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Predicting relapse in patients with severe alcohol use disorder: The role of alcohol insight and implicit alcohol associations

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HIGHLIGHTS

- Implicit alcohol associations may predict relapse in patients with low alcohol insight.
- Participants were 77 patients treated for severe alcohol use disorder in a hospital.
- Alcohol insight and implicit alcohol associations interact to predict relapse.
- Implicit associations predict relapse in patients with low (but not high) insight.

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ABSTRACT

Low insight is reported as a risk factor for relapse among patients treated for alcohol use disorders. However, to date, little is known on why patients with low insight are at higher risk for relapse. In this study, we tested the hypothesis that an implicit preference for alcohol over abstinence predicts relapse in patients with low, but not high, alcohol insight. Participants consisted of 77 patients who had received treatment for severe alcohol use disorder in a hospital in France. During hospitalization, they completed a self-report measure of insight and an implicit association test to assess implicit preference for alcohol over abstinence. The primary outcome was relapse assessed one month after discharge. Control variables were gender, age, cognitive deficit, anxiety, depression, craving, and impulsivity. Data were analysed using logistic regression analysis. After adjusting for demographic and clinical variables, relapse was predicted by the interaction between insight and implicit preference for alcohol but not by their main effects alone. Implicit preference for alcohol predicted relapse among patients with relatively low insight, but not among those with relatively high insight. These findings suggest that patients with low insight and strong implicit preference for alcohol are at a higher risk of relapse. Clinicians may therefore focus on and tailor specific interventions to prevent relapse in this vulnerable and at-risk population.

1. Introduction

Alcohol use disorder (AUD) is a major health issue that is characterized by both a high prevalence rate (twelve-month prevalence was 13.9% in the US and 7.0% in France in 2016; World Health Organization, 2018) and a high rate of relapse (Moos & Moos, 2006). A lack of awareness of the disorder, often referred to as *low insight*, has been proposed as a potential explanation for the high prevalence of AUD and the high risk of relapse among patients suffering from this disorder (Goldstein et al., 2009; Kim et al., 2007). If patients with AUD are not aware (or deny) that their alcohol consumption is problematic, then they may be unlikely to seek treatment and/or to attempt controlling their behavior. In line with this reasoning, some evidence shows that low insight is associated with increased risk of relapse in patients with AUD (Kim et al., 2007). To date, however, little is known on why patients with low insight show elevated risk of relapse after treatment.

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In this study, we attempted to shed new light on this important issue.

Over the last 20 years, a great deal of empirical and theoretical evidence has supported the notion that the cognitive processing that occurs outside one's control, and often even beyond one's awareness, plays a major role in various forms of clinical disorders (for a recent synthesis, see Teachman, Clerkin, Cunningham, Dreyer-Oren, & Werntz, 2019) and in addictive behaviors in particular (for a meta-analysis, see Rooke, Hine, & Thorsteinsson, 2008). For example, research on the alcohol-implicit association test (alcohol-IAT; Lindgren et al., 2013; Wiers et al., 2007) has consistently shown that the tendency to associate alcohol-related stimuli with pleasant stimuli (implicit associations) is an automatic bias that is strongly linked to AUD (Lindgren et al., 2018). According to neurobiological models of addiction, chronic substance use alters the activity of the prefrontal cortex, which is the headquarters of executive functions (Abernathy, Chandler, & Woodward, 2010; Everitt et al., 2007). Neuroplastic alterations in cortical-striatal loops result in the dorsal striatum taking over the drug-seeking and drug-taking behavior, and individuals switch from controlled consumption to compulsive, automatic consumption of drugs (Everitt, 2014; Noël, Brevers, & Bechara, 2013). In this framework, implicit alcohol-related associations are supposed to play a major role in compulsive alcohol consumption (Biscarra & Conde, 2017; Marhe, Waters, van de Wetering, & Franken, 2013; Noël et al., 2013; Wiers et al., 2007).

Alcohol-IAT is the indirect measure most commonly used to assess implicit associations between alcohol and positive or negative valence, arousal or sedation, and approach or avoidance (for a review see Biscarra & Conde, 2017). Research on the alcohol-IAT indicates that heavy drinkers and patients with AUD often show a negative implicit attitude toward alcohol compared to other categories such as soft drinks or water (De Houwer, Crombez, Koster, & De Beul, 2004; Dickson, Gately, & Field, 2013; Wiers, van Woerden, Smulders, & de Jong, 2002). Other studies, however, have reported inconsistent findings (e.g., McPherson & Harris, 2013). Indeed, alcohol can generate ambivalent emotions related to alcohol use in AUD patients, particularly during withdrawal periods (e.g., Conner & Sparks, 2002), which may account for some inconsistent findings in the literature. Further, the use of different variants of the IAT may explain some of the mixed findings in the literature. Some studies have used bipolar IATs in which alcohol as a category is contrasted with another control category. This bipolar approach using contrasting categories was the original design of the IAT (Greenwald, McGhee, & Schwartz, 1998). Others have used unipolar IAT (with the category alcohol contrasted to no category). The literature on the IAT clearly indicates that relative implicit measures (bipolar IATs) have advantages over absolute implicit measures (unipolar IATs) in the prediction of criterion outcome behaviors (e.g., Houben, Nosek, & Wiers, 2010; Kurdi et al., 2019). For instance, the most recent and largest meta-analysis (Kurdi et al., 2019), which includes 217 studies and more than 36,000 participants, indicates that bipolar IATs, especially those with high polarity attributes, are better predictors of criterion outcome behaviors than unipolar IATs (the correlation between IAT scores and criterion behavior was $r = 0.37$ for bipolar IATs and $r = 0.02$ for unipolar IATs). In the same way, using an Internet sample of 4800 participants, Houben, Havermans, and Wiers (2010) compared the effectiveness of six variants of the IAT for predicting alcohol drinking behaviors. They found that alcohol-related bipolar IAT variants were related to drinking behavior, but unipolar IAT variants were not. The authors summarized their findings as follows: "*Overall, the bipolar alcohol-related affective IAT outperformed all other IAT variants with respect to its relationship with explicit measures and drinking behavior*." (p. 204). Unipolar IATs are mostly recommended when there is no obvious reference category (e.g., Serra et al., 2019). The problem with unipolar IATs when different reference categories exist is that people may spontaneously use different reference categories (soft drink, another drug, abstinence, etc.) as anchoring points when evaluating alcohol. With a bipolar IAT, all the respondents are forced to use the same reference category. In a sense, this facilitates the interpretation of the findings. In sum, the use of a bipolar IAT seems clearly preferable in studies where the main objective is to predict drinking behavior.

The concept of insight in psychiatry has long been defined as "*the perception and consciousness of one's own disorder*" (De Sousa, Romo, Excoffier, & Guichard, 2011, p. 146). Within the domain of addiction, Goldstein et al. (2009) defined a lack of insight as "*a failure to recognize an illness, denial of illness, compromised control of action and unawareness of the patient's social incompetence*" (p. 372). More recently, research has sought to propose an operational definition of alcohol insight, which is based on a factorial analysis of responses of AUD patients to an alcohol insight scale (Dandaba, Ebrahimighavam, Langbour, Chatard, & Jaafari, 2020). While the original alcohol insight scale (Hanil Alcohol Insight or HAIS scale; Kim, Kim, Lee, Lee, & Oh, 1998) has been validated in Korea more than 20 years ago, the factorial structure of the scale has not been examined so far. Dandaba et al. (2020) have sought to remedy this neglect and have proposed a French version of the HAIS scale. In this work, alcohol insight has been depicted as a multifactorial concept, which includes a lack of awareness that one has a drinking problem, which is associated with a high tendency to cancel, minimize any drinking issue, and the incapacity to acknowledge the need for help and treatment.

In the present study, we postulated that the influence of implicit alcohol-related associations on compulsive alcohol-consumption should be exacerbated among patients with relatively low alcohol insight. There are two main theoretical reasons for this prediction. First, patients with low alcohol insight are often motivated to conceal their alcohol craving (e.g., to avoid hospitalization), and research indicates that efforts to suppress alcohol-related thoughts can paradoxically increase the likelihood of a later binge or relapse (Bensley, Kuna, & Steele, 1990; Muraven, Collins, & Nienhaus, 2002; Ostafin, Marlatt, & Greenwald, 2008). Second, patients with low alcohol insight may have limited awareness of psychological processes underlying behavior (Nisbett & Wilson, 1977), and they may not be aware of the transient nature of craving (Serre, Fatseas, Swendsen, & Auriacombe, 2015). As a matter of fact, they may overestimate their ability to control the urge to drink alcohol (Langer, 1975; Thompson, Armstrong, & Thomas, 1998). In contrast, patients with high alcohol insight may be less motivated to conceal alcohol craving, and they may have some awareness of their own implicit bias (Hahn, Judd, Hirsh, & Blair, 2014). Increased acknowledgment of implicit bias may be necessary for promoting sustained behavioral change (Hahn & Gawronski, 2019).

Thus, we predicted that patients with relatively strong, rather than weak, implicit alcohol-related associations should be at higher risk of relapse, and this relation should be especially pronounced among patients with relatively low, rather than high, insight. This prediction is not entirely new. A decade ago, Goldstein et al. (2009) made a similar claim when trying to account for the effect of alcohol insight on relapse. They wrote, "*It is (…) possible that compromised awareness enhances the influence of automatized action schemata leading to uncontrollable drug-seeking behaviors*" (p. 377). To the best of our knowledge, however, no study to date has sought to directly test the hypothesis that alcohol insight moderates the effect of implicit alcohol-related associations on relapse. Our aim in this study was to address this issue. Using a sample of patients treated for severe AUD, we tested the hypothesis that implicit alcohol-related associations predict relapse one month after discharge, mainly or only among patients with relatively low insight.

2. Method

2.1. Patients

We carried out a prospective hospital-based observational cohort study from June 2016 to July 2018. A total of 77 patients (61 men and 16 women) from the departments of psychiatry and hepato-gastroenterology of a public university hospital in France were recruited.

Almost all of them had previous alcohol withdrawal experiences (M = 0.6 attempts, SD = 2.19). Patients were considered eligible if they (a) were aged between 18 and 70 years, (b) had severe AUD (c) had no severe or moderate depression or suicidal risk, (d) were free of cognitive disorders, (e) were covered by French social security, and (f) had a good understanding of French. An ethical research committee (*Comité d'éthique du Centre Hospitalier Henri Laborit*, CHLA0007) approved the protocol, and the patients provided their written informed consent. The patients hospitalized for severe AUD were tested during their inpatient stay at the hospital (the treatment protocol spanned 28 days of hospitalization) and at 1-month post-treatment follow-up.

2.2. Procedure

During the first session, we collected socio-demographic data (age, gender) and data related to cognitive impairment (MOCA: Montreal Cognitive Assessment Test; Nasreddine et al., 2005), depression (MADRS: Montgomery-Åsberg Depression Rating Scale; Williams & Kobak, 2008), impulsivity (UPPS: Impulsive Behavior scale; Whiteside & Lynam, 2001; French version by Van der Linden et al., 2006), anxiety (STAI: State-Trait Anxiety Inventory; Spielberger, 1983), addiction (TLFB: TimeLine Follow back of alcohol consumption; Sobell, Brown, Leo, & Sobell, 1996), and craving (VNAS-C: Visual Numeric Analogue Scale of Craving: Morissette, Ouellet-Plamondon, & Jutras-Aswad, 2014).

Patients' insight state was evaluated during their admission using a 20-item self-reported instrument (HAIS; Kim et al., 1998; French version by Dandaba et al. (2020)). When this evaluation could not be performed during admission, it was completed within two days of patient's arrival in the hospital. In the present sample, the internal consistency of the insight scale was satisfactory (Cronbach's alpha = 0.74). Representative items were: "*I find no problem in my drinking*" (reverse coded), "*I am an alcoholic!*", and "*I can control my drinking behavior anytime if I want to*" (reverse coded). Patients indicated their degree of agreement with each item using a 3-point Likert scale ("agree", "not sure", "disagree"). The scoring rule was 2 ("agree"), 1 ("not sure"), and 0 ("disagree") for positively worded items, and −2 ("agree"), −1 ("not sure"), and 0 ("disagree") for negatively worded items. As in previous studies, we summed up responses to the 20 items to form a composite score (Jung, Kim, Kim, Oh, & Kim, 2011; Kim et al., 1998; Kim et al., 2007). Higher scores on this measure indicated high alcohol insight.

Patients also completed an alcohol-implicit association test (alcohol-IAT), similar to the one used in previous studies (Houben et al., 2010; Tello, Bocage-Barthélémy, Dandaba, Jaafari, & Chatard, 2018). This test allowed a comparative evaluation of alcohol with a reference category. Given the relevance of abstinence for patients with AUD, in this study, 'abstinence' was used as the reference category rather than a 'soft drink', which is often used among the general population (Houben et al., 2010; Lindgren et al., 2013; Lindgren et al., 2018; Ostafin & Palfai, 2006; Wiers et al., 2002). Thus, this version of the alcohol-IAT allowed assessing of the tradeoff between automatic tendencies to associate positive and negative stimuli with alcohol compared to abstinence. The words and categories used in the alcohol-IAT and the structure of the different blocks can be found in Supplementary Online Material (Table S1 and Table S2, respectively). The D600 algorithm (Greenwald, Nosek, & Banaji, 2003) was used to compute alcohol-IAT scores. Positive scores indicated a stronger implicit preference for alcohol over abstinence.

One month after discharge, each patient was met in person by a psychiatrist or general practitioner. At this time, we assessed both maintenance of abstinence and relapse. Maintenance of abstinence was assessed with the TLFB (Sobell et al., 1996). This variable was binary coded (maintenance of abstinence was coded 0, and failure to maintain abstinence was coded 1). Relapse was assessed using two measures: total alcohol consumption (TAC) per day and number of heavy drinking days (HDD). Consumption of five or more drinks in a day for men and four or more drinks in a day for women was treated as an HDD (Aldridge, Zarkin, Dowd, & Bray, 2016). Relapse was binary coded. Following recommendations made by the Société Française d'Alcoologie (2015), we coded 1 if the patient reported drinking on 5 or more days within 1 week and/or 5 or more drinks per drinking occasion, and we coded 0 if the patient did not meet these cutoffs (see also Fuller, 1997).

2.3. Statistical analysis

To test our main hypothesis, we ran a logistic regression analysis to predict relapse from alcohol insight, alcohol-IAT scores, and the product term between insight and alcohol-IAT scores. In the regression analysis, we also included demographic variables (gender and age) and clinical variables (cognitive impairment, depression, anxiety, impulsivity and craving) to control for their effects on relapse. The effects of our key predictors on relapse were thus adjusted for the influence of control variables. To facilitate the interpretation of the odds ratio, gender was centered (woman was coded 0.5 and man was coded − 0.5), and all continuous variables were standardized.

In line with best practice recommendations for testing and probing interactions in logistic regression (Aiken & West, 1991; Cohen, Cohen, West, & Aiken, 2003; Hayes & Matthes, 2009; Hosmer & Lemeshow, 1989; Jaccard, 2001; Newsom, 2011), we used the pick-a-point approach to probe the interaction term (Aiken & West, 1991; Hayes & Matthes, 2009). This approach involves selecting representative values (often one standard deviation above and below the mean) of the moderator variable (insight scores in our study) and then estimating the effect of the focal predictor (IAT scores in our case) at those values. This approach is preferred over a dichotomization approach because transforming a continuous variable into a categorical variable (with a median split) reduces statistical power and may lead to spurious conclusions (Cohen, 1983; DeCoster, Iselin, & Gallucci, 2009; Fitzsimons, 2008; Irwin & McClelland, 2003; MacCallum, Zhang, Preacher, & Rucker, 2002; Maxwell & Delaney, 1993; McClelland, Lynch, Irwin, Spiller, & Fitzsimons, 2015). Hence, in this study, we estimated the effect of alcohol-IAT on relapse among participants with relatively low (-1SD from the mean) and high (+1SD from the mean) alcohol insight. Interestingly, these two values (+/-1SD) are close to the cutoffs originally defined by Kim et al. (1998) as "poor insight" (insight scores < 4) and "good insight" (insight scores greater than 15), respectively. Complying with open practices, the data and the code have been made publicly available via the Open Science Framework and can be accessed at https://osf.io/5yr93/.

3. Results

3.1. Sample characteristics

The descriptive statistics of the sample are presented in Table 1. The relapse rate assessed one month after discharge (15 out of 58 patients, or 25.9%) was comparable to that reported in previous studies (Kim et al., 2007). The mean of alcohol-IAT scores was negative and thus indicated that overall patients with AUD had a more negative implicit attitude toward alcohol than toward abstinence. This is consistent with prior research showing that patients treated for AUD often show a negative implicit attitude toward alcohol (De Houwer et al., 2004; Wiers et al., 2002). The mean of alcohol insight in the present sample was 10.74 (SD = 5.03), quite comparable to the one found in the study by Kim et al. (2007). Moreover, there was no significant correlation between alcohol insight and implicit preference for alcohol (see Table S3). Thus, alcohol insight and implicit preference for alcohol could be considered two independent predictors of relapse. Participants lost to follow-up (N = 19) did not differ from the other patients, except that they had more prior experiences of admission to treatment related to drinking problems (M = 1.68, SD = 4.50) than relapsers (M = 0.33,

Table 1
Sample characteristics.

Characteristics	Non-relapsers (n = 43)	Relapsers (n = 15)	Lost to follow-up (n = 19)	*p* value
Demographic situation				
Age, mean (SD) years	46.19 (10.22)	44.27 (16.76)	42.53 (10.04)	0.507
Higher education, yes (%)	27 (63)	11 (73)	13 (68)	0.706
Occupation, yes (%)	20 (47)	7 (47)	6 (32)	0.623
Clinical parameters				
Score of Insight-HAIS, mean (SD)	10.98 (5.25)	9.53 (5.15)	11.16 (5.69)	0.534
Score of Cognitive Assessment-MOCA, mean (SD)	26.84 (2.40)	25.79 (3.09)	27.79 (1.51)	0.132
Score of Depression-MADRS, mean (SD)	8.61 (10.00)	9.27 (9.37)	6.21 (4.06)	0.881
Score of Anxiety-STAI, mean (SD)	43.56 (12.85)	49.79 (10.24)	44.82 (12.63)	0.219
Score of Impulsivity-UPPS urgency, mean (SD)	44.26 (11.65)	42.73 (14.68)	32.42 (23.38)	0.403
Score of Craving-VNAS-C, mean (SD)	1.90 (2.77)	3.38 (3.25)	1.83 (2.69)	0.147
Drinking-related parameters				
IAT-D Score, mean (SD)	-0.51 (0.53)	-0.49 (0.58)	-0.51 (0.61)	0.985
Age at first drink, mean (SD) years	12.98 (4.41)	12.47 (4.81)	12.26 (5.13)	0.934
Duration of drinking problems, mean (SD) years	9.42 (10.02)	8.53 (7.61)	12.18 (11.64)	0.366
Prior experiences of admission treatment due to drinking problems, mean (SD) times	0.31 (0.69)	0.33 (0.49)	1.68 (4.50)	0.043*

Note. HAIS: Hanil Alcohol Insight Scale, MOCA: Montreal Cognitive Assessment Test, MADRS: Montgomery-Åsberg Depression Rating Scale, STAI-Y: State-Trait Anxiety Inventory, UPPS: Impulsive Behavior Scale urgency, VNAS-C: Visual Numeric Analogue Scale of Craving, IAT: Implicit Association Test.

SD = 0.49) and non-relapsers (*M* = 0.31, *SD* = 0.69). This issue is addressed in the supplementary analyses section below.

3.2. Main analyses

The results of the logistic regression model are depicted in Table 2. As shown in the table, control variables accounted for 26.5% of the variance in relapse rate. Among the control variables, the strongest predictor of relapse was impulsivity, followed by depression and gender. The odds ratio indicated that the risk of relapse was somewhat higher among patients with high levels of impulsivity, high levels of depression, and among women. However, none of these variables reached statistical significance. Further, as shown in Table 2, when alcohol insight, alcohol-IAT scores, and the product term between these two last variables were included into the equation, the full model accounted for 41.3% of the variance in relapse rate. After adjusting for control variables, the main effects of alcohol insight and alcohol-IAT scores were not significant. However, as hypothesized, relapse was significantly predicted by the interaction between alcohol insight and alcohol-IAT scores. The negative odds ratio associated with the product term (alcohol insight × alcohol-IAT scores) indicated that patients with both low insight and strong implicit preference for alcohol were at higher risk of relapse than the other patients (see Fig. 1 for conditional estimates plot).

To test our specific predictions, we estimated regression coefficients at different levels of alcohol insight (Judd, McClelland, & Ryan, 2009).

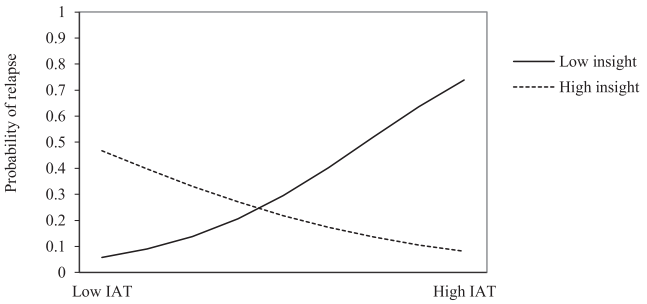

Fig. 1. Conditional estimate plot for probability of relapse (adjusted for control variables) as a function of alcohol insight (computed at +/- 1SD from the mean) and implicit preference for alcohol (computed at +/- 1SD from the mean). Patients with both low insight and high implicit preference for alcohol are at higher risk of relapse than the other patients.

More precisely, we tested whether alcohol-IAT scores predicted relapse in patients with relatively low level of insight (computed at − 1SD from the mean, i.e., 5.62 on the original scale) and in patients with relatively high level of insight (computed at + 1SD from the mean, i.e., 15.89 on the original scale). The +/-1SD values were close to the cutoffs originally defined by Kim et al. (1998) as "poor insight" (insight scores < 4) and "good insight" (insight scores greater than 15), respectively. Our results showed that, after adjusting for control variables, alcohol-IAT scores significantly predicted relapse among patients

Table 2
Logistic regression analysis predicting relapse 1-month after discharge.

	B	S.E.	*p* value	Odds Ratio	95% CI
Control variables					
Constant	−1.07	0.51	0.035	0.34	
Gender	1.42	1.07	0.185	4.14	(0.51, 33.77)
Age	−0.44	0.48	0.352	0.64	(0.25, 1.63)
Cognitive Impairment	−0.53	0.43	0.215	0.58	(0.24, 1.38)
Depression	−0.71	0.49	0.146	0.49	(0.17, 1.30)
Anxiety	0.75	0.62	0.226	2.11	(0.61, 8.17)
Impulsivity (Negative urgency)	−0.90	0.52	0.084	0.40	(0.15, 1.13)
Craving	0.56	0.49	0.261	1.74	(0.65, 4.87)
Nagelkerke R^2 = 0.265					
Main predictors					
Alcohol-IAT	0.39	0.48	0.418	1.47	(0.66, 4.51)
Insight	−0.20	0.37	0.590	0.82	(0.37, 1.70)
Insight × Alcohol-IAT	−1.53	0.71	0.031*	0.22	(0.05, 0.87)

Nagelkerke R^2 = 0.413 (Full model).
Note: IAT: Implicit Association Test, CI: Confidence Interval. * *p*-value < 0.05.

with relatively low insight, OR = 6.79, 95CI[1.16, 39.77], p = .031. The OR indicated that an increase of + 1SD in alcohol-IAT scores (≈ 5 units on the original scale) was associated with an approximately 6-fold increase in the odds of relapse among patients with relatively low insight (for conditional estimates plot, see Fig. 1). In contrast, after adjusting for control variables, alcohol-IAT scores did not predict relapse among patients with relatively high insight, OR = 0.32, 95CI[0.06, 1.54], p = .161.

3.3. Supplementary analyses

We conducted further analyses to determine whether the results were robust to different analytic choices and to the technique used to handle missing data. To begin with, we tested whether the findings were similar when the effects of demographic and clinical variables were not controlled for. The interaction between alcohol insight and alcohol-IAT scores was significant to predict relapse when the control variables were not included in the model, OR = 0.28, 95CI[0.09, 0.85], p = .026. Implicit association positively predicted relapse, but only among AUD patients with relatively low level of insight (-1SD), OR = 4.61, 95CI[1.06, 19.98], p = .042. Thus, the OR was lower when the control variables were not included in the model, but it was still significant.

In the same way, the interaction between alcohol insight and alcohol-IAT scores was significant to predict relapse when the 19 patients lost to follow-up were recoded as relapsers, OR = 0.15, 95CI[0.04, 0.50], p = .003. Implicit association positively predicted relapse, but only among AUD patients with relatively low level of insight (-1SD), OR = 8.19, 95CI[1.71, 39.17], p = .009. This suggests that the exclusion of patients lost to follow-up in the main analyses did not change the findings considerably.

Finally, we examined whether the findings were similar on the measure of failure to maintain abstinence and on the measure of relapse (see Table S3). Over and above the effects of control variables, failure to maintain abstinence was predicted by the interaction between insight and alcohol-IAT scores, but not by their unique main effects. After adjusting for control variables, alcohol-IAT scores significantly predicted failure to maintain abstinence but only among patients with relatively low insight, OR = 9.61, 95CI[1.62, 57.06], p = .013.

Overall, the results of these supplementary analyses confirmed our main findings and extended them to the measure of failure to maintain abstinence.

4. Discussion

Relapse is difficult to predict and prevent in part because individuals who suffer from AUD often show low alcohol insight: they deny their alcohol problem and underreport their alcohol dependence (Goldstein et al., 2009). The present study sought to test one potential reason for the high risk of relapse among patients with low insight. We postulated that implicit alcohol-related associations should exert a greater influence in patients with low, rather than high, alcohol insight. As hypothesized, the findings indicated that alcohol implicit associations were associated with increased risk of relapse among patients with low insight, but not among those with high insight. Relapse was predicted by the interaction between alcohol insight and alcohol implicit associations, over and above the effects of demographic and clinical factors.

In line with Goldstein et al. (2009) hypothesis, our results show for the first time that automatic associative processes exert a greater influence in patients with lower insight, which may ultimately lead to relapse. We found converging evidence for our hypothesis on failure to maintain abstinence. This is consistent with the notion that low insight exacerbates the effect of implicit cognitive processing on compulsive alcohol consumption. Interestingly, the present findings were supported even if there was no direct effect of alcohol insight on relapse in the present study. The lack of a direct effect of alcohol insight on relapse seems to contradict previous research (Kim et al., 2007). However, the present study had a lower sample size and thus a low statistical power to detect a significant correlation as large as the one found in Kim et al. (2007) study. What our findings indicate, however, is that low insight exacerbates the influence of automatic alcohol implicit associations on drinking behavior. They confirm that alcohol insight and implicit associations play a role in self-regulation failure.

The present study has limitations that deserve to be addressed in subsequent work. To begin with, the sample size was rather small. A large proportion of patients dropped out of the study, which reduced the statistical power to detect significant effects and could affect the generalizability of our findings. In an effort to address this issue, we performed a statistical simulation assuming that all the 19 patients lost to follow-up relapsed at one-month follow-up, and the results replicated the main findings with a larger effect size. Thus, results of this simulation suggest that our findings would hold true even if all the patients lost to follow-up relapsed at one-month follow-up. Although a high rate of dropout is not rare in studies involving patients with severe AUD (Edwards & Rollnick, 1997; Kristman, Manno, & Côté, 2003; Sobell, Sobell, & Maisto, 1984), it would be highly desirable to replicate the present findings in larger samples.

Another limitation is that the precise cognitive processes that mediate the effects we observed remain unknown. It would be interesting to better investigate why patients with low insight and high alcohol implicit associations are more likely to relapse. One potential mediator is thought suppression (Bensley et al., 1990; Muraven et al., 2002; Ostafin et al., 2008). Continuous efforts to suppress alcohol-related thoughts may deplete the control resources required to maintain abstinence, thus increasing the risk of relapse. Another complementary mechanism may be the illusion of control (Langer, 1975; Thompson et al., 1998). Patients with low insight and strong alcohol implicit associations may overestimate their ability to control the urge to drink alcohol. As a result of this cognitive distortion, patients with low insight and high alcohol implicit associations may have insufficient control resources to resist to the temptation of alcohol (triggered by environmental cues), even when their control resources are not depleted. Still another potential mediator may be the readiness to change (Gaume, Bertholet, & Daeppen, 2017; Slepecky et al., 2017). For instance, it is possible that patients with low insight and strong alcohol implicit associations have not made sufficient modifications to their behavior and way of life to ensure a sustained behavioral change in the month following the treatment. Future studies are needed to examine these different possibilities.

Finally, a limitation inherent to the use of a bipolar alcohol-implicit association test is that it does not allow drawing definitive conclusions regarding the role of implicit associations as relapse predictors. In particular, it remains unclear whether the high relapse rate observed here in patients with low insight is due to positive implicit associations towards alcohol, or to negative implicit associations towards abstinence. Future studies using different versions of the alcohol-implicit association test may contribute to shed light on this issue.

In spite of its limitations, the present study on a difficult-to-reach clinical population may open up new avenues for treatment of AUD. A direct and straightforward implication of the present findings is that patients with low insight and high alcohol implicit associations should be given special attention and care as they are at higher risk of relapse. A better understanding of the cognitive factors that may lead patients to relapse is needed to fight the major disease of addiction. Clinicians may also want to design specific interventions to improve alcohol insight and reduce implicit alcohol-related cognitions. A previous study suggests that psychological interventions targeting motivation to change could enhance alcohol insight in patients with severe AUD (Jung et al., 2011). Further studies are needed to replicate and extend this finding. A recent *meta*-analysis of 14 studies on cognitive bias modification (Boffo et al., 2019), and at least two preregistered trials (Tello et al., 2018;

Tello, Jaafari, & Chatard, 2020) also suggest that addictive behavior could be changed using computerized tasks targeting alcohol-related cognitive biases. To date, however, there is a lack of evidence that patients suffering severe AUD may benefit from such cognitive bias modification interventions. Further studies are needed to explore this promising issue. In particular, it would be interesting to examine whether cognitive bias modification is effective in reducing implicit evaluations of alcohol (or negative implicit associations of abstinence) and relapse in patients with low insight. It might contribute to understanding causal mechanisms that drive changes in implicit cognition, insight and ultimately, behavior.

To conclude, the present study contributes to a better understanding of why patients with severe AUDs often fail to control their drinking behavior after alcohol treatment. The findings suggest that automatic cognitive processes take precedence over conscious controlled processes in patients with low alcohol insight, rendering any effort to refrain a perilous task.

Credit authorship contribution statement

Meira Dandaba: Data collection, data analysis, writing. **Wilfried Serra:** Data management, data collection, reviewing. **Ghina Harika-Germaneau:** Data collection, reviewing. **Christine Silvain:** Data collection, reviewing, revision. **Nicolas Langbour:** Data collection, data curation, revision. **Marcello Solinas:** Reviewing, critical revision. **Xavier Noël:** Reviewing, critical revision. **Nemat Jaafari:** Reviewing, critical revision. **Armand Chatard:** Conceptualization, data analysis, writing, supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.addbeh.2020.106433.

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