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# Cognitive-enhancing drugs in the healthy population: Fundamental drawbacks and researcher roles

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**Abstract:** The use of pharmacological cognitive enhancers (PCEs) in the healthy population is a controversial topic with numerous and expansive repercussions. By outlining common proponent arguments on the current PCE state of affairs, the definition of normality, and the complex regulation of PCEs, this article addresses why the mainstream use of PCEs in the healthy population is still disadvantageous overall. In this respect, the influence and roles of researchers to the society are emphasized in bringing the focus back to the fundamental issues, which is crucial in deciphering its controversy and avoiding costly societal, research credibility and ethical implications.

**Subjects: Cognitive Neuroscience; Community Health; Health Law and Ethics; Medical Ethics**

**Keywords: cognitive enhancement; neuroenhancement; smart drugs; pharmacological; nootropics**

## 1. Introduction

Modern human society demands increasingly high-performance levels (e.g. study grades or work projects), ideally with the least amount of time necessary. Thus, the ingestion of substances that can boost arousal and concentration (i.e. pharmacological cognitive enhancers or PCEs) in healthy individuals has attracted considerable interest. As these substances (e.g. modafinil and methylphenidate) are typically prescribed for treatment purposes (e.g. to increase arousal in patients with sleep disorders for modafinil), its use in the healthy and mainstream population is controversial with many legal, moral, ethical, and health implications.

## ABOUT THE AUTHOR

Tsee Leng Choy is interested in developing non-verbal measures of consciousness and emotion using event-related brain potentials (ERPs) and music, and received her PhD in Neuroscience from McMaster University. She lectures in the School of Health Sciences in Universiti Sains Malaysia (USM) and is affiliated with USM's BRAINetwork Centre for Neurocognitive Science, which focuses on promoting and integrating neurocognitive research and its dissemination to the community. This article on the mainstream use of cognitive enhancing drugs in the healthy population reflects BRAINetwork's principles on promoting awareness and understanding on how neurocognitive research affects society.

## PUBLIC INTEREST STATEMENT

The mainstream use of cognitive-enhancing drugs or pharmacological cognitive enhancers (PCEs) in the healthy population has become increasingly common. Opinions are currently divided on its benefits and disadvantages, particularly as the consequences of PCE use extend far beyond cognition to involve ethical and social issues. This article discusses why the mainstream use of PCEs in the healthy population is still disadvantageous overall and how researchers play a societal role in this respect.

For example, Santoni de Sio, Faulmüller, and Vincent (2014) considers how a PCE-like modafinil could impose new obligations on select professions (e.g. surgeons) by implying that taking PCEs would minimize risks (e.g. fatigue-related errors) and maximize safety (e.g. successful surgery). Moreover, if these enhancements were empirically demonstrated to be effective and safe, a societal (possibly even professional) expectation to use them could follow; as, it would be argued that, the use of PCEs would be ultimately for the benefit of others (e.g. patient). Santoni de Sio et al.'s (2014) example differs slightly to that of a healthy undergraduate taking methylphenidate or Ritalin (a stimulant-regulating attention) to enable prolonged study for a test or an athlete taking steroids to boost their performance in a sports event, because in these cases the PCE user is seeking to improve their prospects and reap the benefits personally rather than taking drugs to improve their performance in the service of others. However, this distinction makes little difference, serving to emphasize again how the repercussions of PCEs extend well beyond medical realms by modifying current occupational definitions and societal boundaries.

By questioning common proponent arguments, this paper specifically addresses the concept of "acceptable" or "commonplace" use of PCEs in the healthy population, why it still remains disadvantageous fundamentally, and how this entire issue emphasizes our influence and responsibilities as researchers to society.

## 2. Is the status quo acceptable?

Enhancement can be defined as modifying healthy, typically developed systems to perform beyond normal limits. It has been suggested that current views of PCEs as unavoidably risky, fraudulent, and abnormal could be considered dated; with the further suggestion that PCEs can be likened to modern innovations (e.g. the internet), natural enhancers (e.g. exercise) and academic aids (e.g. tutoring; Greely et al., 2008). Outlining PCE drug mechanisms and ensuring responsible use could possibly benefit our modern lifestyle and increased lifespan, besides delaying age-related declines. PCEs may even be necessary in selective professions (e.g. in the military to ensure optimal performance; Greely et al., 2008), an observation elaborated upon in Santoni de Sio et al. (2014).

However, PCEs cannot be equated to innovations, natural enhancers, and academic aids in this respect, as it involves tampering with a normal system, and increasing susceptibility to dependence on something synthetic and inessential (Steiner & Van Waes, 2013); it often presents with side effects like increased heart rate, headache, nausea, and insomnia (Finger, Silva, & Falavigna, 2013) besides encouraging an unhealthy mentality and regime. Although there is some similarity to the internet in terms of being an "abnormal" lifestyle habit, PCEs need to be consumed on more or less a regular basis as effects are dosage-dependent and plateaus with repeated use (Finger et al., 2013; Repantis, Schlattmann, Laisney, & Heuser, 2010), resulting in direct, cumulative internal changes (Steiner & Van Waes, 2013). While one may argue that natural enhancers (e.g. vitamins or minerals) also requires ingestion, it is crucial to realize that natural enhancers are natural substances with generally well-known pathways and mechanisms; serve to sustain basic homeostasis and survival; have minimal side effects and addictive qualities; with gradual overarching effects that promote overall well-being besides performance. The same argument cannot be said for PCEs. It is important to realize PCEs like modafinil and methylphenidate were created to restore baselines in a dysregulated system; thus, we cannot expect these effects to translate perfectly to enhance baselines in a regulated system without consequence.

Research has shown that advantages offered by PCEs are modest (Husain & Mehta, 2011), not straightforward (Lynch, Cox, & Gall, 2014; Urban & Gao, 2014), and merely tips the scale to one's favor (Hyman, 2011). A recent study on medical students using methylphenidate to enhance their grades revealed minimal knowledge of its mechanisms and side effects, with no cognitive benefits aside from prolonged arousal (Finger et al., 2013). Hence, what is incentive for taking PCEs, particularly when several non-PCEs (e.g. exercise) have proven to be more effective and safe (Dresler et al., 2013)? What is the message conveyed (particularly to children) if healthy individuals are encouraged to take drugs over natural and more effective options, creating an additional lifelong cost and

possible addiction? Natural enhancers like exercise, nutrition, and meditation provide means to an end, promoting good social habits, favorable consequences with lifelong benefits (Dresler et al., 2013). But in a world of instant meals and Twitter, who would choose hours of exercise over popping a pill, particularly if the latter was encouraged? (Farah et al., 2004) This practice only endorses a dysfunctional lifestyle and mentality, bringing more problems to an increasingly aging and ailing population.

**3. What constitutes "normal"?**

PCEs have also been likened to the beneficial use of statins in lowering LDL cholesterol in healthy individuals, levels that are not attainable or sustainable by diet or exercise (Hyman, 2011). Perhaps, baseline levels should be redefined (Greely et al., 2008; Hyman, 2011) as we consider our predominantly unnatural lifestyles (e.g. unreasonable working hours) and acceptance/dependence on harmless drugs (e.g. caffeine). However, to deal with an already abnormal lifestyle and substance reliance, it is counterintuitive that we should modify our criteria to consume even more drugs. If anything, this simply creates new diseases in an ordinary population—consider also how thresholds for cholesterol, blood pressure, glucose, and bone density levels are lowered each year, increasing "patient" numbers and reliance on drugs (Welch et al., 2011; cf. Sanghavi, 2011). The safety, side effects, and interactions of statins are considerable and often not discussed (Ravnskov, Rosch, Sutter, & Houston, 2006). One also wonders if below-baseline levels of LFL may actually introduce other health problems, as with abnormally low levels of glucose or fat.

Moreover, if the current regulation of illicit drugs is already a struggle, how would regulating PCEs be any less complicated? Despite strict regulations, the use of performance-enhancing drugs in athletes is common, with up to 95% of athletes estimated to have taken them (Morgan, 2006; cf. Cakic, 2009). If drug regulation is already so problematic in sports (having comparatively less direct contributions to society development in terms of knowledge and technological advancement), one can only imagine how much more difficult it would be to regulate PCEs, particularly when users can insist it leads to a better life for many (e.g. surgeons, military, and academics). Subsequently, a corresponding problem would inevitably manifest in terms of employment, as one will be forced to contemplate hiring individuals whose capabilities are primarily reliant on PCEs or natural talent. In this respect, PCEs simply introduces more problems than solutions.

**4. Who decides or regulates control?**

It was foreseeable that PCEs would veer into the realm of playing God (Bostrom & Sandberg, 2009)—by being in a position to enhance a healthy system beyond its natural capacities, one is able to exert more influence over one's own fate or that of someone else. Consider how the trolley problem (formulated by philosophers Philippa Foot and Judith Jarvis Thompson) illustrates this, an analogy inspired by Reiner (2011). Two scenarios are presented: a hurtling trolley will kill five captives bounded to its tracks, unless a switch is flipped to divert it to another route, killing one person. The second scenario is similar, but instead of a switch, one has to push a portly stranger to land between the trolley and five captives, saving them but killing him. Philosophers are baffled as to why most people feel it is morally acceptable to flip the switch but not push the stranger; given the underlying concept of sacrificing one to save five is the same. The key factor rests in that the latter is more emotionally salient, requiring more direct, personal contact (Greene, Sommerville, Nystrom, Darley, & Cohen, 2001).

Applying this analogy to the topic of PCEs, the vital question becomes where one is positioned—the switch, or beside the stranger. Researcher positions are somewhat distant, like building good switches, regardless of their utility. By advocating that PCEs be incorporated into mainstream policies, we strategically place the switch in the tracks. By convincing physicians and the public, we are improvising the stranger scenario. Yet, as physicians deal more directly with the public, they are more likely to be positioned next to the stranger. In essence, researchers and physicians may have the same intentions (flipping the switch and shoving the stranger), but the latter would suffer the repercussions, just as Greene et al. (2001) noted with the trolley problem. It is little wonder then that

many (not all) physicians tend to err on the side of caution and are still skeptical with PCEs, despite established safety claims (Banjo, Nadler, & Reiner, 2010).

What the trolley problem highlights is that researcher roles, influence, and responsibilities have strayed well beyond isolated laboratories and domains; and that contemplation of the bigger picture and consequences on society has become less optional as we approach controversial areas with far-reaching implications. It is especially important when its consequences are more directly experienced by others (e.g. physicians, society's gatekeepers in many respects; Farah et al., 2004; Greely et al., 2008). The scientific community enjoys a privileged status, but this may easily be compromised if and when its credibility is lost. This is not to say we all need to become neuroethicists, but rather that this perspective be kept in mind in our research endeavors (Urban & Gao, 2014). As Persson and Savulescu (2008) insightfully noted, with PCEs, moral development must follow—just as martial arts gives one superior combat abilities, its disciples are acutely aware of the accountability of their skills and actions.

Taken together, mainstream use of PCEs in the healthy population is certainly not without its merits, but is still outweighed by its graver limitations. In an era already grappling with numerous unresolved diseases and rampant drugs, it really seems counterintuitive to fixate on meddling with a normal, working system. As researchers, bringing the focus back to the fundamental biological and ethical implications of PCEs may just help in deciphering its controversy and context. Presently and in the long run, mainstream use of PCEs in the healthy population will do society more harm than good.

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**References**

Banjo, O. C., Nadler, R., & Reiner, P. B. (2010). Physician attitudes towards pharmacological cognitive enhancement: Safety concerns are paramount. *PLoS One, 5*(12), e14322. doi:10.1371/journal.pone.0014322

Bostrom, N., & Sandberg, A. (2009). Cognitive enhancement: Methods, ethics, regulatory challenges. *Science and Engineering Ethics, 15*, 311–341. http://dx.doi.org/10.1007/s11948-009-9142-5

Cakic, V. (2009). Smart drugs for cognitive enhancement: Ethical and pragmatic considerations in the era of cosmetic neurology. *Journal of Medical Ethics, 35*, 611–615. http://dx.doi.org/10.1136/jme.2009.030882

Dresler, M., Sandberg, A., Ohla, K., Bublitz, C., Trenado, C., ... Repantis, D. (2013). Non-pharmacological cognitive enhancement. *Neuropharmacology, 64*, 529–543. http://dx.doi.org/10.1016/j.neuropharm.2012.07.002

Farah, M., Illes, J., Cook-Deegan, R., Gardner, H., Kandel, E., King, P., ... Wolpe, P. R. (2004). Neurocognitive enhancement: What can we do and what should we do? *Nature Reviews Neuroscience, 5*, 421–425. http://dx.doi.org/10.1038/nrn1390

Finger, G., Silva, E. M., & Falavigna, A. (2013). Use of methylphenidate among medical students: A systematic review. *Revista da Associação Médica Brasileira, 59*, 285–289. http://dx.doi.org/10.1016/j.ramb.2012.10.007

Greely, H., Sahakian, B., Harris, J., Kessler, R. C., Gazzaniga, M., Campbell, P., & Farah, M. J. (2008). Towards responsible use of cognitive-enhancing drugs by the healthy. *Nature, 456*, 702–705. http://dx.doi.org/10.1038/456702a

Greene, J. D., Sommerville, R. B., Nystrom, L. E., Darley, J. M., & Cohen, J. D. (2001). An fMRI investigation of emotional engagement in moral judgement. *Science, 293*, 2105–2108. http://dx.doi.org/10.1126/science.1062872

Husain, M., & Mehta, M. A. (2011). Cognitive enhancement by drugs in health and disease. *Trends in Cognitive Sciences, 15*, 28–36. http://dx.doi.org/10.1016/j.tics.2010.11.002

Hyman, S. E. (2011). Cognitive enhancement: Promises and perils. *Neuron, 69*, 595–598. http://dx.doi.org/10.1016/j.neuron.2011.02.012

Lynch, G., Cox, C. D., & Gall, C. M. (2014). Pharmacological enhancement of memory or cognition in normal subjects. *Frontiers in Systems Neuroscience, 8*(90). doi:10.3389/fnsys.2014.00090

Persson, I., & Savulescu, J. (2008). The perils of cognitive enhancement and the urgent imperative to enhance the moral character of humanity. *Journal of Applied Philosophy, 25*, 162–177. http://dx.doi.org/10.1111/japp.2008.25.issue-3

Ravnskov, U., Rosch, P. J., Sutter, M. C., & Houston, M. C. (2006). Should we lower cholesterol as much as possible? *British Medical Journal, 332*, 1330–1332. http://dx.doi.org/10.1136/bmj.332.7553.1330

Reiner, P. (2011). Neuroethics of cognitive enhancement. In *MiNDS Optimal Brain Summer Symposium*. Hamilton, ON: McMaster University.

Repantis, D., Schlattmann, P., Laisney, O., & Heuser, I. (2010). Modafinil and methylphenidate for neuroenhancement in healthy individuals: A systematic review. *Pharmacological Research, 62*, 187–206. http://dx.doi.org/10.1016/j.phrs.2010.04.002

Sanghavi, D. M. (2011). The perils of excessive medical care. *The Lancet, 377*, 1561–1562. http://dx.doi.org/10.1016/S0140-6736(11)60627-2

Santoni de Sio, F., Faulmüller, N., & Vincent, N. A. (2014). How cognitive enhancement can change our duties. *Frontiers in Systems Neuroscience, 8*, 131. doi:10.3389/fnsys.2014.00131

Steiner, H., & Van Waes, V. (2013). Addiction-related gene regulation: Risks of exposure to cognitive enhancers vs. other psychostimulants. *Progress in Neurobiology., 100*, 60–80. http://dx.doi.org/10.1016/j.pneurobio.2012.10.001

Urban, K. R., & Gao, W. J. (2014). Performance enhancement at the cost of potential brain plasticity: Neural ramifications of nootropic drugs in the healthy developing brain. *Frontiers in Systems Neuroscience, 8*(38). doi:10.3389/fnsys.2014.00038



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