

Poll results: look who's doping

In January, *Nature* launched an informal survey into readers' use of cognition-enhancing drugs. **Brendan Maher** has waded through the results and found large-scale use and a mix of attitudes towards the drugs.

The US National Institutes of Health is to crack down on scientists' 'brain doping' with performance-enhancing drugs such as Provigil and Ritalin, a press release declared last week. The release, brainchild of evolutionary biologist Jonathan Eisen of the University of California, Davis, turned out to be an April Fools' prank. And the World Anti-Brain Doping Authority website that it linked to was likewise fake. But with a number of co-conspirators spreading rumours about receiving anti-doping affidavits with their first R01 research grants, the ruse no doubt gave pause to a few of the respondents to *Nature's* survey on readers' use of cognition-enhancing drugs.

The survey was triggered by a Commentary by behavioural neuroscientists Barbara Sahakian and Sharon Morein-Zamir of the University of Cambridge, UK, who had surveyed their colleagues on the use of drugs that purportedly enhance focus and attention (*Nature* **450**, 1157–1159; 2007). In the article, the two scientists asked readers whether they would consider "boosting their brain power" with drugs. Spurred by the tremendous response, *Nature* ran its own informal survey. 1,400 people from 60 countries responded to the online poll.

We asked specifically about three drugs: methylphenidate (Ritalin), a stimulant normally used to treat attention-deficit hyperactivity disorder but well-known on college campuses as a 'study aid'; modafinil (Provigil), prescribed to treat sleep disorders but also used off-label to combat general fatigue or overcome jet lag; and beta blockers, drugs

prescribed for cardiac arrhythmia that also have an anti-anxiety effect. Respondents who had not taken these drugs, or who had taken them for a diagnosed medical condition were directed straight to a simple questionnaire about general attitudes. Those who revealed that they had taken these drugs, or others, for non-medical, cognition-enhancing purposes

behind 'other' which received a few interesting reasons, such as "party", "house cleaning" and "to actually see if there was any validity to the afore-mentioned article".

Our question on frequency of use, for those who took drugs for non-medical purposes, revealed an even split between those who took them daily, weekly, monthly, or no more than once a year. Roughly half reported unpleasant side effects, and some discontinued use because of them. Some might expect that negative side effects would correlate positively with a low frequency of use, but that doesn't seem to be the case in our sample (see bar graph, below).

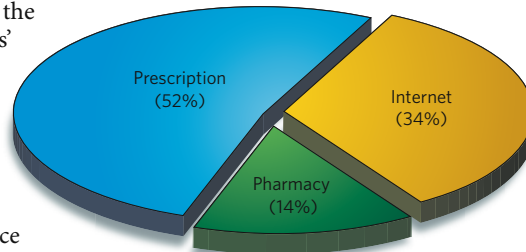
Reported side effects included headaches, jitteriness, anxiety and sleeplessness.

Neuroscientist Anjan Chatterjee of the University of Pennsylvania in Philadelphia predicts a rise in the use of these drugs and other neuroenhancing products and procedures as they become available (A. Chatterjee *Cam. Q. Healthc. Ethics* **16**, 129–137; 2007). Like the rise in cosmetic surgery, use of cognitive enhancers is likely to increase as bioethical and psychological concerns are overcome (see 'Worrying words') and as the products gain cultural acceptance. One difference, Chatterjee says, is that use of cognitive enhancers doesn't rely on training of medical specialists such as surgeons. Internet availability will also greatly accelerate use, he says.

Our poll found that one-third of the drugs being used for non-medical purposes were purchased over the Internet (see pie chart). The rest were obtained from pharmacies or on prescription. It is unclear whether the prescribed

DRUG SOURCES

Answered question: 201
Skipped question: 1,227



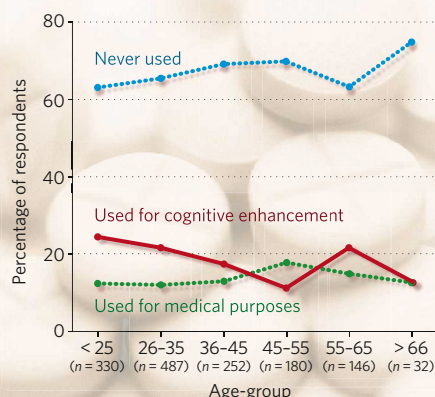
were asked several additional questions about their use. Here's what they had to say:

One in five respondents said they had used drugs for non-medical reasons to stimulate their focus, concentration or memory. Use did not differ greatly across age-groups (see line graph, left), which will surprise some. Nora Volkow, director of the National Institute on Drug Abuse (NIDA) in Bethesda, Maryland, says that household surveys suggest that stimulant use is highest in people aged 18–25 years, and in students.

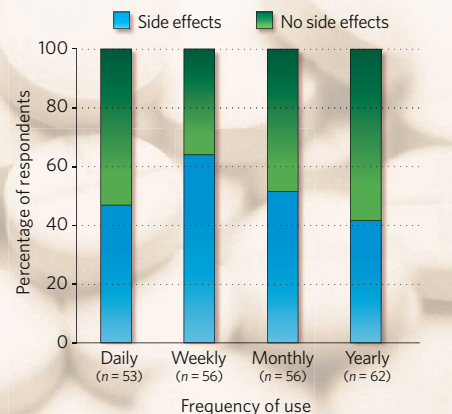
For those who choose to use, methylphenidate was the most popular: 62% of users reported taking it. 44% reported taking modafinil, and 15% said they had taken beta blockers such as propranolol, revealing an overlap between drugs. 80 respondents specified other drugs that they were taking. The most common of these was adderall, an amphetamine similar to methylphenidate. But there were also reports of centropheoxine, piracetam, dexedrine and various alternative medicines such as ginkgo and omega-3 fatty acids.

The most popular reason for taking the drugs was to improve concentration. Improving focus for a specific task (admittedly difficult to distinguish from concentration) ranked a close second and counteracting jet lag ranked fourth,

TRENDS IN USE OF NEUROENHANCERS



EFFECT OF DOSE ON SIDE EFFECTS





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Worrying words

Bioethicists have identified four concerns about taking neuroenhancing drugs. *Nature's* survey respondents confirmed them.

Safety

"The mild side effects will add up to be profound in due course and may even require stronger therapy to control the addiction."

26–35 years old from Nigeria

Erosion of character

"I wouldn't use cognitive enhancing drugs because I think it would be dishonest to myself and all the people who look to me as a role model."

25 or younger from Guyana

Distributive justice

"Morally puts a disadvantage to people without access."

55–65 years old from the United States

Peer pressure

"As a professional, it is my duty to use my resources to the greatest benefit of humanity. If 'enhancers' can contribute to this humane service, it is my duty to do so."

66 or older from the United States

that even if policies restricted their use by kids, pressure would be high for parents," she says.

Few studies have looked in depth at the prevalence of this kind of drug use or at people's attitudes towards it. And few data are available on how effective these neuroenhancing agents are or on long-term side effects. The NIDA doesn't fund any such studies, according to Volkow, but the US Department of Defense does. Chatterjee says that he is working with Martha Farah of the University of Pennsylvania on a small study of the effects of these drugs in students.

The most popular of the drugs used by respondents to *Nature's* poll seem to have fairly mild neuroenhancing effects, says Chatterjee, who calls the massive media interest in these drugs "neurogossip". Nevertheless, the numbers suggest a significant amount of drug-taking among academics. As Eisen's April Fool's prank spread from blog to blog, it was hard to tell who was in on the joke and who was taking the announcement at face value. Although tricking people was a goal, Eisen had been aiming for something so ridiculous that most would chuckle. Instead, he worries that he might have hit a nerve: "I think it did make it less funny because it is actually too real." ■

See Editorial, page 665, and <http://tinyurl.com/4huoqr> to view and download the survey data and post your own analyses.

J. RAE/GETTY neuroenhancers were diverted from other people's prescriptions, prescribed for different purposes or at different doses for the user. A breakdown of how such drugs were obtained in different countries shows that slightly fewer US users get drugs from the Internet. In the few respondents from Britain that answered this question ($n = 14$), all but one reported the Internet as their source.

All participants who took part in the survey were asked 10 questions designed to gauge their attitudes towards neuroenhancing drugs. Almost all respondents (96%) thought people with neuropsychiatric disorders who have severe memory and concentration problems

should be given cognition-enhancing drugs. But perhaps surprisingly, a high four-fifths thought that healthy adults should be able to take the drugs if they want to. And 69% reported that they would risk mild side effects to take such drugs themselves.

When asked whether healthy children under the age of 16 should be restricted from taking these drugs, unsurprisingly, most respondents (86%) said that they should. But one-third of respondents said they would feel pressure to give cognition-enhancing drugs to their children if other children at school were taking them. Morein-Zamir found this coercive factor very interesting. "These numbers strongly suggest