

Analysis of the Causes, Effects, and Treatment of Alcohol Use Disorder

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Abstract. The number of people with alcohol problems is increasing year by year. There is a trend people of younger ages are even more affected by this issue. Alcohol use disorder is an important issue that contemporary society has started paying attention to, thereby making it one of the key topics of today's research. Researchers have made progress in determining the causes and effects of alcohol use disorder, but there are still gaps in research in certain areas, as well as a lack of unified explanations regarding the issues with cognition that alcohol problems cause. In that sense, studies have been conducted on how alcohol use disorder affects working memory, along with other aspects of cognition. Yet, these studies conclude that additional research is necessary in order to discover how the working memory abilities of people with alcohol use disorder can be increased. In studies of alcohol use disorder causes the physical and emotional aspects, experts note that decision-making processes, positive emotions, and negative experiences are common factors that lead to the disorder. To explore therapy and suggestions to treat alcohol use disorder, this paper examined the literature of negative impact of alcohol use disorders on working memory. The results of the analysis concluded that alcohol use disorder severely affects cognition, especially working memory. Further findings determine that combining behavioral therapy and medications is the best strategy patients can have when they are reluctant to stop using alcohol. The consequences of alcohol use disorder are also provided, including both the physical aspects and the cognitive impacts that affect people's daily lives.

Keywords: Working memory; Therapy; Medical treatment; Drinking behavior; Alcohol use disorder.

1. Introduction

At the present moment, around 107 million individuals around the world are believed to suffer from alcohol use disorder. There are significant gender discrepancies, as 32 million of those individuals are female while 75 million are male. This means that 70% of all people with alcohol use disorder are males [1]. Alcohol consumption disorder is very common, especially in the United States. Nearly 86% of adults (18 and older) were reported using alcohol at some point in their lives. According to the 2019 National Survey on Drug Use and Health, around 70% of respondents acknowledged using alcohol the year before [2]. The negative effects of alcohol usage on human health are severe. The development of chronic diseases is demonstrated by the correlation between high alcohol consumption rates and frequent consumption patterns [3].

Another serious research gap is the need for intervention for alcohol use disorder and the actual application of interventions. In other words, the prevalence of alcohol use disorder is too high compared to the availability of interventions. A research gap that might be even more important to overcome is that of clinical treatment and prevention for alcohol use disorder. To be specific, the impact of the treatment and prevention strategies currently employed is negligible when considering public health. Screening and brief counseling are insufficiently implemented outside of the medical context, so it is important for research to investigate how a positive effect in this domain can be achieved [4]. These gaps are largely a result of issues with research design and methodology implemented in researching treatment or prevention opportunities for alcohol problems. For instance, assessment technologies are still not sufficiently employed for evaluating the efficacy of treatment. In other words, innovative research methods are necessary for treatment evaluation, whether those are experimental or quasi-experimental research designs.

In light of this, the current article's goal is to summarize alcohol consumption disorder's causes, effects, and therapy using the most recent research on the subject. Our aim in the study was to explore the critical impact that alcohol use disorder has on cognition, particularly the impact related to working memory. The aspects and angles from which alcohol use disorder was discussed include the phenomenon of people drinking alcohol, especially hangover, dependence, and addiction, the form of AUD with its definition, factors, symptoms, and morbidity, the way in which AUD causes cognitive impairments, including working memory, the treatments, therapies, and complications, the scope that covers adolescents, adults, males and females, as well as the research gap existing in the field. After summarizing and comparing research findings on alcohol use disorder, it can be said that this disorder results in severe health, economic, social, and public health costs. This is supported by further consequences, including a negative environmental impact [2].

The research conclusion of this paper is that alcohol is a central nervous system depressant that causes negative consequences of several brain areas. The most serious impact of alcohol use is memory impairment because it causes problems with aspects of cognition like learning and working memory. In other words, alcohol use prevents new memories to be formed. The greater the amount of alcohol consumed, the greater the damage to memory. Specifically, higher alcohol doses have been associated with significant inhibitions of the brain's normal functioning. Pharmacological and psychological therapies are helpful with abstinence as the pillar of ending alcohol use disorder. The importance of this research rests in its ability to offer fresh perspectives on the medical and psychosocial facets of alcohol use disorder treatment. Through this research, the expert community will be able to further actualize the promotion of abstinence, as well as pharmacological and behavioral therapies, especially cognitive therapy, as both a treatment and a preventive measure against alcohol use disorder.

2. Causes of AUD

2.1 Physical causes

Asymmetry between two decision-making systems—an amygdala-based system for immediate prospects and a prefrontal cortex-based system for future prospects—has been hypothesized as the cause of alcohol use disorder (AUD) [5]. For instance, adolescents with AUD exhibit responses in the left precentral gyrus and bilateral cerebellar areas that are reduced, whereas bilateral parietal cortices showed higher activity in working memory tests when compared to adolescents with normal cognitive competence. This illustrates the characteristic of diminished inhibition and heightened impulsivity in AUD patients [5].

2.2 Genetic causes

It is widely assumed that alcohol use disorder can be caused by genetic factors. More precisely, mental health problems, such as depression, are often of a genetic nature, so it is common for people who have depression, as well as anxiety and more serious mental disorders like bipolar disorder and schizophrenia to also have alcohol use issues. This means that certain people are at a higher risk for developing drinking disorders, as well as that drinking itself can have a more potent influence that contributes to the development of the disorder [5].

2.3 Psychological causes

This paper proposes two main psychological reasons for the formation of AUD: to increase pleasure and as a result of negative emotions. Regarding heightening pleasure, people have increased their motivation to drink to celebrate social occasions and have a good time with others. To exemplify, studies have shown that leisure and social activities, especially for the weekend, increase alcohol use. This issue is particularly relevant to younger people, such as college students [5]. Alcohol causes the body to release endocrine hormones and become excited. Excitement becomes a direct result of excessive drinking, but excessive drinking can change into alcohol use disorder. To be specific, when

one drinks excessive amounts of alcohol for a long period of time and regularly, alcohol use disorder and similar alcohol-related problems can emerge [5].

The second reason for turning to AUD is to appease negative reinforcement, or a tendency to use alcohol to avoid or regulate unpleasant emotions. By observation, people may drink more when facing depression and sadness compared to drinking for celebrating and socializing. The latter is more common when people are experiencing significant damage or are in economic depression in their daily lives, such as during the covid-19 pandemic. In consequence, alcohol use disorder will also lead to changes in the basal ganglia, which guide the formation of habits and eventually lead to forced drinking.

In terms of the perspective of the covid-19 pandemic, it can be said that alcohol has been posing an additional challenge during the pandemic. The pandemic has affected every person across the world, and has left long-lasting effects on public health. In this spirit, alcohol misuse has become an even worse public health concern, deteriorating the well-being of people even further. In the United States, alcohol misuse drastically increased, which became evident from increased alcohol-related deaths and visits of the emergency department. In that way, alcohol additionally complicated the covid-19 pandemic in various ways. For instance, drinking increased people's susceptibility to covid-19 and made the illness more severe by deteriorating their immune systems. In turn, the pandemic has led to even more excessive consumption of alcohol instead of helping people avoid alcohol completely in order to cope with the virus [5]. Research clearly specifies that alcohol consumption patterns became more frequent during the lockdown periods of the covid-19 pandemic. This contributed to a number of mental disorders and physical ailments further emerging in spite of the official discouragement of using any kind of addictive substances. It appears that the cause of this increase is social isolation and the psychological burden of covid-19. The change of patterns led to both medium-terms and long-term consequences [6].

3. Impacts of AUD

Alcohol use disorder is a prevalent psychiatric condition that manifests as excessive alcohol use and drinking habits that cause negative health issues and symptoms. It is a major contributor to global sickness and one of the top causes of preventable death both domestically and abroad. Alcoholic beverages, which, are also viewed as a form of drug are one of the most commonly consumed types of drinks in contemporary society. These beverages include the alcohol molecule ethanol, an organic liquid that acts as a central depressant of the body's central nervous system (CNS) [4]. The chronic heavy consumption of alcohol or alcohol abuse has been related to alcohol use disorder. This condition causes both mental and physical diseases, including dementia, pancreatitis, liver disease, and a number of different cancers. While the risk factors for developing alcohol use disorder are not specifically identified, evidence maintains that heavy drinking and alcohol use disorder have devastating effects on the health of people [3]. The consumption of ethanol commonly leads to impairments in all memory types, as well as in other related faculties of the mind. Chronic alcoholism has been related to impairments of both physical and cognitive nature. Visual working memory and sustained attention are affected by the chronic consumption of alcohol. This means that the ability of alcoholics to perform executive tasks is diminished [4]. Researchers assume that the reason is subservience of certain prefrontal cortex regions.

3.1 Cognitive Impacts of AUD on Working Memory

Working memory (WM) functions by temporarily storing information and integrating it for later manipulation or uses. It consists of three processes: encoding, maintaining, and retrieving information [7]. Having impaired cognitive functions, AUD patients who have poor WM performance often reflect impaired behaviors such as inability to control drinking, repeatedly relapsing, and continued drinking. Despite the harmful physical, psychological, and societal effects of drinking, these relapses

nevertheless occur. Alcohol use disorder causes serious cognitive deficits, especially as associated with impaired executive functions.

Short-term excessive drinking harms cognitive functions such as working memory and executive ability. Internet questionnaires and research on individuals with hangovers showed that the severity of hangovers and the blood alcohol content were significantly correlated with the completion time of execution ability and working memory questionnaires ($p < .05$) [8]. There is a moderate positive correlation between AUD and blood alcohol content and brain damage. Moreover, participants with higher hangovers had longer reaction time and execution ability when answering the working memory questionnaires.

Additional research demonstrates that excessive alcohol use directly harms the brain, as seen by brain imaging and associated neurologic impairments. These deficiencies include deficiencies in executive processes, working memory, visuospatial ability, and the cognitive processing of emotional information. Working memory-related brain regions in AUD patients are reported to be compromised on a neuropsychological level. The anterior prefrontal cortex's level of activation is decreased, and the medial prefrontal cortex's function is dysregulated [9]. The frontal, cerebellar, and subcortical (striatum and thalamus) regions of our brain are specifically connected to deficits in a variety of executive functions, and in particular in performance on tasks requiring cognitive control, according to the evidence [7]. Additionally, the medial dorsal thalamus transmits to the prefrontal cortex (PFC), which is a brain area, has been shown to be highly responsive to variations in dopamine (DA) levels. This is especially true of working memory tasks (PFC). Dopamine (DA) is a key player in this effect, to sum up.

Furthermore, it has been discovered that the PFC has an optimal DA level that conforms to a "inverted U" pattern, indicating that DA levels that are either too low or too high are associated with subpar performance. The PFC is made up of the DLPFC, medial PFC (MPFC; which also includes the ACC and pre-SMA), and orbitofrontal cortex. The MPFC is crucial to the decision-making process' evaluation phase. For instance, the rostral and dorsal ACC as well as the pre-SMA are necessary for response conflict, feedback, and error monitoring [10]. Another important factor for motivation is the MPFC and ACC.

3.2 Physical Impact

Alcohol use disorder patients face other enormous health consequences, including liver disease, cardiovascular disease, malignant neoplasms, and mortality. In the worst cases, alcoholics may face a significant hidden risk of acquiring Korsakoff's syndrome, a condition marked by memory loss and cognitive deterioration that includes both retrograde and anterograde amnesia [11].

4. Therapies and Treatments

This essay contends, based on the relevant literature, that alcohol use disorder causes a major illness burden both domestically and internationally. The current research status places alcohol use disorder as solvable primarily through behavioral treatment. Research suggests that behavioral treatment tailored to deal with alcohol problems specifically leads to notable alcohol consumption reductions, as well as improvements in relationship functioning. Alcohol behavioral therapy has proven to be effective, which is why clinical researchers around the world continue to support it and develop new applications of its basic treatment models. Yet, problems in the research field remain. Namely, the treatment of alcoholism is still elusive, as even behavioral therapy is not certain to help. For that reason, some of the current efforts revolve around the problem of using personalized medicine to apply information related to the gene, protein, and metabolite profile of the patient in order to adjust the treatment to the needs of that individual [3].

4.1 Abstinence

Abstinence only improves cognitive control when used as an intervention, but it also helps rebuild damaged brain tissue. A cross-sectional study, for instance, shows a positive link between extended abstinence and improved performance on a spatial working memory task [11]. A more convincing longitudinal study shows that the working memory performance of the abstinent subgroup was initially statistically lower than that of controls (as measured by reaction time and accuracy on a two-back task), but by the end of the six-month period, the number was equal to that of controls [11]. This highlights the significance of alcohol abstinence, which calls for treatments and therapies.

4.2. Pharmacological treatment

Pharmacological treatment of medications has a wide array of effects to prevent relapse from alcohol use disorder. For instance, type 1/A alcoholics may respond more favorably to naltrexone and selective serotonin reuptake inhibitors than EOA, who may respond more favorably to ondansetron [11].

4.3. Behavioral therapy

Besides medicine, there are also behavioral and psychological evidence-based treatments, such as motivational interviewing, contingency management, and community reinforcement approach, CBT, etc [12]. Medications and cognitive-behavioral techniques aim at improving affect regulation or reducing craving and attentional bias [12]. In that sense, they could work in part at critical decision-making by indirectly improving cognitive control. However, due to side effects such as hepatic toxicity and dysfunction, traditional pharmacological treatments for AUD like disulfiram, naltrexone, and acamprosate, as well as other off-labeled medications from all over the world, have been shown to be unsuitable in many cases [13]. Recently, therapists have been suggesting using WM training as a behavioral treatment to help AUD patients improve their cognitive functions and thereby reduce further alcohol use [14].

Based on these results, WM training appears to be more effective than self-control-based abstinence in strengthening working memory and aiding cognitive recovery. Through cognitive behavioral methods, some therapists are trying to train the WM to enhance the top-down process of inhibiting the impulse to drink alcohol, which also showed a recovery of workability and attention distribution [10]. On the other hand, research was also conducted to compare the WM difference between normal participants and AUD patients in order to specify the function and brain structure of impairment and improve cognitive therapy.

5. Conclusion

In conclusion, alcohol depresses the central nervous system of the body generally. it also has a negative impact on certain brain areas, affecting some of them more seriously than others. one of the most serious consequences of alcohol consumption is memory impairment, leading to serious issues with both working memory and learning. New memory formation is disrupted by alcohol addiction, and this disruption has been associated with both alcohol consumption frequency and volume. As the blood alcohol concentration increases, the degree of inhibition of brain function usually increases. Consequently, alcohol consumption impairs working memory and the formation of new memories. In order to mitigate the effects on people's cognition, it is essential to seek adequate therapies and treatments, including both pharmacological and behavioral ones. This essay primarily focuses on the few medicines and treatments that are currently available. Future studies can perform more research and go deeper to find new ways to support those who are in need.

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