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Research report

Use of cognitive enhancers among medical students in Lithuania

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ABSTRACT

AIMS – The purpose of this study is to analyse the use of cognitive enhancers among medical students in Lithuania, determine the reasons for usage and evaluate the contributing factors such as socio-demographic characteristics, stress levels, sleep quality and knowing somebody who has used a neuro-enhancing drug. DESIGN – A cross-sectional survey study was performed by analysing a convenience sample of n=579 in the two universities offering medical education in Lithuania, Vilnius University and the Lithuanian University of Health Sciences. In 2014, students were asked to fill in anonymous paper questionnaires consisting of 13 items on prevalence of substance use to enhance cognitive performance, and on reasons and correlates (response rate 95%) during lecture time. RESULTS – Of the respondents, 8.1% indicated that they had used cognitive enhancers. Among those who had used these drugs, nootropics were the most frequently mentioned (59.6%), while psychostimulants, such as modafinil, methylphenidate and amphetamine-derived drugs were mentioned less frequently (38.3%). Other substances were indicated by 23.4% of the respondents. Improvement of concentration and increased studying time were predominant purposes (55.3% and 48.9% of users, respectively). Male students reported three times higher prevalence rates than females (14.6% vs. 5.1%, $p<0.05$). Prevalence was also higher in students who knew someone using these substances than among those who did not know such persons (17.3% vs. 5.1%, $p< 0.05$). This was the most associated factor with cognitive-enhancing drug-taking behaviour. No correlation between cognitive enhancement usage and sleep quality or stress levels was found, nor between usage and belonging to a student organisation or having a job. CONCLUSIONS – In Lithuania, 1 of 12 medical students admits to having used neuro-enhancing drugs. Our study results provide an overview of the actual situation on correlates and reasons for taking performance-enhancing substances.

KEYWORDS – cognitive enhancers, neuro-enhancement, students, drug misuse, Lithuania

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Introduction

Use of prescription psychostimulants and nootropics for non-medical purpose is a growing trend, especially in the academic environment. Attempts to increase normal cognitive functions through the usage of pharmacological preparations has gained the name of neuro-enhancement (Normann & Berger, 2008). Both nootropics

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and psychostimulants provide excitation of the central nervous system, although their modes of action are different and the main differences are observed in the type of excitatory effects (Coper & Herman, 1998). Nootropics are defined as centrally acting, non-stimulant drugs that improve higher integrative brain functions, such as memory. Psychostimulants are widely used to treat attention deficit hyperactivity disorder (ADHD), but are also known to counteract fatigue in normal adults. As the mode of action of these drugs involves enhancement of both noradrenergic and dopaminergic functions, the effects in the frontal cortex may improve the working memory (Stolerman, 2010). According to the World Health Organization (WHO) guidelines for Anatomical Therapeutic Chemical (ATC) classification and Defined Daily Dose (DDD), psychostimulants and nootropics belong to the N06B group of drugs called "Psychostimulants, agents used for ADHD and nootropics". By the term "psychostimulant" we refer to such medicines of group N06BA as amphetamine and its derivatives, methylphenidate and modafinil, while "nootropics" here denotes medicines of group N06BX, including racetams and vinpocetine (WHO Collaborating Centre for Drug Statistics Methodology, 2012).

As a phenomenon, neuro-enhancement has drawn worldwide attention among politicians, physicians, the academic community and the general public. Moral aspects of enhancing human mental functions by medical means and the possibility of personality changes through neuro-enhancement have been discussed by philosophers (Dees, 2007). In defence of neuro-enhancement, law morality experts suggest that the use of cognitive enhancing-drugs by prosecutors and judges may help to minimise the probability of error in the court room, where the prosecutors and judges experience high levels of stress and overload in processing a lot of important information (Sandberg, Sinnott-Armstrong, & Savulescu, 2011).

These debates do not bypass the field of medicine. In surgery, where every mistake made by a doctor can be fatal, the use of cognitive enhancers is widely debated (Warren, Leff, Athanasiou, Kennard, & Darzi, 2009). Traditionally, surgeons use substances such as coffee or propranolol (Humayun, Rader, Pieramici, Awh, & de Juan, 1997), but as these substances carry undesirable side effects (such as tachycardia and tremor), some surgeons obtain prescriptions for such drugs as methylphenidate from colleagues (Pary et al., 2002).

Similar challenges are faced by future physicians, that is, medical students. They have the largest workloads of any specialty students. In clinical rotations they do similar jobs as their more experienced colleagues, but without social and financial security, which makes them more at risk of using licit and illicit drugs to improve their performance and deal with stress (Mazanov, Dunn, Connor, & Fielding, 2013). Multiple studies including those from the United States (Emanuel et al., 2013; Webb, Valasek, & North, 2013), Canada (Kudlow, Treurnicht Naylor, Xie, & McIntyre, 2013) and Italy (Castaldi et al., 2012) show that medical students have higher rates of cognitive enhancer usage than students from less competitive study fields. Also, most medical students eventually become the prescribers of such medications, and as a group they are therefore

especially interesting for the evaluation of the prevalence of cognitive enhancement.

The health side effects of neuro-enhancement are not yet properly understood, but raise concern. For example, in its review of modafinil the European Medicines Agency concluded that its benefit/risk profile was not adequate for conditions other than narcolepsy (European Medicines Agency, 2010). A systematic review performed by Repantis, Schlattmann, Laisney, and Heuser (2010) reported such side effects as anxiety, tachycardia and headache associated with the use of neuro-enhancing drugs. Cases of serious consequences, such as myocardial infarction and even sudden death associated with small doses of Adderall have been repeatedly reported (Jiao et al., 2009; Sylvester & Agarwala, 2012). Moreover, negative psychological outcomes should not be neglected: neuro-enhancement may disturb self-efficacy expectations because performance becomes more attributed to the use of supposedly enhancing substances (Wulf, Joksimovic, & Tress, 2009). Seeing the risks of neuro-enhancement we decided to investigate the situation in Lithuania to gauge its prevalence, especially because it has not been widely examined in the Baltic and the Nordic countries.

As substance abuse is prevalent in the region, it is important to evaluate the phenomenon and to assess the necessity of precautionary programmes as soon as possible (Maier, Liechti, Herzig, & Schaub, 2013). Historically, consumption of alcoholic beverages has been high in the countries of the so-called "vodka belt" (Grigg, 2004), but the problem of alcohol usage has at least partially been solved through the introduction of strict political measures. (Room, 2002). The data on alcohol consumption in Lithuania were not available until recently. In 2014, disturbing numbers were revealed: Lithuania was one of the leaders in Europe, and alcohol consumption among populations aged 15 years and over was 12.7 litres per capita per year. (OECD/European Union, 2014). Taking these data into consideration, it is all the more urgent to assess the newly emerged problem of substance abuse of cognitive enhancers.

Medicine is one of the most competitive study fields in Lithuania. Because grades are highly important in the later process of choosing one's specialisation, students may be motivated to use any means available, including cognitive enhancers, in their striving for better grades. The purpose of this study is to evaluate the prevalence of cognitive enhancer usage among medical students in Lithuania. We have also assessed the influence of contributing factors such as gender, stress levels, sleep quality and having a job or a friend that has used neuro-enhancing drugs.

Materials and methods

Students from the two Lithuanian universities offering study programmes in medicine – Vilnius University (VU) and the Lithuanian University of Health Sciences (LUHS) – were asked to fill in anonymous questionnaires consisting of 13 items. The study was performed from February to March in 2014. Approval was obtained from the research ethics board of the Lithuanian University of Health Sciences (No. BEC-MF-232).

The following socio-demographic variables were included into the questionnaire: gender, age, name of university, year of ed-

ucation, grade point average, employment status and membership in any student organisation.

Stress levels and quality of sleep were evaluated by using a subjective visual analogue scale, where 0 referred to minimal and 10 to maximum levels. The students were asked to mark how they rated their sleep quality and stress levels according to their perception. On the sleep scale, 0 meant "I sleep very poorly" and 10 meant "I sleep very well and I always wake up refreshed", while 0 on the stress scale referred to "I feel no stress at all" and 10 indicated that "I feel stress all the time, it interferes with my ability to live a normal life".

Use of cognitive enhancers was tested by the following item: "Have you ever used psychostimulant drugs (e.g. modafinil, methylphenidate, drugs containing amphetamine) or nootropics (e.g. piracetam, vinpocetine) for studying reasons?" The response options were: (1) Yes, (2) No, but I've heard of them, (3) No, I haven't heard of them. If the response was negative, the student was asked to skip the two following questions and proceed to the last one. In case of a positive response, the student was asked to specify the drugs he/she had used. The response options included (1) Modafinil (e.g. Provigil, Modalert, etc.), (2) Methylphenidate (e.g. Ritalin, Concerta, etc.), (3) Drugs with amphetamine (e.g. Adderal, Dexedrine, etc.), (4) Nootropics (e.g. Piracetam (Nootropil), Vinpocentin (Cavinton forte), etc.) and (5) Others, where the students could write the name of the drug. In the following item the students were asked to indicate the main reasons for usage of the substance they had marked. The response options were: (1) to improve concentration, (2) to increase studying time, (3) to improve memory, (4) to increase alertness, (5) as an experiment, (6) to improve academic performance, (7) friends take it, and (8) other reasons. In the last item all students were asked whether they "know someone who has ever used a neuro-enhancing drug", with response options (1) Yes, (2) No, (3) I do not know.

We pretested the questionnaire by asking a group of twenty students to express their opinion regarding the ambiguity of each question. The pilot study included students from the Students' Scientific Society. As a result, questions about caffeine usage were excluded because of the students' ambivalence regarding whether the question referred to caffeine pills or normal coffee.

The survey was conducted during general lectures in large lecture halls. After obtaining permission from lecturers, the researchers described the study and handed out paper questionnaires to every student at the beginning of a class. All the participants were assured that the survey was totally anonymous, which was also mentioned at the beginning of the paper questionnaire. Students refraining from answering were asked to take the paper questionnaire nevertheless and return it blank. This was because we expected that at least some of these students would change their minds about participation. The response rate was calculated by taking the number of completed questionnaires as a numerator and the number of questionnaires handed out as a denominator; it was 95%. On average, the survey took approximately 3 minutes to complete. Nobody was paid to participate in the study.

The choice of questions regarding use

of neuro-enhancers and reasons for this use was based on several studies (Emanuel et al., 2013; McCabe, Knight, Teter, & Wechsler, 2005; Teter, Falone, Cranford, Boyd, & McCabe, 2010). These studies show that members of campus sororities and fraternities – which exist in the United States (Ragan, Bard, & Singh, 2013) but not in Lithuania but which in our opinion are similar to our student organisations – are more likely to engage in neuro-enhancing drugs use. Also, worse sleep quality (Clegg-Kraynok, McBean, & Montgomery-Downs, 2011) and higher stress levels (Sattler, Forlini, Racine, & Sauer, 2013; Weyandt et al., 2009) were associated with a higher risk. These questions were included in our questionnaire, as was a question if the students knew any peers using these substances for non-medical reasons (Verdi, 2013).

Our analysis was based on data from 579 students. As the total medical student population in Lithuania consists of roughly 2900 students studying in the two universities that offer medicine as a study programme (LUHS and VU), our margin of error within a confidence interval of 95% was 3.63%. Foreign students studying medicine in Lithuania were not included in this study.

In our survey, 394 (66%) of the respondents students came from the Lithuanian University of Health Sciences, and 197 (34%) from Vilnius University. Men represented 32% of the participants, 68% were woman. In the whole population of Lithuanian medical students, 1800 (62%) are from LUHS and 1100 (36%) from VU. The female to male ratio is around 2:1. In conclusion, our sample is representative of the total population of Lithuanian medical students and has similar characteristics of university ratios and gender ratios.

In order to compare our data with published data from other countries, we did a search in the PubMed online database by using the following key words: students, neuro-enhancers, cognitive enhancers, psychostimulants and studying. We then selected articles describing original studies and providing calculations of prevalence of substance use to increase cognitive functions among students, as well as evaluating influence of correlating factors.

Statistical analyses were carried out by using software package IBM SPSS version 17.0. Descriptive statistics were calculated, and categorical comparisons between non-users and users were made by using chi-square analyses. We used an independent two-sample t-test to determine if there was a difference of sleep quality and stress levels between users and non-users. In order to ascertain which factors had the greatest influence on consuming the drugs, we did a multiple logistic regression analysis and used standardised beta coefficients to compare the magnitude of effects applying King's formula (King, 2007). In our analyses, we report effects as significant when they are below the alpha level of 5%.

Results

The general characteristics of the sample are described in Table 1.

Of the respondents, 47 (8.1%) indicated that they had used cognitive enhancers at least once in their life. Male participants had used neuro-enhancers almost three times as much as females (14.6% vs. 5.1%, $p<0.05$).

Nootropics had been used by 28 (59.6%)

Table 1. Characteristics of sample (n = 579).

Gender	68% Female
	32% Male
University	66% LUHS
	34% VU
Belongs to an organisation	48%
Has a job	10.9%
Age, mean	22.01, SD 1.46
GPA	
<6.1	0.3%
6.1–7	2.6%
7.1–8	25.7%
8.1–9	51.5%
>9.1	19.9%

of the respondents who reported using neuro-enhancers. Psychostimulants had been used by 18 (38.3%) of these students – which included 7 (14.9%) users of modafinil, 3 (6.4%) of methylphenidate and 8 (17%) of amphetamine-derived drugs. Use of other substances was indicated by 11 (23.4%) respondents.

As shown in Table 2, nootropics are the most popular medication among Lithuanian students of both genders. They are twice as popular among male students as among female users (76.9% vs. 38.1%, $p<0.05$). There were no gender differences in the choice to use psychostimulants (modafinil, methylphenidate and amphetamine-derived drugs) or other substances ($p> 0.05$).

In explaining their reasons to use cognitive enhancers, 26 respondents (55.3%) reported wanting to improve concentration; 25 (53.2%) said it was because they wanted to increase studying time; 23 (48.9%) wanted to improve memory; 20 (42.6%) to increase alertness; 16 (34.0%) had used the drugs as an experiment; and 14 respondents (29.8%) had wanted to enhance their academic performance.

As Table 3 shows, one main difference in motivation of use was found between genders: male students were seeking to improve concentration more often than females (69.2% and 38.1%, $p<0.05$). There were no significant differences in other reasons between the sexes.

Students whose friends had used neuro-enhancers admitted to having used these substances themselves three times more often comparing to those who did not know anyone having used cognitive enhancers (17.3% vs. 5.1% $p<0.05$). It was the most important factor that influenced cognitive-enhancing drug-taking behaviour (the standardised beta coefficient was 0.0395, while for the second most important factor – gender – the coefficient was 0.0388). Table 4 summarises the main factors that contributed to the usage.

There was no relationship between cognitive enhancement use and sleep quality or stress levels. Nor could we establish a link between usage and membership in a student organisation, having a job or studying in either of the two universities.

No other coherences between drug use and socio-demographic characteristics were found ($p>0.05$).

The self-evaluated stress levels did not differ between users (mean 5.98 out of 10; SD 2.47) and non-users (mean 5.93 out of 10; SD 2.17). Users indicated a slightly worse self-evaluated sleep quality than did non-users (mean 5.91 out of 10; SD 2.32 vs. mean 6.23 out of 10; SD 2.19), but the difference was not statistically significant.

Discussion

The purpose of our study was to gain knowledge of whether neuro-enhance-

Table 2. Use of cognitive enhancers among medical students of both genders (n = 579).

Drug	Men (n = 185)	Women (n = 394)
Nootropics*	76.9%	38.1%
Other	19.2%	28.6%
Amphetamines	15.4%	19.0%
Modafinil	15.4%	14.3%
Methylphenidate	7.7%	4.8%

Percentages are based on respondents that admitted to having used at least 1 substance.
*p<0.05

Table 3. Reasons for using cognitive enhancers among medical students of both genders (n = 579).

Reason	Men % (n = 185)	Women % (n = 394)
Improve concentration*	69.2	38.1
Increase studying time	46.2	62.9
Improve memory	61.5	33.3
Increase alertness	34.6	52.4
Experiment	38.5	28.6
Improve academic performance	38.5	19.0
Friends take it	11.5	14.3
Other reasons	3.8	14.3

Percentages are based on reported reasons for substance use.
* p<0.05

Table 4. Logistic regression analysis of factors that had the greatest influence on consuming the drugs (n = 579).

Independent variable	Standardised Coefficient*	P Value
Knowing someone who had used	0.0395	<0.001
Gender	0.0388	<0.001
Stress level (10 point VAS)	0.0091	0.476
Having a job	0.0086	0.447
Age	-0.0005	0.846
GPA	-0.0018	0.981
Belonging to an organisation	-0.0048	0.727
University	-0.0056	0.728
Sleep quality (10 point VAS)	-0.0109	0.361

*Note: calculated using King's formula for logistic regression (see reference).

ment should be addressed in Lithuania and the surrounding countries. The prevalence of substance use for cognitive enhancement has not been previously examined either among university students or in the whole population of Lithuania or in other countries of the Baltic region. Students from this region constitute an interesting population for evaluations, as Lithuania, followed by Estonia, have the

highest rates of alcohol consumption per capita in the European Union (OECD/European Union, 2014). In this study, we did not evaluate alcohol consumption, but a correlation between the use of neuro-enhancing drugs for studying purposes and alcohol consumption has been found in previous studies (McCabe et al., 2005). It is therefore highly interesting to evaluate what the prevalence is of substance abuse of neuro-enhancers in a population where one of the most devastating phenomena of substance abuse (high alcohol consumption) is so common. Several important findings emerged from this study.

Prevalence

A significant proportion (8.1%) of respondents admitted that they had used a neuro-enhancing drug for studying purposes. It indicates that the usage of neuro-enhancing drugs as a phenomenon is present in Lithuania. Also, it may be useful to investigate this phenomenon in the other Baltic countries as well as in the Nordic countries, which share similar cultural backgrounds and educational systems. Together with other studies (Eickenhorst, Vitzthum, Klapp, Groneberg, & Mache, 2012; Maier et al., 2013; Emanuel et al., 2013; Ragan et al., 2012; Mazanov et al., 2012; Castaldi et al., 2012; Habibzadeh et al., 2011; Benotsch, Jeffers, Snipes, Martin, & Koester, 2013), our results show that the problem is widespread. However, we also observed some differences in comparison to the results of studies from the United States (Weyandt et al., 2009; Benotsch et al., 2013; DeSantis, Webb, & Noar, 2008; Garnier-Dykstra et al., 2010) and probably also from the United Kingdom (Low & Gendaszek, 2002). The results of our study are comparable to those from Germany (Eickenhorst et al., 2012; Ragan et al., 2013), Switzerland (Maier et al., 2013), Belgium (Ragan et al., 2013) and Australia (Mazanov et al., 2013): at the time of the surveys and as a main difference from the American studies, we have had lower rates of students using ADHD medications or psychostimulants (methylphenidate, amphetamine derived drugs, modafinil).

This may be explained by a higher availability of these drugs in the United States (Mache, Eickenhorst, Vitzthum, Klapp, & Groneberg, 2012). Furthermore, ADHD diagnosis prevalence in United States was reaching 11% by 2011 (Visser et al., 2013), while in Lithuania and other European countries the prevalence of the disorder ranges from 1 to 3%. Such differences are mainly due to different diagnostic criteria of this condition as defined in DSM-V, used in the United States, and ICD-10, which is used in Europe to diagnose and classify mental illnesses. While it is known that one of four students diagnosed with this condition is prone to sell or distribute these medications to their healthy peers (Ragan et al., 2013), the rising prevalence of the disorder may also influence the spread of non-medical use of prescription drugs. Moreover, there are only few approved medications for this condition in Lithuania, and even those existing are hardly affordable to Lithuanian students not only because of strict law regulations on prescribing these drugs, but also because of a relatively high price compared to the students' monthly income. This may explain why the use of methylphenidate, the only legal drug for attention disorder in Lithuania, was reported to be 20 times less frequent as compared to the rates of

use in South America, where the medication is most widespread (Finger, Da Silva, & Falavigna, 2013; Urrego et al., 2009).

In our study, we also investigated the use of nootropic drugs among medical students. Until recently, only some studies had evaluated the use of these drugs (Clegg-Kraynok et al., 2011; Castaldi et al., 2012). The rate of use of piracetam in these studies was near zero (0.1 and 0.2%), while in our study it was 4%, exceeding the use of all other prescription medications.

On the other hand, our results support the previous findings that piracetam and other nootropics may be widely used by healthy individuals to enhance cognitive functions in study-related performance (Corazza et al., 2014). Therefore, according to the results of our study, investigations of piracetam abuse should be included in future research. We argue that there is a need for evidence-based decision-making, and while our study is a step forward, more studies in this particular population should be conducted.

Gender differences

We also found that male students reported two times higher consumption of neuro-enhancing drugs compared to females. This is consistent with several previous studies (Emanuel et al., 2013; McCabe et al., 2005; Ragan et al., 2013; Verdi, 2013; DeSantis et al., 2008; Bogle & Smith, 2009; Dietz et al., 2013; Franke & Lieb, 2010; Judson & Langdon, 2009), but inconsistent with some others (Teter et al., 2010; Weyandt et al., 2009; Mache et al., 2012; Carroll, McLaughlin, & Blake, 2006; McNiel et al., 2011; White, Becker-Blease, & Grace-Bishop, 2006). These discrepancies may be associated with different attitudes towards substance use of both sexes worldwide. Also, it has to be taken into consideration that higher prevalence of substance use among male students may be due to relatively higher rates of attention deficit disorder among adult males (Mazanov et al., 2013), and these individuals may be self-medicating due to an undiagnosed condition. Attention deficit disorders and other psychiatric disorders continue to be stigmatised in Lithuania and other post-Soviet countries, which often leads to them being neglected and left untreated (Voren, 2013). This could be the case in our sample, too, and should be taken into consideration when investigating the phenomenon in the region.

Influence on substance-using behaviour

In our study, knowing someone who had used neuro-enhancing drugs was the most important factor influencing cognitive-enhancing drug-taking behaviour, implicating that Lithuanian students are vulnerable to peer pressure. This finding is consistent with data from previous research. Carroll et al. (2006) has also showed the relationship and found that even non-users with substance-using peers were more knowledgeable about the effects of these drugs. This knowledge may lead to an increased risk of future substance use for studying purposes in cases where students become interested in seeking positive effects experienced by their friends (Carroll et al., 2006). Because a considerable proportion – 190 respondents (33.8%) of our survey – reported knowing someone who had used such drugs, these individuals may be at risk for neuro-enhancing drug abuse in the future.

Valuable information was obtained in our study that there is no relation between grade point average (GPA) and the use of neuro-enhancing drugs. This could be used to discourage students from taking these substances. Several studies have also shown that students engaged in neuro-enhancement had a lower GPA in comparison to those not engaged (McCabe et al., 2005; Clegg-Kraynok et al., 2011; Habibzadeh et al., 2011; Garnier-Dykstra et al., 2010), further confirming that neuro-enhancement use has no positive effect on students' grades and thus countering usual student expectations of higher grades.

In addition, we found no correlation between involvement in a student organisation's activity or having a job and the use of cognitive enhancers. According to our study, involvement in multiple activities does not lead to searching for medications to help learning, which does not agree with data from previous studies. It was established in the United States that membership of a fraternity/sorority was associated with a higher risk of neuro-enhancing drug misuse among students (McCabe et al., 2005; Clegg-Kraynok et al., 2011). This confirms previous findings that availability of these drugs may be higher for members of these organisations. (DeSantis et al., 2008). While there are no fraternities/sororities in Lithuania, we did include a question regarding participation in student organisations. The reason why we did not find a difference may be attributed to the fact that half of all students belong to these organisations and the relationships between students in them are usually weaker than in sororities/fraternities.

As in a study on sleep quality and prescription psychostimulant usage performed in the United States, where it was found that non-medical users had worse component scores of subjective sleep quality and sleep disturbances (Clegg-Kraynok et al., 2011), we expected that the users of our study would also report worse sleep quality. However, this was not the case. The discordance is probably due to several reasons: low sleep quality was reported by both non-users and users (6.23; SD 2.19, in non-users as compared to5.91; SD 2.32, in users). The insignificant difference ($p>0.05$) presumably results from the medical students' high stress levels and high workloads, which could diminish the influence of sleep quality on neuro-enhancer use. Moreover, the questionnaire interrogated about lifetime prevalence of drug use, while self-evaluated sleep quality referred to the present quality of sleep. Therefore, even though the respondent may have had worse sleep quality at the time of taking the drug, one could still report normal sleep at the time of the survey. Higher self-reported stress levels among users were also expected, as in several previous studies (Verdi, 2013; Webb et al., 2013; Dussault & Weyandt, 2011). However, the relationship was not found in our study and in some other studies (McNiel et al., 2011), most likely because of the same reasons as those acting on subjective sleep quality.

Reasons for use

According to our findings, students choose drugs for studying purposes and prefer short-term effects over long-term effects. Concentration improvement or longer studying time have been the most frequently cited reasons in all studies (Emanuel et al., 2013; Teter et al., 2010; Clegg-

Kraynok et al., 2011; Mazanov et al., 2013; Habibzadeh et al., 2011; Mache et al., 2012; Bogle & Smith, 2009; McNiel et al., 2011). An interesting major difference was found in comparing the reasoning of male and female students: male students were more prone than females to seek improved concentration, suggesting different types of studying by gender. Maybe men who are generally prone to distraction are looking for any way to avoid being distracted and this is why concentration improvement is the main reason leading to any means available, including drugs. Women tend to want more study time – falling asleep is not an option – which is consistent with the finding that increased study time is the main reason reported by female students.

Limitations and future research

There are some limitations in our study. First, students participated in the study without any previous knowledge about it, which means that a surprise factor may have played a role and memories could be biased, especially when the students were asked to self-report non-medical drug use. However, this factor could also be advantageous, for some students could have chosen not to participate in the survey if they had had information about it in advance. Second, in some lecture halls the students were sitting quite close to each other when filling in the questionnaires, so some cases of cognitive enhancement may have gone unreported if the students were concerned that somebody could detect a positive answer, given that non-medical use of prescription drugs is illegal. Still, previous studies have indicated that anonymous self-reported surveys have low misreporting rates (Emanuel et al., 2013). Third, the study was conducted during lecture time. Lecture attendance is non-obligatory by law in Lithuania. We did not find any differences of GPA between users and non-users, but other studies have found lower GPAs among users (McCabe et al., 2005; Clegg-Kraynok et al., 2011; Habibzadeh et al., 2011; Garnier-Dykstra et al., 2010). While medical students tend to attend lectures conscientiously, we cannot exclude that some students with lower GPA skip lectures more frequently than do students with a higher GPA. Our investigated population of students could therefore have a lower proportion of students with a lower GPA.

As the study was designed to gather preliminary data, and the main purpose was to find out whether the phenomenon was present in this particular medical students' population, we obtained information about lifetime, but not last-year, prevalence. This is a limitation that should be tackled in future research on this topic in the region. In addition, no randomisation was performed in our study, resulting in a sample with a large portion of third- and fourth-year students. However, because the study year was not taken into consideration in any comparisons and as we investigated the lifetime and not past-year prevalence, any correlations of the results with the study year would be less important. Another limitation is that we did not collect information regarding other stimulants (nicotine, caffeine or such illicit drugs as cocaine), nor were participants screened for ADHD, anxiety or depression. Lack of this information limits our ability to attribute variances exclusively to cognitive enhancer use and prevents analyses of neuro-enhancer use in participants with pre-existing disorders.

Further studies with more random sampling, performed during obligatory clinical rotations or laboratory practices and with highly secured anonymity are strongly encouraged. Also, we underline the import of long-term effects of cognitive enhancer usage on academic performance. As a new trend of nootropic usage (for example, piracetam) emerged in our study, we believe that more extensive studies regarding this phenomenon should be conducted to get a broader view on this previously underreported phenomenon.

Conclusion

Despite the limitations above, the findings from our study show that a considerable portion (1 of 12) of medical students have used neuro-enhancing drugs in Lithuania, male respondents being three times more likely to engage in this behaviour than females, and knowing somebody who has used such drugs being the main contributing factor. Students are using cognitive enhancers for a variety of reasons, concentration improvement being the most frequently reported. Worth mentioning is a quite high report rate of nootropics use – 4% in our study – as compared to previously reported small numbers (0.1 and 0.2%). This suggests a need to investigate misuse and possible effects on healthy individuals of these medications as well.

We urge future researchers to address similar questions in other Baltic and Nordic countries and to extend the scope of influential factors such as the sources of drugs and availability/ affordability in each country. Our study makes an important contribution to Lithuania's health reporting by giving an overview of the drug-taking behaviour among medical students. This can help to develop educational and preventive strategies to be included into Lithuanian university curricula. University might be an opportune time to educate students in general and medical students in particular about the risks of drug-taking behaviour. Medical students are a high-risk group now and they are also prescribers of drugs in the future. The problem should be addressed before it spreads.

Declaration of interest None.

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