

Social decision making in severe alcohol use disorder: Scoping review and experimental perspectives

Mado Gautier  | Arthur Pabst  | Pierre Maurage 

Louvain Experimental Psychopathology Research Group (LEP), Psychological Science Research Institute, UCLouvain, Louvain-la-Neuve, Belgium

Correspondence

Pierre Maurage, Faculté de Psychologie, UCLouvain, Louvain-la-Neuve, Belgium.
Email: pierre.maurage@uclouvain.be

Funding information

Fonds De La Recherche Scientifique - FNRS

Abstract

Background: Patients with severe alcohol use disorder (SAUD) demonstrate multifaceted impairments in social cognition abilities, including emotional decoding or Theory of Mind. Such impairments are associated with real-life interpersonal difficulties, which in turn could contribute to the persistence of SAUD. However, little is known regarding how patients with SAUD make decisions in a social context and this literature has not been comprehensively reviewed.

Objectives: The main aim of this paper was to conduct the first review specifically focusing on social decision-making abilities in SAUD. Following PRISMA guidelines for scoping reviews, we describe existing knowledge regarding the difficulties experienced by patients with SAUD during social interactions. Our second objective was to propose perspectives for future research, based on the shortcomings identified in the available literature.

Design: We searched three online databases (PubMed, PsycINFO, and Scopus) and identified 14 papers using behavioral tasks to assess social decision making in patients with SAUD.

Results: Included studies assessed social decision making through three paradigms: (1) economic games (four papers), (2) moral dilemmas (four papers), and (3) interpersonal problem-solving (six papers). Results indicated that patients with SAUD behave differently from controls in all three paradigms.

Conclusions: Previous studies suggested large-scale social decision-making impairments or biases in SAUD. However, in light of the limited number of studies available and of the restricted set of processes measured, we call for the extension of this field through more ecologically relevant and model-based paradigms in order to elucidate the underlying mechanisms of these effects.

KEYWORDS

moral dilemmas, severe alcohol use disorder, social decision making, social problem-solving, ultimatum game

INTRODUCTION

Efficient social cognition is the ability to correctly perceive and interpret other individuals' intentions, thoughts, or behaviors, and to generate adapted interpersonal responses (Schmidt et al., 2016). It is an essential ability to develop and maintain a balanced interpersonal

life. A prominent theoretical model (Green & Horan, 2010) identified four social cognition subcomponents: Theory of Mind (the ability to infer others' intentions, dispositions, and beliefs), social perception (the ability to identify social roles, societal rules, and social context), attributional biases (how people typically infer the causes of particular events), and emotion processing (perceiving and using emotions

adaptively), all of which are impaired in severe alcohol use disorder (SAUD; Le Berre, 2019; Pabst et al., 2020a).

These social cognition impairments foster interpersonal difficulties by deteriorating existing social relationships and preventing the emergence of new ones, reducing social support (Bora & Zorlu, 2016; Le Berre, 2019; Pabst et al., 2020b), and increasing social isolation (Cox et al., 2018). In turn, such interpersonal difficulties constitute relapse predictors (Levola et al., 2013; Mau et al., 2018; Zywiak et al., 2003). Conversely, social support increases the chances of recovery (Bolin et al., 2003; Schomerus et al., 2011; Seid, 2016). However, despite the relevance of social interactions in this population, the direct exploration of social performance in SAUD is still lacking.

On the one hand, social cognition processes have been widely explored, and difficulties in the identification and interpretation of social signals are now established in SAUD. On the other hand, real-life interpersonal difficulties, notably characterized by reduced social network (Mowbray et al., 2014) and interpersonal conflicts (Kornreich et al., 2002; Philippot et al., 1999), are also documented in this population. However, a missing link between these two deficits remains to be clarified, namely: *How do impaired social cognition abilities impact social performance in SAUD, ending up in the deterioration of social interactions?* Very limited evidence is available regarding the performance of patients with SAUD in tasks requesting effective social decision making. Abnormal “classical” decision-making abilities have been repeatedly evidenced in laboratory settings, notably through the Iowa Gambling Task, which showed a preference toward short-term uncertain/limited reward over safer/higher long-term reward in SAUD (Brevers et al., 2014; Kornreich et al., 2013; Noël et al., 2007). However, these studies focused on nonsocial situations, where decisions only affected the individual, and those findings cannot be generalized to situations involving social interactions. To fill this gap, the present scoping review systematically mapped the research assessing social decision making in SAUD, beyond social cognition deficits (i.e., external interpretation of social signals without being personally involved in the situation and without having to make a genuine social decision). We opted for a scoping review due to the exploratory aim of this paper, as social decision making in SAUD is an emerging field. Compared to systematic reviews, scoping studies are not focused on a specific question and can address broader topics with various study designs (Arksey & O’Malley, 2005). However, although scoping review protocols do not classically entail individual summaries of each study, we included them for the sake of comprehensiveness. Our primary objective was to offer the first review specifically focusing on social decision making and social performance in SAUD. On this basis, our second aim was to outline perspectives for future research.

METHODS

Articles identification and selection procedure

We followed the guidelines of the Extension for Scoping Reviews of the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA-ScR) and adhered to its checklist (Tricco

et al., 2018). We consulted three databases (PsycINFO, PubMed, and Scopus) on November 27, 2020. The search phrase combined social production words (“social functioning” OR “interpersonal functioning” OR “social interaction” OR “interpersonal interaction” OR “social production” OR “social problem solving” OR “interpersonal problem solving” OR “social judgment” OR “moral judgment” OR “social decision making” OR “social decision-making” OR “moral decision making” OR “moral decision-making” OR “dilemma” OR “dilemmas” OR “utilitarian” OR “deontological” OR “nonutilitarian” OR “unfairness” OR “economic* gam*” OR “game theory”) and a large range of alcohol-related terms (“alcohol” OR “alcoholism” OR “alcoholic” OR “alcohol dependen*” OR “alcohol use disorder” OR “heavy drink*” OR “social drink*” OR “binge drink*” OR “episodic drink*” OR “hazardous drink*”). The initial search identified 293 articles (135 in Scopus, 78 in PubMed, 80 in PsycINFO). No publication date limit was included, and we considered gray literature (e.g., unpublished PhD thesis; however, none of them met the inclusion criteria). We exported the search results into Zotero and selected the articles to be included according to a three-step procedure (Figure 1): First, duplicates were removed, leading to the identification of 158 unique papers. Second, titles and abstracts were screened, and 130 articles presenting one of the following exclusion criteria were removed: (1) not in English ($N = 14$); (2) no experimental data ($N = 64$); (3) no human sample ($N = 4$); (4) no valid assessment of alcohol misuse (i.e., absence of alcohol evaluation with valid tools, e.g., AUDIT, or absence of alcohol-related diagnosis; $N = 29$); (5) no valid measure of social performance (i.e., self-report scale without objective performance measure, or measure of social network as an indicator of interpersonal functioning; $N = 18$); (6) not focused on alcohol (e.g., focus on other psychopathological states, alcohol consumption being only considered as a comorbidity; $N = 1$). Third, as the title/abstract screening did not allow a clear-cut decision regarding their inclusion, the 28 remaining papers were screened through full-text reading, leading to the exclusion of 13 articles, based on the same criteria: (1) no valid assessment of alcohol misuse ($N = 1$); (2) no valid measure of social performance ($N = 11$); (3) not focused on alcohol ($N = 1$). Moreover, a PhD Thesis (O’Connell, 1983, unpublished) was excluded as no full-text numeric version was available. Fourteen articles were included in the review. Although the keywords targeted all types of alcohol misuse, the 14 final papers included focused on SAUD, which is why we will refer only to SAUD in this paper. The first author performed the full selection/inclusion procedure. When the decision regarding the inclusion of a paper was unclear, the last author was consulted, and the inclusion decision was made conjointly.

Data extraction and synthesis

We followed a systematic data extraction procedure to determine the main characteristics of each paper. The first author performed data extraction, based on the previous definition, with the other authors, of the variables to be extracted. Five categories of variables were reported, based on the PICOS framework (Liberati et al., 2009): (1) Population (sample size, age, gender ratio, exclusion criteria); (2)

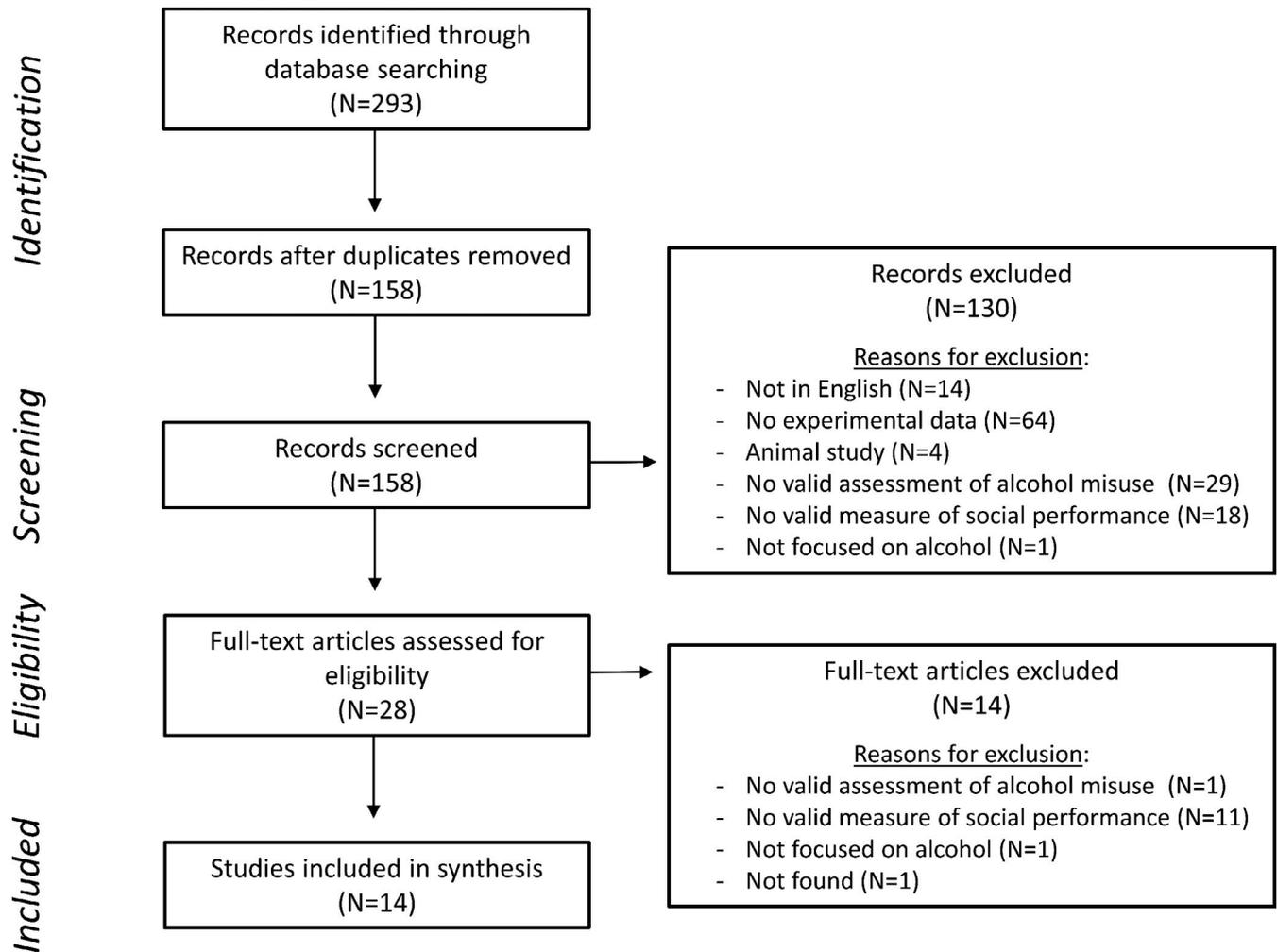


FIGURE 1 PRISMA-ScR flow diagram describing the selection and review process of the papers included

exposure (diagnosis, alcohol consumption measures, psychopathological measures); (3) comparator (control group, matching variables); (4) design (processes measured, tasks, complementary measures); and (5) outcomes (main results, limitations, conclusion). Table S1 presents a comprehensive synthesis of the extracted data.

RESULTS

Three categories of paradigms exploring decision-making abilities in complex interpersonal contexts in SAUD were identified: economic games (i.e., games in which choices of economic agents interact to produce outcomes), moral dilemmas (i.e., situations in which a person has to choose between two situations both involving positive and negative consequences; McConnell, 1988), and social problem-solving tasks (i.e., situations in which a person needs to detect and find the most effective and adaptive responses in problematic interpersonal situations encountered in everyday life; D'Zurilla & Nezu, 1990). We grouped the included studies according to the type of task used. We summarized, for each of them, the population, measures used, and main findings related to the present topic in a narrative way.

Economic games

Making choices in social context requires distinct abilities from those involved in classical cognitive decision making, as the thoughts and affective states generated by interpersonal interactions may bias the decision (Rilling et al., 2008). Strategic choices must thus be adapted to consider the thoughts and intentions of others (Brevers et al., 2013). The Game theory provides a way to explore social decision making (Hinterbuchinger et al., 2018), through economic games measuring the impact of social interaction on decision making (Brevers et al., 2013). In addition, the Game theory approach allows evaluating social decision making in ecological paradigms where the outcome of one player's decision depends on the decisions of the others. It also provides a set of "optimal" decisions in each game (Billeke & Aboitiz, 2013). Economic games are indeed characterized by two properties: (1) Profit to each individual is higher for selfish than cooperative behavior, and (2) mutual cooperation has a higher payoff than mutual defection (Dawes, 1980; Nelissen et al., 2007). One of the most widely used social game paradigms is the ultimatum game, where participants respond to fair or unfair take-it-or-leave-it offers made by a fictitious proposer: The fictitious player is given

an amount of money but must offer a part of it to the participant. The participant can choose to accept or refuse the offer. If he/she refuses it, no one gets any money. Four studies used the ultimatum game in SAUD (Brevers et al., 2013, 2015; Cortes et al., 2018; Tsukue et al., 2015).

Brevers et al. (2013) first showed that patients with SAUD ($N = 40$) more often reject unfair offers during the ultimatum game than matched healthy controls, even though this choice leads to a total money loss. Patients with SAUD may thus have higher unfairness sensitivity, namely, increased difficulty to regulate their emotional impulses under social frustration such as unfair ultimatum game offers, and may respond aggressively or retributively (i.e., by rejecting the unfair offer).

More recent studies went a step further by exploring the causes of this specific response pattern. Brevers et al. (2015) tested whether emotional reactivity underpinned such increased unfairness sensitivity. Twenty-six recently abstinent patients with SAUD performed an ultimatum game during which their emotional state was evaluated through skin conductance responses. Results replicated the previous study by showing higher unfair offers rejection rates in SAUD. Moreover, the proportion of rejected unfair offers correlated with the skin conductance response in SAUD participants only. This suggests that social decision making is influenced by emotional arousal: Heightened emotional reactivity may drive patients to punish the proposer rather than to act as a rational economic agent (i.e., to accept unfair offers even when they bring only small rewards).

Tsukue et al. (2015) investigated the impact of impulsivity on unfairness sensitivity in interpersonal relationships using ultimatum game and delay discounting paradigms among 27 patients with SAUD and matched controls. Brevers et al. (2013) speculated that patients with SAUD might have more difficulties controlling their impulses than controls in unfair situations. Tsukue and colleagues thus hypothesized that a high unfairness sensitivity would be related with impulsivity or a tendency to act rashly in SAUD. The delay discounting task measures impulsivity, and particularly the "lack of premeditation" dimension, by giving participants hypothetical binary choices between either a small but immediate financial reward or a large but delayed reward (e.g., 10€ right now or 20€ in a week). The higher tendency to reject unfair offers was confirmed in SAUD, and correlated with impulsivity, measured through the Delay Discounting task.

Cortes et al. (2018) used fMRI to examine the neural activity underlying social decision making during three runs of the ultimatum game. This study did not replicate previous results, as SAUD patients ($N = 23$) did not reject unfair offers more often than controls. Instead, they accepted a greater number of unfair offers during the first/second runs, compared to controls. Authors assumed methodological differences may explain this discrepancy. For instance, Brevers et al. (2013, 2015) used a variable sum of money to be split, while a fixed amount was used in this study. Results also showed marked behavioral differences across runs: The control group presented a high increase of unfair offers acceptance in the third run, whereas

the SAUD group was consistent in its acceptance of unfair offers across runs. The fMRI analyses centrally revealed group differences in anterior insula activation only during the third run. Indeed, the authors found a signal decrease in the anterior insula of individuals with SAUD during the third run, consistent with recent reports of insula structural and functional impairments (Senatorov et al., 2015; Sullivan et al., 2013).

Moral dilemmas

Moral dilemmas are situations in which a person has to choose between two situations both involving positive and negative consequences (McConnell, 1988). According to the "dual-process theory of moral judgment" (Greene et al., 2004), both cognitive and emotional processes play crucial and sometimes competitive roles in moral judgment. These two processes correspond to two major views in moral philosophy: utilitarianism and deontology (Khemiri et al., 2012). The utilitarian perspective considers that the moral status of different options depends on their consequences, while the deontological perspective rather considers it depends on their consistency with moral norms (Gawronski et al., 2017). When people respond in a utilitarian way, their responses reflect a dominance of abstract reasoning and cognitive control over socio-emotional factors (Greene et al., 2004). Consequently, a deficit in higher-order functioning (e.g., executive functions) should lead to decreased utilitarian responses, while a deficit in emotionality/empathy should lead to decreased deontological responses (Duke & Bègue, 2015). Four studies have explored moral reasoning in SAUD. Considering that patients have impairments in both higher-order executive functioning and social cognition, these studies might help clarifying the mechanisms involved in moral dilemmas (Duke & Bègue, 2015).

Khemiri et al. (2012) investigated moral judgments in SAUD through a battery of hypothetical dilemmas categorized as non-moral, moral impersonal (low in emotional salience, e.g., stealing money) and moral personal (high in emotional salience, e.g., killing someone to save three other lives). Since patients with SAUD exhibit similar decision making as patients with ventromedial prefrontal cortex (VMPFC) lesion (Verdejo-García & Bechara, 2009), authors hypothesized that patients with SAUD will generate increased utilitarian moral judgment while having intact knowledge of explicit social and moral norms, similar to patients with VMPFC (Koenigs et al., 2007). Indeed, the 20 patients with SAUD showed preserved knowledge of social and moral norms (as evaluated through a self-report questionnaire) but generated more utilitarian moral judgments (i.e., were more likely to endorse emotionally aversive actions in favor of aggregate welfare) compared to controls, only when facing moral personal dilemmas, suggesting that VMPFC dysfunction might underlie social decision-making impairments in SAUD.

Carmona-Perera et al. (2013) examined the psychophysiological correlates (i.e., heart rate variations) of utilitarian responses in 31 patients with SAUD when answering moral dilemmas (nonmoral, impersonal moral, personal moral). They replicated the presence of a

utilitarian bias for personal moral dilemmas in SAUD and showed that patients did not modulate their heart rate responses across dilemma types. Conversely, controls exhibited decreased heart rate when processing personal (emotionally salient) dilemmas. Moral decision making in SAUD thus appears to be characterized by insensitivity to negative emotional consequences of personal moral violations, resulting in a rational cost-benefit analysis favoring utilitarian choices.

The same team (Carmona-Perera et al., 2014) investigated the underlying (neuro)psychological processes of this utilitarian bias in the same sample (which limits the generalizability of the following results). Thirty-one individuals with SAUD answered moral dilemmas and completed measures of impulsivity, mood symptoms, and emotional face recognition. Indeed, utilitarian moral judgments of moral personal scenarios had been associated with impulsivity, altered mood states, and emotional face decoding deficits that are also present in SAUD (Koenigs et al., 2007; Lai et al., 2012; Maurage et al., 2009; Verdejo-García et al., 2008). Results showed that patients with SAUD were more likely to endorse utilitarian choices in personal moral dilemmas than controls. Moreover, reduced fear and disgust decoding predicted utilitarian biases in personal moral dilemmas, over and above alcohol consumption, while impulsivity and mood symptoms did not predict social decision making.

Finally, Kornreich et al. (2013) showed that polysubstance-dependent patients (i.e., presenting at least two cooccurring DSM-IV-TR dependence diagnoses for substances other than tobacco or benzodiazepines) endorsed more utilitarian choices than controls for all types of dilemmas: impersonal, personal pareto (i.e., an individual is directly wronged or injured to save others, but his/her lot is not made worse by the proposed action), and personal nonpareto (i.e., an individual is directly wronged or injured to save others, and his/her lot is negatively affected by the proposed action). Patients with SAUD ($N = 25$) had intermediate results between polysubstance-dependent patients and controls, but these differences did not reach significance and these results did not replicate previous ones. These discrepancies might be related to methodological differences (e.g., variations in response modes, dilemmas classification).

This study also showed that moral judgment decisions are not correlated with classical decision-making performance (i.e., Iowa Gambling Task), suggesting that different mechanisms subtend moral dilemmas and decision making under uncertainty.

Social problem-solving

Previous empirical research in SAUD has focused primarily on nonpersonal problem-solving. However, patients with SAUD report difficulties in *interpersonal* situations (Nixon et al., 1992) and suffer from interpersonal conflicts that may result from poor social problem-solving abilities (Schmidt et al., 2016). Social problem-solving is distinct from moral dilemmas, which are characterized by the absence of an optimal response, only two possible

choices, and the remoteness of the proposed scenarios from real-life situations.

Social problem-solving is a complex competence modeled in several theoretical accounts (e.g., Liberman et al., 1986; McFall, 1982; Wallace et al., 1980). Here, we focused on the dominant model in the literature: the five-dimensional model of D'Zurilla et al. (2004). Social problem-solving describes the cognitive-affective-behavioral processes needed to find the most effective responses for problematic interpersonal situations (D'Zurilla & Nezu, 1990). Social problem-solving is a multidimensional construct consisting of two different problem orientation dimensions (i.e., cognitive-affective schemas that represent individuals' beliefs, valuation, and feelings about problems and their own problem-solving ability) and three different problem-solving styles (i.e., cognitive-behavioral activities people engage in when attempting to cope with problems through the application of problem-solving skills (Belzer et al., 2002; D'Zurilla et al., 2004). The two problem orientation dimensions are positive problem orientation (i.e., characterized by optimism, problem-solving self-efficacy, a general disposition to appraise a problem as a challenge, the belief that successful problem-solving takes time and effort, the commitment to solve problems rather than avoiding them) and negative problem orientation (i.e., characterized by a general tendency to view a problem as a threat, low problem-solving self-efficacy, and low frustration tolerance). The three problem-solving styles are rational problem-solving (adaptive style), impulsive/careless style, and avoidance style (maladaptive styles; D'Zurilla et al., 2004; Lutz et al., 2017). Six studies explored problem-solving abilities in SAUD.

Intagliata (1978) explored the potential improvement of interpersonal problem-solving thinking skills of 31 patients with SAUD through 10 sessions of interpersonal problem-solving group therapy. Interpersonal problem-solving was assessed through the means-ends problem-solving procedure (Platt & Spivack, 1975a), based on narratives of situations in which a need is awakened in the protagonist at the beginning of the story and is resolved by him/her at the end. The participant is required to complete the story between the awakening and the satisfaction of the protagonist's need by describing the best thing he/she could do to solve the problem and reach a positive outcome for all participants involved. This paper demonstrated, among patients with SAUD: (1) an interpersonal problem-solving skills deficit compared to the task's norms (Platt & Spivack, 1975b); (2) correlations between problem-solving thinking skills and social ability (i.e., score based on a subject's age, IQ, educational background, employment history, marital history, and occupational level), "planning ahead for problems," and IQ; and (3) that problem-solving thinking skills can be improved using structured training sessions, this improvement generalizing from training sessions to real-life problem situations.

Three studies measured interpersonal problem-solving abilities using the Adaptive Skills Battery (ASB, Jones & Lanyon, 1981), a brief verbal role-playing measure of coping skills considered critical to the maintenance of sobriety. It comprises thirty interpersonal problem situations with high ecological validity (Patterson et al.,

1988), identified as generating difficulties by patients with SAUD. Participants have to generate typical (i.e., the response usually given by the participant when encountering such problem) and optimal (i.e., considered as the best possible answer to solve the problem) responses to face these problems. Scoring is based on response competency, a competent response being defined as one maximizing positive gain and minimizing negative outcome.

Patterson et al. (1988) administered the ASB to 73 males with SAUD. SAUD was associated with lower scores for typical responses, but not for optimal ones, suggesting that patients can determine the optimal response but fail to implement it. While they expected dysfunctional impersonal problem-solving of patients with SAUD to generalize to interpersonal problem-solving, they found no correlation between social problem-solving performance and general cognitive abilities (i.e., performance on neuropsychological tests, including the Block subtest of the WAIS and abstract reasoning measures).

Nixon et al. (1992) tested 34 men and women with SAUD on the same battery, leading to the same results (impaired typical responses but preserved optimal ones), the only gender difference being higher scores for females on the optimal response condition. Coherently with previous results, social problem-solving performance did not correlate with cognitive abilities (i.e., abstract reasoning), nor with self-efficacy expectancies (i.e., self-reported evaluation of one's ability to actually use the strategy described in real-life situations).

Lewis et al. (2019) investigated sex differences in emotional face processing and interpersonal functioning among 56 patients with SAUD. Given the association between impaired emotional face processing and interpersonal difficulties (Hoffman et al., 2020; Kornreich, 2002), they hypothesized that if gender differences were observed in emotional face processing, similar patterns would be present for interpersonal functioning, assessed via the ASB, but also via a self-report questionnaire (Inventory of Interpersonal Problems, IIP-64; Horowitz et al., 2000). The dissociation between preserved optimal response and impaired typical one was replicated, and the IIP-64 results confirmed this result by showing a higher endorsement of interpersonal problems in SAUD. The gender-contingent relationship was found for interpersonal problems (IIP-64), but not in typical responding to situations of interpersonal conflict (ASB), and no relationship was found between ASB typical responding and emotional face processing.

Schmidt et al. (2016) ecologically investigated social cognition and social problem-solving abilities in 31 individuals with SAUD through three subtests (Channon & Crawford, 2010): (1) a social problem-resolution task, assessing the ability to generate and judge optimal solutions for difficult real-life social problems; (2) a social problem fluency task, assessing the capacity to generate solutions for difficult interpersonal situations; and (3) a mentalistic interpretation task, testing the ability to interpret sarcasm and mentalistic actions. In all three tasks, participants read descriptions of real-life social interactions and answered questions related to this interaction. Patients with SAUD showed reduced performance in both freely generated best solutions (i.e., solutions that were both socially sensitive and practically effective) and recognition of best solutions

in interpersonal conflicts. These results contradicted previous ones showing impairments for typical responses only. The authors also assessed attentional and executive functions, as well as trait empathy, as these factors are known to affect performance on social cognition tasks, but no significant correlations emerged.

Finally, Kornreich et al. (2011) tested the performance of 25 patients with SAUD at the Wason selection task (Wason, 1966), consisting of statements describing a rule of the form "If P, then Q" that participants had to read. Then, participants were shown four cards containing information about P on one side and information about Q on the other, representing the four possible logical categories (P, not-P, Q, and not-Q). Participants could only see one side of each card and were asked to indicate which card(s) they would have to turn over to see if the rule had been broken. The logically correct answer was always to pick the P and not-Q cards. Conditional reasoning was assessed with social contract (i.e., "If you take the benefit (P), then you must meet the requirement (Q)"), precautionary (i.e., "If you engage in the hazardous activity (P), then you must take the precaution (Q)"), and descriptive statements (more general descriptive rules, e.g., "If a person becomes a biologist, then that person enjoys camping"). Patients were impaired on social contract reasoning, precautionary reasoning, and descriptive reasoning. However, they performed better on social contracts and precautions than they did on descriptive ones. A relationship between emotion recognition and social contract reasoning was expected because successful social contract reasoning requires understanding others' affective states, and both processes rely on similar brain regions. Emotional intelligence and social exchange reasoning are hypothesized to be part of a broader neural network aimed at solving social problems. Harm avoidance was previously associated with faster reasoning on precautionary rules. However, the authors found no links with emotional intelligence, emotion recognition or reaction times, harm avoidance, and verbal ability. When introducing depression and anxiety as covariates, differences between groups remained significant for social contract and descriptive reasoning, but not for precautionary reasoning. The authors concluded that social contract reasoning deficits may negatively influence patients with SAUD in cooperative situations, and impaired precautionary rules reasoning may be involved in their destructive risky behaviors.

DISCUSSION

Summary of the results

Despite the postulated key role of interpersonal difficulties in the development and maintenance of SAUD, little is known regarding how patients with SAUD actually perform in social situations. Our first objective was to offer a review specifically focusing on social decision making and performance in social contexts among patients with SAUD. Doing so, we identified 14 papers exploring this topic, using three types of tasks, namely, economic games, moral dilemmas, and social problem-solving (Figure 2).

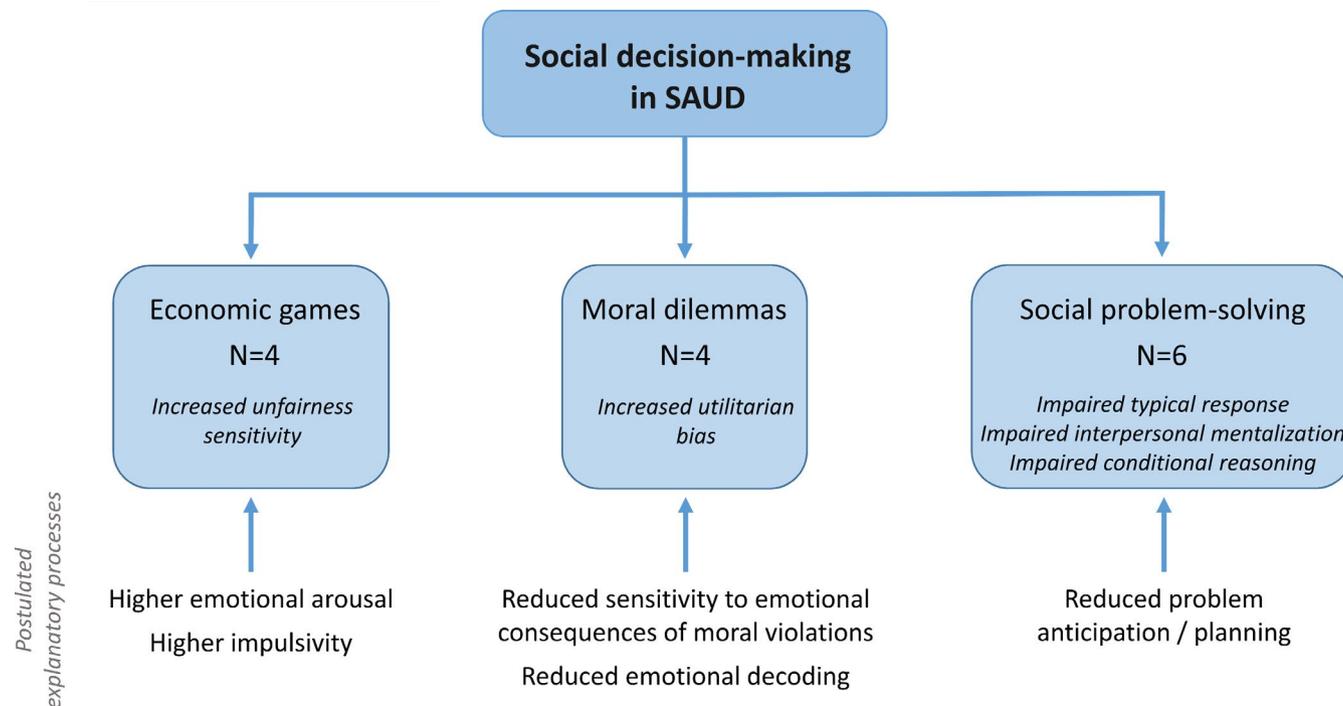


FIGURE 2 Graphical synthesis of the results related to the three categories of social decision-making tasks and of the postulated explanatory processes

Regarding economic games, four studies (Brevers et al., 2013, 2015; Cortes et al., 2018; Tsukue et al., 2015) used the ultimatum game and three of them showed that patients with SAUD rejected unfair offers more often than healthy controls, suggesting difficulties to regulate emotional impulses in situations of social frustration, and hence more aggressive reactions (Brevers et al., 2013). These results appear related to higher psychophysiological reactivity (Brevers et al., 2015) and impulsivity (Tsukue et al., 2015). However, Cortes et al. (2018) did not replicate these results and rather showed that participants with SAUD accepted a greater number of unfair offers than healthy controls during two of the three trials of their ultimatum game task. Methodological differences might account for these discrepancies (i.e., different intertrial interval, offers, and choice durations; fixed or variable sum of money to be split; number of possibilities contained in the range of offers considered as unfair; and monetary compensation directly related to the task outcome or not; Cortes et al., 2018).

Regarding moral dilemmas, three studies indicated a utilitarian bias in SAUD (Carmona-Perera et al., 2013, 2014; Khemiri et al., 2012), patients being more likely to endorse emotionally aversive actions in favor of aggregate welfare. Poor facial emotion decoding (Carmona-Perera et al., 2014) and reduced emotion-induced heart rate modulations (Carmona-Perera et al., 2013) were linked to this deficit. Impaired socio-emotional processing is thus a stronger predictor of utilitarian preferences than the integrity of higher-order cognitive system (Duke & Bègue, 2015). However, Kornreich et al. (2013) challenged these results by reporting an absence of group difference across all dilemma types, which may be due to methodological differences across studies (e.g., variations in response modes, dilemmas classification). Of note, the utilitarian bias in moral dilemma

(increased rational judgment) may appear at odds with the ultimatum game's results (diminished economically rational choice). A proposed explanation is that the ultimatum game involves self-interest and self-related emotions (i.e., social frustration), whereas the moral dilemmas focus on the interest of others and thus require compassion and empathy (Brevers et al., 2013; Moll & de Oliveira-Souza, 2007).

Regarding social problem-solving, three studies (Lewis et al., 2019; Nixon et al., 1992; Patterson et al., 1988) found that patients with SAUD have lower score in their typical response (i.e., what they usually do in social contexts) but not in their optimal ones (i.e., what is the best way to act). These interpersonal problem-solving deficits may thus relate to reduced abilities to apply problem-solving skills, rather than to reduced understanding of social norms. The presence of social problem-solving impairments in SAUD was specified through other paradigms, showing that patients have difficulties both for the free generation and the recognition of optimal solutions, but also for understanding mentalistic interpersonal scenarios and conditional reasoning (Kornreich et al., 2011; Schmidt et al., 2016). Of note, Schmidt et al. (2016) are the only ones suggesting an impaired ability of patients with SAUD to generate optimal solutions in social problems. A detailed analysis of the two tasks generating opposite results, namely, the ASB and the social problem-solving task (Channon & Crawford, 2010) used by Schmidt et al. (2016), reveals no major difference in the difficulty of the proposed scenarios, nor a ceiling effect at ASB's optimal response subtest that would explain why no difference appeared between groups. However, a competent response is defined as one maximizing positive resolution and minimizing negative outcomes in the ASB (Jones & Lanyon, 1981), and as one both socially sensitive and practically effective in

Schmidt et al. (2016). Differences in the definition of an optimal response might account for the discrepancies observed. Interestingly, deficits in social problem-solving might be reduced through interpersonal problem-solving training (Intagliata, 1978).

Current limits in social decision-making research

First, while correlations from studies using economic games suggest that impulsivity and emotional sensitivity may be involved, none of them proposed an experimental paradigm disentangling the psychological processes and mediators of social decision making (e.g., emotions; Teper et al., 2011). Second, studies about dilemmas in SAUD are based on the classical conception of dilemmas, opposing utilitarian and deontological options, but did not manipulate the central feature of this opposition (i.e., consequences and norms), hampering univocal interpretation of the results (Gawronski et al., 2017). Moreover, these studies did not use an established model of the processes involved in dilemmas and capitalized on classic dilemmas, which are highly criticized for being unrealistic (Bauman et al., 2014; Gawronski et al., 2017). Third, moral dilemmas studies were also conducted “off-line,” devoid of real consequences, as participants indicated which decisions should be made without actually having to implement them. As a consequence, these experiments may reflect the knowledge of social rules rather than the action participants would undertake in real-life situations (Kornreich et al., 2013). While dilemmas and economic games might offer situations mimicking real-life interactions, the ecological value of these paradigms remains limited. It could grow through tasks in which participants are actively involved in actual social interactions, which represent the ultimate way to identify genuine social decision-making impairments. Fourth, most studies used self-report questionnaires to evaluate social problem-solving, rather than a direct evaluation. We excluded these studies because we were interested in the performances of patients with SAUD in tasks measuring social decision making and not in their own remote perception. While self-report questionnaire methods can provide useful information about a person's difficulties, they are influenced by social desirability and memory biases. However, it should be noted that some of the included tasks (e.g., the ASB) are still subjective, since participants are asked to self-report their typical response. Finally, a fifth limit concerns the population studied. Despite the fact that our search explored all alcohol consumption misuses, the selected studies focused on SAUD as studies exploring social decision making in other problematic consumption patterns (e.g., heavy drinking, binge drinking) did not fulfill our selection criteria. However, emotional and social cognition deficits have been reported in these subclinical populations (e.g., Lannoy et al., 2021), suggesting potential impairments in social decision making. The generalizability of our review is thus limited, and future research should explore social decision making in subclinical populations. Moreover, the studies' samples are mainly composed of treatment seekers in short-term abstinence, who constitute a specific subpopulation of patients with SAUD.

Perspectives

We propose three main experimental perspectives to develop a comprehensive understanding of social deficits in SAUD.

Regarding the *paradigms* used, further attention should be paid to the links between moral judgments in hypothetical dilemmas and moral behavior in real-life situations (Teper et al., 2011). Studying the social decision-making process in ecological contexts can be done through more realistic moral dilemmas or through paradigms exploring actual behaviors in real-life situations (e.g., simulated interpersonal interaction). Economic games played with a real human counterpart would allow to confront patients with an interpersonal task in which they will be involved. Ecological value could also be increased through tasks based on actual interactions. As real interaction tasks are difficult to implement while maintaining experimental control, we suggest to use immersive computer programs (e.g., RC2S from Peyroux & Franck, 2014) or virtual reality, which offer a valuable compromise between ecological social decision-making measures and experimental control (Hone-Blanchet et al., 2014; Pan & Hamilton, 2018; Parsons, 2011).

At the *methodological* level, going beyond purely behavioral paradigms could improve our understanding of the nature and mechanisms of social impairments in SAUD. Previous studies have used psychophysiological measures (i.e., heart rate, skin conductance) and one of them has used fMRI, but the brain correlates of these social decision-making impairments or biases should be clarified through electrophysiological exploration or additional neuroimaging studies. Incrementing social decision-making tasks with the eye-tracking technology could bring a fine-grained comprehension of the steps involved in social decision making and of their differential impairments (e.g., visual exploration, sustained attention, processing depth). Analyzing gaze behaviors during social decision-making tasks will also allow to measure if and how social cues are perceived and would thus clarify the underlying mechanisms leading to social decisions in interpersonal context. The influence of social factors on decision making, like the attention paid to other players, can also be assessed through this technology (Peshkovskaya et al., 2017).

At the *conceptual* level, to get more insights about the underlying mechanisms involved in social decision making in SAUD, a new conceptualization of the processes explored, based on validated models, is required. For example, for what pertains to moral dilemmas, Gawronski et al. (2017) proposed an approach in which utilitarian responses are inferred from the sensitivity of judgments to morally relevant consequences, and deontological responses are inferred from the sensitivity of judgments to moral norms. They proposed the “CNI model of moral decision making,” a mathematical model quantifying sensitivity to consequences (C), sensitivity to moral norms (N), and general preference for inaction versus action irrespective of consequences and norms (I) in responses to moral dilemmas. This model, still untested in SAUD, could clarify the psychological processes of social decision making. Concerning social problem-solving studies, no previous study used the model proposed by D'Zurilla et al. (2004). A more fine-grained analysis of which problem orientation dimensions (i.e.,

positive or negative) and which specific problem-solving styles (i.e., rational, impulsive/careless or avoidant) are preponderant in SAUD would give more insights about the unique social decision-making profile displayed by patients. On a related note, understanding how social decision-making deficits interact with other well-established alterations in SAUD is of primary theoretical importance. Some studies presented here have started to explore the underlying processes of social decision-making impairments in SAUD, but the influence of classical cognition deficits and social cognition impairments on actual social decision making remains little understood in SAUD. These abilities should be jointly measured with social decision-making tasks to determine their interactions and refine the models of addictive disorders, currently ignoring social decision making. Beyond correlational approaches, future studies should also examine social decision-making processes in SAUD through tasks manipulating essential parameters of social situations, offering insights about the social cognition processes modulating social decisions (Knyazev et al., 2019), as well as the amount of cognitive resources requested, to detect the modulation of social decision making by cognitive alterations.

Limits of the scoping review

This study was not preregistered, and we did not find any gray literature fulfilling selection criteria (or were not able to find the related full document). Moreover, the search process focused on articles' titles due to the high recurrence of our search words in a very large number of abstracts not related to our field of interest.

CONCLUSION

The currently limited knowledge concerning social decision making in SAUD hampers a comprehensive understanding of this disorder. This scoping review summarized findings in this research field, but also identified gaps in the literature, which may guide future research. Fourteen papers meeting our selection criteria were identified. They coherently suggest that patients with SAUD deviate from healthy controls in social decision-making tasks, which encompass increased unfairness sensitivity and interpersonal frustration in economic games, utilitarian bias in social dilemmas, and reduced social problem-solving abilities. Further explorations of these social impairments may improve relapse prevention strategies, as interpersonal difficulties negatively affect the course of the disorder.

ACKNOWLEDGMENTS

Pierre Maurage (Senior Research Associate) and Arthur Pabst (Fresh doctoral grant owner) are funded by the Belgian Fund for Scientific Research (F.R.S.-FNRS, Belgium).

CONFLICT OF INTEREST

The authors declare no conflict of interest.

ORCID

Mado Gautier  <https://orcid.org/0000-0001-8493-7586>

Arthur Pabst  <https://orcid.org/0000-0002-1265-3899>

Pierre Maurage  <https://orcid.org/0000-0003-0197-0810>

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

How to cite this article: Gautier, M., Pabst, A., & Maurage, P. (2021). Social decision making in severe alcohol use disorder: Scoping review and experimental perspectives. *Alcoholism: Clinical and Experimental Research*, 45, 1548–1559. <https://doi.org/10.1111/acer.14664>