

Letter to the Editor

Cognitive enhancing drugs: a future challenge for the workplace?

Dear Editor,

In medical practice, cognitive enhancers (also called nootropics) are defined as therapeutic drugs treating specific cognition impairments in patients with attention deficit hyperactivity disorder, Alzheimer's disease, stroke schizophrenia or aging¹.

However, the non-medical use of cognitive enhancers with the aim of increasing mental alertness and concentration, improving memory, fighting wakefulness and boosting energy has been spreading worldwide². In this concern, scarce investigations have been carried out on the possible risks of chronic non-medical use of nootropics, and these risks seem to be largely overlooked, especially among students³. Considering the ever more competitive nature of modern societies, which also reverberates into workplaces, cognitive enhancers are reasonably expected to become even more common over time⁴. Nonetheless, long-term consequences are as yet unknown.

Cognitive enhancers, used by healthy individuals, are widely known as nootropics: they consist of drugs, supplements and other substances that are allegedly known to improve cognitive function, particularly executive functions, and to strengthen memory, creativity or even motivation. Pharmaceutical substances and compounds known as 'cognitive-enhancers' allegedly boost mental performance and the ability to focus and keep concentration. In broader terms, such drugs are often claimed to heighten and foster the acquisition of motor capabilities and affective skills (i.e., one's ability to deal with anxiety stemming from performing certain work tasks or eliciting feelings of trust and affiliation).

It is worth noting, however, that no drugs are licensed by medical authorities to be recommended and prescribed as 'cognitive enhancers'. Thus, the definition of 'performance-enhancing drug' is usually linked to the off-label use of drugs prescribed for specific medical conditions. These substances are usually stimulants that preferentially target the catecholamines of the prefrontal cortex of the brain to induce their effects⁵.

Historically, amphetamines have been the first drugs used off-label for the purpose of fostering memory consolidation and increasing concentration⁶. Since these substances are legally controlled as drugs of abuse, they can only be obtained on illegal markets. This purchase channel is also used to obtain methylphenidate, which is undoubtedly the most misused drug as cognitive enhancer^{5,7}. Mostly prescribed for treating Attention Deficit Hyperactive disorder (ADHD) and narcolepsy, methylphenidate has been scheduled as an illegal drug in many countries for its abuse liability and side effects, resulting in a rapid expansion of methylphenidate legal analogs onto the drug market. Alternative prescription drugs for the treatment of narcolepsy and ADHD, such as modafinil and armodafinil, are also used as cognitive enhancers⁸. Finally, two last drugs should be mentioned among nootropics: atomoxetine, a selective nor-adrenaline reuptake inhibitor licensed for the treatment of children with methylphenidate-resistant ADHD or undergoing methylphenidate side effects⁹, and donepezil, a second-generation acetylcholinesterase inhibitor licensed for the treatment of mild to moderately severe symptoms of Alzheimer-related dementia¹⁰. At the same time, there has been renewed interest in older prescription drugs (e.g., beta blockers, to decrease performance

anxiety) and illicit psychostimulants (e.g., cocaine, amphetamines), sometimes in different forms or doses^{11,12}.

Whereas there is still little consensus on the actual effectiveness and nature of the cognitive benefits of the above-mentioned drugs in healthy subjects¹³, their use to enhance the level of performance in specific workplaces has been reported for decades¹⁴.

In fact, cognitive enhancement has been a mainstay of military research in the US since the Second World War with the use of amphetamines, modafinil and other cognitive enhancers in the most recent military operations (e.g., Vietnam war, Korean war, operations Desert Shield and Desert Storm in Iraq, later sustained military operations in the Middle East)^{15,16}. Whereas the military use of cognitive enhancers has been known for many years, not only in the US but internationally. More recent studies reported that other occupations present a high prevalence of use: medical doctors and health professionals (e.g., surgeons, surgical technicians' anesthetists), transportation workers (e.g., truck drivers, car drivers, taxi drivers), financial traders, clinical investigators, research managers and lawyers. Finally, the increase of precarious and part-time home works has been recently associated to psychological discomfort and an increase in prescriptions of psychotropic drugs, and a rise in the misuse of cognitive enhancers can be hypothesized¹⁷⁻¹⁹.

Another important factor to be taken into account is the role of the internet as a source of information through web forums and as a way of obtaining those substances. Such dynamics also constitute a cultural shift in the way drugs are obtained and consumed: they are anonymously received and safer than street drugs trafficking, although the actual composition and nature of the substances cannot be precisely ascertained. This latter fact creates a gap of information on the diagnosis of misuse in cases of possible intoxications and fatalities, since neither analytical screening nor confirmation methodologies are currently available for documenting exposure to those profuse and chemically diverse substances. In addition, apart from intoxications and fatalities, it has to be reminded that several of these substances present a potential for abuse liability and abstinence symptoms, which, instead of improving work pressure and overload, can worsen the environmental situation.

In conclusion, we wish to draw the attention of the whole scientific community and policy makers to the increasing importance of the misuse of cognitive enhancers, and to improve public awareness of the phenomenon and contextual political strategies to stop this incoming threat for the health of current and future workers

Conflict of Interest

The Authors declare that they have no conflict of interests.

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