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Behavioral, emotional and social apathy in alcohol-related cognitive disorders

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Abstract: Apathy is a fundamental neuropsychiatric symptom of Korsakoff's syndrome (KS) and has also been reported in patients with alcohol use disorder with no (AUD) or less severe cognitive disorders (ALC). However, research on the nature of apathy is limited in these groups. Aim of this study was to examine the multidimensional nature of apathy in patients with KS, ALC and AUD. Moreover, we examined differences between apathy ratings by patients and their professional caregivers, and related apathy to everyday functioning and overall cognition. Twenty-four patients with KS, 24 patients with ALC and 21 patients with AUD participated in this study. Apathy was measured using the Apathy Motivation Index (AMI), which distinguishes behavioral, emotional and social apathy. Both patients and professional caregivers reported social apathy as most prominent symptom, compared to behavioral and emotional apathy. Apathy ratings did not differ across the three patient groups. Discrepancies between patient and caregiver ratings were observed in patients with KS and ALC, with more severe apathy reported by caregivers. Caregiver-reported behavioral and social, but not emotional, apathy was related to everyday functioning. These results show that apathy is present in a substantial proportion of patients with alcohol addiction with or without cognitive impairments.

Keywords: apathy; neuropsychology; Korsakoff's syndrome; alcohol use disorder; alcohol-related cognitive disorders

1. Introduction

Chronic and excessive alcohol consumption negatively affects brain functioning [1-3], and may result in various degrees of cognitive impairment – in attention, memory, visuospatial functions, and executive functions – in patients with alcohol use disorder (AUD). However, abstinence improves patients' cognitive functioning [4]. Some patients fully recover after a period of abstinence (in the current study referred to as patients with alcohol use disorder, without cognitive impairments, or AUD), but others continue to show cognitive impairments even after longer periods of abstinence (in the current study referred to as patients with alcohol-related cognitive impairments, ALC). Korsakoff's syndrome (KS) is the most severe neuropsychiatric disorder that may develop in the context of chronic and excessive alcohol consumption. It results from thiamine depletion, typically in the context of chronic excessive alcohol consumption and malnutrition. The syndrome is characterized by memory impairments. In addition, neuropsychiatric symptoms such as apathy, lack of illness insight, flattened affect, and confabulations are also present [5]. Although apathy is recognized as a fundamental symptom of Korsakoff's syndrome, it is poorly studied to date. Moreover, apathy has received limited attention in patients with AUD and ALC as well.

The definition of apathy has been refined over the last decades. In 1991, Marin [6] formulated the first operational definition and defined apathy as "a lack of motivation that is not attributable to intellectual impairment, emotional distress, or diminished level of consciousness" (p. 245). He postulated three clinical features: i) reduced goal-directed behavior, ii) reduced goal-directed cognition and iii) reduction of emotion that is associated with goal-directed behavior. Starkstein et al. [7] later expanded the definition by stating that the construct of apathy is independent from cognitive impairment or a depressive disorder, so that both these conditions and apathy can coexist within the same person. Recently, the multidimensional nature of apathy was reconsidered, as 'behavior' and 'cognition' were found to be frequently associated with one another, thus representing one dimension. In addition to a reduction in emotion, impaired social interaction was identified as a separate dimension [8,9]. Accordingly, Robert et al. [10] defined apathy as "a quantitative reduction of goal-directed activity either in behavioral, emotional or social dimensions in comparison to the patient's previous level of functioning in these areas" (p. 73), as reported by the patient himself/herself, or by others.

The few studies on apathy conducted to date in patients with AUD and KS suggest that apathy is present in both groups. To the authors' knowledge, apathy has not been studied in patients with ALC yet. One investigation examining patients with substance dependence, including patients with AUD, reported higher degrees of apathy (assessed using the Frontal Systems Behavior Scale) [11]. In a report by Yang et al. [12], ratings of apathy (assessed using the Lille Apathy Rating Scale-Informant version, LARS-I) were higher for patients with AUD compared to healthy controls. In patients with KS, caregivers rated apathy (assessed using informant questionnaires) as the most severe neuropsychiatric symptom of KS [13]. Furthermore, apathy was found to be a persistent symptom in patients with KS, which – unlike psychotic and affective symptoms and agitation/aggression – was not reduced after a cognitive rehabilitation intervention [14].

Gaining an accurate understanding of apathy in patients with AUD, ALC and KS is complex, due to the limited number of previous studies, investigations examining only one of these patient groups and the variety of instruments used to quantify apathy. It is unclear, for example, whether apathy in patients with alcohol-related cognitive disorders represents a continuous spectrum, with the most severe apathy being present in patients with KS, and less severe apathy in patients with ALC and AUD respectively. Moreover, previous studies addressed apathy in patients with alcohol-related cognitive disorders as a unitary construct, and some instruments used to examine apathy contain only one 'general apathy' item [11-14], There is increasing evidence, however, that apathy has several components.

Kessels et al. [15] were the first to examine the multidimensional nature of apathy in patients with KS, using the informant-version of the Apathy Evaluation Scale (AES-I). They found that 72.1% of the patients with KS could be classified as having an apathy syndrome, with the cognitive dimension of apathy evaluated as more severe compared to the emotional dimension of apathy. Furthermore, AES-I scores were found to correlate with overall cognitive dysfunction as measured with the Montreal Cognitive Assessment (MoCA) [15]. Although these results are promising, the AES-I does not fully cover the most current definition of apathy. The Apathy Motivation Index (AMI) was recently developed as a tool that might better capture the multidimensional nature of apathy, including social apathy, but has not yet been applied in individuals with alcohol-related cognitive disorder.

The aim of the present study is to examine the multidimensional nature of apathy in patients with AUD, ALC, and KS using the recently developed AMI [8]. With the AMI, three dimensions of apathy can be distinguished: behavioral activation (e.g. "I get things done when they need to be done, without requiring reminders from others"), emotional sensitivity (e.g. "I feel awful if I say something insensitive"), and social motivation (e.g. "I start conversations without being prompted"). In addition, we aim to relate the three dimensions of apathy to everyday functioning and overall cognitive performance. Based on previous results [8,9,12,15], we hypothesize that all three dimensions of apathy will be

present in patients with AUD, ALC and KS. We expect behavioral apathy to be the most frequently reported dimension of apathy in all three groups and hypothesize that especially behavioral apathy is negatively related to everyday functioning and cognitive performance. Moreover, we examined differences between patient and professional caregiver ratings on the AMI, as impaired awareness of deficits is highly common in alcohol related cognitive disorders and impaired awareness of deficits and apathy are found to be correlated with each other [8,16,17]. We hypothesize that professional caregivers will report higher levels of apathy than patients with KS and ALC.

2. Materials and Methods

2.1. Participants

Patients were recruited at the Centre of Excellence for Korsakoff and Alcohol-Related Cognitive Disorders of Vincent van Gogh Institute for Psychiatry in Venray, the Netherlands. All were evaluated extensively using neurological, psychiatric, and neuropsychological examinations (covering the domains of attention, memory, executive functioning, visuospatial functions, and social cognition) as part of their diagnostic trajectory at the center. The patients themselves, their family and/or professional caregivers and medical records provided background information (including drinking history). Diagnoses were established by a multidisciplinary expert team. All patients were abstinent from alcohol for at least 6 weeks at the time of testing. None had any evidence of brain pathology unrelated to their alcohol use that would account for their memory deficit (e.g., stroke, tumor or a neurodegenerative disease). None met the DSM-5 criteria for major depressive disorder [18] or met the criteria for alcohol-related dementia [19].

A total of 69 patients were included in this study. Group characteristics are presented in Table 1. The sample consisted of three groups. Twenty-one patients were diagnosed with severe alcohol use disorder in accordance with the DSM-5 [18], but extensive neuropsychological testing did not show disorders in any of the cognitive domains (AUD). Twenty-four patients with alcohol-related cognitive disorder (ALC) participated in this study. These individuals met the criteria for DSM-5 alcohol-induced neurocognitive disorder [18] and showed impairments in one or more cognitive domains. Twenty-four patients with Korsakoff's syndrome participated in this study. They met the criteria for DSM-5 alcohol-induced major neurocognitive disorder, amnestic-confabulatory type [18]. In addition, the criteria for alcoholic Korsakoff's syndrome [20,21] had to be met: "a largely irreversible residual syndrome, caused by severe thiamine deficiency and occurring after incomplete recovery from a Wernicke's encephalopathy, predominantly in the context of alcohol abuse and malnutrition, characterized by an abnormal mental state in which episodic memory is affected out of all proportion to other cognitive functions in an otherwise alert and responsive patient" (p. 10) [21].

The groups were found to be comparable with respect to age, Full-Scale IQ scores on the Wechsler Adult Intelligence Scale-IV (WAIS-IV), and educational level. The level of formal education was assessed using a scale with seven categories based on the Dutch educational system, 1 being the lowest (less than primary education; i.e., six or less years of education) and 7 the highest (academic degree). The sample consisted of more men than women, reflecting the prevalence of alcohol use disorder in the general population.

Table 1. Group characteristics of patients with alcohol use disorder (AUD), alcohol-related cognitive impairments (ALC) and Korsakoff's syndrome (KS).

Characteristic	AUD (*N*=21)	ALC (*N*=24)	KS (*N*=24)	*p*-value
Age (years)	56.4 (9.5)	58.9 (8.3)	61.6 (6.8)	.113
Sex distribution (men/women)	19/2	22/2	16/8	.038[5]
Full-scale IQ[1]	87 (15.4)	84 (12.6)	82 (13.4)	.541
Educational level[2]	4 (5)	5 (5)	5 (5)	.242
MoCA[3] Total score	24.5 (3.3)	22.5 (3.0)	18.7 (3.7)	<.005[6]
MoCA Memory Index Score	11.5 (3.3)	10.2 (2.9)	6.1 (2.3)	<.005[6]
PCRS[4] Total Score	105.5 (9.7)	100.8 (12.1)	83.86 (21.8)	<.001[7]

[1]Means of full-scale IQ scores as measured with the Wechsler Adult Intelligence Scale, fourth edition (WAIS-IV). [2]Educational level (median and range) assessed using a Dutch classification range from 1 (less than primary school) to 7 (university degree). [3]Montreal Cognitive Assessment. [4]Patient Competency Rating Scale. [5]Men > Women. [6]KS < ALC and KS > AUD. [7]AUD and ALC > KS.

2.2. Procedure

On 27 February 2018, approval was obtained from the Vincent van Gogh Institutional Review Board and Board of Directors (CWOP; identification code 2019.00.01).

The Apathy Motivation Index (AMI) [8] was used to examine apathy. The English-language version of the AMI was translated into Dutch by the second author, checked for inconsistencies and phrasing by the last author. Moreover, the patient-report version of the AMI was transformed to an informant version, by changing all "Is" to "he/shes" (e.g. "*I feel sad or upset when I hear bad news*" was transformed to "*He/She feels sad or upset when he/she hears bad news*"). Two expert researchers with knowledge of the field pointed out inadequate expressions and discrepancies in the translated instrument. An independent bilingual translator, with knowledge of the field, translated the instrument back to English. A comparison between the original instrument and the translated version showed no important differences in content. The informant version was also checked against the recently developed English-language informant version [22].

The AMI is an 18-item scale that measures apathy as a multidimensional construct. The three dimensions as distinguished by the AMI are labelled as behavioral activation, social motivation and emotional sensitivity. The AMI was completed by patient and professional caregivers during the period from July 2018 to November 2020. Professional caregivers were trained nurses who had known the patient well for at least six weeks. Answers were based on the patient's behavior in the last two weeks. Each item was rated on a 5-point Likert scale and scored from 0-4 with higher scores indicating more apathy. The scores on the three subscales were used to answer the current research question. The patient-report version of the AMI was completed by 67 out of the total of 69 participants. The informant-version of the AMI was completed by professional caregivers for 58 participants. Both versions of the AMI were completed for a group of 56 patients.

The Dutch version of the Montreal Cognitive Assessment (MoCA) [23] was used to quantify general cognitive functioning. The items of the MoCA add up to a total score with a maximum of 30 with a higher score indicating better cognitive functioning.

The Patient Competency Rating Scale (PCRS) [24], completed by professional caregivers, was used to examine everyday functioning. The PCRS is a 30-item scale that measures everyday functioning, including activities of daily living and physical function. Each item was rated on a 5-point Likert scale with higher scores indicating better competences.

2.3. Statistical analysis

The levels of behavioral, emotional and social apathy were expressed in mean scores for each completed patient-report and caregiver-report version of the AMI. The multidimensional nature of apathy for the current study population was examined using a mixed

ANOVA with apathy dimension as within-subject factor (behavioral, emotional and social) and patient group as between-subject factor (AUD, ALC and KS). This mixed ANOVA was performed for patient-reported and caregiver-reported apathy separately. Differences between patient- and caregiver ratings were examined using paired-sample *t*-tests. For each patient group (AUD, ALC, KS), paired *t*-tests were performed with the patient-reported mean rating and the caregiver-reported mean rating as dependent means for behavioral, emotional and social apathy separately. Pearson correlations were calculated to examine the relationship between behavioral, emotional and social apathy, everyday functioning, and cognitive performance.

3. Results

Figure 1 represents the distribution of individual ratings of behavioral, emotional and social apathy on the AMI (mean ratings and standard deviations for the three patient groups separately are presented in Table A1). A main effect of dimension was found for both patient-reported and caregiver-reported apathy ($F(2,63) = 16.01$, $p < .001$, $\eta_p^2 = .34$; $F(2,54) = 13.76$, $p < .001$, $\eta_p^2 = .34$). Both patients and caregivers reported social apathy as more severe compared to behavioral (patients: $F(1,64) = 29.78$, $p < .001$, $\eta_p^2 = .32$; caregivers: $F(1,64) = 7.75$, $p = .007$, $\eta_p^2 = .11$;) and emotional apathy (patients: $F(1,55) = 11.07$, $p = .002$, $\eta_p^2 = .17$; caregivers: $F(1,55) = 24.55$, $p < .001$, $\eta_p^2 = .31$).

Overall, patient-reported and caregiver-reported apathy did not differ across the three patient groups (patients: $F(2,64) = 2.13$, $p = .127$; caregivers: $F(2,55) = 0.19$, $p = .825$). Furthermore, there was no interaction between dimension and group for patient-reported or caregiver-reported apathy ($F(4,126) = .82$, $p = .515$; $F(4,108) = 1.93$, $p = .111$).

Compared to proposed cut-off scores by Ang et al. [8] based on the data of 479 healthy individuals, patient-reported apathy should be classified as moderate on at least one of the dimensions for 3 patients with AUD (15.8%), 7 patients with ALC (29.2%) and 6 patients with KS (25.0%) and as severe for 5 patients with AUD (26.3%) and 5 patients with KS (20.8%). Caregiver-reported apathy was classified as moderate on at least one of the dimensions for 6 patients with AUD (33.3%), 5 patients with ALC (26.3%) and 8 patients with KS (38.1%) and as severe for 3 patients with AUD (16.7%), 2 patients with ALC (10.6%) and 4 patients with KS (19.0%).

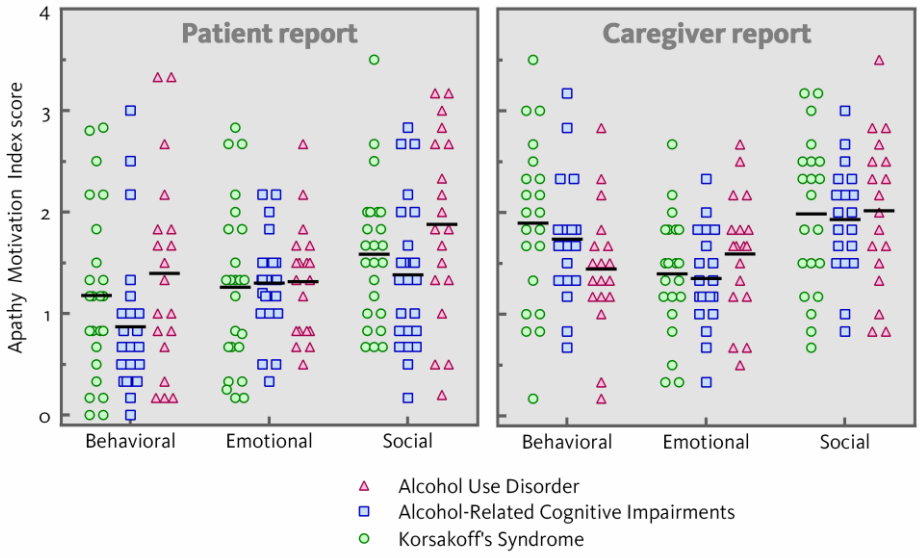

Figure 1. Individual mean ratings of behavioral, emotional and social apathy on the Apathy Motivation Index in patients with alcohol use disorder, alcohol-related cognitive impairments and Korsakoff's syndrome as reported by patients and caregivers.

Table 1 shows the mean ratings and standard deviations of cognitive functioning assessed using the MoCA and mean ratings of everyday functioning assessed using the PCRS. Performance of the three patient groups differed on the MoCA total score ($F(2,55)$

= 14.71, $p < .0005$; AUD and ALC > KS) and the MoCA Memory Index Score ($F(2,55) = 18.98$, $p < .0005$; AUD and ALC > KS).

Ratings of everyday functioning also differed across the three patient groups ($F(2,63) = 11.68$, $p < .001$; AUD and ALC > KS). Table 2 shows the correlations between patient-reported and caregiver-reported apathy, everyday functioning, and the MoCA total score. Significant correlations were present between caregiver-reported behavioral and social apathy and everyday functioning ($r = -.388$, $p = .003$; $r = -.285$, $p = .035$). Neither emotional apathy as reported by caregivers nor any dimension of patient-reported apathy correlated with everyday functioning. Moreover, no significant correlations were found between patient-reported or caregiver-reported apathy and the MoCA total score.

Table 2. Pearson correlations between patient-reported and caregiver-reported behavioral, emotional, and social apathy assessed using the Apathy Motivation Index, everyday functioning assessed using the Patient Competency Rating Scale (PSRS), and cognitive functioning assessed using the Montreal Cognitive Assessment (MoCA).

Patient-reported apathy	PCRS Total score[1]	MoCA Total score
Behavioral apathy	-.163	.082
Emotional apathy	.104	-.047
Social apathy	-.126	.203
Caregiver-reported apathy	**PCRS Total score[1]**	**MoCA Total score**
Behavioral apathy	-.388*	-.063
Emotional apathy	.079	.202
Social apathy	-.285**	-.125

* $p < .01$. ** $p < .05$.

Table 3 shows mean ratings and standard deviations of these patient-reported and informant-reported apathy for AUD, ALC and KS. No differences between patient- and caregiver ratings were present in the AUD group for behavioral, emotional or social apathy ($t(15) = .73$; $p = .479$; $t(15) = -1.36$, $p = .194$; $t(15) = -.20$, $p = .843$). In the ALC group, caregivers reported on average more severe behavioral and social apathy ($M = 1.74$, $SE = .62$; $M = 1.93$, $SE = .54$) compared to the patients themselves ($M = .73$, $SE = .56$; $M = 1.37$, $SE = .68$), $t(18) = -6.04$, $p < .0005$, $d = .73$; $t(18) = -3.88$, $p = .001$, $d = .63$. Ratings of emotional apathy did not differ between patients and caregivers for the ALC group ($t(18) = -.37$, $p = .714$). In the KS group, caregivers reported on average more severe behavioral apathy ($M = 1.90$, $SE = .83$) compared to the patients themselves ($M = 1.18$, $SE = .90$; $t(20) = -3.34$, $p = .003$, $d = .98$). There were no differences between patient- and caregiver-ratings for emotional and social apathy in the KS group, $t(20) = -.82$, $p = .425$; $t(20) = -1.59$, $p = .127$).

Table 3. Mean ratings and standard deviations of levels of patient-reported and caregiver-reported apathy assessed using the Apathy Motivation Index within the same participants for patients with alcohol use disorder (AUD), alcohol-related cognitive impairments (ALC) and Korsakoff's syndrome (KS).

Level of apathy	AUD (*N*=16)		ALC (*N*=19)		KS (*N*=21)	
	Patient-reported	Informant-reported	Patient-reported	Informant-reported	Patient-reported	Informant-reported
Behavioral apathy	1.50 (1.02)	1.36 (.62)	.73 (.56)	1.74 (.62)	1.18 (.90)	1.90 (.83)
Emotional apathy	1.32 (.60)	1.60 (.63)	1.30 (.46)	1.35 (.49)	1.21 (.84)	1.40 (.60)
Social apathy	1.94 (.88)	1.98 (.79)	1.37 (.68)	1.93 (.54)	1.61 (.71)	1.98 (.76)

4. Discussion

This study was the first to examine the multidimensional nature of apathy in patients with AUD, ALC and KS using the patient-report and informant version of the Apathy Motivation Index (AMI). In addition, we examined differences between patient and caregiver ratings, as impaired awareness of deficits is present in patients with ALC and KS.

Furthermore, the relation between the three dimensions of apathy, every functioning and overall cognitive performance was investigated.

Overall, both patients and professional caregivers reported social apathy as more severe compared to behavioral and emotional apathy. Average apathy ratings did not differ between the three patient groups (AUD, ALC and KS). Also, a higher level of social apathy was observed across all three patient groups compared to behavioral and emotional apathy. As hypothesized, discrepancies between patient and observer ratings were found within patients with ALC and KS.

The finding that social apathy is more severe compared to behavioral and emotional apathy is different from previous results [15], showing more severe observer-rated cognitive apathy compared to emotional apathy using the Apathy Evaluation Scale – Informant (AES-I). However, it should be noticed that emotional apathy as measured by the AES is based on two items, while emotional apathy as measured by the AMI is based on six items and therefore covers a broader range of the total construct of apathy. Further the AES-I does not have a separate domain for social apathy. The current results therefore extend our previous findings [15].

In accordance with some previous investigations of apathy in other populations [8,9], the current results corroborate the claim that that social apathy is a separate dimension. In fact, for the current study sample social apathy turned out to be the most relevant dimension, consistently reported by both patients and caregivers. Future research should focus more on the relationship between social apathy and AUD. Social interactions might play an important role in the risk of relapse in excessive alcohol consumption, for example in the case of interaction with other users. However, social interactions might also have an important role in maintaining abstinence by giving support and combat loneliness.

Discrepancies between patient and observer ratings were found within patients with ALC and KS. Formal caregiver of patients with KS reported more behavioral apathy compared to the patients themselves and caregivers of patients with ALC reported more severe behavioral and social apathy compared to the patients themselves. Within the AUD group, there were no differences between patient and caregiver ratings. These findings support our hypothesis that patients with cognitive impairment may have limited insight into their own everyday functioning [17].

As hypothesized, caregiver-reported behavioral apathy was associated with everyday functioning. In addition, however, we also found caregiver-reported social apathy, but not emotional apathy, to be related to everyday functioning. An explanation for this is that both the behavioral and social apathy subscales include items that are clearly related to the patients' activities, whereas the emotional subscale refers to the patient's thoughts and feelings. In contrast to previous results [15] with the AES in KS patients, we did not find a relation between any of the AMI subscales and overall cognitive performance as measured with the MoCA. This may be understood in the context of the samples included in both studies. That is, the current study includes AUD, ALC and KS patients in a psychiatric hospital setting, while the previous study only included KS patients who were residents of a specialized nursing home. Consequently, the latter group was more severely cognitively impaired and more apathetic than the current group. This may explain the strong association between these two symptom dimensions in the previous KS sample.

The current study expands existing literature on the prevalence of apathy. Compared to cut-off scores based on the data of healthy individuals [8], 42.1% of the patients with AUD, 29.2% of the patients with ALC and 45.8% of the patients with KS can be classified as apathetic based on the patients' self-reports. Based on the observer ratings, 50% of the patients with AUD, 36.8% of patients with ALC and 57.1% of the patients with KS were classified as being apathetic on at least one of the dimensions. In a study with patients with Parkinson's disease (PD), in which apathy is a characteristic symptom as well, 35.2% were classified with the AMI as being apathetic based on the same data of healthy individuals [25]. These prevalences of apathy in patients with alcohol use disorder with or without cognitive impairment are comparable or even higher than those in PD.

There is some evidence that the current findings can be understood in the context of dopaminergic dysfunction, which may play a role in apathy across different neuropsychiatric diseases including PD, schizophrenia and alcohol addiction [26]. However, it has also become apparent that dopamine depletion or dopamine receptor blockade is unlikely to be a complete explanation for the apathy syndrome. In patients with syndromes associated with frontotemporal lobe degeneration (FTLD) [26] and patients with PD who develop impulse control disorders on dopamine receptor agonists [27]., apathy and impulsivity are commonly co-occurring and positively correlated. Moreover, there is also some evidence for a negative correlation between cortical thickness and severity of apathy in alcohol-dependent individuals, irrespective of cognitive impairment [12]. Future research might profitably focus on the relationship between apathy and impulsivity in AUD, ALC and KS and its underlying mechanisms.

A strength of the current study is that the multidimensional nature of apathy is examined according to the recent literature in a broad study population including AUD, ALC and KS. Furthermore, the results presented here include the view of patients themselves and show comparable ratings of emotional apathy between the patients and their professional caregivers. This suggest that despite limited insight into being behaviorally and socially apathetic, patients with KS and ALC do have insight into their emotional sensitivity, again reinforcing the observation that there are dissociable domains of apathy.

A limitation of the current study is that depressive symptoms were not measured, while apathy is found to be overlapping with depression. Ang et al. [8] showed that the AMI correlates with the Beck's Depression Inventory (BDI), a measure for the severity of depression. In the current study population none of the patients met the criterion for major depressive disorder, substantiated by consultation of a psychiatrist. However, in future research on apathy, it would be relevant to also assess depressive symptoms.

5. Conclusions

The current results demonstrate that apathy is present in patients with AUD, ALC and KS. In fact, severity levels of apathy and the multidimensional nature of apathy did not differ between these three patient groups. Both patients and caregivers evaluate social apathy as more severe compared to behavioral and emotional apathy. Furthermore, in accordance with previous literature, discrepancies in the evaluation of the severity of apathy between patients and their professional caregivers can be expected for patients with ALC and KS. As apathy has been found to be a predictor of relapse in substance use disorder [28], our results emphasize the need for interventions aimed at reducing apathy in patients with alcohol use disorder with or without cognitive impairment. The current results also demonstrate the relevance of assessing apathy given its association with everyday functioning in individuals with alcohol addiction, irrespective of their cognitive impairments.

Supplementary Materials: The Apathy Motivation Index is available from the authors upon request. Appendix A, Table A1: Mean ratings and standard deviations of levels of self-reported and caregiver-reported behavioral, emotional and social apathy assessed using the Apathy Motivation Index (AMI) for the total study-population and the patient groups separately: patients with alcohol use disorder (AUD), alcohol-related cognitive impairments (ALC) and Korsakoff's syndrome (KS).

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Conflicts of Interest: The authors declare no conflict of interest. NISPA had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

Appendix A

Table A1. Mean ratings and standard deviations of levels of self-reported and caregiver-reported behavioral, emotional and social apathy assessed using the Apathy Motivation Index (AMI) for the total study-population and the patient groups separately: patients with alcohol use disorder (AUD), alcohol-related cognitive impairments (ALC) and Korsakoff's syndrome (KS).

Self-reported apathy	**Total (*N*=67)**	**AUD (*N*=19)**	**ALC (*N*=24)**	**KS (*N*=24)**
Behavioral apathy	1.13 (.86)	1.39 (.98)	.87 (.74)	1.18 (.84)
Emotional apathy	1.29 (.63)	1.32 (.56)	1.30 (.47)	1.26 (.81)
Social apathy	1.60 (.79)	1.88 (.92)[1]	1.38 (.72)	1.58 (.70)
Caregiver-reported apathy	**Total (*N*=58)**	**AUD (*N*=18)**	**ALC (*N*=19)**	**KS (*N*=21)**
Behavioral apathy	1.70 (.72)	1.44 (.63)	1.74 (.62)	1.90 (.83)
Emotional apathy	1.44 (.57)	1.59 (.60)	1.35 (.49)	1.40 (.60)
Social apathy	1.98 (.68)[1]	2.02 (.75)[1]	1.93 (.54)[1]	1.98 (.76)[1]

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