

Hostile attributional biases in severe alcohol use disorder: replication, gender specificity, and mechanistic insights

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Abstract

Aims: Despite their importance in the emergence and persistence of severe alcohol use disorder (SAUD), social cognition impairments remain understudied in this population. Hostile attributional biases (HAB), a key component of social cognition, may be involved in interpersonal problems and SAUD maintenance. However, current evidence for HAB in SAUD is highly preliminary, as it relies on a single study based on a small sample and on a task that cannot dissociate increased hostile from reduced benign attributions. We therefore used an improved methodology to further characterize this bias and disentangle underlying mechanisms. In addition, we explored potential gender differences.

Method: A total of 56 patients (28 women) diagnosed with SAUD and 66 (27 women) demographically matched controls completed the Word-Sentence Association Paradigm-Hostility, which provides a valid, spontaneous, and relatively implicit assessment of both hostile and benign social attributions related to ambiguous situations. They also completed self-report measures of psychopathology and interpersonal problems.

Results: At the group-level, patients with SAUD presented higher HAB than controls, without group differences for benign attributions. Gender analyses revealed that this effect selectively emerged in men with SAUD. Further, patients' benign attributions did not differ from their hostile attributions. Finally, HAB (not benign attributions) were associated with interpersonal problems and state anxiety in patients.

Conclusions: The association between SAUD and HAB at the group level is genuine and replicable across samples and tasks. This association may further selectively emerge in men. Our results also confirm the functional significance of HAB in SAUD, and point to potential mechanisms and clinical recommendations.

Keywords: alcohol use disorder; social cognition; hostile attributional bias; interpersonal problems; relapse

Introduction

Neuropsychological research in severe alcohol use disorder (SAUD) has recently gone beyond the classical exploration of “cold” cognitive abilities (e.g. memory, executive functions) to evidence robust impairments in social cognition (i.e. the perception, interpretation, and mobilization of social cues; Bora and Zorlu 2017). This line of work is pivotal for understanding the interpersonal problems implicated in the severity and persistence of SAUD (Zywiak et al. 2003; Heilig et al. 2016; Sliedrecht et al. 2019). Moreover, recent evidence that social cognition impairments predict premature treatment drop-out and relapse, and do not spontaneously recover over the first months of abstinence, underscores their direct clinical relevance for the early steps of detoxification treatment (Rupp et al. 2017; Rolland et al. 2019; Rupp et al. 2021). Unfortunately, social cognition research in SAUD is currently characterized by a narrow focus on emotion recognition and Theory of Mind (i.e. the ability to infer others' mental states), unduly restricting our comprehension of the range of impairments in that domain, and limiting potential for action (Pabst et al. 2022).

Authoritative taxonomies (Green et al. 2008) emphasize attributional biases, and particularly hostile attributional biases (HAB; i.e. the tendency to endorse others' hostile intentions as the cause of ambiguous social events), as a

core component of social cognition pertinent to clinical populations. Accordingly, HAB have been evidenced in several disorders, including schizophrenia, major depressive disorder, Parkinson disease, and bipolar disorder (Lahera et al. 2015; Smith et al. 2016; Decombe et al. 2022; Buck et al. 2023), demonstrating their broad transdiagnostic value. HAB further bear clear relevance to SAUD. Indeed, they represent key psychological processes in isolation, loneliness (Okruszek et al. 2021), and particularly aggression (Klein Tuente et al. 2019), which are frequently observed in SAUD (Akerlind and Hörnquist 1992; Chou et al. 2011; Levola et al. 2014; Gautier et al. 2023). HAB could thus hamper the recovery process in SAUD through their negative influence on interpersonal bonds, increasing conflicts and reducing social support. For example, HAB might directly increase perceived criticism (i.e. the frequency/intensity of negative feedbacks and reproaches, as self-reported by the patient), which has been identified as promoting relapse (Fals-Stewart et al. 2001). Indeed, HAB may favor *actual* criticism due to its impact on relationship quality but also lead to misinterpretations of benevolent/neutral comments as being critical. In spite of this importance, the association between HAB and SAUD remains insufficiently studied.

Pabst et al. (2020) recently provided the first and, to our knowledge, only direct evidence for HAB in SAUD.

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They used the Ambiguous Intentions Hostility Questionnaire (Combs et al. 2007), which requests participants to provide open-ended statements to explain why people behaved in a certain way in written vignettes of ambiguous social situations (e.g. “You walk past a bunch of teenagers at the mall and you hear them start to laugh”). The statements were ascribed hostility scores by an external rater. The results showed that patients with SAUD had higher hostility scores than healthy controls (HC) (i.e. a higher tendency to infer that people present hostile intentions or attitudes toward them in ambiguous social situations), suggesting that SAUD is associated with HAB. HAB was further linked with state anxiety and interpersonal problems among patients.

This work constitutes a valuable starting point for exploration of HAB in SAUD to date. However, definitive conclusions should not be based on a single study. Moreover, methodological aspects in Pabst et al. (2020) limit the straightforward interpretation of their data. First, the Ambiguous Intentions Hostility Questionnaire is an explicit measure that overtly instructs participants to reflect, without time restrictions, on the causes of social situations. This makes researchers’ goals transparent, thereby increasing risks of social desirability biases, and reduces the ecological validity of the task. Furthermore, a task encouraging reflective reasoning may be suboptimal to capture the spontaneousness and implicitness thought to characterize HAB (Wilkowski and Robinson 2010). Second, the involvement of external raters adds a layer of subjectivity that may introduce further bias. Third, the design does not allow determining whether the elevated scores in SAUD actually reflect increased HAB, a reduced tendency to endorse non-hostile attributions, or both. Indeed, recent work suggests that SAUD may be linked to reduced biases toward positive, rather than increased biases toward negative, social information (Pabst et al. 2023b). Finally, the study comprised a relatively low sample size, potentially affecting the reliability of the effects (Button et al. 2013).

Given the above-mentioned interpersonal and clinical relevance of this social cognition component in this population, and in line with accumulating calls for replication of novel findings in addiction science (e.g. Heirene 2021; Pearson et al. 2022), our primary aim was to confirm the validity and robustness of the association between SAUD and HAB while addressing the limitations of Pabst et al. (2020). We used a different, highly validated task, the Word-Sentence Association Paradigm – Hostility (WSAP-H; Dillon et al. 2016; Pabst et al. 2023a, 2023b). Briefly, the WSAP-H requests participants to spontaneously rate the extent to which hostile and benign words *relate to* sentences describing ambiguous social situations. It has important advantages compared with the Ambiguous Intentions Hostility Questionnaire. It eliminates the need for external raters as scores are directly obtained from participants, hence removing noise introduced by subjectivity or evaluator bias. It also yields both benign and hostile attribution scores, offering the possibility to disentangle the source(s) of the observed group differences. While these caveats are also addressed by the Social Information Processing–Attribution and Emotional Response Questionnaire (Coccaro et al. 2009), the other most commonly used task assessing HAB, which asks participants to rate the likelihood of four statements explicitly pertaining to the intentions of protagonists in eight ambiguous social scenes, the WSAP-H exhibits additional features that make it an ideal measure in our context. First, it is more implicit and ecological as it does

not emphasize the need to reflect on the cause of the situation. Because it urges participants to respond as spontaneously and naturally as possible, as they normally would in everyday life, it reduces the impact of biases affecting explicit tasks (e.g. social desirability). Finally, although it has a larger content coverage of ambiguous situations than both other tasks, it is very short (<5 min) and easy to complete, avoiding any effect of fatigue or reduced cognitive abilities. Besides using this more valid task, we also increased the sample size to further strengthen the reliability of our study.

Secondarily, we explored potential gender differences. Some emotion recognition and Theory of Mind studies suggested that among individuals with SAUD, women may be more vulnerable to alterations in social cognition (Frigerio et al. 2002; Onuoha et al. 2016; Lewis et al. 2019). On the other hand, men were found to show higher levels of HAB compared with women in a population-based sample (Chen et al. 2012). However, gender differences in the relation between SAUD and HAB have not been examined. Addressing this question may inform our understanding of the stable sources of heterogeneity in social cognition impairments in SAUD, and bear critical implications for the individualized tailoring of interventions.

Finally, we investigated the consistency of previously reported associations between HAB, interpersonal problems, and psychopathological symptoms in SAUD.

Method

Participants

A total of 56 patients with a DSM-5-confirmed diagnosis of SAUD and 66 age, gender, and education-matched HC took part in the study. A power analysis conducted on G-Power indicated that a sample size of 51 participants per group was sufficient for our primary objective of detecting medium-sized (which we selected as a conservative estimate given the large differences observed in Pabst et al. 2020) between-group differences and a small-to-medium within-between interaction with a power of 0.80. We recruited patients from Belgian specialized detoxification units. A trained psychiatrist screened them upon hospital admission to ensure that SAUD was their primary problem and that they did not present major comorbidities interfering with successful withdrawal treatment. Patients reported no lifetime diagnosis of comorbid psychiatric disorder besides depression, anxiety, and tobacco use disorder, and had abstained from alcohol for 8 days to 3 months at testing time. We recruited HC via social media and flyer advertisements, and by mobilizing the participant pool of our department. HC reported no lifetime diagnosis of psychiatric disorder and no first-degree (parents, siblings) family history of alcohol use disorder. They further had Alcohol Use Disorder Identification Test (AUDIT; Babor et al. 2001) scores below eight, indicating low-risk consumption, and reported drinking less than 10 units per week on average and never more than three units per day (1 unit = 10 g of ethanol). The ethical committee of the department of psychology of UCLouvain and the biomedical ethical committee of the local University hospital approved all study procedures.

Main measure

We used the French-validated version of the WSAP-H (Pabst et al. 2023a, 2023b) to assess HAB. It comprises 15 sentences of ambiguous social situations (e.g. “A friend does not say hello,” “A shopping cart bumps into you”), each presented

once alongside a benign (e.g. “Unaware,” “Accidental”) and once alongside a hostile (e.g. “Ignoring,” “Aggressive”) word. For each of the 30 trials, participants are instructed to indicate, as spontaneously as possible, how strongly the word relates to the sentence on a 1 = “Not at all” to 6 = “Extremely” scale. The order of the sentences was fixed, with at least five trials separating two occurrences of the same sentence, but whether the first occurrence was associated with a benign or a hostile word was counterbalanced across participants. As per previous research (e.g. Dillon et al. 2016; Quan et al. 2019), we indexed HAB by averaging the ratings of the 15 hostile items, and computed a benign attribution score by averaging the ratings of the fifteen benign items. The internal consistencies of the scores on hostile attribution items were $\alpha = 0.78$, $\omega = 0.84$ in HC and $\alpha = 0.82$, $\omega = 0.87$ in patients with SAUD. The internal consistencies of the scores on benign attribution items were $\alpha = 0.72$, $\omega = 0.78$ in HC and $\alpha = 0.81$, $\omega = 0.86$ in patients with SAUD.

Additional measures

We used the Inventory of Interpersonal Problems (IIP; Horowitz et al. 2003) to assess social interaction difficulties. This self-report questionnaire comprises 64 items from eight subscales [Cold/Distant (e.g. “It is hard for me to show affection to others”), Domineering (e.g. “I am too aggressive with others”), Intrusive/Needy (e.g. “It is hard for me to stay out of people’s business”), Overly accommodating (e.g. “I am too easily exploited by others”), Nonassertive (e.g. “It is hard for me to assert myself to others”), Self-sacrificing (e.g. “I am excessively generous with others”), Socially inhibited (e.g. “It is hard for me to introduce myself to new people”), and Self-centered (e.g. “It is hard for me to support others in their life projects”)] scored according to personal relevance on a 5-point scale from 0 = “Not at all” to 4 = “Extremely.” We also used the 13-item Beck Depression Inventory (BDI; Beck and Steer 1987) to assess depression symptoms, the State-Trait Anxiety Inventory (STAI; Spielberger and Gorsuch 1983) to assess general state/trait anxiety symptoms, and Liebowitz Social Anxiety Scale (LSAS; Liebowitz 1987) to assess social anxiety symptoms.

Statistical analyses

To determine the robustness and validity of previous results at the group level (independently of gender), we first used a 2 x 2 mixed analysis of variance (ANOVA) to investigate the effects of group (SAUD vs. HC, between), and attribution type (Benign vs. Hostile, within) on participants’ WSAP-H scores. We then explored potential gender differences by adding gender (men vs. women, between; no participant reported a different gender) as an additional factor in a separate model 2 x 2 x 2 ANOVA. We investigated the relations between WSAP-H scores and interpersonal problems, psychopathological symptoms, and alcohol-related variables within the SAUD group as a whole, and separately by gender, using bivariate Pearson correlations. We finally investigated the potential confounding role of psychopathology symptoms variables found to differ between groups and to correlate with WSAP-H scores in any group by individually entering them as covariates (along with interactions with our factors of interests, to account for potential violations of the assumption of homogeneity of slopes) in the relevant models. We conducted all analyses on R

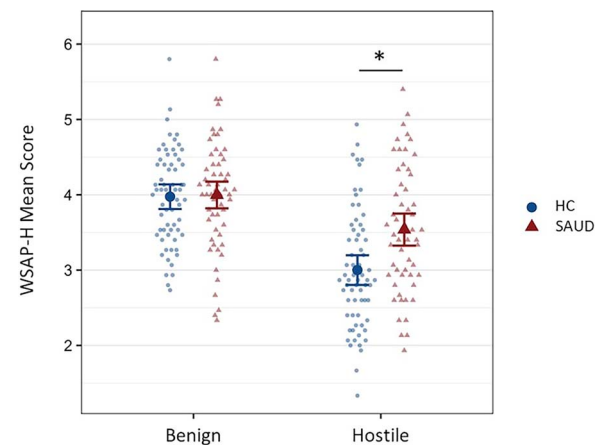


Figure 1 Mean scores for benign and hostile attributions in patients with SAUD and HC

(R Core Team 2019) supplemented by the “afex” (Singmann et al. 2021), “emmeans” (Lenth et al. 2021), and “psych” (Revelle 2022) packages.

Results

Socio-demographic, psychopathological, interpersonal problems, and alcohol-related measures

Groups did not differ in gender, age, or education. Patients with SAUD had higher scores on every collected psychopathological measure and every interpersonal problem subscale, and had higher AUDIT scores. Participant characteristics by gender are provided as Supplementary Table 1. Importantly, men were on average younger than women (Table 1).

WSAP-H scores as a function of group and attribution type

We found a significant main effect of group [$F(1,120) = 10.87$, $P = 0.001$, $\eta^2_p = 0.08$], with higher scores in patients with SAUD ($M = 3.77$, $SE = 0.06$) than HC ($M = 3.49$, $SE = 0.06$), as well as a significant main effect of attribution type [$F(1,120) = 47.30$, $P < 0.001$, $\eta^2_p = 0.28$], with benign attribution scores ($M = 3.99$, $SE = 0.06$) being higher than hostile attribution scores ($M = 3.27$, $SE = 0.07$). The group x attribution type interaction was also significant [$F(1,120) = 6.10$, $P = 0.015$, $\eta^2_p = 0.05$]. The follow-up between-groups t -tests showed that the group effect on benign attribution scores was nonsignificant and very small [$t(120) = 0.19$, $P = 0.851$, $d = 0.03$; SAUD: $M = 4.00$, $SE = 0.09$; HC: $M = 3.97$, $SE = 0.08$], whereas the group effect on hostile attribution scores was significant and associated with a medium effect size [$t(120) = 3.68$, $P < 0.001$, $d = 0.67$; SAUD: $M = 3.54$, $SE = 0.11$; HC: $M = 3.00$, $SE = 0.10$], indicating that patients with SAUD had higher hostile attribution scores compared with HC, but equivalent benign attribution scores. Additional within-groups follow-up t -tests confirmed that benign attribution scores were higher than hostile attribution scores both in patients with SAUD [$t(120) = 3.00$, $P = 0.003$, $d = 0.39$] and HC [$t(120) = 6.90$, $P < 0.001$, $d = 0.87$] (Fig. 1).

Table 1. Socio-demographic, psychopathological, interpersonal problems, and alcohol-related measures in patients with SAUD and HC: Mean (SD).

	SAUD (<i>n</i> = 56)	HC (<i>n</i> = 66)
<i>Socio-demographic measures</i>		
Gender ratio (M/F)	28/28	39/27
Age	49.80 (10.00)	47.00 (11.61)
Education level (in years since starting primary school)	14.18 (2.19)	14.62 (2.72)
<i>Psychopathological measures</i>		
BDI ^a	10.77 (6.18) ⁶	3.05 (3.34)
STAI ^b -State	32.32 (10.10)	28.68 (6.87)
STAI-Trait	52.59 (9.14) ⁵	38.51 (9.11)
LSAS ^c	51.16 (29.57) ⁶	37.52 (26.75)
<i>Interpersonal problems</i>		
Total IIP ^d	94.62 (33.04) ¹	64.94 (32.82)
Domineering	7.20 (3.04)	5.43 (3.51)
Self-centered	8.59 (4.99)	5.83 (3.97)
Cold/distant	9.72 (7.13)	5.88 (4.78)
Socially inhibited	11.68 (9.24)	7.72 (6.99)
Nonassertive	14.51 (8.80)	10.58 (7.12)
Overly accommodating	14.71 (7.44)	11.57 (6.31)
Self-sacrificing	17.85 (6.53)	12.25 (6.41)
Intrusive	12.25 (6.99)	6.20 (4.58)
<i>Alcohol consumption measures</i>		
AUDIT ^e	30.98 (5.42) ⁹	3.18 (2.25)
Number of abstinence days	24.93 (19.44) ²	/
Number of previous detoxifications	1.38 (2.01)	/
Duration of SAUD (in years)	19.55 (17.08)	/
Number of alcohol units per day ^f	17.03 (10.47) ¹	/
Number of DSM-5 SAUD symptoms	8.73 (1.72)	/

^aBeck Depression Inventory (Beck and Steer 1987). ^bState/Trait Anxiety Inventory (Spielberger and Gorsuch 1983). ^cLiebowitz Social Anxiety Scale (Liebowitz 1987). ^dInventory of Interpersonal Problems (Horowitz et al. 2003). ^eAlcohol Use Disorder Identification Test (Babor et al. 2001). ^fBefore detoxification (an alcohol unit corresponds to 10 g of ethanol). Note. Bold lines indicate a significant difference between groups. Superscript numbers indicate the number of missing data.

WSAP-H scores as a function of group, attribution type, and gender

In addition to replicating the above-mentioned significant effects of group, attribution type and group x attribution type interaction ($ps < 0.023$), the ANOVA model including gender revealed a significant group x attribution type x gender effect [$F(1, 118) = 10.16, P = 0.002, \eta^2_p = 0.08$]. We analyzed this interaction via group x attribution type ANOVAs separately conducted in men and women (Fig. 2).

In women, there were no significant group [$F(1, 53) = 3.19, P = 0.080, \eta^2_p = 0.06$] or group x attribution type [$F(1, 53) = 0.31, P = 0.580, \eta^2_p = 0.006$] effects, but there was a significant attribution type effect [$F(1, 53) = 22.75, P < 0.001, \eta^2_p = 0.30$], indicating greater benign ($M = 3.98, SE = 0.09$) than hostile ($M = 3.21, SE = 0.11$) attribution scores in both groups.

In men, the group [$F(1, 65) = 8.02, P = 0.006, \eta^2_p = 0.11$; SAUD: $M = 3.84, SE = 0.09$, HC: $M = 3.48, SE = 0.10$], attribution type [$F(1, 65) = 23.41, P < 0.001, \eta^2_p = 0.26$; Benign: $M = 3.97, SE = 0.09$, Hostile: $M = 3.35, SE = 0.10$], and group x attribution type effects were significant [$F(1, 65) = 18.82, P < 0.001, \eta^2_p = 0.22$]. Follow-up between group *t*-tests showed that the interaction was due to patients showing higher hostile attributions [$t(65) = 4.75, P < 0.001, d = 1.20$; SAUD: $M = 3.81, SE = 0.15$, HC: $M = 2.89, SE = 0.13$], whereas there was no group difference for benign attributions [$t(65) = 1.13, P = 0.261, d = 0.29$; SAUD: $M = 3.88, SE = 0.13$, HC: $M = 4.07, SE = 0.11$]. Within-group *t*-tests showed that benign scores were significantly

higher than hostile scores in HC [$t(65) = 7.10, P < 0.001, d = 1.13$] but not in SAUD [$t(65) = 0.06, P = 0.745, d = 0.06$]. Additional between-group *t*-tests showed that (i) men with SAUD not only had significantly increased hostile scores compared with HC men, but also compared with both women groups ($ps < 0.011$), and (ii) HC men did not differ from both women groups on hostile or benign scores ($ps > 0.055$). Finally, given that men were on average younger than women, we examined whether the critical group x attribution type x gender interaction remained after controlling for age, which was verified [$F(1, 114) = 10.68, P = 0.001, \eta^2_p = 0.09$].

Links between WSAP-H scores, psychopathology symptoms, interpersonal problems in patients with SAUD

Considering the above-mentioned results, we report these relationships both in the group of patients with SAUD as a whole, and in men and women with SAUD separately, but will mostly focus our interpretations on findings in the whole group and in men. In the SAUD group as a whole, but not in men or women with SAUD separately, hostile attribution scores were significantly and positively associated with state anxiety (It should be noted that there were no significant correlations between psychopathological symptoms and hostile attribution scores in the HC group as a whole or in either gender group separately, all $ps > 0.12$). Hence, we only investigated the confounding role of state anxiety as it was the only psychopathological variable differing between groups and correlated with hostile

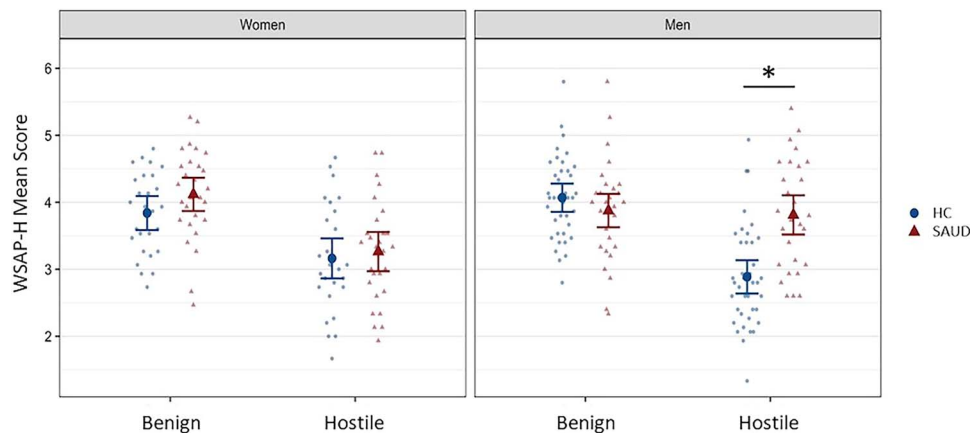


Figure 2 Mean scores for benign and hostile attributions in patients with SAUD and HC as a function of gender

attribution scores.). Given that there was a specific effect of SAUD on state anxiety in men (i.e. significantly higher state anxiety in men with SAUD compared with HC men, but no difference in state anxiety between women with SAUD and HC women, see [Supplementary Table 1](#)), we verified that our effects of interest remained unaltered after including state anxiety in our models. This was confirmed as the group [$F(1,114) = 9.66, P = 0.002, \eta^2_p = 0.08$], group \times attribution type [$F(1,114) = 4.63, P = 0.034, \eta^2_p = 0.04$], and most importantly group \times attribution type \times gender effects [$F(1,114) = 7.94, P = 0.006, \eta^2_p = 0.07$] remained significant in the model including all participants, and the group \times attribution type [$F(1,63) = 13.91, P = 0.004, \eta^2_p = 0.18$] and ensuing specific group differences for hostile [$t(63) = 4.22, P < 0.001$] but not benign [$t(63) = 0.84, P = 0.404$] remained in the models including men only. Hostile attribution scores also correlated significantly with Domineering, Self-centered, and Cold/Distant interpersonal problems in the SAUD group as a whole. The associations with Domineering and Cold/distant (at a trend level in women) interpersonal problems persisted in both gender groups separately, whereas the association with the self-centered scale was only significant in women. Benign attribution scores were not significantly related with psychopathological symptoms or interpersonal problems, except negatively with Cold/Distant interpersonal problems in women. Finally, given the relatively wide range of abstinence durations in our SAUD sample, we explored their potential association with HAB. We found no significant correlation in the whole sample (Benign: $r = -0.06, P = 0.660$; Hostile: $r = -0.14, P = 0.308$) or among men (Benign: $r = 0.07, P = 0.727$; Hostile: $r = -0.21, P = 0.295$) or women (Benign: $r = -0.27, P = 0.168$; Hostile: $r = 0.02, P = 0.908$) ([Table 2](#)).

Discussion

We probed and confirmed preliminary findings of an association between SAUD and HAB ([Pabst et al. 2020](#)) while relying on an improved design overcoming key methodological limitations. We recruited a larger sample and used a task assessing spontaneous HAB in a more implicit way, and without the involvement of external raters. Our results further strengthen previous conclusions by showing that patients with SAUD specifically show greater hostile attributions, not lower benign

attributions, than HC. We thus provide evidence that the association between SAUD and HAB *at the group level* is genuine and replicates across samples and tasks. This underscores HAB as a critical social cognition component in this disorder, and more generally reaffirms the value of expanding the social cognition literature in SAUD beyond emotion recognition or theory of mind ([Pabst et al. 2022](#)).

Our secondary analyses also revealed that these group-level findings masked gender-specific effects. Indeed, SAUD-related increases in HAB were selectively observed in men. These findings align with the emerging literature reporting gender differences in SAUD-related social cognition alterations ([Frigerio et al. 2002](#); [Onuoha et al. 2016](#); [Lewis et al. 2019](#)), and extend them toward HAB. Importantly, however, these previous studies, assessing emotion recognition of Theory of Mind, found women with SAUD to be particularly affected, suggesting that gender may influence social cognition alterations in SAUD differently depending on the component assessed. The heterogeneity in social cognition alterations in SAUD may thus not only concern the extent to which individuals are generally impaired ([Maurage et al. 2021](#); [Pabst et al. 2021](#)), but also the specific components that are affected, and gender may represent an important stable factor in that regard. Our results therefore advocate for a greater consideration of gender, as well as for joint assessments of different social cognition components, to improve our understanding of the complex profile of SAUD-related alterations in that domain.

In addition to identifying patients at higher HAB risk, our results point to potential mechanisms of real-life HAB. Indeed, the fact that patients' benign attributions were not lower than their hostile attributions suggests that they may judge benign and hostile attributions as similarly adequate when these are rendered salient (benign and hostile words appeared below the sentences). Yet, [Pabst et al. \(2020\)](#) found that in the absence of cues, patients privilege hostile attributions nonetheless. A possible explanation is that, rather than being significantly more strongly adhered to within patients, hostile attributions are more readily accessed than benign ones. Once accessed, the stronger endorsement of hostile attributions compared with controls, which we evidence here, may hamper the consideration of alternatives and prevent reappraisal. Such a proposal is compatible with cognitive models of HAB, according to which certain individuals are more prone to produce spontaneous hostile interpretations, to allocate greater and reinforcing cognitive resources to such interpretations, and to

Table 2. Correlations between benign and hostile attribution scores and psychopathological symptoms and interpersonal problems, in the whole sample of patients with SAUD, as well as in men and women separately.

	Benign						Hostile					
	Whole sample		Women		Men		Whole sample		Women		Men	
	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>
<i>Psychopathological measures</i>												
BDI ^a	−0.11	0.427	−.35 ²	0.077	.05 ⁴	0.804	0.11	0.457	.12 ²	0.557	.24 ⁴	0.263
STAI ^b -State	−0.13	0.346	−0.20	0.318	−0.02	0.907	0.26	0.050	0.20	0.296	0.18	0.367
STAI-Trait	0.00	0.999	−.19 ¹	0.340	.16 ⁴	0.467	0.05	0.719	.07 ¹	0.723	.15 ⁴	0.491
LSAS ^c	0.03	0.862	−.06 ²	0.783	.05 ⁴	0.825	0.07	0.615	.14 ²	0.510	.19 ⁴	0.367
<i>Interpersonal problems</i>												
Total IIP ^d	−0.16	0.202	−0.18	0.350	.08 ¹	0.688	0.22	0.113	0.37	0.054	.24 ¹	0.234
Domineering	0.01	0.910	−0.00	0.962	−0.26	0.189	0.38	0.004	0.38	0.044	0.41	0.034
Self-centered	−0.14	0.252	−0.32	0.102	0.10	0.063	0.30	0.025	0.41	0.030	0.23	0.252
Cold/distant	−0.23	0.071	−0.45	0.016	0.06	0.754	0.34	0.010	0.37	0.053	0.40	0.042
Socially inhibited	−0.14	0.253	−0.24	0.230	0.10	0.616	0.20	0.143	0.29	0.131	0.17	0.391
Nonassertive	−0.16	0.204	−0.15	0.448	0.19	0.346	0.02	0.904	0.17	0.383	0.07	0.718
Overly accommodating	−0.08	0.534	0.32	0.100	−0.04	0.842	−0.12	0.395	0.04	0.847	−0.07	0.742
Self-sacrificing	−0.07	0.590	0.00	0.973	0.17	0.391	0.04	0.755	0.16	0.426	0.05	0.809
Intrusive	−0.04	0.734	−0.12	0.551	0.01	0.948	0.17	0.202	0.14	0.466	0.19	0.340

^aBeck Depression Inventory (Beck and Steer 1987). ^bState/Trait Anxiety Inventory (Spielberger and Gorsuch 1983). ^cLiebowitz Social Anxiety Scale (Liebowitz 1987). ^dInventory of Interpersonal Problems (Horowitz et al. 2003). Note. Bold lines indicate a significant correlation. Superscript numbers indicate the number of missing data.

show difficulties regulating them (Wilkowski and Robinson 2010). Moreover, studies showing increased recall of negative memories in SAUD (Cuervo-Lombard et al. 2016; Nandrino and Gandolphe 2017) support the idea that negative material is more accessible, whereas evidence of impairments in emotion regulation, and specifically in the cognitive reappraisal of negative affect in SAUD (Petit et al. 2015) aligns with the view that patients with SAUD may not, or fail to, challenge hostile attributions when they arise. A direct test of these proposals is now warranted.

We finally investigated the links between attributions, psychopathological symptoms, and interpersonal problems in SAUD. Using a different task in a different sample, we corroborated the pattern of findings from Pabst et al. (2020). Specifically, we confirmed the link between HAB and state anxiety at the group level indicating that HAB may be exacerbated in patients currently experiencing higher anxiety (we assessed state anxiety before HAB). This is consistent with HAB theories incorporating affect, and according to which negative emotional states facilitate access to hostile attributions and hinder their reappraisal (Lemerise and Arsenio 2000; Smeijers et al. 2019). Importantly, however, state anxiety did not entirely account for group differences in HAB. Relatedly, current depressive and trait anxiety symptoms were not related to HAB in either group. It should however be noted that we did not test the influence of past depression/anxiety diagnosis nor of current tobacco use. We thus cannot totally exclude that these partly influenced our results. We also confirmed associations between HAB in SAUD and specific interpersonal problems, and notably in the “domineering” domain, which comprises items that are characteristic of aggressive behaviors. This reinforces the idea that HAB may play a role in the conflicts and interpersonal violence associated with SAUD (Gautier et al. 2023). The specific increase of HAB in men may further partly explain gender differences in SAUD-related aggression (e.g. Fukushima Tedor et al. 2018), although in our sample, women with SAUD did not differ from men with

SAUD on the “domineering” subscale. HAB were also consistently related to cold behaviors that are incompatible with the forming and maintaining of satisfying and enduring relationships, highlighting the various ways in which HAB may compromise interpersonal functioning. Finally, the absence of correlation between HAB and abstinence duration suggests that these biases do not spontaneously evolve during the initial steps of recovery and could constitute quite stable factors in SAUD.

Taken together, and in complement to Pabst et al. (2020), our results bear clinical implications. We first confirm the presence and functional significance (in terms of relations with interpersonal problems) of HAB in SAUD, and thus their relevance as a treatment target. We further suggest that men with SAUD are at particular risk of elevated HAB, and that assessments and treatments should be tailored accordingly. Given the specific increase in HAB in SAUD, and the equivalent adherence to benign and hostile attributions when these are salient, we further propose that there may be therapeutic value in (i) raising patients’ awareness of their HAB tendencies and promoting reasoning about the holistic social situation before committing to an interpretation (Mathes Winnicki and Schmidt 2023), and (ii) increasing the *accessibility/ saliency* of benign alternatives via repeated interpretation training and facilitating attention to positive social cues (Cogle et al. 2017; Smith et al. 2018; Pabst et al. 2023b). Finally, our replication of the state anxiety–HAB association suggests that interventions aimed at decreasing stress in anticipation of social interactions (Pabst et al. 2023a) may also be beneficial.

Our cross-sectional design precludes causal inferences regarding the links between variables, and our sample of recently detoxified patients, while constituting a key population to explore the role of social cognition in early treatment adherence and outcome (Rupp et al. 2017; Rolland et al. 2019; Rupp et al. 2021) may not be representative of the global population with SAUD. Beyond these limitations, we provide converging evidence that SAUD is associated with

HAB and relates to interpersonal problems in this group. We further show that elevated HAB in SAUD may be selectively driven by men with SAUD, and that this effect is due to increased HAB, not decreased benign attributions in patients compared with HC. Moreover, patients' ratings of benign and hostile attributions were not significantly different. These findings offer interesting insights into potential mechanisms and bear clear clinical implications. Future studies should elucidate the causes of the observed gender differences, and longitudinally assess the effects of HAB on treatment adherence and relapse in SAUD.

Author contributions

Arthur Pabst (Conceptualization [lead], Formal analysis [lead], Investigation [lead], Methodology [lead], Writing—original draft [lead]), Mado Gautier (Conceptualization [supporting], Investigation [supporting], Methodology [supporting], Resources [equal], Writing—review & editing [equal]), and Pierre Maurage (Conceptualization [supporting], Funding acquisition [lead], Investigation [supporting], Project administration [equal], Supervision [lead], Writing—review & editing [equal])

Conflict of interest

The authors report that they have no conflicts of interest.

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Data availability

The data underlying this article can be accessed at <https://osf.io/hpfm3/>.

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