RESEARCHUPDATE
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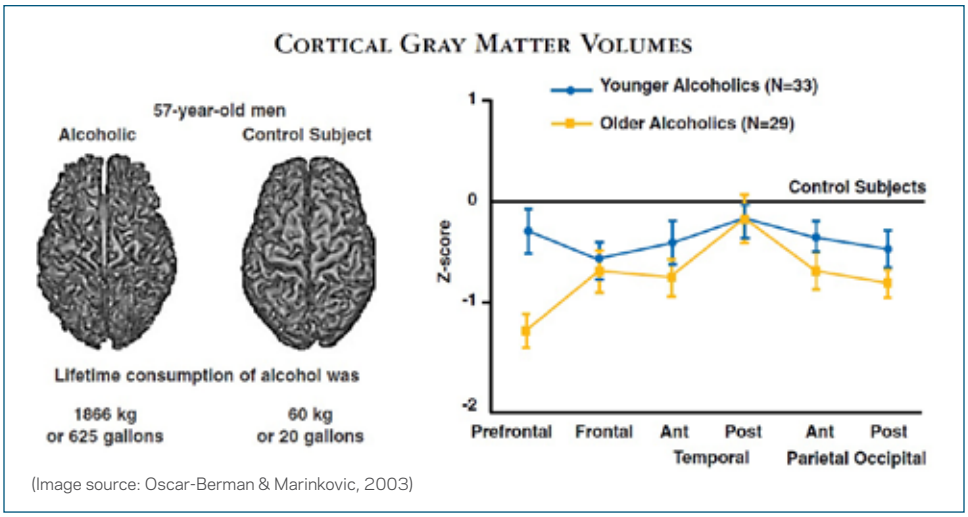
Cognitive Improvement and Alcohol Recovery

Most people with alcohol dependence have experienced the memory problems and slowed thinking that come with alcohol use. While drinking, they may have difficulty recalling memories or remembering new information, such as a person's name. Afterward, they may experience a blackout: an inability to remember entire conversations or events that occurred while they were drinking. It is less commonly known why these side effects occur and how heavy drinking can eventually cause serious long-term damage to the brain. But what happens to alcoholics in recovery? Can damage caused by heavy drinking ever be reversed?

How Does Alcohol Affect the Brain?

Alcohol has a profound effect on the complex structures of the brain. It blocks chemical signals between brain cells (called neurons), leading to the common immediate symptoms of intoxication, including impulsive behavior, slurred speech, poor memory, and slowed reflexes.[1,2] If heavy drinking continues over a long period of time, the brain adapts to the blocked signals by responding more dramatically to certain brain chemicals (called neurotransmitters). After alcohol leaves the system, the brain continues overactivating the neurotransmitters, causing painful and potentially dangerous withdrawal symptoms that can damage brain cells.[1,2,3] This damage is made worse by drinking binges and sudden withdrawal.[1,4] Alcohol's damage to the brain can take several forms. The first is neurotoxicity, which occurs when neurons over react to neurotransmitters for too long. Too much exposure to a neurotransmitter can cause neurons to eventually "burn out."[1] Since neurons make up the pathways between different parts of the brain, when they begin burning out, it can cause noticeable slowing in the reactions of these pathways. In addition to pathway damage, brain matter itself is also damaged by heavy alcohol use. People with alcohol dependence often experience "brain shrinkage," which is reduced volume of both gray matter (cell bodies) and white matter (cell pathways) over time.[1,2,5] There are some subtle differences in how brain damage occurs in men and women, but regardless of gender, loss of brain matter increases with age and amount of alcohol consumed.[2,6,7]



(Image source: Oscar-Berman & Marinkovic, 2003)

What are the observable effects of this damage? Since alcohol affects a large portion of the brain, many different kinds of cognitive impairment can occur as a result of heavy drinking, including problems with verbal fluency and verbal learning, processing speed, working memory, attention, problem solving, spatial processing, and impulsivity.[8,9,10] Parts of the brain relating to memory and "higher functions" (e.g., problem solving and impulse control) are more susceptible to damage than other parts of the brain, so problems in these areas tend to

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THE HAZELDEN BETTY FORD FOUNDATION EXPERIENCE

Patients are screened for cognitive deficits after admittance to treatment at the Hazelden Betty Ford Foundation and, when necessary, referred for further testing. Individual treatment plans accommodate deficits so patients can benefit maximally from their treatment experience.

The Butler Center for Research has recently conducted research that has revealed biased attention and memory processes among alcoholics[21] and is working to further our understanding of how treatment can be improved to address these and other areas of cognitive function.

CONTROVERSIES AND QUESTIONS

Are there gender differences in how the brain recovers from alcohol abuse?

Since men and women have biological differences in the makeup of their brain tissue, there have been many debates on whether alcohol affects men and women differently and whether their brains recover differently. Studies have found that age and alcoholism affect both genders similarly[7] and that there are no significant differences between genders for the cognitive benefits of long-term sobriety.[16]

Are some people too impaired to ever recover their full cognitive functioning?

Long-term abstinence over many years can allow the brain to heal enough to recover most cognitive function, but there are still some lasting effects on certain areas, such as spatial processing.[9] Chronic alcohol-related diseases such as alcohol-related dementia and Wernicke-Korsakoff syndrome are permanent.[1,2,6,7]

HOW TO USE THIS INFORMATION

Clinicians: Monitor patients' cognitive performance levels and be wary of persistent problems with memory or executive function. Tailor interventions to consider cognitive deficits and avoid reliance on educational methods early in treatment, as patients will require time to return to normal learning ability.

Newly Recovering People: If you feel you are having difficulty remembering, learning, or understanding, ask for help. This is a normal part of early recovery and nothing to be ashamed of. Early treatment yields the best results. Remain abstinent and give yourself plenty of time in recovery to heal.

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be worse than others.[5,11,12] Adolescents are especially at risk for long-lasting or permanent damage and performance deficits, since their most-impacted areas of the brain are still in development.[10,11,13,14] Without treatment, cognitive impairment grows worse, eventually developing into a lasting syndrome known as alcohol-related dementia—which represents about 10% of all dementia cases[1] (additionally, alcohol is estimated to contribute to roughly 29% of all other dementia cases[8]). Cognitive deficits are made worse by malnutrition, especially a deficiency of vitamin B (a common deficiency in alcohol dependent individuals). Malnutrition and heavy alcohol use can cause serious impairments in memory and language over time and can potentially result in a permanent cognitive disorder called Wernicke-Korsakoff syndrome, which causes amnesia and can lead to coma if left untreated.[1,2,6,7]

What Happens in Recovery?

For most people, the brain can heal. If started in time, abstinence from alcohol can reverse much of the physical damage caused by heavy drinking.[8,9,10] Magnetic resonance imaging (MRI) studies are used to view and measure both the damage and improvement to tissue in all areas of the brain. These MRI studies have shown that lost gray matter volume due to chronic alcohol abuse begins to regenerate in as little as two weeks of abstinence.[15] Increased brain tissue was also found in a study that scanned alcoholics after three months of abstinence, but there were no significant increases for patients who relapsed in the first three months, which suggests that relapsing into heavy alcohol use reverses the rapid regeneration that occurs soon after abstinence.[16] A study of alcoholics after six months of continued abstinence or moderate resumption of alcohol use showed continued growth of brain tissue that was present among patients who had consumed small amounts of alcohol, suggesting that tissue damage is primarily the result of heavy or chronic alcohol use.[17]

Just as brain damage leads to cognitive impairment, healed brain tissue leads to improved cognitive performance. In addition to improvements resulting from healed brain tissue, some cognitive improvement comes as a result of the brain adapting to the damage and creating new pathways to complete tasks impacted by neuron pathways damaged by alcohol abuse.[18] Most noticeable improvement in cognitive function begins after one year of abstinence from alcohol,[8,19] although longer periods of abstinence result in greater improvements.[20] A meta-analysis of 12 areas of cognitive function among alcoholics found that cognitive performance was significantly improved across all 12 areas after one year of continuous abstinence, with only small differences between alcohol dependent and control subjects.[8] Another study found that attention and working memory were significantly improved in patients who had remained abstinent from alcohol for at least one year, as compared to those who had been abstinent for less than one year.[19]

Summary

Alcohol use can result in cognitive deficits, but several studies have shown that abstinence can reverse much of the physical and cognitive damage caused by heavy drinking if treatment begins in time. Therefore it is important that substance-dependent people seek help as soon as possible.

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The Butler Center for Research informs and improves recovery services and produces research that benefits the field of addiction treatment. We are dedicated to conducting clinical research, collaborating with external researchers, and communicating scientific findings.

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