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Psychosocial motivators of “smart drug” use amongst university students

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Abstract

University students' use of “smart drugs” during the course of their studies appears to be on the rise. “Smart drugs”, more formally known as nootropics (noo = mind, tropic = to turn or change; Cakic, 2009; Giurgea & Salama, 1977), are substances which can be prescribed to improve mental performance, including memory recall, attention and concentration, amongst other cognitive abilities. Nootropic medications are commonly prescribed to reduce the cognitive deficits associated with a number of medically diagnosed conditions, including vascular dementia, stroke, attention-deficit hyperactivity disorder (ADHD), and schizophrenia. Whilst these substances may be legitimately prescribed to address cognitive impairments in clinical populations, there has been a notable increase in societal concern over the use of these substances by healthy individuals as means of improving their cognitive performance without a medical prescription. A key risk group for the non-prescribed use of these stimulant nootropic “smart drugs” are university students, who may use substances such as methylphenidate (“Ritalin”), wakefulness-promoting medications or eugeroics (e.g. modafinil), as well as various legal substances, nutraceuticals and dietary supplements, to improve their performance in their academic studies. The aim of this chapter is to briefly review the use of non-medically prescribed stimulant “smart drugs” by university/college students in higher education, focusing on the psychosocial motivators underlying students' use of smart drugs to improve academic performance, and an outline of potential interventions for reducing use in this population.

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The prevalence of “smart drug” use amongst university students

The overall rate of prescription of cognitive enhancing “smart drug” substances like Ritalin and modafinil appears to have increased over the past ten or so years (e.g., Piper et al., 2018; Renoux, Shin, Dell’Aniello, Fergusson, & Suissa, 2016). Establishing the actual prevalence of non-prescribed stimulant use amongst students is, however, a difficult endeavour. There is a limited understanding of the prevalence of university students’ use of non-prescribed stimulants, especially outside of the USA (Ragan, Bard, & Singh, 2013), although students appear to be more likely to use non-prescribed stimulants compared to their same-age peers not in university/college (Ford & Pomykacz, 2016). There is also some empirical evidence to suggest that use of Ritalin and similar substances to improve academic performance has not increased since the 1960s despite media reports to the contrary (Rosiers & Van Hal, 2010). It is possible that ‘smart drug’ use amongst university students is less widespread than commonly assumed.

Many students who use smart drugs appear to do so on an intermittent basis (McCabe, Teter, & Boyd, 2006) and tend to secure these substances via classmates and friends, who may themselves have legitimate prescriptions and medical reasons for their use (Bavarian et al., 2017; Garnier-Dykstra, Caldeira, Vincent, O’Grady, & Arria, 2012; McCabe et al., 2006; Vrecko, 2015). Research has suggested that around half of students legitimately prescribed stimulant medications (e.g. for a diagnosis of Attention-Deficit Hyperactivity Disorder) have been approached by other students to sell, trade, or pass on their medication (McCabe et al., 2006). Longitudinal data has also suggested that around 60% of university students have been offered a prescription stimulant during the course of their studies (Garnier-Dykstra et al., 2012), indicating a potential issue with the availability of such stimulants to students. Alternative sources of smart drugs can include family members, clinicians deceived into prescribing stimulants, to more illicit sources such as university “black markets” where students sell cognitive enhancers to other students (Vrecko, 2015), online via the Dark Web (Cunliffe, Décarry-Hêtu, & Pollak, 2019; Del Vigna et al., 2016) and from unregulated internet pharmacies (Ragan et al., 2013). Given that obtaining smart drugs may involve illegal behaviour, which users may be unwilling to openly declare, ascertaining the true rates of student smart drug use may be difficult to determine.

Estimates of the prevalence of lifetime, recent, and active smart drug use amongst students have been provided by a number of published empirical studies. These studies typically suggest rates of any lifetime use of non-prescribed cognitive enhancing medications for academic purposes as being around 6-7%, with rates varying across countries (e.g., Helmer et al., 2016; Lucke et al., 2018; McCabe, 2008; McCabe, Knight, Teter, & Wechsler, 2005). Rates of recent use over the past 12 months lie are lower compared to lifetime use at around 4% (Lucke et al., 2018; McCabe et al., 2005), and around 2% in the past month amongst US students (McCabe et al., 2005). Most research has tended to focus on

undergraduate students, although there is some evidence to suggest similar rates of lifetime use exist amongst graduate students (Verdi, Weyandt, & Zavras, 2016).

There are, however, some well-known issues with understanding the prevalence of non-prescribed stimulants amongst students. There are inconsistencies across studies in how use is assessed and defined, and whether stimulant use includes recreational use in addition to intended use for promoting cognitive and academic performance (Ford & Pomykacz, 2016; Hall et al., 2005; Ragan et al., 2013; Schleim, 2010). Notably higher lifetime rates of non-prescribed stimulant use have been reported in student samples when the reasons for use are unspecified or include both recreational and academic use (Carter, Peralta, & Xi, 2019; Silvestri & Correia, 2016), for example “for non-medical purposes” (Bavarian et al., 2017) or “illegal use” (DeSantis, Webb, & Noar, 2008). Reported lifetime usage rates in such studies have included 8% (McCabe et al., 2006; Teter, Esteban, Cranford, Boyd, & Guthrie, 2005), 13.7% (Hall et al., 2005), 17% (Bavarian et al., 2017), 31% (Garnier-Dykstra et al., 2012) and 34% (DeSantis et al., 2008). Clearly, there is a need for empirical studies and surveys to focus on students’ intended non-prescribed stimulant use for academic reasons and avoid the possible inflation of prevalence rates by conflating these statistics with usage for more recreational purposes.

Whilst the use of non-prescribed “smart drugs” may be relatively low in the student population (i.e. is not a majority behaviour), awareness that these substances may be used to promote cognitive function and academic performance is likely to be significantly higher (Weyandt et al., 2009). For example, Maier and colleagues’ (2013) study suggested that a significant majority (93.7%) of their Swiss university student sample were aware that prescription stimulants could be used to improve their cognitive function. Sixty percent of Weyandt et al.’s (2009) sample reported knowing of other students who misuse non-prescription stimulants. The high awareness of these substances amongst students remains a concern for preventing use.

Generally, students report use non-prescribed stimulants to improve their cognitive and academic functioning (e.g., Bavarian et al., 2017; Kerley, Copes, & Griffin, 2015; Verdi et al., 2016). It should be noted, however, that a variety of substances aside from non-prescribed stimulants may be used by students to aid their academic performance, including various legal and illegal substances, over-the-counter medicines and medications which impact on other aspects of physiological functioning. Common legal substances which students use to improve their academic performance include coffee, tea, caffeine pills, energy drinks, Omega 3 supplements, over-the-counter cold and flu tablets, alcohol and tobacco (Lucke et al., 2018; Maier, Liechti, Herzig, & Schaub, 2013; Maier & Schaub, 2015). The reported rates of the use of such legal substances to promote academic performance remains higher compared to those reported for non-prescribed stimulants (e.g. 46.6; Lucke et al., 2018).

Common illicit substances used to aid performance typically includes cannabis, followed by cocaine, other forms of amphetamines, speed and crystal methamphetamine (Lucke et al., 2018). There is also evidence that students may use non-prescribed sedatives and sleeping medications to improve next-day cognitive functioning as an aid to relaxation, known as “indirect cognitive enhancement” (Lehne et al., 2018; Maier et al., 2013), potentially in combination with non-prescribed stimulants.

Whilst university students may use a variety of non-prescribed stimulants to aid their academic performance, these substances are also accompanied with a number of side-effects which may hinder aid their learning (Maier & Schaub, 2015). For example, a large scale survey study of Swiss university students’ use of prescription medicines and drugs of abuse for cognitive enhancement reported that common negative consequences of use included nervousness, disordered sleep, headaches, depressive symptoms, loss of appetite, tachycardia, anxiety attacks and aggressive behaviour, with 5% of the sample also reporting problems with their education as a result of their stimulant use (Maier et al., 2013). Although, a significant proportion of the sample in Maier et al’s (2013) study (38.1%) reported experiencing no problems related to using neuroenhancing substances. There are also potential risks with sourcing “smart drugs” online, including whether the substances obtained are counterfeits and/or whether these substances contain innocuous or harmful compounds due to their illicit, unregulated nature. It is not unreasonable to expect some potentially serious reactions to counterfeit cognitive enhancing stimulants obtained online.

In sum, whilst the use of “smart drugs” by university students appears to be a minority behaviour, there is evidence to suggest that a clear majority of the student population are aware that these non-prescribed substances can be taken as a potential means of improving their academic performance. Despite this, there are several potentially severe side-effects which may accompany the use of these non-prescribed stimulant medications, including negative effects on students’ academic achievement in addition to various health-related consequences, indicating that using these substances is not without risk.

Why do university students use ‘smart drugs’? A review of psychosocial motivators for students’ smart drug use.

Improving Academic Performance

Perhaps unsurprisingly, university students appear to be largely motivated to use smart drugs to improve their general academic performance and learning (Kerley et al., 2015; Maier et al., 2013; Weyandt et al., 2013). Related motivations include improving students’ focus during teaching sessions, improving test performance and coursework grades (e.g., London-Nadeau, Chan, & Wood, 2019; Verdi et al., 2016; Weyandt et al., 2009, 2013). Those students who perceive greater academic benefits associated with the use of non-prescribed

stimulants for academic performance have been reported to have higher odds of personally using such smart drugs themselves (Arria et al., 2018). More specifically, students tend to endorse using smart drugs to improve their cognitive abilities in the context of their studies, such as improving their memory recall, alertness, and concentration span (Bavarian et al., 2017; DeSantis, Noar, & Webb, 2010; Teter et al., 2005). Other research has suggested that motivations for using prescription stimulants change over the course of university studies, such as moving from initial curiosity towards more academic performance-related motives (Garnier-Dykstra et al., 2012).

In contrast to many students' expectations regarding the potential benefit of smart drug use for academic performance, longitudinal evidence suggests no clear benefit in terms of academic outcomes (namely grade point averages) associated with non-prescribed stimulant use (Arria et al., 2017). Rather, academic performance was significantly improved over time amongst those who abstained from using non-prescribed stimulants (Arria et al., 2017). Lower academic performances (i.e. lower grade point averages) have also been associated with greater likelihoods of non-prescribed stimulant use (McCabe et al., 2005, 2006), which could indicate a perceived pressure to use such "smart drugs" as a means to improve one's academic performance. A separate study reported that university students who used non-medically prescribed stimulants had poorer academic performance at the end of their first year of study, and also studied less, missed more scheduled teaching and socialised more than non-users (Arria, O'Grady, Caldeira, Vincent, & Wish, 2008). Although, only a minority (14%) of the student sample in Hall and colleagues' (2005) study agreed that use of illicit stimulants had long-term positive effects on their academic performance. Whilst students may be motivated to use non-prescribed stimulants to improve their academic performance, there is no convincing evidence that such substances are actually associated with improved grades.

To date, the majority of the research on students' motivations for using smart drugs for academic performance has been quantitative in nature. Quantitative approaches may provide a limited understanding of students' experiences and justification for using these substances, although some qualitative studies have explored students' experiences and decisions to use smart drugs. For example, students have discussed how non-prescribed stimulants like Adderall helped them to stay awake for longer to read and write assignments, and improved their focus during lectures which in turn enhanced their retention of information (Kerley et al., 2015). Qualitative studies have also provided indicated that some students perceive increases to their intelligence associated with their stimulant use (DeSantis et al., 2008, 2010; Kerley et al., 2015), although other studies have suggested the contrary position, of no perceived benefit to intelligence or cognitive abilities in the longer term associated with stimulant use (London-Nadeau et al., 2019).

Non-academic Social Reasons for Use

Aside from academic reasons, students also report using non-prescribed stimulants for social and recreational purposes, including to “get high” (Teter et al., 2005), be more talkative and sociable (DeSantis et al., 2010), and to experiment and “party longer” (Bavarian et al., 2017). Non-prescribed stimulants are often taken with other substances for recreational purposes, most commonly alcohol (DeSantis et al., 2010). Although the extent of such motives do seem to vary in the literature, with some students viewing non-prescribed stimulants as purely a means to improve their academic performance and not for recreational use (e.g. DeSantis et al., 2008; 2010). Students using stimulants for academic purposes appear to view their use as being rational and legitimate in nature, and as a valid short-term means of achieving their career aspirations, compared to those who use the same substances for recreational purposes (Kerley et al., 2015).

Common Demographic Risk Factors for Use

A number of risk factors for the use of prescription stimulants by students has been identified. For example, having an existing legitimate prescription for stimulants has been associated with higher odds of using these substances on a non-medical basis to improve academic performance (Lucke et al., 2018). There is mixed evidence on the role of year of study on usage rates (Weyandt et al., 2013), with some reports of increased use amongst students in later years of study (e.g., McCabe et al., 2006). Other studies have failed to observe differences in use based on students’ current year of study (Gallucci et al., 2017; Weyandt et al., 2009), suggesting no real increase in use over the course of university studies (Garnier-Dykstra et al., 2012).

In terms of sex-differences in use, male students tend to be more likely to use non-prescription stimulants than female students (Gallucci et al., 2017; Hall et al., 2005; Lucke et al., 2018; Maier et al., 2013; Rosiers & Van Hal, 2010; Teter et al., 2005; Weyandt et al., 2013). There is, however, some evidence to suggest female students are more likely to use “soft enhancers” like coffee, vitamins and tonics, and energy drinks, compared to male students (Maier et al., 2013). The specific reasons for this sex-difference in the use of non-prescribed stimulants are not wholly clear and some studies have failed to observe gender-difference in motives for using non-prescription stimulants despite differences in prevalence rates (Teter et al., 2005; Weyandt et al., 2013). Other risk factors for smart drug use include being White, and being affiliated to a student society such as a sorority or fraternity (DeSantis et al., 2008; McCabe, 2008; McCabe et al., 2005, 2006; Pino, Tajalli, Smith, & DeSoto, 2017; Weyandt et al., 2009, 2013).

There is some evidence to suggest that students’ place of residence influences the use of “smart drugs”, with higher use amongst those living away from their parental home (Rosiers

& Van Hal, 2010), off-campus in general (Bavarian et al., 2017; McCabe et al., 2006), and those who live off-campus without family members (Pino et al., 2017). The role of Greek sorority/fraternity affiliation as a risk factor for use amongst US students may be reflective of shared residences for members of these societies and the ease of obtaining smart drugs from others (DeSantis et al., 2010). Smart drug use may be more likely when living with other students without being on the immediate university premises, where use could be caught or subject to reprimands by the university. Given that students tend to obtain prescription stimulants from other students (Garnier-Dykstra et al., 2012), whether explicitly from others or potentially by theft, it is not surprising that living with other students is one risk factor for use.

Academic Pressure and Competitiveness

A growing literature body of research has linked the use of non-prescribed stimulants specifically to perceived academic pressures and competitiveness (DeSantis et al., 2008; Maier et al., 2013), with heavier use noted at universities with more competitive entry requirements (McCabe et al., 2005). Specific subgroups of students may also be at higher risk for use, particularly those studying courses associated with high stress levels and competition. For example, medical students who had stronger perceptions that medical school is competitive, and who had higher stress levels, were more likely to use non-prescribed stimulants to improve their academic performance (De Bruyn, Wouters, Ponnet, & Van Hal, 2019). Students who reported use of non-prescribed stimulants in the previous year were more likely to engage in other forms of academic dishonesty, particularly plagiarism of other students' work (Gallucci et al., 2017), which may be broadly indicative of pressures to perform well in academic studies.

Students may experience heightened pressures to perform at key assessment and examination periods and may turn to using non-prescribed stimulants at these key times of the academic year (Kerley et al., 2015). Indeed many students appear to justify their use of non-prescription stimulants only during times of heightened stress (Kerley et al., 2015). There have, however, been some mixed findings on the role of assessment periods as a key time for smart drug use. Some studies have reported increased use of smart drugs at key assessment times and examination periods (Rosiers & Van Hal, 2010), including during final examinations (DeSantis et al., 2010; Hall et al., 2005), whilst others have suggested that students tend to use softer cognitive enhancers (e.g. coffee) nearer to examinations (Maier et al., 2013). A novel study analysing twitter posts relating to Adderall, a commonly abused cognitive enhancer, also suggested peaks of posts during December and May assessment periods (Hanson et al., 2013). Whilst a common assumption is that students may increase their use of cognitive enhancing "smart drugs" at the time of assessments, the evidence to date is somewhat more mixed although few studies have focused on use of non-prescribed stimulants over the course of an academic year.

Social Norms and Social Acceptability of “smart drug” use

A body of research has investigated the potential social pressures experienced by students to use non-prescribed stimulants for academic purposes. These influences can include an explicit pressure to initiate or maintain use, or an implicit perception that using smart drugs is a commonplace and an accepted behaviour amongst students on the same course or at the same institution. Indeed, a number of studies have reported that students commonly perceive “smart drug” use to be a common and widespread behaviour at their institution (DeSantis et al., 2010; Kerley et al., 2015). In a study sampling graduate students the most frequently reported perceived motivations for smart drugs included knowing of other students using non-prescribed stimulants during examinations and whilst studying and during final assessments (Verdi et al., 2016). Indeed, associating with other stimulant-using students has been associated with higher odds for personal use of such substances for academic purposes (Lucke et al., 2018). Students who use non-prescribed stimulants often view these substances as being different from common “street drugs”, which may have negative physiological effects on the user, and viewed smart drugs as a more socially acceptable and legitimate means for achieving their goals and career aspirations (Kerley et al., 2015).

A number of studies have explicitly focused on students’ social normative perceptions of non-prescribed stimulants amongst their peers. Perceived social norms are a key predictor of various health-related behaviours, and whilst there are different conceptualisations for what a social norm is, they commonly focus on perceived peer use and perceived peer approval of use (Dempsey, McAlaney, & Bewick, 2018). For example, a large study with European university students reported that the majority of students thought that the majority of their peers at their university used stimulants more frequently than themselves to improve their academic performance (Helmer et al., 2016). Other studies have suggested similar misperceptions or overestimations of the use and acceptability of non-prescription stimulants (McCabe, 2008; Silvestri & Correia, 2016). These misperceptions are similar to those noted for other substances used by students (Perkins, Meilman, Leichliter, Cashin, & Presley, 1999), including alcohol (McAlaney et al., 2015), tobacco (Pischke et al., 2015), cannabis (Dempsey et al., 2016), other illicit substances (Helmer et al., 2014) and non-prescribed sedatives (Lehne et al., 2018). Perceptions, or “misperceptions”, that smart drug use is more common and more accepted by one’s peers may exert social pressure on students to match what they perceive the social norm is (Festinger, 1954). For example, students who perceived that their friends and family are more approving of non-prescription stimulant use for academic purposes were more likely to use these substances (Pino et al., 2017). Similarly, students who use non-prescribed stimulants in the past year perceived that their peers had greater use and approval of smart drug use than non-users (Silvestri & Correia, 2016). However, the study by Silvestri and Correia (2016) focused on general non-prescription stimulant use, rather than use for academic purposes alone.

Overestimations of the use and acceptability non-prescription stimulants amongst students may arise for a number of reasons, such as the false consensus effect (Ross, Greene, & House, 1977). The highlighting of what is a minority behaviour by the media and through casual conversation may make such behaviours seem to be commonplace, may ignore the actual healthy behaviours of the majority, and inflate the perceived social norms of using “smart drug” substances (Dempsey et al., 2018; Maier & Schaub, 2015; Perkins, 2003). Given that non-prescription stimulant use for academic purposes appears to be a minority behaviour, these misperceptions could make “smart drugs” appear to be more normative and acceptable than the actual reported rates.

Expectancy effects

Similar to the inflated perceptions of the social norms of “smart drug” use, there is a growing body of research suggesting that students misperceive, possibly overestimate, how effective non-prescribed stimulants will be in terms of improving their cognitive abilities and academic performance. There is evidence of a placebo or an expectancy effect associated with the use of cognitive enhancers by students. For example, a novel experimental study found that students were no better than chance at guessing whether they had actually been prescribed an enhancer (mixed-amphetamine salts) or a placebo (Cropsey et al., 2017). Students given a cognitive-enhancer only improved performance on two out of thirty-one cognitive performance tasks in this study; however, those who believed that they had received the active medication, regardless of what they actually received, had improved performance on the cognitive experimental tasks (Cropsey et al., 2017). Other experimental studies with student samples (without ADHD) suggest that the benefits associated with stimulant medication may be due to expectancy effects (Lookatch, Fivecoat, & Moore, 2017), and that any benefits are more pronounced for subjective measures (e.g. positive emotion) and/or autonomic functioning (e.g. heart rate; Weyandt et al., 2018). These studies with otherwise healthy students without a history of ADHD supports other research suggesting limited cognitive benefits associated with taking cognition-enhancing stimulants amongst healthy individuals (Lookatch et al., 2017).

Motivations for not using “smart drugs”

So far, this review of the psychosocial motivators of non-prescribed stimulants for academic purposes has focused on the factors associated with an increased likelihood of use. There are, however, a small number of studies which have explicitly focused on the factors associated with abstinence from using “smart drugs”. For example, students who have a more academic “ethic”, i.e. those who prioritise their academic studies and who study in a disciplined and intense manner, are less likely to use non-prescribed stimulants (Pino et al., 2017). Factors such as students’ concern over the possible negative consequences of using non-prescribed stimulants and social disapproval from friends and family have been

highlighted as other motivators for abstinence from using stimulants (Rosansky & Rosenberg, 2019).

Ethnicity has been consistently identified as a possible protective factor against using “smart drugs”. Various studies have found that non-White students are less likely to use non-prescribed stimulants compared to White students (e.g., Arria et al., 2008), although some studies have failed to observe differences in stimulant use between students of different ethnicities (Carter et al., 2019). However, a stronger sense of ethnic identity (relating to a closer social identification with one’s ethnicity and positive self-esteem) reduced the use of non-prescription medications amongst non-White students but not for White students (Carter et al., 2019). These studies are however limited by their dichotomisation of ethnicity into groups of White versus non-White students, limiting an understanding of the experiences of specific ethnic groups (Arria et al., 2008; Carter et al., 2019). Although, some studies have reported lower rates of use amongst Asian and African American students compared to White/Caucasian students (e.g. McCabe et al., 2005; Teter et al., 2005). It may be that having stronger identification with a relevant social group who share similar cultural values, especially one which has low approval of stimulant use, is important in determining one’s use of stimulants.

Summary of motivators of “smart drug” use

There are several key motivators for students’ use of non-prescribed stimulant substances. Improving one’s academic performance and ability to study appear to be significant motivators for use, however a range of demographic factors (e.g. being male, living off-campus with other students, affiliation with a student society), perceived pressure to succeed academically, and the expectancy that “smart drug” use will improve performance also appear to be important in the uptake of such substances. There is also a significant role for social influence factors, such as perceived social norms and pressure from peers. Students who use non-medically prescribed prescription stimulants appear to perceive that these substances are more socially acceptable and more widely used by their peers and seem to view these substances as being more effective on their academic performance, than the reality. Targeting such misperceptions and faulty beliefs about these substances’ effectiveness, alongside addressing their availability, appears to be important for intervention efforts to reduce students’ use of stimulant “smart drugs”.

How can “smart drug” use be discouraged amongst university student populations?

There are several potential targets for intervention to reduce students’ use of non-prescribed stimulants, however, a number of the reviewed risk factors for using stimulants by students are unchangeable or difficult to change (e.g. fixed demographic variables). Therefore, intervention efforts need to be focused on those psychosocial factors which can be targeted and changed (Looby, Beyer, & Zimmerman, 2015), such as students’ self-

efficacy, expectancies, beliefs and perceptions of the benefits of stimulant use, and the perceived social norms of use. To date, however, there have been few published interventions focusing on psychosocial factors to reduce students' usage of non-prescribed stimulants.

A novel study tested an expectancy-challenge based intervention amongst a sample of stimulant-naïve students (i.e. those without a history of use) which presented students with research evidence challenging the perceived cognitive benefits of stimulant use (Looby, De Young, & Earleywine, 2013). Students receiving the challenge intervention had weakened positive expectancies of the cognitive enhancement benefits of stimulants post-intervention, with no difference between the intervention and a no-intervention control group at a six-month follow-up. There were, however, no group differences in the initiation of non-prescription stimulant use between groups, although more negative expectancies of stimulant use relating to arousal and anxiety feelings appeared to be protective against stimulant use (Looby et al., 2013).

One potential existing intervention method for stimulant use is the Social Norms Approach, a means of promoting positive behaviour by challenging misperceptions of the perceived acceptability and use of substances amongst a clearly defined social group (Dempsey et al., 2018; Perkins, 2003). This approach has been widely used with university student groups to challenge other substance use behaviours, particularly alcohol (Dempsey et al., 2018). Such interventions challenge overestimations of peer use and attitudes towards substances through information-based interventions, primarily using web-based personalised normative feedback to highlight discrepancies between students' own attitudes and use with the perceived and actual norms. A promising approach would be using social normative feedback to discourage initiation of stimulant use amongst students by promoting the low actual rates of use amongst the student body. Indeed, previous work with students who abstain or drink low amounts of alcohol has indicated that social norms feedback can protect against time-related increases in use (Neighbors et al., 2011). To date, no studies appear to have applied this approach to reduce or prevent use of non-prescribed stimulants amongst students.

Alongside challenging the perceived social pressure and norms of stimulant use, it would also be appropriate for interventions to focus on improving students' self-efficacy and ability to resist initiating use of stimulants. As previously discussed, university students appear to perceive that such substances are readily available on campus, can be sourced from other students, and are commonly used by their peers. Improving students' confidence in their academic abilities, and improving their "academic work ethic" (Pino et al., 2017), may also be potential targets for interventions to bolster individual students' abilities to resist initiating use. In relation to this, work by Carter et al (2019) suggests the potential benefits

of a shared social identity with a group which disapproves of stimulant use. Whilst in Carter's study this focused on ethnic identity, it may also be prudent to reinforce students' sense of shared identity with other students at their university alongside intervention messages highlighting the low actual rates of stimulant use.

Alternative suggested targets for intervention from the empirical literature include highlighting the actual lack of improvements to academic performance amongst students at-risk for using prescription stimulants for academic purposes (Arria et al., 2017). Highlighting the potential risks of non-medically prescribed stimulant use has also been suggested (Arria et al., 2008), although this could be problematic as there is evidence to suggest students misperceive the likelihood of personally experiencing negative consequences of substance use (Mallett, Lee, Neighbors, Larimer, & Turrisi, 2006). In addition to these potential psychosocial factors, addressing the actual availability of stimulants on-campus is a concern for intervention efforts, especially considering the high number of students who report that such substances are available to them (e.g. Weyandt et al., 2009). Whilst the intervention literature is somewhat limited in relation to reducing use and preventing initiation of stimulant use, there are some clear targets for interventions. Focusing on reducing the availability of these substances, students' expectancies of the benefits of these substances and the perceived norms of their use, alongside improving students' academic self-efficacy, require testing in appropriately controlled interventional studies.

Conclusions & Future Directions

Despite media reports to the contrary, the use of non-medically prescribed stimulants by students to improve their academic performance appears to be a minority behaviour on university campuses. Awareness of these stimulants and perceptions that these substances could potentially improve one's cognitive abilities and academic performance does, however, appear to be more prevalent. Unsurprisingly, students who do use these substances tend to do so for the perceived benefits on their studies and performance at university. There is a lack of evidence demonstrating that using non-prescribed stimulants actually leads to improvements in academic performance. Rather, it seems that there are expectancy or placebo-like effects associated with these substances, particularly for more subjective outcomes and mood states. In terms of the empirical literature, improvements are needed in terms of how stimulant use for academic reasons is assessed in studies in order to avoid conflating recreational use with intended use for improving academic performance.

Given that most students tend to obtain these substances from other students or family members, and that such substances are perceived to be readily available and effective, intervention efforts need to focus on boosting students' academic self-efficacy, their ability to resist initiating use, and on challenging the myths that such substances are widely used

by their peers. It should be noted, however, that students may use a range of licit and illicit substances to improve their academic performance, including “soft enhancers” such as caffeine and over-the-counter medications, in addition to non-pharmacological means. To date, the interventional literature focusing on reducing and/or preventing stimulant use amongst students is limited in quantity and there is a clear need for high quality, controlled, interventional studies. Whilst the use of non-prescription stimulants may involve illegal behaviours, and may be associated with negative health and academic outcomes, there is a need for a societal debate about which forms of cognitive enhancement are deemed to be acceptable for use amongst students (Brühl, d’Angelo, & Sahakian, 2019).

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