

# Systematic review shows 'smart drug' modafinil does enhance cognition

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The drug modafinil was developed to treat narcolepsy (excessive sleeping), but it is widely used off-licence as a 'smart drug' to promote cognitive enhancement, where qualities such as alertness and concentration are desired to assist someone with, for example, exam preparation. Past studies on sleep-deprived individuals have shown a strong positive effect of modafinil on these functions, but there has been less attention and scientific consensus on the drug's overall effectiveness as a cognitive enhancer in people that are not sleep-deprived - presumably the majority of people taking it. Now, a new systematic review, published online in the peer-reviewed journal *European Neuropsychopharmacology* shows that modafinil does indeed confer significant cognitive benefits in this group, at least on a particular subset of tasks.

Dr Ruairidh Battleday and Dr Anna-Katharine Brem from the University of Oxford and Harvard Medical School evaluated all research papers on [cognitive enhancement](#) with modafinil from January 1990 to December 2014. They found 24 studies dealing with different benefits associated with taking modafinil, including planning and decision making, flexibility, learning and memory, and creativity.

Unsurprisingly, they found that the performance-enhancing capacity of modafinil varied according to the task. What emerged was that the longer and more complex the task tested, the more consistently modafinil conferred [cognitive benefits](#).

Modafinil made no difference to working memory, or flexibility of thought, but did improve decision-making and planning. Very encouragingly, the 70% of studies that looked at the effects of modafinil on mood and side effects showed very little overall effect, although a couple reported insomnia, headache, stomach ache or nausea (which were also reported in the placebo group).

According to Ruairidh McLennan Battleday (University of Oxford): "This is the first overview of modafinil's actions in non-sleep-deprived individuals since 2008, and so we were able to include a lot of recent data. Interestingly, we found that the type of test used to assess modafinil's cognitive benefits has changed over the last few decades. In the past, people were using very basic tests of cognition, developed for neurologically-impaired individuals. In contrast, more recent studies have, in general, used more complex tests: when these are used, it appears that modafinil more reliably enhances cognition: in particular 'higher' brain functions that rely on contribution from multiple simple cognitive processes."

According to Anna-Katharine Brem (University of Oxford and Harvard Medical School):

"So, we ended up having two main conclusions: first, that, in the face of vanishingly few side effects in these controlled environments, modafinil can be considered a cognitive enhancer; and, second that we need to figure out better ways of testing normal or even supra-normal cognition in a reliable manner. However, we would like to stress the point that with any method used to enhance cognition, ethical considerations always have to be taken into account: this is an important avenue for future work to explore."

Professor Guy Goodwin, President of the European College of Neuropsychopharmacology (ECNP) commented:

"This overview suggests that, on current evidence, modafinil enhances cognition independent of its known effects in sleep disordered populations. Thus, the authors say that "modafinil may well deserve the title of the first well-validated pharmaceutical nootropic agent". In other words, it's the first real example of a 'smart drug', which can genuinely help, for example, with exam preparation. Previous ethical discussion of such agents has tended to assume extravagant effects before it was clear that there were any. If correct, the present update means the ethical debate is real: how should we classify, condone or condemn a drug that improves human performance in the absence of pre-existing cognitive impairment?

As the authors point out, modafinil is not licenced for this use, and it will not be because it would be outside the current terms of reference of regulatory bodies. The non-medical use of mind altering drugs has hitherto broadly conflicted with the work ethic of many societies, has been very popular but leads to a range of demonstrable harms. Regulation has been and remains problematic. We cannot know either if demand for [modafinil](#) in the same societies will actually be significant, whether society will be more accepting and how regulation will then be framed.

**More information:** Modafinil for cognitive neuroenhancement in healthy non-sleep-deprived subjects: a systematic review, R.M. Battleday and A.-K. Brem, *European Neuropsychopharmacology*, [DOI: 10.1016/j.euroneuro.2015.07.028](https://doi.org/10.1016/j.euroneuro.2015.07.028)

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