This is your Brain on Drugs: SUD, Cognitive Impairment, and Mental Health Disorders

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Abstract

“This is your brain (an egg). This is your brain on drugs (egg broken to fry in a hot pan).” This large-scale anti-narcotics public service campaign was launched in 1987 in the United States by the Partnership for a Drug-Free America. Substance use is commonly utilized as a means to self-medicate cognitive impairments and mental health disorders, hence, the broken egg. Further, as substance use and subsequent abuse advances to substance use disorder (SUD), the potential rises for the activation of predisposed conditions, the exacerbation of existing difficulties, and the onset of additional pathologies, for example; anxiety, depression, mood disturbances, memory loss, attention deficits, and impaired conditional reasoning. A tremendous problem arises with assessment, evaluation, and treatment of co-occurring disorders. “Which came first, the chicken? Or the egg?” How can comprehensive and integrated treatment regimens be developed and navigated with so many variables and dynamics, interrelated cognitive factors, functions, as well as neurological and affective processes to consider, decipher, and address? It is the opinion of this researcher that greater recognition regarding the interwoven tapestry of these dynamics needs to be met with conviction of willingness toward collaboration and diligence on the behalf of scholars, theorists, researchers, and practitioners to share expertise. The combined benefits of multiple theoretical models and methods of treatment to address disorders concurrently have the potential to create more effective modalities, shorter treatment timelines, and even cut costs. It has become imperative that progressive action be taken by all psychological professionals and specialists in open-minded and respectful ways to catalyze healing the human condition and save lives.

Keywords: Cognitive impairment; Comorbidity; Mental health treatment; PTSD; SUD

Introduction

If the co-occurrence of SUD and cognitive pathology were regarded as a personal relationship, the best way to describe it would be; it’s complicated. The comorbidity of SUD, impaired cognitive functioning, and mental health issues such as mood and personality disorders creates innumerable confounding variables of diagnosis, assessment, and treatment. For example, as far back as 1995, the National Comorbidity Survey suggested that, among persons with PTSD, the lifetime comorbidity rate for alcohol use disorder (AUD) was 51.9% and 34.5% for drug use disorders [1]. Due to the prevalence of co-occurring post traumatic stress disorder (PTSD) and (SUD), that addiction treatment facilities need to require systematic screening for PTSD. Simple deductive reasoning would then further conclude that individuals presenting PTSD would benefit from SUD screening. Of further consideration, PTSD comorbidity with SUD is significantly and uniquely associated with increased risk for greater system disease burden (SDB) among U.S. military personnel and veterans [2]. According to George Washington University’s Face the Facts USA Initiative [3], about 300,000 veterans do service, one in five of the wars in Iraq and Afghanistan, have been diagnosed with PTSD. The amalgamation of this data reveals that the mental health crisis currently faced in the U.S. from perspectives that are individually, economically, socially, even globally relevant, is highly troublesome.

The purpose of this brief report is to further explore and expose the baffling nature of the comorbidity between SUD, cognitive impairment, and mental health disorders. The goal is to shed light on a number of the pieces related to this puzzle leading to pathways that could encourage, inspire, and motivate professionals in all fields of psychological endeavor to make a more deliberate and determined effort to bring their knowledge and resources together in collaboration to produce advances in treatment.

SUD, Anxiety and Depression

According to Zvolensky et al. [4], although there has been a preponderance of scientific work focused on SUD and a number of psychopathological disturbances, the relationship between anxiety and stress vulnerability processes and drug and alcohol problems has been largely ignored. Both anxiety and depression have the ability to negatively impact cognitive processing abilities [5,6]. Becker and Leininger [7] recently investigated how individuals experiencing anxiety and depression will unconsciously seek out stimuli and substances to compensate for the cognitive difficulties this creates. This is indicative of an individual’s need to “self-medicate.”

A series of articles to highlight this issue included: social anxiety and alcohol consumption; cocaine use and anxiety sensitivity; the expectation of anxiety created by marijuana use; the relationship between alcohol outcome expectancies, social anxiety, and hazardous drinking; and finally, panic attacks and substance use including panic-relevant cognitive processes among heavy cigarette smokers and nonsmokers. The postulations encountered through the investigation of these issues, has led to the recommendation for much more study to develop a comprehensive understanding of these co-occurrences [4]. Such efforts would serve to inform future clinical and empirical work.

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on accurate assessment and evaluation of these impairing conditions toward appropriate and effective treatment including prevention.

**SUD, Brain Abnormalities, and AMD**

Recent research has indicated that the use of marijuana can increase an individual’s risk for psychiatric problems [8]. However, much of this attention has been focused on the development of schizophrenia or the intensification of its symptoms, while the potential relationship between the use of cannabis and the onset of anxiety, depression, and other mood disorders remains grossly unexamined. The results showed that the heaviest marijuana users compared to non-users were twice as likely to report anxiety and mood disorders (AMD). Other research examines the prefrontal cortex abnormalities repeatedly described in individuals who abuse depressants, and adolescents who were brought up in alcoholic homes show deficiencies of activation in the right middle temporal gyrus and left inferior frontal gyrus [9].

As previously explored, the exposure to cognitive stress triggered by the fear response can be a key factor in the appraisal of emotion, and a myriad of other mental processes that affect decision making, problems solving, critical thinking skills, etc. [10-14]. The dynamic relationship between the prefrontal cortex, amygdala, and hippocampus, and psychopathologies that can result from damage and malfunctioning of these, show that separating cognitive difficulties, mood disorders, SUD, and even traumatic brain injury is extremely difficult, if not impossible. The prefrontal cortex, the center for judgment, morality, decision making, impulsivity, and self-control, when damaged, can result in deficits of the recognition of acceptable, appropriate individual and social conduct [15]. Damage to the amygdala causes impairment of emotional appraisal derived from social signals, especially fear [16].

Major findings by Grant et al. [17] through a study conducted by the National Epidemiologic Survey on Alcohol and Related Conditions (NECARS) have documented the strength and association between SUD and AMD in the United States. At the time, the prevalence of AMD represented approximately 42 million adults in the U.S., and the rate of current SUD represented 19.4 million. Of these individuals, about 20 percent of all persons indicating an SUD presented at least one concurrent mood disorder and 18 percent had one current anxiety disorder. Similarly, around 20 percent of individuals with at least one current mood disorder had a co-occurring SUD, and about 15 percent of those with an anxiety disorder had an SUD. Also, of clinical relevance, were findings that 40.7 percent of those seeking treatment for alcoholism had at least once current mood disorder and 33 percent presented an anxiety disorder.

**SUD Effects on Memory and Perception**

The effects of severe chronic alcoholism on cognitive functioning are complex [18]. AUD results in deteriorated executive and memory performances and reduced spontaneous affective behaviors with other typical behaviors described as dull and emotionally flat. The neurotoxic effects of alcohol also cause further harm for chronic excessive drinkers in the storing and processing of affective information. Wernicke-Korsakoff syndrome, considered a possible outcome of alcohol-related brain damage, is characterized by the following cognitive malfunctions; severe difficulties in solving complex problems, the inability to discern the relevancy of information, and severe amnesiatic complications, specifically, anterograde memory deficits [18].

With such pathology in memory function, great potential would also exist for cognitive malfunctioning of perception in both top-down and bottom-up processing. With memory impairment presented by the lack of ability to recall previous information, an individual would experience difficulty in the ability to categorize, match, and sort information, creating a deficit in the schema-driven mechanism of top-down processing [19]. Impairment of top-down processing can be equated to how Einstein defined insanity; “Doing the same thing over and over again and expecting different results.” Similarly, as bottom-up processing of perception is data driven [20], the absence of available data resulting from amnesiatic episodes would create difficulty in an individual’s ability to recognize how parts of information or a concept fit together to complete the whole. This causes difficulties due to a lack in understanding of rational relationships, and recognizing what step in task completion comes next.

It can also be surmised, with the occurrence of anterograde memory deficits due to the presentation of Wernicke-Korsakoff syndrome resulting from chronic alcohol consumption [18], that the three component system of the Baddeley and Hitch model of working memory (WM) [21] would produce a void of coherent data. This would occur due to the lack of information from the experience of events received through the central executive and routed to the phonological loop and the visuospatial sketchpad. This would account for the phenomenon of the alcohol-induced “blackout.” Along with such effects on short-term memory (STM), significant alcohol consumption would further impair long-term memory (LTM) due to a negative relationship with the level or processing (LOP) variable [22].

All of these shortfalls in memory capacity created by AUD, including the operation of WM through malfunctions in the processing of STM and LTM, would further exacerbate the perception of reality, past and present, by producing memory distortions either naturally or through suggestion [23]. This can open the door that leads an alcoholic to construct a false-image of him or herself in an effort to portray an acceptable form of their being and existence to others by wearing social masks. Such distortions also have a direct relationship to the defense mechanisms of the ego as an individual desires to accommodate core social motives such as belonging and self-enhancement, fueled by the fear of being ostracized by family, friends, and other associates triggered by resentment, guilt, shame, and remorse [14].

**SUD Effects on Problem Solving, Decision Making, and Free Will**

As examined, severe deteriorations in memory functions, especially STM and executive functions, produces a lack of ability in chronically alcoholic individuals to develop an awareness of their own personal health condition, and make conscientious decisions regarding health and well-being. Other important data showed that severe alcohol abuse over years creates deficiencies in the ability to correctly perceive the affective state of surrounding others through the recognition of facial expressions. This leads to a negative impact on personal relationships which can result in the development of inadequate coping strategies [18].

This deficit in interpretation and the resulting confusion has a negative impact on the problem-solving, decision-making, and coping strategy development of those with SUD, particularly alcoholism. Also associated with SUD, is the propensity to take risks and predispositions for impulsivity and novelty seeking. It is hypothesized that frequent risky behavior can be attributed to impaired reasoning about precautionary rules. The possibility exists that conditional reasoning difficulties might precede, and actively trigger, the onset of alcohol use, abuse, and eventually dependence [9]. Once again, it is Baddeley’s model of WM [21], and the effects of alcohol consumption on STM,
that plays a key role with consideration for the phonological loop and visuospatial sketchpad. Without adequate information stored in STM or LTM, problem solving skills could be diminished significantly with analysis of what Sio and Ormerod [24] referred to as the incubation period. Over time, with a growing inability to acquire and formulate new skills in problem solving, barriers would also develop in a variety of other areas and levels of reasoning, critical thinking, and creative processes [12]. Essentially, the chronic alcoholic becomes trapped in a mind with no chance of being able to think his or her way out of dysfunction and difficulties [14]. In the end, when the problem drinker completely loses the ability to reasonably assess the potential for impending negative consequences, he or she becomes powerless at the consumption of the first drink [13], and the demonstration of free will becomes impossible [10]. At this point, the physical allergy to alcohol now also becomes a disease of the mind [25], an obsession [13], and one that has led, and continues to lead many, down the path of complete and profound humiliation, demoralization, and for many, a certain and horrific death [14].

SUD, Social Contract Reasoning, and Emotional Intelligence

Further data indicating that alcoholic patients have difficulty in decoding non-verbal signals can also lead to impairment in reasoning about social contracts [11]. Individuals predisposed to SUD may demonstrate a lack of ability to empathize with others and offer compassionate support. Deficits in emotional intelligence (EI) and in theory of mind tests have also been indicated in those suffering from severe chronic alcoholism. This was found to be related to stress, limited coping abilities, and negative feelings about well-being, quality of life, and interpersonal relationships. The inability to identify and label emotions in oneself, termed alexithymia, has been widely studied and found to be independent of anxiety or depression factors in alcoholics [9].

The SPARRS approach, an appraisal theory of emotion (schematic, propositional, analogical, and associative representation systems), utilizes fear, anger, disgust, happiness, and sadness as its five emotion-building components [11]. For an alcoholic, with combined deficits in perception, memory, reasoning, critical thinking, problem solving, decision making, coping strategies, and a variety of other cognitive distortions and misrepresentations, there is little or no chance for emotional growth to occur or EI to develop. This overwhelming barrier, combined at the level of negative cognitive pathology and other psychological defense mechanisms, relieves those addicted to alcohol of an opportunity to pursue individual goals or find little peace and comfort within the dynamics and constructs of a functioning society, culture, and community [12].

Conclusion

This examination of SUD, cognitive impairment, and mental health disorders provides clear and persuasive evidence that the potential for co-occurrence of SUD must be assessed by psychiatrist, psychologists, addiction treatment specialists, neurologists, counselors, and other providers; while conversely, the potential for cognitive impairment and mental health disorders must be assessed by addiction treatment specialists, counselors, and providers [26]. This researcher believes that it is only through the integration of knowledge from diverse disciplines that the problems associated with the comorbidity of cognitive deficits, mental health issues, and substance use disorders will ever be unraveled in an effort to formulate and develop concurrent and effective modalities of assessment, evaluation, and treatment. However, questions regarding the sequencing in the onset of co-occurring SUD and cognitive disturbance, or the causal mechanisms underlying their relationship [17] remain unresolved. In the final analysis, that may not be a problem that requires solving in order to develop beneficial solutions. Cheung et al. [8] noted that their findings indicated the importance of simply recognizing the potential co-occurrence of AMD in individuals seeking treatment for cannabis use necessitating clinical intervention.

This literature review and synthesis reveals the importance of assessment and evaluation to determine the current symptomatic nature of co-occurring SUD with cognitive impairment and mental health disorders. With the removal of the substance of choice, regular follow-up testing is crucial to determine what, if any, cognitive deficits and mental health pathologies may remain or emerge. This creates the necessity for thorough and regularly updated treatments plans to address all of the dynamics of co-occurring disorders concurrently. This will provide the most efficient means for recovery from SUD and significantly improve mental health by simultaneously reducing, even possibly eliminating the symptoms of cognitive difficulties, anxiety, depressive, mood, and personality disorders, and the potential for substance use relapse. Additional hope lies in the results from existing integrated treatment programs that have been implemented in recent years in an effort to synergize methods to assist forensic patients with cognitive impairment, and those who suffer from PTSD who present SUD upon clinical assessment for in-patient admission [27,28]. There is much more collaboration, research, and work to be done, and with so many lives at stake, the need is eminent.

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