The Use and Impact of Cognitive Enhancers within Higher Education in the United Arab Emirates

Thesis submitted to the University of Hertfordshire in partial fulfilment of the requirements for the degree of Doctor of Philosophy (PhD)

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November 2022

DECLARATION

I confirm that this is my own work and written all the text herein and the use of all material from other sources have been properly and fully acknowledged.

Signed: Safia Sharif

Date: 10 Nov 2022

ACKNOWLEDGEMENTS

First, my gratitude goes to Allah (my Lord) for His guidance and for giving me the power, the strength, and patience to accomplish my doctoral degree thesis even with the struggles I went through during my PhD journey.

I wish to express my gratitude towards my academic supervisors. First and foremost, I would like to send a special thanks to Dr. Amira Guirguis who has supported and guided me from the very beginning of my PhD journey. I have learned so much about what it takes to be an academic and her feedback I received from her was sometimes not what I wanted to hear; it was always what I needed to hear.

A huge thank you to Dr. Suzanne Fergus for encouraging me to stay on track when it was so easy to become derailed. Her constructive feedback and consistency were precisely the push and the motivation that I needed to complete this work.

An endless thanks to the most helpful person that I met ‘’Professor Fabrizio Schifano’’ for his guidance and advice who provided invaluable feedback on this research from its early development and the additional layer of support.

Moreover, I am deeply thankful to Mr. Nigel Smeeton for the productive collaboration in the survey analysis. I would like to thank him for his indispensable role in supporting with the survey study

Finally, I would like to thank my four children (Dana, Arwad, Saif and Fatima) for their patience and understanding through those long nights of studying, “I’m almost finished.” I am ecstatic to say, “I’m finally finished!” Thank you to my husband, Ali, who never underestimated my ability to complete this enormous task and for pushing me when I was ready to give in.

Thank you to my mother ‘Fatma’ for supporting my dreams, and proposed this idea said, ‘’I’m sure you can do it’’. Those words were the spark that motivated this journey. Thank you!

To each of the above, I extend my deepest gratitude.

PUBLICATIONS AND CONFERENCE PRESENTATION FROM THIS THESIS

Publications

- **Publication I . Sharif, S.,** Guirguis, A., Fergus, S., & Schifano, F. (2021). **The Use and Impact of Cognitive Enhancers among University Students: A Systematic Review.** *Brain Sciences*, *11*(3), 355. https://doi.org/10.3390/brainsci11030355.
  (Impact factor. 3.114)

- **Publication II. Sharif, S.,** Fergus, S., Guirguis, A., Smeeton, N., & Schifano, F. (2022). **Assessing prevalence, knowledge and use of cognitive enhancers among university students in the United Arab Emirates: A quantitative study.** *PloS One*, *17*(1), e0262704. https://doi.org/10.1371/journal.pone.0262704 **(Impact factor. 3.24)**

- **Publication III.** Schifano, F., Catalani, V., **Sharif, S.**, Napoletano, F., Corkery, J. M., Arillotta, D., Fergus, S., Vento, A., & Guirguis, A. (2022). **Benefits and Harms of 'Smart Drugs' (Nootropics) in Healthy Individuals.** *Drugs*, 10.1007/s40265-022-01701-7. Advance online publication. https://doi.org/10.1007/s40265-022-01701-7 **(Impact factor. 9.546)**

Scientific Conference Presentations

- **Sharif, Safia;** Guirguis, Amira; Fergus, Suzanne; Schifano, Fabrizio **"The Use and Impact of Cognitive Enhancers among University Students: A Systematic Review".** Oral Presentation at the University of Hertfordshire, 18 March 2019, Hatfield, UK

- **Sharif, Safia;** Guirguis, Amira; Fergus, Suzanne; Schifano, Fabrizio "**The Use and Impact of Cognitive Enhancers among University Students: A Systematic Review."** Oral Presentation at the Dubai International Pharmaceuticals and Technologies Conference and Exhibition (DUPHAT), 5-7 April 2021, Dubai, UAE

Scientific Conference Posters

- **Sharif, Safia;** Guirguis, Amira; Fergus, Suzanne; Schifano, Fabrizio **"The Use and Impact of Cognitive Enhancers among University Students: A Systematic Review".** Poster at the University of Hertfordshire, 15-16 April 2019, Hatfield, UK.

- **Sharif, Safia;** Guirguis, Amira; Fergus, Suzanne; Schifano, Fabrizio **"The Use and Impact of Cognitive Enhancers among University Students: A Systematic Review".** Digital Poster at the Dubai International Pharmaceuticals and Technologies Conference and Exhibition (DUPHAT), 5-7 April 2021, Dubai, UAE

ABSTRACT

Introduction: Cognitive enhancers (CEs), also known as 'smart drugs,' 'study aids' or 'nootropics' are a cause of concern. Recent research studies investigated the use of CEs being taken as study aids by university students. Despite being illegal in most countries, the diverted non-prescription use of these molecules and the related potential for dependence and/or addiction is being reported. It has been demonstrated that healthy students (i.e. those without any diagnosed mental disorders) are increasingly using drugs such as methylphenidate, mixtures of dextroamphetamine/amphetamine, and modafinil, for the purpose of increasing their alertness, concentration or memory. These products are available on prescriptions and on the illicit market. Due to high academic pressure, university students are at risk of CE misuse. However, data regarding this issue are limited, especially in the United Arab Emirates (UAE).

Aim: The current PhD thesis aimed to exploring the phenomenon of cognitive enhancers use among UAE University students.

Methodology: Study 1. A systematic review was performed, in adherence with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. Whilst 1,400 studies were identified within this review through a variety of electronic databases (e.g. 520 through PubMed, 490 through Science Direct and 390 through Scopus), 48 papers were deemed as relevant and were included in the review. **Study 2.** A cross sectional study based on a validated online survey that was distributed using university-licensed software (Qualtrics) as a direct web link via email and social media to all Medical, Pharmacy, Dentistry, Nursing and Engineering students enrolled in six UAE Universities. Associations between student characteristics and CE use were investigated using the Pearson's Chi-squared test and Multiple logistic regression (MLR). Reasons for CE use, temporal patterns of use, details regarding purchase and types of CE used were compared by gender. **Study 3.** The study was a qualitative research design conducted in different academic settings of the UAE. Data were analysed thematically for the identification of themes and subthemes within the data using a coding protocol.

Results: Study 1. The most popular molecules identified here included the stimulant CEs, e.g. methylphenidate, modafinil, amphetamine mixtures and caffeine-related compounds; stimulant CEs' intake was more prevalent among males than females; drugs were largely obtained from friends and family, as well as via the Internet. **Study 2.** One quarter of students had used CEs**.** There was a clear difference between users and non-users in terms of gender ($p<0.001$). CE users were disproportionately

represented by students from either UAE or other Arab countries ($p<0.001$), and by students of Medicine, followed by Pharmacy, Dentistry, and Engineering ($p<0.001$). CE use increased with year of study, reaching the highest level in the fourth year ($p<0.001$), which for most programmes is the final year. Modafinil was self-administered, especially in males, for concentration and alertness; B12 was typically taken by female students for academic performance and concentration; and high-dosage caffeine compounds were ingested to improve alertness levels. Use of the internet for both obtaining information and purchasing CEs was frequently reported. Multiple logistic regression analysis showed that gender, nationality, and year of study were associated with CE use among UAE university students. **Study 3.** The semi-structured interview transcripts were analysed. The study identified four main themes and 12 subthemes from students and three main themes and their five sub-themes from university faculty staffs. The qualitative findings revealed that CEs are accessible to enhance performance in terms of concentration, motivation and meeting academic deadlines.

Discussion: It is suggested that CEs are increasingly being used among healthy individuals, mainly students without any diagnosed cognitive deficits, to increase their alertness, concentration, or memory, in the belief that these CEs will improve their performance during examinations or when studying. The impact of stimulant CEs may include tolerance, dependence and/or somatic (e.g. cardiovascular; neurological) complications.

Conclusions: Universities need to address the prevalence of CE use amongst their students by providing effective support programs. The ethical concerns related to the use of these substances should be considered by universities against the legal restrictions related to their use.

Key Words: neuroenhancement, cognitive enhancement, Cognitive enhancers, drug abuse, drug misuse, study drugs, non-medical drug use, smart drugs, university students, UAE

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ABBREVIATIONS

- Ajman University (AU)
- Al-Ain university (AAU)
- Anabolic-androgen steroids (AAS)
- Attention deficit hyperactivity disorder (ADHD)
- Attention deficit disorder (ADD)
- General Data Protection Regulatory (GDPR)
- Cognitive Enhancers (CEs)
- Dopamine (DA)
- General sales list (GSL)
- General practitioner (GP)
- Health Authority Abu Dhabi (HAAD)
- Higher Education Institution (HEI)
- Image and Performance Enhancing Drugs (IPED)
- Ministry of Higher Education and Scientific Research (MOHESR)
- Mohammed Bin Rashid University of Medicine and Health Science University (MBRU)
- N-methyl-D-aspartate (NMDA)
- New psychoactive substances (NPS)
- Noradrenaline (NA)
- Nucleus accumbens (NAc)
- Over the counter (OTC)
- Performance-enhancing drugs (PED)
- Pharmacy medicines (P)
- Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)
- Prescription-only medicines (POMs)
- Psychoactive Substances Act 2016 (PSA)
- Ras Al-Khaimah (RAK)
- Registered Prescription (RP)
- Statistical package for the social sciences (SPSS)
- Strengthening the Reporting of Observational studies in Epidemiology (STROBE)
- The theory of planned behaviour (TPB)

- The social cognitive theory (SCT)
- The theory of triadic influence (TTI)
- Thematic analysis (TA)
- United Arab of Emirates (UAE)
- United Kingdom (UK)
- United Nations of Drugs and Crime (UNODC)
- United States of America (US)
- University of Hertfordshire (UH)
- University of Science and Technology (USTF)
- University of Sharjah (UOS)

1. CHAPTER 1: INTRODUCTION

The scope of this thesis is aimed to explore the phenomenon of cognitive enhancers (CEs) use among United Arab Emirates (UAE) University students and identify the reasons for their use. Furthermore, this thesis will suggest an educational intervention to improve knowledge, attitude, and awareness of the misuse of CEs by university students in the UAE. This first Chapter presents an introduction to the issue of CEs use among university students in the United Arab Emirates (UAE). The rationale of the study aims, and research questions will be addressed. The Chapter concludes by defining the terms used and providing a layout of all the Chapters and content in this thesis.

1.1 Background

Cognitive enhancement is defined as an "amplification or extension of core capacity of the mind by improving the internal and external information processing systems" (Bostrom & Sandberg, 2009). Cognitive enhancement can be achieved in two ways, e.g. 'pharmacologically', by taking cognitive enhancers (CEs) drugs/substances (Schelle et al., 2015a); or 'non-pharmacologically', by maintaining a healthy lifestyle, which includes being physically, mentally and socially active; eating a healthy, balanced diet; drinking alcohol only in moderation; and maintaining good sleep habits (Nicholson et al., 2015b).

CEs, also known as 'smart drugs' or 'nootropics', are a heterogeneous group of chemical substances that are used to improve cognitive function (Froestl et al., 2012), particularly memory, alertness, creativity and motivation (Smith & Farah, 2011). CEs are typically being obtained, by healthy individuals (Advokat, 2010), on prescription, over-the-counter, online, or through other sources such as family or friends (Ram et al., 2020)

The clinical impact of CEs' ingestion can be significant, with these molecules being able to affect various neurotransmitter pathways in the brain, including the cholinergic, dopaminergic, noradrenergic and serotonergic pathways (Rasetti et al., 2010). Whilst their mechanism of action is not fully understood (Froestl et al., 2012), most popular CEs (e.g. methylphenidate, modafinil and amphetamine mixtures) are stimulants (Carlier et al., 2019). Methylphenidate increases the levels of noradrenaline (NA) and dopamine (DA) in both the prefrontal cortex and the cortical/subcortical regions, and this effect may be associated with levels of improved attention in Attention Deficit Hyperactivity Disorder

(ADHD) (Bisagno et al., 2016). Conversely, with modafinil - a drug being used to treat narcolepsy - stimulant actions are associated with an impact on NA, glutamate (NMDA or N-methyl-D-aspartate) and DA (Müller et al., 2004).

A stimulant medication promotes wakefulness by increasing dopamine (as well as norepinephrine) in the brain (Greenhill, 2006). In particular, modafinil increases DA levels in the caudate and nucleus accumbens (NAc), whilst blocking DA transporters in a healthy individual's brain (Volkow et al., 2009). Out of these molecules, modafinil may be better tolerated (Teodorini et al., 2020), inducing less adverse drug reactions whilst not being associated with a high risk of dependence (Schmitt & Reith, 2011). The amphetamine mixtures (e.g. in the branded product Adderall) block the re-uptake of both NA and DA into the pre-synaptic neuron, and increase their release as well from the pre-synaptic neuron, hence increasing their concentration in the synaptic cleft (Faraone, 2018)

Indeed, since the 1940s, both modafinil and amphetamine (e.g. 'go pills') CE categories have been the subject of military research, to help soldiers stay alert whilst attenuating the effects of sleep deprivation (Caldwell et al., 1999; Hall, 2003; Christiansen et al., 2015). However, these drugs are increasingly being used by healthy individuals, including students and night shift workers, to improve their cognitive and motivational functions (Batistela et al., 2016). The lifetime prevalence rate of prescribed CEs' intake for non-medical reasons, as a self-attempt to increase cognitive performances, among university students in the UK and Ireland has been estimated to be around 10% (Singh et al., 2014). However, these levels of intake may be underestimated and the trend has attracted a considerable interest (Singh et al., 2014), relating to its social, ethical and legal implications (Greely et al., 2008; Fowler, 2015;).

Whilst most studies have focused on the prevalence of a limited range of a few CEs (e.g., modafinil; methylphenidate; amphetamine mixtures) considering their intake by students in Higher Education Institutions (HEIs), a study by Napoletano et al (2020) identified a total of 142 unique CEs. These molecules were then sub-grouped into 10 categories, according to recently proposed classifications (Schifano et al., 2019), including: prescribed drugs, plants/herbs/products, psychostimulants; image- and performance-enhancing drugs (IPEDs), miscellaneous, GABAergic drugs, phenethylamines, cannabimimetics, tryptamine derivatives, and piperazine derivatives.

Over the past few years, the use of cognitive enhancers by university students has raised substantial ethical, legal, and social concerns and debates (De Bruyn et al., 2019; de Oliveira Cata Preta et al., 2020; Dietz et al., 2018a; Jain et al., 2017; Lifeline Project, 2016; Monnet et al., 2021a; Sharif et al.,

2022). Ethical issues are related to whether their availability would increase or undermine equality, and about whether individuals will be directly or indirectly coerced into using pharmacological cognitive enhancers (PCEs) (Ragan et al., 2013a). Legal concerns were mainly related to the fact that some of these drugs are controlled medicines. Furthermore, many of these drugs could be obtained by individuals through unofficial or illegal channels, overcoming the restrictions that many countries have set on their sale (Garasic & Lavazza, 2016a).

Restrictions on the prescription of CEs vary considerably from one CE to another. At international levels, controlled drugs are commonly classified according to a hierarchy of schedules, reflecting different degrees of restriction of availability (Haber, 2013). In the UK, several legislations governing the prescribing and usage of medicines and controlled drugs exist including: The Human Medicines Regulations 2012, Misuse of Drugs Act 1971, and Psychoactive Substances Act 2016 (PSA).

Based on the review of the literature, no studies have been conducted in the UAE on the use of pharmacological CEs drugs among students. However, a study by Ghalia, 2016 in Zayed University (UAE) among students reported that 86% of the participants consumed caffeinated beverages to boost their energy and concentration (Ghali et al., 2016). Therefore, no data exist on the estimated prevalence of the pharmacological CEs misuse. However, there are websites containing adverts relating to the use of CEs as food supplements for example (https://nootropix.shop). Buying CEs drugs from the pharmacy is not as restrictive in the UAE (Sharif et al., 2015) as it is in the UK. From self-experience, medical and pharmacy students buy drugs such as Modafinil, Amphetamine, Methylphenidate to enhance their cognition and keep them alert specifically during exam period (Sharif et al., 2022).

Thus, the current research aims to better understand levels of use and impact of CEs within Higher Education institutions in the UAE.

1.2 Rationale of the study

It is established that there is a problematic increase in the use of CEs among healthy individuals, and particularly so university students (Garasic & Lavazza, 2016b). To the best of the researcher's knowledge, there is no study assessing the prevalence, perception, and attitude of pharmacological CEs use among university students in the UAE. Therefore, this PhD thesis aims at assessing the prevalence of pharmacological and alternative ('soft') CEs intake; evaluate students' knowledge, perceptions, and attitudes of these substances; and identify student characteristics associated with CE usage.

The Figure below defines the pharmacological and soft CEs use:

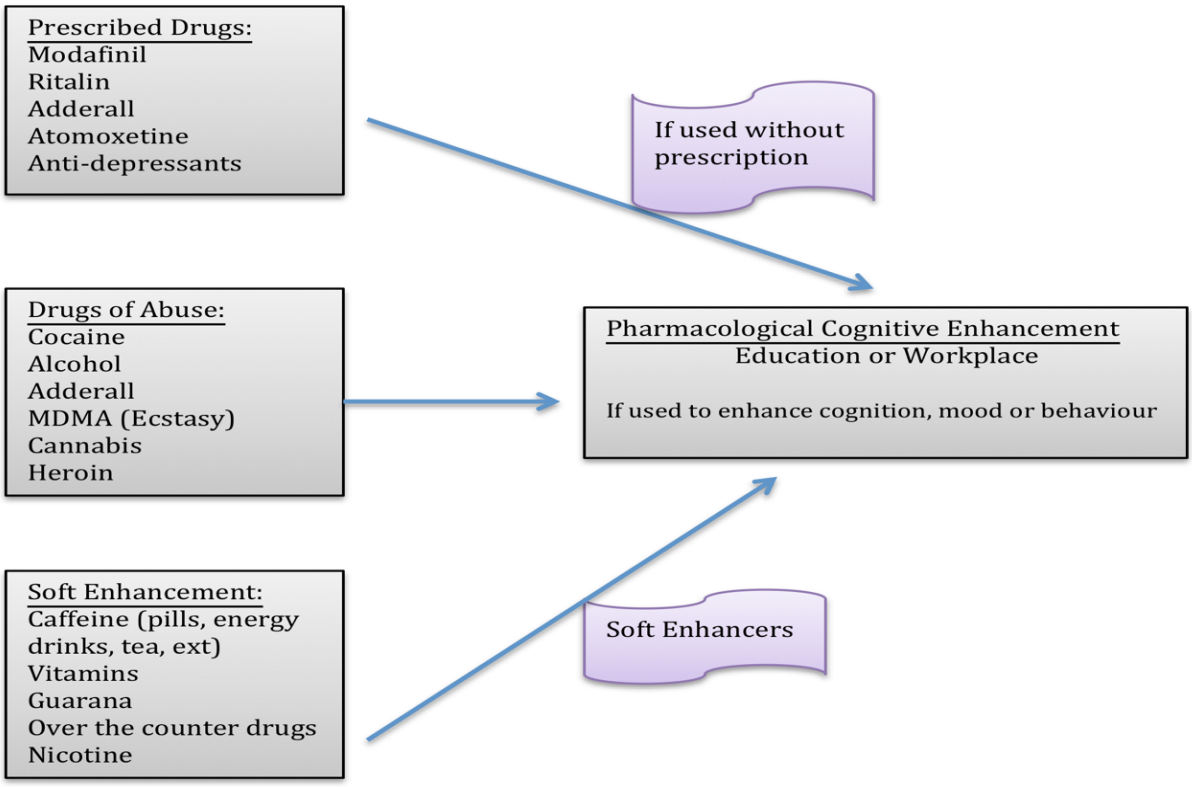

Fig 1. The definition of pharmacological cognitive enhancement based on users' intention and behaviour, and the substances used for cognitive performance enhancement or increased psychological well-being in Europe. Adapted from (Maier & Schaub, 2015).

1.3 Prevalence use among university students:

The number of recent studies published concerning CEs use indicates the rising interest in the academic field (Brumboiu et al., 2021; Monnet et al., 2021a; Monnet et al., 2021b; Narayanan et al., 2021; Petersen et al., 2021; Plumber et al., 2021; Shakeel et al., 2021; Sumbul-Sekerci et al., 2021).

A systematic literature review (Sharif et al., 2021) focusing on an updated overview of 48 studies in various countries on the use of the most popular CEs prescription and non-prescription drugs among healthy university students from (2000 - 2020) (*Chapter 2*) was recently published. Prescription CEs including amphetamine salt mixtures, methylphenidate, modafinil and piracetam; and non-prescription CEs including caffeine, cobalamin (vitamin B12), guarana, pyridoxine (vitamin B6) and vinpocetine were mentioned, although the most popular prescription CEs used among the university students were modafinil, methylphenidate and amphetamine salt mixtures

Methylphenidate reported the most popular prescription PCEs (Carlier et al., 2019), and caffeine pills the most popular non-prescription ('soft') CEs (Cappelletti et al., 2015). However, the effectiveness of CEs among healthy participants and their efficacy is still unclear (Dresler et al., 2019; Smith & Farah, 2011).

In the UK, a study showed that out of 1614 students, 33% of them had used prescription CEs that had not been prescribed for them (Holloway & Bennett, 2012). From a sample of 877 students from UK and Irish universities, it was found that the lifetime prevalence of the use of modafinil, methylphenidate and amphetamine were, respectively, 6.2%, 5.9%, and 2% (Singh et al., 2014). A meta-analysis from the US estimated that the misuse of CEs among university students was 17% (Benson et al., 2015a). In a study conducted in Brazil, out of 1865 students 4.2% reported to having had used CEs in the last 12 months, with the most popular being methylphenidate (Cândido, et al., 2019). Based on the review of the literature, only one study has been conducted in the UAE; this was focussed on the use of caffeine consumption only as a CEs among University students (Ghali et al., 2016).

The Global Drug Survey carried out in 2015 and 2017 among healthy university students reported on CEs prescription drug use rates; these increased over time in all 15 countries for which data were analysed (Maier et al., 2018a). Main reported sources of supply for CEs included friends (47.8%); the web (11.8%); family members (6.1%); and physicians (3.8%) (Maier et al., 2018a).

There may be levels of substantial CE use among students in high-ranking universities and highly competitive courses such as Medicine (Fallah et., 2018a) and Pharmacy (Hanna et al., 2018). A study conducted in Saudi Arabia, a country that is geographically and socially similar to UAE, assessed the prevalence and motivation of illicit use of stimulants in 1177 medical students; some 29 (2.46%) were found to be using stimulants illicitly (Alrakaf et al., 2020).

1.4 Aim of the study

The current PhD thesis aimed to exploring the phenomenon of cognitive enhancers use among UAE University students and identify the reasons for their use.

1.5 Research Questions:

The current research project consists of objectives for three phases: a) systemic literature review, b) quantitative study (survey), c) qualitative study (interview); each study presented with its own research questions as follows:

1.5.1 Phase (1) Systematic literature review:

1.5.1.1 There are two research questions designed for this part of the study:

1. What are the reasons and justifications reported by university students for using CEs?
2. How important is the awareness campaign in reducing the harm of CEs among adults in higher education?

1.5.2 Phase (2): Quantitative study (survey)

1.5.2.1 There are two research questions designed for this part of the study:

1. What is the prevalence of CEs use in UAE universities? Is this comparable to that reported elsewhere?
2. Is there a gender, age, year of study, study programs and nationalities difference in the use of CEs among UAE university students?

1.5.3 Phase (3): Qualitative study (interview)

1.5.3.1 There are three research questions designed for this part of the study:

1. What are the factors influencing CEs use among university students in the UAE?
2. What impact do students who use CEs have on the views and behaviours of non-users?
3. What is the attitude of university lecturers and their perception towards the use of CEs among university students?

1.6 Statement of the Problem

1.6.1 New psychoactive substances (NPS)

According to the United Nations of Drugs and Crime (UNODC), NPS are defined as drugs of abuse, either in a pure form or a preparation, that are not controlled by the 1961 Single Convention on Narcotic Drugs or the 1971 Convention on Psychotropic Substances, but which may pose a public health threat (UNODC, 2021). Furthermore, they represent a heterogeneous group of chemical

substances with more than 1124 compounds appearing in European markets between 2009 and 2021. The market in 2015 showed an annual increase of approximately 100 since 2014 (Miliano et al., 2016). They are categorised as phenethylamines, piperazines, tryptamines, synthetic cathinones, alkylindoles (synthetic cannabinoids), and arylcyclohexylamines (Schifano et al., 2015a).

As a result of their heterogeneity and difficulty in controlling their production and use, they were widely misused and are not included in the International United Nations Conventions, which can easily bypass the supply reduction strategies of law enforcement agencies and sanctions related to the use and sale of illicit substances (Schifano et al., 2015a).These agents mostly enhance dopaminergic, serotonergic, and noradrenergic activities in the brain. Therefore, their use is associated with different psychological effects, which are similar to the effects associated with remaining controlled substances. NPS are classified according to their effect into: stimulants, empathogens-entactogens, sedative-hypnotic-anxiolytics, dissociative, and hallucinogens (Khaled et al., 2016). The use of NPS is well established to have several negative health impacts on consumers. These can be physical or psychological, including cardiovascular arrythmias, seizures, renal failure, myocardial infarction, anxiety, agitation, memory loss, depression, and psychosis (Khaled et al., 2016). Therefore, over the last 10 years NPS have emerged as a subject of concern and a basis for legislative action for international and national authorities concerned with controlling drugs (UNODC, 2021).

1.6.2 IMAGE AND PERFORMANCE ENHANCING DRUGS (IPED):

Image and Performance Enhancing Drugs (IPED), are substances used with the intention of altering or improve a person's appearance or abilities (Elliott et., 1997). This could include improving athletic performance, academic performance, sexual performance, altering skin tone, losing fat, reducing wrinkles, or increasing muscle mass (Schelle et al., 2015a). The use of IPED in the general population is a public health concern as they tend to be self-administered without medical supervision or guidance (McVeigh et al., 2021). Furthermore, they became increasingly accessible through the internet (Brennan et al., 2013). There are several categories of IPEDs that are currently available among the general population, in particular the use of performance-enhancing drugs (PED) by athletes and non-athletic weightlifters. For example, in the US between 2.9% to 4.0% Americans have used anabolic-androgen steroids (AAS), as IPED, at some time in their lives (Brennan et al., 2013).

1.6.3 SIMILARITIES AND DIFFERENCES BETWEEN CE, NPS, AND IPEDS

Compared with CEs, both NPS and IPED have no medical indication, but they are intentionally used for their psychoactive effects, as with NPS, or to improve altering or improving a person's appearance or abilities as the case with IPED. The use of NPS and IPED substances has lately become popular and/or more widely available, constituting a reason of current or potential public health and legal (Hassan et al., 2017). Even though their level of safety, composition, and legal status are mostly unknown, they are mostly sold online, via illicit online pharmacies, as the quickest way to improve cognitive, sexual, muscular, attentive, and other natural capacities (Corazza et al., 2014). Additionally, Pregabalin and Adderall can be purchased without a prescription and at discounted prices, as well as a wide range of pharmaceuticals (Corazza et al., 2014).

This is a new and rapidly growing trend of abuse that requires extensive monitoring and study, including the use of near-real-time and unstructured sources of information, such as Internet news and online reports, to acquire rapid knowledge. The health risks associated with counterfeit products sold online are increased (Corazza et al., 2014).

1.7 Research context

1.7.1 UNITED ARAB OF EMIRATES

The United Arab of Emirates UAE is in the heart of the Arabian Gulf. It is bordered to the East by the Gulf of Oman and the Sultanate of Oman, to the west by Qatar and Saudi Arabia, to the north by the Arabian Gulf, and to the south by the Sultanate of Oman and Saudi Arabia. In 2017, the UAE's population was 9.2 million, of which 1.4 million are UAE citizen. The remainder population are migrants, workers and their families (United Arab Emirates Profile, 2018). The first spoken language in UAE is Arabic. However, within the last few years, the English language is commonly spoken and taught at all higher education institution and Educational research institutes (Al-Issa, 2017). For that reason, the research survey and semi-structured interviews will be distributed to students in the UAE in English language.

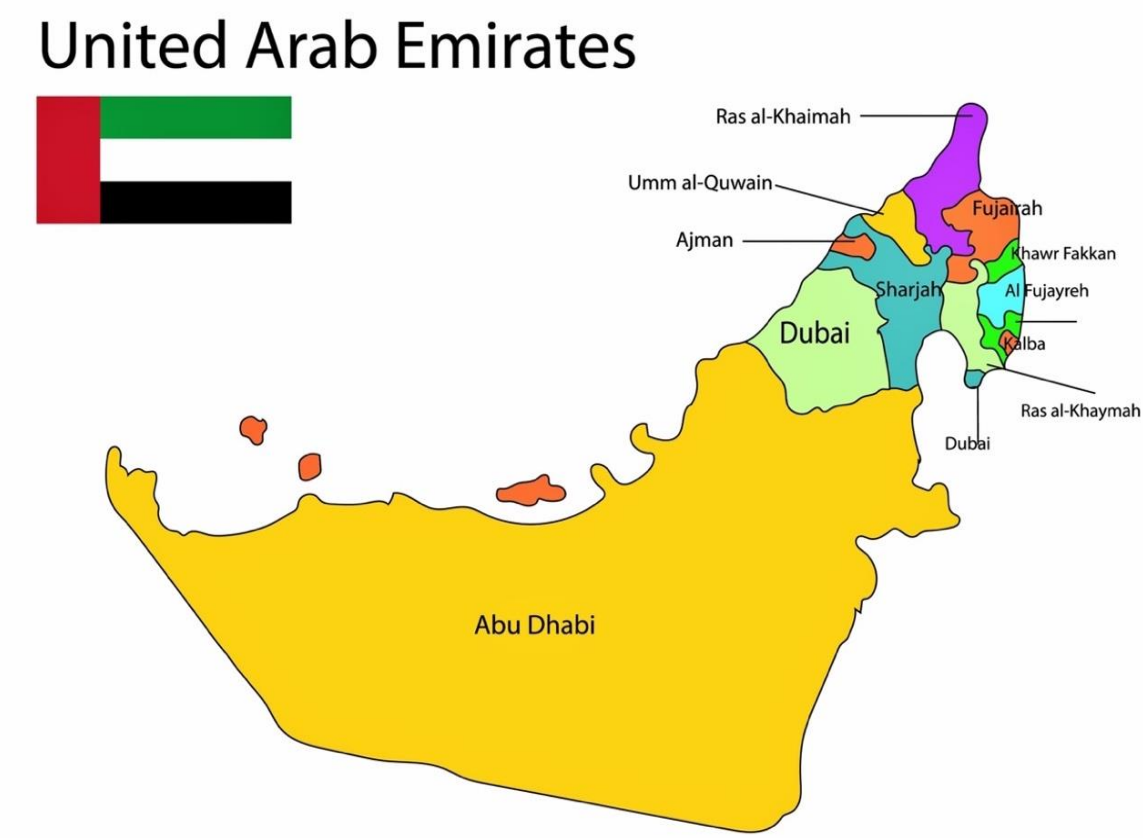

Fig 2. UAE map by Google maps

1.7.2 UAE LEGISLATION:

There is zero-tolerance for drug use for recreational purposes in the UAE (Yeboah, 2013) Production, import, export, transit, purchase, sale, possession, and storage of narcotic and psychotropic substances are all prohibited under Federal Law No. 14 of 1995, unless they are done as part of supervised and controlled medical or scientific activity in conformity with the relevant legislation (Yeboah, 2013). The UAE police has specialised divisions to address drug-related issues. Most medicines are available in community pharmacies and hospitals in the UAE. However, narcotic, psychotropic, and other controlled drugs and medicines of class A or B are not easy to come by in the UAE; nor are they freely imported into the country (Yeboah, 2013).

TABLE 1: CURRENT CLASSIFICATION OF HARMFUL DRUGS IN THE UNITED ARAB EMIRATES

Classification	Drugs	Maximum penalties
Class A (CDa)	Acetorphine, Alfentanil, Carfentanil, Morphine, Fentanyl, Heroin, lysergic acid (LSD), ecstasy, cocaine, crack cocaine, methamphetamine, Opium, whether raw, prepared, or medicinal.	For possession: 7 years' imprisonment or a fine (or both); for supply: life imprisonment or a fine (or both)
Class B (CDb)	Amphetamines, codeine, Cannabis and cannabis resin, methylphenidate.	For possession: 5 years' imprisonment or a fine (or both); for supply: 14 years' imprisonment or a fine (or both)

The UAE is a signatory to several international conventions on narcotic and psychotropic substances (UNODC, 2021). The UAE conventions involve applying internationally valid control measures to ensure that narcotic and psychotropic substances are not freely available to layman (UAE Ministry of Health (2001). The conventions aim to

- Make narcotic and psychotropic substances available only for medical and scientific purposes.
- Prevent their diversion into illicit channels.
- Eliminate drug trafficking and abuse.

The Federal Health Authority (FHA) handles the executive responsibilities for the Ministry of Health (MoH), with a focus on increasing the efficiency and competitiveness of the UAE health system. The foundation of the Ministry of Health (MoH) was laid in accordance with the Federal Law No. 1 of 1972 (Balasubramanian et al., 2015). UAE federal healthcare laws are governed by the ministry of health (Hasan & Lessing, 2015). Federal Law No. 14 of 1995, describes how these conventions are applied in the UAE and Federal Law No. 4 of 1983 describes the basic requirements for prescribing and supplying prescription medicines.

- Narcotic and psychotropic (controlled drug - Class A or CDa) drugs are controlled. Controlled medicines are administered to patients of acute and chronic diseases in accordance with modern medical practice. They are mostly administered to in-patients.
- Controlled drug - Class B (CDb) are semi-controlled.

Majority of medicines which are used worldwide are available in community pharmacies and hospitals in the UAE (UAE Ministry of Health (2001).

1.7.3 PRESCRIPTION OF CONTROLLED MEDICINES IN THE UAE

The misuse of psychoactive substances within the UAE was not an issue until the 1980s, when an increase in drug consumption was observed; this led to a broader spread, particularly among Emirati's citizens. It has been noticed that the spread of substance misuse was moving faster among Emirati's citizens compared to other nationalities within the society, making it a crucial issue of national security concern. The UAE is implementing a strategy for preventing and restricting the use and import of controlled agents, and treating substance abusers (Pack, 2018). Accordingly, controlled drug Class A (CDa), such as narcotic and psychotropic agents, if not used responsibly, can lead to addiction, and have significant abusive potential. However, controlled drugs/medicines of class A or B are not freely available in the UAE, and cannot be freely imported (Pack, 2018). By prohibiting the use of drugs and restricting the use of controlled medicines, the UAE aims to strengthen the prevention and treatment of substance abuse, including narcotic drug abuse.

1.7.4 COUNTERFEIT MEDICINES IN THE UAE

There is a serious threat of medicine counterfeiting around the world because the presence of the wrong or the absence of the desired active pharmaceutical ingredient in the formulation can result in serious health consequences for the patient (Hasan & Lessing, 2015). There has been reports that counterfeit medicines are not only being imported into the UAE, but also being transported there. In 2009, approximately 5.5 million fake medicines were detected to be transported through the UAE (Wilbur, 2013). Additionally, the Ministry of Health warns UAE citizens against buying counterfeit medicines online (Reporter, 2015). The sale of medicines over Internet is the most underregulated domain of pharmacy federal law. Illegal sale of medicines is increasing online, and this is an issue which is difficult to deal with. Consumers are encouraged to timely report the concerned regulatory authorities regarding the presence of these medicines (Hasan & Lessing, 2015).

1.7.5 THE FOLLOWING DRUGS WERE SELECTED IN THE CURRENT PHD RESEARCH STUDIES:

Amphetamine and methylphenidate are Controlled drugs (Class B, CDb) Modafinil and piracetam are (POM), whereas caffeine pills, guarana, cobalamin (vitamin B12), vinpocetine and pyridoxine (vitamin B6) considered (GSL). More details are elaborated in Table 2b.

1.8 Personal interest in this research study:

As a research associate at one of the UAE universities, I have had direct interaction with students who have used cognitive enhancers drugs most often to enhance their studies. These students are determined to be necessary because of increasing demands in education, the workplace, and social life. This ignited my interest in the research study. In the past decade, the terms "cognitive enhancement" has been used to describe this phenomenon. The media has misinterpreted several recent studies reporting a high prevalence of pharmacological cognitive enhancement for several reasons.

At the beginning of this thesis, no data on cognitive enhancers drugs use among university students in UAE were available. However, despite a minimal number of prevalence studies, research has shown and indicated that psychoactive substance abuse does occur in the U.A.E (Abou-Saleh et al., 2001; Sharif et al., 2015), found that the purposes might be prevalent in UAE.

This thesis is the first research conducted in the UAE to evaluate the use of CE illicit drugs among UAE university students for the purpose of improving academic performance, concentration, and alertness. In addition, despite the sensitive nature of the subject, we were able to compare CE users with non-users and identify characteristics associated with a higher risk of CE use.

This PhD study consists of three sub-studies which have represented in three phases: a) systematic literature review, b) quantitative study (survey), and c) qualitative study (interview). The findings and conclusions may inform the universities in the UAE to raise awareness of the harms of CEs use, provide knowledge, counteract myths regarding the safety of CEs use and address cognitive enhancement at an early stage of higher education as preventative public health measures. The university system should correct the wrong perception of the benefits of sustained use of 'smart drugs' among UAE university students, a practice strongly apparent in this study.

1.9 Thesis Layout:

The present Chapter presented an introduction about the issue of cognitive enhancer (CEs) use among university students in the United Arab Emirates (UAE). The rationale of the study, aim and research questions were addressed. A clear definition of cognitive enhancers (CEs) drugs/substances was

presented, and the motives for the misuse of CE among university students were outlined and explained. The context for CEs in the UAE was presented. This thesis consists of eight Chapters.

Chapter Two presents a systematic literature review that was carried out, in adherence with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, to investigate the level of knowledge, perception and impact of the use of a range of CEs within Higher Education institutions; it includes critical review of previous relevant worldwide literature relating to cognitive enhancers use among university students and the associated factors.

Chapter Three. In this Chapter, the theory of triadic influence (TTI) is presented as an important and comprehensive framework for understanding the risk factors associated with the use of CEs among university students. Considering this study, universities may be able to implement concrete prevention initiatives. It integrates ideas from several 'smaller' theories, such as the social learning theory and the theory of planned behaviour, into a comprehensive framework that emphasizes the importance of personal, social, and cultural factors.

Chapter Four. This Chapter explains the research methodology used in this thesis. It describes and justifies the theoretical framework and research methods adopted in this thesis. Further, it explains the research design and methods used to answer the research questions and achieve the research objectives, aim and strategy of a mixed-method approach using a sequential explanatory design initiated by quantitative (Phase 1) and then qualitative (Phase 2) data collection methods. Finally, techniques to increase the reliability and validity of this research were discussed as well as an analysis of both qualitative and quantitative data and ethical considerations in this research.

Chapter Five deals with the quantitative analysis of data gathered through cross sectional study based on a validated online survey that was distributed using university-licensed software (Qualtrics) as a direct web link via email and social media to all Medical, Pharmacy, Dentistry, Nursing and Engineering students enrolled in six UAE universities. Associations between student characteristics and CE use were investigated using the chi-squared test and multiple logistic regression. Reasons for CE use, temporal patterns of use, details regarding purchase and types of CE used were compared by gender, to assess the prevalence of CE intake; evaluate students' knowledge of these substances and identify student characteristics associated with CE usage.

Chapter Six covers two parts applying a qualitative approach. Part 1 explores the understanding, perceptions, behaviour, and attitude of CEs among university students in the UAE. Part 2 in this

Chapter explores the attitude of university lecturers and their perception towards the use of CEs among university students. I am particularly interested in the perceptions of teaching faculty staff on evidence suggesting the use of CEs among their students. This is because they have direct interaction with students.

Chapter Seven draws a discussion in a systemic way on the overall thesis studies, summing up the issue and identifying the limitations of this research.

Finally, **Chapter Eight** draw a conclusion and limitation to the entire thesis and will address a recommendation to develop an intervention targeting adults in higher education institution in the UAE. The recommendation will help to educate students on the effect of using CEs drugs/ substances to university students, and how we can help if students face an addiction from CEs.

1.10 Summary of the Chapter

This introductory Chapter has briefly presented the topic of the current research study while providing both definitions of the terms used and an overview of the dissertation Chapters. The following Chapter presents a systematic literature review of CEs use among university students worldwide.

2 CHAPTER TWO: SYSTEMATIC REVIEW

2.1 Introduction to the Chapter

The aim of this Chapter is to review the current literature on the use and impact of cognitive enhancers among university students worldwide, using a systemic literature review approach. Methods for the review are included in the Chapter, including criteria for literature searches, selection of studies, and data extraction and synthesis.

In response to the review questions, the findings were summarised and a discussion of the limitations/implications of the included studies was reported.

2.2 Background

Cognitive enhancers (CEs), also known as 'smart drugs,' 'study aids' or 'nootropics' are a cause of concern. Recent research studies investigated the use of CEs being taken as study aids by university students. Despite being illegal in most countries, the diverted non-prescription use of these molecules and the related potential for dependence and/or addiction are being reported. It has been demonstrated that healthy students (i.e., those without any diagnosed mental disorders) are increasingly using drugs such as methylphenidate, a mixture of dextroamphetamine/amphetamine, and modafinil, for the purpose of increasing their alertness, concentration, or memory.

A systematic literature review delivers a clear and comprehensive overview of available evidence on a given topic (Whitehead, 1997). It also helps to identify all the related study on CEs use among university students, based on our search we found that there is no study investigated the use and impact of CE among university students in the UAE. This allowed us to fill the research gaps in our current understanding of a field and can highlight methodological concerns in research studies that can be used to improve future work in the topic. The aim of this Chapter is to review the current literature on the use and impact of cognitive enhancers among university students worldwide, using a systematic literature review approach.

2.3 Methods

The current systematic literature review was performed in adherence with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines (Moher et al., 2009), to

estimate CEs' prevalence of intake; and assess knowledge, awareness, and impact of CEs' use among university students.

2.3.1 LITERATURE SEARCH (INCLUSION AND EXCLUSION CRITERIA)

The focus was here on quantitative and qualitative studies relating to CEs' use among university students from three databases: Scopus, PubMed and Science Direct. Inclusion criteria were quantitative and qualitative studies having been carried out among students aged 18 years and older in HEIs. Articles were included if they related to a range of nine CEs (methylphenidate, amphetamine, modafinil and piracetam, caffeine pills, guarana, cobalamin/vitamin B12, vinpocetine and pyridoxine/vitamin B6), which were selected here because of their popularity among university students. Studies written in English, from the year 2000 (i.e. from around the time when NPS started to emerge in drug scenarios) to 2020 were included in the study search. Regional/world drug reports (e.g., from the European Monitoring Centre for Drugs and Drug Addiction/EMCDDA and the United Nations Office for Drug and Crime/UNODC) were included here as well. Conversely, studies focussing on underage children or on preclinical experiments were excluded.

The literature search was performed using a range of key word strings, e.g. cognitive enhancers AND neuroenhancement, prescription drug misuse OR prescription drug abuse among healthy individuals AND enhancement. In particular, the search strategy for each of the three databases were as follows:

- **Scopus** (*searched in Advanced Search)
  (TITLE-ABS-KEY (cognitive OR mental OR CE OR "cognitive enhancer" OR cognitive improver OR smart drugs)) AND ((TITLE-ABS-KEY ("smart drugs *" OR "cognitive improvement " OR "mental test*" OR "cognitive enhancers" OR "students)) OR (TITLE-ABS-KEY ("mental function" OR "cognitive test *" OR "among students "). Number of hits was 390.
- **PubMed** (*searched in Advanced Search)

  (TITLE- (cognitive OR mental OR CE OR "cognitive enhancer" OR cognitive improver OR mental improver)) AND ((TITLE-ABS-KEY ("mental functions *" OR "cognitive improvement " OR "mental test*" OR "smart drugs" OR "drug)) OR (TITLE-ABS-KEY ("mental function" OR "cognitive test *" OR "among students")). Number of hits was 520.
- **Science Direct** (*searched in Advanced Search)
  (Title (cognitive OR mental OR CE OR "cognitive enhancer" OR cognitive improver OR mental improver) AND ((TITLE-ABS-KEY ("mental functions *" OR "cognitive improvement " OR

"mental test*" OR "smart drugs" OR "drug)) OR (TITLE-ABS-KEY ("mental function" OR "cognitive test *" OR "among students"). Number of hits was 490.

Finally, a manual search was also carried out using *Google Scholar* in order to ensure none of the key articles and studies were missed.

2.3.2 QUALITY ASSESSMENT

Based on the inclusion criteria, the selected articles were appraised for quality using PRISMA checklists (Moher et al., 2009). Search results were exported to Mendeley, a free reference manager and academic social network. This tool was used to determine the structure of the index study methodology (Moher et al., 2009).

2.4 Results

2.4.1 SUMMARY OF THE LITERATURE SEARCH

The literature search identified here a total of 1,400 studies here (e.g., 520 through PubMed, 490 through Science Direct and 390 through Scopus) (Fig. *3*). Forty-eight studies were excluded as they were duplicates, 1,294 studies were screened and were excluded based on their title and abstract, 10 did not meet the inclusion criteria, and 48 were deemed relevant and were included in this review *(Table 1a)*.

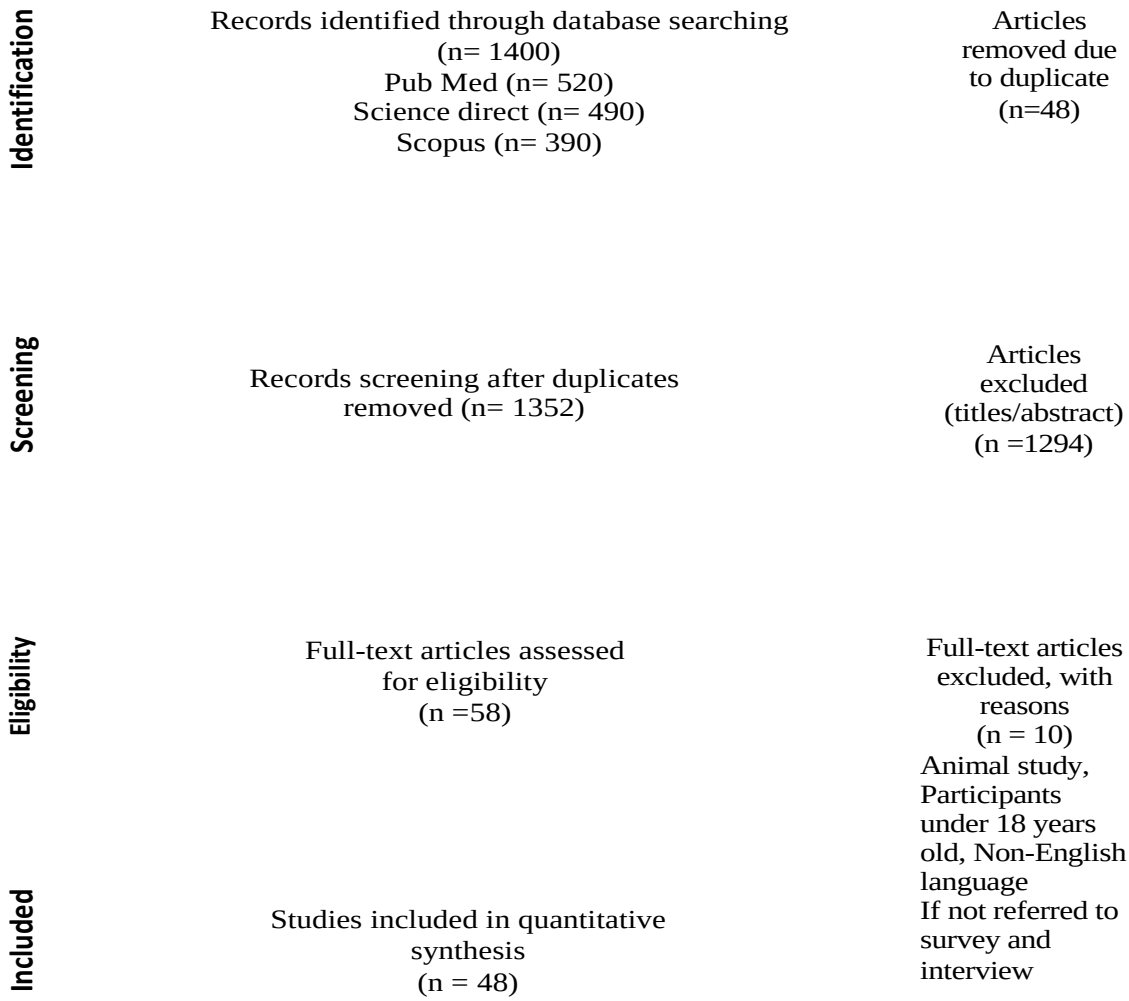

Fig 3. Cognitive enhancers' intake in university students: PRISMA Flow Diagram

The section (*Table 2a*) below shows the summary of findings from the literature review on the prevalence of CEs among university students.

TABLE 2A. SUMMARY OF LITERATURE REVIEW FOCUSING ON COGNITIVE ENHANCER DRUG(S)/SUBSTANCE(S) BEING CONSIDERED FOR THE STUDY (E.G., METHYLPHENIDATE, AMPHETAMINE, MODAFINIL AND PIRACETAM, CAFFEINE PILLS, GUARANA, COBALAMIN (VITAMIN B12), VINPOCETINE AND PYRIDOXINE (VITAMIN B6):

Author (Year)	Country	CE drug brand(s)/ Substance(s)	Study sample	Methodology used	Results/Lifetime prevalence of CE	Note/Limitation
(McDermott et al., 2020)	UK	Ritalin, Adderall, Modafinil and Armodafinil	506 participants.	Online survey and Interview.	Out of 506 participants, 45.5% (n=230) reported that they had used a range of CEs drugs in the previous 12 months for the purpose of study. Male usage was reported as being more than two and a half times higher than female usage	The motivational factors behind CEs use investigated with greater understanding of the factors influencing their use. Universities need to develop a greater awareness of the prevalence of CEs use amongst their students and consider taking an active approach in reducing their use.
(de Oliveira Cata Preta et al., 2020)	Brazil	Modafinil Methylphenidate Piracetam.	1,865 participants.	Online survey.	Out of 1,865 respondents, 4.2% had used CEs in the previous 12 months, and the prevalence among Law students reached 14.3%. The most commonly used smart drug was methylphenidate. The drug was mostly obtained through a friend.	The limitation was the questionnaire itself. It is possible that there was a memory bias and omission of response, underestimating the prevalence found. However, the limitation was reduced as the questionnaire was self-administered and anonymous.

(Champagne et al., 2019)	UK	Modafinil Amphetamine Methylphenidate Beta Blockers.	612 participants from Russell Group universities.	Online survey.	17% reported having used smart drugs previously.	The limitation of this study was that it was open to all UK full-time undergraduate students, although the majority of the participants were from the Russell Group universities. However, they did not collect additional data on discipline or university and, therefore, cannot be sure how representative the sample is for the UK university population as a whole or the population at the host university. This means that factors such as competitiveness cannot be extracted from the data.
(Steward & Pickersgill, 2019)	UK	Modafinil.	15 undergraduate students at Russell Group universities.	Interview.	All users took Modafinil, with some also having tried Adderall and Ritalin for the purpose of study. By recruiting both users and non-users, all non-users were found to be female.	All interviewees reported improving academic study as the primary purposes of drug use, particularly valuing improved focus, increased efficiency and reduced procrastination. These effects were judged highly desirable in the context of time constraints and fatigue when approaching exams and deadlines.
(Mousavi et al., 2019)	Iran	Modafinil, Methylphenidate, Amphetamine, Piracetam Vinpocetine.	Cross-sectional study was performed by analysing a total sample of 579 students in the one University of Medical Sciences students from 1st to 5th year.	Paper survey.	Some 44 (17.6%) of the respondents answered that they had used CEs at least once in their life, to increase concentration. There was a significant relationship between CE use and the age of respondents ($P < 0.05$). According to logistic regression analysis, there was a	Sample's collection was one of the main limitations. For example, female sample was larger than males. Students entered the study without prior notice of it, which means that a factor may play a role, as well as memory bias, especially when students are being asked to take non-pharmaceutical use. Finally, it is recommended that a study should be conducted in all universities of Iran and their results are compared. Therefore, although it is obvious that the use of these drugs for increasing cognition was investigated

					significant relationship between knowing someone who had used, stress level and CE use ($P < 0.05$).	more among student populations, it is not possible to generalise to other populations.
(Javed et al., 2019)	Pakistan	Methylphenidate	A cross-sectional study was conducted in medical colleges in Pakistan, using a self-constructed, validated questionnaire. The sample size (400) was calculated using open-source Statistics for Epidemiological Health software.	Paper survey.	27 participants admitted the use of Methylphenidate to improve concentration. Peer pressure was found to be a major factor in its misuse.	The study determined the prevalence of non-therapeutic use of methylphenidate as well as ascertaining any benefits, side effects, and other factors associated with this use. This is a cross-sectional study and, apart from a chi-square test, no other statistical analysis could be performed. The study only includes two cities in Pakistan and must be expanded to include other regions as well, especially the regions labelled as high risk for drug misuse. This study does not extensively explore the reasons for a participant opting for drug abuse, regardless of academic performance or environment.
(Cândido et al., 2019)	Brazil	Methylphenidate	Simple random sample of students of the Universidad Federal de Minas Gerais (n=438), invited to answer an online questionnaire about the use of methylphenidate	Online survey.	Out of 378 students included, 5.8% (n=22) reported using methylphenidate for CE; in that, 41% (9/22) in the 4 weeks prior to the survey.	The study estimates the prevalence of, and factors associated with, the use of methylphenidate for cognitive enhancement among Undergraduate students.

(Bruyn et al., 2019)	Belgium	Methylphenidate, Amphetamine, Modafinil.	A cross-sectional study of 3,159 Medical students.	Paper survey and online survey.	8.7% of the students reported that they used CE to improve their academic performance during exam time.	The study investigated the prevalence of the non-medical use of methylphenidate and knowledge of this drug among Undergraduate Medical students of the University of the Free State.
(London-Nadeau et al., 2019)	Canada	Methylphenidate, Amphetamine, Modafinil Caffeine.	11 focused groups, 3-7 participants per group.	Focus group interview.	5% to 30% of students reported the use of CE.	The study has certain limitations. Firstly, for confidentiality reasons, they did not ask participants about their own history of using CEs. This precluded them from knowing when participants were truly referring to a friend in their narratives, or when they were following the interviewer's instructions to mask their own illicit activities. Second, they did not directly question participants on how they knew about the effects of CEs, as this was an unexpected line of inquiry.
(Pighi et al., 2018)	Italy	Coffee, Ginkgo-biloba, Caffeine, Energy drinks, Amphetamine, Modafinil, Methylphenidate	433 medical students.	Paper survey.	74.7% of the students said they have used CE to improve cognitive functions. The remaining students were aware of concerns about safety and side effects.	The study explored the use and attitudes toward the use of CE in Italian Medical students. Only one university was involved, therefore, the generalizability of their findings to the whole Italian student population is limited.

(Fallah et al., 2018b)	Iran	Amphetamine, Methylphenidate.	Cross-sectional study was conducted among 560 Medical students and clinical residents of Babol University of Medical Sciences during the academic year 2014-2015.	Paper survey.	444 students (79.3%) filled out the questionnaires. 49 (11%) of individuals reported amphetamine and methylphenidate (Ritalin) use. The mean age of the stimulant drug users was 24.6±4.8 years. The main initiating factor was to improve concentration (n=29; 59.2%).	The study was to evaluate the current situation of stimulant use among medical students and residents of Babol University of Medical Sciences. The survey was conducted in class before the lecture started, so the students may have been in a rush to finish the questionnaires.

(Maier et al., 2018b)	UK, France, Austria, Belgium, Brazil, Canada, German, Hungary, Ireland, New Zealand, Australia, USA, Portugal, Switzerland and the Netherlands.	Methylphenidate, Modafinil, Amphetamine, Cannabis.	(2015) n=79,640 (2017) n=29.758	Online survey. Non-probability sample. The Global Drug Survey is an annually conducted anonymous web survey on substance use. Two data sets from male and female Global Drug Survey (GDS) participants, aged 16 to 65 years with no previous ADHD.	Global Drug Survey (GDS) is the largest study on CEs drugs that has ever been conducted. Across both years, there were more male than female respondents. According to responses from both years, the main source of supply for CE drugs participants was the circle of friends (47.8%). One in ten indicated that the Internet was their main source (11.8%). Family members with a prescription (6.1%) and the physician (3.8%) were less common sources for stimulant drugs used for CEs. Overall, 4.9% and 13.7% of the global sample reported the use of CE drugs to improve performance at work or while studying.	Several limitations were considered: The first two, and most important limitations of the study, are the self-selection of GDS survey participants and the use of self-report data. Since the sample is self-selected and the substance use for CE drugs consists of self-report data, the actual extent of CE drugs in the participating countries is not accurately known. The sample should not be considered representative of any country's general population. A third limitation is that the impact of recall bias or deliberate misreporting on results must be considered. Finally, due to the anonymous web survey instrument, the same individual might have completed the GDS2015 multiple times. However, <1% of the sample provided identical response sets across demographics and key variables used in these analyses.
(Lucke et al., 2018a)	Australia	Methylphenidate, Modafinil, Amphetamine.	1,136 Australian students.	Online survey.	6.5% reported that they used CE to improve academic performance.	The study evaluated that the prevalence of non-medical prescription stimulant use, to improve academic performance, is low among university students in

						Australia. The cross-sectional design means that it is not possible to infer causal relationships between the use of prescription stimulants and other factors. The use of self-report measures may have introduced recall and social desirability biases.
(Dietz et al., 2018b)	Australia	Caffeine pills.	2,284 students.	Paper survey.	14.9% of participants reported the use of Caffeine pills.	(I) To investigate whether including caffeine Tablets in the definition of PN within a questionnaire increases the PN prevalence estimate (framing effect), (II) To investigate whether the health-related risk attitude is increased in students who use PN.
(Riddell et al., 2018)	Australia	Methylphenidate, Modafinil, Amphetamine.	642 students.	Online survey.	6.32% of individuals reported lifetime use of one or more prescription CEs drugs, listed for the purposes of study-related enhancement.	Even though this study provides some insights into the CEs drug use that occurs at Australian universities, there are some limitations to consider. Results should be interpreted in the light of the convenience and cross-sectional sampling methods used. Participants studying Science degrees, women and undergraduates were also oversampled. As a result, the distribution of the students in the current study may not be an accurate representation of the entire student population at Australian universities. The number of illicit CEs drug users was also so low that statistical analyses were deemed inappropriate for this group. Therefore, caution should be exercised in interpreting the results, given the constraints of our sample. As per previous work, future studies may consider examining the academic outcomes of Australian students that use CE drugs, particularly contextualised regarding coping.

(Hanna et al., 2018)	UK	Methylphenidate, Adderall, Modafinil, Caffeine.	All Level 1 and Level 4 M. Pharm.	Paper survey. Convenience sample.	The response rates were 89.3% (Level 1) and 89.0% (Level 4) with 48.0% of respondents reporting they were CEs users (largely caffeine). Additionally, 42.4% thought using pharmaceutical CEs for improving academic grades breached their Code of Conduct.	The study could be done for other Schools, such as other healthcare disciplines. However, the opinions were captured at one point in time, data were self-reported, and the findings are not generalisable. Perhaps, if the study had been conducted immediately before the written examinations, prevalence of CE use would have been higher. Manually distributing paper-based questionnaires to students in a compulsory class and an online distribution would enhance the response rate. Other ways to maximise the response rate included having a relatively short questionnaire with questions largely in a closed question. Educational workshops could further explore ethical issues.
(Papazisis et al., 2018)	Europe, Central and Southern America.	Cannabis.	19,932 Medical students.	Online survey.	A systematic review and metanalysis was performed with adherence to the PRISMA guidelines. 1 in 3 Medical students had used Cannabis once in their life, and 8.8% reported that they were current users.	To analyse the prevalence of lifetime and current use of Cannabis among Medical students worldwide. Many of the included studies had sample sizes smaller than 400 and they were published before 2000, which may have had an impact on the exact prevalence of Cannabis use.
(Ram et al., 2017)	New Zealand.	Methylphenidate, amphetamine, Modafinil.	449 Pharmacy, Medicine, Nursing and Law Students.	Paper survey.	Response rate was 88.6% (442/499). Prevalence rate of CE was 6.6 % in the university environme nt sampled. There were no sig	To investigate what factors, explain the decision to use CEs among tertiary students in New Zealand, using the Theory of Planed Behaviour. This research supports the notion that the decision to use CEs is not just an autonomous choice that occurs in

					nificant differences in student motivation and learning strate gies between users of CE and non-users.	isolation. Attitudes on the ethical and social acceptability of CE use were more likely to drive the decision to use CEs.
(Lazuras et al., 2017)	Greece.	Methylphenidate , Modafinil, ginseng, taurine, caffeine, Vitamin B complex,	450 university students.	Paper survey.	The findings show that university students may engage in PCE use independent of their student experiences. Rather, a chemically assisted performance enhancement mindset seems to differentiate users from non-users of PCE substances.	The study did not address whether such achievement motivations underlie the decision-making processes to use PCE substances among university students.
(Jain et al., 2017)	South Africa.	Methylphenidate .	Year 5 Undergraduate Medical students (541 students).	Paper survey.	Some 11% reported the use of methylphenidate for study enhancement purposes.	There are few limitations in this study. The survey was self-administered, and the questionnaire was conducted in class before the lecture started, so the students may have been in a rush to finish it. The questionnaire was not structured in such a way to determine whether the participants with ADHD were using methylphenidate as prescribed or misusing it for reasons not related to their ADHD.
(Vagwala et al., 2017)	UK	Methylphenidate , Amphetamine, Modafinil.	66 participants from Russell Group universities.	Focus group interview.	Some 58/66 students thought that it is a good choice to use CEs.	This study was to compare the acute effects of methylphenidate/MPH, modafinil, and 3,4-methylenedioxymethamphetamine on the neural mechanisms underlying response. Not able to disentangle neural activation in response to successful

						vs failed inhibitions in the present study due to the modest number of no-go trials. The small number of inhibition trials (i.e., no-go trials) also limited the functional relevance of our behavioural results, albeit MPH and modafinil significantly increased the probability of inhibition.
(Jensen et al., 2016)	Australia	Methylphenidate, Amphetamine, Modafinil.	38 students.	Interview.	N=5 had used CEs.	CEs users reported higher levels of stress and lower levels of ability to cope than the sample average.
(Ghali et al., 2016)	UAE	Caffeine.	175 university students in one university only: Year 1 to year 4. The Schools of: Art and Creative Enterprises. Business Sciences, Communication and Media Sciences. School of Education and School of Sustainability Sciences	Paper survey. Convenience sample.	Eighty-six per cent of the 175 participants, both males and females, at Zayed University, Dubai consumed caffeinated beverages with an average intake of 249.7 ± 235.9 mg. The intake among the 150 caffeine consumers varied from 4.2 mg/day to 932.2 mg/day.	The study was to determine the prevalence of caffeinated beverage consumption among university students and the perceived benefits. In addition to the estimation of daily caffeine consumption, the study was undertaken in one university only. In the UAE, the limited studies that were done regarding this concern showed the high tendency of university students towards the consumption of caffeinated drinks, mainly energy drinks.

(Gudmundsdottir et al., 2016)	Iceland	Methylphenidate, Adderall, Modafinil.	n=521.	Online survey.	11% used CE without prescription, 42% were holding a prescription. The reason for the misuse was to improve their academic performance.	To review historical information concerning prescription stimulants and to summarise the literature with respect to misuse among adults, particularly college students, including risk factors, mediators and moderators, and motivations for prescription stimulant misuse. Lack of understanding in variability according to dose level and individual variability is a clear limitation across most studies examining the potential for neurocognitive enhancement from prescription drugs.
(Fond et al., 2016)	France	Methylphenidate, Modafinil, MDMA, piracetam, amphetamine .	1,718 Medical students and physicians.	Online survey.	33% reported the use of CE, mainly to increase academic performances and to stay awake during exam preparations.	To estimate the prevalence of psychostimulant use in the French medical community and their motives. Lack of direct information on the period of stimulant use. It was a choice to keep the questionnaire short to maximize the response rate. This limit was partially addressed by the age at the first psychostimulant use, which has been considered in our analyses.
(Lengvenytė & Strumila, 2016)	Lithuania	Modafinil, Methylphenidate, Amphetamine .	A cross-sectional survey study was performed by analysing a convenience sample of n=579 in the two universities offering Medical Education in Lithuania.	Paper survey.	8.1% reported that they had used CE in their lifetime.	To analyse the use of cognitive enhancers among medical students in Lithuania, to determine the reasons for usage and evaluate the contributing factors, such as sociodemographic characteristics, stress levels, sleep quality and knowing somebody who has used a neuro-enhancing drug. 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.

(Hupli et al., 2016)	Lithuania and Netherland	Racetam group substances Benzodiazepines Modafinil, Methylphenidate, Amphetamine Caffeine pills	Interview n=35 Survey n=113	Online survey and Interview	From 113 respondents in the survey, 24 (21%) reported having tried CEs. Most of participants turned to CEs to enhance their concentration for the purpose of study and time management.	Future research needs to take into account the great variety of drugs/substances that students use as CEs in real-life settings.
(Schelle et al., 2015a)	The Netherlands.	Methylphenidate, Modafinil, Rivastigmine, Beta Blockers.	1,572 students.	Online survey.	No response was reported on the use of Modafinil and Rivastigmine. 52 students reported the use of methylphenidate. 36% used Beta Blockers at least once in their lifetime.	Convenience sampling constituted only an approximate representation of the student population in the Netherlands. Women, for example, were oversampled. In addition, the sample was not equally distributed for different universities, as well as not distributed in line with the absolute difference in number of students of the 14 Dutch Government supported universities.
(Abbasi-Ghahramanloo et al., 2015)	Iran	Methylphenidate, Alcohol.	16,000 medical students.	Paper survey.	The prevalence of prescription drug misuse, last year alcohol use, and every illicit substance use was 4.9%, 6.9%, and 2.9%, respectively.	There is limited information about illicit drug use and associated factors in hookah smokers in Iran. So, the aim of this study was to assess the status of illicit drug use and associated factors among hookah smokers of Khalil Abad city in 2015.

(Liakoni et al., 2015)	Swiss	Methylphenidate, Modafinil.	Students at three Swiss universities were invited by email to participate in a web-based survey. Of the 29,282 students who were contacted, 3,056 participated.	Online survey.	22% used CE to improve cognitive performances while studying.	Investigate students' attitudes toward PCE. The response rate for the present survey was 10%. The study sample may not have been necessarily representative of all Swiss students. Although all students from UniBas and ETHZ were invited, only 5,000 of a total of 26,000 students who are currently enrolled at UZH, who had previously agreed to be contacted for participation in various studies, could be invited.
(Singh et al., 2014)	UK and Ireland.	Modafinil, Methylphenidate, Adderall.	877 students in 104 universities.	Paper survey of a convenience sample of 877 students measured PCE prevalence, attitudes, sources, purposes and ethics.	Only 2% reported that they have used CE.	Results from convenience sample survey may be biased, due to participants self-selection. They only use an online survey, which was considered too costly and unfeasible due to access barriers.
(Vargo et al., 2014)	Northern Ireland, Wales and England.	Cannabis, Ecstasy, amphetamines.	3,706 students from 7 universities across Northern Ireland, Wales and England. England (Gloucestershire N = 908, Bath Spa N = 462, Oxford Brookes N = 203, Chester N = 883,	Paper survey. Convenience sample.	5% reported that they had regular used CE, and 25% used CE occasionally. Some 5% reported that they had regular use of CE, and 25% used CE occasionally, and 70% never.	The study could be carried out at other schools, such as other healthcare disciplines. However, the opinions were captured at one point in time, data were self-reported, and the findings are not generalisable. Perhaps if the study had been conducted immediately before the written examinations, prevalence of CE use would have been higher. Manually distributing paper-based questionnaires to students in a compulsory class and an online distribution would enhance the response

			Plymouth N = 167); Wales (Swansea N = 398); and the Republic of Northern Ireland (Ulster N = 463). Each participating institution provided ethical approval.			rate. Other ways to maximise the response rate included having a relatively short questionnaire with questions largely in a closed question.
(Ott & Biller-Andorno, 2014)	Swiss	Methylphenidate, Adderall, Modafinil.	1,765 students.	Online and paper survey.	4.7% had used CE for the purpose of studying.	The findings from this survey can lead to a better understanding of why some students are already using CE and can also add to the discussion on social norms and values in the context of legalizing or prohibiting such products.
(Micoulaud-Franchi et al., , 2014)	France	Methylphenidate, Modafinil, amphetamines, Piracetam.	206 students.	Online survey sent to French sample of Medicine and Pharmacology students using email.	Among 206 undergraduate students, 139 students (67.4%) declared to have consumed at least one cognitive enhancer in the past 12 months. Twelve students (8.6% of cognitive enhancers users and 5.8% of our total sample) used illicit pharmaceutical neuroenhancer.	Assess prevalence and motivations for licit (use inside medical indication) and illicit pharmaceutical neuroenhancer consumption (Tablet form) in a non-selected French sample of Medicine and Pharmacology students. A prevalence of 5.8% for smart drugs consumption in Pharmacology and Medical students, mostly in order to enhance academic performances and vigilance. Methylphenidate was the most frequently consumed molecules.

(McCabe et al., 2014)	USA	Methylphenidate, Adderall.	4 years repeated study.	Online survey.	1 in 5 students reported the use of CE at least once in their lifetime.	Examined stimulants' cognitive enhancement effects and the psychological profile of non-medical stimulant users. a double-blind, placebo-controlled experiment, found no enhancing effect of mixed amphetamine salts (Adderall) on healthy participants' inhibitory control, working memory, episodic memory, convergent creativity, perceptual intelligence and a standardized achievement test. No moderating effects of baseline performance or COMT genotype were detected.
(Hildt et al., 2014)	Germany	Amphetamine, Methylphenidate, Ecstasy, Cocaine.	18 participants.	Interview.	Among all participants (n = 18 = 100%), 77.8% (n = 14) had used illicit stimulants (AMPH) and 38.9% (n = 8) prescription stimulants (MPH). 22.2% (n = 4) had used prescription as well as illicit stimulants for academic performance enhancement.	Several limitations were reported. One of them is the limited number of interviews: Only 18 interviews were taken into consideration. In spite of the fact that the University population was 36.000 registered students who had the possibility to notice the advertising placards of this interview study throughout the campus, only 30 students contacted them, and only 22 were willing to participate. Given CE prevalence rates of 3 – 20%, there should have been a much higher number of potential participants for this study. They hypothesize that the stigmatizing subject of this study is the reason for the low participation rate, notwithstanding the fact that anonymity was guaranteed and that participants were remunerated for their time and effort with 30 Euros.

(Emanuel et al., 2013a)	Chicago	Methylphenidate, Amphetamine.	1,115 medical students a multi-institutional census using a 31– 48 item online survey regarding use of prescription psychostimulants	Online survey.	18% had reported that they used CE at least once in their lifetime.	Given that students' responses are self-reported and that non-medically prescribed stimulant use is illegal, misreporting is a potential concern in this survey. However, the survey did not distinguish between giving away (illegal) or selling (criminal) these drugs. Previous studies have indicated that anonymous self-reported surveys have low misreporting rates.
(Hanson et al., 2013)	USA	Adderall.	213,633 tweets.	Online survey.	12.9% tweets the use of Adderall for studying purposes.	First, not every Adderall tweet is related to actual use. For example, we observed song lyrics that impact these counts, such as the two often quoted lines "College hoes love alcohol and popping Adderall" and "I've been up for 3 days… Adderall and red bull." In our sample, there were 4,275 tweets that have the words "college hoes love" and 894 that have the words "been up for three 3 days". These numbers probably inflate the number of matches for "college", "alcohol", and "red bull" above the number of people tweeting about using these substances.
(Dietz et al., 2013)	Germany	Adderall, Modafinil, Methylphenidate.	2,569 students.	Paper survey.	An estimated 12 month prevalence of using cognitive enhancing drugs was 20%.. Prevalence varied by sex (male 23.7%, female 17.0%), field of study (highest in students studying Sports related fields, 25.4%), and semester (first	As a result of the study findings, drug prevention models need to be established at all universities in Germany.

					semester 24.3%, beyond first semester 16.7%).	
(Bossaer et al., 2013)	USA	Adderall, Methylphenidate, Modafinil.	372 Medical, Pharmacy and Respiratory Therapy students.	Online survey.	10.9% Medicine, 9.7% Pharmacy and 26.3% Respiratory of the students reported the use of CE to enhance alertness and improve academic performance.	The incidence of psychosis or withdrawal associated depression is not known for prescription drugs.
(Kudlow et al., 2013)	Canada	Methylphenidate, Modafinil, Caffeine pills.	647 Medical students across all four years.	Online survey.	8% of the Seniors report the use of CE vs 2% of Junior students using CE for cognitive enhancement.	It was carried out at a single institution; however, we have no reason to believe that the results are not generalizable to students studying elsewhere. While self- selection may have led to a positive response bias, it is equally plausible that non respondents did not wish to disclose use of cognitive enhancers.
(Holloway & Bennett, 2012)	UK	Methylphenidate, Caffeine pills.	1,614 students.	Online survey.	33% had used drugs without prescription of which 0.5% used stimulants for a studying reason. 6% used caffeine pills.	The limitation in this study is that the response rates are quite low and also the study is exposed to the limitations of all self-reported surveys.
(Castaldi et al., 2012)	Italy	Modafinil, Methylphenidate, Adderall.	77 Undergraduate students.	Paper survey.	16% reported they had taken CE in the past.	The limitation in this study is the question on CE use in which did not specify what exactly the students took, their behaviour risk is difficult to assess, assumes that the truly problematic behaviour is to take CE drugs without having a prescription.

(Habibzadeh et al., 2011)	Iran	Methylphenidate	Group of Medical students	Paper survey.	8.7% reported the use of methylphenidate at least once in their lifetime.	First limitation is the validity of self-reported methylphenidate use among respondents depends on their willingness to reply truthfully on the survey. Second, the sample in the study was from a one university, thereby necessitating similar studies be conducted in other medical schools for comparison. Third, the study did not explicitly address duration or frequency of methylphenidate use. Therefore, it is unknown whether non-prescription users took methylphenidate regularly or only occasionally.
(Franke et al., 2011)	Germany	Methylphenidate, Adderall, Modafinil, MDMA.	1,035 students of pupils from (Vocational and Grammar Schools) and 512 students from Medicine, Pharmacy and Economics Schools.	Paper survey.	1.55% of pupils from Vocational and Grammar School vs 0.78% among students in Medical, Pharmacy and Economics reported a lifetime provenance for CE use. 2.42% of pupil's vs 2.93% of students reported lifetime use of CE for cognitive enhancement.	Data sampling was non-random, participants were not able to refuse participation in a discrete way. At least in the student population, in which approximately 30% did not fill in the questionnaires, it cannot be excluded that stimulant use is underreported since especially students with "negative behaviours" did not fill in the questionnaires leading to underreporting of stimulant use.
(Teter et al., 2006)	USA	Adderall, Methylphenidate	4,580 students.	Online survey.	75.8% reported that they have used amphetamine (Adderall) in the past year, 24.5% used methylphenidate (Ritalin).	Sample consisted of students from a single university, which may limit the generalizability of our results. However, the prevalence rates of illicit use of prescription stimulants in this single institution study were comparable to those found in national surveys of college students.

(Teter et al., 2005)	USA	Adderall, Methylphenidate	9,161 students.	Paper survey.	8.1% reported lifetime use of CE, 5.4% reported past year use of CE to increase alertness and concentrate better.	The 2001 CAS did not measure legitimate medical use of prescription stimulants or diagnosis, so it was not possible to assess how many students with legitimate prescriptions for stimulants may have misused their own or someone else's stimulant medication. As the data were cross-sectional, inferences about causality are limited and we could not assess whether certain factors preceded initiation of non-medical use of prescription stimulants. Longitudinal data are needed to further examine the directionality of these associations.
(Low & Gendaszek, 2002)	USA	Methylphenidate, Adderall, MDMA.	150 students.	Paper survey.	35.3% reported they had misused Amphetamine once in their lifetime, 10% abused it monthly and 8% weekly.	Reports of stimulant use are high in the present research; it may be that a relatively small sample is not representative of college students in general, despite attempts to avoid selection bias. A significant proportion of students came from Undergraduate Psychology classes and these students may differ from those in other Majors. Alternatively, it is possible that small, competitive colleges attract students who have been exposed to stimulant use, or who are willing to experiment with Amphetamines to enhance academic performance.

Nine studies were conducted in the UK (i.e., 6 survey studies, 2 interviews and 1 mixed method). Remaining countries included the USA (8 survey studies), Iran (4 survey studies), Australia (3 surveys and 1 interview), Canada (1 survey study and 1 focus group interview), Germany (2 surveys and 1 interview); 2 survey studies were carried out as well in each of the following countries: Italy, Brazil, Swiss, France; and 1 study each was carried out in Lithuania, Greece, the Netherlands, New Zeeland, Belgium, Iceland, Pakistan, UAE and South Africa. Finally, one mixed-method study was carried out in Lithuania & the Netherlands. Participants were students from a range of disciplines, including Medicine, Pharmacy, Engineering, Law, Computer Science, Business, Education, Psychology and Social Sciences. The sample size of the different studies ranged between 77 and 80,000 participants each.

An overview of the demographic variables, the prevalence of use, technical knowledge of CEs, motivations for use, source of CEs' acquisition and positive/negative subjective effects is summarised here.

2.4.2 DEMOGRAPHICS' VARIABLES

Males were here identified as the most typical CEs' misusers (Benson et al., 2015; Bossaer et al., 2013; Champagne et al., 2019; de Oliveira et al., 2020; Emanuel et al., 2013; Franke et al., 2011; Ghali et al., 2016; Gudmundsdottir et al., 2016; Habibzadeh et al., 2011; Hockenhull et al., 2020; Low & Gendaszek, 2002; Schelle et al., 2010; Singh et al., 2014; Teter et al., 2005), with some studies reporting a male:female ratio of 3:1 (Lengvenytė & Strumila, 2016). In contrast with this, a Welsh study reported that females representation was slightly more than males (Holloway & Bennett, 2012).

2.4.3 PREVALENCE OF CE USE

A growth of CEs' intake over the past few years has been reported, including from both high-ranking universities and highly competitive courses such as Medicine and Pharmacy (Schelle et al., 2010). In the UK, findings showed that 33% of the participants used CEs which were not prescribed to them for the purpose of study (Holloway & Bennett, 2012). In a survey conducted among UK and Ireland university students, it was found that the lifetime prevalence of the use of modafinil, methylphenidate and amphetamine were respectively 6.2%, 5.9%, and 2% (Singh et al., 2014). Conversely, the lifetime prevalence of CEs' intake among University students in

the US was estimated to range between 5% and 43% (Vinck, 2009). More precisely, a meta-analysis from the US estimated that the misuse of CEs among university students was 17% (Benson et al., 2015b). Compared to the US, most British university students may be more cautious in using prescription drugs as CEs (Vagwala et al., 2017).

A recent study in Brazil reported that, out of 1,865 students from different academic disciplines, 4.2% reported to had used CEs in the last 12 months, with the most popular molecule having been methylphenidate which was not associated with an ADHD diagnosis. With respect to what is being described in less competitive study fields (Lengvenyte et ., 2016), Medicine and Pharmacy have been identified as being both stressful and highly competitive academic courses worldwide (Hanna et al., 2018; Papazisis et al., 2018). To this respect, a study that was conducted among Iranian medical students (2000-2007 showed that methylphenidate users' mean knowledge score was higher than that of nonusers ($P = 0.008$), with age, gender and school year having been positively correlated with knowledge score ($P < 0.05$). Some 8.7% of participants had taken methylphenidate at least once in their lifetime (Habibzadeh et al., 2011). Similarly, a study carried out in Lithuania reported that the prevalence of CEs (modafinil, methylphenidate and amphetamine) among medical students was 8.1% (Lengvenyte et al., 2016). Finally, caffeine use as a CE has grown in popularity worldwide (Cappelletti et al., 2015). A study in the UAE assessed the prevalence and perceived benefits of caffeinated beverage consumption among university students (Ghali et al., 2016). More than 98.5% of the study participants were shown to be caffeine consumers, with 31% having reported to be addicted to caffeine; heavy caffeine consumption was significantly associated with heart problems (Ghali et al., 2016).

2.4.4 KNOWLEDGE OF CES AND REPORTED POSITIVE/NEGATIVE EFFECTS

University students may be attracted by stimulant drugs for several reasons, e.g. to increase awake time, enhance cognitive performance, improve professional and academic achievement (Lucke et al., 2018b), but also to help with socialising and getting high (Schleim, 2020). Indeed, the main motivations for misusing methylphenidate may relate to improving concentration (65.2%), helping with studying (59.8%) and increasing wakefulness (47.5%) (Teter et al., 2005). Other studies have associated methylphenidate misuse with the need to help concentration, stay alert, have more energy and improve self-confidence levels (Batistela et al., 2016; Habibzadeh et al., 2011; Javed et al., 2019). A 2019 UK qualitative study with

Biomedical Science undergraduate students examined their understanding of the risks of non-prescribed drugs, and particularly modafinil, misuse. Drivers of use related to university pressures and desires to increase productivity; the customisation of the sleep-wake cycle was described as a key benefit of study drug use (Steward & Pickersgill, 2019).

Increasing the levels of cognitive performance may indeed potentially allow students to study for more hours, and/or increase working memory performance (Repantis et al., 2010; Teter et al., 2005). According to Greely et al (2008), modafinil may be chosen as a CE because of its levels of online accessibility. Conversely, whilst studies in the UK suggested that CE drugs such as modafinil can enhance thinking skills (Sharp, 2016), over-confidence was reported as one of the CE's side effects, together with a high-risk of dependence (Nicholson et al., 2015a).

The popularity of caffeine and related products as CEs may be related to the need to boost energy, stay awake, improve mood, increase concentration and socialise (Ghali et al., 2016). In the UAE, the mean level of knowledge about caffeine was described as less than 33%. Younger participants ($p = 0.008$) and those who worked in healthcare and education ($p < 0.001$) were significantly more knowledgeable about its negative effects, including anxiety, insomnia, tachycardia, irritability and muscle tremors (Ghali et al., 2016). A recent systematic review g focussing on the effects of the caffeine-containing plant paullinia cupana ('guarana') on cognition in young, healthy adults found improvement levels in both reaction time and accuracy performance (Konstantinos & Heun, 2019). Guarana has also been described to improve memory performance and increase alertness levels (Haskell et al., 2006). Long-term use of guarana can, however, result in a series of adverse effects, including irritability, palpitation and anxiety (Marques et al., 2019; Nicholson et al., 2015a). Despite the legal restrictions that control the possession and supply of prescribed CEs, students often obtain them due to their desired pharmacological effects. Table 1B summarises the desired effects of CEs and their neuro-modulatory effects.

TABLE 2B. STUDIES SUMMARISING CES' LEGAL CLASSIFICATION, DESIRED EFFECTS, AND NEURO-MODULATORY MECHANISMS:

Drug (CE) **(IUPAC Name)**	**Brand Name**	**Misuse of Drug** **Regulation (2001)**	**Misuse of Drug Act 1971 (UK)**	**Class Drug (UAE)**	**Currently recommended clinical use and Neuro-modulatory mechanism**
Modafinil	Provigil	_	_	POM	Wakefulness-promoting agents such as modafinil and armodafinil are stimulant drugs which are used in the treatment of narcolepsy and shift workers sleep disorders (Hockenhull et al., 2020). The mechanism of action of modafinil is poorly explained in the literature. It has been reported that modafinil affects GABAergic and dopaminergic pathways in the prefrontal cortex and has effects on neurotransmitter systems (e.g. noradrenaline and dopamine) (Repantis et al., 2010). Modafinil is praised for its ability to improve reaction time, logical reasoning and problem solving (Lengvenyte et al., 2016).
Amphetamine salts	Adderall	Schedule 2	Class B	Psychotropic Schedule II	Amphetamines are a class of pharmaceuticals that include Adderall, dextroamphetamine, and lisdexapmhetamine (L-lysine-d-amphetamine) (Abelman, 2017). These drugs were developed to treat ADHD (attention deficit hyperactivity disorder) in adults and children (Smith & Farah, 2011). These molecules are classified as Schedule II according to the Misuse of Drug Regulation (2001) and Class B according to the Misuse of Drug Act 1971, due to their high abuse potential. Even though the risk of developing dependence on these drugs is believed to be low for individuals taking them for ADHD, the Schedule II classification indicates that there is a high potential for abuse and severe dependence (Smith & Farah, 2011). These drugs were also demonstrated to improve episodic memory, working memory, and some aspects of attention in general population (Ilieva et al., 2015). The therapeutic effect of both amphetamine and methylphenidate in ADHD is consistent with the finding of the abnormalities in the catecholamine system in individuals with ADHD (Volkow et al., 2008; Volkow & Insel, 2003).

Caffeine pills	Super- strength caffeine pills.	OTC	OTC	OTC	The usage of caffeine is increasing worldwide (Franke & Bagusat, 2015). The underlying motivations are mainly memory and concentration enhancement and physical performance improvement. Coffee and caffeine-containing products affect the central nervous system, with their locomotor activity stimulation and anxiogenic-like effects (Cappelletti et al., 2015). Caffeine also impacts on other neurotransmitters, including dopamine, noradrenaline, serotonin, glutamate, acetylcholine and gamma-aminobutyric acid (Ruxton, 2008). Caffeine consumption is very prevalent among the UK (Brunton et al., 2019) and UAE (Ghali et al., 2016) population. Healthy consumption needs to be promoted (Ghali et al., 2016). Although caffeine is also a stimulant, it is not illegal to use without a prescription (Bossaer et al., 2013).
Vinpocetine	Vinca minor	OTC	OTC	OTC	Is an alkaloid of the periwinkle plant (*Vinca minor*) (Seneca, 2007), which has been shown to exert a brain neuroprotective effect by a combined action on brain metabolism, cerebral circulation and rheological properties of the blood. This may boost the cerebral metabolism thus enhancing both oxygen and glucose utilization whilst consequently improving cerebral functions and providing protection even in conditions of hypoxia and ischaemia (Ogunrin, 2014; Zaitone et al., 2012). It is commonly used as a nootropic that promotes memory formation (Zaitone et al., 2012).
Guarana	Paullinia cupana	OTC	OTC	OTC	*Paullinia cupana* is a plant native to the Amazon basin which is especially common in Brazil (Kennedy et al., 2004). A review study on the effect of Guarana among healthy individuals reported an improvement in reaction time and accuracy of performance at cognitive tasks (Konstantinos & Heun, 2019). Guarana seeds are popular worldwide for their cognitive, stimulant and behavioural effects (Konstantinos & Heun, 2019).
Methylphenidate	Ritalin	Schedule 2	Class B	Psychotropic Schedule II	It is a stimulant drug used to treat ADHD and narcolepsy. It has been controlled as Schedule II according to the Misuse of Drug Regulation (2001) and Class B according to the Misuse of Drug Act 1971 due to its high abuse potential. Volkow and colleagues (2004) showed the effects of methylphenidate on motivation, which can affect academic performance whilst increasing cognitive ability and improving students' self-rated interest in a relatively dull mathematical task. A study reported that methylphenidate has one of the highest prescriptions rates, associated with

					an abundance of websites offering to sell and supply the drug without a prescription to UK users (Hockenhull et al., 2020). University students might be attracted to methylphenidate because of its alleged increase in attention and focusing levels (Bogle & Smith, 2009). Among university students, the self-reported misusing rates were from 1.5 to 31% depending on the different surveys considered, with the most nationally representative study estimating an annual illicit methylphenidate usage of about 4% (Bogle & Smith, 2009).
Pyridoxine	Vitamin B6	OTC	OTC	OTC	Pyridoxine, one of the most common forms of Vitamin B6 (Ford & Almeida, 2019), is said to significantly improve verbal memory and executive function (Solomon et al., 2015). It can aid in the synthesis of neurotransmitters and amino acids. Some of these neurotransmitters are norepinephrine, serotonin, GABA and dopamine (Solomon et al., 2015). There is no evidence that Vitamin B6 short-term use (e.g. for 5–12 weeks) improves cognitive function or mood (Malouf & Evans, 2003). More evidence is needed to determine whether Vitamin B6 supplements might improve cognition in healthy people.
2-(2-oxopyrrolidin-1-yl) acetamide	Piracetam	_	_	POM	Compounds from the racetam family include piracetam, oxiracetam, etc (Giurgea & Salama, 1977). Piracetam belongs to the nootropic drugs' group includes the brain cell metabolism and energy enhancement (Robbins, 2009). Although Piracetam is officially recognized as a nootropic, its enhancing effects in the healthy individual's brain are moderate (Wilms et al., 2019; Lengvenytė & Strumila, 2016). The racetam molecules are being used across a range of brain disorders, including Alzheimer's disease, narcolepsy, ADHD and brain aging (Husain & Mehta, 2011).
Cobalamin	Vitamin B12	OTC	OTC	OTC	It is also called cobalamin. It may help patients on long-term medications and those with neurological disorders (Ontario, 2013). Cognitive performance can be improved, and the risk of brain atrophy reduced, by Vitamin B12 (Gröber et al., 2013).

2.4.5 SOURCES OF CE ACQUISITION

Sources of CEs acquisition may relate to friends and family (de Oliveira Cata Preta et al., 2020; Ott & Biller-Andorno, 2014). Students diagnosed with ADHD, but not taking their methylphenidate medication regularly, have been reported as the main source for fellow students (Smith & Farah, 2011). In another study, 75.5% of methylphenidate was identified as having been purchased from friends at a university campus whilst 64.3% of modafinil was obtained online (Singh et al., 2014). Accessing the web for drug acquisition activities is a reason for concern (Hockenhull et al., 2020), with young people (18-25 years old) being at high risk because they are extensive users of the Internet (Morton & Tighe, 2011); it was found that over a third of the websites selling modafinil specifically recommended use of the drug to aid studying (Hockenhull et al., 2020).

2.5 Discussion

The current systematic review provided an in-depth and updated understanding on CEs' prevalence of use; levels of knowledge; and their impact on HEI university students, which is clearly a critical public health issue. The past few years have seen increasing levels of concern about the use of pharmaceutical cognitive enhancement among university students worldwide, with the lifetime prevalence of CEs misuse among these subjects ranging from between 6% to 20%, depending on the study subject (Kudlow et al., 2013). Of particular concern, however, is CE's use in Health Sciences/Biomedical students (Abbasi-Ghahramanloo et al., 2015; Bruyn et al., 2019; Emanuel et al., 2013a; Fallah et al., 2018b; Franke et al., 2011; Habibzadeh et al., 2011; Jain et al., 2017; Javed et al., 2019; Kudlow et al., 2013; Lengvenytė & Strumila, 2016; Papazisis et al., 2018; Pighi et al., 2018). Most data initially emerged from the United States (Benson et al., 2015b; McCabe et al., 2014; McNeil et al., 2011), eventually followed by reports from the United Kingdom (Singh et al., 2014), Australasia (Jensen et al., 2016; Ram et al., 2017); and Europe, namely from France (Fond et al., 2016; Micoulaud-Franchi et al., 2014), and Italy (Castaldi et al., 2012; Pighi et al., 2018).

Recent systematic reviews have found that stimulant drugs, such as modafinil, methylphenidate; amphetamine mixtures; and caffeine-related compounds are the most popular CEs. At times, use of illicit drugs such as MDMA or cannabis were mentioned here

as well. Conversely, piracetam, vinpocetine, Vitamin B6 and Vitamin B12 were only rarely mentioned here as having been ingested by students. Although not confirmed by a few studies (McNeil et al., 2011; Weyandt et al., 2009), males were identified as more likely to use CEs drugs than females (Franke, 2010; Benson et al., 2015b; Champagne et al., 2019; Emanuel et al., 2013a; Gudmundsdottir et al., 2016; Lengvenyte et al., 2016). Indeed, several social factors have been identified to influence CEs' use practices among university students (Schelle et al., 2015a). These included: peer-pressure, competition, performance demands and prior drug use (Garasic & Lavazza, 2016b), but also recreation (Schleim, 2020).

The availability of CEs for non-medical indications in the different countries is affected by a range of factors, including legal, social, and ethical (Maher., 2008); Maier et al., 2018; Mousavi et al., 2019). Indeed, some CEs are being openly made available online (Hockenhull et al., 2020; Napoletano et al., 2020), where they are marketed as 'smart drugs', 'study drugs', 'plant food', 'research chemicals' and 'designer drugs' as well (Pighi et al., 2018). The unregulated online access, and especially so for modafinil and methylphenidate, is likely to be associated with an increase of CEs' non-medical use and subsequent harm (Hockenhull et al., 2020). Indeed, high levels of modafinil may have reportedly been sold and shipped to students at high-rank/top UK universities, mostly during the examination period (Marsh, 2017). Conversely, as CEs' legal alternative to either prescribing or illicit drugs of abuse, guarana was found here to be popular, with affordable online prices encouraging young users/students to buy greater quantities in order to receive discounts and free shipping (Dennehy et al., 2005; Hockenhull et al., 2020).

Sahakian et al (2008) opened a debate on the positive impact on improving cognitive functions, suggesting that benefits of CEs should be maximised, and their harm minimised (Greely et al., 2008). In some studies, CEs drugs have been shown to moderately enhance cognitive performance in healthy individuals (d'Angelo et al., 2017). Accordingly, CE tools including pharmacological cognitive enhancement could improve quality of life of both busy workers and exhausted students to extend their work/academic productivity levels (Beddington et al., 2008), hence benefitting both the individual and society (Greely et al., 2008). There have been extensive reports focussing on CEs' intake to aid concentration and memory among healthy individuals, including students, academics, shift workers, and even chess players to improve their cognitive performance (Franke et al., 2017). A study by Smith & Farah (2011a) suggested that the effects of both methylphenidate and amphetamine mixtures on cognitive performances

in healthy participants showed positively consistent effects in learning, but especially so in delayed recall and recognition testing, pointing to an effect on memory consolidation (Smith & Farah, 2011). An additional study by Schelle et al. (2015) showed a positive effect of methylphenidate on memory and planning performance in healthy individuals. However, others have suggested that evidence regarding the clinical benefits of CEs in healthy individuals is still inconclusive (Maslen et al., 2014). A 2010 systematic review and meta-analysis of published randomised controlled trials of the effect of both modafinil and methylphenidate in healthy individuals showed that the anticipated effects of these two agents as cognitive enhancers exceeded their actual effect (Repantis et al., 2010). Hence, it has been suggested that the ability of amphetamine-type substance mixtures to enhance academic performance among students could be attributed to their effect on energy, confidence and motivation levels rather than to a direct effect on cognitive performance (Vrecko, 2013). In fact, individuals may be biased in predicting their own performance, e.g. they either underestimate or overestimate their academic competence (Dunning, 2011). Moreover, cognitive improvement seems to vary considerably from one agent to another, and Smith et al (2011) reported that one third of studies from past literature reviews showed null results. One could then argue that there are more unpublished studies in the literature with null results, due to publication bias favouring positive results (Smith & Farah, 2011).

On the other hand, use of stimulant CEs may be associated with negative academic performances in terms of the euphoric state induced, with abnormal mood elation preventing the student from spending enough time in preparation for an exam (Abbasi-Ghahramanloo et al., 2015; Batistela et al., 2016). Furthermore, methylphenidate is reported to present with an addiction potential (Morton & Stockton, 2000), and modafinil dependence cases have been identified as well (Krishnan & Chary, 2015). It is also worth noting the amphetamine-type substance-related dependence; withdrawal; and psychosis issues (Schifano et al., 2015). Untoward effects relating to the index CE may indeed influence students' choices, with them being keen to consider modafinil as opposed to methylphenidate and amphetamine mixtures. Indeed, Steward & Pickersgill (2019) found that all their CEs' users had ingested modafinil, with only some also having tried methylphenidate and amphetamine mixtures for the purpose of study. In fact, students described how the use of methylphenidate and amphetamine mixtures could result in dependence, and hence these were approached more cautiously (Steward & Pickersgill, 2019). Overall, however, the use of methylphenidate has significantly increased,

with its consumption, in defined daily doses, having increased to approximately 2.4 billion worldwide (Cândido et al., 2019).

In the UK, both methylphenidate and amphetamine compounds are Class B controlled drugs (UK Home Office, 2016). This means they can be provided via prescription, the maximum quantity issued should not exceed 30 days (as best practice rather than a legal requirement), and a personal import/export licence is required to transport the drug in or out of the UK if the amount exceeds 3-months' supply (Hockenhull et al., 2020). In contrast, modafinil is a prescription-only medicine in the UK, but it is not controlled under the Misuse of Drugs Act 1971 or subject to scheduling under the Misuse of Drugs Regulations 2001; hence it is illegal to supply it without a prescription, but it is not illegal to possess the drug for personal use (UK Home Office, 2016). To cope with these restrictions, CEs' selling websites provide discreet packaging; offer free reshipment if the package is seized; and encourage third-party, difficult to track, payment methods (Hockenhull et al., 2020). Finally, although caffeine is also a stimulant, its use is not associated with either acquisition; affordability; availability; or legality issues (Bossaer et al., 2013; Dietz et al., 2018b). However, with caffeine high-dosage intake a range of medical and psychiatric effects can be observed, most typically including anxiety; panic attacks; sleeping disorders and cardiovascular issues (McDermott et al., 2002).

2.6 LIMITATIONS

There are a few limitations that were considered in this study. The first limitation related here to the sole focus on English language studies having been included in the search; future studies should consider further languages. The second important limitation related to the methods used by the different studies, typically involving self-reporting surveys which could have introduced biases. Finally, the current study focused only on undergraduate students; however, postgraduate pupils; academic staff; and remaining workers should be considered by future studies.

2.7 Conclusions

This Chapter provides a systematic literature review on the studies that looked at the use and impact of CE use among university students. The main conclusion was that some students worldwide may be willing to consider CEs' ingestion to improve their academic performances.

The attitude of university students about CEs and their possible benefits is, however, based on anecdotal, and arguably biased, information obtained from the media; the web; and friends (Finger et al., 2013). Overall, it seemed from this review that the topic is not being sufficiently covered in the curriculum of modern universities. Conversely, this issue should be discussed, as an inter-professional or inter-disciplinary learning opportunity, from a public health perspective (de Oliveira Cata Preta et al., 2020; Hanna et al., 2018). CE use may arguably be reduced if students' levels of awareness were raised, emphasising that CE intake may pose a risk to safety, and especially so in vulnerable individuals (Champagne et al., 2019). Indeed, impacts of CE drugs' intake may include tolerance, dependence, withdrawal, cardiovascular and neurological disorders with a related risk of death due to overdose (Napoletano et al., 2020). The implementation of a harm reduction campaign, in order to bring the overall consumption lower, has been proposed as well (Abelman, 2017; Kimberly J. Schelle et al., 2010b).

Finally, Shaw (2014) suggested that one of the most fascinating issues in the emerging field of neuro ethics is pharmaceutical cognitive enhancement. Medical debate (Schelle et al., 2014) has largely focused on the CEs' potential to help those who are cognitively impaired. Hence, it is here suggested that CEs' use by university students seems to raise the issue of 'cosmetic' neuropsychopharmacology (Shaw, 2014; Zaami et al., 2020).

2.8 Summary of the Chapter

It was important for the systematic literature review to identify this research study 'gap' where no previous study had been conducted in the gulf countries including the UAE on the use and impact of CE illicit drugs among university students.

The following chapter provides an overview of the theory of triadic influence (TTI) in order to better understand the risks associated with the use of CEs among UAE university students.

3 CHAPTER 3: THEORETICAL FRAMEWORK

3.1 Introduction

The findings of the systemic literature review presented in 'Chapter 2' indicate that there has been an increase in the misuse of CEs among university students, to enhance their academic performances, which has been identified as a public health concern (Sharif et al., 2021). In most studies on CEs misuse, prevalence rates and individual determinants, like gender and personality, have been examined (Alrakaf et al., 2020; Arria & DuPont, 2010; Benson et al., 2015a; Schelle et al., 2015b; Sharif et al., 2022). However, to prevent healthy students from misusing CEs, we need to understand not only individual-level factors but also socio-cultural contexts in which students live and study (Flay et al., 2009). As students spend most of their time in an academic environment, influences from peers and level of competitiveness seem inevitable (Leonard et al., 2015).

There are four factors involved in this approach to identifying public health issues of the use of CE among university students in the UAE. Moreover, identifying and defining the research problem is critical, and this can only be achieved by obtaining a thorough understanding of the issue and relevant risk factors. A suitable tool should be employed to assess the research problem and systematically analyse the thoughts of students and university teaching faculty staff on the use of CE drugs/substances among university students. This is presented in Fig. 4.

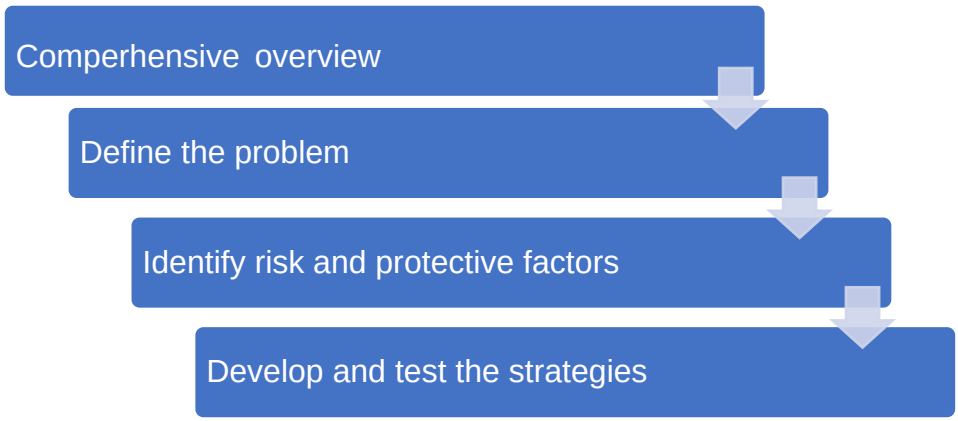

FIG 4. PUBLIC HEALTH APPROACH FRAMEWORK (Centres for Disease Control and Prevention, 2020)

3.1.1 STEPS APPROACH

There are four key steps involved in this PhD thesis (Wald & Daniel, 2020):

1. **Step 1.** Perform a systematic literature review. The purpose of this is to provide a clear and comprehensive overview of available research about the use of CEs among university students worldwide. Additionally, this helps in identifying important research gaps.
2. **Step 2.** Define the problem. This can be achieved using a survey approach, which is useful in gaining insight into the use of cognitive enhancers among UAE university students from a larger population.
3. **Step 3.** Identify the risk factors. Subsequently, the current researcher is meant to carry out a range of semi structure interviews to discuss the factors causing students to turn to CEs.
4. **Step 4.** Plan. Make recommendations for developing and implementing a harm reduction campaign.

This thesis has been developed specifically to address the research questions whilst also fulfilling the research aims and objectives. The finding from our systematic literature is evident that the use CEs has increased amongst university students in recent years (Chapter 2). However, this issue has not yet been tackled in the UAE context. Thus, this study is the first of its kind to investigate the use of CEs drugs/substances amongst university students in the UAE.

Therefore, a theoretical framework was needed for better understanding CEs drugs/substance use among UAE university students.

3.2 Theoretical Framework

As the foundation for research plans, a theoretical framework provides a framework for analysis so that a problem under investigation can be understood (Bryman, 2016). A logical framework that incorporates a theory is known as a theoretical framework (Wald and Daniel, 2020). Using prior information and the narratives of others who have had similar experiences, Sinclair (2007) described the theoretical framework as a map that helps the researcher navigate the knowledge structures (theories).

The theoretical framework often referred to as a paradigm justifies the researcher's ontological and epistemological presuppositions (Creswell, 2003). The research paradigm includes the ideas and presuppositions that guide thinking and research as well as the research technique and methodologies (Creswell, 2003).

As a result, the reported prevalence of CE drugs uses among university students and risk factors associated with the behaviour, perception and attitude have varied across studies (Bavarian et al., 2013a). Given the relatively recent CE drugs and its impact on the public's health, a more comprehensive understanding and synthesis of the research on risk factors for CE use among students in the university is needed to guide prevention efforts.

Addressing these research gaps, through the systematic literature review, is essential for accurately assessing the scope of CE use and identifying the multitude of factors associated with CE use on any one campus.

In examining the behaviours, expectations, perception and attitudes among students on their use of CE drugs, the theory of Triadic Influence (TTI) was applied (Flay & Petraitis, 1994; Flay et al., 2009). It is noteworthy that despite the existence of a wide range of theories of health behaviour (Flay et al., 2009), the ecological-based TTI allows for the unification of various intrapersonal, social, and environmental theories into a single framework. Therefore, the TTI was chosen as the theoretical guide due to its comprehensive framework (Bavarian et al., 2015a).

3.3 The Triadic Influence Theory

This research adapted the theory of triadic influence (TTI) (Flay and Petraitis, 1994, Flay et al., 2009), a theory that includes constructs and combines ideas from several 'smaller' theories, such as the **"Social learning theory"** (Bandura, 1986) "*that is considered to be critical in promoting desirable behavioural changes (Nabavi, 2012). Moreover, interactions between humans in social contexts underpin this theory. When observing the behaviours of others, individuals often develop similar behaviours (Bandura, 1978). Additionally, once a person has observed the behaviour of others, they often imitate that behaviour, particularly if their observational experiences have been positive or rewarding (Bandura, 1978)",* and the **"Theory of planned behaviour (TPB)**", (Ajzen, 1991). According to this theory, people have

"the ability to exert self-control over a wide range of behaviours. The key component of this model is behavioural intent; behavioural intentions are influenced by both the subjective assessment of the risks and benefits of the expected outcome and the attitude towards the likelihood that behaviour will achieve it. In addition to health behaviours and intentions, the TPB is used to predict and explain health behaviours and intentions, such as smoking, drinking, and using addictive substances. It is emphasized in the TPB that behavioural achievement depends both on motivation (intention) and ability (behavioural control)" (Ajzen, 1991). Into a comprehensive framework indicating the importance of three steams of influence and four levels of causation. (1) (**Intrapersonal** (biology and personality that influences self-efficacy), (2) **Interpersonal** stream (social situation), (3) **Sociocultural** stream (cultural environmental factors that influence attitudes towards a behaviour (Flay et al., 2009). Moreover, the four levels of causation range from ultimate causes (which an individual has the least control over) to distal influences on proximal predictors to immediate precursors (which an individual has the most control over). Each of the pathways can be combined in this integrated, comprehensive theory.

This framework is considered to help explain how laws and regulations affect people's health behaviours and overall population health. The TTI is a broad ecological model that can be used to explain health-related behaviours and to direct the change of unhealthy behaviours. Under the TTI, theories and variables can be categorized in two dimensions, namely levels of causation and social-ecological streams of influence (Flay & Petraitis, 1994).

The TTI postulates that causes of behaviour operate along multiple pathways, which can be ultimate, distal, or proximal levels of causation. These pathways (Fig. 5) contain two sub-streams and flow through three ecological streams. Additionally, it is believed that experiences with specific behaviour feedback alter the initial causes (Flay & Petraitis, 1994).

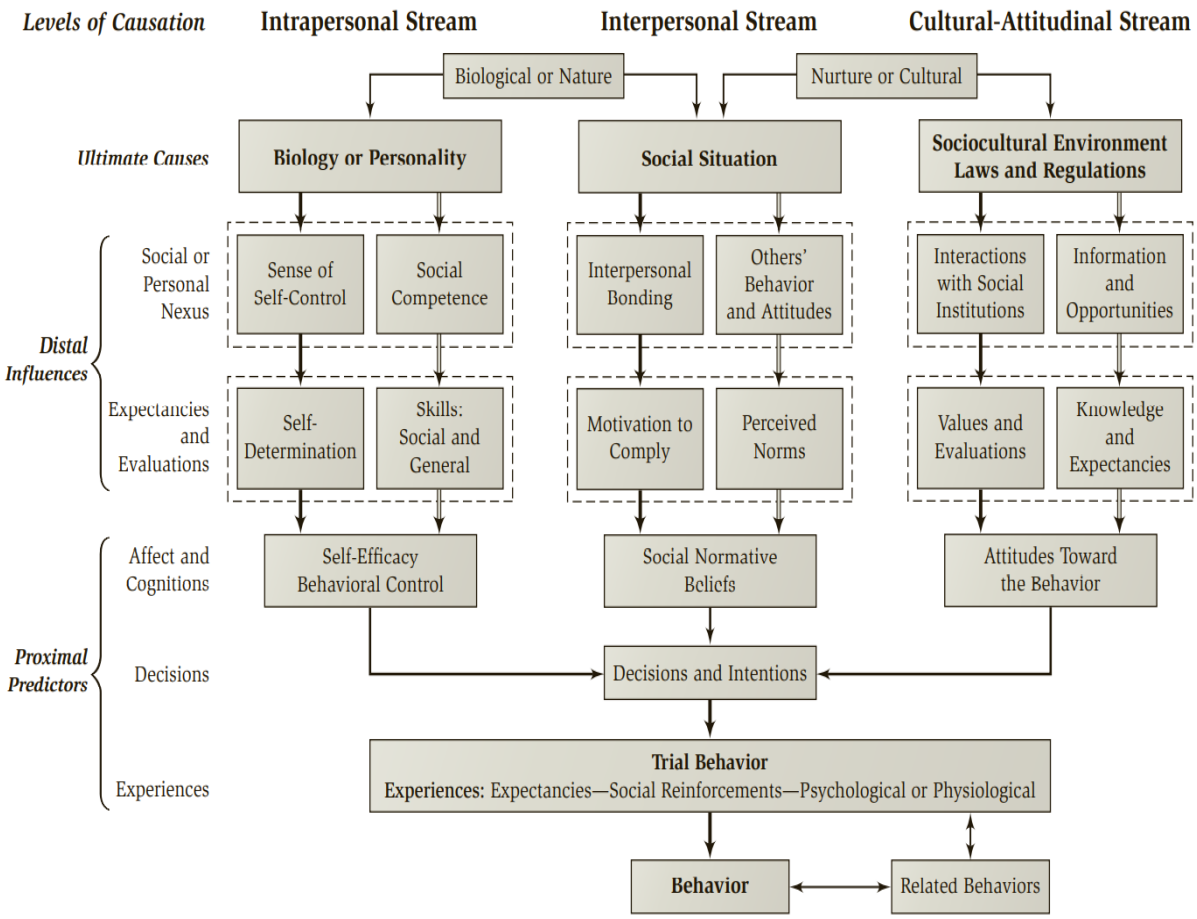

Fig 5. The Theory of Triadic Influence (Flay et al., 2009)

According to the TTI, it is assumed that there are three primary streams of influence **(Fig. *5*):**

1. **The intrapersonal stream** flows from genetic predispositions and personality through self-determination and skills to self-efficacy. According to Bandura (1986), self-regulation can enable individuals to guide themselves towards achieving and developing self-management skills. Moreover, there are many different forms of self-regulation, such as goal setting, seeking social support, and rewarding oneself. According to the self-control theory (Bavarian et al., 2013b), a person's self-control develops during childhood and is likely to stay consistent throughout adulthood. Bavarian et al (2013a) have indicated that poor or insufficient socialising is linked to lower levels of self-control. They added that low self-control makes people more prone to delinquent behaviours, including health-related ones like drug use. Because of this, the severity of legal penalties or punishments depends on an individual's level of self-

control, which in turn mediates the impacts of public health regulations. In brief, it is more likely that individuals with high self-control will obey laws than those with lower levels of self-control.

2. **The interpersonal (or social-normative) stream** flows from an individual's social contexts and relationships (university, family, peer networks) through the behaviours of and relationships with others, to social normative beliefs. This includes perceived norms regarding the behaviours of others, as well as a person's motivation to comply and please others. Social psychology-based theories of law compliance can also help to explain the impacts of safety and prevention laws (Tyler, 2001). According to compliance theories, people follow the law due to fear and risk of being punished. However, recent research indicates that the extent to which individuals obey laws is more strongly influenced by their perception of the laws' legitimacy (Tyler, 2001).

One framework that can be used to examine the influences that social relationships have on behaviour is the Social Attachment Theory, in which it is assumed that humans naturally crave close relationships with others, albeit intimate, romantic, or child-parent relationships (Bavarian et al., 2015). People who are emotionally attached to traditional societal norms are more likely to comply with laws that restrict their ability to behave in certain ways. Studies have shown that compliance motivations are directly influenced by the quantity and quality of attachment (interpersonal bonding) (Bavarian et al., 2015). Social networks and relationships have a significant impact on how people behave, including their responses to laws. A wide range of theories known as "social network theories" describe the structural features, roles, and various forms of social support that make up an individual's social network (Flay & Petraitis, 1994). Thus, those who have intimate exposure to specific behaviours being carried out by others are more likely to carry out this behaviour themselves. Observational learning focuses on how individuals adopt new behaviours that they see other people performing, especially if the behaviour is reinforced by reward systems within a person's social system (Bavarian et al., 2015).

3. **The cultural-attitudinal or sociocultural, stream** flows from wide-ranging sociocultural factors (i.e., legal, economic, political, religious, or media-related factors) through an individual's interactions with these social systems and the extent to which

such interactions influence their attitudes towards a specific behaviour (Bavarian et al., 2015). This also includes the influence that social systems have on one's values and perceptions of consequences. It also considers how a person's expectations regarding behavioural consequences are influenced by the information provided by such institutions (Flay et al., 2009).

Nonetheless, it is important to note that all three streams end at a person's intentions (or decisions), which serve to create a reliable prediction of actual behaviour. Although psychologists often highlight the affective or emotional component of the second sub-stream, sociologists tend to focus more on aspects of self and social control (Bavarian et al., 2013a). Moreover, Flay et al. (1994) point out that, under the TTI, these variables are organised based on various levels of causation, namely ultimate causes, proximal predictors and distal influences. Some factors, including attitudes toward the behaviour, social normative beliefs about the behaviour, and self-efficacy or behavioural control (confidence in carrying out a specific behaviour), can have an immediate impact on intentions regarding that behaviour and thus consequently become proximal causes of that behaviour. Other influencing factors that are mediated by other variables can be considered causally distal, such as a person's social skills, other people's attitudes and behaviours, and their interactions with social institutions. Lastly, several factors including the law, poverty, neighbourhood characteristics and personality traits serve as important underlying behavioural drivers that people do not usually have much control over.

Several studies (Bavarian et al., 2013a; Bavarian et al., 2013b, Bavarian et al., 2015, DeBruyn, 2021) have used the TTI to investigate the misuse of stimulants among university students. Using one comprehensive theory, the studies aimed to organise what is known about stimulants drugs in the university population. This was so that professionals in higher education can plan prevention and intervention activities based on this review. Due to the increased time, financial, and academic demands faced by this generation of college students, stimulants drugs will likely remain prevalent in universities for the foreseeable future. For this reason, maintaining a healthy learning and living environment for university students requires addressing this substance use behaviours.

The researcher in this PhD thesis will contribute to the current scientific knowledge on two aspects: (1) procrastination, fear of failure, academic stress, financial worries, and competitiveness within the faculty's study climate (2) we test this model in a subpopulation of

medical, dentistry, pharmacy, nursing, and engineering students in the UAE, who might be vulnerable to misuse CEs drugs/substances.

3.3.1 DEVELOPED FRAMEWORK

Our knowledge of how public health rules and regulations affect behaviour has been influenced by many social psychology theories. Such as the theory of planned behaviour (Ajzen, 1991), social cognitive theory (Nabavi, 2012), and expectancy theory (Flay et al., 2009).The major principles involved in TTI have been adopted by the current researcher to help university students in the UAE understand CE drugs. Additionally, an integrative theoretical framework based on the concept of triadic impact has been employed in this work to address the research question.

TTI was applied to develop the theoretical framework that would be used in this study because it is integrative and suits the philosophy of systemic theory. In other words, the researcher believed that this framework enables them to investigate the topic amongst students, teachers, family members, friends, and society. The TTI is very similar to the systemic way of thinking. Furthermore, TTI focus on examining interactions between students and their social institutes based on personal, social, and socio-cultural components. The modified TTI facilitates a profound understanding of the topic, which can ultimately be used to ensure that society is healthy and aware.

The TTI framework has been modified by the researcher in the present work to suit the study being conducted, and to shape the systemic literature review, quantitative and qualitative study. It also serves as a valuable tool for assessing quantitative and qualitative data. Consequently, the framework used in the present work emphasizes three major influences on students, namely their personal lives, their social lives, and the interaction between students and their peers and friends, as well as their interactions with society and culture through cultural environments. These components are presented in the following diagram:

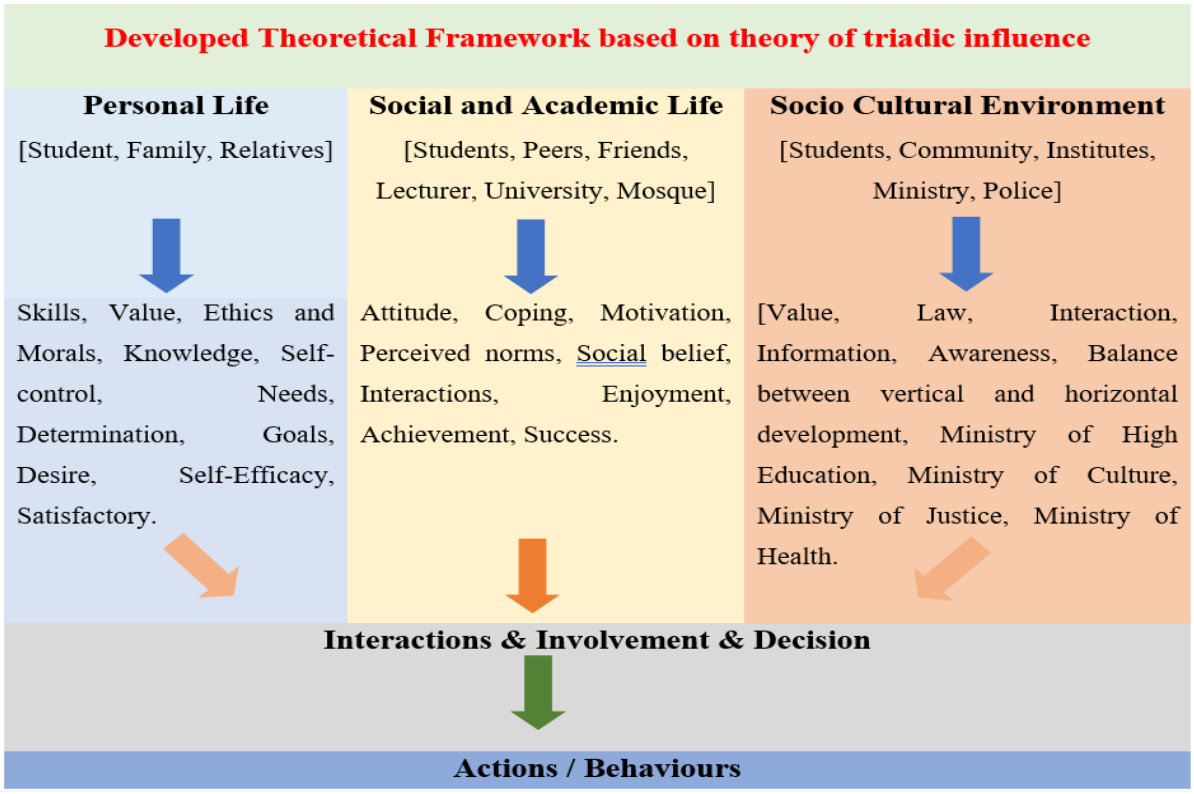

Fig 6. Developed theoretical framework based on (TTI) adopted from (Flay et al., 2009)

3.3.2 THE VALUE OF THE TTI MODEL

The TTI cultural-attitudinal stream exemplifies how governmental policies and regulations influence social, and institutional practices and structures, which, in turn, shape individuals' behaviours regarding their health; for example, when the government advise health institutions to follow safeguarding measures when they deal with patients, Institutional structures, and practices such as work guidance for staff and patients about how to deal with risks can have an impact on a person's opportunities, access to goods and information, and interactional capacities. The TTI suggests that expectations and assessments about a certain conduct impact attitudes toward that behaviour, drawing on theories previously discussed. A proximal factor that determines intentions and the adoption of behaviour is one's attitude toward a certain behaviour.

The TTI expands upon other integrative theories by incorporating a wider variety of psychological and sociological theories of behavioural growth and change, such as the Social Cognitive Theory. Many key principles of such theories are coherently organised in the TTI to explain health-related behaviours. The TTI also takes into account development, feedback,

control systems, and a systematic understanding of how many causes affect various behaviours either directly, through mediated routes, through the moderation of other causes, or feedback systems.

3.3.3 PATHWAYS OF INFLUENCE

The pathways along the cultural-attitude stream are like economic utility theories and rational decision-making theories. They also contain components of procedural justice theories and deterrence theories of compliance (Flay et al., 2009). Laws governing public health may also have an impact via less logical channels involving interpersonal interactions and feelings. Laws, for instance, can mediate the effects of societal and intrapersonal elements. For example, legislation might influence people to alter their attitudes or behaviour (interpersonal stream). This will cause changes in perceptions of behavioural norms. Subsequently, this will change the extent of a person's relationship with others, as well as their desires to please them and their social normative beliefs. Laws can also directly influence a person's sense of control or social competence in the intrapersonal stream. For instance, disability discrimination law can make disabled individuals feel validated in their attempts to find accommodation at work (Petraitis et al., 1995), resulting in changes through the intrapersonal stream, impacting self-efficacy and intentions.

The TTI can be used to identify and measure key constructs that explain behavioural differences. This can be beneficial in understanding how laws change health-related behaviour. Eleven variables that play a critical role in understanding how legal institutions and practices influence behaviour have been proposed. Moreover, many tools can be used to measure these behavioural factors (Flay et al., 2009), including government resources (Petraitis et al., 1995).

3.4 Summary of the Chapter

The previous Chapter reported a systematic review on the use and impact of cognitive enhancers among university students around the world.

It was explained in the current chapter why the TTI is an appropriate and comprehensive framework for understanding the risks associated with CEs drug use among medical, dentistry, pharmacy, engineering, and nursing students. In this chapter, a solid foundation for concrete prevention initiatives that universities in the UAE could implement is provided. The

research methodology will be discussed in the next chapter, including the methodological strategy, the methods, and a step-by-step description of sampling, data collection, and data analysis.

4 CHAPTER 4. RESEARCH METHODOLOGY

4.1 Introduction

This Chapter outlines the research design and approach (pilot study, procedure, materials, measurement, data collection and analytic methods employed) to investigate the use of cognitive enhancers (CEs) among UAE university students with a clear discussion of the philosophical views underpinning the research study and then outlines the sequential explanatory design adopted. The advantages and challenges of the adopted approaches are also discussed. Ethical considerations and the involvement of participants throughout the study are considered. In addition, the Chapter provides detailed accounts of how validity and reliability were ensured throughout the study, and how data from the two phases (quantitative and qualitative) were analysed and drawn together.

The Chapter concludes with a critical reflection of the chosen method and approaches. The second Chapter in the current PhD thesis reports a systematic review on the use and impact of CEs among university students around the world. It was clear that the use of CEs among university students is growing worldwide, but there are fewer studies focusing on Arab countries (Alrakaf et al., 2020; Damiri et al., 2021). Hence, this study proposes to reduce the research gap by conducting primary research, comprised of two studies:

Study one: Quantitative study assessing the prevalence, knowledge and use of cognitive enhancers among university students in the United Arab Emirates (UAE). Study two: Qualitative study which explores the behaviour, perception, and attitude of cognitive enhancers among university students in the United Arab Emirates.

4.2 PHILOSOPHICAL FOUNDATIONS

This research involves a philosophical analysis of research methodologies. Philosophy is building the knowledge through a form of logically interconnected systems. Knowledge is built up on the answers of questions (Creswell & Clark, 2007). Teddlie and Tashakkori (2009) described paradigms as a group of beliefs, values, and techniques that influence the way a

particular research issue is approached. As others have suggested, paradigms are collections of basic beliefs about social and natural principles. There are four branches of research paradigms involved in research, that includes Ontology, Epistemology, Methodology and Axiology (Teddlie and Tashakkori, 2009).

4.2.1 Ontology

Ontology refers to the nature of reality and beliefs. Ontology deals with what exists and how it is viewed and is determined by Objectivism and Subjectivism (Bryman, 2008). According to Objectivism, reality consists of a single existence that can be measured either directly or indirectly by the researcher. As per the subjectivism concept, perceptions and actions of individuals relate to studies of interest and make a theory dependent upon the researcher (Bryman, 2008).

4.2.2 Epistemology

In epistemology, knowledge is defined by its nature, possibilities, scope, and basis (Abdul Rehman & Alharthi, 2016). This can be related to what is considered appropriate knowledge about the social world (Bryman, 2008). The philosophy explains what kind of knowledge is possible and how to ensure its adequacy (Grix, 2003). An epistemological positions include objectivism (assumes knowledge is out there and people only need to find it), constructivism (rejects objectivism and sees knowledge as the result of social engagements between subject and object) and subjectivism (meaning is imparted by the subject to the object) (Grix, 2003). Two contrasts in the epistemology positions are those known as 'positivism' and 'interpretivism'. Positivism (Deductive approach) is associated with quantitative methods and is based on testing the hypothesis (Grix, 2003). On the contrary, interpretivism (inductive approach) is associated with qualitative methods and is based on the concept that generates the hypothesis. Therefore, the current research combined deductive and inductive approaches to deeply understand the impact of CEs in the UAE through the literature review and views of participants.

4.2.3 Axiology

Axiology refers to the aims of the research. This element of the research philosophy attempts to clarify if you are trying to predict or explain the world (Bryman, 2008). Research design is

as distinct as the overall strategy a scholar plans to use to answer the research question (A. Bryman, 2008). Research design defines axiology as the science and art of planning methods for conducting a research study and obtaining the best findings (Creswell, 2003). As it is widely acknowledged, researchers who conduct any type of research to guide themselves throughout the study process require a detailed plan. The approach of this research consists of formalising clear objectives resulting from the research questions and then specifying the data sources, collection, and data analysis (Creswell & Clark, 2007). The research plan consists of two main steps: Phase 1 (quantitative phase), followed by Phase 2 (qualitative phase). Each phase of the current study has its research questions which can create a clear picture of the goal of this research.

4.3 Triangulation research methodology

Research methodology is one of the important steps in conducting good research. Bryman (2008) defined research methodology as the path through which the research is conducted by the researcher, based on assessing the transformative theory and actions through the use of a mixed method approach to strengthen the study and gain more views about the research area. In other words, the methodology Chapter should justify the design choices, by showing that the chosen methods and techniques are the best fit for the research aims and objectives and will provide valid and reliable results (Bryman, 2008).

Guest and Namey (2015) argue that the combination of qualitative and quantitative components can be beneficial as well as challenging. To begin the evaluation process, the quantitative data must be collected and analysed first for the qualitative analysis (Guest & Namey, 2015). That is the approach that was used in this PhD research as justified in the early parts of this section. A good research methodology provides scientifically sound findings, whereas a poor methodology does not. There are three types of research methodology: quantitative, qualitative, and mixed methods. Quantitative research methodology focuses on numbers, qualitative research methodology focuses on words or mixed methods combine both (Creswell & Clark, 2007) and each has its strengths and limitations. This Chapter justifies the research rationale, theoretical framework, and research methodology.

Further, it explains the research design and methods used to answer the research questions to achieve the research objectives and aim. Finally, both quantitative and qualitative data were analysed, and ethical considerations were addressed in this research. The methodological approach has opted to address the research questions through assessing a complete set of scientific studies and reports as well as undertaking quantitative and qualitative research methods**.**

4.4 RESEARCH PARADIGM (PRAGMATISM)

In this research, the pragmatic paradigm, based on both qualitative and quantitative methods (mixed-method approach), was appropriate for meeting the research aim and allowing the researcher to choose appropriate techniques to achieve the research goals and objectives (Teddlie and Tashakkori, 2009). 'Mixed methods' is a procedure for collecting, analysing, and integrating both quantitative and qualitative data to proceed with the research process within a single study to gain a better understanding of the research problem (Teddlie and Tashakkori, 2009). Additionally, the mixed-method approach will allow the researcher to understand the impact of CEs from both the students' and lecturers' perspectives in the UAE.

4.5 PILOT STUDY

4.5.1 PILOT QUANTITATIVE STUDY:

The questionnaire was adapted from surveys available in the literature (Bossaer et al., 2013; Castaldi et al., 2012; Charmaine et al., 2016; Ragan et al., 2013b; Singh et al., 2014; Smith, 2013; Smith & Farah, 2011). To validate the questionnaire, the questions were checked by the researcher followed by the supervisory team consistent with the 'Face Validity' approach (Bowling, 2014). Again, a UK Royal Pharmaceutical Society expert in the field of quantitative surveys provided further advice and minor changes were made to improve the quality of the questions, in line with the 'Content Validity' (McGartland Rubio, 2005) approach. The survey was piloted amongst 80 undergraduate students from the university of Hertfordshire to ensure that questions were coherent, and further changes were implemented to improve the comprehension of some of the questions ('Discriminant Validity') (Bowling, 2014).

4.5.1.1 AIM:

The pilot study aims to ensure that the instructions and questions of the questionnaire are clear, understandable and suiTable regarding the culture, gender, age and educational level of the participants. Also, the pilot seeks to ensure the validity and reliability of the questionnaire (Cohen et al., 2006).

4.5.1.2 MATERIALS:

SPSS version 26.0 software package was used to collect data online due to the Covid-19 pandemic among male and female participants. The consent form (*Appendix 9*) and information sheets (*Appendix 8*) were tested to ensure they are relevant to use in the data collection.

4.5.1.3 PROCEDURE:

Ethical approval was obtained from the University of Hertfordshire (*Appendix 1*) and the Authorities in the UAE (*Appendix 2 & 3*). The sample of participants for the pilot study from University of Hertfordshire (UH) (UK), with consideration of anonymity and confidentiality. Also, participants were informed that they can withdraw their participation in the study at any time if they wish to do so.

4.5.1.4 OUTCOMES:

The main purpose of conducting the pilot study was to ensure that the validity and reliability are acceptable:

a) Reliability was verified by doing Cronbach's alpha. This test was applied to the collected data by using SPSS. The score of reliability (from 0 to 1) was 0.81 which is considered an acceptable and good level of reliability (Tavakol & Dennick, 2011). The split-half method was conducted and was significant ($r=0.41$, $p<0.01$). Lastly, test-retest reliability was carried out after 15 days, the researcher applied the second application which was significant ($r =0.65$, $p=0.01$, $n=47$).

b) Validity was measured through these tests: the surveys were accepted by some experts in the field from the UK and UAE which includes. The PhD research supervisor's internal consistency was significant at this level (r= 0.25 to 0.78, $p<0.05$). Discriminatory validity between the upper group and lower group in the questionnaire, ($t = 25.67$, $p=0.001$, $n=48$) was in favour of the upper group, which means the questionnaire has good discriminatory validity. The questionnaire (survey) based on the outcome of validity and reliability was validated and could then be used in a real study.

4.5.2 PILOT QUALITATIVE STUDY:

The researcher randomly chose 10 postgraduate University students, six of them from Gulf countries an Arabic native speaker, and the other four was English native speaker. The aim and purpose of the study, consent form, confidentiality, information sheet, and ability to withdraw at any time were provided to them and the process of conducting the qualitative study and the nature of the interviews were verbally explained to them. After completing these 10 interviews, the researcher amended some of the interview questions with approval from the research supervisors at the University of Hertfordshire (UH).

4.6 Research methods

In the current research, mixed methods were adopted to complement each other effectively. Using a combination of both methods (quantitative and qualitative) allows for more robust analyses and takes advantage of the strengths of each method (Bryman, 2008). The integration of quantitative and qualitative data can enhance the value of mixed methods research (Bryman, 2008).

Qualitative data can be used to assess the validity of quantitative findings (Creswell & Clark, 2007). Quantitative data can also be used to help generate the qualitative sample or explain findings from the qualitative data. Qualitative inquiry can inform the development or refinement of quantitative instruments or interventions or generate hypotheses in the qualitative component for testing in the quantitative component (Bryman, 2008).

Creswell et al. (2003) also added that in mixed-methods sequential designs, the quantitative and qualitative phases are connected, in the stage when the first phase of the study (quantitative) results of the data analysis inform the data collection in the second phase of the study (qualitative). In the sequential explanatory design, a researcher connects the two phases while

selecting the participants for the qualitative follow-up analysis based on the quantitative results from the first phase (Bryman, 2008). The rationale for this study approach is that the quantitative data and their subsequent analysis provide a general understanding of the research problem. The qualitative data and their analysis refine and explain those statistical results by exploring participants' views in more depth (Creswell & Clark, 2007). The limitation of the mixed methods study is the feasibility of resources and the lengthy time to collect and analyse both data (Creswell & Clark, 2007). As already pointed out, in the current research, a three-phased mixed method sequential explanatory study was used: a) Systematic literature review; b) Quantitative study; and c) Qualitative studies.

The two main methods used in survey research are probability sampling and non-probability sampling. Probability sampling includes (simple random, systematic, stratified and cluster sampling) which means that every member of the population has a chance of being selected. They are representative of the whole population (Bryman, 2008). A non-probability sampling includes (purposive sampling, snowball sampling and convenience sampling) which is easier and cheaper to access, but it has a higher risk of sample bias and is not appropriate to use to make valid statistical inferences about the whole population (Bryman, 2008).

The cross-sectional design is one of the most popular research designs and is also known as social survey design as well. In addition, cross-sectional design entails the collection of data on more than one case and at a single point in time to collect a body of quantitative in connection with two or more variables, which are then examined to detect patterns of association (Bryman, 2008).

4.6.1 PHASE (1): SYSTEMATIC LITERATURE REVIEW

4.6.1.1 AIM

A systematic literature review aimed to investigate the use and impact of the use of a range of CEs within Higher Education institutions (*Chapter 2*).

4.6.1.2 SAMPLE

The sample of the literature search identified a total of 1400 studies here (e.g., 520 through PubMed, 490 through Science Direct and 390 through Scopus) (*Chapter 2*). Forty-eight studies were excluded as they were duplicates, 1294 studies were screened and were excluded based

on their title and abstract, 10 did not meet the inclusion criteria, and 48 were deemed relevant and were included in this review

4.6.1.3 PROCEDURE

A systematic review was here performed, in adherence with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines (*Fig 3*). The most popular molecules identified here included the stimulant CEs, e.g., methylphenidate, modafinil, amphetamine mixtures and caffeine-related compounds; stimulant CEs' intake was more prevalent among males than females; drugs were largely obtained from friends and family, as well as via the Internet. It is here suggested that CEs are increasingly being used among healthy individuals, mainly students without any diagnosed cognitive disorders, to increase their alertness, concentration, or memory, in the belief that these CEs will improve their performance during examinations or when studying. The impact of stimulant CEs may include tolerance, dependence and/or somatic (e.g., cardiovascular; neurological) complications.

4.6.2 PHASE (2): QUANTITATIVE METHOD

Creswell (2003) reported that quantitative research is the process of collecting, analysing, interpreting, and writing the results of a study. Specific methods exist in both experimental and survey research that relates to identifying a sample and population, specifying the type of design, collecting and analysing data, presenting the results, making an interpretation, and writing the research in a manner consistent with a survey or experimental study (Creswell, 2003). The most popular tool for collecting quantitative research data is the use of questionnaires. The survey tools can be structured or semi-structured (Creswell & Clark, 2007).

Surveys should be representative of participants so that information gathered from a representative sample allows the researcher to draw valid conclusions about the overall research population. Surveys can be conducted in several means. The face-to-face survey, for instance, is more expensive compared to an internet survey in terms of collecting data and personnel involvement. Besides the content of the survey, we need to observe two important issues when conducting a survey: confidentiality and recruitment.

4.6.2.1 AIMS

This study aims to assess the prevalence of CEs intake; evaluate students' knowledge of these substances and identify student characteristics associated with CEs usage.

4.6.2.2 PARTICIPANTS

The selected sample consisted of 385 participants from the target population of the quantitative study which comprised 7760 eligible students registered in the Medical, Pharmacy, Dental, Engineering and Nursing courses at the six universities during the academic year 2020/2021. The sample was generated from a cross-sectional study based on a validated online survey that was distributed using University-licensed software (Qualtrics) through a direct web link via email and social media to all Medical, Pharmacy, Dentistry, Nursing and Engineering students enrolled in six UAE Universities.

The study was conducted in six institutions: Al-Ain university (AAU) which is located in the Southwest; Mohammed Bin Rashid University of Medicine and Health Science University (MBRU) in the Northeast; and four institutions located in the Northern Emirates of UAE (Ajman University (AU), University of Science and Technology (USTF), Ras Al Khaimah Medical and Health Sciences University (RAKMHSU) and University of Sharjah (UOS). These Universities were selected considering on their geographical location. Also, this study identified one Ministry of Higher and Scientific Research accredited university offering Dentistry, Medicine, Pharmacy, Engineering, and Nursing courses per state. All selected courses were highly competitive programmes requiring top grades from applicants for entry.

Regarding the type of sample, to determine the best sampling method the current researcher conducted a systematic review in (*Chapter 3*) on studies that were held worldwide among students misusing cognitive enhancers (CEs) and the main limitations of each study with regards to its sampling and survey method. Most of the reported studies have recruited participants using a convenience sampling method. There is a high possibility that using a convenience sample may produce biased results because it might represent the views of a specific group and not the entire population. Some groups are over-represented, and some groups are under-represented. A high possibility of a sampling error may occur too since selection itself is biased (Bryman, 2008).

In order to reduce biases, cluster sampling technique was selected for the study. Participants were randomly selected among these clusters to form a sample. Cluster sampling is a method of probability that is often used to study large populations based on geographically regions.

4.6.2.2.1 INCLUSION AND EXCLUSION CRITERIA:

All students registered in the selected undergraduate universities and the selected programmes aged 18 years or more were eligible for inclusion. Younger, postgraduate, and students registered on other courses were excluded.

4.6.2.3 MEASUREMENT

The online questionnaire consisted of 17 questions covering a range of topics concerning substances used to enhance cognition for study/academic/work purposes. Alongside questions on personal data such as gender, age group, nationality, programme of study and year of the course for information gathering purposes whilst ensuring full anonymity. The possible characteristics of CEs use were tested by a range of questions (see *Appendix 4*), which included the name/s of the drug used, reasons for use, frequency and duration of consumption, source of drugs/substances, cost, if the users achieved the required benefits, and if they recommended using these substances.

4.6.2.4 SAMPLE OF QUESTIONS

Below is a sample of questions in the survey:
(3) Have you ever used psychostimulants drugs/ nootropics for memory/concentration/ learning ability enhancement?

- Yes
- No (*Thank you for participating and 'your survey is completed!*)
- Do not know/unsure

4.6.2.5 PROCEDURE

A cross-sectional survey-based study was conducted from March 2020 until November 2020. The period included the examination and typical end-of-term deadlines characteristic of all universities in the UAE. The questionnaire was in English. While the first spoken language in

UAE is Arabic, over the last decade as reported by the Ministry of Higher Education and Scientific Research (MOHESR), English has become a commonly spoken language, taught at all Higher Education and Research Institutions (Al-Issa, 2017). Based on the findings from a recent systematic review by (Sharif et al., 2021), 9 drugs/substances (modafinil, amphetamines mixtures, methylphenidate, pyridoxine/vitamin B6, super strength caffeine pills, Guarana, piracetam, vinpocetine, cobalamin/vitamin B12) were included in the study. These drugs/substances have proved to be most popular among university students and are frequently mentioned on the web as well (Zaami et al., 2020).

Due to better ease of access (Reips, 2002); the current COVID-19 pandemic, and the administrative difficulties of paper surveys, use of an online tool was considered here the best option. The online questionnaire consisted of 17 questions covering a range of topics concerning substances used to enhance cognition for study/academic/work purposes. It included questions on personal data such as gender, age group, nationality, programme of study and year of course for information gathering purposes whilst ensuring full anonymity. The possible characteristics of CE use was tested by a range of questions (see appendix 4), which included the name/s of drug used, reasons for use, frequency and duration of consumption, source of drugs/substances, cost, if the users achieved the required benefits; and if they recommended using these molecules. To encourage participation in what could be seen as a sensitive area of research, CE non-users could record just their gender and age group. Non-CE users who provided information on nationality, programme of study and year of course were here referred to as 'non-user reporters'.

The questionnaire was distributed using a University-licensed software (Qualtrics) and posted as a direct web link to students on emails concerning their chosen course. Students were emailed directly with a short explanation (consent), that included a title and the aims of the study; it also provided the student with a link to complete the survey online. Participants who completed the survey were entered into a draw for a £100 internet purchase voucher. The questionnaire took an average of about 5 minutes to complete. To facilitate the process and increase the ease of participation, survey access was made possible through the smartphone as well; an email reminder was sent to the students once a week for three months to increase the response rate.

Online survey companies normally provide a measure to secure confidentiality. Using passwords makes the data more secure to ensure that the researchers are those to whom the password has been revealed. This can act as a safety device that eliminates the prospect of people outside the research population tapping into the survey and 'contaminating' the findings (Denscombe, 2014). Another option that was included in the study is attracting people to the survey through publicity and advertising – for example, creating a mini-poster and displaying it via the University social networking site (Study Net, Twitter, and Facebook). When inviting people to participate in the survey, it is a good practice to put the web address in the message in the form of a hyperlink. All that the participants need to do is click on the link to be taken directly to the questionnaire (Denscombe, 2014).

4.6.2.6 ETHICAL CONSIDERATION

The study received full Ethical approval from the University of Hertfordshire UH (UK) [LMS/PGR/UH/04025] (Appendix 1), RAK Medical and Health Sciences RAKMHSU (UAE) [RAKMHSU-REC-178-2020-PG-P] (Appendix 2), and the Ministry of Health and Prevention Research Ethics Committee RAK Subcommittee (UAE) [MOHAPIREC/2020/35-2020-PG-P] (Appendix 3).

Participation was voluntary and anonymous, in compliance with the General Data Protection Regulatory (GDPR) requirements (Information Commissioner's Office, 2018). Before participation to the study, all potential participants were informed about the aims of the study and their rights to refuse participation or withdraw from the study at any stage without any consequences. Each student gave their consent before participating in the study. The president of each student union received a telephone call from the researcher and an email was sent to all universities selected for the study requesting their permission to run the study in their academic institutions following the approval of the Ethical Boards.

4.6.2.7 DATA ANALYSIS

Files were kept on a password-protected laptop used by the researcher only, with scanned versions of study data having been kept in an encrypted folder until the completion of the project. Data collected from the survey were automatically generated on an Excel sheet. All data were checked for incomplete access and rogue entries and questionnaires providing

meaningful information were retained. Data were then coded for analysis. Statistical analyses were carried out by using the IBM SPSS version 26.0 software package. The number of participants with missing data due to not reporting or incomplete survey entries was recorded for each variable and indicated in the Tables. For each statistical analysis, participants with missing values were excluded.

The reliability and validity of the survey questionnaire were assessed using Cronbach's alpha (Tavakol & Dennick, 2011). Variables were summarised by frequencies and percentages. The chi-squared test was used to compare users and non-users of CE about gender and age group (Fisher's exact test; was used when cell entries were small, i.e., more than 20% of cells had an expected value of less than 5, and users with non-CE users reporters on nationality, a programme of study and year of study. The significance level was taken to be 0.05. Univariate analyses were used to select variables for inclusion in the subsequent multiple logistic regression analyses. Subject to both gender and age group giving a p-value of less than 0.25 in univariate analyses (David et al., 2000), users and non-users of CEs were compared by multiple logistic regression with gender and age group as explanatory variables. Independence of observations was assumed as the students who participated studied at universities with different geographical locations. Lockdown and distance teaching meant that students answered the questionnaire online. Spending most of the time physically apart from their fellow students, they were more likely to give independent responses.

As an exploratory exercise, CE users were compared with the CE non-user reporters first by simple logistic regression and then by multiple logistic regression using gender, age group, nationality, programme of study and year of study as explanatory variables. To check for potential bias, non-user reporters were compared with the remaining non-users on gender and age group. For CE users only, demographics and characteristics of CE use were compared by gender with the Pearson's Chi-squared test or Fisher's exact test using the same criteria as described above (i.e., Fisher's exact test; (Kim, 2017) chosen when expected cell entries were small).

4.6.3 PHASE (3): QUALITATIVE METHOD

Qualitative research is the opposite of quantitative research (Grix, 2003). It usually involves an in-depth investigation of knowledge and involves collecting and analysing non-numerical data (e.g., text, audio, or video) to understand concepts, opinions, or experiences. It can be used to

gather in-depth insights into a problem or generate new ideas for research. The three most common qualitative methods are *participant observation* (which is appropriate for collecting data on naturally occurring behaviours in their usual contexts), *in-depth interviews* (which are optimal for collecting data on individuals' personal histories, experiences and perspectives, particularly when sensitive topics are being explored), and *focus groups* (are effective in eliciting data on the cultural norms of a group and in generating broad overviews of issues of concern to the cultural groups or subgroups represented). Each method is particularly suited for obtaining a specific type of data (Creswell, 2003).

Qualitative data can be collected via interviewing technique (in structured interviews each candidate is asked similar questions in a predetermined format, unstructured interviews are much more casual and unrehearsed or semi-structured interviews it does not strictly follow a formalized list of questions). Instead, they will ask more open-ended questions entailing the use of open and closed questions which have been developed by the researcher before conducting the interviews and the questions are flexible in response to participant comments.

When choosing between an in-depth interview or focus group interview, the decision is made purely for logistical reasons, although there are some issues that for privacy reasons are better dealt with in an in-depth interview (Adams et al., 2008). Some researchers reported that individual interviews produce more detail than focus groups, and offer more in-depth into a participant's thoughts, feelings, and world view (Guest et al., 2017). Focus group interviews are less appropriate for sensitive or intimate topics (Guest et al., 2017).

4.6.3.1 AIM:

This study aims to explore the understanding the perception, behaviour, and attitude of CEs use among university students and their teaching faculties in the UAE.

4.6.3.2 PARTICIPANTS

4.6.3.3 A) STUDENTS (PART 1):

Out of the 18 students selected, 13 lived in Arab countries, while the other five lived in non-Arab countries such as the USA, UK, Pakistan, and India and one of them their first languages

was Arabic. 15 students were in medical fields, and three students were Engineering students (Chapter 6).

The current researcher recruited 18 full-time university students from six institutions. AAU (*n*=5); MBRU (*n*=3); AU (*n*=2), USTF (*n*=1), RAKMHSU (*n*=3) and UOS (*n*=4). Subjects were in the range 18 to 24 years old, with more females participating in the study (*n* = 13) than males. The majority of participants were UAE and Arab national residents (*n* = 13), with the balance of international students originating mainly from America, Britain, and Asia. The distribution across subject disciplines and levels of study were: Medical students (*n*=5) from 2nd, 3rd and 4th year, Pharmacy students' (*n*=8) with a majority from 4th year (*n*=6) and the remaining (*n*=2) from 2nd year, Engineering 4th year (*n*=3), and 4th year of Dentistry and Nursing (*n*=2).

The target population for this study were undergraduate students at various university levels in the UAE. Purposive sampling was initiated as the sampling method to gather data. Purposeful sampling is used as a selection method in qualitative research to identify individuals who are knowledgeable about a phenomenon of interest in addition to being willing and available to participate (Palinkas et al., 2015; Patton, 2002). All students registered in the selected undergraduate Universities and the selected programmes aged 18 years or more were eligible for inclusion. Younger; postgraduate; remaining courses students, were excluded. The interview was arranged by email contact (*Appendix 10*), and a date was arranged for interviews

The first spoken language in UAE is Arabic (Al-Issa, 2017). However, within the last few years, the English language is commonly spoken and taught at all higher education institutions and educational research institutes. Students were given the option to be interviewed in English or Arabic, but all participants chose to communicate in English.

4.6.3.4 B) TEACHING FACULTIES (PART 2):

A purposeful sample was chosen by email contact (*Appendix 11*), and a date was arranged for interviews with 7 teaching faculties from six institutions in UAE. Four of these selected participants were male and the other 3 them were female. A qualitative study design was conducted among teaching faculties from the same universities that were selected in (Part I), by arranging voice calls via the 'Zoom' platform and the researcher led the discussions. An email of invitation and a study information sheet was sent to the teaching faculties that took

part in teaching students. Telephone contact was then made, and a date was arranged for interviews with 7 teaching faculties from six institutions in the UAE. Faculties were given the option to be interviewed in English or Arabic; all participants chose to communicate in English, for that reason, the interviews were carried out with faculties in the English language. The participants seemed to fall into one of three groups: (1) absolute denial of CE use (P1, P3, P5); denies CEs use in UAE but reports seeing CEs use elsewhere (P4, P7); reported CEs use in UAE (P2, P6).

4.6.3.5 SAMPLE OF QUESTIONS

Below are the sample of questions from the qualitative study:

1- What is your Nationality, please?
2- Age? Gender?
3- Tell me about your education, University, and year of study.
4- Have you ever heard of CEs/smart drugs?
    - If yes, tell me more
    - If NO, CEs/smart drugs are ----------
5- What do you think about CEs?

4.6.3.6 PROCEDURE

Interviews were carried out face-to-face or remotely, such as by telephone or online communication tools such as (Zoom/ Skype/ Microsoft team) may be well-suited to potentially sensitive topics because this technique provides participants with the opportunity to disclose intimate and closely held experiences without feeling uncomfortable (Elmir et al., 2011); this provided an opportunity for potential participants who live at a distance from the researcher to participate in research endeavours (Elmir et al., 2011).

Creswell et al (2008) thought that during an interview it is important to consider that the more structured an interview is, the less likely it is for the participants to feel at ease and reveal important and relevant issues. However, the less structured the interview, the harder it is to analyse afterwards. The format for an in-depth interview can take on many forms (e.g. scenario-led or task-led). Initially, it is useful to start the interview with a brief background of the study and permission for interviewing and recording (Adams et al., 2008). Holloway et al (2010)

suggested that semi-structured interviews are the most common type of interviews used in qualitative research.

Confidentiality was considered during the recruitment of participants by assuring the anonymity of the information and sensitivity concerning its later usage (Creswell & Clark, 2007).

Trustworthiness of data means considering issues of reliability and validity when qualitative research is conducted (Creswell & Clark, 2007). Researching qualitatively is challenging because there is a potential for bias and findings may not be generalizable but on other hand, If the study is conducted properly, qualitative research can introduce reliable, valid, unbiased, credible, and meaningful data (Bryman, 2008).

4.6.3.7 DATA ANALYSIS

The interviews of students and teaching faculties were transcribed by the researcher, and interview transcripts were then uploaded into NVivo 12 for coding. The interviews were coded to differentiate between various schools at the selected universities. The interview data were analysed using the six-stage process according to thematic analysis (TA) outlined by (Braun & Clarke, 2006). Thematic analysis is used to analyse and report repeated patterns of themes in several ways within the data (Braun & Clarke, 2013).

The data were analysed by finding out the main and sub-themes and codes as well as supported by citations as examples from participants to approve the themes about the impact of using CEs among university students and the perspectives of teaching faculties towards the use of CEs among students.

4.7 SEQUENTIAL EXPLANATORY APPROACH

In this design, the *explanatory sequential design* (Creswell, 2003). typically involves two phases: Study 2 *(Chapter 5)* is an initial quantitative instrument phase (survey), followed by Study 3 *(Chapter 6)*, a qualitative data collection phase (one to one interview via Zoom) in which the qualitative phase was built directly on the results from the quantitative phase. In this way, the quantitative results are explained in more detail through the qualitative data. The rationale for this approach is that the quantitative data and their subsequent analysis provide a

general understanding of the research problem. The qualitative data and its analysis refines and explains those statistical results by exploring participants' views in more depth (Creswell & Clark, 2007).

4.8 Confidentiality:

All possible ethical aspects that may arise from conducting the research study were considered. Official written approval to conduct the study has been requested from the research/ ethical committee at UH (UK) and RAK Medical and Health Sciences University (UAE) and the Ministry of Health and Prevention Research Ethics Committee IRAK Subcommittee (UAE). Participants have been assured of data anonymity; their details are never passed on to third parties. Participants were assured that personal information would not be revealed. Codes were used to maintain anonymity. Respondents were offered the option to withdraw from the study at any time without consequences, with maintaining the confidentiality of the participants' identities throughout the data collection process.

The data provided was to be kept completely confidential and anonymous. Data was consisting of the answers to 17 survey questions and semi structured interview. All participants were reassured about the confidentiality of the information provided.

4.9 Consent:

Participants were asked to sign the consent form which explains all the procedures. To enable respondents to make informed consent, particulars of the study, including its aim(s), methods and design, the names and contact details of key people and, as appropriate, the risks and potential benefits, how the information collected was be stored and for how long, and any plans for follow-up studies that might involve further approaches to participants, were included in the participant information sheet (Bryman, 2008). Participants were informed of how personal information on this form will be stored and for how long. Details of involvement in the study, the event of any significant change to the aim(s) or design of the study were communicated back to participants and they were asked to renew their consent to participate in the study (Bryman, 2008).

4.10 Participant information sheet:

Participants were informed of the details of the study in lay terms. Participants were assured that they were able to withdraw from the study at any time without a disadvantage or having to give a reason. Participants were assured that there was no risk of suffering harm or adverse effects if they decide to take part in the study participants were informed on how information related to the study (data obtained in the course of the study, and data provided by me about myself) was be handled: how it was kept secure, who was have access to it, and how it was or may be used. It was noted that the information provided was to be treated confidentially and was kept in a manner to ensure confidentiality and privacy (*Appendix 8*).

4.11 Summary of the Chapter

This Chapter justified the methods applied to this thesis which explores the use of cognitive enhancers prescription drugs and over the counter among university students in the UAE. Evidence shows no recent UAE study exists on the topic and there is limited research exploring the reasons for CE use and the experiences of CE users. It was determined that a sequential explanatory mixed method design was most appropriate to address the purpose of this research.

The data was collected by using a self-completed questionnaire survey among UAE university students. A purely quantitative approach does not provide a clear picture of the reasons why university students in the UAE use CE or how it affects them. Therefore, semi structured interviews were used to semi-structured on, attitudes and experiences of the use of CE among university students in the UAE.

The Chapter also provided information on ethical issues, setting, access and data collection, questionnaire design, sample size and statistical analysis. The process of thematic analysis was described, including how themes evolved from the initial stages using NVivo software. In the following chapter, the results of the quantitative study examining cognitive enhancer use, knowledge, and prevalence among university students in the United Arab Emirates are presented.

5 CHAPTER 5. A QUANTITATIVE STUDY

Assessing prevalence, knowledge, and use of cognitive enhancers among university students in the United Arab Emirates

5.1 Introduction

Most substances referred to as pharmacological cognitive enhancers were originally developed to treat neuropsychiatric disorders that are often accompanied by cognitive deficits (Schelle et al., 2015a). These pharmacological cognitive enhancers (CEs), also known as study drugs and nootropics, are additionally used due to their alleged potential to improve memory, mental alertness, concentration and boost energy levels in healthy individuals, despite the reported drawbacks of its use such as dependency and the occurrence of psychiatric disorders. (Husain & Mehta, 2011;Smith & Farah, 2011). Cognitive enhancement is defined as an amplification or extension of core capacity of the mind by improving the internal and external information processing systems (Bostrom & Sandberg, 2009). Substance use for cognitive enhancement has been reported by healthy university students to boost their academic performance (Maier et al., 2013).

A survey involving around 60 countries showed that 20% of participants had already tried CEs; some 34% of subjects had purchased these from the internet, 14% from a pharmacy, and 52% from a physician (Greely et al., 2008). The Global Drug Survey carried out in 2015 and 2017 among healthy university students reported on CE prescription drug use rates; these increased over time in all 15 countries for which data were analysed (Maier et al., 2018a). Main reported sources of supply for CEs included friends (47.8%); the web (11.8%); family members (6.1%); and physicians (3.8%) (Maier et al., 2018a).

In UAE, the rates of both non-medical use of prescription stimulants and the use of legal/illegal drugs to enhance cognitive performance in healthy individuals are still not known. This study was designed to estimate the prevalence of CEs use in six UAE undergraduate universities; describe the socio-demographics of CEs-using students compared to non-users; identify factors associated with higher risk of CEs use; and evaluate characteristics of the use of CEs within the UAE Higher Education institutions involved.

The main study hypotheses were as follows: (1) the prevalence of CEs use in UAE universities is comparable to that reported elsewhere; (2) gender, age, year of study, study programs and nationalities are candidate variables/factors associated with CE use among the UAE university students; (3) Male and female students differ in their use of CEs.

5.2 Material and methods:

5.2.1 STUDY DESIGN AND SETTING:

A cross-sectional survey-based study was conducted from March 2020 until November 2020. The period included the examination and typical end-of-term deadlines characteristic of all universities in the UAE.

5.2.2 STUDY POPULATION:

The target population for this study included undergraduate students at various university levels in the UAE.

The study was conducted in six institutions: Al-Ain university (AAU) which is located in the Southwest; Mohammed Bin Rashid University of Medicine and Health Science university (MBRU) in the Northeast; and four institutions located in the Northern Emirates of UAE (Ajman University (AU), University of Science and Technology (USTF), Ras Al Khaimah Medical and Health Sciences University (RAKMHSU) and University of Sharjah (UOS). These universities were selected based on their geographical location. Also, this study identified one Ministry of Higher and Scientific Research accredited university offering Dentistry, Medicine, Pharmacy, Engineering, and Nursing courses per state. All selected courses were highly competitive programmes requiring top grades from applicants for entry.

5.2.2.1 INCLUSION AND EXCLUSION CRITERIA:

All students registered in the selected undergraduate universities and the selected programmes aged 18 years or more were eligible for inclusion. Younger, postgraduate, and students registered on other courses were excluded.

5.2.2.2 SAMPLE SIZE DETERMINATION

The sample size n required to estimate a prevalence p with a specified margin of error e was calculated using the formula by Awosanya et al. (2013) as follows (Awosanya et al., 2013):

$$n = z^2 p (1 - p)/e^2$$

The value $p = 0.5$ was selected rather than the likely prevalence, as this gives the maximum possible requirement for a specified margin of error. In this study, the chosen $e = 0.05$ and z represents the value from a standard normal distribution corresponding to a 95% confidence level = 1.96, giving a requirement of $n \approx 385$ participants. The target population of our study comprised 7760 eligible students registered on the medical, pharmacy, dental, engineering and nursing courses at the six universities during the academic year 2020/2021.

5.3 RESULTS

In total, 560 completed questionnaires were received, exceeding the minimum sample size required for this study. Following checks for incomplete access and spam entries, 38 of these were removed. Hence, 522 (7%) of the eligible students completed the questionnaire correctly and participated (Fig 7: Flow Chart).

The survey questionnaire was found to be highly consistent and indicated high reliability (Cronbach's alpha = 0.903). Table 1 summarises the demographic data for all participants. Around 60% of the respondents were female, and nearly all (94.6%) were from the 18–25-year-old age group. The prevalence of CE usage in the total sample of study was 25.3% (132 out of 522 students). Of the 390 non-users, 109 (27.9%) reported their nationality, 71 (18.2%) reported their programme of study and 101 (25.9%) reported their year of study, with 109 non-users reporting at least one of these items.

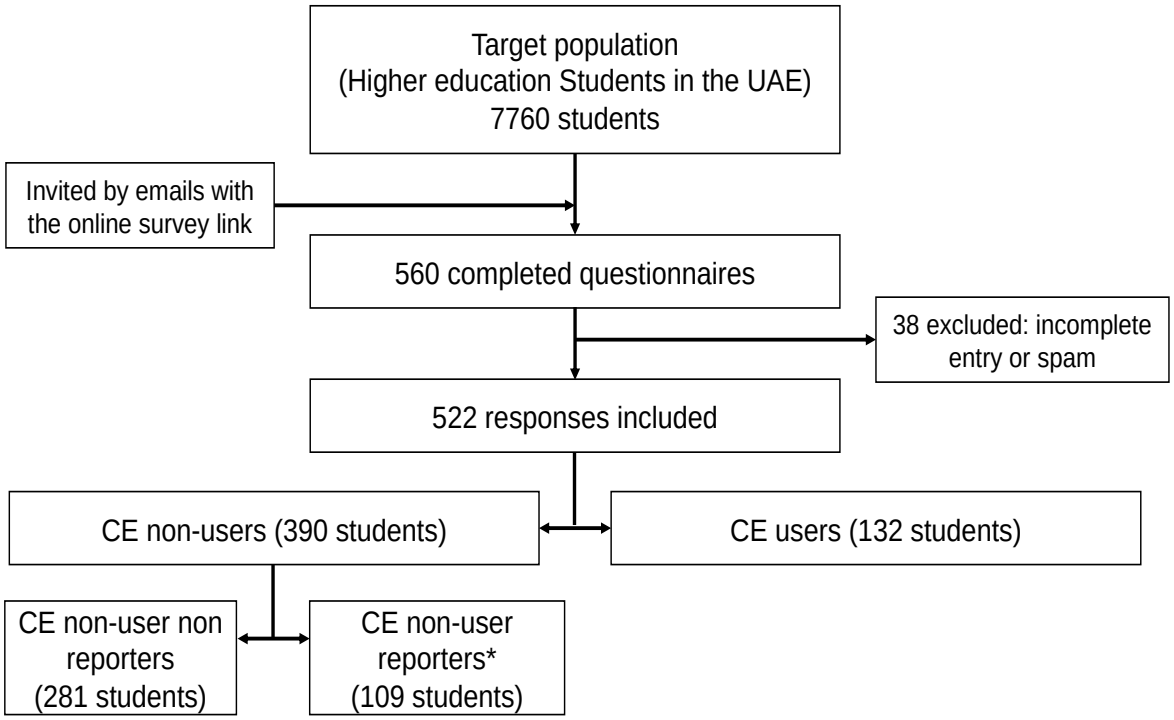

Figure 7. Study Flow Chart

The distribution of nationality for the CE users was similar to that for the population of students on these programmes as a whole, with UAE nationals and Asians representing the majority of the population.

TABLE 3: DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS FROM THE UAE UNIVERSITIES:

Number		522
Gender	Female	307 (59.5%)
	Male	209 (40.5%)
	(Missing)	6
Age	18-25 years	494 (94.6%)
	26-35 years	15 (2.9%)
	above 35	13 (2.5%)
CE consumer	No	390 (74.7%)
	Yes	132 (25.3%)
Nationality	UK	14 (5.8%)
	EU	1 (0.4%)
	USA	2 (0.8%)
	UAE	69 (28.8%)
	Arab countries	73 (30.4%)
	Asian countries	62 (25.8%)
	Other	19 (7.9%)

	(Missing)	282
Degree	Medicine	104 (51.2%)
	Pharmacy	38 (18.7%)
	Dentistry	33 (16.3%)
	Nursing	9 (4.4%)
	Engineering	19 (9.4%)
	(Missing)	319
Year of Study	First	37 (15.7%)
	Second	40 (17.0%)
	Third	67 (28.4%)
	Fourth	71 (30.1%)
	Fifth	19 (8.1%)
	Sixth	2 (0.9%)
	(Missing)	286

Data are presented as frequencies (percentage of the non-missing responses from the UAE universities); missing values are shown for comprehensive reporting purpose only. Percentages may not sum to 100 due to rounding.

Tables 4A and 4B present a comparison of CE users with either non-users (4A) or non-user reporters (2B). There were significant differences between users and non-users regarding gender ($p<0.001$) but not relating to the age group ($p=0.875$). With only one significant univariate result relating to all non-users, it was not necessary to perform multiple logistic regression on the complete sample of students.

CE users were disproportionately represented by students from either UAE or other Arab countries ($p<0.001$), and by students of Medicine, followed by Pharmacy, Dentistry, and Engineering ($p<0.001$). CE use increased in line with year of study, reaching the highest level in the fourth year ($p<0.001$), which for most programmes is the final year.

TABLE 4A: UAE STUDENTS; DEMOGRAPHICS OF CES USERS VS NON-USERS:

		users	non-users	p value
Number		132	390	
Gender	Female	40 (30.5%)	267 (69.4%)	p<0.001 *
	Male	91 (69.5%)	118 (30.6%)	
	(Missing)	1	5	
Age	18-25	126 (95.5%)	368 (94.4%)	p= 0.875
	26-35	3 (2.3%)	12 (3.1%)	
	above 35	3 (2.3%)	10 (2.9%)	

*** Significant difference between CE users and non-users.**

TABLE 4B: UAE STUDENTS; DEMOGRAPHICS OF CES USERS VS NON-USER REPORTERS:

		users	non-user reporters	
Number		132	109	
Nationality#	UK	8 (6.1%)	6 (5.5%)	
	EU	1 (0.8%)	0	
	USA	1 (0.8%)	1 (0.9%)	
	UAE	55 (42%)	14 (12.8%)	p<0.001 **
	Arab countries	49 (37.4%)	24 (22%)	
	Asian countries	16 (12.2%)	46 (42.2%)	
	Other	1 (0.8%)	18 (16.5%)	
	(Missing)	1	not applicable	
Degree	Medicine	64 (50%)	36(50.7%)	
	Pharmacy	24 (18.8%)	14 (19.7%)	
	Dentistry	19 (14.8%)	14 (19.7%)	p<0.001 **
	Nursing	2 (1.6%)	7 (9.9%)	
	Engineering	19 (14.8%)	0	
	(Missing)	4	38	
Year of Study	First	9 (6.9%)	27 (26.7%)	
	Second	16 (12.1%)	24 (23.8%)	
	Third	39 (29.5%)	27 (26.7%)	
	Fourth	53 (40.2%)	17 (16.8%)	p<0.001 **
	Fifth	12 (1.5%)	6 (5.9%)	
	Sixth	2 (1.5%)	0	
	(Missing)	1	8	

**** Significant difference between CE users v. non-user reporters**
 # Fisher's exact test
Percentages may not sum to 100 due to rounding

In the assessment of potential bias, CE non-user reporters were comparable to remaining non-users in terms of age group: 101/109 (92.7%) vs 267/281 (95.0%) aged 18-25 years. However, non-user reporters differed somewhat from the remaining non-users on gender: 88/109 (80.7%) vs 179/276 (64.9%) female, respectively (p<0.001). Working with the assumption that CE non-user reporters were broadly representative of all CE non-users, simple logistic regression followed by multiple logistic regression for CE use was applied to the CE users and CE non-user reporters with gender, age group (18-25 vs above 25), nationality (UK, EU and USA vs UAE and Arab vs Asian), programme of study (Medicine v. others) and year of study (first two years vs final years) as explanatory variables.

The simple logistic regression analyses showed that students who were males; 18-25-year-old; from Emirati/remaining Arab origins; studying Medicine; and in the final years of their study

programmes presented with increased odds of using CEs. Students of Asian nationality had reduced odds of using CEs. Based on the p value threshold of 0.25 for entry into the multiple logistic regression, only gender, nationality, and year of study were selected.

The multiple logistic regression analysis showed that for university students in the UAE, male gender and being in the final years of study were independently associated with a higher risk of CE use. There was an indication of higher CE use with students of Emirati/ remaining Arab origin whereas being of Asian nationality was associated with a reduced risk, although these findings did not reach statistical significance (Table 5).

TABLE 5: LOGISTIC REGRESSION ANALYSIS FOR CE USE AMONG UNIVERSITY STUDENTS IN THE UAE:

Variables	**Simple regression analysis**		**Multiple regression analysis**	
	Crude OR[a] (95% CI)	p value	Adjusted OR[b] (95%CI)	p value
Gender				
(Baseline: Female)				
Male	5.15 (3.35-7.92)	<0.001	6.91 (3.440-13.91)	<0.001
Age				
(Baseline: Above 25 years)				
18-25 years	1.26 (0.50-3.20)	0.630		
Nationality				
(Baseline: UK, EU and USA)				
UAE and Arab	1.19 (0.50-2.90)	0.707	2.68 (0.95-7.51)	0.062
Asian	0.16 (0.10-0.30)	0.001	0.43 (0.17-1.08)	0.073
Programme of Study				
(Baseline: Other programs)				
Medicine	0.988 (0.55-0.1.77)	0.967		
Year of study				
(Baseline: First two years)				
Final years (3-5)	4.28 (2.39-7.69)	<0.001	2.40 (1.20-4.80)	0.001

[a]: Simple logistic regression, [b]: Multiple logistic regression
The model reasonably fits well, assumptions met and no interaction or multicollinearity problems

For CE female users, the proportion studying Dentistry exceeded that for males whereas the reverse was true for Engineering students (p=0.012 for differences in degrees' distribution; Table 6). The distribution for the year of study did not differ significantly between males and females.

TABLE 6: GENDER-BASED DEMOGRAPHIC DISTRIBUTION OF CES' USERS AMONG THE UAE STUDENTS

		Female (40)	Male (91)	p value*
Age#	18-25 years	36 (90%)	89 (97.8%)	
	26-35 years	3 (7.5%)	0	p = 0.053
	above 35 years	1 (2.5%)	2 (2.2%)	
CE usage	Multiple CEs	16 (43.2%)	48 (53.3%)	p = 0.301
	Single CE	21 (56.8%)	42 (46.7%)	
Nationality#	UK	7 (17.5%)	1 (1.1%)	
	EU	0	1 (1.1%)	
	USA	1 (1.1%)	0	
	UAE	12 (30%)	43 (47.3%)	p = 0.076
	Arabs	13 (32.5%)	35 (38.5%)	
	Asians	6 (15%)	10 (10.1%)	
	Other nationalities	1 (2.5%)	0	
Degree#	Medicine	17 (44.7%)	47 (52.8%)	
	Pharmacy	8 (21.1%)	16 (18%)	
	Dentistry	10 (26.3%)	8 (9%)	p = 0.012
	Nursing	2 (5.3%)	0	
	Engineering	1 (2.6%)	18 (20.2%)	
Year of Study#	First	7 (17.5%)	2 (2.2%)	
	Second	7 (17.5%)	9 (9.9%)	
	Third	9 (22.5%)	29 (31.9%)	p = 0.121
	Fourth	15 (37.5%)	38 (41.8%)	
	Fifth	1 (2.5%)	11 (12.1%)	
	Sixth	1 (2.5%)	1 (1.1%)	

***p values for chi-squared test (or #Fisher's exact test where necessary) to compare the gender-based differences in the demographics among the CE users only**
Percentages may not sum to 100 due to rounding

Characteristics of CE use are compared by gender in Table 7. Most common reasons behind CE intake were "academic performance" (30.5%) followed by "concentration" (27.5%) and "alertness" (25.2%). With respect to females, male users felt that a positive effect was more frequently associated with CE use (87.9% vs 60.0; p=0.008). CEs were mostly ingested during the "Exams" period (80.1%) and most typically for a period of "1-6 months" (53.4%) and "<1 month" (29%), with some 52.6% having reported a CE intake once/less than once per semester. The duration of CE use seemed more prolonged in males (e.g., 67% used CEs for 1-12 months, whilst 40% of females used CEs for less than 1 month). Conversely, about one third of students reported a daily CE intake. The web, and especially so for males, was identified as the main CE source in about two thirds of cases, while only 9% of users had a CE prescribed to them. Friends and online advertisements represented here the major channels through which the students were made aware of CEs, with no significant differences by gender. Half of CE users considered CEs as "expensive"; finally, vitamin B12, caffeine and modafinil were the most frequently reported CEs. Vitamin B6 intake was more common in females (22.5% vs 5.5%; p=0.014) and modafinil in males (48.4% vs 7.5%; p<0.001).

TABLE 7: CE CHARACTERISTICS OF USE AMONG UAE STUDENTS; DIFFERENCES ACCORDING TO GENDER

		Female (40)	Male (91)	p value*
Reason	Concentration	12(30.0%)	24(26.4)	0.676
	Memory	2 (5.0%)	9 (9.9%)	0.502
	Alertness	7(17.5%)	26(28.6)	0.198
	Academic performance	9(22.5%)	31(34.1)	0.220
	Other reasons	10 (25.0%)	1 (1.1%)	<0.001
Positive effect (yes)#		24 (60.0%)	80(87.9)	0.008
Time#	Exams	27 (67.5%)	78(85.7)	
	Course deadlines	2 (5.0%)	1 (1.1%)	
	Studying	5 (12.5%)	9 (9.9%)	0.267
	Daily	4 (10.0%)	1 (1.1%)	
	Other	2 (5.0%)	2 (2.2%)	
Duration#	< 1 month	16 (40.0%)	22(24.2)	
	1-6 months	12 (30.0%)	58(63.7)	
	6-12 months	7 (17.5%)	8 (8.8%)	0.027
	1 – 2 years	0	2 (2.2%)	
	2 years or more	5 (12.5%)	1 (1.1%)	
Frequency#	Daily	15 (37.5%)	23(25.3)	
	Weekly	3 (7.5%)	7 (7.7%)	
	Monthly	3 (7.5%)	8 (8.8%)	0.705
	Once/semester	9 (22.5%)	34(37.4)	
	< Once a semester	8 (20.0%)	18(19.8)	
Source of acquisition#	Prescribed to me	9 (22.5%)	3 (3.3%)	
	Friend	6 (15.0%)	17(18.7)	0.022
	Online	17 (42.5%)	64(70.3)	
	Other	8 (20.0%)	7 (7.7%)	
Cost	Very expensive/ expensive	12 (31.6%)	56(62.9)	0.002
	Fair/Cheap	26 (68.4%)	33(37.1)	
Heard about#	Social media	3 (7.5%)	10 (11%)	
	Scientific literature	3 (12.5%)	2 (2.2%)	
	Internet	9 (22.5%)	24(26.4)	0.052
	Friends	14 (35.0%)	49(53.8)	
	Family	2 (5.0%)	4 (4.4%)	
	Other	7 (17.5%)	2 (2.2%)	
Drug used	B12	18 (55.0%)	32(35.2)	0.255
	B6#	9 (22.5%)	5 (5.5%)	0.014
	Methylphenidate	3 (7.5%)	9 (9.9%)	0.864
	Adderall/amphetamines#	1 (2.5%)	9 (9.9%)	0.325
	Super caffeine pills	16 (40.0%)	35(38.5)	0.718
	Modafinil	3 (7.5%)	44(48.4)	<0.001
	Paullinia Cupana/Guarana#	1 (2.5%)	3 (3.3%)	0.955

***p* values for Chi-square test (or #Fisher's exact when necessary) to compare the gender-based differences in characteristics of CE use in CE users only. Percentages are reported as fraction of the total number of male/female in the CEs users.**

Medical students reportedly took CEs for a range of different reasons, whilst memory performance improvement did not represent a reason for CE use among other programmes ($p<0.001$; chi-squared test). Similarly, compared to other programme students, medical students were those most frequently reporting: a daily use of CEs ($p<0.001$); resourcing to the web for CE acquisition ($p<0.05$); and of having been influenced by peers in deciding to access CEs ($p<0.05$).

Modafinil was self-administered, especially in males, for concentration and alertness; B12 was typically taken by female students for academic performance and concentration; and high-dosage caffeine compounds were ingested to improve alertness levels.

5.4 DISCUSSION

To the best of our understanding, at the time of writing this Chapter, this study was the first one to focus on CE drugs use in Higher Education Universities in the United Arab Emirates. This study explored the prevalence of use; the users' socio-demographics, and the CE characteristics of use in a large sample (n=522) of students. Among the large sample of participants who completed the online survey, one quarter were found to be CE users; a result which is in line with those identified among university students from both the UK (McDermott et al., 2020) and Iran (Abbasi-Ghahramanloo et al., 2015). This level of CE use seems to be at odds with previous suggestions (Singh et al., 2014) that students are resistant to using CEs.

Around two thirds of CE users were males, a finding which is consistent with several previous studies (Franke, 2010; Benson et al., 2015b; Champagne et al., 2019; Emanuel et al., 2013a; Gudmundsdottir et al., 2016). Indeed, there may be gender-related different attitudes towards both recreational (Schifano, 2008) and CE drug use (Lengvenytė & Strumila, 2016; Mache et al., 2012; Maier et al., 2013) worldwide, although some conflicting results have been published (McNeil et al., 2011; Weyandt et al., 2009).

About one half of CE users were medical students, followed by Pharmacy, Dentistry, Engineering and Nursing, with their usage increasing in the final years of study programmes when the medical students start to have more patient interaction and get under the stress of clinical rotations. This may tentatively suggest that the usage of CEs is in most cases transient and may start only in association of increasing levels of academic load. Present findings support

previous studies, which reported levels of use of CEs among both medical (Emanuel et al., 2013b; Habibzadeh et al., 2011; Lengvenytė & Strumila, 2016; Pighi et al., 2018) and pharmacy students (Hanna et al., 2018); levels which are higher than those recorded in other schools (Bossaer et al., 2013).

Improving academic performance, concentration and alertness were among the main reasons to ingest CEs, and especially so during the exam preparation times. Other studies also reported the same motivations for use (Abbasi-Ghahramanloo et al., 2015; Emanuel et al., 2013a; Lengvenytė et al., 2013; Ram et al., 2017). However, relative to their male counterparts, the reasons for CEs use included concentration (30.0% vs 26.4 respectively in females and males) but not alertness (17.5% vs 28.6% respectively in females and males). In line with previous findings (Mache et al., 2012; McDermott et al., 2020) peer influence and the web were here reported as facilitating the students' uptake of CEs. Most users, but especially so males (e.g., 70% vs 40%) accessed their CEs from online sources, with the web having been previously described as the focus of drug acquisition activities (Corazza et al., 2014; Hockenhull et al., 2020; Mooney et al., 2017). Indeed, a high circulation UK newspaper has reported on the high levels of online sales of modafinil, being shipped to students from the universities of Cambridge, Oxford and London Imperial College (Marsh, 2017) and more frequently so at the time of the exams. Sources of CEs was another aspect where nationality played a role in differences in responses among CEs users. While Emirati and Arab students favoured the internet option, other nationalities relied on a range of different sources to access the index CEs.

Overall, B12 was mainly taken for academic performance reasons, followed by concentration. Modafinil was also taken for concentration and alertness, confirming previous findings (Turner et al., 2003). Conversely, in line with previous studies (Ghali et al., 2016; Singh et al., 2014), caffeine/ super-strength caffeine pills were mainly ingested for alertness. The distribution of the CEs drugs ingested showed differences relating to gender. In particular, B6 was more popular in females than in males (e.g., 22.5% vs 5.5%), whilst modafinil was more significantly reported in males (e.g., 48.4% vs 7.5%). In line with a recent study conducted in the UK (McDermott et al., 2020), the intake of remaining CEs was not significantly different between the two groups. This study has shown that it is important to raise awareness of the harms of CE use, provide knowledge, counteract myths regarding the safety of CE use and address cognitive enhancement at an early stage of higher education as preventative public health measures

(Sharif et al., 2021). Indeed, universities should focus on correcting the wrong impression of the benefits of the sustained use of ‘smart drugs’, a practice here suggested to be highly prevalent among UAE university students.

5.5 Strengths

This is the first study to estimate the prevalence of CE use among UAE university students for the purpose of improving academic performance, concentration, and alertness. In addition, despite the sensitive nature of the subject, we were able to compare CE users with non-users and identify characteristics associated with a higher risk of CE use. Participation in the study was anonymous, limiting the effects of bias.

5.6 Limitations

There are a few limitations in our study to be acknowledged. The major and first limitation was the delay of data collection from UAE universities due to the COVID-19 pandemic; whilst the initial plan was for three months only, the survey remained available for almost 8 months. The second limitation to acknowledge is that the current study focused only on undergraduate students from the Medical, Pharmacy, Dentistry, Engineering and Nursing undergraduate courses; combined with a response rate of 7% this may limit the generalizability of the results. The third limitation is that due to the sensitive nature of the subject, CE non-users were asked to provide only their gender and age group. Since only 30% of the CE non-users reported additional demographic information, there is a potential for bias in the current findings.

5.7 Conclusions

The high levels of reported prevalence of CE use may be a reason of concern. Indeed, these molecules appeared here to be mostly acquired without the consultation of a physician for both diagnostic and monitoring purposes. Furthermore, it should be noted that in the UAE it is possible to access medicinal compounds without a prescription from pharmacies (Sharif et al., 2015). At this stage, a few issues need to be better addressed in future studies, including health of student CE users; and understanding if these drugs may put some of these students at an unfair advantage over remaining non-using students.

Universities may need to develop better awareness levels regarding the prevalence of CEs use amongst their students and consider taking an active approach in reducing their use, educating students on the dangers of CEs use whilst providing them with a safe space to seek help.

5.8 Summary of the Chapter

An overview of the results of the cross-sectional survey and a description of the prevalence of CE use among UAE university students were presented in this chapter. Several types of CE drugs and substances were listed along with their names.

Among university students, the use of CE drugs can have serious consequences, and the findings add to the growing body of literature suggesting that such drug use is widespread.

As a result of the qualitative data analysis, the next chapter discusses the participants' perceptions, behaviours, and attitudes regarding the use of CEs among university students in the UAE.

6 CHAPTER 6. A QUALITATIVE STUDY

‘Exploring the behaviours, perceptions, and attitudes of cognitive enhancers usage among university students in the United Arab Emirates’

6.1 Introduction

In Chapter 5, we discussed the purpose of the research study: assessing the prevalence and knowledge of CEs among university students in the UAE. For the purpose of comprehending participants' perceptions, behaviour, and attitudes, the researcher categorised those participants from the same selected university/course who were willing to participate in the qualitative phase (*Chapter 6*).

6.2 Justification for the use of a qualitative approach

Qualitative research methods are a powerful methods that helps the researcher to achieve an in-depth, holistic understanding of the relationship between international culture and communication from the perspective of those inside a society or ethnic group (Daymon & Holloway, 2010). A semi-structured interview method will be used in this research to enable participants to talk freely about the focal issue. Interviews are a flexible tool for gathering data (Dearnley, 2005) and enabling the researcher to evaluate personal knowledge or information as well as understand the issue from the people’s cultural views, beliefs, and values. Interviews provide the researcher with a “multi-sensory channel to be used: verbal, non-verbal, spoken and heard” (Braun & Clarke, 2013). Interviews also enable the researcher to get an in-depth understanding of people’s experiences and perceptions about a specific issue or topic in the context of their personal circumstances because interviews give participants the opportunity to express themselves in-depth as well as raise some issues with regards to the research aims. Thus, an interview is characterised by capturing detailed, rich, and complex information from participants. However, despite the advantages of using interviews for data collection, they are expensive and time consuming (Dearnley, 2005).

Guest et al (2020) reported that determining the point of saturation is a difficult endeavour, because researchers have information on only what they have found (Guest et al., 2020). They

agreed and acknowledged that a stopping point for an inductive study is typically determined by the "judgement and experience of researchers" (Guest et al., 2020). The present study continued on expanding the sample size until data collection supplied no new data (Braun & Clarke, 2006). The sample employed in this study was purposive in nature in order to recruit the participants that matched the inclusion and exclusion study criteria (Hammarberg et al., 2016). Patton (2002) argues that 'the logic and power of purposive sampling lies in selecting information-rich cases for study in depth' (Patton, 2002). Creswell et al (2007) thought that during an interview, it is important to consider that the more structured an interview is, the less likely it is for the participants to feel at ease and reveal important and relevant issues. However, the less structured the interview, the harder it is to analyse afterwards. The format for an in-depth interview can take on many forms (e.g. scenario-led or task-led). Initially the interview was started with a brief background to the study and permission for interviewing and recording (Adams et al., 2008). Confidentiality was also announced by assuring the anonymity of the information and sensitivity concerning its later usage (Creswell & Clark, 2007). Holloway et al (2010) recommended that semi-structured interviews are the most common type of interviews used in qualitative research

- **There are three research questions designed for this qualitative study:**

1. What are the factors influencing CE use among university students in the UAE?
2. What impact do students who use CEs have on the views and behaviours of non-users?
3. What is the attitude of university lecturers and their perception towards the use of cognitive enhancers (CEs) among university students?

6.3 Student Interviews (Part I)

The first part of this qualitative study is conducting interviews with students. The following were the semi structured interview questions:

1. Gender?
2. University?
3. Nationality?
4. Course/ year of study?
5. Have you ever heard of CEs/smart drugs?
6. What do you think about CEs?

7. Have ever tried using CEs? If yes.
8. Does it make you smarter/alert?
9. To what extent do they help? How?
10. What is the reason of the use?
11. Do you get any bad effect after using it? What is it?
12. Where do you get it from?
13. How easy do you think it is for students to get the CEs?
14. Do you think using CEs drugs leads to better grades? How?
15. Are you going to use them in future?
16. Do you know anyone else who uses them?
17. Is there an orientation in the university in regards the CEs use?
18. Is there anything more you would like to add?

6.3.1 METHODS & DESIGN OF STUDIES:

A qualitative study design was conducted in six institutions: Al-Ain university (AAU) which is located in the Southwest; Mohammed Bin Rashid University of Medicine and Health Science university (MBRU) in the Northeast; and four institutions located in the Northern Emirates of UAE (Ajman University (AU), University of Science and Technology of Fujairah (USTF), Ras Al Khaimah Medical and Health Sciences University (RAKMHSU) and University of Sharjah (UOS). These universities were selected based on their geographical location. Also, this study accredited by the Ministry of Higher and Scientific Research that offers Dentistry, Medicine, Pharmacy, Engineering, and Nursing courses, one university per state. All selected courses were highly competitive programmes requiring top grades from applicants for entry.

6.3.2 SAMPLE:

The target population for the current study were undergraduate students at various university levels in the UAE. Purposive sampling was initiated as the sampling method to gather data. Purposeful sampling is used as a selection method in qualitative research to identify individuals who are knowledgeable with a phenomenon of interest in addition to being willing and available to participate (Palinkas et al., 2015; Patton, 2002).

All students registered in the selected undergraduate universities and the selected programmes aged 18 years or more were eligible for inclusion. Younger; postgraduate; remaining courses' students, were excluded.

The current researcher recruited 18 full-time university students from six institutions. AAU (*n*=5); MBRU (*n*=3); AU (*n*=2), USTF (*n*=1), RAKMHSU (*n*=3) and UOS (*n*=4). Ranging from 18 to 24 years, with more females participating in the study (*n* = 13) than males (n=5). The majority of participants were UAE and Arab national residents (*n* = 13), with the balance of international students originating mainly from America, Britain, and Asia. The distribution across subject disciplines and level of study were: Medical students (n=5) from 2nd, 3rd and 4th year, Pharmacy students' (n=8) with a majority from 4th year (n=6) and the remaining (n=2) from 2nd year, Engineering 4th year (n=3), and 4th year of Dentistry and Nursing (n=2). Demographic data were collected from all participants as shown in Table (8).

TABLE 8. DEMOGRAPHIC DATA OF THE PARTICIPANTS:

Participants	Gender	University	College	Year group	Type of CE used	Ethnicity
1 (U1)	Female	RAKMHSU	Dentistry	4th	Caffeine pills/ Piracetam	Iraqi
2 (N1)	Female	RAKMHSU	Nursing	4th	Non-user	UAE
3 (U2)	Male	USTF	Engineering	4th	Caffeine pills/ Guarana	UAE
4 (N2)	Female	RAKMHSU	Pharmacy	4th	Non-user	Egyptian
5 (N3)	Female	AU	Pharmacy	2nd	Non-user	Iraqi
6 (N4)	Female	AAU	Pharmacy	4th	Non-user	Jordon
7 (U3)	Female	AAU	Pharmacy	4th	Adderall, Caffeine pills	Egyptian
8 (U4)	Male	AU	Pharmacy	4th	Adderall, Ritalin, Vitamin B12	UAE
9 (N5)	Female	UOS	Pharmacy	4th	Non-user	Indian
10 (U5)	Female	UOS	Medicine	4th	Adderall	US
11 (U6)	Male	UOS	Medicine	4th	Piracetam	Iraqi
12 (N6)	Female	MBRU	Medicine	2nd	Non-user	US
13 (N7)	Male	AAU	Engineering	4th	Non-user	Iraqi
14 (N8)	Male	AAU	Engineering	4th	Non-user	Syrian
15 (U7)	Female	MBRU	Medicine	4th	Concerta/ Guarana	British
16 (N9)	Female	UOS	Pharmacy	2nd	Non-user	Pakistan
17 (U8)	Female	AAU	Pharmacy	4th	Modafinil/ Folic acid/ Ginkgo biloba/ Vit B12	Kuwaiti
18 (U9)	Female	MBRU	Medicine	3rd	Adderall/ Modafinil	UAE

- **U= CE user**
- **N= CE non-user**

6.3.3 PROCEDURE & DATA COLLECTION

In line with COVID-19 restrictions, in-person interviews were not possible to maintain social distancing, etc. Therefore, individual interviews were carried out remotely, with all participants using the voice call via 'Zoom' platform, and the researcher led the discussions. Online individual interviews to a total of 18 students from six UAE universities were conducted using audio-visual interface 'Zoom'. The researcher discussed with the participants the two choices for conducting the interviews, video or voice interview via Zoom, most of the participants preferred the voice interview without video.

The conversations started with covering some points outlined below and the conversational style including requesting a code for the session "pseudonym" (McDermott et al., 2020), to ensure anonymity of all participants. Participants were asked to complete a short demographic questionnaire (consent form), which presented with a short preface defining the misuse of CEs drugs/ substances to help with studying or staying focused and alert. Each interview lasted between 20 to 30 minutes; sessions were recorded using digital recorders (voice only) for transcription. All students were asked the same questions but, in some cases, additional questions were asked to elaborate on their answers and give more clarification (e.g., can you elaborate? do you want to add more? what do you mean, can you explain?). The audio files of the interview sessions were transcribed by the researcher using the support of Al technology software (Otter.ai).

Codes were then grouped into themes and sub-themes. During the analyses, data and coding were re-examined to confirm and identify additional themes as appropriate until themes are saturated. Coding is not just labelling, it is linking to the idea, "It leads you from the data to the idea, and from the idea to all the data pertaining to that idea" (Creswell & Clark, 2007).

Coding was completed by the researcher, then reviewed by the PhD supervisors. All data gathered were analysed thematically to allow for identification of common themes, areas where views and/ or practice differed markedly and where information gaps emerged.

6.3.4 ETHICAL CONSIDERATIONS:

The study received full Ethical approval from the University of Hertfordshire UH (UK) [LMS/PGR/UH/04025], RAK Medical and Health Sciences RAKMHSU (UAE) [RAKMHSU-REC-178-2020-PG-P], and the Ministry of Health and Prevention Research Ethics Committee

RAK Subcommittee (UAE) [MOHAPIREC/2020/35-2020-PG-P). Participation was voluntary and anonymous, to ensure anonymity, pseudonyms are used throughout the study. Prior to participation in the study, all potential participants were informed about the aims of the study and their rights to refuse participation or withdraw from the study at any stage without any consequences. An invitation and a consent sheet were sent to each of the students by email before participating in the study.

Permission to conduct the study and access study participants was also granted from the Dean of each of the Colleges included in the study. Students were informed that they could choose to withdraw from the study at any time without consequences, with the confidentiality of the participants' identities maintained through the data collection process. The interviews were recorded with the knowledge and consent of participants and subsequently transcribed verbatim. The recording session saved on a USB and stored with the researcher, with a completely confidential and anonymous manner in compliance with the General Data Protection Regulatory (GDPR) requirements (Information Commissioner's Office, 2018).

6.3.5 DATA ANALYSIS:

Computer-assisted qualitative data analysis packages enabled qualitative data to be sorted and organised more easily. In qualitative data analysis, NVivo is one of the most common and flexible software packages. Therefore, interview transcripts were uploaded into NVivo 12 for coding.

The interviews were coded to differentiate between various schools at the selected universities. To analyse qualitative data, a broad range of analytical methods can be adopted (e.g., IPA, discourse analysis, grounded theory, thematic analysis) (Creswell & Clark, 2007). The current study was analysed using Braun and Clarke's thematic analysis method which is an iterative process that consists of six steps (Table 2). Using thematic analysis and an inductive approach. The purposes for using an inductive approach are to (1) to condense extensive and varied raw text data into a brief, summary format; (2) to establish clear links between the research objec tives and the summary findings derived from the raw data and (3) to develop of model or theo ry about the underlying structure of experiences or processes which are evident in the raw data. The inductive approach reflects frequently reported patterns used in qualitative data analysis (Thomas, 2003).

The codes of the inductive data analysis were directly derived from the data without trying to fit it into a pre-existing framework, theory, or structure, and emerging themes are closely related to the data (Braun & Clarke, 2006). This means that inductive thematic analysis is data-driven (Braun & Clarke, 2006). Inductive analysis is a common technique in qualitative research despite being considered a time-consuming (Creswell, 2003).

Generating codes requires marking interesting features of the data in a systematic way and then collating the data. Initial codes generate preliminary themes, gathering all data relevant to the theme. Reviewing themes is the process of checking whether the themes work in relation to the coded extracts and the entire data set (Braun & Clarke, 2013).

TABLE 9: BRAUN & CLARKE'S (2006) SIX-PHASE FRAMEWORK FOR CONDUCTING A THEMATIC ANALYSIS:

Step 1	Become familiar with the data
Step 2	Generate initial codes
Step 3	Search for themes
Step 4	Review themes
Step 5	Define themes
Step 6	Write up

6.3.5.1 BECOME FAMILIAR WITH THE DATA

To become familiar with the data, the researcher reads all interview transcripts several times. Initial notes and ideas are further developed into codes that identify characteristics considered appropriate to the research questions.

6.3.5.2 GENERATE INITIAL CODES

Codes in qualitative research are words or short phrases taken from the data that are formed from the interview transcripts (Creswell & Clark, 2007). Data are organised in a systematic way to answer the specific research questions. In this study, thematic analysis coupled with an inductive technique was employed for data analysis. In this respect, the researcher has coded all the text. Despite being considered a time-consuming process, inductive analysis is common to qualitative research (Maguire & Delahunt, 2017).

To ensure the trustworthiness of the coding, the research supervisors checked and agreed on the coded sample. As the current researcher discussed, new codes were generated, and existing ones were modified. Therefore, the qualitative data analytic software was used to implement these modifications (Nvivo 12).

6.3.5.3 SEARCH FOR THEMES

A theme is characterised by its significance; there are no easy or hard ways of creating a theme (Braun & Clarke, 2006). After the codes were generated, they were re-checked, and some codes were merged and/or dropped in order to define the themes. Further analysis of the coding combinations allowed the researcher to revise and develop a final series of themes and sub-themes, giving an insight into the experiences of participants in addition to more in-depth levels of analysis.

6.3.5.4 REVIEW THEMES

Once all themes were created, the researcher defined the 'miscellaneous themes' which were thought not to be relevant to the research questions just to support the data.

The software (NVivo 12) facilitated the merging of some themes together to form a new theme (Braun & Clarke, 2006). The researcher went through each theme and considered whether the data answers the research questions.

6.3.5.5 DEFINE THEMES

This was the final step after the satisfactory themes were created and developed (Table 3). The ''essence'' of individual themes was identified to ensure that there was no overlap between themes. Finally, after this step, the researcher developed a clear view of the defined themes and sub-themes, in addition to how their combinations produced an overall view of the data (Braun & Clarke, 2006).

6.3.5.6 WRITING UP

Writing up was the final phase of the thematic analysis. The report would show the validity of the analysis that provides concise, coherent, logical, non-repetitive, interesting themes within

the data, illustrate the story that we are telling about the data, and make an argument in relation to our research questions (Maguire & Delahunt, 2017).

6.3.6 RESULTS

The semi-structured interview transcripts were analysed (more than 500 minutes of interviews). The current study identified 20 codes, which then were categorised under four main themes and 12 subthemes as shown in (Table 10). Thematic analysis by Braun and Clarke (2006) are presented here to help identify patterns and themes within our qualitative data. The goal of our thematic analyses was to identify themes which were related to factors affecting CE use, cognitive effect, pattern of behaviours and designing a campaign. Table 10 outlined the final themes and subthemes which emerged from the analyses of the collected qualitative data.

TABLE 10: FOUR MAIN THEMES AND SUBTHEMES AMONG UNIVERSITY STUDENTS (N=18)

Themes	Subthemes
1) Factors affecting CEs use	Awareness and social acceptability
	Accessibility and affordability
	Perceptions about safety
	COVID-19 pandemic effects
2) Cognitive effects	Negative effects
	Positive effects
	A requirement for academic work
3) Patterns of behaviours	Motivation
	Intention to use CEs post university studies
	Pressure & Stress
4) Recommendation to Intervention	Lack of knowledge
	The need for an intervention

6.3.6.1 THEME (1): FACTORS AFFECTING CE USE:

The first theme that emerged from the interview responses based on the participants' descriptions of their experiences with CE use with many participants reporting how social

norms were a major influence. This theme comprised four subthemes: awareness and acceptability, accessibility, perceptions about safety and the Covid-19 pandemic effects. The first theme can answer the first research question of the qualitative study: 'What are the factors influencing CE use among university students in the UAE?'

6.3.6.1.1 AWARENESS AND SOCIAL ACCEPTABILITY

Students (*n*=18) were asked if they were aware of the use of CEs and whether they accepted their use. It seems that there was a general awareness of CEs among users and non-users (*n*=17). The majority of the participants stated that they were aware and/or have heard about CEs, again, here about half of the students that were interviewed accepted the use of CEs.

Some students talked about the awareness and familiarity of CE among adult students:

"YES, I have heard about the CEs, and I'm sure majority of student are aware about it too'' (N2).

'' I'm familiar of the racetam group'' (U6)

However, some students spoke about the positive impacts and benefits of using CE.

'*' I have heard of them from my friends, they talk about this frequently and its benefit''*(U1)

''Yes, I've heard about them. I know that they can be used to improve cognitive ability'' (U3)

Others stated that they have heard about certain drugs although they were not familiar with the terminology of CEs. This was best illustrated by participant U8 who explained that

"didn't hear about the term cognitive enhancers, but yah I know drugs that could enhance the memory and it could help in focusing during exams'' (U8)

Furthermore, it was described that the drug "Adderall" seemed a popular one, especially for participant U6 who said that he knew:

"The famous one is Adderall" (U6)

Another interpretation of the level of awareness was noted among students who were studying medicine as they showed a better understanding of the effects (positive and negative) of using CEs. Medical students were aware of safety measures when using CEs, making sure not to overdose on them and use them only if needed.

''I only use when them when I need them. I don't take them regularly, I'm a medical student, and I know what I'm doing and what I'm taking. I don't really overwork myself and give myself an overdose to a drug that I don't really need, I would never be overstimulating myself'' (U5)

Some of the interviewees acknowledged that they would rather rely on good lifestyle such as having enough hours of sleep and a balanced diet rather than taking CEs.

''I feel each person should sleep for about seven to eight hours to maintain their brain. To make their brain more active, they need to maintain their diet eating like nuts will help too, that will keep them more alert. Sleeping is better than taking some supplements or drugs, it's a natural thing that people can do without harming themselves. Another thing perfect suggestion could be doing some mathematics, riddles or so on to keep their brain active'' (N3).

''Most of our students are still young, they need to get eight hours of sleep at night, if they eat healthy food and eat nuts and making exercise. If they feed their brain well like reading books or playing games like chess that keeps their brain alive. I don't think they would really require cognitive enhancers unless there's a compelling reason'' (N4).

Furthermore, students who are against using CEs seemed to be aware of the negative impacts of using CEs:

'' I don't think it makes them smarter, it might only boost energies, so I don't think it would help in exams, the drugs can't magically pop information in your brain, what you know is what you studied in a peace after a good sleep'' (N7)

According to the students' responses, there was high peer pressure at the university that drives them to use CEs. Some participants started using CEs just to conform with the students' community who are already CE users. If students see their peers achieving better academically, they easily succumb into substance use. This was evidenced by participants who elaborated:

''Actually, my friend gave me a few pills that were purchased online, he used it and it helped'' (U1)

''My best friend tried Modafinil, and she started getting 'A' grades. She told me about it and recommended I try it too''. (U8)

Peer effects appeared to play an important role among students. Users recommended Adderall based on their experiences. However, they recognised that Adderall was difficult to access in UAE but could be available elsewhere and/or online web, as one student said:
''Yeah, my friend in Hungary, who's studying medicine there, said that a lot of students I know here who take Adderall. So, I think that it's not as strict to get from Hungary as they are here in the UAE (lots of laughter). So, getting the drugs from outside UAE it's easier with reasonable price, which are affordable'' (U3)

Again, another participant added:

''*Well, my friend told me about the online drugstore that sells them without hassle, I order them from that online website, and they deliver it to my doorstep, easy and affordable price''* (U9)

Despite an ongoing debate about the benefits associated with CEs, an additional component contributing to the acceptability of CE drugs was students' views over the morality. Concerned about the ethics of their use and thinking it was unfair and cheating to take the drugs, one of the students said:

''I think people should just be studying without taking any pharmacological booster, because it would be unfair and I think it considers a cheating, like other people who put in the effort and work without the drugs, comparing it's not fair and its indirect way of cheating'' (N6)

Some participants thought the price to buy the CEs was reasonable and affordable and couple of students added:

‘’*In terms of the price they are reasonable as not expensive’’* (U2)

‘*’It was cheap and great option’’* (U5)

In contrast to all participants, only one student that was not aware and/or heard of what a CE was; he stated

‘’Not really. I haven’t heard about it at all. It is my first time to hear about such a drug (laughter)’’ (N8)

6.3.6.1.2 ACCESSIBILITY AND AFFORDABILITY

The accessibility of CE drugs/substances was another important factor in determining their usage. Most students obtained their supply of prescription medicines illegally, participants offered to describe the ways they obtained CEs. The most noted responses here was through purchasing online, student stated:

‘’*I order them online, it's very simple’’* (U1)

Again, here participant 18 noted how easy with no hassle they could get the CE drugs at their doorstep, she said:
‘*’the online drugstore that sells them without hassle, I order them from that online website, and they are delivering to my doorstep, easy and affordable price’’* (U9*)*

Furthermore, several participants reported that some individuals can obtain their CEs by relying on illegal channels through friends, or family, faking an ADHD diagnosis at the psychiatric clinic, or by online source prescription from a psychiatrist. It seems like some individuals find it easy to get a prescription from a doctor, especially if they know them personally. It seemed like some individuals found it easy to get a prescription from a doctor, especially if they know them personally. For example

‘’ *Yeah, some people know the doctor (laugh) and get the drug prescription”* (N1)

‘*’I decided to go to a psychiatrist complaining about how I feel that I'm no longer capable or able to follow up with my studies in medical school. I have prescribed Piracetam.’’* (U6)

The same participant expanded that

‘*’I have known friends had a prescription of Adderall from the psychiatric, he told the doctor that he is not able to focus, and he thinks it’s an ADHD*’’ (U6)

‘’*It can be done by getting the prescription from a doctor you know (laugh)”* (N9)

Accessibility had seemed here easy through friends/peers too. Other students generally reported that they obtained their CEs through a peer or friend that obtained prescription stimulants from a peer with a prescription, who shared their medication

‘’ My friend gave me a few pills that she purchased online’’ (U1)

‘’*I bought it from my friend who tried it too, she got it from her brother who was diagnosed with ADHD* (U7).

Another student who had experienced using CEs after one year of studying at university said:

‘’I heard about them from my friend at uni, she told me that it can help me to stay alert and it's going to enhance my memory. So, she gave me a drug called Adderall, she called it the SMART pills’’ (U9)

6.3.6.1.3 PERCEPTION OF SAFETY:

One of the main factors influencing students' intentions to use cognitive enhancers was their perceptions of their legitimacy and safety. Some have benefited from CEs and used them with no worries, considering that the use of CEs is safe because these drugs are government-regulated, created in clean labs and manufactured under Good Manufacturing Practice (GMP),

prescribed by medical professionals (Gouveia, Rijo, Gonçalo, & Reis, 2015), and dispensed with appropriate labels that have directions for use and administration. Some participants explained:

‘’ *I think it’s beneficial, and I know lots of people take them so why will I be worried’’* (U1).

‘’As long as it’s sold in the pharmacy, I think they are safe to use, these drugs prescribed by doctors. I'm not worried about them’’ (U5).

Another student tried to normalise using CEs as he said:

‘*’They are medication for a disease so, It's already safe’’* (U8).

Despite knowing that these medicines are associated with risks of dependence, addiction and use disorders, some students thought they could manage their use. Another participant reported that there would be no problem with using CE only when needed and said that it would not cause addiction, she said:

‘’ *It would help, but the problem with these drugs that maybe addiction can come, like for example with amphetamine. So, taking them only during the exams or so I don’t see it a problem, you should be carefully when using it’’* (U3).

Interestingly, the statement of participant 15, who thought that CEs should be legalised for advanced courses. Cognitive enhancement has much to offer individuals and society, and a proper societal response will involve making enhancements available while managing their risks (Greely et al., 2008), said:

‘’*If it becomes prioritised and legalised, everyone should be able to try it 'lots of laugh' we live once why don't we live smart. I truly think about legalising this and making this such a norm to people everywhere. Anyone studying any degree, medicine isn't the only high degree there's law, there's engineering, there's mathematics, there's so many of these degrees that are super hard, and people struggle day by day’’* (U7)

In contrast, other participants reported that they avoid CEs because they are aware of the side-effects and involves certain health risks like addiction. Here students stated the following:
''Yes, it is the side effect, it's exactly why I avoid them. I'm a little prone to like anxiety. I'm able to be in nursing without drugs and alhamdullilah I'm coping well''* (N1)
****This is an Arabic phrase meaning "praise be to God''***

''I think they could have negative side effects on healthy person, it can be addictive'' (N7)

6.3.6.1.4 COVID-19 PANDEMIC EFFECTS:

Another subtheme identified how the COVID-19 pandemic caused stress and challenge for students to study online. The anxiety that students experienced not only came from the threats of COVID-19 itself, but also from social and physical restrictions, lack of familiarity with new learning platforms and technical issues. Based on participants' responses, several reasons for promoting the use of CEs drugs, were here identified:

''COVID pandemic and the lockdown caused anxiety to most of us, like being wrapped up in the same place in our room, all the time. This is where you study, this is where you sleep everything is restricted and the unfamiliarity with online learning, and when you don't get to meet your own friends. All that accumulated in our minds. Honestly, therefore I started taking Adderall as a cognitive enhancer to keep me motivated to study and boost my cognition'' (U3)

Another participant, who did not use CEs explained the reasons which supported using CEs during the Covid-19 pandemic, stated:

''We are going through very immense stress now, the COVID pandemic is stressing almost everyone, online learning it's not easy for a medical student, not only that, but the stress also that you don't know how long it's going to last, itself is the catastrophe. So, that itself is a reason which could lead students like medical students to use cognitive enhancers pills'' (N6)

6.3.6.2 THEME (2): COGNITIVE EFFECTS

The second theme in our qualitative analyses related to the effects that participants experienced when using CEs. The majority reported the positive effects of CEs and hence, justified the need

for CE use. However, there were also a few negative effects experienced by participants. The second theme comprised three sub-themes: 1. Negative effects, 2. Positive effects and 3. A requirement for academic work. This theme could answer the second research question in this qualitative study: ‘What impact do students who use CEs have on the views and behaviours of non-users?’

6.3.6.2.1 NEGATIVE EFFECTS

Participants who were non-users of CEs only acknowledged that there could be health risks that CE drugs could pose, using them without a prescription is illegal and can lead to unwanted side-effects, such as increased both anxiety and heart rate or even cause addiction.

‘’ *Well, I think it's not good decision for a healthy individual to use these things because it definitely can be harmful and lead to a bad effect like increased anxiety, even in a long term’’* (N3)

‘’I don't think I would use it; I would be worried if I could get addictive or get a serious side effect from them” (N7)

6.3.6.2.2 POSITIVE EFFECTS

The vast majority of participants described their experiences, reported how they benefited from taking CEs and how it helped with keeping them alert and focus during their examination, they said:

‘*’Yes, it really helped. It makes me alert all night during examination’’* (U1).

‘*’Yes, it helped a lot made me stay alert and focused all night during my exams. in terms of thinking and memorise things much easier than being without the drugs’’*(U2).

Another participant reported the experience she had before and after the use of CEs in terms with their grade improvements, and stated:

‘’ *Like, based on what I experienced with me and my friend that tried it too, we used to get D's in most of the courses, but honestly after we started with the pills it really helped and now we are on B's and A's so I really do think they had a great effect’’* (U3).

Another common positive effect reported was related to increasing concentration levels:

‘’*Honestly, I do think that they helped me to concentrate well but of course it doesn’t make you smarter it boosts up your cognition though’’*(U5).

One participant explained the effects she felt with Adderall and Modafinil, and stated:

‘*’Really, it made me more concentrated, it enhances my memory. I can memorise things much, much more effectively, and also it keeps me awake for a long time’’.* (U9)

6.3.6.2.3 REQUIREMENT FOR ACADEMIC WORK

Participants in this sub-theme reported their need of CEs drugs during their exam period and when they are submitting coursework, and stated:

‘’ *I take it when I need it, like when I have exams or a submission of a course work when I need to stay awake all night’’* (U1)

Similarly, another student justified that there are some benefits of using CEs, particularly during exam periods, and said:

‘*’Um, I mean it's a weapon with two ends like they say, it can absolutely be good for people that need it, with academic load sometimes we need anything to boost our cognition, we need to concentrate and stay awake specifically during exams and submitting work, its medicine school my dear’’* (U6).

6.3.6.3 THEME (3): PATTERNS OF BEHAVIOUR

The third theme that emerged from the interviews related to patterns of behaviour with CE use among university students in the UAE. Socially, students become more independent; some

students leave their families to go to university, which could cause feelings of loneliness and nostalgia; increased influence and pressure of their university peers, such as test scores, career choice and so on. Academically, students need to process large amounts of study material for themselves, may face performance and assessment pressures, and experience new levels of competition.

Three key subthemes emerged from the analysis. This included motivation, intention to use CEs post-University studies and pressure and stress that causes participants' use of CEs. During the interviews, participants also discussed further about the reason for using CEs and whether they have the intension of using them in the future. This theme can help answer the third research question for the qualitative study: 'What are the reasons and justifications reported by UAE University students for using/not using CEs? Three key subthemes that emerged from the analysis are as follows:

6.3.6.3.1 MOTIVATION

The interviews showed that participants were motivated with an interest in using CEs. Based on some participants, they were certain that CEs had kept them alert with high levels of concentration, and stated:

'*''It would help, I know that some of them can work, for example, increasing the adrenalin in the body to keep you alert and awake or increasing the dopamine levels in the body''*(U3)

'' *From what I've been through. They're amazing. They give you the desired effect you seek''* (U6)

Another participant who used CEs, justified their use, and mentioned the benefits of using them during exam periods for students, and said:

'' *It is amazing (lots of laughter). I think it's such a good idea it helped a lot of my friends to be able to stay more focused and to do better in their exams, you're just enhancing your natural ability by staying focused for a longer period and staying concentrated in the work that you need as a medical student'' (*U7)

6.3.6.3.2 INTENTION TO USE CES POST-UNIVERSITY STUDIES

After discussing the motivation of CE use and academic pressure, participants were asked about their intention to use CEs in the future. Surprisingly, the majority of students replied that they were aiming to use the CEs in future, stating the following:

‘’*Yeah. I would take it for sure, just because I want to stay concentrated and boost up knowledge faster (laugh)’’* (U2)

‘’ *As I'm facing issues with concentrating and paying attention from now that I'm still young, I don't really see that it is a problem because to not use it, so yes I will use them in the future’’* (U3)

Similarly, another participant expressed the intention of using CEs in post-university studies, and said:

‘’*Well, to be honest, I would be going with amphetamine only in the future as it was the best one out of all’’* (U4)

Participant 18 admitted that it wasn’t harmful when using them, assuring that she will be using it in the future too, and said:

‘’ *Ah, I think yes, whenever I need them. I will continue to use them because as I told you they didn’t harm me so far, and they really helped, so why not’’* (U9)

In contrast, some participants that had not tried CEs in the past did not think that they would try them in the future

‘’ Not sure as everything has advantages and disadvantages’’ (N2)

‘’ I don't really don’t think so because, like, we need to live our life healthily, we can't keep risking for our health. Eventually, I don't think so’’ (N3)

6.3.6.3.3 PRESSURE & STRESS

When students join the university, they go through stressful conditions related to adapting to changing an environment, new academic roles, and their commitment to their family, as it has been found that psychological symptoms, including stress, were commonly manifested among students, another stress-inducing factor is the highly competitive educational environment. Some respondents explained that students could be involved in CE use to cope with these types of stressful conditions, as said:

‘’ *I work so hard to make my family proud of me, we go through very stressful, the fees are so much, and my family are paying so much money, all this accumulate a big stress’’* (U1).

Another student who had experience using CEs, justified the use of these drug as it enabled students to manage the huge stress they are facing in their studies; he said:
‘’ Engineering, It's a competitive course. It's very difficult especially in the last year now before graduating. Some time we had to submit multiple coursework at the same time. Stress with no end that your family waiting like what to see you a good engineer’’ (U2)

Participant 10 had a similar view and she normalised using CEs to manage the stress of studying, she said:

‘’ *Well, It's a lot of pressure. I mean, it's pressure from your family, you need high grades at school to get into medical school and then you're expected to do well in it, because you are expected to good grades for the rest of your life’’* (U5)

Again, here looking for a high grade to get the discount toward the fees increased the anxiety among students that led them to use CEs; he stated:

‘’ *I use them because there is huge pressure on me. It's not because of the passion of medicine it's more of the five Figures we pay every year for the costs of the college here because colleges of medicine here specifically are very expensive, but you get discount if you score good grades, which created this anxiety in each one”* (U6)

Other participants reported how they were coping with educational or social stress without using CEs. Shared options for safer CEs or recommended alternative coping strategies. Among others, they recommended a good night's sleep, a balanced diet, exercise.

"Get away from the stress or anything that makes you feel pressurised or feeling stressed, just concentrate on the positive thing because whenever you just think of the positive things, your brain mentally or gradually will be working and functioning well" (N3)

"Well, I do exercise regularly, balance my diet, I try to have a minimum of five hours of sleep, and I do a lot of meditation. But still I do experience a lot of stress at university or even at my social life, but I just try to cope with it, by taking the problems as a case that needs to be solved." (N5)

6.3.6.4 THEME (4): RECOMMENDATIONS AND INTERVENTIONS

The fourth, and the last theme from the qualitative analyses, indicated that while some students were aware of the potency of CE drugs/ substances, they still used them without a doctor's prescription. There are two sub-themes that emerged from this theme which are participants' lack of knowledge about the harm of CE use and students' recommendation of guidance in the university. Most of the participants commented that there was a lack of knowledge in providing information regarding CE misuse and they think that orientation would be an important option that can be undertaken at the institutional level as there was no guidance ever carried in the university about this issue. As a result, recommendations for proposed intervention are discussed in the following sub-themes:

6.3.6.4.1 LACK OF KNOWLEDGE ABOUT THE HARM OF CE:

According to the participants' responses it shows that no intervention to guide students had been carried out in their institutions before and, there was lack of knowledge about the harm of CEs drugs/substances use; somebody said:

''No intervention regarding cognitive enhancers drugs in the uni. Some of our students are lacking the knowledge about the harm of CEs. There is no advice from our staff in regards that, all they do is stressing us with exams (laugh)'' (U1)

However, another participant who did not use CEs, she believed that the lack of correct knowledge was one of the main reasons for using CEs; she said:

''There's lack of knowledge skills about the harm of cognitive enhancers in general'' (N1)

Similarly, another student here said:
'' It would be good idea to educate the students from an early stage as I mean from year 1, as they are lacking the knowledge about the harm of use drugs just to boost their cognition'' (N3)

In contrast, another user of CEs talked positively about the importance of CEs in improving students' cognition and making their study easier, he said:

''Students are not educated about the misuse of the drugs which they think can boost them up or can improve their cognition. It's very important to educate them, they are lacking knowledge'' (U6)

6.3.6.4.2 THE NEED FOR AN INTERVENTION

Most of the participants here have provided a range of rich information regarding the need of an intervention within the University. Interesting statements from non-users as well as those who use CEs are shown below. A participant who used CEs provided some recommendations from his experiences, and said:
''I think it's very important recommendation to the university'' (U1)
''It would be a great idea if the university organise for such a programme because what I know students, they imitate each other here (laugh) specially when they improve their grades and so on'' (U4)

However, some participants felt that the increasing use of CEs is becoming a problem which requires a solution soon; she said:

''There is no intervention in our campus but trust me as this issue is spreading a lot in the UAE now like how it is in the US. We need to be guided then'' (U5)

Another student agreed with the above statement; he said:

''We need an intervention to educate the student what they need, but in a very controlled tours and very regulated way because the stress of the medical school will never change. It will never end to say that we're going to make medical school stress free''(U6)

Other students who did use CEs deny any intervention programme to educate students about the negative impact of using CEs:

''No there is no intervention but trust me I think they should organise such a thing we need it'' (N1).

Similarly, a student believes that there is great value to creating a healthy environment to support University students to take care of their health and to use good skills to manage University studies instead of using CEs, she said:

''The intervention can be done in a lot of ways, maybe as a workshop or something like a cognitive enhancers misuse club where students can attend outside their lecture or lab time. Yeh, it's just an idea but yeh we need it'' (N3)

Conversely, two participants explained that they started to use CEs for academic purposes, so they thought an intervention was not needed, stating:

''No intervention programme carried in our university before, but to be honest, I wouldn't recommend such a campaign because it's useless (laugh) trust me the stress to study pharmacy is extremely severe and we can't control this stress without boosters, so even if they run ab intervention sessions students wouldn't take the advice (laugh) (U3)

Moreover, another student did not recommend using any of the orientation awareness programme, she said:

''I think there is no need for that, we are all grown up here and future doctors, we use it only for academic purpose, not just for fun. I wouldn't recommend for it no'' (U9)

6.4 Teaching faculty staff interview (Part II)

It is important to investigate any phenomenon through various perspectives, thus, the researcher was interested to add the views of students about using CE and the teaching faculties to get more than one source for the data which was collected through interviewing students and their lecturers.

6.4.1 AIM

The aim of this part of the study is to explore the nature of CEs use among students and the reasons behind it from a lecturer's perspective.

6.4.2 RESEARCH QUESTION

What are the factors that professionals contribute towards the use of cognitive enhancers (CEs) among university students?

6.4.3 SAMPLE

A purposeful sample was chosen via telephone contact, and a date was arranged for interviews with a member from each of the seven teaching faculties (Table 4) from six institutions in UAE. Four of these selected participants were males and the remaining three were females.

6.4.4 METHODS

A qualitative study design was conducted among teaching faculties from the same universities that were selected in (Part I), by arranging voice calls via the 'Zoom' platform and the researcher led the discussions. An email of invitation and a study information sheet was sent to the teaching faculties that took part in teaching students. Telephone contact was then made, and a date was arranged for interviews with seven teaching faculties from six institutions in UAE. Teaching faculties were given the option to be interviewed in English or Arabic. All

participants chose to communicate in English, for that reason, the interviews were carried out to faculties in the English language. The participants seem to fall into one of three groups: (1) absolute denial of CE use among students (P1, P3, P5); (2) denies CE use among students in the university, but reports seeing CE use elsewhere (P4, P7); (3) reports CE use among students in the university (P2, P6). Demographic data were collected from all participants (Table 11).

TABLE 11. DEMOGRAPHY OF THE PARTICIPANTS (N=7)

Participants	Gender	University	College	Ethnicity	Years of working
1 (AD1)	Male	MBRU	Medicine (Physiology)	Jordan	4 years
2 (R1)	Male	RAKMHSU	Student Affairs (Physical Education)	Egyptian	12 years
3 (AD2)	Male	AAU	Pharmacy (Pharmacology)	Libyan	11 years
4 (D1)	Female	AU	Medicine (Internal medicine)	Iraq	6 years
5 (AD3)	Female	USTF	Pharmacy	Sudan	8 years
6 (R2)	Female	UOS	Pharmacy (Pharmacology)	Syrian	10 years
7 (D2)	Male	RAKMHSU	Medicine (Psychiatric)	Egyptian	14 years

- **AD=Absolute denial of CE use**
- **D=Denies CE use in university but reports seeing CE use elsewhere**
- **R=Reports CE use in the university**

The interviews were recorded with the knowledge and consent of participants and subsequently transcribed verbatim. The recording session saved on a USB and kept with the researcher, with a completely confidential and anonymous manner in compliance with the General Data Protection Regulatory (GDPR) requirements (Information Commissioner's Office, 2018).

6.4.5 RESULTS

The interviews were transcribed by the researcher, then uploaded into NVivo 12 for coding. The interviews were coded to differentiate between various schools at the selected universities. The interview data were analysed using the six-stage process (Table 2) of thematic analysis (TA) outlined by (Braun & Clarke, 2006). Thematic analysis used to analyse and report repeated patterns of themes in several ways within the data (Braun & Clarke, 2013). The results analysed from seven university lecturers consist of three main themes and their five sub-

themes, as shown in Table 12. These themes represented the attitude of university lecturers and their perception towards CEs, in addition to their roles in raising a campaign against using CEs among University students.

TABLE 12. FACULTY INTERVIEW THEMES:

Themes	Subthemes
1. Teaching staff attitudes and general behaviours	1. Moral attitude 2. Students' behaviour patterns and stress 3. Peer effect
2. Perception of CE use	1. Professionals' personal experience with CEs 2. Placebo effect
3. Raising a campaign	

6.4.5.1 THEME 1. TEACHING STAFF ATTITUDES AND GENERAL BEHAVIOURS

During this second phase of the qualitative analysis, the first theme explored the attitudes of university faculty (pharmacy and medicine) toward CE use among students. In this study, three sub-themes are discussed (professionals' moral attitudes towards CEs, students' behaviour patterns & stress, and peer effects).

6.4.5.1.1 MORAL ATTITUDES

Surprisingly, most teaching faculty academics strongly disagreed with the fact that their students misused with any drugs including CE drugs because they are aware of the side effects, and it is morally unaccepted in UAE because they are future healthcare practitioners. One teaching faculty believed it is not ethically acceptable for students to use CEs for any reason, stated:

''I doubt here in the UAE things like that can happen. I can't say all our students are perfect but no news about addiction, in general, has never reported in our university before. ***Ethically not accepted****, they are our future healthcare practitioners, and aware of the side effects of using a drug that is not prescribed to them''* (AD1)

Another teaching faculty voiced their concerns towards students using CEs due to the negative impacts on their health, as one of them said:

''I didn't see or hear anything like that from them before. I can tell you that our students have good knowledge on misusing drugs in general ***because they are aware of the serious effect they could face****''* (AD2)

Another teaching faculty felt that using CEs is against ethical and moral values and students should not practise this harmful behaviour:
''I did not hear from any of our students that they have taken cognitive enhancers before, it ***morally unaccepted*** *by future pharmacist''* (AD3)

Another teaching faculty was hugely surprised that students and especially medical students use CEs; she said:

''No. nothing like that I came across off, ***how can they do that?! they are the future doctors****. I strongly think that our students would not misuse CEs for any reasons"* (D1)

Another teaching faculty denied admitting that the behaviour of using CEs is not common in the UAE, said:

''Thank God because ***this concept is not spreading here in UAE****. It is not well known among our students. I haven't met students asking for that in the UAE, this concept is not in UAE''* (D2)
In contrast, the participant here did not give a view on the morality of CE use. The participant who works in Student Affairs and has a close interaction with students made this point more strongly and acknowledged that some students do use CEs during exams to boost their cognition and keep them alert, as he said:

''Yes, I'm aware, because of my job nature of being a part of the Student Affairs. I have direct and close contact with students. Literally from the informal way of discussion, students shared

their experience about their use of cognitive enhancers drugs and substance pills for the purpose of improving performances and concentration'' (R1)

Here, the lecturer believed that students consume lots of coffee and energy drinks as CEs, but did not give a view on the morality of CE use:

''I do believe that they consume lot of coffee drink and Red Bull as a cognitive enhancer, as they say keeps them alert and make them more able to perform better, but apart from that, no I really don't know' (R2)

6.4.5.1.2 STUDENTS' BEHAVIOUR PATTERNS AND STRESS

A positive behaviour was reported by the participants on students, as follows:

''I know students here they are working so hard to get the academic discount because if they get a high score, they can get a good discount. So, yeah, they have some financial challenges, as well as social challenges to get any higher scores, I can say a positive behaviour changes in which they make good peers, making exercises improving their lifestyle'' (AD3).

Another faculty staff acknowledged a negative behaviour e.g., that during the pandemic students were anxious and looked depressed, adapting to campus closures, physical distancing, and quarantining time at home:

''During the COVID pandemic, they were so anxious and looked depressed. Because of the online teaching they used to be at the campus, meeting friends. The long-distance learning appeared to have a negating behaviour effect on students'' (D1)

The stress and tiredness expressed by students, especially medical students, were reflected badly on their voluntary physical activity (PE) sessions that they used to attend to relieve their stress. Another teaching faculty raised a concern that these students seem to be easily tired, as he said:

''During exams students specifically medicine students, come to the PE session very tired, and can't enjoy their exercise because they didn't sleep for the whole night to study. That is a case of concern'' (R1)

6.4.5.1.3 PEER EFFECTS

Peer pressure was an important factor in the study in which students could be influenced by their friends on CE use behaviour. This sub-theme showed the relationship and found that even non-users could be affected by users' peers and could become 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. Participant 2 added that students were motivated to try CEs out of curiosity, as they belonged to peers who were using these drugs. Reassured by their peers' positive experiences, and the expectations of knowledge to CEs were mainly formed from the experiences of peers' already using these drugs. Moreover, these students were not concerned about the consequence about the negative outcomes and detrimental side effects:

'' being in a medical field is not easy we all agree on that, and friends have a major effect on each other means that some of them copy each other, whatever one does the other get influenced. But again, what I always hear from them is the stress they face from their family that they need to get a high percentage so they can claim the discount towards the fees'' (R1)

On similar direction, another teaching faculty believes that the impact of peers is huge as peers can copy each other in good and bad ways:

''What I believe that students in general get effect by their peers easily. I see the way in the seminars most of them bring in energy drink like Red Bull (lots of laughter), if one drink the friends copy the habit'' (R2)

''I advise students to interact with good peers, share knowledge and study together that can help them to be more motivated as I'm so sure that friends influence each other'' (AD3)

''My advice to students is to always choose the right peer. I know they are affected by their peers'' (D2)

6.4.5.2 THEME (2): FACULTY STAFF' PERCEPTION OF CES USES AMONG STUDENTS

The second theme was to emphasis the professional's personal experience on the use of CEs, placebo effect and the importance of an awareness campaign in the universities.

6.4.5.2.1 PERSONAL EXPERIENCE WITH CES

Interestingly, some staff gave their own experience of CE use when they were medical students in their countries stating the following:

''Back when I was medical student in Iraq, we used to share the substance (Gingko biloba) during exam times only to make us alert, as we needed to be more conscious, we all needed anything to be mentally concentrated and focused'' (D1)

Another member of a teaching faculty shared his experience when he was a student, he said: *''When I was a student a very long time ago in Egypt, my best friend used to take Nootropil (Piracetam). I don't know if they work or it work like placebo, but (laugh) I heard many positive responses from him, he was recommending Piracetam as cognitive enhancer to other peers too''* (D2).

6.4.5.2.2 PLACEBO EFFECT

Interestingly, participant 7 was ambivalent about whether he believed that the use of CEs by students was common at university and acknowledged the possibility of a "placebo effect." Although it was recognised that CEs did not actually change the way students thought, or that they would be more concentrated or focused on their tasks but realised the feeling of enjoyment. In this sense, it can be stated that CEs provide an experience that in general is rewarding for the user at both a cognitive and an affective level.

As would be expected, participants who described the placebo as pleasurable, tended to seek an intense, potentiated effect, and engaged in habitual use CEs:

''Very good. The good thing to hear was a student's coming back to with this big smile and telling me how he felt more focused and concentrated while studying (lots of laughter).

'' I'm supported to give Placebo because if the placebo works well WHY not even giving it'' (D2)

Another teaching faculty member commented on the placebo effect:
''In fact, I think Physicians may use placebos to students as a cognitive enhancer, the placebo effect may underlie positive outcomes'' (R2)

6.4.5.3 THEME (3): RAISING A CAMPAIGN

In this theme, it shows that some faculty members had open discussions on the topic of misusing a drug in general but that did not occur very often:

''I never done that myself maybe Student Affairs staff in the university might be arranging things like that, but we didn't arrange as such a campaign before'' (AD1)

Another teaching faculty believed that students were facing important challenges in order to deal with stress without using CEs, as he said:

''Yes, but not a proper intervention but I advise them always about how they shouldn't use any substances and/or drugs for any reason. I have had sent them a power point by mail several times about the misuse of drugs in general, it's very important, I think. Students are in a high risk to do anything to reduce their studying stress. They need to be more educated on the long-term effect that the dug could cause'' (R1).

Here, the participant appreciated the idea of the intervention even though believed that the use of CEs by students was uncommon at university:

''I think I can propose like an elective course as part of an academic programme to teach students how to avoid taking cognitive enhancers drugs and advice the natural way like exercises, we have many alternatives to enhance our memories, our memorization with other habits, we can do. Okay, other than using these pills. So, offering a course, even a lecture, of course, to students will it be a good idea to do in the future maybe'' (AD3)

Another teaching faculty member was concerned about the absence of any intervention that can increase the awareness of the damage of CEs on students, especially the long-term impact:

''In our university I haven't heard of an intervention about the misuse of CEs drugs, but I always give advices to students that to enhance their concentration without drugs, they need to fix their sleeping pattern, that has effect on memory because most of our memories occur during our sleep and most of the information we are reading solidify during the sleep so if you sleeping is disturbed, all the information you take it will not be stored nicely in your brain. In general, I welcome the idea of the campaign well done'' (D2)

In contrast to others, some participants stated that raising an intervention can have a negative impact on students. In this subtheme of analysis, it was found that some teaching faculties did not consider the discussion on the misuse of CE drugs, as that could increase the awareness of CEs among those who have no knowledge about it:

''No, I don't think so, I haven't come across that we usually do orientation regarding misuse of drugs in general, but I think we've never done, such an orientation on cognitive enhancers drugs. I think we should not raise the campaign on the misuse of a drugs that enhances cognition because we might increase the awareness of students about the use of cognitive enhancers No, I think it's wrong some have no knowledge about that and once they hear that there is something that could make you smart even if it's dangerous, they will try I think it's my opinion only (AD2)

Another teaching faculty agreed with the above as raising a campaign to increase the awareness of the risk of using CEs can inadvertently promote CE use among students and lead them to try it in their battle against dealing with exams stress, she said:

''I think no, awareness about the cognitive enhancer's pills in a specific no, we give advice and awareness during the lectures about the misuse of drugs in general all the time. I think we shouldn't as a teaching faculty mention CEs drugs to students as I think that could result with a negative impact outcome'' (R2)

6.5 Discussion

This study aimed to explore in further detail the survey findings to provide an in-depth understanding of the reasons why university students in the UAE use CE drugs from students and teaching faculty's perspective. Despite ambiguity around effects and definitions, several studies have looked at the increasing prevalence of CE drug use worldwide (see Chapter 2), especially among university student populations and with a focus on stimulants.

The current study is the first qualitative study that has carried out an in-depth interview on the perception, behaviour and attitude regarding cognitive enhancers use in Gulf countries including the UAE among university students. It emphasised the increased use of pharmacological CEs illicitly by healthy university students aged 18-25 to gain an academic advantage. In this study we have outlined the interview structure, style, setting and recording the data to answer the research questions and to explore the results in this Chapter that were obtained from quantitative survey study (*Chapter 5*).

The qualitative study is presented in this Chapter to provide a deep understanding of the cultural background and awareness level among participants about the use of CE (Daymon & Holloway, 2010). Multiple qualitative methods within a single study are beneficial to explore complex phenomena (Morse, 1994). Our study combined data from semi-structured interviews among students and professionals' views on CE use among students. Using these two qualitative approaches together provide a complementary perspective on the phenomenon (Morse, 1994).

The study was conducted in six Universities in the UAE that are known for competitive college acceptance. Semi-structured interviews with 18 University students (Part I) who were interested to discuss their experiences and/or other people's experiences with the use of prescription stimulants during their academic careers. Furthermore, another semi-structured interview with seven teaching faculty staffs (Part II) brought to light the perception of university teaching staff (pharmacists and doctors) towards the use of CEs in the University they are working in.

Three research questions have been established to reach an answer. The completion of these questions will be addressed in the subheadings below.

6.5.1 WHAT ARE THE FACTORS INFLUENCING CE USE AMONG UNIVERSITY STUDENTS IN THE UAE?

Firstly, this study attempted to explore the factors that influences CE use among university students in the UAE.

The responders indicated in Part I, out of 18 students who have been interviewed, nine used CE (licit and illicit) drugs and almost all, the participants were aware or have heard about CEs, the staff faculty in (Part II) strongly disagreed with the fact that there are university students who use CEs for cognitive enhancement. The findings from Part I of the study showed that out of 18 students, half of them reported that they tried taking CEs and when asked about their motivations for CE use, participants chiefly referred to the expected improved academic performance mainly associated with a better memory and focus. This finding aligned with previous qualitative studies that explored university students' experiences on CE for academic purposes (McDermott et al., 2020; Monnet et al., 2021b). Similarly, several studies found that people who used CE thought that they could benefit from its use in improving their focus and concertation and reducing the level of anxiety and stress in particular among adult students (Repantis et al., 2010; Maier et al., 2015; Plumber et al., 2021).

For example, one of the students who uses CEs said:

''Yes, I've heard about them. I know that they can be used to improve cognitive ability'' (U3). Greely *et al*., (2008) reported that some University students worldwide sell and buy CE in order to improve the opportunity of getting higher academic achievement. This transaction uses the most common drugs Ritalin and Adderall, it is illegal which can increase crime. Unfortunately, the use of CE is a common issue which has spread among people, in particular, students who believe in the importance of using CE to get better academic achievement and reduce the exam stress. One of participants said:

''I only use it when I need to, I actually make sure I do not take them regularly, I am a medical student, I know what I'm doing and what I'm taking. I don't really overwork myself and give myself an overdose to drugs that I don't really need, and I would never overstimulate myself'' (U5).

The use of CE among university students in the UK and Ireland has been estimated to be around 10% (Singh et al., 2014); with US University students reaching 8.3% (Teter et al., 2006); and 6.5% among Australian university students (Lucke et al., 2018b); and 5% to 30% of students in Canada reported the use of CEs (London-Nadeau et al., 2019). Research reported that the spread of using CEs is increasing yearly in the US, which is an alarming indicator for society Figures that should encourage them to stand firmly against it (Lucke et al., 2011; Greely *et al*., 2008; Partridge, 2017). Moreover, some University students believe that using CEs gives them an opportunity to increase and improve the quality of their studies and academic achievement (Volkow et al., 2008; Ragan et al., 2013) and Shakeel et al., (2021) also added that CEs can make the purpose of study.

The current qualitative study showed that the most common prescribed drugs used among students in (Part I) was 'Adderall' and for non-prescribed drugs it was caffeine supper strength pills, this is a line with previous studies (Sharif et al., 2022). However, there has been no exact data or previous studies that reported the prevalence misuse of CEs in UAE, it only indicated that 86% of male and female students in Zayed University (UAE) showed a positive attitude towards coffee consumption as a CEs (Ghalia et al., 2016). There are 142 unique CEs which is a huge number of different types or groups and some of these drugs are commonly used (Napoletano et al., 2020). Several studies show big concerns that there is an increase in the use CEs among adult students in an attempt to improve academic achievement (e.g., Monnet et al., 2021a; Narayanan et al., 2021; Shakeel et al., 2021).

Surprisingly in Part II of the study, the majority of the teaching faculty responded that CE use among their students is not common and that there are no behavioural problems that could be related to fear of disreputing the university. These findings are consistent with those reported by (Ram et al., 2020).

An awareness of CEs and the potential benefits of such stimulants were central in determining their use among students. The majority of our participants in both (Part I and II) reported that peer influence was highly influential in terms of their uptake of the CE, that is in a line with a previous qualitative study that was carried out in UK (McDermott et al., 2020).

The findings in current study from Part I, shows that CE users believe that the drugs to be safer than the non-users, and that users more strongly believe that they know enough about the drugs

to use them safely. Students have expressed security in the safety of CEs as the drugs is a prescribed medication, not a street drug, and is safe because it has gone through extensive testing by pharmaceutical companies and is prescribed by medical professionals. These results are in line with another study (Nguyen et al., 2021; Ram et al., 2020). However, researchers have voiced their concerns about university students use of CEs under false consideration that CEs have a positive impact rather than a negative one on their personal and academic life, this means those adult students are at a high risk (Greely et al., 2008; Lucke et al., 2018a).

A relevant factor that was identified in the study was the lack of awareness to address the dangerous use of CEs in the University environment. For this reason, the current study is very important to allow the UAE and other Arab countries to show the risk of using cognitive enhancers (CE), it is essential to provide knowledge and information supported with research evidence to University students in an attractive and gentle way to ensure these students review their information about the false benefit and risks of using CE (Sharif et al., 2022).

Another suggestion was to run campaigns for improving student's confidence and making the coursework more enjoyable. Universities might also include general and introductory educational sessions on the dangers of CE use, side effects, and options to seek help (Abelman, 2017). It is important to initiate awareness campaigns among students to help students understanding the risk and damage caused by using CE, especially in the long term. Research supports the way of dealing with this issue as there is wrong information spreading among university students that claims that using CE can help them to increase their academic achievements (Colagiuri et al, 2010). On the other hand, research criticized how adult students believe unapproved information which is not supported by clinical evidence about the benefit of CE use (Napoletano et al., 2020).

There are serious ethical and legal issues involved in the non-medical use of any psychotropic, with nootropics potentially causing major public health problems (Schifano et al., 2022). Cognitive enhancers among university students has been identified as a public health issue (Benson et al., 2015b). The outcome of the semi-structured interview and the thematic analysis was to discuss the importance of the intervention programme from the opinions of the students.

6.5.2 WHAT IMPACT DO STUDENTS WHO USE CEs HAVE ON THE VIEWS AND BEHAVIOURS OF NON-USERS?

The current interview study findings highlighted that peer influence had an effect, that including participants' awareness and ease of availability by sharing the drugs, as well as greater acceptance of use of CEs within students in UAE Universities. Similarly, Javed et al., (2019) conducted a study among 27 participants in Pakistan which provided evidence that one of the CE drugs helped to improve the concentration of these students. Study reported that the student's peers showed profound impact on the usage of CE and its spread (Javed et al., 2019). A suggestion given in the literature on academia to deal with and/or prevent CE use among students (Abelman, 2017), was to provide systems that reduce **peer pressure** and stigma by advising students to not share medication. Therefore, it seemed that the impact of peers on University students is huge and can reduce or increase the use of CEs, which means it is important to ensure that the University atmosphere is healthy and provides attractive activities to increase the awareness about the risk of using CEs.

Systematic reviews of the relationship between peer pressure and alcohol consumption (Borsari & Carey, 2001) and cigarette smoking (Mpousiou et al., 2018), have primarily focused on adolescents and college and university students; however, peer pressure perceptions may persist as students get older. The concept of peer pressure is particularly relevant when an individual is trying to change his or her past alcohol consumption behaviour, going against established norms and behavioural patterns (Morris et al., 2020). The peer pressure that led to this higher cigarette smoking rate among students was an important factor and predicts more substance use among students than parental influence. They assert peer influences adolescent substance use in a stronger and more direct way than parental influence" (Mpousiou et al., 2018).

The findings in current study from Part I, shows that CE users believe that the drugs to be safer than the non-users, and that users more strongly believe that they know enough about the drugs to use them safely, these results are in line with another study (Nguyen et al., 2021). However, researchers have voiced their concerns about university students use of CEs under false consideration that CEs have a positive impact rather than a negative one on their personal and academic life, this means those adult students are at a high risk (Greely et al., 2008; Lucke et al., 2018a). Furthermore, most non-users seemed to be resilient despite the views and behaviours of CE users. Non-users made a strong case against CE use by using alternative

strategies such as maintaining a good lifestyle by having sufficient hours of sleep and a balanced diet rather than taking CEs drugs, using ethical arguments and by being concerned about the negative effects.

In addition, non-users were concerned about the negative effects, one of the students said: *''I don't think I would use it; I would be worried that I could get addicted or get a serious side effect from them"* (N7).

Many people had a range of concerns and criticized those who spread wrong and non-factual information about the benefit of using CEs among students. However, one non-user of CE said: *'' Not sure as everything has its advantages and disadvantages''* (N2);

Thus, not all non-users of CE will be completely against them, and this can happen for various reasons, these participants seem to not be fully convinced about the positive and negative effects of CE use.

6.5.3 WHAT IS THE ATTITUDE OF UNIVERSITY LECTURERS AND THEIR PERCEPTION TOWARDS THE USE OF COGNITIVE ENHANCERS (CES) AMONG UNIVERSITY STUDENTS?

It seemed from here that the teaching faculties tried to deny or admit that there is a problem of CEs misuse among students; however, half of the students admitted that they have used CEs for a good purpose which is to improve their focus and deal with exam stress in order to increase their academic achievement. Also, it is noticeable through what the students said in their interviews that they did not feel ashamed, and some of them were pleased that they found these CE to help them in their study.

However, some teaching faculties from Part II were less optimistic about the effects of peer pressure. However, the current researcher agreed with Abelman (2017) who reported the essential role of peers in terms of their impact on the student's attitude towards CEs.

Interestingly, one of the professionals in part II, believed that the use of CEs by students was common at university and acknowledged the possibility of a "placebo effect." Among the studies utilizing placebo pills to manipulate performance expectation, only few studies (Looby

& Earleywine, 2011) have directly addressed whether placebo administration is effective in inducing cognitive enhancement measured subjectively and objectively. The participants' expectation to take placebo thought to be methylphenidate, enhanced the subjective arousal, but not the actual cognitive performance (Looby & Earleywine, 2011). By contrast, other studies have reported a placebo effect on objective measures of cognitive performance in healthy individual taking a placebo pill enhanced memory and attention performance in comparison to a no pills control condition (Oken et al., 2008). Interestingly, expectancy of improvement and actual improvement of cognitive performance were associated (Oken et al., 2008). A study by Colagiuri et al (2010) on a double-blind randomised-controlled experiment among university students reported that the participants who believed they had been allocated to the cognitive enhancing drug, due to false (positive) feedback given about their cognitive performance, performed better than those who believed they had been given a placebo (Colagiuri et al., 2010). A recent systematic literature review by Plumber et al (2021), reported that CEs are often used to increase focus for academic purpose. Taking these results into consideration, they recommended for future research to look for possible placebo effects with the use of Adderall in healthy brains as students using them for cognitive enhancement might feel motivated because they are simply taking a stimulant known to improve focus (Plumber et al., 2021).

The outcome of the semi-structured interviews and the related thematic analysis was to discuss the importance of the intervention programme from the opinion of students. The University environment should allow enough space to promote educational processes and articulates social and health public policies. Also, the current study showed that some of these teaching faculty 'educators' do not put enough effort into discussing the use of CEs with students as part of their work, and they certainly did not believe that student CE use is a responsibility or priority of the university or faculty. It is vital to develop effective and suitable intervention programmes to provide University students with the correct knowledge.

Therefore, both students and teaching faculties should cooperate to develop good intervention programmes which can empower students with the required skills about healthy and safe actions towards the use of CEs. In addition, actions need to be raised and carried out such as in lectures, workshops or by giving leaflets and videos all that can be carried out by the teaching faculties as part of their duties. Similarly, current results also showed that teaching faculty

‘educators’ realise that they need training to allow them to work in an interdisciplinary way to deal with CE, along with improving their own actions towards the use of CE and providing support networks and legislation on CEs and drugs in general.

Our study showed that some of these educators did not regard discussing the use of CEs with students as part of their work, and they certainly did not see addressing student CE use as a responsibility of the university. The main factor that was identified in our study is the lack of awareness to address the dangers of CEs usage in university field. In addition, actions need to be raised such as lectures, workshops, giving leaflets and videos. All that can be carried out by the teaching faculties during their duties. Results also show that educators realise the need for their own training to work in an interdisciplinary way with this issue, therefore, not only directed to their own performances, but also concerning support networks and legislation on CEs and drugs in general. A suggestion given in the literature on academia can deal with and/or prevent CE use among students (Abelman, 2017), was to provide systems that reduce peer pressure and stigma by advising students to not share medication.

Another suggestion was to run campaigns for improving students' confidence and making the course work more enjoyable. Universities might also include general and introductory educational sessions on the dangers of CE use, side effects, and options to obtain help (Abelman, 2017). In the context of international research, the results of this study contribute to the understanding of underlying causes of the use of CE drugs for academic purposes.

The university environment must be understood as a space which promotes educational processes and articulates social and health public policies, raising a campaign.

6.6 Conclusions

The outcomes of the semi-structured interview and the thematic analysis was to discuss the importance of the intervention programme from the opinions of the students.

The study showed that students indicate high levels of stress and workload as a justification for the use of cognitive enhancers while also acknowledging the stress they face to get high grades

to get the discount towards the fees values that lead the students in UAE university as the reason for practices related to CE use.

As part of our study, we investigated the perceptions and experiences of university students in UAE toward CE drugs and substances. Although our findings cannot be generalized to the student population in UAE, our study provides more insight into the uses of cognitive enhancers and their impact on the lives of students who access and repurpose CE in academic settings. The use of CE can have two main sides of use, it can be well used and provide good benefits, or it can cause problems, risks, and damage (Greely, et al., 2008). Our study showed that some healthy students attempt to use stimulants CE drugs to improve their quality of life.

The study concluded that the prevalence of CEs was updated, and it was shown that their use has increased significantly among UAE students. Additionally, motivational factors and facilitators behind cognitive enhancer use were investigated, filling gap in subsequently providing an understanding of actors influencing their use. In order to reduce the use of cognitive enhancers drugs among their students, universities need to increase their awareness of their prevalence. Researchers in UAE should be interested in this research because students may be increasingly using stimulants for cognitive enhancement, and the reasons behind this should be addressed by both academic staff and students' welfare service.

6.7 Limitations

The main limitation was the use of online interviews rather than face-to-face which prevented the researcher building a better rapport with the participants. Due to the COVID-19 pandemic, the results of this study may not have been not generalisable to a larger population of university faculty. This study discussed major challenges, namely time constraints and physical distance, both of which directly affected faculty staff and students.

6.8 Summary of the Chapter

This study presented a qualitative investigation of CEs drugs use among students in a Universities within the UAE. A total sample of 18 participants (students) and 7 participants (faculty staff) was purposively selected for this study. Data from the survey investigation

(*Chapter 5*) was used to develop semi structured interviews. Qualitative study was used when it was deemed necessary to explore the topic further.

In the analysis of student interview transcripts, there were four main themes, and in the analysis of faculty staff interview transcripts, there were three main themes.

In the study, it was concluded that a higher rate of CEs use was observed among UAE students. There has been some controversy over CE misuse among students, with the teaching faculties trying to deny or admit it. However, most students admitted that CEs have been used to improve their focus and cope with exam stress in order to improve academic success.

7 CHAPTER 7. DISCUSSION

7.1 Introduction

The current PhD thesis aimed to exploring the phenomenon of cognitive enhancers use among UAE University students and identify the reasons for their use. A sequential explanatory mixed-method approach was used to answer seven research questions. An online survey study was administered among 516 UAE University students, as well as semi-structured interviews with 18 university students and seven University faculty members. This Chapter summarises the main findings from the entire research in an integrated manner to meet the overall aim of the thesis, draws together results from the quantitative and qualitative studies and examines the findings in relation to the wider literature on CEs use among university students in the UAE.

7.1.1 THE REASONS AND JUSTIFICATIONS REPORTED BY UNIVERSITY STUDENTS FOR USING CES

The current PhD research provided an updated understanding on CEs' prevalence of use; levels of knowledge; and their impact on HEI university students worldwide *(Chapter 2)*, which is clearly a critical public health issue. The past few years have seen increasing levels of concern about the use of pharmaceutical cognitive enhancement among university students worldwide, with the lifetime prevalence of CEs misuse among these subjects ranging from between 6% to 20%, depending on the study subject (Kudlow et al., 2013).

The systematic review studies *(Chapter 2)* identified that most popular CEs included stimulant drugs, e.g., modafinil, methylphenidate; amphetamine mixtures; and caffeine-related compounds. At times, use of illicit drugs such as MDMA or cannabis were mentioned here as well. Conversely, piracetam, vinpocetine, Vitamin B6 and Vitamin B12 were only rarely mentioned as having been ingested by students. Although not confirmed by a few studies (McNeil et al., 2011; Weyandt et al., 2009), males were identified as more likely to use CEs drugs than females (Franke, 2010; Benson et al., 2015b; Champagne et al., 2019; Emanuel et al., 2013a; Gudmundsdottir et al., 2016; Lengvenyte et al., 2016). Indeed, several social factors have been identified to influence CEs' use practices among university students (Schelle et al.,

2015a). These included: peer-pressure, competition, performance demands and prior drug use (Garasic & Lavazza, 2016a), but also recreation (Schleim, 2020).

The availability of CEs for non-medical indications in the different countries is affected by a range of factors, including legal, social, and ethical (Maher, 2008; Maier et al., 2018; Mousavi et al., 2019). Indeed, some CEs are being openly made available online (Hockenhull et al., 2020; Napoletano et al., 2020), where they are marketed as 'smart drugs', 'study drugs', 'plant food', 'research chemicals' and 'designer drugs' as well (Pighi et al., 2018). The unregulated online access, and especially so for modafinil and methylphenidate, is likely to be associated with an increase of CEs' non-medical use and subsequent harm (Hockenhull et al., 2020). Indeed, high levels of modafinil may have reportedly been sold and shipped to students at high-rank/top UK universities, mostly during the examination period (Marsh, 2017). Conversely, as CEs' legal alternative to either prescribed or illicit drugs of abuse, guarana was found here to be popular, with affordable online prices encouraging young users/students to buy greater quantities in order to receive discounts and free shipping (Dennehy et al., 2005; Hockenhull et al., 2020). Sources of CEs acquisition may relate to friends and family (de Oliveira Cata Preta et al., 2020; Ott & Biller-Andorno, 2014). Students diagnosed with ADHD, but not taking their methylphenidate medication regularly, have been reported as the main source for fellow students (Smith & Farah, 2011). In another study, 75.5% of methylphenidate was identified as having been purchased from friends at a university campus whilst 64.3% of modafinil was obtained online (Singh et al., 2014). Accessing the web for drug acquisition activities is a reason for concern (Hockenhull et al., 2020), with young people (18-25 years old) being at high risk because they are extensive users of the Internet (Morton & Tighe, 2011); it was found that over a third of the websites selling modafinil specifically recommended use of the drug to aid studying (Hockenhull et al., 2020).

7.2 Overview of Quantitative and Qualitative findings:

7.2.1 THE FINDINGS FROM THE QUANTITATIVE STUDY:

To the best of our understanding, this research is the first study to focus on CE illicit drugs use in Higher Education Universities in the United Arab Emirates (*Chapter 5*). The study explored the prevalence of use; the users' socio-demographics, and the CE characteristics of use in a large sample (n=516) of students. Among the large sample of participants who completed the

online survey, one quarter were found to be CE users; a result which is in line with those identified among university students from both the UK (McDermott et al., 2020) and Iran (Abbasi-Ghahramanloo et al., 2015). This level of CE use seems to be at odds with previous suggestions (Singh et al., 2014) that students are resistant to using CEs.

7.2.1.1 IS THE PREVALENCE OF CEs USE IN UAE UNIVERSITIES IS COMPARABLE TO THAT REPORTED ELSEWHERE?

Around two thirds of CE users were males, a finding which is consistent with several previous studies (Franke, 2010; Benson et al., 2015b; Champagne et al., 2019; Emanuel et al., 2013a; Gudmundsdottir et al., 2016). Indeed, there may be gender-related different attitudes towards both recreational (Schifano, 2008) and CE drug use (Lengvenytė & Strumila, 2016; Mache et al., 2012; Maier et al., 2013) worldwide, although some conflicting results have been published (McNeil et al., 2011; Weyandt et al., 2009).

About one half of CE users were medical students, followed by Pharmacy, Dentistry, Engineering and Nursing, with their usage increasing in the final years of study programmes when the medical students start to have more patient interaction and get under the stress of clinical rotations. This may tentatively suggest that the usage of CEs is in most cases transient and may start only in association of increasing levels of academic load. Present findings support previous studies, which reported levels of use of CEs among both medical (Emanuel et al., 2013b; Habibzadeh et al., 2011; Lengvenytė & Strumila, 2016; Pighi et al., 2018) and pharmacy students (Hanna et al., 2018); levels which are higher than those recorded in other schools (Bossaer et al., 2013).

Improving academic performance, concentration and alertness were among the main reasons to ingest CEs, and especially during the exam preparation times. Other studies also reported the same motivations for use (Abbasi-Ghahramanloo et al., 2015; Emanuel et al., 2013a; Lengvenytė & Strumila, 2016; Mazanov et al., 2013; Ram et al., 2017). However, relative to their male counterparts, the reasons for CEs use included concentration (30.0% vs 26.4 respectively in females and males) but not alertness (17.5% vs 28.6% respectively in females and males). In line with previous findings (Mache et al., 2012; McDermott et al., 2020) peer influence and the web were here reported as facilitating the students' uptake of CEs. Most users, but especially males (e.g., 70% vs 40%) accessed their CEs from online sources, with

the web having been previously described as the focus of drug acquisition activities (Corazza et al., 2014; Hockenhull et al., 2020; Mooney et al., 2017). Indeed, a high circulation UK newspaper has reported on the high levels of online sales of modafinil, being shipped to students from the universities of Cambridge, Oxford and London Imperial College (Marsh, 2017) and more frequently at the time of the exams. Sources of CEs was another aspect where nationality played a role in differences in responses among CEs users. While Emirati and Arab students favoured the internet option, other nationalities relied on a range of different sources to access the index CEs.

Overall, B12 was mainly taken for academic performance reasons, followed by concentration. Modafinil was also taken for concentration and alertness, confirming previous findings (Turner et al., 2003) Conversely, in line with previous studies (Ghali et al., 2016; Singh et al., 2014), caffeine/ super-strength caffeine pills were mainly ingested for alertness. The distribution of the CEs drugs ingested showed differences relating to gender. In particular, B6 was more popular in females than in males (e.g., 22.5% vs 5.5%), whilst modafinil was more significantly reported in males (e.g., 48.4% vs 7.5%). In line with a recent study conducted in the UK (McDermott et al., 2020), the intake of remaining CEs was not significantly different between the two groups.

7.2.2 THE FINDINGS FROM THE QUALITATIVE STUDY:

The qualitative study *(Chapter 6)* aimed to explore in further detail the survey findings (*Chapter 5*) to provide an in-depth understanding of the reasons why university students in the UAE use CE drugs from students and teaching faculty's perspective. Despite ambiguity around effects and definitions, several studies have looked at the increasing prevalence of CE drug use worldwide (see *Chapter 2*), especially among university student populations and with a focus on stimulants. As discussed earlier in our qualitative approach (*Chapter 6*) was the first study that has carried out an in-depth interview on the perception, behaviour and attitude regarding cognitive enhancers use among university students in Gulf countries including the UAE *(Chapter 6).* It emphasised the increased use of pharmacological CEs illicitly by healthy university students aged 18-25 to gain an academic advantage. In this study we have outlined the interview structure, style, setting and recording the data to answer the research questions and to explore the results in this Chapter that were obtained from quantitative survey study *(Chapter 5).*

The study was conducted in six universities in the UAE that are known for competitive college acceptance. Semi-structured interviews with 18 university students who were interested to discuss their experiences and/or other people's experiences with the use of prescription stimulants during their academic careers. Furthermore, another semi-structured interview with seven teaching faculty staffs brings to light the perception of university teaching staff (pharmacists and doctors) towards the use of CEs in the university they are working in.

7.2.3 WHICH ARE THE FACTORS INFLUENCING CE USE AMONG UNIVERSITY STUDENTS IN THE UAE?

Firstly, the study attempted to explore the factors that influences CE use among university students in the UAE. The responders indicated that out of 18 students who have been interviewed, nine used CE (licit and illicit) drugs and almost all, the participants were aware or have heard about CEs, the staff faculty in strongly disagreed with the fact that there are University students who use CEs for cognitive enhancement. The findings showed that out of 18 students, half of them reported that they tried taking CEs and when asked about their motivations for CE use, participants chiefly referred to the expected improved academic performance mainly associated with a better memory and focus. This finding aligns with previous qualitative studies that explored university student's experiences on CE for academic purposes (McDermott et al., 2020; Monnet et al., 2021b). Similarly, several studies found that people who used CE thought that they can benefit from its use in improving their focus and concertation and reducing the level of anxiety and stress among adult students (Repantis et al., 2010; Maier et al., 2015; Plumber et al., 2021).

Greely et al., (2008) reported that some university students worldwide sell and buy CE to improve the opportunity of getting higher academic achievement. This transaction uses the most common drugs Ritalin and Adderall, it is illegal which can increase crime. Unfortunately, the use of CE is a common issue which has spread among people, in particular, students who believe in the importance of using CE to get better academic achievement and reduce the exam stress. The use of CE among university students in the UK and Ireland has been estimated to be around 10% (Singh et al., 2014); with US university students reaching 8.3% (Teter et al., 2006); and 6.5% among Australian university students (Lucke et al., 2018b); and 5% of students in Canada reported the use of CE (London-Nadeau et al., 2019). This alarming prevalence among university students across world should be addressed carefully and there

should be good efforts to raise awareness through conducting training and campaigns. Research reported that the spread of using CE is increasing yearly in the US, which is an alarming indicator for society Figures that should encourage them to stand firmly against it (Lucke et al., 2011; Greely et al., 2008; Partridge, 2017). Moreover, some university students believe that using CEs gives them an opportunity to increase and improve the quality of their studies and academic achievement (Volkow et al., 2008; Ragan *et al.*, 2013) and Shakeel et al., (2021) also added that CEs can make the purpose of study.

The current qualitative study showed that the most common prescribed drugs used among students was 'Adderall' and for non-prescribed drugs it was caffeine strength pills, this is a line with previous studies (Sharif et al., 2022). However, there has been no exact data or previous studies that report the prevalent misuse of CEs in UAE, it only indicates that 86% of male and female students in Zayed University (UAE) show a positive attitude towards coffee consumption as a CEs (Ghalia et al., 2016). There are 142 unique CEs which is a huge number of different types or groups and some of these drugs are commonly used (Napoletano et al., 2020). Several studies show big concerns that there is an increase in the use CEs among adult students in an attempt to improve academic achievement (e.g., Monnet et al., 2021a; Narayanan et al., 2021; Shakeel et al., 2021).

Surprisingly, the majority of the teaching faculty responded that CE use among their students is not common and that there are no behavioural problems. These findings are consistent with those reported by (Ram et al., 2020). The findings shows that CE users believe that the drugs to be safer than the non-users, and that users more strongly believe that they know enough about the drugs to use them safely. Students have expressed security in the safety of CEs as the drugs is a prescribed medication, not a street drug, and is safe because it has gone through extensive testing by pharmaceutical companies and is prescribed by medical professionals, these results are in line with another study (Nguyen et al., 2021; Ram et al., 2020).

However, researchers have voiced their concerns about university students use of CEs under false consideration that CEs have a positive impact rather than a negative one on their personal and academic life, this means those adult students are at a high risk (Greely et al., 2008; Lucke et al., 2018a).

7.2.4 WHAT IMPACT DO STUDENTS WHO USE CES HAVE ON THE VIEWS AND BEHAVIOURS OF NON-USERS?

Our interview study findings highlighted that peer influence had an effect, that includes participants awareness and ease of availability by sharing the drugs that is in line with other study (Garasic & Lavazza, 2016b), as well as greater acceptance of use of CEs within students in UAE universities. Similarly, Javed et al., (2019) conducted a study among 27 participants in Pakistan which provided evidence that one of the CE drugs helped to improve the concentration of these students. Study reported that the student's peers showed profound impact on the usage of CE and its spread (Javed et al., 2019).

A suggestion given in the literature on academia to deal with and/or prevent CE use among students (Abelman, 2017), was to provide systems that reduce **peer pressure** and stigma by advising students to not share medication. Therefore, it seems that the impact of peers on university students is huge and can reduce or increase the use of CEs, which means it is important to ensure that the university atmosphere is healthy and provides attractive activities to increase the awareness about the risk of using CEs.

The findings shows that CE users believe that the drugs to be safer than the non-users, and that users more strongly believe that they know enough about the drugs to use them safely, these results are in line with another study (Nguyen et al., 2021). However, researchers have voiced their concerns about university students use of CEs under false consideration that CEs have a positive impact rather than a negative one on their personal and academic life, this means those adult students are at a high risk (Greely et al., 2008; Lucke et al., 2018a). Furthermore, most non-users seemed to be resilient despite the views and behaviours of CE users. Non-users made a strong case against CE use by using alternative strategies such as maintaining a good lifestyle by having sufficient hours of sleep and a balanced diet rather than taking CEs drugs, using ethical arguments and by being concerned about the negative effects.

7.2.5 WHAT ARE THE ATTITUDES OF UNIVERSITY LECTURERS AND THEIR PERCEPTION TOWARDS THE USE OF COGNITIVE ENHANCERS (CES) AMONG UNIVERSITY STUDENTS?

It seems that the teaching faculties tried to deny that there was a problem of CEs misuse among students, however, half of the students admitted that they had used CEs for a good purpose which is to improve their focus and deal with exam stress in order to increase their academic achievement. Also, it is noticeable through what the students said in their interviews that they do not feel ashamed, and some of them are pleased that they found these CE to help them in their study.

However, some teaching faculties staff in our study were less optimistic about the effects of peer pressure. However, the current researcher agrees with Abelman (2017), who reported the essential role of peers in terms of their impact on the student's attitude towards CEs. Interestingly, one of the professionals' staff, believed that the use of CEs by students was common at university and acknowledged the possibility of a "placebo effect." Among the studies utilizing placebo pills to manipulate performance expectation, only few studies (Looby & Earleywine, 2011) have directly addressed whether placebo administration is effective in inducing cognitive enhancement measured subjectively and objectively. The participants' expectation to take placebo thought to be methylphenidate, enhanced the subjective arousal, but not the actual cognitive performance (Looby & Earleywine, 2011). By contrast, other studies have reported a placebo effect on objective measures of cognitive performance in healthy individual taking a placebo pill enhanced memory and attention performance in comparison to a no pills control condition (Oken et al., 2008). Interestingly, expectancy of improvement and actual improvement of cognitive performance were associated (Oken et al., 2008).

A study by Colagiuri & Boakes (2010) on a double-blind randomised-controlled experiment among university students reported that the participants who believed they had been allocated to the cognitive enhancing drug, due to false (positive) feedback given about their cognitive performance, performed better than those who believed they had been given a placebo (Colagiuri & Boakes, 2010). A recent systematic literature review by Plumber et al (2021), reported that CEs are often used to increase focus for academic purpose. Taking these results into consideration, they recommended for future research to look for possible placebo effects

with the use of Adderall in healthy brains as students using them for cognitive enhancement might feel motivated because they are simply taking a stimulant known to improve focus (Plumber et al., 2021).

7.3 Summary of the Chapter

This Chapter examined the results of both phases of the study (quantitative and qualitative) with an aim to explore the prevalence, perceptions, behaviours, and attitude of CEs use among university students in the UAE. Several studies have demonstrated that the qualitative data can be used to enhance understanding of the quantitative results of the study, but it is also not uncommon for the qualitative results and findings to differ slightly, as it might be the case when the qualitative collection process involves a limited sample, so the findings might not be generalisable. In the next Chapter, the findings are discussed in more detail, explaining the major factors leading students to use CEs as well as the relevance of the intervention campaign, as well as limitations related to the study design.

8 CHAPTER 8. CONCLUSIONS AND RECOMMENDATION

8.1 Conclusions

Throughout this chapter, all research objectives were met, and the research questions were answered. It presents two unique studies (*Chapters 5 and 6*) pertaining to the use of CEs among UAE university students within this PhD thesis.

An intervention campaign was identified and recommended as the best approach to tackling this phenomenon. The researcher in this PhD thesis has addressed the gap in the literature regarding perceptions for the CEs use for academic achievement among university students in the UAE. These findings concludes that students perceive the use of CEs (licit &illicit) differently.

Several students worldwide may be willing to consider CEs' ingestion to improve their academic performances. The attitude of university students about CEs and their possible benefits is, however, based on anecdotal, and arguably biased, information obtained from the media; the web; and friends (Finger et al., 2013). Overall, it seemed from this review that the topic is not being sufficiently covered in the curriculum of UAE universities. Conversely, this issue should be discussed, as an inter-professional or inter-disciplinary learning opportunity, from a public health perspective (de Oliveira Cata Preta et al., 2020; Hanna et al., 2018). Cognitive enhancers use may arguably be reduced if students' levels of awareness were raised, emphasising that CEs' intake may pose a risk to safety, and especially so in vulnerable individuals (Champagne et al., 2019). Indeed, impacts of CE drugs' intake may include tolerance, dependence, withdrawal, cardiovascular and neurological disorders with a related risk of death due to overdose (Napoletano et al., 2020; Schifano, 2020; Schifano et al., 2015). The implementation of a harm reduction campaign, in order to bring the overall consumption lower, has been proposed as well (Abelman, 2017; Schelle et al., 2015b).

At this stage, a few issues need to be better addressed in future studies, including health of student CE users; and understanding if these drugs may put some of these students at an unfair advantage over remaining non using students. Universities may need to develop better awareness levels regarding the prevalence of cognitive enhancers' use amongst their students and consider taking an active approach in reducing their use, educating students on the dangers

of CEs use whilst providing them with a safe space to seek help. The outcome online survey and the semi-structured interview along with the thematic analysis was to discuss the importance of the intervention programme from the opinions of the students.

The study showed that students indicate high levels of stress and workload as a justification for the use of cognitive enhancers while also acknowledging the stress they face to get high grades to get the discount towards the fees values that lead the students in UAE university as the reason for cognitive enhancers practices. As part of our study, we investigated the perceptions and experiences of university students in UAE toward CE drugs and substances. Although our findings cannot be generalized to the student population in UAE, our study provides more insight into the uses of cognitive enhancers and their impact on the lives of students who access and repurpose CE in academic settings. The use of CE can have two main sides of use, it can be well used and provide good benefits, or it can cause problems, risks, and damage (Greely, et al., 2008). Our study showed that some healthy students try to use stimulants CE drugs to improve their quality of life.

The study concluded that the prevalence of CEs was updated, and it was shown that their use has increased significantly among UAE students. Additionally, motivational factors and facilitators behind cognitive enhancer use were investigated, filling gap in subsequently providing an understanding of actors influencing their use. In order to reduce the use of cognitive enhancers drugs among their students, universities need to increase their awareness of their prevalence. Researchers in UAE should be interested in this research because students may be increasingly using stimulants for cognitive enhancement, and the reasons behind this should be addressed by both academic staff and students' welfare service.

8.2 Recommendations

I agree that the following recommendations should be made to address the risks associated with the use of cognitive enhancers, It is important to emphasize the ethical dimension of human enhancement as well, as this has implications for the broader society.

- A relevant factor that was identified in the study is the lack of awareness to address the dangerous use of CEs in university environment. For this reason, the current PhD research is very important to allow the UAE and other Arab countries to show the risk of using cognitive enhancers (CE), it is essential to provide knowledge and information supported with research evidence to University students in an attractive and gentle way to ensure these students review their information about the false benefit and risks of using CE (Sharif et al., 2022). It is important to initiate awareness campaigns among students to help them with understanding the risk caused by using CE without medical issue, especially in the long term.

- Individuals with a pre-existing mental disease background in their families may be particularly vulnerable to the risks associated with cognitive enhancers. To minimize these risks, it is important to consult with a healthcare professional before taking any cognitive enhancers. They can provide guidance on the safe use of these substances and monitor for any adverse effects.

- Another suggestion was to run campaigns for improving students' confidence and making the coursework more enjoyable. Universities might also include general and introductory educational sessions on the dangers of CEs use, side effects, and options to seek help (Abelman, 2017). There are serious ethical and legal issues involved in the non-medical use of any psychotropic, with nootropics potentially causing major public health problems (Schifano et al., 2022). The outcome of the online survey and semi-structured interview studies was to discuss the importance of the intervention programme from the opinions of the students (chapter 5&6). In the context of international research, the results of this study contribute to the understanding of underlying causes of the use of CE drugs for academic purposes. The university

environment must be understood as a space which promotes educational processes and articulates social and health public policies, raising a campaign. This study has shown that it is important to raise awareness of the harms of CE use, provide knowledge, counteract myths regarding the safety of CE use and address cognitive enhancement at an early stage of higher education as preventative public health measures (Sharif et al., 2021).

In conclusion, recommendations should be made to address the risks associated with the use of cognitive enhancers, especially for individuals with a pre-existing mental disease background in their families. The ethical dimension of human enhancement should also be considered to ensure that the use of these substances is fair and just for all individuals.

8.3 Research Strengths and Limitations

In this PhD thesis, we have considered the Creswell (Creswell, 2003) suggestions, describing three types of triangulations in research data: (a) data triangulation: our research on CE use has relied on a variety of data sources, including quantitative surveys of students and interviews with them. Furthermore, we conducted another interview with teaching faculty staff. This interview provided insight into the perspective of teaching faculty staff concerning the use of CEs among students, which might not otherwise be revealed in a standard interview (Creswell & Clark, 2007); (b) investigator triangulation: the data for qualitative studies were reviewed by PhD supervisors to increase coder reliability; (c) theoretical triangulation: a theory can be viewed as a lens for observing reality in a different way. Developing a research-guided theory (TTI) to gain an overall picture of CE use among university students. We identified novel findings within the research field because of this theory-driven research; and (d) we applied a mixed-method perspective within the research field. Through combining the quantitative results with an in-depth interview with students and faculty members, we can strengthen our study.

There are a few limitations that were considered in this PhD thesis. The first limitation is related to the sole focused on undergraduate students; however, postgraduate students, academic staff, and remaining workers should be considered by future studies.

A second limitation is to be acknowledged here is the delay of data (e.g., surveys and interviews) collection both (Survey and interviews) from UAE universities due to the COVID-19 pandemic.

The third limitation was the use of online interviews rather than face-to-face which prevented the researcher building a better rapport with the participants. Our interest in the Chapter of the qualitative research approach can have a great role to complement the quantitative research done earlier (Sharif et al., 2022). However, the results of the study could be generalized to the larger population of university faculty.

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APPENDICES

Appendix 1. (UH Ethics approval)

University of Hertfordshire UH

HEALTH, SCIENCE, ENGINEERING AND TECHNOLOGY ECDA ETHICS APPROVAL NOTIFICATION

TO Safia Sharif

CC Dr Amira Guirguis, Ass Prof Suzanne Fergus, Prof Fabrizio Schifano

FROM Dr Rosemary Godbold, Health, Science, Engineering & Technology ECDA Vice Chair.

DATE 06/02/2020

Protocol number: **LMS/PGR/UH/04025**

Title of study: A comparative study on the estimated perceived in the use and impact of cognitive enhancers (CE) within higher education in the UK

and UAE

Your application for ethics approval has been accepted and approved with the following conditions by the ECDA for your School and includes work undertaken for this study by the named additional workers below:

no additional workers named.
General conditions of approval:
Ethics approval has been granted subject to the standard conditions below:

Permissions: Any necessary permissions for the use of premises/location and accessing participants for your study must be obtained in writing prior to any data collection commencing. Failure to obtain adequate permissions may be considered a breach of this protocol.

External communications: Ensure you quote the UH protocol number and the name of the approving Committee on all paperwork, including recruitment advertisements/online requests, for this study.

Invasive procedures: If your research involves invasive procedures you are required to complete and submit an EC7 Protocol Monitoring Form, and copies of your completed consent paperwork to this ECDA once your study is complete.

Submission: Students must include this Approval Notification with their submission.

Validity: This approval is valid: From: 06/02/2020 To: 20/11/2020

Please note:

Failure to comply with the conditions of approval will be considered a breach of protocol and may result in disciplinary action which could include academic penalties.
Additional documentation requested as a condition of this approval protocol may be submitted via your

supervisor to the Ethics Clerks as it becomes available. All documentation relating to this study, including the information/documents noted in the conditions above, must be available for your supervisor at the time of submitting your work so that they are able to confirm that you have complied with this protocol.

Should you amend any aspect of your research or wish to apply for an extension to your study you will need your supervisor's approval (if you are a student) and must complete and submit form EC2. Approval applies specifically to the research study/methodology and timings as detailed in your Form EC1A. In cases where the amendments to the original study are deemed to be substantial, a new Form EC1A may need to be completed prior to the study being undertaken.

Failure to report adverse circumstance/s may be considered misconduct.

Should adverse circumstances arise during this study such as physical reaction/harm, mental/emotional harm, intrusion of privacy or breach of confidentiality this must be reported to the approving Committee immediately.

Appendix 2 . RAKMHSU (Ethics approval)

RAK Medical & Health Sciences University
(Member of RAK Human Development Foundation)

جامعة رأس الخيمة للطب والعلوم الصحية
(عضو مؤسسة رأس الخيمة للتطوير والتنمية البشرية)

February 3, 2020

From:	To:
Dr. Tarig Hakim Merghani Chairperson, Research & Ethics Committee, RAKMHSU, Ras Al-Khaimah.	**Dr. Areeg Anwar, Safia Sharif** RAKCOPS RAKMHSU, Ras Al-Khaimah.

Dear Dr. Areeg Anwar, Safia Sharif

Subject: Approval of the research proposal RAKMHSU-REC-178-2020-PG-P

The research proposal entitled **"A *comparative study of the estimated perceived use and impact of cognitive enhancers within higher education in the UK and UAE"*** has been approved by the Research and Ethics Committee of RAKMHSU.

Please note that, for the part of work outside RAKMHSU, you have to get RAK REC approval before starting the study.
Kindly submit your final results to RAKMHSU REC after completion of the Study.

Yours sincerely,

Dr. Tarig Hakim Merghani Hakim
MBBS, MSc, MD, PhD, FCCP
Associate Dean- Basic Sciences- RAKCOMS
Chairperson- Research & Ethics Committee
Chairperson- Department of Physiology
RAK Medical & Health Sciences University
P.O. Box 11172- Ras Al-Khaimah, UAE
Tel: +971 7 2269000 Ext. 249
Email: tarig@rakmhsu.ac.ae
research@rakmhsu.ac.ae

Research & Ethics Committee
Approval Date:

Copy to: Dean, RAKCOPS

Appendix 3. RAKREC (Ethics approval)

UNITED ARAB EMIRATES
MINISTRY OF HEALTH & PREVENTION

الإمارات العربية المتحدة
وزارة الصحة و وقاية المجتمع

Ministry of Health and Prevention
Research Ethics Committee /RAK Subcommittee

Date: 19/4/2020

Study Title: A comparative study of the estimated perceived use and impact of cognitive enhancers Within higher education in the UK and UAE.

Subject: Approval Reference No: MOHAP/REC/2020/ 35 -2020-PG- P

Dear: Dr. Amira Guirguis

Dr. Suzanne Fergus

Prof. Fabrizio Schifano

In regard to the above-mentioned Study protocol, this is to confirm that on the meeting dated (12/3 /2020) the Ministry of Health and Prevention Research Ethics Committee has reviewed the Study protocol as well as all the documents submitted in the Submission file from the ethical point of view and has approved the conduct of above-mentioned study.

Opinion: Approval

UNITED ARAB EMIRATES
MINISTRY OF HEALTH & PREVENTION

الإمارات العربية المتحدة
وزارة الصحة و وقاية المجتمع

The MOHAP Research Ethics Committee is organized and operated according to guidelines of the International Conference on Harmonization and constituted according to ICH-GCP requirements.

This Ethical approval applies for the following study sites only:

This approval is subject to the following conditions:

1. The MOHAP research ethics committee approval does not imply that the researcher is granted access to data, medical records or biological samples from the MOHAP health care facilities neither the Private MOHAP licenced health care facilities. Researchers must seek permission and follow the policy and procedure from the concerned directories after the approval from the Research Ethics Committee

2. Please note that it is the Principal Investigator's responsibilities, to immediately inform the Committee of any changes in the research protocol and/or the research Methodologies, should the need for those changes arise prior to or during the conduct of this research study

3. The approval is valid for up to 1 year from the date of approval. If the study extends beyond this date, a progress report must be sent to the research ethics committee to renew the approval

4. The research ethics committee must be informed when the research has been completed and a copy of the final research report must be submitted for our records

Yours sincerely,

Dr. Abeer Hassan Kassem
Chairman MOHAP-REC
RAK Subcommittee

منطقة رأس الخيمة الطبية ★ وزارة الصحة ★ Research Ethics Committee ★ لجنة أخلاقيات البحث العلمي

Signature /Stamp

21/11/2020
Date

Appendix 4. Survey Questionnaire

This is a survey to explore your knowledge and use of CE among university students in the UK and UAE. Kindly fill in this survey to the best of your knowledge and understanding. This survey will take approximately five minutes to complete. The information provided will be strictly kept confidential and anonymous.

'Please tick as appropriate'

1. Gender:
    - Male
    - Female
    - Prefer not to say
2. Age:
    - 18 to 25
    - 26 to 35
    - 36 to 45
    - 46 to 55
    - 56 to 65
    - 66+
3. Have you ever used psychostimulants drugs/ nootropics for memory/ concentration/ learning ability enhancement?
    - Yes
    - No (*Thank you for participating and 'your survey is completed'!*)
    - Do not know/unsure
4. *If 'Yes' which one? (select all that apply)*
    - MDMA/ecstasy
    - Modafinil
    - Adderall/amphetamines mixture
    - Ritalin/Methylphenidate
    - Alpha Brain/vitamin B6
    - Super strength caffeine pills
    - Guarana
    - Piracetam
    - Vinpocetine
    - Cobalamin/vitamin B12
    - Other drug or substance used
5. Nationality:
    - UK
    - EU
    - USA
    - UAE
    - Arab nationality
    - Other, (please specify)
6. What degree are you studying?
    - Medicine
    - Pharmacy
    - Dentistry
    - Nursing
    - Engineering
    - Other, (please specify)
7. Year of Education
    - First year
    - Second year
    - Third year
    - Fourth year
    - Fifth year
    - Sixth year

8. Please specify the reason (s) for use? *(select all that apply)*
   - To improve concentration
   - To improve your memory
   - To increase alertness
   - To improve academic performance
   - Other, please specify…….

9. Do you get positive effects from the use of these drugs/substances (e.g. euphoria, alertness)?
   - Yes. If yes, please, specify……..
   - No

10. When was the time of your most recent consumption?
   - During exam weeks
   - During course work deadlines
   - During studying
   - Daily basis

11. How long did you take the CE for?
   - Less than 1 month
   - 1 month but less than 6 months
   - 6 months but less than 1 year
   - 1 year but less than 2 years
   - 2 years and more

12. Approximately, how frequently did you use the drugs/substances?
   - Daily
   - Weekly
   - Monthly
   - Once a semester/term
   - Less than once a semester/term

13. Where did you obtain these drugs/substances?
   - They are prescribed for me
   - They were given to me by a friend
   - They were given to me by a stranger
   - They were prescribed for somebody else
   - I purchased them online
   - Other, please specify

14. How do you consider the cost of the drugs/ substances are?
   - Very expensive
   - Expensive
   - Fair
   - Cheap
   - Very cheap

15. Do you know anyone who uses these (drugs/substances)?
   - Yes
   - No

16. Where have you heard about these drugs/substances?
   - Social media
   - Scientific literature
   - Internet
   - Friends
   - Family
   - Other

17. Will you recommend these drugs to others?
   - Yes
   - No

Thank you for your time

Appendix 5. Mini Poster

University of Hertfordshire UH Ethics Committee

Smart Drugs

Ethics protocol No. RAKMHSU-REC-178-2020-PG-P

All undergraduates from **Medical, Dentistry, Pharmacy, Engineering and Nursing Programs.** Students are kindly requested to participate to this study

I would appreciate your open and honest participation by completing the survey using the barcode below. It will only take 5 minutes. Your participation is very much appreciated, and it is anonymous

Sofia Sharif
PhD Candidate

Appendix 6. Letter to Dean (Survey Study)

Title of study:

A comparative study on the estimated perceived in the use and impact of cognitive enhancers (CE) within higher education in the UK and UAE.

Protocol Number UH: < LMS/PGR/UH/04025 >

Protocol Number RAKMHSU: < RAKMHSU-REC-178-2020-PG-P >

Protocol Number IRAK: MOHAPIREC/2020/ 35 -2020-PG- P >

Approving Committee:

- The University of Hertfordshire Health, Science, Engineering and Technology Ethics Committee with Delegated Authority
- RAK Medical and Health Sciences University Ethics Committee Delegated Authority.
- Ministry of Health and Prevention Research Ethics Committee IRAK Subcommittee

(**This is an official notification by a <Safia Sharif > of the University of Hertfordshire (UK), RAK Medical and Health Sciences University (UAE) and Ministry of Health and Prevention Research Ethics Committee IRAK Subcommittee (UAE) in respect of a study involving human participants**)

Dear Dean of student affairs,

I am conducting a research study on the use of substances taken by students to enhance their cognitive function for the purpose of the study and other reasons such as staying alert and concentrated. I will be collecting data using an anonymous online survey. This survey has been approved by the University of Hertfordshire Institutional Review Board and RAK Medical and Health Sciences University. Below is a brief introduction to cognitive enhancers.

I would kindly request if I could allow me to conduct my study at your university among Undergraduate from the first to the final year of (Medical, Dentistry, Pharmacy, Engineering and Nursing) students are kindly requested to participate in the study
The survey contains a total of 17 questions and is expected to take no more than five minutes to complete. I would appreciate their open and honest participation in this research project by completing the survey using the link below or the Barcode. Simply click the link and you will be taken directly to the questionnaire.

(https://qtrial2019q1az1.az1.qualtrics.com/Q/EditSection/Blocks?ContextSurveyID=SV_9YU2Mqf0OIutfPT)

Their participation in this research project is completely voluntary. Additionally, the data will be kept completely confidential and anonymous in compliance with the General Data Protection Regulatory (GDPR) requirements. Data will be coded to distinguish between demographic variables and information will only be examined in aggregate form.

‘’Cognitive enhancers are pharmaceuticals either on prescription, over the counter that has been sold in health food shops or online or provided through illegal sources such as family or friends. However, they can be misused as prescribed drugs by healthy individuals to improve memory, increase mental alertness, and for cognitive improvement. Prescription drug abuse is defined as “the use of a medication without a prescription, in a way other than as prescribed, or for the experience of feeling elicited. Cognition refers to an information processing capacity, changing preferences and applying knowledge’’.

Participants who complete the survey will have the opportunity to be entered into a drawing for a £100 Amazon Voucher.

Should you have any questions about this research project, please feel free to contact me at the information provided below.

Sincerely,

Safia Sharif
PhD Students
University of Hertfordshire
Room 2J030, New Science Building.
College Lane Campus,
Hatfield, Herts
AL10 9AB
s.sharif2@herts.ac.uk,

Tel, 00441707286548
Mobile tel, 00447493377392

Appendix 7. Invitation Letter for students (Survey study)

Dear Students,

I am conducting a research study on the use of substances taken by students to enhance their cognitive function for the purpose of study and other reasons such as staying alert and concentrated. *'Cognitive enhancers are pharmaceuticals either on prescription, over the counter that has been sold in health food shops or online or provided through illegal sources such as family or friends. However, they can be misused as prescribed drugs by healthy individuals to improve memory, increase mental alertness, and for cognitive improvement. Prescription drug abuse is defined as "the use of a medication without a prescription, in a way other than as prescribed, or for the experience of feeling elicited. Cognition refers to an information processing capacity, changing preferences and applying knowledge'.*

This survey is to explore the knowledge and use of CE among the university students in the UK and UAE. Kindly fill in this survey to the best of your knowledge and understanding. The information provided, will be strictly kept confidential and anonymous.

This survey has been approved by the University of Hertfordshire Institutional Review Board Protocol Number (LMS/PGR/UH/04025) and RAK Medical and Health Sciences University Protocol Number RAKMHSU: (RAKMHSU-REC-178-2020-PG-P).

The survey contains a total of 17 questions and is expected to take no more than five minutes to complete. Undergraduates from first to final year of (Medical, Dentistry, Pharmacy and Engineering and Nursing) students are kindly requested to participate to the study.

Your participation in this research project is completely voluntary. Additionally, your data will be kept completely confidential and anonymous in compliance with the General Data Protection Regulatory (GDPR) requirements. Data will be coded to distinguish between demographic variables and information will only be examined in aggregate form.

Participants who complete the survey will have the opportunity to be entered into a drawing for a £100 Amazon Voucher.

Should you have any questions about this research project, please feel free to contact me for further information.

Sincerely,
Safia Sharif
PhD Student
University of Hertfordshire. UK
+447493377392

Appendix 8. PARTICIPANT INFORMATION SHEET

Title of study

'The use and impact of cognitive enhancers within Higher Education in the UAE'

Introduction

You are being invited to take part in a research study. Before you decide whether to do so, it is important that you understand the study that is being undertaken and what your involvement will include. Please take the time to read the following information carefully and discuss it with others if you wish. Do not hesitate to ask us anything that is not clear or for any further information you would like to help you make your decision. Please do take your time to decide whether or not you wish to take part. Thank you for reading this.

What is the purpose of this study?

The purpose of this PhD study is to explore the understanding, perception and level of access of cognitive enhancers (CEs) among university students in UAE.

Do I have to take part?

It is completely up to you whether or not you decide to take part in this study. If you do decide to take part, you will be given this information sheet to keep and be asked to sign a consent form. Agreeing to join the study does not mean that you have to complete it. You are free to withdraw at any stage without giving a reason.

Are there any age or other restrictions that may prevent me from participating?

You should be 18 years or older in order to be eligible to participate.

How long will my part in the study take?

If you decide to take part in this study, you will be involved in a online one to one interview and last for not more than 'thirty minutes'. Remember, if you want to stop the interview at any time, you can do so without giving any reason at all.

What are the possible disadvantages, risks or side effects of taking part?

Participating in this study is not anticipated to cause you any disadvantages or discomfort. No potential physical and/or psychological harm or distress will be caused by this study. However, if at any point you feel that you are distressed, you can stop the interview. Withdrawing from the study will not be held against you in any way, and all the data that will collect during the course of the study will be kept strictly confidential. Your institution will also not be identified or identifiable.

What are the possible benefits of taking part?

Possibly this study would benefit you as an individual, increasing your knowledge on the topic of the misuse of drugs specifically cognitive enhancers. Furthermore, it has the potential to decrease the abuse of CEs and increase the wellbeing of students.

How will my taking part in this study be kept confidential?
Your identity will not be disclosed in any part of this study or in any dissemination activities involving the outputs from this research. The analysis will use anonymous coding to identify each participant and no names will be collected.

Audio-visual material
Audio files and electronic files of the interview's transcripts will be destroyed under secure conditions. During the 6 months the audio recordings will be transcribed to a USB, after that it will be destroyed under secure conditions.

What will happen to the data collected within this study?
The data you provide will be confidential and only used for the research purpose. All the information that we collect during the course of the research will be kept strictly confidential. Data collected may be shared in an anonymised form to allow reuse by the research team and other third parties, your right of confidentiality is consistently respected. To achieve this, your name, address and other details will be excluded from the study.

- The data collected will be stored electronically, in a password in only one device, for 6 months, after which time it will be destroyed under secure conditions;
- All 'Zoom' recordings will be stored on computer to which only the researcher/supervisors will have access. Recording and electronic/paper files of the interview's transcripts will be destroyed under secure conditions (i.e. shredded) 6 months after completion of the writing of thesis.
- All data collect electronically, and audio recordings will be anonymised prior to storage.
- Storage and usage of personal information will be undertaken in accordance with the Data Protection Act 1998 and the EU Directive 95/46 on Data Protection

Will the data be required for use in further studies?
The results will be disseminated at conference presentations and via academic publications

Who has reviewed this study?
This study has been reviewed by: My supervisors: Associate Professor S. Fergus , Dr. Guirguis, Prof. Schifano, The University of Hertfordshire Health, Science, Engineering and Technology Ethics Committee with Delegated Authority (UK) and RAK Medical and Health Sciences University (UAE)

Protocol Number UH: < LMS/PGR/UH/04025 >

Protocol Number RAKMHSU: < RAKMHSU-REC-178-2020-PG-P >

Protocol Number IRAK: MOHAPIREC/2020/ 35 -2020-PG- P >

Factors that might put others at risk

Participating in this study is not anticipated to cause you any disadvantages or discomfort. No potential physical and/or psychological harm or distress will be caused by this study. However, if at any point you feel that you are distressed, you can stop and leave the interview. Withdrawing from the study will not be held against you in any way. Please note that if, during the study, any reveal illegal or dangerous activity, such as unlawful activity become apparent that might or had put others at risk, the University may refer the matter to the appropriate authorities.

Who can I contact if I have any questions?

If you would like further information or would like to discuss any details personally, please get in touch with me, in writing, by phone or by email:

Safia Sharif
University of Hertfordshire
Room 2J030, New Science Building.
College Lane Campus,
Hatfield, Herts
AL10 9AB
s.sharif2@herts.ac.uk,
Mobile. 00447493377392

Although we hope it is not the case, if you have any complaints or concerns about any aspect of the way you have been approached or treated during the course of this study, please write to the University's Secretary and Registrar at the following address:

Secretary and Registrar
University of Hertfordshire
College Lane
Hatfield
Herts
AL10 9AB

Thank you very much for reading this information and giving consideration to taking part in this study.

Appendix 9. Consent form

The undersigned consents to participate in a research study about the use of substances taken by students to enhance their cognitive function for the purpose of study and other reasons such as staying alert and concentrated.

1 I confirm that I have been given a Participant Information Sheet (a copy of which is attached to this form) giving particulars of the study, including its aim(s), methods and design, the names and contact details of key people and, as appropriate, the risks and potential benefits, how the information collected will be stored and for how long, and any plans for follow-up studies that might involve further approaches to participants. I have also been informed of how my personal information on this form will be stored and for how long. I have been given details of my involvement in the study. I have been told that in the event of any significant change to the aim(s) or design of the study I will be informed and asked to renew my consent to participate in it.

2 I have been assured that I may withdraw from the study at any time without disadvantage or having to give a reason.

3 I have been told how information relating to me (data obtained in the course of the study, and data provided by me about myself) will be handled: how it will be kept secure, who will have access to it, and how it will or may be used.

4 I understand that if there is any revelation of unlawful activity or any indication of non-medical circumstances that would or has put others at risk, the University may refer the matter to the appropriate authorities.

5 I have been told that I may at some time in the future be contacted again in connection with this or another study.

Signature of
participant……..…Date……...

Signature of (principal)
investigator……Safia……Date……

Appendix 10. Invitation letter to participants to students (Interview study)

Dear Students,

I am a PhD student at the department of Pharmacy, Pharmacology and Postgraduate Medicine at the University of Hertfordshire (UK). I am conducting a research study on the use of substances taken by students to enhance their cognitive function for the purpose of study and other reasons such as staying alert and concentrated.

This interview is to explore the knowledge and use of cognitive enhancers (CEs) among the university students in UAE.

I will appreciate if you agree to participate in the interview, the information you provide during the interview is strictly confidential. The study received full Ethical approvals from Universities of Hertfordshire UH (UK) **[**LMS/PGR/UH/04025], RAK Medical and Health Sciences RAKMHSU (UAE) [RAKMHSU-REC-178-2020-PG-P], and the Ministry of Health and Prevention Research Ethics Committee RAK Subcommittee (UAE) [MOHAPIREC/2020/35-2020-PG-P).

Undergraduates from first to final year of (Medical, Dentistry, Pharmacy and Engineering and Nursing) students are kindly requested to participate to the study.

The interview will last approximately (30) minutes and will be conducted virtually using 'Zoom'. Please note that your participation in this interview is completely voluntary, and you have the right to withdraw from the study at any time without giving any reason. If you agree to take part in this study, please sign the attached consent form and forward it back to me via the email proved at the end of this letter, indicating the date and time that is convenient for you. The information provided, will be strictly kept confidential and anonymous.

Date..... Time.....

Should you have any questions about this research project, please feel free to contact me for further information.

Sincerely,

Safia Sharif
PhD Student
University of Hertfordshire. UK
+447493377392
Email. S.sharif2@herts.ac.uk

Appendix 11. Invitation letter to participants (Faculty) (Interview study)

Dear Doctor,

I am a PhD student at the department of Pharmacy, Pharmacology and Postgraduate Medicine at the University of Hertfordshire (UK). I am conducting a research study on the use of substances taken by students to enhance their cognitive function for the purpose of study and other reasons such as staying alert and concentrated.

This interview is to explore the knowledge and use of cognitive enhancers (CEs) among the university students in UAE.

I will appreciate if you agree to participate in the interview, the information you provide during the interview is strictly confidential. The study received full Ethical approvals from Universities of Hertfordshire UH (UK) **[**LMS/PGR/UH/04025], RAK Medical and Health Sciences RAKMHSU (UAE) [RAKMHSU-REC-178-2020-PG-P], and the Ministry of Health and Prevention Research Ethics Committee RAK Subcommittee (UAE) [MOHAPIREC/2020/35-2020-PG-P).

The interview will last approximately (30) minutes and will be conducted virtually using 'Zoom'. Please note that your participation in this interview is completely voluntary, and you have the right to withdraw from the study at any time without giving any reason. If you agree to take part in this study, please sign the attached consent form and forward it back to me via the email proved at the end of this letter, indicating the date and time that is convenient for you. The information provided, will be strictly kept confidential and anonymous.

Date..... Time.....

Should you have any questions about this research project, please feel free to contact me for further information.

Sincerely,

Safia Sharif
PhD Student
University of Hertfordshire. UK
+447493377392
Email. S.sharif2@herts.ac.uk

Appendix 12. Interview guide (Part 1)

Interviewer: I would like to thank you for participating for this interview. We are conducting research as part of my PhD study on the use of substances taken by students to enhance their cognitive function for the purpose of study and other reasons such as staying alert and concentrated. 'Cognitive enhancers are pharmaceuticals either on prescription, over the counter that has been sold in health food shops or online or provided through illegal sources such as family or friends. However, they can be misused as prescribed drugs by healthy individuals to improve memory, increase mental alertness, and for cognitive improvement. Prescription drug abuse is defined as "the use of a medication without a prescription, in a way other than as prescribed, or for the experience of feeling elicited. Cognition refers to an information processing capacity, changing preferences and applying knowledge'. The aim of this study is to explore the understanding, perception and level of access of CEs among university students in UAE. This interview is part of my PhD research at the University of Hertfordshire (UK) and it should take around (30) minutes to complete. Please note that the conversation will be voice recorded only and transcribed verbatim to ensure the full interpretation of your and its content is confidential.

Only the research team, comprising of me (Mrs Safia Sharif), and the supervisory team, will have access to this recording and transcript. Once the interview is transcribed, you have seven days to request for a deletion of the conversation without given any reason. There are no right or wrong answers to the questions that I am going to ask you. Please feel free to share your opinion and experience.

6- What is your Nationality please?
7- Age? Gender?
8- Tell me about your education, University, year of study?
9- Have you ever heard of CEs/smart drugs?
    - If yes, tell me more
    - If NO, CEs/smart drugs are ----------
10- What do you think about CEs?
11- Have ever tried using CEs? If yes.
    - Does it make you smarter/alert?
    - To what extent do they help? How?
    - What is the reason of the use?
    - Do you get any bad effect after using it? If yes elaborate.
    - Where do you get it from?
12- How easy do you think it is for students to get the CEs?
13- Do you think using CEs drugs leads to better grades? Elaborate.
14- Do you consider using CEs/smart drugs in future?
15- Do you know anyone who uses them?
16- Is there an orientation in the university in regards the CEs use? Elaborate.
17- Is there anything more you would like to add?

Appendix 13. Interview guide (Part 2)

Interviewer: I would like to thank you for participating for this interview. We are conducting research as part of my PhD study on the use of substances taken by students to enhance their cognitive function for the purpose of study and other reasons such as staying alert and concentrated. 'Cognitive enhancers are pharmaceuticals either on prescription, over the counter that has been sold in health food shops or online or provided through illegal sources such as family or friends. However, they can be misused as prescribed drugs by healthy individuals to improve memory, increase mental alertness, and for cognitive improvement. Prescription drug abuse is defined as "the use of a medication without a prescription, in a way other than as prescribed, or for the experience of feeling elicited. Cognition refers to an information processing capacity, changing preferences and applying knowledge'. The aim of this study is to explore the understanding, perception and level of access of CEs among university students in UAE. This interview is part of my PhD research at the University of Hertfordshire (UK) and it should take around (30) minutes to complete. Please note that the conversation will be voice recorded only and transcribed verbatim to ensure the full interpretation of your and its content is confidential. Only the research team, comprising of me (Mrs Safia Sharif), and the supervisory team, will have access to this recording and transcript. Once the interview is transcribed, you have seven days to request for a deletion of the conversation without given any reason. There are no right or wrong answers to the questions that I am going to ask you. Please feel free to share your opinion and experience.

1. What is your Nationality please?
2. Gender?
3. May I know the university you are teaching in, and how long for please?
4. Are you aware of the use of cognitive enhancers among your students?
5. Is there any evidence as an interaction with the students that suggest the use of cognitive enhancers?
6. Can you please tell me if there is a behavioural change among the students during the term?
7. What about an orientation to your students, talking about the side effects of misusing cognitive enhancers drugs among healthy students in your university?

Appendix14 . Thank you letter to participants of the research (Debriefing)

Dear. (Student, Faculty, Pharmacist, G.P)

Thank you very much for participating in an interview about the use and impact of cognitive enhancers within Higher Education in the UAE. I appreciate the time you took from your busy studying schedule to spend with me.
The information you shared will be very helpful to the research study. If you have any questions regarding this study, please feel free to ask the researcher at this time.
In the event that you feel psychologically distressed by participation in this study, we encourage you to contact the researcher by email within 7 days prior to the interview for a deletion of the conversation without giving any reason.

Thanks again for your participation.

Sincerely,
Safia Sharif
PhD student
Department of Life and Medical Sciences
University of Hertfordshire
Hatfield,
United Kingdom

Appendix 15. Research Development Programmes and Workshops

Title	Date
Induction online	03/10/2018
RD	
RDP	
Learning chemistry with understanding ad application	03/10/2018
Health and safety	
Research degree process	
Introduction to research impact	10/10/2018
Exploring and organising your literature.	
Registration and doctoral review assessment	
Turnitin	
The viva and process of research degree exam	11/10/2018
Postgraduate research students conference 2018	15/10/2018
Exploring factors affecting attainment in undergraduate students (CaPS)	17/10/2018
Development in the epidemiology of drug related mortality in the UK over the last 30 years	
Poster presentation	18/10/2018
Becoming a member your discipline	25/10/2018
CaPS research seminar (Elaborate and assess a model to conduct an integrated testing strategy for the discrimination and the evaluation of irritants and sensitizers)	31/10/2018
The impact of novel psychoactive substances on acute mental health services	
Technical Writing	21/11/2018
Quantitative Analysis of Survey data & related design issues	26/11/2018
Introduction to Endnote	05/12/2018
Statistics: Sample size and power	05/12/2018
Literature searching: Using online resources.	12/12/2018
The role of mHealth in patients with type 2 diabetes in Kuwait.	12/12/2018
PPARβ/δ receptor mediated control of vascular tone	12/12/2018
Questionnaire design and sample selection	24/01/2019
Literature review	24/01/2019

Registration and Doctoral review assessment	07/02/2019
Imposter syndrome	13/02/2019
The role of complement in the differentiation and polarisation of monocyte-derived macrophages and dendritic cells.	20/02/2019
The role of endotoxins in unexplained inflammation haemodialysis patients	
Defining the off-target effects of NSAIDs	06/03/2019
Understanding the role of semicarbazide-sensitive amine oxidase (SSAO) in cardiovascular disease: potential link to vascular calcification	
Endogenous Fibrinolysis – A predictor of cardiovascular risk.	
Poster presentation (Annual LMS Research Conference)	16/04/2019
Giving a talk on my study	12/06/2019
Grant a fund	04/07/2019
Mixed Method	01/09/2019
Statistics: Getting Started with Stats	16/01/2020
How to write a scientific paper (and get it accepted!) RDP online session via MS Teams	03/06/2020
Taking care of your mental health and wellbeing for your PGR journey	30/06/2020
Quantitative Analyses Training	15/02/2021 To 03/03/2021
Qualitative Data Analysis: Methods and Techniques	05/07/2021
Presentation in 'DUPHAT' UAE	06/07/2021
Poster Presentation in 'DUPHAT'	07/07/2021
Critical Reading and Writing	14/09/2022
Supporting Your Well-Being	16/09/2022

Appendix 16. Certificate of Attendance (Quantitative Analyses Training)

Appendix 17. Certificate of Presentation in 'DUPHAT'

مؤتمر ومعرض دبي الدولي للصيدلة والتكنولوجيا
Dubai International Pharmaceuticals & Technologies Conference & Exhibition

CERTIFICATE OF CONTINUING EDUCATION

This is to Certify that

has attended

DUPHAT 2021

Equivalent to

_____ CME Credit Hours Awarded by Dubai Health Authority, UAE

_____ CME Credit Hours Awarded by The Society of Hospital Pharmacists of Australia

5 - 7 APRIL 2021

Dubai World Trade Centre, United Arab Emirates

Dr. Ali Al Sayed Hussain, M.S., Ph.D.
Chairman - DUPHAT

Credit Hours: **29.75**
Accreditation Number: **0417/21**

Credit Hours: **20**
Accreditation Number: **S2021/20**
"This CPD event has been accredited for 20 hours of Group-1 CPD (or 20 CPD credits), suitable for inclusion in an individual pharmacist's CPD plan."

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Appendix 18. Certificate of Poster Presentation 'DUPHAT'


مؤتمر ومعرض دبي الدولي للصيدلة والتكنولوجيا
Dubai International Pharmaceuticals & Technologies Conference & Exhibition

CERTIFICATE OF PARTICIPATION

This Certificate is Awarded to

Safia Sharif

in gratitude for the outstanding contribution to

DUPHAT 2021

as Professional Poster Presenter

5 - 7 APRIL 2021

Dubai World Trade Centre, United Arab Emirates

Dr. Ali Al Sayed Hussain, M.S., Ph.D.
Chairman - DUPHAT

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Appendix 19. Gantt Chart