CS was elevated in every group regardless of the main substance of addiction. Previous studies showed that individuals who received tobacco cessation treatment during drug/alcohol treatment had better overall treatment outcomes compared with those who did not.^{17,45} Although the tobacco scores generated by the mASI could not replace a formal diagnostic evaluation of tobacco use disorder, the mASI items might help clinicians to systematically address tobacco use and to discuss tobacco cessation programs with their patients, regardless of the patient's main concern.

The ASI-Gambling of Lesieur and Blume¹⁴ has been shown as valid; however, this section is optional¹³ and will only be used if the interviewer determines it is needed. In our sample, we found that the Gambling CS of the modified ASI was higher among individuals seeking treatment for gambling problem; however, the gambling CS was not null in the other groups seeking treatment for substance use disorders. A non-null gambling CS should not be systematically interpreted as a gambling disorder diagnosis. The objective of this study was not to define a gambling CS threshold to determine a gambling disorder diagnosis. In our sample, only a few participants reported gambling, and the majority of those who reported gambling also endorsed a gambling disorder diagnosis. To better assess the usefulness and validity of the gambling CS in gambling disorder diagnosis, further studies are needed in larger samples that include nongamblers, gamblers without gambling disorder, and gamblers with gambling disorder. However, our findings highlight the need to systematically assess gambling even among those who seek treatment for a substance use disorder. Gamblers with a previous history of substance-related disorder treatment have shown more severe psychosocial problems,

apparently resulting from their gambling behavior, than gamblers without past substance use disorder treatment.⁴⁶

This mASI characterizes and quantifies the severity of multiple health, psychological, and social problems found among those with an addiction. Compared with the 6th version of the ASI, it evaluates tobacco use and gambling like any other addiction. However, this modified version did not answer all of the shortcomings of the standard 5th version of the ASI. It is noteworthy that the 6th version of the ASI introduces a 6-month time frame to better assess current problems. Moreover, although the CSs received considerable evidence for their validity,^{10,12,41} they were not standardized. The 6th version of the ASI developed new standardized severity scores, the Recent Status Scores (RSSs), that exhibited good psychometric properties^{11,47} and can be incorporated into our mASI. Finally, further studies are needed to specifically examine the validity of the new tobacco and gambling section in larger and more diverse samples, i.e., tobacco users with and without tobacco use disorder and gamblers with and without gambling disorder.

Our findings nevertheless support the usefulness of this modified version of the ASI. A more systematic use of the mASI may be helpful to clinicians for designing the best treatment plans for a patient; for policy makers to objectively understand the needs in treatment, care centers, or other institutions; and also for researchers to measure contemporary issues in addiction treatment. For research purposes, the use of a unique instrument allows researchers to better address the similarities and differences between addictions by avoiding potential artifacts due to a multiplicity of tools needed to assess the same individual. The difficulty in determining the impact of an addictive behavior on the treatment outcome of another addictive behavior may be explained by the heterogeneity of the assessment tools. Treatment programs focused on promoting abstinence from substance use might consider monitoring all possible addictive behaviors, including tobacco use and gambling, as it is possible that the addictive disorder might still be active, and individuals may switch their addictive behaviors to tobacco, gambling, or other addictive behaviors.⁴⁸

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Author contributions

Cécile Denis, Mélina Fatséas, Jean-Pierre Daulouède, and Marc Auriacombe have full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. *Research conception and design:* Marc Auriacombe, Cécile Denis. *Collection of data:* Cécile Denis, Virginie Beltran, Fuschia Serre, Jean-Marc Alexandre, Romain Debrabant. *Analysis and interpretation of data:* Cécile Denis, Mélina Fatséas, Marc Auriacombe. *Writing and revision:* Cécile Denis, Mélina Fatséas, Jean-Pierre Daulouède, Marc Auriacombe. All authors contributed to and have approved the final manuscript.

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