



Cognitive enhancement drug use among resident physicians: Prevalence and motivations for use - results from a survey

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ABSTRACT

Background: Non-medical use of prescription drugs for the enhancement of cognitive functioning has gained popularity in recent years, especially among young educated adults. To our knowledge, no previous study investigated this phenomenon among resident physicians.

Objective: To analyze cognitive enhancement drugs use motivations and patterns among resident physicians.

Methods: A survey and statistical analysis regarding the use of drugs traditionally prescribed for the treatment of Attention Deficit Hyperactivity Disorder: stimulants, amphetamines and modafinil.

Participants: 1,453 residents who took their written residency exam in the summer of 2017. The response rate was 32.3%.

Results: 28.1% of responders reported past use, with 73.67% of them reporting use without a related medical diagnosis. Almost half of the users (47.1%) acquired the drug with a prescription, but without a diagnosis of a related medical disorder. The first use was predominantly during residency (54.3%), with 45% reporting it as related to the residency exam.

Factors found to positively impact non-medical use include: declaring undiagnosed Attention Deficit Hyperactivity Disorder, fear of failing the exam, a belief that more than 30% of other examinees take cognitive enhancements drugs, and a learning disability diagnosis. Self-reports of being a competitive person and being a parent, were negatively correlated with non-medical use.

Conclusions: The use of drugs that are taken traditionally for the treatment of Attention Deficit Hyperactivity Disorder is common among resident physicians, both with and without related medical indication. Interestingly, factors associated with the fear of being “left behind” increase non-medical use and not the desire to succeed.

KEYWORDS

substance misuse; cognitive enhancement; physicians; prescription stimulants; residents

Introduction

Non-medical use of prescription drugs in order to enhance cognitive functioning in healthy adults has gained popularity in recent years,^{1,2} particularly among young educated adults.³ Popular cognitive enhancement drugs are the drugs traditionally used for the treatment of Attention Deficit Hyperactivity Disorder (ADHD): stimulants (e.g., methylphenidate), amphetamines (e.g., dextroamphetamine) and modafinil. Throughout this paper, we will refer to the use of prescription cognitive enhancement

drugs without a proper medical diagnosis as “misuse”.

The prevalence of misuse was evaluated in a number of studies, both in the general population and in specific subpopulations such as students and medical doctors. Misuse prevalence rate varies between studies due to methodological differences and location specific features such as population attributes and local enhancement drugs regulations. A 2015-2016 survey of US adult population estimated that 6.6% used prescription stimulants in the year before, with 2.1% misusing prescription stimulants at least once.⁴

Non-medical prescription stimulant use is more common among college students than among same age peers not attending college.⁵ According to a number of studies, the lifetime prevalence rate of misuse among college students varies between 8%⁶ and 43%,⁷ with a recent meta-analysis estimating it at 17%.⁸ In one German university 20% of the students revealed that they used cognitive enhancement drugs in the 12 months prior to the survey.⁹

With regard to medical students, in a 2011 US medical students census it was found that 18% used prescribed psychostimulants at least once.³ A study conducted among Israeli medical students found that 17% of them used methylphenidate at least once, of which 48.7% took the drug “off-label”.¹⁰ A Canadian study reported that 15% of medical students misused stimulants.¹¹ Another study estimated that the prevalence of use of medically prescribed psychostimulants, such as corticoids, methylphenidate, modafinil and piracetam in the French medical community (medical students and physicians) is 6.7%, and 5.2% using illicit psychostimulants such as cocaine, amphetamines¹, methamphetamine and 3,4-methylendioxy-methamphetamins (MDMA).¹² A Greek study reported only 1.4% of methylphenidate misuse among medical students.¹³ A study conducted among surgeons, estimated the lifetime prevalence of prescription or illicit drug use exclusively for cognitive enhancement at 19.9%.¹⁴ From the above, we can conclude that the use of prescribed drugs for cognitive enhancement is not a marginal phenomenon, especially for young educated adults.

Previous studies found that both being a male and having symptoms of ADHD have a strong positive impact on misuse.^{3,8,12} The reported reasons for the use of stimulant and related medications as cognitive enhancers are varied and include: active and stressful lifestyles, balancing academic duties and free time and enhancement of academic performance due to a competitive school environment.^{15,16} However, no previous work has explored the underpinnings of use in a competitive environment – is it the desire to succeed or the fear to lag behind others?

In light of the popularity of prescription drug misuse among young educated adults and the

fact that physicians have professional knowledge and access to medications, we believe that better understanding of misuse patterns among physicians is needed. In addition, no previous study has evaluated cognitive enhancement use patterns in young physicians. In this work, we look at the attributes of misuse in resident physicians, who typically are subjected to a stressful, demanding, and competitive environment. Our survey was done during an even more stressful period of the responders’ residency – studying for and taking the written residency exam.²

In this study we followed a number of research questions:

1. What is the prevalence of use and misuse of cognitive enhancement drugs in medical residents? Both lifetime prevalence and during preparations for the exam.
2. What are the main factors impacting the use and misuse? Specifically, is it the desire to succeed or the fear from lagging behind?
3. How do misusers obtain the drug?
4. How many of the responders plan to continue misusing the drug in the future?
5. What are the characteristics of misusers?

Methods

We distributed an anonymous, cross-sectional, voluntary survey on cognitive enhancement drug use to Israeli resident physicians who took their written residency exam in June of 2017. Survey design included a pilot on 5 residents, who completed it in 3-8 minutes. Survey sections included a demographic profile, psychostimulant and related drugs (we collected information regarding the use of drugs traditionally used for the treatment of ADHD: stimulants, amphetamines, and modafinil, we did not collect data about illicit substances use) use before and during studying for the residency exam, motivations for use, relevant diagnoses (ADHD and/or Learning disability) and attitudes toward the residency in general and the exam itself. The survey was comprised of 53 questions for individuals who used cognitive enhancement drugs and 31 questions for non-users. The survey was approved by Beer-Yaacov - Ness-Ziona Mental Health Center Institutional

Table 1. Respondent's medical specialty.

Medical specialty	N	Percent
Oncology	10	2.1
E.N.T	6	1.3
Pathology	6	1.3
Public health	2	0.4
Anesthesia	31	6.6
Obstetrics and gynecology	23	4.9
Urology	8	1.7
Orthopedic surgery	14	3.0
Cardiothoracic surgery	1	0.2
Vascular surgery	1	0.2
General surgery	20	4.3
Plastic surgery	14	3.0
Neurology	10	2.1
Dermatology	9	1.9
Ophthalmology	2	0.4
Psychiatry	31	6.6
Nuclear medicine	1	0.2
Emergency Medicine	1	0.2
Medical jurisprudence	3	0.6
Physical medicine and rehabilitation	4	0.9
Internal medicine	144	30.8
Pediatrics	64	13.7
Family medicine	62	13.3
Total	467	100.0

*Two persons did not respond to this question.

Review Board (IRB), on June 1st, 2017 (IRB reference #575).

Examinees were invited to complete the survey in two modes. First, surveys were distributed on-site on exam days (June 2017). Second, we circulated a web-based survey in the following month (until mid-July). The web-based survey was distributed on relevant social media channels and via E-mail. All subjects expressed consent by filling the survey and were asked to complete it only once.

Data analysis was performed using a number of R (version 3.6.1) functions. Descriptive statistics of sample demographics and stimulant use were calculated. A logistic regression was used in order to estimate the impact of personal characteristics on the probability of using stimulants while studying for the exam. Estimation was done using R's "glm" function with logit link function (family = "binomial"). The personal attributes examined were gender, age, being a parent (children indicator), marital status, medical school, specialty, the number of times taking the exam, ADHD and Learning Disability diagnosis, as well as perceptions regarding having an undiagnosed ADHD. Other examined factors were the responders' perceptions regarding the exam and the residency as a whole, such as: the fear of failing the exam, the perception of oneself

as competitive, the perception of the residency as competitive and perceptions regarding the number of other residents who take enhancement drugs. Using a logistic regression estimation enables us to control for the above-mentioned personal characteristics and accurately answer our questions regarding stimulant use. Odds ratios of significant variables are reported, a significant outcome means that the variable significantly impacts usage probability, an odds ratio value greater than 1 indicate a positive impact, while below 1 a negative one. 95% confidence intervals (CI) are reported for the odds ratios.

Results

Participants

A total of 1,453 physicians took the 2017 written residency exam. 32.3% (469) the examinees completed our survey. The average age of was 35.7 years (SD = 3.6, range 26-53, forty-four no response), 58.2% (272/467, two no response) were females, 82.4% (382/467, two no response) were married or in common law relationship and 73.4% have children (293/399, seventy no response). Responders' medical specialties are presented in Table 1. The mean time in residency was 3.8 years (SD = 1, range 2-10, thirty-four no response). For most of the respondents it was the first time taking the exam (82.9%, 377/455).

Psychostimulant use

With regard to psychostimulant usage, 28.1% (132/469) of the respondents reported taking one or more of the drugs in question at least once in their lifetime. Non-medical use was common with 20.7% (97/469) of respondents reporting taking the drug with no related medical diagnosis. For most users, the first use was during their residency (54.3%, 70/129, three no response), with 45% (58/129) reporting it was related to the exam. Almost a quarter of the sample, 23.9% (112/469) took one of the medications during their preparation for the exam, with 17.1% (80/469) without medical diagnosis.

Most of the users (47.1%, 56/119, thirteen no response) acquired the drug with a prescription from a doctor, but without a related medical

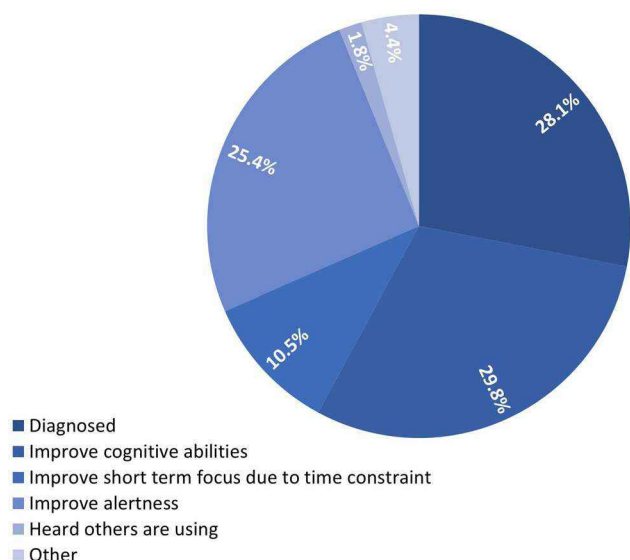


Figure 1. Motivations of pre-exam use. * $N=114$, eighteen no response.

diagnosis, anecdotally, there were a few reports of respondents issuing their own prescriptions. 14.3% (17/119) received or bought the drug from another person without a prescription. Lastly, 32.8% were diagnosed with ADHD and used the drug under medical supervision.

Motivations for pre-exam use are described in [Figure 1](#). 57.8% (74/126, 6 no response) believed the drug helped them while preparing for the exam. In addition, 38.9% (49/126) of the users state that they plan to continue taking the medications after the exam.

Non-medical use characteristics

Using a logistic regression, we analyzed the impact of the attitudes and personal attributes of responders with no ADHD diagnosis, on the probability of taking a drug before the exam. As seen in [Table 2](#), the probability of non-medical use is increased (odds ratio greater than 1) with male gender, self-report of fear of exam failure, being diagnosed with a learning disability, the examinee belief that he suffers from an undiagnosed ADHD and that 30% or more of other examinees take cognitive enhancement drugs (both 30-50% and 50% and more). The probability of non-medical use decreases for parents and for people who reported themselves as being a competitive person. Being married has a negative impact on the probability of use, but is also

highly correlated with being a parent, so was dropped from the final model. Perceiving the residency as a competitive environment, importance of exam score, age, years in residency and the number of times taking the exam did not significantly impact misuse risk. For odds-ratio, confidence-interval and number of observations, see [Table 2](#). Using odds-ratio we can evaluate the magnitude of the impact of various variables on the probability of use. For example, being a male (significance is at the 90% confidence level) increases the probability of use by 90%, the fear of failure in the exam, increases the odds four fold, being diagnosed with a learning disability increases the odds 6.8 times, belief that you have an undiagnosed ADHD increases the risk by 7.7 and the belief that 50% or more of other examinees take stimulants increase the probability by almost 17 times. On the other hand, being a parent decreases the probability of usage by 75% and being a competitive person by 63%.

Discussion

In recent years misuse of stimulants among healthy individuals is on the rise and receives increased attention.¹⁷ To our knowledge, our study is the first to investigate misuse among resident physicians from a variety of medical specialties. The lifetime prevalence of drug-misuse in our sample is 20.7%, with another 7.4% who use it with proper medical indication. The above results conform to what was found in most of the literature.^{8,9,11,14} Contrary to that, in France where methylphenidate and modafinil are highly regulated and amphetamine is not allowed,¹² and in Greece, where only methylphenidate is available, the prevalence rate is lower. These contradicting results highlight the importance of regulation on stimulants use and its impact on misuse.

Our study shed some light on a number of possible explanations to the misuse rate among resident physicians. In many cases, first use occurred while studying for the written residency exam. This might be because medical residencies tend to be competitive and residents tend to be under a lot of stress,¹⁸ especially with a big test approaching. This notion is in agreement with

Table 2. Results of the logistic regression estimation.

Variables	Odds ratios	95% CI
Increases non-medical stimulant use		
Male gender	1.903*	(0.926, 4.029)
Fear of exam failure	4.170***	(1.698, 11.510)
Belief that between 30-50% of other examinees took ADHD medications	3.389***	(1.570, 7.549)
Belief that more than 50% of other examinees took ADHD medications	16.761***	(6.472, 47.024)
Learning disability diagnosis	6.839***	(1.348, 33.656)
Belief that one has undiagnosed ADHD	7.714***	(3.788, 16.384)
Decreases non-medical stimulant use		
Self-report of competitiveness	0.366***	(0.176, 0.752)
Being a parent	0.254***	(0.115, 0.544)
Statistics		
(Intercept)	0.045***	(0.012, 0.149)
N	331	
Adj. R-SQ	0.332	

Odds-ratio p-values: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

other studies, which pointed out that a highly competitive college environment predicts ADHD prescription misuse both in the general student population^{19,20} and among medical students.²¹

But what factors in a competitive environment increase the risk for misuse? Is it the desire to succeed or the will not to stay behind? Self-reports of being highly competitive negatively impacted misuse and perceiving the residency environment as competitive, or a desire to score high in the test had no significant effect on the propensity of misuse. On the other hand, responders who feared failing the exam and who reported a potential disadvantageous position compared to other examinees, were more inclined to misuse. The results described above, indicate that misuse is driven by the fear of being “left behind” and not by competitiveness factors (Figure 2). This perspective was not addressed in previous studies, but is consistent with a study in which a higher usage was recorded in schools with class ranks.³

It might be that competitive people will make an effort to be as competent as possible during residency, therefore will be well prepared for the test and will not need to use cognitive enhancement drugs. Another explanation is that competitive people with a strong sense of self accomplishment, might want to succeed using their own skills without any medical support.

Regarding examinees who thought they have undiagnosed ADHD, misuse may be regarded as self-medication (in order to ameliorate symptoms associated with ADHD) or as a higher likelihood of substance use, related to people who suffer

from ADHD.²² Another possibility is that this answer is just a matter of misuse justification.

Parents were less likely to use, compared to other examinees. A possible explanation is that parents tend to take fewer risks,²³ such as taking an unprescribed medication.

The fact that most misusers obtained the drug with medical prescription raises questions not only regarding prescription demand, but also about prescription supply. One possibility is that the prescription was provided by a colleague, family member or a friend, another is that it was prescribed in a medical encounter (without having relevant diagnosis). A survey in Germany reported that 14% of primary care physicians/internists have been asked, at least once, for a methylphenidate prescription without any medical indication. Among them, 29% issued a prescription.²⁴ Future study should seek to understand the characteristics of physicians who provide prescriptions without related medical diagnosis. In this context, it is important to note



Figure 2. The impact of competitiveness related factors on misuse.

that residents hold a major role in shaping the future of health care systems, a fact which highlights even more the need for further studies.

The high proportion of misusers raises questions on medical safety and whether clinical best practices are used with these types of medications. Our hope is that misusers are guided by medical knowledge and that the recommended dosage, contraindications and adverse effects are being considered. Future study may address those issues.

Our study recruited examinees from different specialties, however, some of the specialties had only few participants. We acknowledge this limitation and left for future studies to conclude whether different specialties carry different risk for misuse.

Other possible future questions could be what is the prevalence of stimulant use disorder among users? What other personal characteristics predicts misuse? What are the prevalence and characteristics in other groups of young professionals (such as lawyers)?

This study has several methodological limitations. This was a self-report survey on a controversial subject, and therefore misreporting might be a concern. However, previous studies have pointed out that anonymous surveys have a low share of misreporting.²⁵ Our response rate was 32.3%, and little is known about the habits of non-responders. On the other hand, our sample includes physicians from almost all specialties, all parts of the country, and a variety of hospital settings. Nevertheless, because we cannot rule out non-response bias, caution is needed in generalizing the results.

Conclusions

The use of drugs that are taken traditionally for the treatment of Attention Deficit Hyperactivity Disorder is common among resident physicians, both with and without related medical indication. Interestingly, factors associated with the fear of being “left behind” increase non-medical use and not the desire to succeed. More studies are needed in order to learn more about this phenomenon.

Notes

1. Amphetamines and its derivatives are not allowed for medical prescription.
2. Residents in Israel are certified by two exams: a written exam after finishing at least 2 years of their residency and an oral exam in the last year of residency.

Declaration of interest

The authors report no conflicts of interest, and no funding was received.

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