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### Nootropics for Healthy Individuals

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With recent advances in fields like biotechnology and genetic engineering, the concern for a just and equal distribution of human enhancement technologies undoubtedly became one of the most significant ethical dilemmas of the 21st century. And with the sudden rise of cognitive enhancement drug (otherwise called as nootropics) use in society, the need for developing policies to address these dilemmas have now become an urgent issue that the scientific and political community must confront. Once only used by the few with special needs or neurological disorders, nootropics are now being utilized by a significant part of the population for cognitive enhancement, inciting a debate of the regulation and legalization of nootropics. Nonetheless, given the currently known benefits and risks of nootropics, the mechanisms through which nootropics function, and the ineffectiveness of policy restrictions, it would be more pragmatic to inform and allow for the non-prescription uses for some nootropics rather than to restrict its use.

### Benefits, Risks, and Viability of the Use of Nootropics

Among many other nootropics, two drugs have become the de facto nootropics for many healthy individuals: modafinil (commercially known as Provigil) and methylphenidate (commercially known as Ritalin). Used as prescribed, modafinil and methylphenidate have different purposes; modafinil is used to alleviate symptoms of “excessive daytime sleepiness”, while methylphenidate (MPH) is used for the treatment of attention-deficit hyperactivity disorder (Repantis et. al, 2010, p. 188). Despite these differences between the two, they are both frequently used for the singular purpose of improving the ability to complete a cognitive task.

Modafinil’s most significant effect, as it could be inferred by its primary use, is the promotion of wakefulness and the maintenance of cognitive capacity for those who are sleep-deprived. This effect of modafinil have been used by military to stave off the inevitable cognitive decline of long missions (Repantis et. al, 2010, p. 188). In non-sleep-deprived individuals, Professor Repantis et al. found in his meta-analysis that modafinil promoted only the capacity to pay attention in the studies in which modafinil was consumed once (2010, p. 203). Another meta-analysis have found modafinil may enhance working memory (Lynch et al, 2012, p. 122), which is a “process whereby information is held in mind for brief periods” (Husain & Mehta, 2011, p. 28). Beyond attention, another study have reported improvements in mood, memory for digits, pattern recognition, “spatial planning, and stop-signal reaction time” (Turner et al., 2002, p. 260). By contrast, there are studies that report contradictory results, with one study reporting that modafinil only raised the anxiety levels of the volunteers who took modafinil, and moreover with no cognitive enhancements (Randall et al., 2003, p. 163).

Like modafinil, effects of methylphenidate (MPH) can vary widely depending on the studies. And like modafinil, the primary mechanism and function of MPH is known; MPH primarily leads to the arousal of the person by increasing the levels of dopamine and noradrenaline, which is known to positively affect the spatial working memory (SWM) in monkeys (Mehta et al., 2000, p. 1). This arousal is also thought to lead to improvements in attention in theory, as the meta-analysis by Professor Lynch et al. has concluded (2011, p. 121). However, a study by Professor Elliott et al. have found that while there were no enhancements of attention, spatial working memory may be enhanced by MPH. The study also demonstrated the

intricate influences of MPH, showing that the MPH improved the performance of new tasks while it hindered the performance of familiar tasks (1996, p. 196).

While numerous benefits of modafinil and MPH have been observed in many different studies as shown above, the contradictions and discrepancies between the studies led Professor Cools and Robbins to conclude that the cognitive enhancements of nootropics are generally only modest across population (Cools & Robbins, 2004). However, many studies, including the study by Professor Cools, argue that the potential societal benefits of nootropics are much more significant than what the general cognitive benefits of nootropics may be for several reasons. First, Professor Cools states that there are significant individual variations of the effects of nootropics, which means that many people may derive significant cognitive benefits from nootropics despite the modest benefits across population. Another reason is the significance of non-cognitive effects of the nootropic. While some of the effects of nootropics might not be purely “cognitive”, these nootropic effect on mood and motivation are utilized by many to engage more with their cognitive tasks (Lynch. et al, 2011). For example, one study have found that MPH raised dopamine levels when the subjects were solving math problems, thus increasing the motivation to perform an academic task (Volkow et al., 2004, p. 1172). These three possible benefits of nootropics, when considered as a whole, are certainly a nudge towards the societal utilization of nootropics.

However, beyond its benefits, the risks of nootropic use must also be considered to make an optimal, informed decision. One contention against the use of nootropic is the possibility of increased nootropic use due to societal coercion. The argument suggests that once the nootropic use is legalized, people might feel compelled to take nootropics to maintain their competitive edge against others who take nootropics. That might be certainly true. However, psychology Professor Cakic in his article argues that that social coercion is the wrong factor to focus on. Instead, he states that social coercion is arguably harmful only if the nootropics themselves are harmful (Cakic, 2009, p. 613). Indeed, just as few might consider social coercion to use caffeine as a significant threat, social coercion for nootropics will not be a significant threat if nootropics are relatively harmless. And as current population studies seem to suggest that the use of nootropic like modafinil are mostly harmless (Cakic, 2009, p. 613), the fear of social coercion could be overblown.

Another risk involved with the nootropics legalization is the unestablished relationship between long-term nootropic use and academic performance. As nootropics are often used by students for academic purposes (Farrah et al, 2004), this risk is quite pertinent. While the nootropics do bring about cognitive enhancements and increase motivation to do academic work (Lynch. et al, 2011; Volkow et al., 2004, p. 1172), that does not necessarily mean that academic performance will improve with nootropics use. As many worry, students may be using nootropics as a clutch, relying solely on the effects of the nootropic to get through the studies. The findings of a survey of about 1500 German primary school and university students presents the hypothesis as a possibility. The survey have found that students with bad grades were more likely to use prescription stimulants as nootropics in the past month or in their lifetime (Franke et. al, 2010, p.65). This finding, the authors noted, matched with the findings of another study that have also found that the misuse of stimulants were associated with bad grades. However, these studies do not necessarily demonstrate a negative causal relationship between nootropic use and academic performance, nor are these studies flawless. As the authors of the study state, the study is not necessarily conclusive due to the possibility of response bias, unrepresentative homogenous population, and the failure to distinguish the frequency of the use (Franke et al,

2010, p. 65-66). However, these studies do emphasize a need for a study to investigate the nootropic effect on academic performance.

#### Nootropics and Cognitive and Socioeconomic Equality

Among characteristics of nootropics stated above, individual variations of cognitive enhancement are thought to be a particularly powerful determinant of the effects of nootropics in many studies (Randall et. al., 2005; Cools & Robbins, 2004). And as these studies have found, baseline performance (performance prior to the experiment) is likely to be the cause of the variations, with lower baseline performance levels corresponding with greater cognitive benefits from nootropics and vice versa. This effect persisted through various types of cognitive performance, such as working memory, short-term memory, and attention (Randall et. al, 2005; Cools & Robbins, 2004). The mechanism behind such discrepancies, as Professor Cools and Robbins theorize, is the interaction between the optimal levels of neurotransmission and the nootropic's influence on neurotransmitter activity (2005). As Cools and Robbins explain, the peak cognitive performance of an individual can only be achieved with an optimal level of neurotransmitter activity - and not with deficient nor excessive levels of activity. Thus, nootropic's ability to increase neurotransmission within the brain may be beneficial for those who have lower than optimal level of brain activity and, by extension, neutral or even harmful to those whose neurotransmission levels are already at the optimal levels (2005).

This phenomenon of neurotransmission levels and nootropics are not only pertinent to people with ADHD who are clinically diagnosed to have low levels of neurotransmitter activity, but also to "healthy" individuals that can reach a more optimal level of brain activity with nootropics. For these individuals, who may not meet one of the many criteria to be diagnosed as ADHD, nootropics may serve as a cognitive equalizer. By contrast, nootropic's ineffectiveness for people who are already at their optimal neurotransmission levels serves as a relief for many who were concerned about nootropics creating "unfair" advantages. Ultimately, based on these mechanisms of nootropics, existing regulations and restrictions that limit access to nootropics may encourage greater cognitive disparity in the society.

Furthermore, considering the typical users of nootropics in United States, regulations may further accentuate the socioeconomic disparity among the population. As neuroscientist Martha J. Farah et al. have observed, typical users of nootropic tend to be "college students, an overwhelmingly middle-class and privileged segment of the population" (2004, p. 423). Regulations play a role in this disparity of nootropic use by financially restricting people of lower socioeconomic status from accessing the costly prescription drugs. And if nootropics can significantly improve one's academic or business performance, restrictions to nootropics may widen the wealth and the knowledge gap between the haves and have-nots. However, nootropics may also be used to bridge the gap; as Farah suggested, the relative ease of distributing nootropics compared to other neurocognitive enhancements, such as "good nutrition [and] high-quality schools" (Farah et al, 2004, p. 423), may be utilized to reduce the gap. Therefore, the removal of the effective nootropic regulations may promote a greater cognitive and socioeconomic equality.

#### Ineffectiveness of Nootropics Regulation and Possible Alternatives

Not only could regulations of nootropics possibly lead to cognitive and socioeconomic inequality, but it is also likely to be ineffective at reducing the use and the risks of nootropics. In his commentary, Professor Cakic compares the regulation of nootropics to that of the performance-enhancing drugs in athletics, which have largely been unsuccessful. Summarizing the study of Foddy and Savulescu, Professor Cakic argues that "any attempt to prohibit

performance-enhancing drugs is condemned to failure” (Cakic, 2009, p. 612). Furthermore, he states that the current, prevalent non-prescription use of controlled nootropics (like modafinil and MPH) already demonstrates that effective regulations on nootropics are impossible (Cakic, 2009, p. 612).

So how should the government promote the safety of the people who opt to utilize nootropics? One possibility is to hold public awareness campaigns about the benefits and risks of the nootropics. Currently, the lack of awareness of nootropic’s mechanisms may cause many to take nootropics, yet derive no significant cognitive enhancements other than the effects of placebo (Looby & Earleywine, 2011, p. 433). Furthermore, as stated above, nootropics may even inhibit some aspects of cognition or cause negative effects for those with high baseline cognitive performance (Randall et al., 2003, 2005; Cools & Robbins, 2004). Another possibility is to encourage more clinical studies on the long-term effects of nootropics. While the use of nootropics like modafinil have been observed and generally deemed as possessing low risk of harm, the lack of a rigorous clinical study makes the analysis of risks uncertain and hidden risks possible (Cakic, 2009, p. 613). Undoubtedly, the removal of the nootropic regulations will allow for a more rigorous and robust clinical trials, and thus better insure the safety of the people. Indeed, these alternatives would be much more beneficial compared to the ineffective regulation.

#### Summary

While the benefits of cognitive enhancement drugs appear to be only moderate in large studies, the small risks of nootropics and the large individual variations of drug effectiveness suggests that the benefits of nootropic use may outweigh the risks for many individuals. In particular, the cognitive enhancements that nootropics can provide may help equalize the cognitive deficiencies that may incur due to genetic or environmental differences. Policy restrictions on nootropics may worsen the intellectual disparity between the people who have access to nootropics and those who do not, nor will it be effective in its purpose. Therefore, rather than to continue the ineffective regulations of nootropics, it might be a better choice to inform the public of the effective nootropics and their benefits and risks.

As our society of “Information Age” face increasing demands for intellectual labor and diminishing demands for physical labor, it is inevitable that the societal qualities we value, such as socioeconomic equality and welfare, will be increasingly interlinked with our individual cognitive capacities. With such trend, it has undoubtedly become necessary for us to now consider the possibility of enhancing our cognition through these more potent nootropics. Indeed, just as we learned to utilize caffeine for their cognitive benefits, we would need to carefully consider if these emerging nootropics can be our next caffeine.

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