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Posted Date: 24 August 2023

doi: 10.20944/preprints202308.1708.v1

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Article

Attention and Self-Control Dimensions of Impulsivity Predict the Quality of Life among Male Patients Seeking Treatment for Alcohol Use Disorder: The Mediating Role of Anxiety and Severity of Alcohol Use Disorder

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Abstract: Alcohol use disorder (AUD) is a chronic and relapsing biopsychosocial condition that leads to a wide range of medical, psychological, social, economic, and personal issues. The study investigated the predictors of quality of life (QoL) among male patients seeking treatment for AUD based on attention, cognitive instability, motor impulsiveness, perseverance, and self-control dimensions of trait impulsivity. The study also investigated the potential mediating effect of anxiety and alcohol use severity in this relationship. After an initial assessment, participants underwent comprehensive evaluations, including sociodemographic data, clinical history, and QoL domains. Evaluations also covered AUD severity, impulsivity dimensions, cognitive functions, craving intensity, depression, anxiety and self-efficacy. Multiple linear regressions were employed to identify associations between independent variables and QoL. Attention dimension of impulsivity and anxiety symptoms significantly predicted physical health QoL. Self-control dimension and severity of alcohol use disorder predicted psychological QoL. Indirect effect of attention dimension on physical health was significant [effect = -1.082, 95% CI (-2.008, -0.3598)]. The significance of impulsivity in influencing QoL for individuals with AUD has profound clinical implications. These findings underscore the importance of addressing anxiety and impulsivity in managing AUD, given their considerable impact, particularly on QoL, ultimately shaping treatment outcomes.

Keywords: quality of life; impulsivity; attention and self-control dimensions of impulsivity; alcohol use disorder; anxiety symptoms; WHOQOL-BREF

1. Introduction

Alcohol use disorder (AUD) is a chronic and relapsing biopsychosocial condition that leads to a wide range of medical, psychological, social, economic, and personal issues. This complex challenge not only affects physical health but also psychological well-being and overall quality of life. Problematic alcohol use is associated with various health problems such as liver cirrhosis, cardiovascular diseases, mental disorders, and increased risks of accidents and injuries. In 2016, approximately 43% of the global population aged 15 years and above were identified as current drinkers. During the same year, the harmful use of alcohol resulted in around 3 million deaths globally, constituting 5.3% of all recorded deaths. This also contributed to the loss of 132.6 million disability-adjusted life years (DALYs), equivalent to 5.1% of the total DALYs for that year. Globally, harmful alcohol use ranks as the seventh leading cause of premature death and disability [1]. It's

worth noting that the mortality caused by problematic alcohol use surpasses that of diseases like tuberculosis, HIV/AIDS, and diabetes [2].

The goal of AUD recovery is not only to stop heavy drinking or to achieve abstinence but to improve biopsychosocial functioning and quality of life as well. A sustained recovery process requires progress in these areas that are indicators of progress in recovery [3–5]. Therefore researchers have expanded their studies to explore the impacts of alcohol use disorder (AUD) treatment on quality of life and nondrinking outcomes beyond mere reductions in drinking [6]. The integration of behavioral and medical services, along with resilience and well-being, is increasingly being recognized as important to addressing chronic relapses in substance use disorders [7]. Consequently, improving quality of life (QoL) is now gaining attention in AUD treatment [6].

Quality of life (QOL) is defined by the World Health Organization as "an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns" [8]. Studies have found significant impairment of QOL in individuals with alcohol use disorder, particularly with respect to their physical health and psychological domains compared to general population [9,10]. It has also been studied the predictors of QOL among patients with alcohol use disorder under treatment. There are several factors that predict baseline QOL in such studies, such as severity of alcohol use disorder, marital status, employment status, age, and personality disorder [11–13]. Recent studies have highlighted impulsivity, positive affect, anxiety, and craving as predictors of quality of life during treatment for AUD [14–17]. There is also evidence that various dimensions of impulsivity, including non-planning, attentional impulsivity, and motor impulsivity, are associated with well-being and health-related quality of life (HRQoL) in individuals recently detoxified from AUD [18].

Researchers have also found a relationship between the outcome of AUD treatment and quality of life, and they report that poorer drinking outcomes are often associated with lower quality of life and more alcohol-related problems [19]. While improved drinking outcomes during treatment are associated with improved QoL scores [20,21]. Studies indicate that behavioral interventions combined with anti-craving medication maintenance can improve drinking outcomes by improving Quality of Life (QoL) [13,22]. It appears that the outcome of treatment and QoL may be bidirectional, both during and after the treatment process.

Numerous behavioral models of impulsivity have been put forth in research. A comprehensive definition that encompasses these various viewpoints characterizes impulsivity as a tendency for quick, unplanned behaviors, disregarding the possible adverse outcomes [23]. The concept of impulsivity aligns with a couple of indicators of alcohol dependence and use disorder outlined in both the ICD-10 and DSM-V criteria. These indicators involve consuming more alcohol than initially intended and continuing to drink despite awareness of potential adverse outcomes. Recent research suggests that impulsivity is a complex concept that can be viewed from different angles. It can be seen as a consistent personality trait or as a behavioral indicator of decision-making and actions. "Trait impulsivity" refers to a relatively stable form of impulsivity that is part of a person's character. This aspect is usually evaluated using self-report questionnaires. On the other hand, "behavioral impulsivity" refers to patterns of impulsive behavior, assessed through objective measurements in various situations, often involving tasks [24,25]. The Barratt Impulsiveness Scale (BIS) developed by Patton et al. (1995) [26], and the UPPS-P Impulsive Behavior Scale by Whiteside and Lynam (2001) [27], are self-report questionnaires used to assess impulsivity as a personality trait. These scales also identify various subcategories of impulsive traits through specific subsections. People with alcohol use disorder score higher on BIS compared to those without the disorder [28,29]. Earlier research has demonstrated a positive link between trait impulsivity and alcohol consumption [30,31]. Studies have also indicated bidirectional relationship between impulsivity and alcohol use [32]. Impulsivity appears to play a significant role in the onset and progression of substance use disorder, either as an underlying susceptibility or as a result of prolonged substance abuse [33]. Moreover, there is evidence indicating that alcohol can potentially influence impulsivity patterns as time goes on [34].

In alcohol use disorder (AUD) recovery, the emphasis on successful outcomes has primarily revolved around traditional measures like decreased alcohol and drug consumption during treatment. However, there's a growing realization that the overall quality of life (QoL) is a crucial aspect of recovery. Current AUD treatment and medication trials have centered on endpoints like abstinence and reduced heavy drinking days. Hence, there is a requirement to investigate clinical, impulsivity, and cognitive indicators linked to the quality of life in individuals with AUD. This investigation should particularly focus on fundamental aspects of trait impulsivity such as attention, cognitive instability, motor impulsiveness, perseverance, and self-control. By examining factors that can predict quality of life throughout and after AUD treatment, it becomes possible to pinpoint areas for intervention and improvement in the treatment process.

This study examined the association between attention, cognitive instability, motor impulsiveness, perseverance, and self-control dimensions of trait impulsivity and quality of life (QoL) among male patients seeking treatment for alcohol use disorder (AUD). Furthermore, the study investigated the predictors of quality of life (QoL) among male patients seeking treatment for alcohol use disorder (AUD) based on attention, cognitive instability, motor impulsiveness, perseverance, and self-control dimensions of trait impulsivity. The study also investigated the potential mediating effect of anxiety and alcohol use severity in this relationship. This study hypothesized that attention, cognitive instability, motor impulsiveness, perseverance, and self-control dimensions of trait impulsivity would be predictive of all four domains of QoL. A second hypothesis was that anxiety and severity of alcohol use would mediate the effects of impulsivity dimensions on QoL.

2. Materials and Methods

2.1. Study setting & participants

This study was carried out at a leading substance use disorder treatment centre in India (Dayal and Balhara, 2017). The 50-bed centre is staffed by well-qualified multidisciplinary faculty and staff to provide a variety of treatments. The centre provides training in addiction psychiatry, treats patients suffering from substance use disorders, and carries out relevant clinical research. It also makes recommendations to policymakers regarding addictive substances in India. The centre provides inpatient and outpatient treatment, as well as services for psychotherapeutic interventions and psychosocial rehabilitation. Patients are admitted to the centre primarily for opioid and alcohol detoxification. The duration of their stay is typically 2–3 weeks. During their inpatient stay, patients are given medications for symptomatic management of withdrawal symptoms. Benzodiazepines are used to treat alcohol use disorder, while buprenorphine is generally used for the treatment of opioid use disorder (Dayal and Balhara, 2017). Following alcohol detoxification, patients are prescribed anti-craving medications, either Acamprosate or Naltrexone, based on the clinical judgment of the treating physician. Nonpharmacological treatments such as psychoeducation, motivational enhancement and relapse prevention therapy are also utilized to prevent relapse. Recruitment for this study took place between December 2019 and June 2020. At the time of recruitment, all patients were undergoing detoxification and remained in treatment as inpatients. Ethical approval was received from the Institute Ethics Committee of the All India Institute of Medical Sciences, New Delhi. Written informed consent was obtained from all study participants.

2.2. Inclusion and Exclusion

Inclusion criteria were: (1) age between 18 and 60 years, (2) able to read and write, (4) diagnosis of alcohol use disorder (AUD) as per DSM 5 using the Mini-International Neuropsychiatric Interview (MINI) - Plus, (5) inpatient with score <7 on Clinical Institute Withdrawal Assessment of Alcohol Revised Scale (CIWA-Ar), (6) Willing to participate in the study. Exclusion criteria were as follows: (1) comorbid chronic physical illness, (2) DSM 5 substance use disorders other than nicotine and alcohol.

2.3. Procedure

Prior to obtaining their informed consent, all participants were provided with a comprehensive overview of the entire research protocol. Following this, a thorough screening process was conducted to determine adherence to the specified inclusion and exclusion criteria. Once all criteria were met, patients were officially enrolled in the study. After that, we conducted detailed assessments to collect the following information:

Sociodemographic and clinical characteristics: All participants were assessed for sociodemographic data, including their name, age, gender, educational qualifications, occupation, family type, and residence type, age of onset of alcohol use, duration and quantity of alcohol use.

Quality of Life Assessment: The World Health Organization Quality of Life-BREF (WHOQOL-BREF) questionnaire was employed to evaluate participants' quality of life.

Alcohol Use Disorder Severity Evaluation: The Alcohol Use Disorders Identification Test (AUDIT) was utilized to gauge the severity of alcohol use disorder among participants.

Impulsivity Measurement: The Barratt Impulsiveness Scale-11 (BIS-11) was administered to assess the levels of impulsivity exhibited by participants.

Cognitive Function Assessment: Cognitive functions were evaluated using the NIMHANS Battery, a comprehensive battery of cognitive tests.

Craving Evaluation: At the baseline, the Obsessive Compulsive Drinking Scale (OCDS) was employed to measure the intensity of craving in relation to alcohol consumption.

Depressive Symptom Assessment: The Hamilton Depression Rating Scale (HAM-D) was utilized to quantify the presence and severity of depressive symptoms.

Anxiety Symptom Evaluation: The Hamilton Anxiety Rating Scale (HAM-A) was employed to measure the extent and intensity of anxiety symptoms.

Self-Efficacy Examination: The Alcohol Abstinence Self-Efficacy (AASE) questionnaire was administered to assess participants' beliefs in their ability to abstain from alcohol consumption.

2.4. Top of Form

Instruments

World Health Organization Quality of Life Brief Version (WHOQOL) Group, 1998).

The Quality of Life (QoL) was assessed using the World Health Organization Quality of Life Brief Version. This self-report tool comprises 25 items measuring QoL across four domains: physical health, psychological, social relationships, and environment quality of life. Responses are rated on a 5-point Likert scale, with higher scores indicating improved QoL. The WHOQOL-BREF has shown strong reliability and validity in previous studies.

Barratt Impulsiveness Scale (BIS)

The Barratt Impulsiveness Scale (BIS) is widely used to measure impulsivity in psychiatric studies. The BIS-11 version assesses three impulsivity domains: motor, cognitive, and non-planning. The study identified six first-order factors through principal component analysis (PCA): attention, motor, self-control, cognitive complexity, perseverance, and cognitive instability. A subsequent analysis revealed three higher-order factors: "motor impulsiveness," "non-planning impulsiveness," and "attentional impulsiveness." While the BIS-11 ($\alpha = 0.83$), and some factors demonstrated good reliability, such as non-planning impulsiveness ($\alpha = 0.72$) and attentional impulsiveness ($\alpha = 0.74$), motor impulsiveness had lower reliability ($\alpha = 0.59$). Among the first-order factors, only attention ($\alpha = 0.72$) and self-control ($\alpha = 0.72$) showed good reliability.

Alcohol Use Disorders Identification Test (AUDIT)

It is a comprehensive assessment tool, comprised of 10 items, meticulously crafted by the World Health Organization (WHO). This instrument is designed to thoroughly evaluate patterns of alcohol

consumption, behaviors related to drinking, and the presence of alcohol-associated issues. Each of the 10 questions within the AUDIT framework is accompanied by a scale of responses, ranging from 0 to 4. Notably, questions 9 and 10 deviate slightly, offering responses on a scale of 0, 2, and 4. The scoring spectrum spans from 0 to 40, encompassing the gamut of potential responses. According to the discerning guidelines set forth by the World Health Organization (WHO), a score of 1 to 7 indicates consumption patterns associated with minimal risk. In contrast, scores between 8 and 14 signify a potential for hazardous or detrimental alcohol use, while a score of 15 or higher raises concerns about the prospect of alcohol dependence, indicating a moderate to severe alcohol use disorder. Notably, individuals with the most profound severity, as classified by the DSM-5, consistently manifest notably elevated mean scores on the AUDIT, distinguishing them from those exhibiting less severe manifestations.

Obsessive Compulsive Drinking Scale (OCDS)

The Obsessive Compulsive Drinking Scale (OCDS) is a 14-item questionnaire. It is a widely used tool to measure cravings for alcohol. It's a quick and reliable test that gives you a total score and two smaller scores: one for the obsessive cravings (based on questions 1-6) and another for the compulsive cravings (based on questions 7-14). The OCDS has been tested with adults who have issues with alcohol use. The test-retest correlation for the OCDS total score is 0.96, and the obsessive and compulsive subscales test-retest correlations are 0.94 and 0.86, respectively. The internal consistency of the items in the OCDS is high (0.86).

Alcohol Abstinence Self-Efficacy Scale (AASE)

It is a 20 item questionnaire that measures an individual's self-confidence to abstain from drinking in a range of situations. AASE demonstrated a solid subscale structure and strong indices of reliability and validity. The four 5-item subscales measured types of relapse precipitants labeled negative affect, social positive, physical and other concerns, and withdrawal and urges. Both in structure and mean scores the AASE demonstrated no substantive gender differences. The AASE appears to represent a brief, easily usable and psychometrically sound measure of an individual's self-efficacy to abstain from drinking.

NIMHANS neuro-psychological Battery for Cognitive Functions

Cognitive functions were assessed using the NIMHANS Battery, including the Auditory Verbal Learning Test, Complex Figure Test, Verbal N Back Test, Digit Symbol Substitution Test, Animal Names Test, Stroop Test and Wisconsin Card Sorting Test.

Hamilton Anxiety Rating Scale (HAM-A)

The HAM-A was one of the first tools created to measure how serious anxiety symptoms are. It's still used a lot today in both medical and research settings. The tool has 14 questions, each describing a set of symptoms. It measures two kinds of anxiety: mental anxiety (feeling restless or distressed) and physical anxiety (having physical problems because of anxiety). The HAM-A doesn't have set questions for the person being tested. Even so, the results show that different testers get similar scores, which is good. Each question gets a score from 0 (no problem) to 4 (very serious). The total score can range from 0 to 56. Scores under 17 mean mild anxiety, scores between 18 and 24 mean mild to medium anxiety, and scores between 25 and 30 mean medium to serious anxiety.

The Hamilton Depression Rating Scale (HAM-D)

It stands as the preeminent tool for evaluating depression under the guidance of clinicians. Comprising a set of 17 items, this assessment scale delves into the spectrum of depressive symptoms experienced over the course of the previous week. The methodology for scoring varies across different iterations of the scale. In the context of the HAM-D, a score ranging from 0 to 7 is conventionally interpreted as indicative of a state within the normal range or clinical remission.

Conversely, a score of 20 or higher, denoting at least a moderate level of severity, is typically the threshold for eligibility in clinical trial enrollment.

2.5. Statistical analysis

The data were analyzed using Statistical Package for Social Sciences (SPSS) version 25.0. P values <0.05 were considered significant. Continuous variables were presented as mean and standard deviation (SD), while categorical variables were expressed as percentages. Within the WHOQoL BREF scores (ranging from 0 to 100), an assessment was conducted for each domain, encompassing physical, psychological, social relationships, and environmental domains. To compare QoL scores between individuals with alcohol use disorder and non-user controls, an independent t-test was utilized, with significance set at a p-value below 0.05. Categorical variables pertaining to sociodemographic and clinical characteristics were evaluated between the two groups using a chi-squared (X²) test, where significance was considered at a p-value less than 0.05. Multiple linear regression analysis was employed to establish associations between independent variables and QoL. This encompassed variables identified with a p-value of less than 0.2 during unadjusted analysis, and unstandardized beta coefficients were estimated. Significance in this analysis was recognized at a p-value of less than 0.05. Mediation analysis was conducted using the PROCESS Macro. The focus of this analysis was the Physical Health domain of QoL, with attention factor scores on the BIS-11 serving as the predictor variable and anxiety scores on the HAM-A serving as the mediator variable. The outcome of the analysis was assessed in terms of statistical significance.

2.6. Ethical approval

All subjects gave their informed consent for inclusion before they participated in the study. The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee the Institute Ethics Committee of the All India Institute of Medical Sciences, New Delhi. Committee Reference number: IEC-278/01.06.2018, RP-31/2018 dated 19th June 2018.

3. Results

Tables 1 and 2 consists of information from 88 participants, and various variables have been examined in relation to different domains of Quality of Life (QoL). The average age of the participants was 37.55 years, with a standard deviation of 8.31. Among the participants, 43.2% (38) had received a school education, while 56.8% (50) had a college education. In terms of employment status, 36.4% (32) were unemployed, while 63.6% (56) were employed. Additionally, 45.5% (40) lived in joint family setups, while 54.5% (48) lived in nuclear family setups. Marital status indicated that 31.8% (28) were unmarried, and 63.6% (60 individuals) were married.

Table 1. Comparison of socio-demographic characteristics, QOL domains, and BIS -11 dimensions between non-alcohol user healthy controls and individuals with alcohol use disorder.

	Non-alcohol user healthy controls(Alcohol n=44)	Disorder(n=88)	Use
Variable	N(%) / Mean (SD)	N(%) / Mean (SD)	P value
Socio-demographic variables			
School -educated	14(31.82)	38 (43.2)	0.207
College-educated	30 (68.18)	50 (56.8)	
Joint family	30(68.18)	48 (54.4)	0.133
Nuclear Family	14(31.3)	40(45.5)	
Part-time Employed	15 (34.09)	32 (36.4)	0.797
Full -time Employed	29 (65.90)	56 (63.6)	
Unmarried	11(25.0)	28(31.8)	0.338
Married	33(75.0)	60 (68.2)	
Age(yrs)	36.06(9.80)	37.55(8.31)	0.387

Quality of life domains			
QOL Physical health	78.25(14.18)	59.93(16.74)	<0.001
QOL Psychological	75.56(13.45)	50.75(18.93)	<0.001
QOL Social Relationships	77.00(16.75)	64.39(27.78)	0.002
QOL Environment	75.88(14.21)	74.77(17.44)	0.507
BIS -11 dimensions and total score			
BIS-11 Attention	8.69(2.09)	10.48 (3.29)	<0.001
BIS-11 Cognitive Instability	6.23(2.31)	6.70(2.03)	0.225
BIS-11 Motor	16.15(2.85)	18.09(3.38)	0.001
BIS-11 Perseverance	6.38(1.44)	7.95(2.47)	<0.001
BIS-11 Self-Control	9.69(1.84)	12.27(3.45)	<0.001
BIS-11 Cognitive Complexity	12.69(2.42)	14.07(2.43)	0.003
BIS- 11 Total	59.84(6.90)	68.43(8.79)	<0.001

BIS -11=Barratt Impulsiveness Scale; QOL= Quality of life (Measured by WHOQOL-BREF).

Table 2. Sociodemographic characteristics of the participants and their association with quality of life (QOL) (measured with the WHOQOL-Bref).

		Total sample 88	QOL Physical Health			QOL Psychological Health			QOL Social Relationship			QOL Environment		
Variables		n(%)	Mean	(SD)	p	Mean	(SD)	p	Mean	(SD)	p	Mean(SD)	p	
Age (mean)		37.55(8.31)	59.53	16.74	.269*	50.75	18.93	.708*	64.39	27.78	.465*	74.77	17.44	.151*
Education	School Educated	38(43.2)	60.79	(19.49)	.771	53.42	21.08	.421	66.79	30.02	.623	75.84	17.75	.727
	College Educated	50(56.8)	59.28	(14.70)		48.72	17.28		62.56	26.44		73.96	17.53	
Employment Status	Unemployed	32(36.4)	56.81	(17.93)	.356	49.82	19.58	.672	63.38	35.213	.858	74.81	16.79	.991
	Employed	56(63.6)	61.71	(16.09)		52.38	18.24		64.96	23.232		74.75	18.112	
Living type	Joint Family	40(45.5)	61.65	(16.46)	.541	50.80	17.79	.987	65.35	18.79	.837	77.05	19.86	.436
	Nuclear Family	48(54.5)	58.50	(17.11)		50.71	20.14		63.58	33.91		72.88	15.32	
Marital Status	Unmarried	28(31.8)	52.86	17.77	.055	41.64	16.02	.028	47.29	27.15	.004	69.43	19.79	.168
	Married	60(63.6)	63.23	15.45		55.00	18.91		72.37	24.64		77.27	15.98	

*Pearsons correlation with different domain of QOL .

The differences in quality of life (QoL) between individuals with alcohol use disorder and healthy controls who do not consume alcohol was found to be statistically significant across domains of physical health, psychological , and social relationships. However, there was no statistically significant difference observed in the domain of environment. Significant associations were observed between marital status and the social relationship domain of QoL. The mean QoL score for the social relationship domain was 47.29 (SD = 27.15) for unmarried individuals and 77.27 (SD = 15.98) for married individuals. This association was found to be statistically significant ($p = 0.004$).

Table 3 presents the descriptive statistics and correlation matrix of various study variables based on a sample size of 88 individuals. The table provides means, standard deviations (SD), and the correlation coefficients between different variables. Correlations are denoted by coefficients ranging from -1 to 1, with positive values indicating a positive relationship and negative values indicating a negative relationship. Correlation coefficients marked with ** are significant at the 0.01 level (two-tailed), while those marked with * are significant at the 0.05 level (two-tailed). The table helps to understand the relationships between different variables and provides insights into potential associations between factors such as quality of life, impulsiveness, psychological measures, cognitive function, and alcohol-related assessments. The Barratt Impulsiveness Scale-11 (BIS-11) 1st Order factor of Attention exhibited significant correlations with the Physical Health ($r = -0.655$) and Environment ($r = -0.547$) domains of QoL. Similarly, the BIS-11 1st Order factor of Self-Control

demonstrated significant correlations with the domains of Physical Health ($r = -0.343$) and Psychological Health ($r = -0.406$) in the context of QoL. Scores on the HAM-D (Hamilton Depression Rating Scale) and HAM-A (Hamilton Anxiety Rating Scale) exhibited significant correlations with all four domains of QoL. Furthermore, the total scores from the Alcohol Use Disorders Identification Test were significantly correlated with the Psychological Health domain ($r = -0.325$) of QoL. The scores from the Obsessive Compulsive Drinking Scale displayed significant correlations with the Environment ($r = -0.388$) and Physical Health ($r = -0.388$) domains of QoL. There was no significant correlation between any cognitive test assessment and the four domains of quality of life. Furthermore, the scores derived from the Alcohol Abstinence Self-Efficacy Scale (Confident) demonstrated significant associations with both the Psychological Health domain ($r = 0.345$) and the Relationships domain ($r = 0.436$) of Quality of Life (QoL).

Table 3. Descriptive Statistics and Correlation Matrix of Study Variables (n = 88).

	N	Mean	SD	1	2	3	4	5	6	7	8	9	10	11
1 QOL Physical Health	88	59.93	16.74	-										
2 QOL Psychological	88	50.75	18.93	.551**	-									
3 QOL Social Relationships	88	64.39	27.78	.314*	.346*	-								
4 QOL Environment	88	74.77	17.44	.651**	.438**	0.264	-							
5 BIS Attention	88	9.48	3.29	-.655**	-.441*	-.372*	-.547**	-						
6 BIS Cognitive Instability	88	6.70	2.03	-0.239	-0.113	-0.204	-0.075	0.213	-					
7 BIS Motor	88	18.09	3.38	-0.145	-0.148	-0.025	-0.062	0.325*	0.237	-				
8 BIS Perseverance	88	7.95	2.47	0.161	0.201	-0.255	0.047	-0.029	0.275	0.039	-			
9 BIS Self-control	88	12.27	3.45	-.343*	-.406*	-0.144	-.462**	.497**	0.042	.310*	-0.083	-		
10 BIS Cognitive Complexity	88	14.07	2.43	0.106	-0.109	0.219	0.165	-0.140	0.018	0.104	0.074	0.081	-	
11 BIS Total Score	88	68.43	8.79	-.402**	-.360*	-0.245	-.369*	.661**	.459**	.682**	.305*	.685**	.295	-
12 HAM D score	88	3.02	3.40	-.527**	-.433**	-.388**	-.595**	.504**	0.045	0.088	-0.074	.347*	-0.124	0.310*
13 HAM A score	88	6.45	5.10	-.658**	-.485**	-.317*	-.637**	.475*	.054	0.089	-0.226	.255	-.062	.239
14 AUDIT Total scores	88	31.52	5.47	-0.269	-.325*	-0.270	0.025	.299*	0.266	0.252	0.093	-0.142	-0.073	0.202
15 OCDS Total scores	88	7.80	11.40	-0.229	-0.171	-0.142	-.388**	.318*	-0.296	0.170	-0.079	0.284	-0.096	0.180
16 Age	88	37.55	8.31	0.170	0.058	-0.113	0.220	-0.113	0.070	0.274	-0.042	-0.169	-0.179	-0.066
17 Duration of alcohol use	88	12.77	8.04	-0.001	-0.114	-0.173	-0.087	.114	0.184	0.182	0.011	0.128	-0.113	0.147
18 AASE (C) Total	88	58.75	19.74	0.281	.345*	0.285	.436**	-.476*	-0.023	-0.218	-0.075	-.444**	0.127	-.390*
19 RAVLT Total	88	45.59	7.23	-0.135	0.066	-0.015	-0.191	0.321*	-0.005	0.014	0.193	0.242	-0.022	0.245
20 RAVLT IR	88	9.73	2.35	-0.189	-0.206	0.051	-0.223	0.239	-0.149	-0.227	0.085	0.129	-0.013	0.031
21 RAVLT DR	88	10.00	2.27	-0.055	-0.010	-0.037	-0.022	0.177	-0.066	-0.175	0.194	0.003	0.021	0.038
22 N 2 BACK Hits	88	6.25	1.33	-0.142	-0.154	0.080	-0.261	0.189	0.011	0.026	-0.060	-0.147	0.081	.034
23 N 2 BACK Error	88	3.75	1.54	0.125	0.144	-0.225	0.194	0.040	-0.098	-0.062	-0.149	0.105	-0.218	-0.115
24 CFT Copy	88	34.15	2.87	0.016	-0.227	-0.072	0.000	0.102	-0.193	-0.112	0.039	0.037	-0.022	-0.040
25 CFT IR	88	19.64	6.31	0.046	0.117	-0.074	-0.021	0.024	0.026	-0.248	0.000	-0.022	-0.175	-0.149
26 CFT DR	88	18.78	6.38	0.118	0.189	-0.073	0.030	-.035	-0.048	-0.196	0.004	-0.120	-0.236	-0.221
27 DSST TT	88	310.20	112.41	0.016	0.144	0.240	-0.183	-0.073	-0.153	0.116	0.028	-0.088	0.053	-0.034
28 ANT Total	88	11.73	3.07	0.097	0.207	.211	0.244	-.026	0.035	0.005	0.069	-0.050	0.180	0.048
29 Stroop Effect	88	153.63	78.80	-0.147	-.046	0.100	-.105	.202	-0.292	0.145	-0.144	0.057	0.142	0.093

QOL = Quality of life; BIS= The Barratt Impulsiveness Scale Version 11; HAM D= Hamilton Depression Rating Scale; HAM A= Hamilton Anxiety Rating Scale ; AUDIT= Alcohol Use Disorders Identification Test ; OCDS= Obsessive Compulsive Drinking Scale; AASE(C)= Alcohol Abstinence Self-Efficacy Scale (Confident); RAVLT Total= Rey Auditory Verbal Learning Test total score of 5 trials ; RAVLT IR= Immediate recall ; RAVLT DR= Delayed recall ; N 2 BACK Hits= Verbal 2 N Back test Hist ; N 2 BACK Error = Errors ; CFT Copy= Complex Figure Test copy score ; CFT IR = Immediate Recall ; CFT DR = Delayed Recall ; DSST TT = Digit Symbol Substitution Test Time Taken; ANT Total = Animal Names Test total score. **Correlation significant at the 0.01 level (2 tailed) *Correlation significant at the 0.05 level (2 tailed).

Table 4 presents the univariate and multivariate Linear Regression Analyses to identify predictors of quality of life (WHOQOL-BREF) among individuals undergoing detoxification for alcohol use disorder.

Table 4. Univariate and Multivariate Linear Regression Analyses to Identify Predictors of Quality of Life (WHOQOL-BREF) among Individuals Undergoing detoxification for Alcohol Use Disorder (n=88).

Variables	Unadjusted					Adjusted				
	Estimate SE		95% CI		p	Estimate	SE	95% CI		p
			LL	UL				LL	UL	
Linear regression results for physical health domain										
(Constant)						92.111	7.021	77.9	106.31	0
BIS Attention	-3.327	0.593	-4.523	-2.131	0.000	-2.272	0.672	-3.631	-0.912	0.002
BIS Self-control	-1.664	0.703	-3.082	-0.246	0.023	-0.101	0.582	-1.278	1.076	0.863
HAM D Total Score	-2.589	0.645	-3.890	-1.288	0.000	-0.393	0.796	-1.217	2.003	0.624
HAM-A Total Score	-2.160	0.381	-2.928	-1.391	0.000	-1.642	0.517	-2.687	-0.597	0.003
R²/Adjusted R²						.587/.545				
Liner regression results for Psychological domain										
(Constant)						116.30	17.95	79.94	152.65	0
BIS Attention	-2.533	0.796	-4.139	-0.927	0.003	-0.083	0.991	-2.165	3.058	0.731
BIS Self-control	-2.227	0.773	-3.788	-0.667	0.006	-1.941	0.851	-3.663	-0.219	0.028
HAM D Total Scores	-2.404	0.773	-3.965	-0.844	0.003	-0.188	1.091	-2.397	2.021	0.864
HAM A Total Score	-1.798	0.501	-2.808	-0.788	0.001	-1.112	0.711	-2.551	0.327	0.126
AUDIT Total Scores	-1.125	0.505	-2.144	-0.105	0.031	-1.053	0.485	-2.551	-0.071	0.036
R²/Adjusted R²						.409/.331				
Linear regression results for social relationships domain										
(Constant)						51.526	22.038	6.95	96.101	0.025
BIS Attention	-3.137	1.208	-5.574	-0.700	0.013	-1.332	1.389	-4.142	1.478	0.344
HAM D Total scores	-3.165	1.160	-5.506	-0.824	0.009	-1.903	1.737	-5.415	1.609	0.28
HAM A Total scores	-1.728	0.796	-3.335	-0.121	0.036	0.123	1.138	-2.178	2.424	0.914
Marital Status	25.081	8.236	8.460	41.702	0.004	18.1	8.772	0.457	35.742	0.045
R2/adjusted R2						0.273/.198				
Linear regression results for Environment domain										
(Constant)						104.098	14.901	73.906	14.291	0
BIS attention	-2.896	0.684	-4.276	-1.516	0.000	-0.877	0.779	-2.455	0.701	0.267
BIS self-regulation	-2.333	0.691	-3.729	-0.938	0.002	-1.041	0.678	-2.414	0.332	0.133
HAM D Total scores	-3.046	0.635	-4.328	-1.764	0.000	-0.475	0.93	-2.359	1.409	0.612

HAM-A	-2.178	0.406	-2.998	-1.358	0.000	-1.36	0.586	-2.547	0.172	0.123
Total scores										
OCDS Total	-0.594	0.218	-1.033	-0.155	0.009	-0.09	0.225	-0.545	0.336	0.692
scores										
AASE Total	0.385	0.123	0.137	0.633	0.003	0.046	0.14	-0.239	0.33	0.748
scores										
R ² /adjusted										
R ²						0.540/0.465				

QOL = Quality of life; BIS= The Barratt Impulsiveness Scale Version 11; HAM D= Hamilton Depression Rating Scale; HAM A= Hamilton Anxiety Rating Scale; AUDIT= Alcohol Use Disorders Identification Test ; OCDS= Obsessive Compulsive Drinking Scale; AASE(C)= Alcohol Abstinence Self-Efficacy Scale (Confident).

A multiple linear regression analysis was conducted to predict the physical health domain of quality of life based on the attention dimension scores of the BIS-11, the self-control dimension scores of the BIS-11, as well as scores from the HAM-A and HAM-D scales were utilized. The results revealed a statistically significant regression equation ($F(4, 83) = 13.87, p < .000$), with an R-squared value of .587. The predictive equation for participants' physical health domain of quality of life was determined as follows: $Y = 92.111 - 2.272(\text{BIS Attention}) - 0.101(\text{BIS Self-control}) - 0.393(\text{HAM-D}) - 1.642(\text{HAM-A})$, where all independent variables were measured as continuous on a scale. Notably, a one-unit increase in attention factor scores on the BIS 11 led to a significant decrease of 2.272 units in participants' predicted physical health domain of quality of life. Similarly, a one-unit increase in HAM-A scores resulted in a substantial decrease of 1.642 units in the predicted score for the physical health domain of quality of life. Both attention factor scores on BIS and anxiety score on HAM -A were significant predictors of physical health domain of quality of life. These predictors demonstrated that higher scores on attention factor of the BIS-11 and elevated anxiety scores on the HAM-A were associated with lower scores in the physical health domain of quality of life. The mediation analysis was performed using PROCESS Macro. The outcome variable for analysis was Physical health domain of QoL. The Predictor variable for the analysis was attention factor scores on BIS -11. The mediator variable for the analysis was anxiety scores on HAM-A. The indirect effect of attention factor scores on BIS -11 on Physical health domain of QoL was found to be statistically significant [effect = -1.082, 95% CI (-2.008, -0.3598)], and the results are comprehensively presented in Table 5. Importantly, these effects were found to be partially mediated by anxiety scores, as depicted in Figure 1.

Table 5. Results of mediation analysis performed using PROCESS Macro.

Relationship	Total effect	Direct effect	Indirect effect	95% CI		Conclusion
				LL	UL	
BIS attention-> HAM-A score->QOL Physical Health domain	-3.326	-2.244	-1.082	-2.008	-0.3598	Partial mediation
P value	.0000	.0004				
BIS Self-control ->AUDIT score-> QOL Psychological domain	-2.227	-2.531	.303	-2.273	.900	No Mediation
P value	.006	.001				

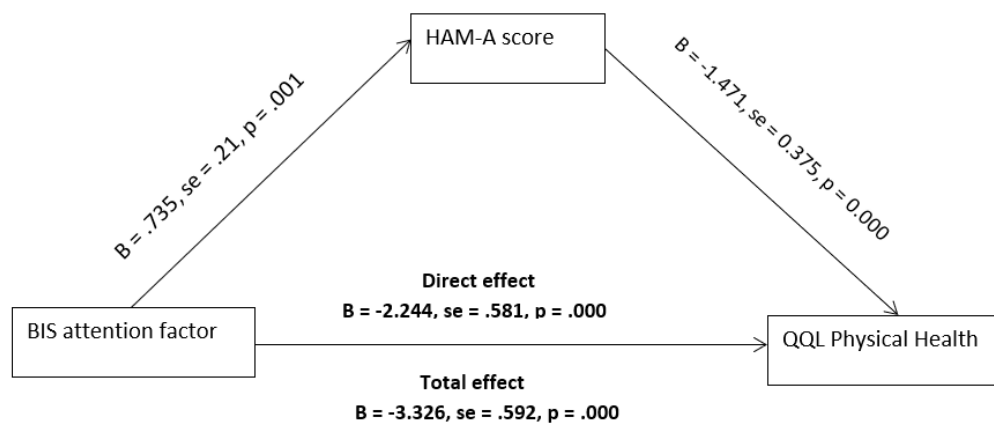


Figure 1. Mediation analysis: BIS attention-> HAM-A score->QOL Physical Health.

A multiple linear regression analysis was conducted to predict the psychological health domain of quality of life. The predictor variables included the attentional factor scores of BIS-11, the self-control factor scores of BIS-11, scores from the HAM-A scale, scores from the HAM-D scale, and total scores from the AUDIT. The analysis revealed a statistically significant regression equation ($F(5,82) = 5.258, p < .001$), with an R-squared value of .409. The equation representing the prediction of participants' psychological health domain of quality of life was determined as follows: Predicted Psychological Health = $116.30 - 0.083$ (BIS Attention) - 1.941 (BIS Self-control) - 0.188 (HAM-D) - 1.112 (HAM-A) - 1.053 (AUDIT score). All independent variables were measured as continuous values on a scale. Notably, a one-unit increase in self-control factor scores on the BIS 11 led to a significant decrease of 1.941 units in participants' predicted physical health domain of quality of life. Similarly, a one-unit increase in AUDIT scores resulted in a decrease of 1.053 units in the predicted score for the psychological health domain of quality of life. Both self-control factor scores on BIS and anxiety score on HAM -A were significant predictors of psychological health domain of quality of life. This indicated that higher self-control factor scores on the BIS-11 and greater severity of alcohol use, as indicated by higher AUDIT scores, were linked to lower scores on the psychological health domain of quality of life. The mediation analysis was performed using PROCESS Macro. The outcome variable for analysis was psychological domain of QoL. The Predictor variable for the analysis was self-control factor scores on BIS -11. The mediator variable for the analysis was alcohol use severity measured by AUDIT. The indirect effect of self-control factor scores on BIS -11 on psychological domain of QoL was not found to be statistically significant [effect = .303 95% (-.273,.900)] as demonstrated in Figure 2. The results are comprehensively presented in Table 5.

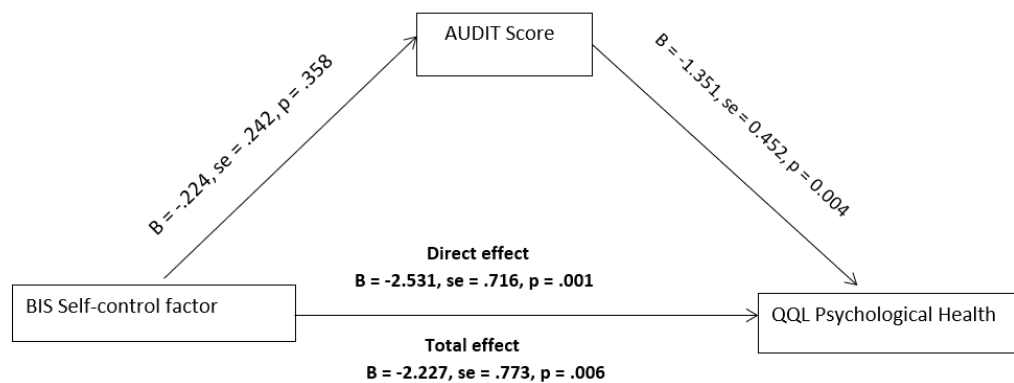


Figure 2. Mediation analysis : BIS Self-control → AUDIT score → QOL Psychological Health.

A multiple linear regression analysis was conducted to predict the quality of life within the social relationships domain. The predictive factors included scores from the attention factor of BIS-11, HAM-A scores, HAM-D scores, and marital status. The results revealed a statistically significant regression equation ($F(4, 83) = 3.655, p < .013$) with an R-squared value of .273. The predicted quality of life score in the relationship domain for participants was estimated using the formula: $51.526 - 1.332(\text{BIS Attention}) - 1.903(\text{HAM-D}) - 0.123(\text{HAM-A}) + 18.1(\text{Marital status})$. It's important to note that all independent variables were measured on a continuous scale, except for marital status, which was coded as 1 for unmarried and 2 for married participants. Remarkably; the marital status emerged as the sole significant predictor of quality of life in the relationship domain. Married participants exhibited a notable increase of 18.1 points in their quality of life in relationship domain scores compared to unmarried participants.

A multiple linear regression analysis was conducted to assess the relationship between the quality of life in the environmental domain and several variables, including the attentional factor scores from BIS-11, self-control factor scores from BIS-11, HAM-A (Hamilton Anxiety Rating Scale) scores, HAM-D (Hamilton Depression Rating Scale) scores, OCDS (Obsessive-Compulsive Drinking Scale) scores, and AASE (Adolescent Alcohol Sensation Seeking) scores. The results revealed a statistically significant regression equation ($F(6, 81) = 7.235, p < .000$), with an R-squared value of .540. The predicted environmental quality of life score for participants can be calculated using the following equation: $104.098 - 0.887(\text{BIS Attention}) - 1.041(\text{BIS Self-control}) - 0.475(\text{HAM-D}) - 1.360(\text{HAM-A}) - 0.090(\text{OCDS score}) + 0.140(\text{AASE})$, where all the independent variables were measured on a continuous scale. No independent variables were found to be significant predictors of quality of life in the environmental domain.

4. Discussion

Our study aimed to assess the association between attention, cognitive instability, motor impulsiveness, perseverance, and self-control dimensions of trait impulsivity and quality of life (QoL) among male patients seeking treatment for alcohol use disorder (AUD). Furthermore, the study investigated the predictors of quality of life (QoL) among male patients seeking treatment for alcohol use disorder (AUD) based on attention, cognitive instability, motor impulsiveness, perseverance, and self-control dimensions of trait impulsivity. The study also investigated the potential mediating effect of anxiety and alcohol use severity in this relationship. These scores were then compared to those of demographically matched, healthy individuals who did not consume alcohol. We also explored the correlations between domains of Quality of Life (QoL) and socio-demographic, cognitive, and clinical factors in order to pinpoint the most significant predictors of QoL.

The differences in quality of life (QoL) between individuals with alcohol use disorder and healthy controls who do not consume alcohol was found to be statistically significant across domains of physical health, psychological, and social relationships. However, there was no statistically significant difference observed in the domain of environment. The psychological domain exhibited the lowest mean score, followed by the mean score in the physical health domain among individuals with alcohol use disorder. These findings are consistent with previous studies that have also documented diminished scores in the psychological and physical health domains [11,17,35]. However, a deviation from these findings is observed in a separate study, Olickal et al.(2021) which reported the highest mean (SD) score in the physical domain when compared to other QoL domains[17]. This discrepancy in our findings could potentially be attributed to variations in the study setting and the characteristics of the study subjects, including the inclusion of patients experiencing severe addiction and undergoing inpatient detoxification. Patients with AUD demonstrated higher mean scores on impulsivity factors assessed by the BIS 11 compared to the control group, aligning with findings from prior research [28,29].

Marital status exhibited a significant association with the social relationships domain of Quality of Life (QoL) among individuals with alcohol use disorder. Those who were married showed a notable positive effect on the social relationships domain of QoL. This observation aligns with prior research that highlights the beneficial effects of cohabitation with a partner on the social functioning aspect of QoL [36,37]. Conversely, factors such as age and education did not demonstrate any correlation with the various domains of QoL within this study, which is consistent with findings from earlier investigations [37]. It's worth noting, however, that contrary to these results, other studies have presented evidence indicating that advancing age [38] and lower educational attainment [13] do indeed exert a negative impact on QoL.

Our findings did not show any significant correlation between cognitive abilities and Quality of Life (QoL). In prior studies, the relationship between anxiety/depressive symptoms and QoL in individuals with Alcohol Use Disorder (AUD) was examined. These studies indicated that both depression and anxiety could contribute to diminished QoL among AUD patients [16,39,40]. Consistent with these findings, we observed a significant correlation between anxiety/depressive symptoms and various domains of QoL. Thus, the individuals with AUD who experience more pronounced symptoms of depression and anxiety are likely to have a lower QoL. Consistent with prior research carried out in the context of AUD and binge drinking, our study revealed a significant correlation between psychological domain of QoL and the AUDIT score. However, in contrast to earlier studies, we did not identify any significant correlation between the age of onset of AUD and QoL[41,42]. This observed relationship indicates that the extent of AUD severity is negatively correlated with the psychological domain of QoL.

A multivariable linear regression was conducted using the four domains of Quality of Life (QoL) as the dependent variables to identify the predictors of QoL. Notably, the dimensions of impulsivity that showed significant predictive power were attention dimension and self-control dimension of impulsivity. Specifically, attention dimension was found to be a predictor of physical QoL, while self-control was associated with psychological QoL. This finding aligns with a prior study [16,18]. It's worth mentioning that the study's results diverged from those of Reichl et al. (2022)[18], as the motor dimension of impulsivity did not emerge as a significant predictor across QoL domains. This discrepancy could potentially be attributed to methodological differences in measurement tools—our study employed the BIS-11, whereas Reichl et al. (2022) utilized alternative tasks for assessment. A plausible explanation for how the attention and self-control dimensions of impulsivity are linked to a diminished quality of life is as follows: The inability to plan ahead and involve oneself in intricate tasks (self-control impulsivity) can pose challenges in making purposeful choices and restoring a stable overall functioning, encompassing aspects like employment and financial stability. Concurrently, a deficiency in focus (attentional impulsivity) may hinder an individual's ability to stay present and prevent persistent rumination. Nevertheless, it is essential for forthcoming research endeavors to validate this conjecture.

Anxiety symptoms, as measured by the HAM-A scale, were found to predict the physical domain of QoL. This finding aligns with previous research indicating that both impulsivity and anxiety were predictors of QoL among individuals with AUD [16]. Moreover, using PROCESS analysis, a significant indirect correlation was established. This link correlated the attention dimension of impulsivity to the physical QoL domain through anxiety symptoms. It's important to note that the partial mediation effect was notable specifically for the physical domain QoL. This means that higher scores on the attention dimension of impulsivity could result in heightened anxiety symptoms, subsequently increasing the likelihood of a lower level of physical QoL. Studies have shown that anxiety significantly affects the quality of life in individuals with Alcohol Use Disorder (AUD) [43]. Anxiety and AUD can influence each other in a two-way manner. Some people with anxiety disorders may turn to alcohol as a way to self-medicate and manage their symptoms. This can, in turn, increase the risk of developing AUD [44]. On the other hand, research has also demonstrated that AUD can lead to the emergence of anxiety symptoms [45,46]. As a result, addressing anxiety becomes a crucial consideration when treating individuals with AUD.

The severity of AUD as measured by the AUDIT was found to predict psychological domain QoL. On the other hand, being married was found to have a positive impact, acting as a protective factor for social relationship QoL. There was an observed negative correlation between QoL scores and AUDIT scores, with the AUDIT score standing out as a predictor of psychological domain QoL. However, we didn't identify a significant indirect correlation between the self-control dimension of impulsivity and psychological domain QoL through the severity of AUD.

4.1. Clinical Implications

Furthermore, the role of impulsivity in determining QoL for those with AUD is highly significant from a clinical standpoint. Notably, various studies have indicated that impulsivity is not only linked to the initial development of AUD [47], but it also contributes to the likelihood of relapse [48], even following periods of abstinence [49]. Given these findings, when dealing with AUD, it is essential to take into accounts both anxiety and impulsivity due to their impact, particularly through their influence on QoL, on the outcome of treatment. Along with medications, various approaches like engaging in physical activity [50] or practicing meditation [51] could be suggested to help control anxiety and impulsivity in people with AUD.

5. Conclusions

AUD is chronic biopsychosocial condition leading to various health and life challenges. The study, conducted at a prominent Indian treatment center from Dec 2019 to Jun 2020, gathered data on demographics, AUD severity, impulsivity, cognitive function, craving, emotional well-being, and self-efficacy. Analysis showed attention dimension of impulsivity and anxiety predicted physical health QoL, while self-control dimension and severity of alcohol use disorder anxiety predicted psychological QoL health. Attention dimension of impulsivity indirectly affected physical health. The significance of impulsivity in influencing the quality of life (QoL) for individuals with AAUD holds substantial clinical importance. Remarkably, impulsivity plays a dual role—it is not only intertwined with the initial onset of AUD but also exerts a notable influence on the probability of relapse, even subsequent to phases of abstinence. These research findings underscore the imperative of considering both anxiety and impulsivity in the context of AUD management. This consideration becomes pivotal due to their profound effects, notably through their sway over QoL, ultimately shaping the treatment outcomes.

Author Contributions: Prabhoo Dayal: Fund acquisition, Conceptualization, Methodology, Project administration, Formal analysis, Resources, Validation, Writing – original draft, Writing – review & editing. Gauri s Kalooya: Methodology (supporting) Writing – review & editing. Rohit Verma: Conceptualization (supporting), Writing – review & editing. Nand Kumar: Writing – review & editing.

Funding: This study was funded by a research grant (DST/CSRI/2017/149) from the Department of Science & Technology, Government of India under the Cognitive Science Research Initiative (CSRI).

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee the Institute Ethics Committee of the All India Institute of Medical Sciences, New Delhi. Committee Reference number: IEC-278/01.06.2018, RP-31/2018 dated 19th June 2018.

Informed Consent Statement: All subjects gave their informed consent for inclusion before they participated in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Acknowledgments: We want to thank all patients who agreed to participate in this study.

Conflicts of Interest: The authors declare no conflict of interest.

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