

Comprehensive examination of the patterns, correlates, and
motivations for benzodiazepine use

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I. Abbreviations

AIS: Athens Insomnia Scale

ASR: adjusted standardized residual

AUD: alcohol use disorder

AUDIT: Alcohol Use Disorders Identification Test

BIS-R-21-SF: Barratt Impulsiveness Scale Revised – Short Form

BSMAS: Bergen Social Media Addiction Scale

BSSS: Brief Sensation Seeking Scale

BWAS: Bergen Work Addiction Scale

BZD: benzodiazepine

BZD-MQ: Benzodiazepine Use Motives Questionnaire

CAST: Cannabis Abuse Screening Test

CBT: cognitive behavioral therapy

CFA: confirmatory factor analysis

CFI: comparative fit index

DSM-IV: Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition

DSM-IV-MR-J: Diagnostic Statistical Manual-IV-Adapted for Juveniles

DSM-5: Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition

DMQ-R: Drinking Motives Questionnaire-Revised

EAI: Exercise Addiction Inventory

EFA: exploratory factor analysis

EMCDDA: European Monitoring Centre for Drugs and Drug Addiction

EMQ: European Model Questionnaire

EUDA: European Union Drugs Agency

FIML: full information maximum likelihood

GAD: generalized anxiety disorder

GMQ: Gambling Motives Questionnaire

IGD: internet gaming disorder

IGDT-10: Ten-Item Internet Gaming Disorder Test

ICD-10: International Classification of Diseases and Related Health Problems, 10th Revision

ICD-11: International Classification of Diseases and Related Health Problems, 11th Revision

KW: Kruskal-Wallis test

NIDA: National Institute on Drug Abuse

NMU: non-medical use
MBUQ-48: Motives for Benzodiazepine Use Questionnaire
MGH-HPS: Massachusetts General Hospital Hairpulling Scale
MLR: maximum likelihood robust
MMM: Marijuana Motives Measure
MOGQ: Motives for Online Gaming Questionnaire
MW: Mann-Whitney test
OUD: opioid use disorder
PGSI: Problem Gambling Severity Index
PHQ-15: Patient Health Questionnaire Somatic Symptom Scale
PIUQ: Problematic Internet Use Questionnaire
PMPUQ-SV: Problematic Mobile Phone Use Questionnaire Short Version
POGQ: Problematic Online Gaming Questionnaire
PSS-4: Perceived Stress Scale
PSWQ: Penn-State Worry Questionnaire
RMSEA: root mean square error of approximation
SAMHSA: Substance Abuse and Mental Health Services Administration
SCOFF: SCOFF Questionnaire
SD: standard deviation
SRMR: root mean square residual
SSRI: serotonin reuptake inhibitor
SUD: substance use disorder
SUMM: Substance Use Motives Measure
RCBS: Richmond Compulsive Buying Scale
RFQ-8: Reflective Functioning Questionnaire
RRS: Ruminative Response Scale
TLI: Tucker-Lewis index
TCA: tricyclic antidepressant
U.S.: United States
VIF: variance inflation factor
WBI-5: WHO's Well-Being Scale
WHO: World Health Organization
WISDM: Wisconsin Inventory of Smoking Dependence Motives
WLSMV: weighted least squares means and variances

II. Background

The first benzodiazepine (BZD), namely the chlordiazepoxide appeared in clinical use in the US in 1960 (Nielsen, 2017; Schmitz, 2016; Wick, 2013). BZDs modulate the GABA_A receptor leading to sedative and anxiolytic effects (Edinoff et al., 2021; Griffin et al., 2013; Sanabria et al., 2021). BZDs can be short-acting (a half-life of less than 12 hours), intermediate-acting (half-life of 12-40 hours), and long-acting (40-250 hours half-life) (Griffin et al., 2013). BZDs can also be classified by their relative potency: the first medications were low to medium potency, however, the newer, high-potency BZDs have more effective therapeutic effects and faster onset of action (Griffin et al., 2013).

BZDs have quickly become popular because they seem to be less toxic and have lower addictive potential than previous medications (i.e. the barbiturates) (Wick, 2013). Therefore, in the 1970s, BZDs have become one of the most frequently prescribed medications due to their wide therapeutic range. At the same time, they have also come into the focus of psychobiological studies in terms of the patterns of use and its correlates.

1. Introduction to benzodiazepines and patterns of usage

1.1. Medical use of benzodiazepines

BZDs are primarily recognized for their sedative–hypnotic, anxiolytic, anticonvulsant, and muscle-relaxant effects (Edinoff et al., 2021; Sanabria et al., 2021). The usage of evidence-based guidelines on BZD began to appear in the 1980s. The first guidelines suggested that BZDs are effective in the treatment of emotional disorders, anxiety, insomnia, neuromuscular disorders characterized by muscle spasticity, status epilepticus, different phobias, alcohol withdrawal and are also used as a preoperative medication (WHO Review Group, 1983). Later, anxiety-related problems such as panic disorder or generalized anxiety disorder (GAD) and insomnia have become the most common cases for BZD use (Bounds et al., 2024; Edinoff et al., 2021; Griffin et al., 2013). However, BZDs are also used to treat seizure disorders, catatonia, alcohol and/or BZD withdrawal (Bounds et al., 2024; Edinoff et al., 2021; Zaman et al., 2019). Severe seizure emergencies such as status epilepticus or seizures related to alcohol and BZD withdrawal are also important indications for BZD treatment (Bounds et al., 2024; Edinoff et al., 2021).

However, there are several known side effects of BZDs that should be taken into account before medical usage. These may include drowsiness, somnolence, lethargy, or fatigue as well as psychomotor retardation, impaired memory, attention and concentration. Further side effects can be vertigo, blurry vision, slurred speech, mood changes or swings, or inappropriate

behavior. Especially in combination with other drugs (e.g. opioids), respiratory depressant effects may become more significant causing life-threatening conditions, stupor or coma (Edinoff et al., 2021; Griffin et al., 2013; World Health Organization, 2019). In addition, there is a risk of premature birth and low birth weight in case of BZDs use during pregnancy (Edinoff et al., 2021). There is also an increased risk of falls, insomnia, memory loss, confusion and further psychiatric problems related to BZD use for the elderly (Edinoff et al., 2021; Griffin et al., 2013). Prolonged period of use can result in tolerance, dependence, and withdrawal.

Instances of potential adverse effects of BZDs such as potential abuse and/or dependence has been increasing, therefore, the newest guideline of the World Health Organization (WHO) for mental, neurological and substance use disorders (SUD) does not recommend BZDs for the treatment of GAD and/or panic disorder (World Health Organization, 2023). The WHO suggests the use of selective serotonin reuptake inhibitors (SSRIs) or tricyclic antidepressants (TCAs) as well as cognitive behavioral therapy (CBT), relaxation and/or mindfulness for GAD and/or panic disorder. Based on their recommendation, BZDs may be considered primarily for emergency management of acute and severe anxiety symptoms, but only for a short time (3–7 days) (World Health Organization, 2023). The reason for these new recommendations is that research results from recent years suggest that BZDs have high addictive potential, therefore, they carry a risk of non-medical use (NMU) and/or dependence.

1.2. Non-medical use of benzodiazepines

Several medications are in clinical practice that are also used non-medically; however, three types are usually distinguished: NMU of opioids, stimulants, and central nervous system depressants (i.e., sedatives, hypnotics, and anxiolytics) (McCabe et al., 2009; Schepis, Teter, & McCabe, 2018). Multifarious definitions for NMU (often referred to as misuse) of prescription drugs can be found in the scientific literature. The definition of the National Institute on Drug Abuse (NIDA) for non-medical BZD use refers to taking BZDs in a manner or dosage other than prescribed; taking someone else's prescription (even if for a legitimate medical reason); or taking the medication to get high (National Institute on Drug Abuse, 2020). Based on the definition of The Substance Abuse and Mental Health Services Administration (SAMHSA), NMU means BZD use without prescription; use in higher dosage, more regularly, or longer than recommended; and use in any other way not prescribed by a doctor (Center for Behavioral Health Statistics and Quality, 2023). The European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) (now known as the European Union Drugs Agency, EUDA) refers to NMU as the use of a drug *„for self-medication, recreational or enhancement purposes, with or*

without a medical prescription but outside of the accepted medical guidelines” (European Monitoring Centre for Drugs and Drug Addiction, 2021). Nevertheless, Karjalainen (2018) has suggested as a revision of the EMCDDA’s European Model Questionnaire (EMQ) to define NMU as the use of BZDs without medical prescription, in larger doses, for longer periods of time than recommended and/or for different purposes than prescribed (e.g. for recreational purposes).

In addition, further definitions can be also found in the scientific literature. It is difficult to understand the similarities and differences between these concepts due to the lack of consensus about the use of these terms and their accurate definitions. Furthermore, terms like “misuse” or “non-medical use” are also used for some elements of disorders related to BZD use.

1.3. Benzodiazepine use disorder

Among substance-related disorders, sedative, hypnotic, or anxiolytic use disorder is included in the 5th edition of Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (American Psychiatric Association, 2013). The criteria indicates the loss of control over use, spending much time and effort on activities related to substance use (even at the expense of other activities), risky substance use, and pharmacological criteria (tolerance and withdrawal). The presence of two or three symptoms indicates mild sedative, hypnotic or anxiolytic use disorder, while having four or five symptoms suggests moderate disorder. Six or more symptoms indicates severe use disorder.

The 10th revision of the WHO’s International Classification of Diseases and Related Health Problems (ICD-10) code 13 indicates sedative, hypnotic, or anxiolytic related disorders (World Health Organization, 2016). The latest, 11th revision (ICD-11) characterised disorders associated with the use of these drugs (including barbiturates, BZDs, and Z-drugs¹) by the pattern and consequences (World Health Organization, 2019). The ICD-11 draws attention to the dependence-inducing properties of sedatives, hypnotics, or anxiolytics that are related to the dose and duration of use. They may induce intoxication, dependence, withdrawal and several other mental disorders. These disorders are indicated by code 6C44 in the ICD-11 (World Health Organization, 2019). Sedative, hypnotic or anxiolytic intoxication (6C44.3) appears shortly after the consumption of sedatives, hypnotics or anxiolytics. It is a clinically significant condition described by disturbances in consciousness, cognition, perception, affect,

¹ Z-drugs are non-BZD modulators of GABA receptors resulting in sedative-hypnotic effect

behavior, or coordination depending on the consumed amounts. Sedative, hypnotic or anxiolytic dependence diagnose (6C44.2) is usually made when substance use is present over a period of at least 12 months but the diagnosis may be given for at least 3 months of continuous use. Dependence is described by repeated or continuous use which is accompanied by urge or craving to use substances and impaired ability to control use, and increasing priority given to use over further activities. Physiological features of dependence including tolerance or withdrawal symptoms following cessation or reduction in use can also appear. Sedative, hypnotic or anxiolytic withdrawal (6C44.4) can clinically occur when prescribed drugs have been used in standard therapeutic doses. Symptoms of withdrawal may include anxiety, insomnia, psychomotor agitation, increased hand tremor, and autonomic hyperactivity (e.g., tachycardia, hypertension, sweating), or postural hypotension and transient visual, tactile or auditory illusions or hallucinations (World Health Organization, 2019). The withdrawal state may be complicated by seizures, and anxiolytic-induced delirium may also occur.

Harmful use of sedatives, hypnotics or anxiolytics (only one episode or a pattern) are marked as separate diagnostic categories in the ICD-11 (World Health Organization, 2019). Harmful sedative, hypnotic or anxiolytic use is considered equal to the DSM-5’s mild sedative, hypnotic or anxiolytic use disorder as well as to the substance abuse in the previous version of the DSM (DSM-IV) (American Psychiatric Association, 1994; Saunders, 2017). These categories are characterized by use of sedatives, hypnotics or anxiolytics that has caused clinically significant harm to a person’s physical or mental health or to the health of others. The harm can occur due to the behavior related to intoxication, direct or indirect toxic effects on the body’s organs and functions, or a harmful manner of administration. Harm to health of others includes physical harm that is directly attributable to behavior due to sedative, hypnotic or anxiolytic intoxication. For the differences and the similarities between the DSM-5 and ICD-11 diagnostic categories see Table 1.

Table 1: *Differences and similarities between DSM-5 and ICD-11 criteria for sedative, hypnotic, or anxiolytic use disorder/dependence*

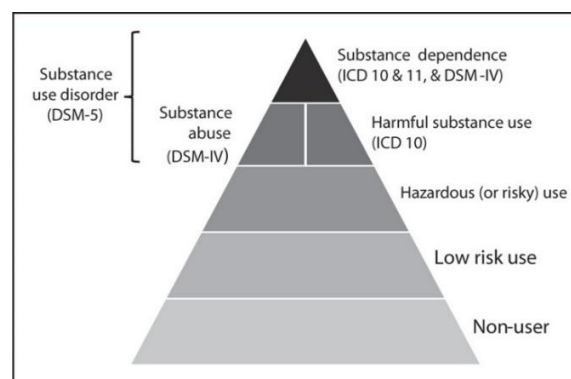
DSM-5: Sedative, hypnotic, or anxiolytic use disorder	ICD-11: Sedative, hypnotic, or anxiolytic dependence
Symptoms within a 12-month period. Problematic pattern of use leading to clinically significant impairment or distress.	Symptoms within a 12-month period, but the diagnosis may be made if the use is continuous (daily or almost daily) for at least 3 months. Potential to cause numerous forms of harm, both to mental and physical health.

Taking sedatives, hypnotics, or anxiolytics in larger amounts or over a longer period than was intended.	A strong internal drive or craving to use these substances manifested by impaired ability to control use.
Craving/strong desire or urge to use the sedative, hypnotic, or anxiolytic.	
Persistent desire or unsuccessful efforts to cut down or control sedative, hypnotic, or anxiolytic use.	Increasing priority given to use over other activities.
Spending a great deal of time in activities necessary to obtain the sedative, hypnotic, or anxiolytic; use the sedative, hypnotic, or anxiolytic; or recover from its effects.	
Recurrent use resulting in a failure to fulfill major role obligations at work, school, or home.	Persistence of use despite harm or negative consequences.
Continued sedative, hypnotic, or anxiolytic use despite persistent or recurrent social or interpersonal problems caused or exacerbated by the effects of sedatives, hypnotics, or anxiolytics.	Increasing priority given to use over other activities.
Giving up or reducing important social, occupational, or recreational activities because of sedative, hypnotic, or anxiolytic use.	
Recurrent sedative, hypnotic, or anxiolytic use in situations in which it is physically hazardous.	Persistence of use despite harm or negative consequences.
Sedative, hypnotic, or anxiolytic use is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by the sedative, hypnotic, or anxiolytic.	
Tolerance and withdrawal.	Physiological features of dependence: tolerance and withdrawal symptoms following cessation or reduction in use.
305.40 Mild: presence of 2-3 symptoms 304.10 Moderate: presence of 4-5 symptoms 304.10 Severe: presence of 6 or more symptoms	6C44.1: Harmful use 6C44.2: Dependence

In the ICD-11, hazardous use of sedatives, hypnotics or anxiolytics (QE11.2) has been included in a separate chapter as a health risk factor (World Health Organization, 2019). Hazardous use is described by a pattern of use that increases the risk of harmful physical or mental health consequences to the user or to others. The risk may be from the frequency of use

of these drugs, from the amount used on a given occasion, from risky behavior associated with use of these drugs or the context of use, or from a harmful route of administration. Hazardous use of substances has not yet reached the level of clinically significant harm to physical and/or mental health of the user or people around the user. To understand the hierarchy of these aforementioned categories, see the figure of Saunders (2017) (Figure 1). However, Saunders (2017) also notes, that these diagnostic criteria were based mostly on a confirmatory approach, and in case of several substances (including BZDs, which are primarily described by a doctor), they are difficult to use and it is hard to sharply separate the different levels of categories (e.g. the occasional NMU versus the NMU that deserves clinical attention).

Figure 1: *The hierarchy of substance-related disorders in DSM and ICD made by Saunders (2017)*



2. Epidemiology of the patterns of benzodiazepine use

There is little data available in the scientific literature about the worldwide prevalence of BZD use due to the difficulties in monitoring the consumption (including NMU) and the different therapeutic practices between countries. Monitoring is further complicated by the fact that the European market for illicit drugs has seen a significant increase in uncontrolled and new BZDs in recent years (European Monitoring Centre for Drugs and Drug Addiction, 2021). Due to the above factors, in addition to patient appearances, the prevalence of BZD use (including NMU) can be estimated by general population surveys.

In the United States (U.S.) 12.5% of the adult population used BZDs in 2015-2016, 2.1% reported NMU of BZDs at least once, and 0.2% had BZD use disorders. Among BZD users, 17.1% reported NMU, and 1.5% had BZD use disorders (Blanco et al., 2018). Regarding the sociodemographical variables, NMU of BZDs was associated with several factors (e.g. being male, being uninsured and unemployed, having lower family income and poor education level). However, in regard of the gender differences in BZD use, analyses yielded different results across studies, suggesting that gender differences are likely to be only one of several factors (Votaw, Geyer, et al., 2019a). In the U.S., the rate of BZD use was the highest among

older adults, aged between 50 and 64 (12.9%), while the prevalence of NMU was the highest among young adults (18-25 years) (5.2%). Using BZDs without prescription was the most common type of NMU, and friends or relatives were the most common sources (Maust et al., 2019). Becker et al. (2007) investigated the NMU of sedatives, hypnotics or anxiolytics in general and documented that 9.8% of surveyed people met the criteria for BZD dependence. In the same study, the NMU was associated with being female, criminally charged, uninsured, and unemployed.

In several European countries, the lifetime prevalence of BZD use varies from 10.1 to 45.0%, and from 1.7 to 6.5% for NMU (Hockenhull et al., 2021). Study of López-Pelayo et al. (2019) have found 9.7% prevalence of BZD use with 96.1% NMU based on the patients' healthcare data. Among participants who reported lifetime BZD use, approximately 80% were aged over 35 years and the proportion of NMU was significantly higher among participants aged 34 or younger (Hockenhull et al., 2021). Lifetime BZD use and NMU were both more common among females (Hockenhull et al., 2021). An other international, cross-sectional study focusing on European adults aged over 65 years documented that the prevalence of BZD use varies from 0.7 to 35.5% and females were significantly more associated with BZD use (Lukačšínová et al., 2024). In this study, 70.7% of BZD users took these medications for more than 1 year, and 35.9% for more than 5 years.

There is little epidemiological data about the occurrence of non-medical sedative and hypnotic use in Hungary. In 2019, 7.6% of 16 year-old students reported that they have already used sedatives and/or hypnotics without medical prescription during their lifetime, and 6.7% have already used alcohol with these medications (Péterfi & Bálint, 2022). Among hospitalized patients in psychiatric and addiction rehabilitation wards in Budapest, symptoms of sedative and hypnotic dependence, use of multiple sedatives and hypnotics, and combining these medications with alcohol were frequent. Withdrawal symptoms were experienced by 69.2% of the patients in addiction rehabilitation and 58.7% of the patients in general psychiatric rehabilitation (Tóth et al., 2020). Furthermore, 26.1% of the patients in psychiatric rehabilitation and 38.4% of the patients in addiction rehabilitation reported that they have used multiple sedatives and hypnotics at once. 55.7% of the participants in addiction rehabilitation took these medications with alcohol (Tóth et al., 2020). Nevertheless, in the general adult population of Hungary, the prevalence of non-medical BZD use was unknown.

Overall, using BZDs non-medically as well as BZD dependence have become an increasing public health concern in recent years, therefore, understanding these phenomena more comprehensively (including their correlates, risk and protective factors, motivations)

across different populations could be crucial in establishing efficient prevention and intervention programs.

3. Correlates, risk factors and protective factors of benzodiazepine use

3.1. Personality factors related to benzodiazepine use

Due to the sedative, hypnotic, anxiolytic effect and the clinical indications of BZDs, a relationship between BZD use and higher anxiety sensitivity, or introversion (i.e. internalising personality traits) can be assumed. These associations have been demonstrated by several studies, for instance, the role of anxiety sensitivity has been documented among young adults by Chinneck et al. (2018). Konopka et al. (2013) have found higher level of neuroticism, introversion, and higher prevalence of emotional based coping mechanisms among participants with a diagnosis of BZD dependence compared to non-addicted BZD users. Avoidant coping mechanism was also reported to be associated with long-term BZD use compared to short-term use (Zandstra et al., 2004) and greater coping skills at an older age of BZD initiation and fewer days of NMU (C. F. Wong et al., 2013). Based on the results of Mol et al. (2005), the feeling of personal unworthiness and inadequacy, and the feeling of guilt was associated with higher craving and higher risk of BZD addiction. A link between higher levels of neuroticism and withdrawal severity was documented by Schweizer et al. (1998).

Nevertheless, BZD use (especially the NMU and BZD dependence) can be studied within the scope of addictological problems as well. Several personality traits associated with BZD misuse are also well-documented risk factors for addictive behaviors in general (Hamdan et al., 2018). For instance, Stewart et al. (2021) have found an association between impulsivity and NMU of prescription sedatives and hypnotics. Among university students, impulsivity, compulsivity and risk-taking behaviors were also linked to NMU of sedatives and hypnotics (Grant et al., 2020). In a study of Jamt et al. (2020), thrill and adventure seeking behavior patterns were also reported to be associated with BZD use. The role of sensation seeking in non-medical BZD use was demonstrated by Chinneck et al. (2018) in a young adult sample. However, these traits are related to psychiatric symptoms and/or disorders (including further addictions) as well, therefore, it is difficult to separate the personality factors, and psychiatric disorders during the examination of correlates and risk factors for BZD use.

3.2. Psychiatric disorders related to benzodiazepine use

As mentioned previously, BZDs are used in the treatment of several psychiatric disorders and conditions, therefore, psychiatric symptoms (particularly depression and anxiety) have reported to be associated with the frequency of BZD use, BZD dependence and the

severity of dependence (Hall et al., 2010; Kan et al., 2004; Konopka et al., 2013). Psychiatric symptoms and disorders, especially anxiety and mood disorders are linked not only to the development of BZD dependence but also to NMU among adults and adolescents (Goodwin & Hasin, 2002; Huang et al., 2006; Schepis & Hakes, 2013; Schepis & Krishnan-Sarin, 2008; Votaw, Geyer, et al., 2019a; Zullig & Divin, 2012). In addition, several studies have shown an association between personality disorders (e.g. antisocial and borderline) and NMU of BZDs (Goodwin & Hasin, 2002; Huang et al., 2006; Kidorf et al., 1996). Moreover, a study of Fenton et al. (2010) documented that personality disorders showed stronger association with NMU of BZDs than anxiety and mood disorders. Nevertheless, it is important to note that causality between these factors is unknown. Several longitudinal studies have suggested that NMU of BZDs was associated with a risk for onset of psychiatric disorders a few years later (Schepis & Hakes, 2011), however, earlier onset of depression has been also associated with BZD dependence (Schepis & McCabe, 2012). Distinct studies have demonstrated gender as a moderator of the relationship between some psychiatric symptoms (e.g. anxiety, depression) and NMU of BZDs. Several results showed a stronger link between these factors among women (McHugh et al., 2017; Votaw, Geyer, et al., 2019a; Zullig & Divin, 2012), while other studies found that the association between panic disorder and sedative use disorder was stronger among men (Conway et al., 2006; Votaw, Geyer, et al., 2019a).

Psychiatric symptoms and disorders are also associated with NMU of BZDs and BZD dependence in populations with other substance use issues (e.g., alcohol use disorder (AUD), cannabis, or NMU of opioids) (Anagnostopoulos et al., 2018; Boyd et al., 2018; Mateu-Gelabert et al., 2017; Nocon et al., 2007). Alcohol use in itself and AUD increases the risk of non-medical BZD use (Becker et al., 2007; Goodwin & Hasin, 2002; Huang et al., 2006): among participants with AUD, the NMU of sedatives and hypnotics is significantly (3-4 times) higher than in the general population (Votaw, Witkiewitz, et al., 2019). The prevalence of NMU of BZDs was even higher among patients under treatment for AUD (McHugh et al., 2018; Morel et al., 2016). McCabe (2005) highlighted that NMU of sedatives/hypnotics was associated with smoking and binge drinking, as well as with cocaine, ecstasy, prescription stimulant, and prescription opioid use among young adults. Particularly in opioid use disorder (OUD), the occurrence of non-medical sedative, hypnotic use is significantly (approximately 20 times) higher compared to the general population (Votaw, Witkiewitz, et al., 2019). Non-medical BZD use is also common among patients receiving treatment for OUD, negatively affecting treatment outcome (Apantaku-Olajide et al., 2012; Eiroa-Orosa et al., 2010; Franklyn et al., 2017; McHugh et al., 2017; Stein et al., 2017). In addition, the occurrence of non-medical BZD use is also high among

illicit drug users (e.g., cocaine) (Keckojevic et al., 2015; Kurtz et al., 2011). Non-medical use of BZDs is associated with increased levels of polysubstance use as well as with emergency room visits and accidental injuries (Schuman-Olivier et al., 2013; Votaw, Witkiewitz, et al., 2019). The co-involvement of BZDs and alcohol and/or opioids in overdose deaths is also very common (Bushnell et al., 2022; Lo-Ciganic et al., 2022; Park et al., 2020; Tori et al., 2020). Overall, the relationship between non-medical BZD use and further substance-related disorders is well-documented, however, the investigation of the association between non-medical BZD use and behavioral addictions has received scarce attention. Fernández-Aliseda et al. (2020) found a link between sedative consumption and compulsive internet use among Spanish adolescents and Ganson et al. (2021) suggested that BZD use is strongly associated with eating disorders among college students. Young adults are considered to be a high-risk population in terms of addictions, including NMU of prescription drugs and behavioral addictions.

In conclusion, the relationship between NMU of BZDs and psychiatric symptoms and psychiatric outcomes has been documented across age groups and populations (Keckojevic et al., 2015; Schepis, Teter, Simoni-Wastila, et al., 2018; Schepis et al., 2021a), however, several risk factors and correlates are still unexplored due to the multifactorial nature of this phenomenon.

3.3. Protective factors for benzodiazepine use

Several studies can be found in the scientific literature related to the correlates and risk factors for non-medical BZD use and dependence, however, little is known about the protective factors. Life satisfaction, positive emotions, future orientation, secure attachment and gratitude were documented as significant protective factors preventing addictive behaviors in adolescents (Shoshani et al., 2024). Furthermore, religiosity, especially the individual dimension of religiosity (namely spirituality) has been also reported as a protective factor against addictions and a contributing factor in successful recovery from addictions (Dermatis & Galanter, 2016; Livne et al., 2021; Yeung et al., 2009). The efficacy of 12-step-oriented intervention programs in the rehabilitation of SUD is well-known (Hai et al., 2019). Religious beliefs and practices may also influence the course of psychiatric disorders by helping to cope with the symptoms (Bonelli & Koenig, 2013; Pargament & Lomax, 2013). In addition, therapeutic choices and treatment outcomes can also be modulated by religious beliefs (Bonelli & Koenig, 2013; Peteet, 2017). Previous studies have documented a relationship between religiosity and higher self-esteem, higher levels of mental health stability, lower levels of impulsivity and sensation seeking (Caribé et al., 2015; J. E. Grant et al., 2023; Li et al., 2020; Pajević et al., 2007). Furthermore,

religious people are more likely to use adaptive emotional stress-regulation strategies (Vishkin et al., 2019). Overall, the aforementioned psychological factors may play a mediating role in the relationship between religiosity/spirituality and addictive behaviors (including BZD use and NMU or dependence). However, protective factors of non-medical BZD use and dependence should be investigated more comprehensively.

4. Motivations for benzodiazepine use

4.1. The background of studies focusing on motivations for benzodiazepine use

Beside the correlates, risk factors and protective factors, previous research emphasized that motivations are also crucial in understanding addictive behaviors (Cooper, 1994; Cox & Klinger, 1990). In the beginning, studies investigating the motivations for substance use mostly focused on alcohol use. Cooper (1994) and Cox and Klinger (1990) identified two underlying dimensions (positive/negative reinforcement and internal/external source) and four motives in alcohol use: (1) enhancement (i.e. using alcohol for pleasure); (2) coping (i.e. treating negative feelings); (3) social (i.e. using alcohol to ease socialization); and (4) conformity (i.e. fear of missing out or social pressure) (Cooper, 1994; Cox & Klinger, 1990). To measure drinking motives, Cooper (1994) developed the Drinking Motives Questionnaire-Revised (DMQ-R). Later, other studies have found five-factors in DMQ-R including two dimension of coping: coping with depression and coping with anxiety (V. V. Grant et al., 2007; Mezquita et al., 2011). Drinking motives were reported to be associated with the patterns of alcohol use (Carey & Correia, 1997; V. V. Grant et al., 2007; Mezquita et al., 2011). For instance, coping with anxiety, social motivations and enhancement were linked to alcohol consumption on weekends, while coping with anxiety and social motivations were significant factors in alcohol use on weekdays (Mezquita et al., 2011). Furthermore, patients with AUD reported drinking motives related to negative reinforcements (coping and conformity). Also in AUD, social motives and enhancement predicted drinking frequency, while coping with depression and also social motives and enhancement predicted the quantity of alcohol consumption (V. V. Grant et al., 2007). The relationship between social motives and heavy drinking, between conformity and alcohol problems as well as between coping motives and both heavy drinking and alcohol problems was revealed by Sun et al. (2015).

Results have also appeared in recent years focusing on the motivations and the measurement of motivations in other substance use cases. For instance, the motivation factors were extended to cannabis use by the Marijuana Motives Measure (MMM) that was formulated and validated by Simons et al. (1998). To examine smoking motivations, The Wisconsin

Inventory of Smoking Dependence Motives (WISDM) (Piper et al., 2004) was created with two main and thirteen subscales. Biolcati and Passini (2019) published the Substance Use Motives Measure (SUMM) for assessing general alcohol and substance use motivations. Eight factors of SUMM were identified: enhancement, social, conformity, self expansion, performance and coping with anxiety, coping with depression, and coping with boredom. In addition, motivations have been investigated in behavioral addictions. Enhancement, coping and social motivations have been identified by the Gambling Motives Questionnaire (GMQ) (Stewart & Zack, 2008). Online gaming motivations can be measured by the Motives for Online Gaming Questionnaire (MOGQ) (Demetrovics et al., 2011) that includes seven motivating factors: social, escape, coping, competition, fantasy, skill development and recreation. In conclusion, motivations for different addictive behaviors have received increasing focus in recent years. However, exploring the motivations for NMU of prescription drugs is more complex and more difficult to comprehensively investigate due to the several types of medications which are used non-medically (e.g. opioids; sedatives, hypnotics, and anxiolytics; stimulants).

4.2. Studies focusing on the motivations for benzodiazepine use

Several studies have been published investigating the motivations for BZD use in recent years: non-medical BZD use was found to be motivated by coping with negative states (including affective and somatic) among the general population of the United Kingdom (Kapil et al., 2014), as well as among young adults and adolescents (Boyd et al., 2006; Brandt et al., 2014; Dagirmanjian et al., 2017; Terry-McElrath et al., 2009). Furthermore, Dagirmanjian et al. (2017) also documented enhancing social interactions as a motivating factor for BZD use. In a qualitative study, Liebreuz et al. (2015) asked high-dose BZD dependent participants about their BZD use at the beginning of usage. Most of the motivating factors were related to stressful life situations causing lower levels of psychological well-being or symptoms of psychiatric disorders. Sleeping difficulties, compulsive thoughts, social anxiety and managing other substance-related problems (i.e. alcohol or opioid withdrawal) also appeared to be common motivations for BZD use as well as the combination of the aforementioned reasons. Overall, four broad categories were identified as an explanation for continued BZD use in a qualitative study: (1) coping with symptoms of psychological distress or psychiatric disorder, (2) managing physical or psychological symptoms of a somatic condition, (3) alleviating symptoms of SUDs, and (4) recreational motivation (Liebreuz et al., 2015). Nevertheless, as demonstrated by Drazdowski et al. (2020), gender should be taken into account as a moderator factor in the

motivations for BZD use: they found higher level of recreational motivations among men, and higher occurrence of self-treatment motivations among women.

The motivations for BZD use can also differ across populations, for instance, Stein et al. (2017) reported that the most common motivations for BZD use among opioid users are coping with anxiety, enhancement, sleep management, and decreasing opioid withdrawal. Among participants receiving treatment for OUD, Fatséas et al. (2009) identified three groups based on the motivations for BZD use: hedonistic motivations (to get high), self-treatment (reducing negative emotional states or withdrawal symptoms) and the combinations of these motivations. Among those with AUD, the most frequent motivation was coping (including negative emotional states, sleeping disturbances and withdrawal), followed by enhancement and social motivations (McHugh et al., 2018). In addition, the motivations for BZD use were found to be associated with the source of BZD: using BZDs for coping with anxiety appeared among participants who usually get their BZDs from a doctor, while those who reported BZD use for getting high were more likely to buy BZDs on the street (Stein et al., 2016). In conclusion, the main indications for BZDs play a significant role in the motivations for non-medical BZD use and the development of dependence. However, due to the high addictive potential of BZDs, a double reinforcing role should be also considered, which can create a psychological balance by inducing pleasant feelings and states, while also eliminating unpleasant ones.

Nevertheless, the previous literature suggests that motives behind substance use are highly related to the development of SUDs, therefore, examining comprehensively and systematically the motivations for BZD use (including NMU) and the development and validation of scales and questionnaires can be crucial in recognizing risk factors and preventing BZD use disorders and their consequences. Furthermore, the existence of a standardized tool for comprehensively assessing the motivations behind BZD use could also help professionals to choose the appropriate therapy and to increase the efficiency of therapeutic processes. However, to the best of our knowledge, no standardized scale or questionnaire is available in the scientific literature for the comprehensive investigation of the motivations for BZD use.

III. Aims and hypotheses

Non-medical prescription drug use and prescription drug dependence have become increasingly severe public health concerns in recent years; therefore, the investigation of these phenomena is crucial in clinical practice and for the general population as well. In the present thesis, studies across six different samples (including community samples of different ages and

a clinical sample) were conducted where the patterns of sedative/hypnotic use (including NMU) and the co-occurrences of different psychological factors, further addictive behaviors and motivational factors were all examined comprehensively. For this purpose, the present thesis had five aims:

Aim 1: The epidemiology and follow-up of the patterns of sedative/hypnotic use and NMU are crucial due to the number of potential individuals and public health consequences of NMU. Therefore, an explanatory study was conducted in order to reveal the prevalence of sedative/hypnotic use and NMU in Hungary (Study 1).

Aim 2: Based on the scientific literature, young adults are a risk population in terms of NMU of sedatives/hypnotics (Schepis, Teter, Simoni-Wastila, et al., 2018; Votaw, Geyer, et al., 2019a), however, this population is also at risk for further types of addictions including a broad factor of behavioral addictions due to distinct psychological characteristics of this age group (higher level of impulsivity or sensation seeking). However, the relationship between these behaviors has received scarce attention in young adult samples. Thus, our aim was to examine the relationship between NMU of sedatives/hypnotics and the symptoms of a broad spectrum of addictive behaviors in this high-risk population (Study 2). Based on the literature about the co-occurrence of addictive behaviors among young adults, we assumed that participants who reported NMU of sedatives and/or hypnotics would show higher levels of the examined behavioral addiction symptoms.

Aim 3: There is evidence for the protective role of religiosity and spirituality preventing the development and aiding the recovery from several addictive behaviors (e.g., alcohol use disorder) due to the mental stability and coping mechanisms related to religious beliefs (Dermatis & Galanter, 2016; Pargament & Lomax, 2013; Shoshani et al., 2024). Although the investigation of NMU of prescription drugs has received increasing focus in recent years, protective factors and the role of religiosity in non-medical sedative/hypnotic use are unknown. Therefore, our aim was to explore the link between religiosity and NMU of sedatives/hypnotics in the Hungarian adult population and in a young adult sample of Budapest as well (Study 3). Based on the previously documented protective role of religiosity, we hypothesized that the prevalence of non-medical sedative and hypnotic use would be lower among religious participants and that this effect would be consistent in both adult and young adult samples.

Aim 4: Following the studies and models of Cooper (1994) and Cox and Klinger (1990), several studies have been published emphasizing the importance of understanding the motivations in addictive behaviors. Regarding the BZD use, literature suggests that motives behind BZD use are highly related to the indication of the BZDs (i.e. coping with negative

states) and enchainment as well (Dagirmanjian et al., 2017; Fatséas et al., 2009; Kapil et al., 2014; Liebreuz et al., 2015; McHugh et al., 2018). However, the comprehensive examination of these motivations across different populations has been missing, therefore, our aim was to explore the motivations as a first step to design a standardized tool for assessing the motivations behind BZD use (Study 4).

Aim 5: The scientific literature suggests that motives behind substance use are highly related to psychiatric disorders (Liebreuz et al., 2015; McHugh et al., 2018; Stein et al., 2016), therefore, investigating the motivations for BZD use (including NMU) can be crucial in prevention and intervention processes. A standardized tool for exploring the motivations behind BZD use could also help professionals to choose the appropriate therapeutic plan and to recognize the underlying factors that can turn BZD use into a NMU and dependence. However, to the best of our knowledge, no standardized measurement can be found in the scientific literature which can comprehensively assess the motivations for BZD use. Therefore, our aim was to develop an assessment by identifying the factor structure of the previously collected motives in a large community sample as well as to support the construct validity of our questionnaire in a community and in a clinical sample (Study 5). Based on the previous models and results related to the motivations in addictive behaviors, we assumed that four factors will appear as well as that the role of coping will be more expressed in the community and clinical samples as well.

IV. Materials and methods

1. Samples

1.1. National Survey on Addiction Problems in Hungary (NSAPH) 2019

The aim of the National Survey on Addiction Problems in Hungary (NSAPH) is to monitor addiction problems and trends in the general Hungarian adult population. The NSAPH has been conducted every four years on a representative sample of the Hungarian adult population between the ages of 18 and 64 years. Several sociodemographic and psychological factors, different types of substance use (including sedative/hypnotic use and NMU) as well as behavioral addictions were assessed by a mixed method arrangement of face-to-face and self-administered questionnaires. Data were used from data collection conducted in the spring of 2019. The study was approved by the Scientific and Research Ethics Committee of the Medical Research Council (ETT TUKEB).

The final sample size was 1385. Sample attrition was corrected by weighting by layer categories. The extent of the theoretical error margin was 2.6% at a reliability level of 95%. The detailed methodology has been published by Paksi et al. (2021). In the final sample, 46.8% of the participants were male (n=648) and the mean age was 41.77 years (SD=13.08). Analyses on the sample of the NSAPH 2019 were conducted in Study 1 and Study 3.

1.2. Budapest Longitudinal Study (BLS)

The Budapest Longitudinal Study (BLS) is a representative longitudinal study assessing the prevalence and characteristics of same substance use and behavioral addictions among young adults as in the NSAPH study. The data collection was conducted across four waves on a representative sample of Budapest aged between 18 and 34 years. The same methodology (mixed method arrangement of face-to-face and self-administered questionnaires) was used as in the NSAPH study. Data from the first data collection (conducted in 2019) were used in our studies. The study was approved by the Scientific and Research Ethics Committee of the Medical Research Council (ETT TUKEB).

The weighted sample by layer categories included 3890 participants. In the sample, 48.4% of the participants were male (n=1883). The mean age was 27.06 years (SD=4.76). Data from the BLS sample were used in Study 2 and Study 3.

1.3. Psychological and Genetic Factors of Addictive Behaviors (PGA) Study

The Psychological and Genetic Factors of Addictive Behaviors (PGA) Study aimed to take a multidisciplinary approach by testing psychological and genetic factors in different types of addictions. The study was conducted by participating young adults from several Hungarian education facilities across four data collection waves, between 2011 and 2015. During the data collections, self-report questionnaires were administered. Three basic topics were examined: sociodemographic information, psychological factors, and addictive behaviors (including substance use and behavioral addictions such as gambling, problematic internet use, problematic video gaming, problematic social media use, exercise addictions, eating disorders, and hairpulling). The study was also approved by the Scientific and Research Ethics Committee of the Medical Research Council (ETT TUKEB).

The size of the sample was 3003 with 42.6% male participants (n=1280). The mean was 21 years (SD=2.8). A detailed introduction to the procedure and the substance use assessment have both been published by Kotyuk et al. (2019). Data from the PGA sample were used in Study 2.

1.4. The summary of motivations for benzodiazepine use

During the collection of motivations for BZD use (Study 4), data from a smaller sample were analyzed. Participants were included by snowball sampling targeting individuals who use BZDs in their everyday life. In the sample including 49 participants, 70.2% of them were female (n=40). The mean age was 43.56 years (SD=15.08). Participants were asked online (in Qualtrics) about their sociodemographical variables, the types of BZDs they have ever used, the prevalence of use and their motivations for BZD use. The study was approved by the Research Ethics Committee of the ELTE Eötvös Loránd University.

1.5. Motivations for benzodiazepine use in community sample

An online survey was administered targeting adult people (18 years of age or older) who use BZDs. Overall, 7677 individuals completed the questionnaire, however, only those data were included in the final analyses who reported past year BZD use and provided responses on more than half of the items measuring motives for BZD use. In addition, participants' invalid textual responses were also excluded. Based on these criteria, 1424 individuals were included in the final sample, with 81.21% female (n=1157); and 18.19% male participants (n=259), while 0.56% of the sample reported other gender (n=8). The mean age was 49.31 years (SD=14.75). The study was approved by the Institutional Review Board of the Faculty of Education and Psychology, ELTE Eötvös Loránd University (Budapest, Hungary). Data from this sample were used in Study 5.

1.6. Motivations for benzodiazepine use in clinical sample

Data collection was conducted at the Department of Psychiatry, University of Szeged, Hungary targeting hospitalized adult (18 years of age or older) patients with psychiatric disorders who used BZDs before their admission. The exclusion criteria were dementia, acute psychosis, withdrawal, or being under guardianship. Based on these criteria, 113 participants were included in the study with 61.06% (n=69) female and 38.94% (n=44) male participants. The mean age was 46.13 years (SD=14.54). The study was approved by the Regional and Institutional Review Board of Human Investigations in University of Szeged. Data from the clinical sample were also used in Study 5.

2. Materials and methods

Study 1: The prevalence of sedative/hypnotic use in a representative Hungarian adult population

Measures

The prevalence of sedative and hypnotic use (including NMU) was explored by the revised questions of the Epidemiological Model Questionnaire (EMQ) (EMCDDA, 2002; Karjalainen, 2018). The NMU was defined as the use of these substances without medical prescription, in larger doses, for longer periods of time than recommended and/or for different purposes than prescribed (EMCDDA, 2002; Karjalainen, 2018).

Methods

IBM SPSS 24 was used for statistical analysis (IBM Corp, 2016). During the analyses, Chi-Square tests were conducted to explore the gender differences in the past month and past year prevalence of sedative/hypnotic use in general and NMU as well as in the frequency of these behaviors. Statistical significance was considered if $p < 0.05$.

Study 2: The severity of symptoms of behavioral addictions among young adults using non-prescribed sedatives/hypnotics

Measures

In the BLS sample, the prevalence of sedative and hypnotic use (including NMU) was defined and investigated the same way as in the NSAPH sample (see in Study 1). In the PGA study, the non-medical sedative/hypnotic use was assessed by the following questions: "Have you ever used sedatives, hypnotics without medical prescription or with alcohol? If yes, when was the last time you used?" The behavioral addictions shown in Table 2 were included in Study 2 and are considered as common behaviors among young adults:

Table 2: *Characteristics of the instruments assessing the symptoms of behavioral addictions in the BLS and PGA samples*

<i>The assessed construct</i>	Sample	Scale	References	Characteristics of the used scale	α
Problematic internet use	BLS	Problematic Internet Use Questionnaire (PIUQ) – 9-item version	Demetrovics et al., 2008; Koronczai et al., 2011	9 items; Likert scale ranging from 1 to 5	0.93
	PGA	Problematic Internet Use Questionnaire (PIUQ) – 6-item version	Demetrovics et al., 2016	6 items; Likert scale ranging from 1 to 5	0.75

Problematic video gaming	BLS	Ten-Item Internet Gaming Disorder Test (IGDT-10)	Király et al., 2017, 2019	10 items; Likert scale ranging from 0 to 2	0.90
	PGA	Problematic Online Gaming Questionnaire (POGQ)	Demetrovics et al., 2011; Pápay et al., 2013	12 items; Likert scale ranging from 1 to 5	0.92
Problematic social media use	BLS	Bergen Social Media Addiction Scale (BSMAS)	Andreassen et al., 2017; Bányai et al., 2017	6 items; Likert scale ranging from 1 to 5	0.90
	PGA				0.82
Problem gambling	BLS	Problem Gambling Severity Index (PGSI)	Gyollai et al., 2013	9 items; Likert scale ranging from 0 to 3	0.92
	PGA	Diagnostic Statistical Manual-IV-Adapted for Juveniles (DSM-IV-MR-J)	Fisher, 2000	12 yes/no items	0.79
Exercise addiction	BLS	Exercise Addiction Inventory (EAI)	Demetrovics & Kurimay, 2008; Griffiths et al., 2005; Mónok et al., 2012; Terry et al., 2004	6 items; Likert scale ranging from 1 to 6	0.93
	PGA				0.78
Eating disorders	BLS	SCOFF Questionnaire	Morgan et al., 1999	5 yes/no items	0.73
	PGA				0.46
Compulsive buying behavior	BLS	Richmond Compulsive Buying Scale (RCBS)	Maraz et al., 2015; Ridgway et al., 2008	6 items; Likert scale ranging from 1 to 7	0.94
	PGA	-	-	-	-
Problematic mobile phone use	BLS	Dependence subscale of Problematic Mobile Phone Use Questionnaire (PMPUQ-SV)	Lopez-Fernandez et al., 2014	5 items; Likert scale ranging from 1 to 4	0.88
	PGA	-	-	-	-
Work addiction	BLS	Bergen Work Addiction Scale (BWAS)	Andreassen et al., 2012; Orosz et al., 2016	7 items; Likert scale ranging from 0 to 4	0.87
	PGA	-	-	-	-
Problematic hair pulling	BLS	-	-	-	-
	PGA	Massachusetts General Hospital Hairpulling Scale (MGH-HPS)	Keuthen et al., 2014	7 items; Likert scale ranging from 0 to 4	0.94

Abbreviations: BLS: Budapest Longitudinal Study; PGA: Psychological and Genetic Factors of Addictive Behaviors; α : Cronbach's α

Methods

IBM SPSS 24 was used for statistical analysis (IBM Corp, 2016). During the analyses, three groups were formed based on the NMU of sedatives and hypnotics to explore the severity of symptoms of the aforementioned behavioral addictions. The first group was the non-user group (NU) which included participants who had never used sedatives/hypnotics non-medically; the second group was the lifetime users' group (LU) with participants who reported NMU during their lifetime, but not in the past 30 days; and the third group was the current user group (CU) including participants who reported NMU in the past 30 days.

Some of the behavioral addictions (compulsive buying behavior, problematic mobile phone use, work addictions, and hair pulling) were investigated in only one of the samples, while distinct behavioral addictions (problematic video gaming and problem gambling) were operationalized in different ways across the two samples (see below in *Measures*). Therefore, analyses were conducted separately. Non-parametric Kruskal-Wallis tests (KW) were used to explore the severity of behavioral addiction symptoms in the three groups due to the different number and non-normal distribution of the participants in each group (Kolmogorov-Smirnov Goodness-of-Fit Test: $p>0.05$). In case of significant KW, Mann-Whitney (MW) tests were conducted for post-hoc analyses. Statistical significance were considered if $p<0.05$ for the KW, and $p<0.017$ for the MW (after Bonferroni correction).

Study 3: The potential role of religious status in the patterns of sedative/hypnotic use

Measures

Study 3 was conducted using the NSAPH and BLS samples, therefore, for the definition and assessment of sedative/hypnotic use (including NMU) see below the *Measures* in Study 1 (p. 20). Religiosity was defined in both samples as the individual's subjective perception of their own religious status. It was assessed by the following question: "Which of the following statements describes you the best?" (1=religious, following the rules of a church; 2=religious, in his/her own way; 3=don't know whether he/she is religious; 4=not religious; 5=atheist).

Methods

For the statistical analyses, IBM SPSS 24 was used (IBM Corp, 2016). The previous literature investigating the association between religiosity and addictions mainly focuses on the individual's own understanding of the 'higher power', independent of the type of the religion and the religious practice (Dermatis & Galanter, 2016). Therefore, three groups were formed for the present analysis: religious; agnostic, and non-religious. The term 'agnostic' refers to participants being uncertain or undecided about their religious status.

Chi-Square tests were conducted to investigate the differences in the past-year non-medical sedative/hypnotic use across the three religious status groups (religious, agnostic and non-religious) in the national representative adult sample of Hungary and in the representative young adult sample of Budapest. Adjusted standardized residuals (ASRs) were calculated to determine which groups contributed significantly to the results of Chi-Square tests.

Study 4: The summary of motivations for benzodiazepine use

Measures

During the collection of motivations for BZD use, participants selected by snowball sampling were asked about their BZD use (including NMU) using the revised questions of the EMQ (EMCDDA, 2002; Karjalainen, 2018) and to complete the following sentence in their own words: “I use benzodiazepines because...”

Methods

Respondents were encouraged to address as many reasons for their BZD use as possible. Beside the collection of BZD use motivations from BZD users, motivations were also collected from the literature of studies focusing on this topic. During the review of the articles, “motivation” OR “motives” AND “benzodiazepine” OR were used as key search terms. Furthermore, the items of the Hungarian version of Drinking Motives Questionnaire (DMQ-R) (Cooper, 1994; Németh et al., 2012) were also included in the collection of the motivations by changing the term „alcohol” to „benzodiazepines”.

Study 5: Motivations for benzodiazepine use in a community and in a clinical sample

Measures

Participants completed the same questionnaire with questions related to BZD use and NMU in both samples. The frequency of BZD use and NMU in the past year were examined based on the questions of the EMQ (EMCDDA, 2002; Karjalainen, 2018). NMU was defined as using BZDs without medical prescription, in greater doses or frequency, and/or for different purposes than prescribed (i.e., with alcohol or other substances). BZD motives were measured by the items collected in Study 4. The participants indicated on a Likert scale from 1 to 5 (1=never/almost never; 5=almost always/always) how often did they use BZDs for the specified reason in the past year. For the items of the potential BZD use motives questionnaire see the Results of Study 4. Participants were also asked if they acquired BZDs from an alternate source other than their doctor (i.e. from a family member, a friend, another doctor, a stranger or through the Internet). The self-perceived 11 symptoms of BZD use disorder indicated in the

DSM-5 (e.g. tolerance, withdrawal symptoms, etc.) (American Psychiatric Association, 2013) were also assessed. High rates of internal consistency were observed in both the community ($\alpha=0.81$) and clinical samples ($\alpha=0.83$). For standardized scales and questionnaires measuring distinct psychological constructs and substance use see Table 3.

Table 3: *Characteristics of the instruments assessing psychological constructs and substance use in the community and in the clinical sample*

<i>The assessed construct</i>	Scale	References	Characteristics of the used scale	α in the community sample	α in the clinical sample
Impulsivity	Barratt Impulsiveness Scale (BIS-R-21-SF)	Barratt, 1959; Kapitány-Fövény, 2021; Kapitány-Fövény et al., 2020; Patton et al., 1995	10 items; Likert scale ranging from 1 to 4	0.80	0.79
Rumination	Ruminative Response Scale (RRS)	Eszlári & Kökönyei, 2021; Kokonyei et al., 2016; Treynor et al., 2003	10 items; Likert scale ranging from 1 to 4	0.87	0.86
Well-being	WBI-5	Martos & Csordás, 2022; Susánszky et al., 2006; World Health Organization, 1998	5 items; Likert scale ranging from 0 to 3	0.88	0.88
Stress	Perceived Stress Scale (PSS-4)	Cohen et al., 1983; Du et al., 2023	4 items; Likert scale ranging from 0 to 4	0.84	0.71
Sleeping difficulties	Athens Insomnia Scale (AIS-8)	Soldatos et al., 2000, 2003	8 items; scale ranging from 0 to 3	0.84	0.88
Hazardous alcohol use	Alcohol Use Disorders Identification Test (AUDIT)	Allen et al., 1997; Horváth et al., 2021; Saunders et al., 1993	10 items; Likert scale ranging from 0 to 4	0.90	0.95
Hazardous cannabis use	Cannabis Abuse Screening Test (CAST)	Legleye et al., 2007, 2011	6 items; Likert scale ranging from 0 to 4	0.87	0.87

Abbreviations: α : Cronbach's α

Methods

In the community sample, an online survey was administered in Qualtrics between February 2023 and April 2024. After informing the participants about the goals of the research, they had to accept informed consent before starting the survey. The participation was anonymous, voluntary and can be cancelled at any time during the completion of the survey. Incentives were offered: sweepstakes for ten vouchers with a value of approximately €50 each.

The clinical study was conducted at the Department of Psychiatry, University of Szeged, Hungary between December 2021 and July 2024 involving hospitalized adult patients with psychiatric disorders who used BZDs before their admission. Medical doctors explained the purpose and methodology of the study to the participants in a face-to-face manner. After providing their written informed consent, participants answered an anonymous, self-reported survey. All patients could discontinue the survey at any time. Medical records were also used to collect sociodemographical data and data related to the patients' present or past hospitalizations.

During the statistical analyses, the factor structure of the questionnaire measuring BZD motives was developed first, with exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) in the community sample. Therefore, this sample was randomly divided into two more samples: EFA was performed in Sample 1 (N=712) and CFA in Sample 2 (N=712). In both EFA and CFA, the items of the questionnaire were determined as ordinal variables and the weighted least squares means and variances adjusted (WLSMV) estimation procedure was applied to correct for item-level deviations from the expected normal distribution. In EFA, the goal was to achieve a factor structure with primarily and moderately-strongly loading items on only one factor and low cross-loadings on the other factors. Thus, items were considered suitable if the strongest factor loading was $>|0.40|$, further factor loadings were $<|0.30|$, and the difference between the two strongest factor loadings was >0.20 (Howard, 2016). All items that did not fit these criteria were excluded. The decision on the number of final factors was based on the scree plot and the content of the factors. The goal was to have at least 3 items on each factor. Oblique rotation was used. The goodness-of-fit of the factor structure was tested by using CFA on Sample 2: optimal fit was indicated with ≥ 0.95 comparative fit index (CFI) and Tucker-Lewis index (TLI) and ≤ 0.05 root mean square error of approximation (RMSEA) and standardized root mean square residual (SRMR). For adequate fit, the values of the CFI and TLI had to be ≥ 0.90 and the values of the RMSEA and SRMR had to be ≤ 0.08 . Interfactor correlations were also calculated based on EFA and CFA in the community sample, while correlations between subscales of BZD motives were also investigated in the clinical sample. A maximum likelihood robust to non-normality (MLR) estimation procedure was applied for the latter. To examine the factors' internal consistency, Cronbach's α was calculated in both subsamples of the community sample and in the clinical sample. The developed questionnaire was named as the Motives for Benzodiazepine Use Questionnaire (MBUQ-48) (see in Table S3 of the Supplementary Material).

The construct validity of the developed questionnaire was examined across a number of analyses. First of all, bivariate correlations were applied in the community and clinical samples between each subscale of BZD motives and gender (including only male and female participants due to the very low number of participants from ‘other’ gender group), age, illegal BZD access, frequency of BZD use (both medical and non-medical), severity of the symptoms of BZD use disorder, well-being, stress, rumination, sleep difficulties, impulsivity, hazardous alcohol use and hazardous cannabis use. In addition, biserial and polyserial correlations were calculated with current treatment for a psychiatric or neurologic disorder in the community sample, while in the clinical sample correlations were also estimated with the presence of psychiatric disorders. Finally, bivariate correlations were also applied by using the WLSMV technique.

To test the incremental validity of the developed questionnaire, regression analyses were used to investigate the predictive effects of motives on different outcome variables of BZD use. In the community sample, the effects of gender (as previously indicated, only male and female participants), age, well-being, stress, rumination, sleep difficulties, impulsivity, hazardous alcohol use and hazardous cannabis use, current treatment for a psychiatric/neurologic disorder were controlled. In the clinical sample, due to the small sample size, only the subscales BZD motives were entered as predictor variables in regression models, while the effects of further variables were not controlled. Predictive effects were examined for six outcome variables in both samples: illegal BZD access, frequency of medical BZD use, frequency of non-medical BZD use and BZD use disorder symptom severity. First, probit regression was applied to predict the dichotomous outcome variable, while ordinal regression models were used to predict different frequencies of medical and non-medical BZD use and linear regression was used in the last case.

Finally, supplementary analyses were performed to compare the community and clinical samples for each variable. Chi-square tests were applied for categorical and ordinal variables, and independent samples t-tests were used for continuous variables. Post hoc power analyses were also applied. Analyses were performed using IBM SPSS 26 software (IBM Corp., 2018), factor analysis and validity testing for BZD motives were performed with MPlus 8.0 software (Muthén & Muthén, 2017), while sensitivity power analyses were performed by using G*Power 3 software (Faul et al., 2007).

VI. Results

Study 1: The prevalence of sedative/hypnotic use and non-medical use in a representative Hungarian adult population

1. The prevalence of sedative/hypnotic use in the Hungarian adult population

In the Hungarian adult population aged between 18 and 64 years, 8.3% ($\pm 1.5\%$) have consumed sedative and/or hypnotic during their lifetime with or without medical prescription. The past year prevalence of sedative/hypnotic use was 7.5% ($\pm 1.4\%$), while the past month prevalence was 6.7% ($\pm 1.4\%$) (see in Table 4). During the past year, 1.7% ($\pm 0.7\%$) of the adult population (more than a quarter of the users (26.3% $\pm 9.4\%$)) reported sedative and hypnotic use at least 4 times a week. During the past 30 days before the research 1.4% ($\pm 0.6\%$) of the adult population (slightly more than a fifth of users (21.5% $\pm 8.6\%$)) consumed sedatives or hypnotics at least 20 times. The past year and past month prevalence as well as the frequency of sedative and hypnotic use was significantly different between male and female participants (Table 4). Among female participants, both past year and past month prevalence of sedative/hypnotic use were approximately twice compared to male group. However, no significant difference was found in the frequency of use among participants who reported sedative/hypnotic use in the past year and past month ($\chi^2(3)=3.13$; $p=0.372$; $V=0.19$; $\chi^2(3)=4.60$; $p=0.203$; $V=0.23$).

Table 4: *Gender differences in the prevalence and frequency of sedative/hypnotic use in the Hungarian adult population*

	Male		Female		Sig. (<i>p-value</i>)	In aggregate		
	N	%	N	%		N	%	CI
Past year prevalence	604	4.8	684	9.8	0.001	1288	7.5	± 1.4
Past month prevalence	614	4.6	690	8.7	0.003	1304	6.7	± 1.4
Consumption at least 4 times a week in the past year	597	0.5	679	2.8	0.001	1277	1.7	± 0.7
Consumption at least 20 times in the past month	614	0.5	690	2.3	0.012	1304	1.4	± 0.6

2. The prevalence of non-medical sedative/hypnotic use in the Hungarian adult population

The lifetime prevalence of non-medical sedative/hypnotic use was 3.2% ($\pm 1\%$) in the Hungarian adult population. The past year prevalence of NMU was 2.9% ($\pm 0.9\%$), while the past month prevalence was 2.4% ($\pm 0.8\%$) (Table 5). During the past year prior to data collection, 0.1% ($\pm 0.2\%$) of the adult population (2.9% ($\pm 6.1\%$) of the sedative/hypnotic users)

consumed these medications non-medically at least 4 times a week. In the past 30 days prior to the research, 0.2% ($\pm 0.2\%$) of the adult population (6.2% ($\pm 8.4\%$) of the users) consumed sedatives/hypnotics non-medically more than 20 times. There was no significant difference in terms of gender in the past year and past month prevalence of NMU of sedatives/hypnotics ($\chi^2(1)=0.04$; $p=0.839$; $\phi=0.01$; $\chi^2(1)=0.49$; $p=0.486$; $\phi=0.02$) nor was there any in the frequency of use in the past year and past month ($\chi^2(4)=1.00$; $p=0.911$; $V=0.03$; $\chi^2(4)=4.85$; $p=0.303$; $V=0.06$) (Table 5). Within the sedative/hypnotic users, also no significant differences were found regarding the frequency of non-medical use ($\chi^2(3)=0.95$; $p=0.813$; $V=0.18$; $\chi^2(3)=4.57$; $p=0.206$; $V=0.38$).

Table 5: *Gender differences in the prevalence and frequency of non-medical sedative/hypnotic use in the Hungarian adult population*

	Male		Female		Sig. (<i>p</i> -value)	In aggregate		
	N	%	N	%		N	%	CI
Past year prevalence	605	3.0	682	2.8	ns	1286	2.9	± 0.9
Past month prevalence	614	2.8	691	2.2	ns	1305	2.4	± 0.8
Consumption at least 4 times a week in the past year	600	0.0	679	0.1	ns	1278	0.1	± 0.2
Consumption at least 20 times in the past month	613	0.0	691	0.3	ns	1305	0.2	± 0.2

Abbreviations: ns: non-significant

Study 2: The severity of symptoms of behavioral addictions among young adults using non-prescribed sedatives/hypnotics

In the BLS sample, the NU group included 97.9% of the participants ($n=3713$), while 0.6% was assigned to the LU group ($n=23$) and 1.5% to the CU group ($n=57$). In the PGA Study, 92.3% of participants were assigned to the NU group ($n=2746$). The LU group included 6% ($n=178$) and the CU group included 1.7% of the participants ($n=52$).

Table 6 shows the medians and mean ranks of assessments examining the severity of behavioral addiction symptoms in groups as well as the results of the KWs.

Table 6: *Medians and mean ranks of scales measuring the severity of distinct behavioral addiction symptoms in the three groups formed based on non-medical prescription sedative/hypnotic use*

Behavioral addiction	Group	BLS (N=3890)					PGA (N=3003)				
		<i>n</i>	Median	Mean rank	<i>H</i> -value	Sig. (<i>p</i> -value)	<i>n</i>	Median	Mean rank	<i>H</i> -value	Sig. (<i>p</i> -value)

Problematic internet use	NU	3531	9.00	1790.06	38.435	v	0.001	2716	9.00	1464.32	2.624	0.269	
	LU	19	11.90	2341.39				175	10.00	1565.62			
	CU	50	13.22	2570.52				51	10.00	1531.09			
Problematic video gaming	NU	3657	0.00	1869.38	6.280	v	0.043	2608	12.00	1417.41	2.191	0.334	
	LU	23	0.00	1932.43				168	12.00	1388.28			
	CU	54	0.00	1920.29				49	12.00	1262.85			
Problematic social media use	NU	3539	6.00	1797.89	34.757	v	0.001	1594	8.00	846.34	16.435	v	0.001
	LU	21	8.00	2298.83				100	9.00	972.43			
	CU	54	9.18	2515.97				21	12.00	1197.90			
Problem gambling	NU	3652	0.00	1862.26	57.971	v	0.001	2704	0.00	1459.25	7.718	0.021	
	LU	23	0.00	2082.63				177	0.00	1572.25			
	CU	57	0.00	2313.68				51	0.00	1483.79			
Exercise addiction	NU	3654	0.00	1864.70	25.814	v	0.001	2704	12.00	1473.00	6.886	0.032	
	LU	23	0.00	1960.30				177	10.00	1327.60			
	CU	57	0.00	2338.69				52	13.50	1629.67			
Eating disorders	NU	3587	0.00	1824.53	75.518	v	0.001	2716	0.00	1448.61	35.441	v	0.001
	LU	22	1.00	2684.00				177	0.00	1750.26			
	CU	56	0.00	2404.15				52	1.00	1803.01			
Compulsive buying behavior	NU	3655	0.00	1866.16	9.142	v	0.011						
	LU	23	0.00	1914.37									
	CU	56	0.00	2169.63									
Problematic mobile phone use	NU	3634	15.00	1872.20	13.940	v	0.001						
	LU	23	13.00	1457.63									
	CU	57	13.00	1405.89									
Work addiction	NU	3663	2.00	1862.00	44.969	v	0.001						
	LU	23	1.38	1853.59									
	CU	57	8.00	2786.54									
Hair pulling	NU							1500	0.00	806.08	0.579	0.749	
	LU			-				94	0.00	822.41			
	CU							20	0.00	843.75			

Abbreviations: BLS: Budapest Longitudinal Study; PGA: Psychological and Genetic Factors of Addictive Behaviors Study; NU-non-users; LU: lifetime users; CU: current users; Values in bold indicate statistically significant results.

Compared to the NU group, the severity of symptoms of problematic internet use was significantly higher among both LUs (MW: $p=0.013$) and CUs (MW: $p<0.001$) in the BLS sample. The severity of problematic social media symptoms was significantly higher in the CU group, compared to the NU group in the BLS (MW: $p<0.001$) as well as in the PGA (MW: $p=0.001$) sample. Furthermore, in the PGA sample, the severity of problematic social media use symptoms was also significantly higher in the LU group compared to the NU participants (MW: $p=0.013$). In the BLS sample, the severity of problem gambling symptoms was significantly higher among CU participants, compared to the NUs (MW: $p<0.001$) and among LUs in the PGA sample (MW: $p=0.006$). The severity of symptoms of exercise addictions was significantly higher among the CU participants of the BLS sample, compared to the NUs (MW:

$p < 0.001$). Although the first statistical analysis (i.e. the KW) showed significant difference in the symptoms of exercise addiction in the PGA sample, the post hoc MW showed no significant difference between the three groups. In addition, regarding the eating disorders, compared to the NU groups of both the BLS and PGA samples, the severity of symptoms was significantly higher among LU participants (MW in BLS: $p < 0.001$; PGA: $p < 0.001$) as well as among CUs (MW in BLS: $p < 0.001$; PGA: $p = 0.001$). Furthermore, the severity of the symptoms of compulsive buying behavior was also significantly higher among CUs, compared to the NUs (MW: $p < 0.001$). Regarding the problematic mobile phone use, the NUs showed significantly more severe symptoms, compared to the CU participants (MW: $p = 0.001$). The severity of work addiction symptoms was significantly higher among CU participants compared to both NUs (MW: $p < 0.001$) and LUs (MW: $p = 0.001$). Finally, no significant differences were found between the three groups regarding the severity of problematic internet use in PGA sample, the severity of problematic video gaming in both of the samples, and the severity of hair-pulling symptoms in the PGA sample.

Study 3: The potential role of religious status in the patterns of sedative/hypnotic use

The past-year prevalence of non-medical sedative/hypnotic use in the three religious status groups of the NSAPH and BLS samples is presented in Table 7. The past-year prevalence of NMU of sedatives/hypnotics was significantly different among groups of the NSAPH sample with significantly lower level of religious participants than expected, based on the ASR indicator. However, the prevalence of past year non-medical sedative/hypnotic use did not differ significantly between groups in the BLS sample.

Table 7: The number and percentage of participants who reported non-medical sedative/hypnotic use during the past year in the three religious status groups of the NSAPH and BLS samples

Group	NSAPH (n=1385)						BLS (n=3890)					
	Yes (%)	N	ASR	χ^2 (df)	Sig. (p-value)	V	Yes (%)	N	ASR	χ^2 (df)	Sig. (p-value)	V
Religious	1.6	10	-2.7	8.928 (2)	0.012	0.084	1.7	23	-1.0	5.210 (2)	0.074	0.038
Agnostic	6.3	5	1.8				3.5	13	2.2			
Non-religious	3.9	22	1.9				1.9	35	-0.4			

Abbreviations: NSAPH: National Survey on Addiction Problems in Hungary; BLS: Budapest Longitudinal Study; ASR: adjusted standardized residuals; V: Cramer's V value. Values in bold indicate statistically significant results.

Study 4: The summary of motivations for benzodiazepine use

Based on our collection by snowball sampling, 26 different motivations for BZD use were explored, after the literature search, 124 further motivations were identified (including the items of the Hungarian version of DMQ-R (Németh et al., 2012; Cooper, 1994)). Thus, 150 motivations for BZD use were collected. After excluding the duplicate items and merging the similar ones, 82 motivations were left. For these 82 motivations, see Table S1 of the Supplementary Material.

Study 5: Motivations for benzodiazepine use in a community and in a clinical sample

1. Preliminary analysis: Comparison of the community and clinical samples

For the descriptive statistics (and comparisons) of the community and clinical samples see Table S2 of the Supplementary Material. Compared to the community sample, participants in the clinical sample were characterized by significantly lower age, higher proportion of males, more frequent medical BDZ use and non-medical BDZ use, higher BZD use disorder symptom severity as well as lower well-being, higher levels of stress, rumination, impulsivity, sleep difficulties, and hazardous alcohol use.

2. Exploratory and confirmatory factor analyses

18 items had a response option with a frequency of lower than 10, therefore, they were excluded prior to the EFA. In addition, further 16 items were excluded as they did not meet the defined criteria for factor loadings. Thus, the final EFA model contained 48 items. Figure 2 presents the scree plot related to the model. Based on the scree plot as well as the content of the factors, a four-factor model was selected ($\chi^2 [942]=2156.04$; $p<0.001$; CFI=0.99; TLI=0.98; RMSEA=0.04; SRMR=0.05).

Figure 2: *The scree plot related to the 48-item EFA model*

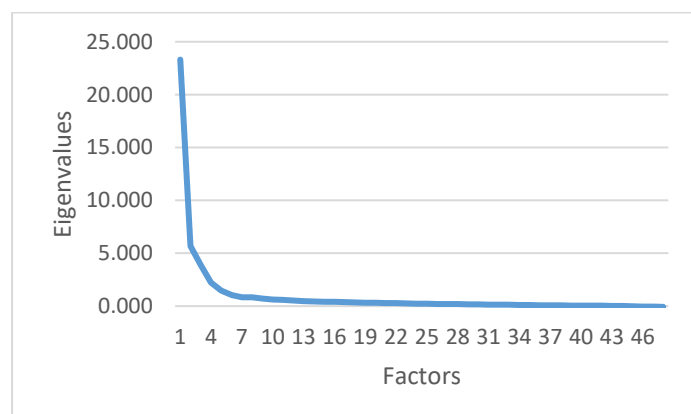


Table 8 shows the standardized factor loadings of the four-factor EFA model. From the 48 items, 18 loaded primarily and strongly or close-to-strongly on Factor 1. These items

included motives related to positive affective changes, positive effects on cognitive or task-related performance, positive effects on social life, and enhancement of creativity and awareness due to BZD use. Therefore, Factor 1 was named as ‘personal and interpersonal benefits’. A total of 5 items loaded primarily and strongly on Factor 2, including motivations related to alcohol or other psychoactive substance use, as well as coping with the use and non-use of alcohol and other substances. Thus, Factor 2 was named as ‘substance use regulation’ factor. Furthermore, 18 items loaded primarily, strongly and close-to-strongly on Factor 3. These motives described alleviating and coping with different negative affective states, such as stress, psychological tension or strain, depression, anxiety, as well as coping with difficult situations and problems in general. Factor 3 also comprises motives for improving mood or affective states, and motives of escapism. Therefore, Factor 3 was labelled ‘coping’. Finally, seven items loaded strongly on Factor 4 which was named ‘sleep facilitation’, because the items generally represented positive changes to sleep, specifically to its different stages and its quality. Based on the CFA with Sample 2, the four-factor model showed an adequate fit to the data ($\chi^2 [1074]=2784.56$, $p<0.001$; CFI=0.98; TLI=0.97; RMSEA=0.05; SRMR=0.08). All standardized factor loadings were significant, strong, and positive. Therefore, the MBUQ-48 was accepted based on the results of the EFA and CFA.

3. Inter-factor correlations and internal consistency

Table 9 demonstrates the inter-factor correlations and internal reliabilities in both community and clinical samples. The ‘personal and interpersonal benefits’ factor showed a strong positive association with ‘coping’, moderate-to-strong positive association with ‘substance use regulation’, and weak-to-moderate positive association with ‘sleep facilitation’. ‘Coping’ showed moderate-to-strong positive association with ‘sleep facilitation’ and weak-to-moderate positive correlation with ‘substance use regulation’ in both samples. The strongest levels of inter-factor correlations were observed between ‘personal and interpersonal benefits’ and ‘coping’ motives in both samples, while the correlation between ‘coping’ and ‘sleep facilitation’ was also very strong in the clinical sample. Very good internal consistency was observed in both samples for the factors of ‘personal and interpersonal benefits’, ‘coping’ and ‘sleep facilitation’. Adequate and very good internal consistency was observed in the case of ‘substance use regulation’.

4. Bivariate correlations

Table 10 demonstrates bivariate correlations between motivation subscales and study variables. Only those correlations are reported here which were significant in both samples or

were significant and moderate in either of the two samples. Higher levels of ‘personal and interpersonal benefits’ had significant weak-to-strong positive correlations with higher frequency of medical BZD use, frequency of non-medical BZD use with greater dose or frequency and with alcohol or other substances, BZD use disorder symptom severity, rumination, stress, impulsivity, and sleep difficulties in both samples. In addition, higher levels of ‘substance use regulation’ showed significant, positive and weak-to-moderate correlations with being male, the frequency of all forms of non-medical BZD use, rumination, and hazardous alcohol use in both samples. Higher levels of ‘coping motives’ showed significant, positive and weak-to-strong correlations with frequency of medical BZD use, frequency of non-medical BZD use with greater dose or frequency and with alcohol or other substances, illegal BZD access, BZD use disorder symptom severity, stress, sleep difficulties, rumination, impulsivity, and hazardous cannabis use in both samples. Higher levels of ‘sleep facilitation’ showed significant weak-to-moderate positive correlations with higher rates of frequency of non-medical BZD use with greater dose or frequency and with alcohol or other substances, illegal BZD access, BZD use disorder symptom severity, stress, rumination and sleep difficulties in both samples. Furthermore, higher levels of ‘substance use regulation’ showed significant weak positive correlations with illegal BZD access and hazardous cannabis use in the community sample, while higher levels of ‘coping’ had a significant weak negative correlation with well-being. Also in the community sample, the presence of current treatment for a psychiatric or neurologic disorder showed significant, positive, and moderate correlation with ‘personal and interpersonal benefits’ and ‘coping’.

In the clinical sample, frequency of BZD use without medical prescription showed significant, positive and moderate correlations with ‘coping’ and ‘personal and interpersonal benefits’ motives. Significant, positive and moderate-to-strong correlations were found for ‘substance use regulation’ with the presence of alcohol use-related psychiatric disorders and the absence of mood disorder. Finally, positive and moderate-to-strong correlation was between ‘sleep facilitation’ and the presence of other substance use-related psychiatric disorders.

5. Predictive effects

Predictive effects on different outcomes of BZD use are demonstrated in Tables 11 and 12 in both samples. Only the significant predictive effects related to BZD motives are reported here. Illegal BZD access was significantly, positively, and weakly associated with ‘coping’ and ‘substance use regulation’ in the community sample. In addition, significant, positive, and weak associations were found between the frequency of medical BZD use and ‘coping’, ‘personal

and interpersonal benefits', and 'sleep facilitation' in the community sample. Also in the community sample, all four motives had significant, positive, and weak predictive associations with the frequency of non-medical BZD use with greater dose or frequency and on BZD use disorder symptom severity. Finally, 'substance use regulation' was significantly, positively, and weakly associated with the frequency of non-medical BZD use in the community sample.

In the clinical sample, 'coping' showed significant, positive, moderate-to-strong predictive effects on the frequency of medical BZD use, as well as of non-medical BZD use with greater dose or frequency and with alcohol or other substances, and BZD use disorder symptom severity. Furthermore, higher frequency of BZD use without prescription showed significant and moderate association with higher 'substance use regulation' and lower 'sleep facilitation' in the clinical sample. However, the bivariate correlation with BZD use without prescription was non-significant, therefore, this negative association should be interpreted with caution.

Table 8: *Standardized factor loadings and internal reliability indices based on exploratory and confirmatory factor analyses in the community sample*

	Sample 1: Exploratory factor analysis (N=712)				Sample 2: Confirmatory factor analysis (N=712)			
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 1	Factor 2	Factor 3	Factor 4
Because it helps in studying	0.92***	-0.18	-0.08	-0.02	0.69***			
Because it helps me concentrate	0.91***	-0.22***	0.02	0.09	0.85***			
To be more efficient	0.89***	-0.21***	0.08	0.06	0.90***			
To don't feel like I'm missing out on something	0.88***	0.20	-0.17	-0.04	0.80***			
Because it makes me more creative	0.86***	0.10	-0.07	-0.02	0.80***			
To increase my awareness	0.84***	-0.18	0.00	0.04	0.74***			
To get energy	0.82***	-0.02	0.00	0.22***	0.87***			
Because it makes me more open to new experiences	0.79***	0.06	0.11	-0.01	0.86***			
To feel refreshed	0.78***	0.07	-0.06	0.18***	0.68***			
To fit into a group of people I like	0.76***	0.18	0.00	0.07	0.83***			
To stay focused	0.76***	-0.22***	0.22***	-0.01	0.89***			
To have fun with my friends	0.76***	0.18	0.04	0.06	0.81***			
To make me feel more confident	0.70***	0.05	0.26***	-0.14***	0.86***			
To be able to fulfill my duties	0.69***	-0.25***	0.18	-0.04	0.70***			
To make me feel more assertive	0.69***	0.06	0.26***	-0.09	0.91***			
To make it easier for me to socialize	0.68***	0.20***	0.11	-0.03	0.85***			
Because it helps me see things from a new perspective	0.55***	0.19***	0.23***	0.05	0.78***			
To get high	0.49***	0.23***	0.23***	0.08	0.80***			

	Sample 1: Exploratory factor analysis (N=712)				Sample 2: Confirmatory factor analysis (N=712)			
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 1	Factor 2	Factor 3	Factor 4
Because it helps to deal with my alcohol problems	0.08	0.97***	0.02	-0.18		0.96***		
Because it helps to drink less alcohol	0.13	0.86***	0.03	-0.15		0.96***		
To counteract the effects of other drugs	-0.05	0.80***	-0.04	0.18		0.61***		
Because it alleviates the lack of alcohol or other drugs	0.13	0.80***	0.09	-0.06		0.92***		
To reduce the effect of other drugs	-0.03	0.73***	-0.03	0.19		0.81***		
Because it helps me when I'm tense	-0.10	-0.02	1.00***	0.00			0.90***	
Because it helps to deal with stress	-0.02	-0.01	0.93***	-0.02			0.86***	
To relieve my tension	0.01	-0.04	0.92***	-0.04			0.89***	
Because it helps me when I'm nervous	-0.10	0.09	0.90***	0.04			0.84***	
Because it eases my restlessness	-0.03	-0.02	0.90	0.04			0.89***	
To ease my anxiety	0.05	-0.18***	0.89***	-0.14***			0.86***	
Because it calms me down	-0.04	-0.07	0.84***	0.08			0.87***	
Because it helps in difficult times	0.08	0.01	0.77***	0.07			0.85***	
Because it helps in difficult situations	0.19***	-0.07	0.67***	-0.07			0.80***	
Because it eases my frustration	0.19***	0.13***	0.67***	0.00			0.85***	
To make my problems less pressing	-0.04	0.07	0.67***	0.09			0.75***	
To feel better	0.27***	0.06	0.63***	-0.03			0.85***	
To forget about my worries	0.14	0.22***	0.61***	0.13***			0.84***	
Because it eases my anger	0.04	0.27***	0.59***	0.14***			0.70***	

	Sample 1: Exploratory factor analysis (N=712)				Sample 2: Confirmatory factor analysis (N=712)			
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 1	Factor 2	Factor 3	Factor 4
Because it helps me to deal with depression	0.28***	-0.06	0.56***	0.03			0.76***	
Because it helps me to relax	0.04	0.16***	0.56***	0.26***			0.70***	
To avoid panic attacks	0.16	-0.22***	0.54***	-0.21***			0.59***	
Because it helps me not to think about everyday problems	0.22***	0.21***	0.49***	0.17***			0.85***	
Because it helps with sleep	0.06	-0.05	-0.05	0.98***				0.96***
Because it helps me to fall asleep	-0.02	0.00	0.01	0.97***				0.93***
To sleep well enough	0.07	-0.05	-0.02	0.95***				0.93***
To improve the quality of sleep	0.02	0.03	0.02	0.92***				0.92***
Because it helps me to reduce sleep disturbances	0.00	-0.05	0.09	0.91***				0.92***
Because it helps me to sleep deeper	-0.06	0.07	0.12	0.90***				0.94***
To be able to rest	0.10	-0.01	0.10	0.79***				0.86***

Values next to each item are standardized factor loadings (λ). Bolded factor loadings in exploratory factor analysis are ≥ 0.40 (in absolute value). Level of significance: *** $p < 0.001$ (to ease the interpretation of the findings, significant factor loadings at lower p-levels are not highlighted). Factor 1: Personal and interpersonal benefits; Factor 2: Substance use regulation; Factor 3: Coping; Factor 4: Sleep facilitation.

Table 9: *Inter-factor correlations, internal reliability indices, and descriptive statistics of the motivation subscales*

Community sample (N=1424)						Clinical sample (N=112)			
1.	2.	3.	4.	Cronbach's α	McDonald's ω	1.	2.	3.	4.

1. Personal and interpersonal benefits	-	0.50***	0.77***	0.24***	0.92	0.97	-				
2. Substance use regulation	0.39***	-	0.34***	0.24***	0.75	0.93	0.34**	-			
3. Coping	0.69***	0.17*	-	0.39***	0.95	0.97	0.72***	0.30**	-		
4. Sleep facilitation	0.22***	0.08	0.31***	-	0.96	0.98	0.47***	0.22*	0.71***	-	
Cronbach's α	0.94	0.77	0.95	0.97			0.95	0.85	0.97	0.95	
McDonald's ω	0.97	0.94	0.97	0.98			-	-	-	-	
M (SD)	6.48 (10.51)	0.78 (2.21)	23.13 (18.98)	14.06 (10.05)			14.43 (16.61)	3.19 (4.83)	36.02 (22.01)	17.10 (9.55)	

Notes. In the community sample correlation coefficients (r) below the diagonal are estimated based on exploratory factor analysis (Sample 1; $N=712$), while estimates above the diagonal are estimated based on confirmatory factor analysis (Sample 2; $N=712$). Cronbach's α values below the diagonal are estimated in Sample 1, while Cronbach's α values above the diagonal are estimated in Sample 2. In the clinical sample each motivation subscale was treated as observed variables (not latent variables) to calculate correlation coefficients. Mean (M) and standard deviation (SD) values are estimated based on the complete community and clinical samples. Level of significance: * $p<0.05$; ** $p<0.01$; *** $p<0.001$.

Table 10: *Bivariate correlations with each motivation subscale*

	Community sample (N=1424)				Clinical sample (N=113)			
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 1	Factor 2	Factor 3	Factor 4
Gender: males (vs. females)	0.06	0.29***	-0.02	-0.07	0.04	0.34***	-0.14	-0.03
Age	-0.10***	-0.19***	-0.16***	-0.01	-0.08	-0.13	-0.14	-0.06
Illegal BZD access: yes (vs. no)	0.12***	0.31***	0.21***	0.15***	0.22	0.15	0.42***	0.34**
Frequency of medical BZD use	0.28***	-0.01	0.29***	0.13***	0.19*	-0.13	0.33***	0.17
Frequency of non-medical BZD use: greater dose or frequency	0.37***	0.27***	0.44***	0.26***	0.39***	0.23*	0.59***	0.37***
Frequency of non-medical BZD use: with alcohol or other substances	0.26***	0.29***	0.31***	0.15***	0.46***	0.40***	0.54***	0.25*

	Community sample (N=1424)				Clinical sample (N=113)			
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 1	Factor 2	Factor 3	Factor 4
Frequency of non-medical BZD use: without prescription	-0.01	0.21***	0.05	0.07*	0.41***	0.46***	0.44***	0.18
BZD use disorder symptom severity	0.43***	0.28***	0.45***	0.27***	0.54***	0.15	0.62***	0.46***
Well-being	-0.19***	-0.05*	-0.32***	-0.14***	-0.12	-0.05	-0.15	-0.12
Stress	0.31***	0.13***	0.44***	0.16***	0.20*	0.05	0.34***	0.23**
Rumination	0.34***	0.13***	0.45***	0.18***	0.37***	0.19*	0.44***	0.25*
Sleep difficulties	0.18***	0.09***	0.25***	0.30***	0.32***	0.17	0.40***	0.41***
Impulsivity	0.25***	0.22***	0.30***	0.07**	0.27**	-0.01	0.41***	0.15
Alcohol use: hazardous use (vs. abstinence or low risk drinking)	0.19***	0.37***	0.22***	0.14***	-0.13	0.59***	0.03	-0.09
Cannabis use: hazardous use (vs. abstinence or low risk use)	0.09*	0.34***	0.15***	0.10*	0.08	-0.02	0.33*	0.02
Current treatment for a psychiatric or neurologic disorder: yes (vs. no)	0.39***	0.03	0.40***	0.07*	-	-	-	-
Alcohol-related disorders: presence (vs. absence)	-	-	-	-	-0.05	0.52***	0.00	-0.16
Other substance use-related disorders: presence (vs. absence)	-	-	-	-	0.24	0.20	0.29*	0.38**
Schizophrenia- and psychosis-related disorders: presence (vs. absence)	-	-	-	-	0.15	-0.21	-0.01	-0.02
Mood disorders: presence (vs. absence)	-	-	-	-	-0.05	-0.51***	0.02	0.23
Anxiety disorders: presence (vs. absence)	-	-	-	-	-0.11	0.06	-0.04	-0.04

Notes. Level of significance: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. Factor 1: Personal and interpersonal benefits; Factor 2: Substance use regulation; Factor 3: Coping; Factor 4: Sleep facilitation.

Table 11: *Predictive effects on outcomes of BZD use in the community sample*

	Outcome variables							
	Illegal access	BZD use	Frequency of medical BZD use	Frequency of medical BZD greater dose or frequency	non-use: or alcohol or substances	Frequency of non-medical BZD use: with other prescription	Frequency of non-medical BZD use: without prescription	BZD disorder symptom severity
Gender: males (vs. females)	0.07 (0.04)		0.01 (0.03)	0.12 (0.03)***		0.08 (0.04)*	0.08 (0.03)*	0.03 (0.02)
Age	-0.19 (0.04)***		0.24 (0.03)***	-0.07 (0.04)		-0.07 (0.05)	-0.24 (0.04)***	0.04 (0.03)
Well-being	0.04 (0.05)		-0.04 (0.03)	0.00 (0.05)		-0.03 (0.06)	-0.02 (0.05)	-0.02 (0.04)
Stress	0.04 (0.05)		0.06 (0.04)	0.03 (0.05)		-0.03 (0.06)	-0.01 (0.05)	0.01 (0.04)
Rumination	0.04 (0.04)		-0.07 (0.03)*	0.00 (0.04)		0.06 (0.05)	0.03 (0.04)	0.00 (0.03)
Sleep difficulties	0.05 (0.04)		-0.02 (0.03)	0.07 (0.04)		-0.04 (0.04)	0.08 (0.04)*	0.15 (0.03)***
Impulsivity	0.09 (0.04)*		-0.03 (0.03)	0.13 (0.04)***		0.09 (0.04)*	0.05 (0.03)	0.10 (0.03)***
Alcohol use: hazardous use (vs. abstinence or low risk drinking)	0.12 (0.04)**		-0.09 (0.03)**	0.09 (0.03)**		0.26 (0.03)***	0.08 (0.03)*	0.02 (0.02)
Cannabis use: hazardous use (vs. abstinence or low risk use)	0.15 (0.04)***		-0.04 (0.03)	0.08 (0.03)*		0.17 (0.03)***	0.10 (0.03)**	0.10 (0.02)***
Current treatment for a psychiatric or neurologic disorder: yes (vs. no)	-0.15 (0.03)***		0.45 (0.02)***	0.13 (0.04)***		0.09 (0.04)*	-0.36 (0.03)***	0.12 (0.02)***
Motives: personal and interpersonal benefits	-0.06 (0.04)		0.12 (0.03)***	0.10 (0.04)**		0.08 (0.04)	-0.07 (0.04)	0.15 (0.03)***

Motives: substance use regulation	0.13 (0.04)***	0.02 (0.03)	0.07 (0.04)*	0.05 (0.04)	0.07 (0.03)*	0.12 (0.02)***
Motives: coping	0.12 (0.05)*	0.10 (0.04)**	0.15 (0.05)**	0.08 (0.05)	0.06 (0.04)	0.18 (0.03)***
Motives: sleep facilitation	0.06 (0.04)	0.06 (0.03)*	0.11 (0.04)**	0.04 (0.04)	0.02 (0.04)	0.09 (0.03)***
Explained variance (R ²)	28%	35%	35%	32%	29%	34%

N=1313. Values next to each predictor variable are standardized regression coefficients (β) and standard error (SE) values. Level of significance: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 12: *Predictive effects on outcomes of BZD use in the clinical sample*

	Outcome variables					
	Illegal BZD access	Frequency of medical BZD use	Frequency of non-medical BZD use: greater dose or frequency	Frequency of non-medical BZD use: with alcohol or other substances	Frequency of non-medical BZD use: without prescription	BZD disorder symptom severity
Motives: personal and interpersonal benefits	-0.02 (0.21)	-0.18 (0.16)	-0.08 (0.17)	0.03 (0.18)	0.29 (0.18)	0.22 (0.12)
Motives: substance use regulation	0.06 (0.15)	-0.23 (0.12)	0.06 (0.13)	0.24 (0.14)	0.37 (0.12)**	-0.09 (0.07)
Motives: coping	0.20 (0.24)	0.56 (0.27)*	0.69 (0.24)**	0.73 (0.24)**	0.38 (0.21)	0.47 (0.14)**
Motives: sleep facilitation	0.28 (0.21)	-0.02 (0.22)	-0.07 (0.20)	-0.36 (0.20)	-0.34 (0.17)*	0.04 (0.13)
Explained variance (R ²)	20%	21%	37%	43%	44%	42%

N=66-75. Values next to each predictor variable are standardized regression coefficients (β) and standard error (SE) values. Level of significance: * $p < 0.05$; ** $p < 0.01$.

VII. Discussion

Using prescription medications non-medically has become an increasing public health concern in recent decades with several potential harmful consequences (e.g. SUD, overdose, mental and/or physical health issues or suicidal behavior) (European Monitoring Centre for Drugs and Drug Addiction., 2020; Votaw, Geyer, et al., 2019b). Sedatives and hypnotics (especially BZDs) are among the most commonly prescribed psychiatric drugs with a wide range of clinical uses (European Monitoring Centre for Drugs and Drug Addiction, 2021; Substance Abuse and Mental Health Services Administration, 2020). Therefore, various studies have been published in recent years regarding this phenomenon, however, its exact prevalence across countries, its risk factors and correlates such as the motivational background are still unexplored due to the multifactorial nature of it. In the present thesis, five studies were conducted where the prevalence, some correlates and protective factors of non-medical sedative/hypnotic use as well as the motivations for BZD use were comprehensively examined among community samples and in a clinical sample including hospitalized psychiatric patients.

Based on the results of Study 1, the lifetime prevalence of sedative/hypnotic use was 8.3%, while the lifetime prevalence of NMU was 3.2% in the Hungarian adult population. In Study 2, the investigation of the non-medical sedative/hypnotic use in Hungary was expanded by exploring the relationship between NMU of sedatives/hypnotics and behavioral addictions in two large young adult samples. It was reported that symptoms of most of the examined behavioral addictions were significantly more severe among lifetime and/or current non-medical sedative/hypnotic users, compared to non-user young adults. In Study 3, the relationship between religious status and NMU of sedatives/hypnotics was examined and the protective role of religiosity was corroborated in the representative Hungarian adult sample, but not in the representative young adult sample of Budapest. In Study 4, motivations for BZD use were explored in a small sample of BZD users as well as from the scientific literature, thus, 82 motivations were noted. In Study 5, we aimed to identify the factors in the motivations for BZD use and to develop an assessment for exploring the motivations for BZD use in community sample as well as to support the validity of the developed questionnaire in the same community and in a clinical sample as well.

Our results regarding the prevalence of sedative/hypnotic use and NMU (Study 1) can help us to detect this public health concern in Hungary as well as to examine the occurrence of this behavior in an international context. For instance, comparing the data from five European countries (including France, Germany, Italy, Spain and the United Kingdom) from 2017 with

the results of the NSAPH 2019 shows that the lifetime prevalence of sedative/hypnotic use in Hungary is lower compared to the aforementioned countries (even two years later), however, regarding the NMU of sedatives and/or hypnotics, the lifetime prevalence was the second highest in Hungary (after Spain with 6.5%). Nevertheless, it should be noted that little data is available in the international scientific literature on the prevalence of sedative and/or hypnotic use and NMU across individual countries. Our results regarding the prevalence and frequency of this behavior in Hungary also draws attention to the importance of monitoring this phenomenon (including the correlates of NMU, risk factors and protective factors) both in Hungary and internationally.

For instance, regarding the correlates of NMU of sedatives and/or hypnotics, to the best of our knowledge, our Study 2 was the first study which comprehensively examined the relationship between non-medical sedative/hypnotic use and several types of behavioral addictions. Previous studies have documented an association between several behavioral addictions, and the symptoms of depression and/or anxiety as well as poor sleep quality (Carli et al., 2012; Hussain et al., 2020; H. Y. Wong et al., 2020; Ioannidis et al., 2018; Lin et al., 2021; Liu & Ma, 2019; Orosz et al., 2016; Serrano-Fernández et al., 2021; Starcevic & Khazaal, 2017; Weinstein et al., 2015). Furthermore, Dutheil et al. (2020) documented depressive symptoms, greater perceived stress as well as lower sleep quality and lower well-being among participants with higher risk of work addiction. As sedatives and hypnotics are usually used for the treatment of anxiety and sleep disturbances, therefore, these constructs may play mediating roles between NMU of sedatives and/or hypnotics and behavioral addictions. Nevertheless, Sohn et al. (2021) found similar results regarding the relationship between problematic mobile phone use and poor sleep quality, however, it should be noted that nearly 40% of the young adults (aged between 18 and 30 years) reported smartphone addiction in the United Kingdom. Thus, the commonness of problematic mobile phone use in this population can overwrite the differences alongside non-medical sedative/hypnotic use as also seen in the results of our analyses.

In addition, Fan et al. (2020) documented an indirect effect of depression symptoms on problematic internet use via NMU of sedatives which also suggests a mediating role between non-medical sedative/hypnotic use and behavioral addictions. However, the causality between addictive behaviors has yet to be established. For instance, escape mechanisms for negative mood behind behavioral addictions should be taken into account (Wegmann et al., 2017; Yen et al., 2019). Nevertheless, behavioral addictions may also contribute to the symptoms of depression, anxiety or sleep disturbances leading to NMU of prescription drugs, which in turn

could aggravate the severity of behavioral addictions and vice versa (Starcevic & Khazaal, 2017). Furthermore, due to the similarities between substance-related addictions and behavioral addictions, a general predisposition for addictive behaviors should also be taken into account, which may simultaneously manifest in NMU of prescription drugs, behavioral addictions and/or further types of SUDs. Further investigation of potential mediating effects behind NMU and behavioral addictions could help us to better understand the nature of the associations between these phenomena, especially because early onset of NMU was found to be associated with the development of prescription drug dependence (McCabe et al., 2007), while early onset of behavioral addictions can be related to greater severity and worse psychopathological states (Valero-Solís et al., 2018). Thus, adequate preventive interventions would be crucial for this high-risk population.

Nevertheless, for effective prevention it is important to better understand the potential protective factors of NMU. As one of these potential protective factors, religiosity was examined in the nationally representative adult sample of Hungary and in the representative young adult sample of Budapest (Study 3). Our results revealed that being religious is the only significant indicator regarding the relationship between religiosity and non-medical sedative/hypnotic use with lower past-year prevalence of NMU among religious participants, however, this protective role was only shown in the nationally representative adult sample, but not among young adults. The protective effect of religiosity/spirituality in the development and recovery from SUDs is well-documented (Dermatis & Galanter, 2016; Hai et al., 2019; Livne et al., 2021; Yeung et al., 2009). A possible explanation for this protective role is that individuals with intrinsic religiosity who found to be committed to (and less likely to have personal struggles with) their religion can be described by a higher level of psychological well-being (Bravo et al., 2016). In addition, previous research have also documented that religious identity commitment correlates with general life satisfaction and coherence in life, since religiosity in itself may contribute to a coherent worldview (Galen & Kloet, 2011; Villani et al., 2019). However, based on our results, religiosity did not appear to be protective among young adults. Studies in the literature examining the religiosity/spirituality in this age group have documented that young adults' beliefs are highly individualized. Only a weak relationship was found between religious socialization in childhood and current religious beliefs or attendance (Arnett & Jensen, 2002). Furthermore, it was also documented by Arnett and Jensen (2002) that young adults are often skeptical of religious institutions. In addition, based on a longitudinal study that investigated the changes in religious affiliation and identity in the ages of transition from adolescence to young adulthood revealed that affiliation with religious groups or faith

declined significantly among youths (Chan et al., 2015). Therefore, this change can overwrite the protective effect of religiosity in this age group. For adequate explanations of our results, further studies are required, nevertheless, results (including ours) about the protective role of religiosity on non-medical sedative/hypnotic use among adults corroborate that religiosity has implications regarding healthcare compliance and adherence. Thus, professionals working in the field of psychiatry, especially of addictions should pay more attention to patients' religious beliefs. Our findings can contribute to the development of more complex and integrative prevention programs.

These personalized, complex prevention and intervention programs for non-medical BZD use or BZD use disorder can also be improved by a comprehensive exploration of the motives for BZD use. In our Study 5, a new assessment for different motives for BZD use was developed and the construct and incremental validity of the Motives for Benzodiazepine Use Questionnaire (MBUQ-48) was evaluated using community and clinical samples. To the best of our knowledge, this was the first study which comprehensively examined the motives for BZD use and developed a new assessment for exploring BZD motives. During the statistical analyses, 48 different motivations were identified comprising of four factors: 'personal and interpersonal benefits', 'substance use regulation', 'coping', and 'sleep facilitation' with significantly higher occurrence of all these motives in the clinical sample. The number of the identified factors in BZD use is consistent with the first motivational model of Cooper (1994) and Cox and Klinger (1990) for alcohol use, nevertheless, Cooper's model was different in some points: conformity and social motives appeared to be two separate factors, however, personal and interpersonal motives for BZD use include both social motives (e.g., *To make it easier for me to socialize*) and conformity (e.g., *to don't feel like I'm missing out on something*) as well as other motives related to positive affective changes (e.g., *to get high*), which were involved in the enhancement factor in the motivational model of alcohol use. Furthermore, sleep facilitation has not appeared among the motives for alcohol use. This can be caused by the fact that BZDs are also prescribed for the treatment of sleeping disturbances. In addition, coping appeared to be a significant motive for both BZD and alcohol use, however, there are many similarities between these two substances and they often appear comorbid as well, which can explain the presence of coping motives in case of both substances (Blanco et al., 2018; Lopez et al., 2021; Maust et al., 2019). Furthermore, substance use regulation as a significant motive for BZD use can also be connected to the high comorbidity of BZD and further substance use, especially alcohol use. Overall, motives explored in our study were consistent with the results of previous studies on this topic which have documented that anxiety and stress and/or sleep

management, emotion regulation, recreational motives, and getting high were the most common motives for BZD use (McCabe & Cranford, 2012; Messina et al., 2016; Rigg & Ibañez, 2010; Schepis et al., 2021b). However, it should be noted that most of the aforementioned studies investigated the motives for the use of prescription medications in general, not just sedatives and hypnotics. To the best of our knowledge, our study was the first that focused specifically on BZDs and developed a psychometric assessment for BZD motives by comprehensively identifying the motives and the factors underlying BZD use. The presence of this psychometric scale for BZD motives can help clinicians to identify individuals with risk of NMU and BZD use disorder symptoms as well as to develop individual treatment plans.

The construct validity of the MBUQ-48 was not only corroborated in the community and clinical samples but also across several variables correlating with specific motives (e.g., hazardous cannabis use with substance use regulation; or the presence of psychiatric or neurological disorders with coping in the community sample; and alcohol-related psychiatric disorders also with substance use regulation, and non-medical BZD use with coping in the clinical sample). Furthermore, motivational factors had significant predictive effects on distinct outcomes of BZD use (e.g., substance use regulation on illegal BZD access in the community sample, or coping on the frequency of non-medical BZD use in both samples). These findings are consistent with the results of previous studies that documented coping (especially with anxiety and stress due to adverse life events) as one of the most frequent motives for non-medical BZD use (Rigg & Ibañez, 2010).

Drazdowski et al. (2020) found that mental health problems were more common among individuals with NMU of tranquilizers with the motive of dealing with their negative emotions and NMU of sedatives to relieve their tension or relax. It has also been documented that non-therapeutic motives for sedative/hypnotic use (such as curiosity, experimentation, or altering the effects of other psychoactive substances) were associated with a more extensive history of other substance use (McLarnon et al., 2013). It is also important to highlight that other studies have documented that using BZDs for reducing withdrawal symptoms from other substances or to increase the effect of these drugs is very common among participants with further SUDs (Gelkopf et al., 1999; Liebrez et al., 2015; Rigg & Ibañez, 2010). These were consistent with our results in the clinical sample: the presence of alcohol-related diagnoses was associated with substance use regulation motive for BZD use.

Our findings draw attention to the need for better exploration of the characteristics of BZD users and the motivations for their BZD consumption, which may help mental health professionals in the early recognition of the risk of BZD abuse and dependence. Information

about the relationship and the predictive effect of motivational subtypes on different outcomes of BZD use may also help clinicians in a more efficient identification of BZD abuse and dependence in general health or psychological care, which can also help the earlier start of prevention and/or intervention processes.

Moreover, the efficiency of therapeutic processes may also be increased by having information about motivations for BZD use. For instance, in case of using BZDs for coping, it may be crucial to teach the individual about alternative methods (such as stress management) that can be used in situations that require everyday coping (Rigg & Ibañez, 2010). Furthermore, for individuals who use BZDs for sleeping disturbances, CBT could be recommended as a first-line treatment for insomnia (Riemann et al., 2017). In conclusion, the results of our Study 5 may help develop more individualized treatment plans for BZD users as well as for patients with BZD dependence.

VIII. Strengths and limitations

Some strengths and limitations of the studies should be noted. A key strength of the studies is that they investigate a phenomenon that is common in the clinical practice, however, the correlates, protective factors and motivations for this behavior are still unexplored comprehensively. In addition, large and representative samples as well as a sheer number of variables were included to the analyses. Regarding the limitations of the studies, self-administered questionnaires were applied during the data collections, therefore, social desirability bias should be taken into account. Furthermore, the studies were cross-sectional, which does not allow the determination of causal pathways between the examined constructs. Other research designs such as longitudinal investigations are needed to explore the causality and the longitudinal psychometric characteristics (e.g., test-retest reliability, longitudinal invariance) of the MBUQ-48.

Regarding Study 2, more detailed and higher levels of statistical analyses examining mediating and moderating factors are needed to provide a more accurate picture of the nature of relationships between non-medical sedative/hypnotic use and behavioral addictions. Additionally, some of the examined behaviors in Study 2 are more accurately viewed as obsessive-compulsive disorders (e.g. hair pulling) (American Psychiatric Association, 2013) rather than addictions that may be a potential cause for some non-significant results in this context. Some differences in assessments between the two samples could have also led to different results in some cases (e.g. regarding problematic internet use).

As for the investigation of the role of religiosity (Study 3), it is a multidimensional construct with different definitions in the scientific literature, however, the present study assessed the individuals' subjective perception of their religiosity, independent of the religious practice and the type of the religion. This conceptualization can be considered reductionist, thus, further information should be collected about the individuals' beliefs, attitudes, and feelings in regard of the religion.

Regarding the motivational study (Study 5), both of the included samples were non-representative to the population of Hungary, limiting the generalizability of the findings. In addition, the sample size of the clinical sample was relatively small compared to the community sample. Future studies should investigate the factor structure of the developed MBUQ-48 in a larger clinical and a nationally representative sample. The disproportion regarding the gender distribution in the community sample should be also accounted for. Due to the smaller sample size in the clinical sample, comparisons between the community and clinical sample were applied without measurement invariance testing, therefore, measurement biases might have also been present. Furthermore, the validation of the developed MBUQ-48 on other samples and in other languages would significantly increase the generalizability of our study. Finally, all of the studies investigated the NMU of sedatives and hypnotics, however, exploring further types of non-medical prescription drug use (i.e. opioid pain relievers or stimulants) would also be crucial to comprehensively understand the correlates, risk factors, protective factors and motivations for NMU.

IX. Main findings and conclusions

In the present thesis, five studies related to sedative/hypnotic use and NMU were introduced. According to the results, the novel findings of the present thesis are the following:

1. Our Study 1 revealed that the lifetime prevalence of sedative/hypnotic was 8.3% ($\pm 1.5\%$), the past year prevalence was 7.5% ($\pm 1.4\%$), while the past month prevalence was 6.7% ($\pm 1.4\%$) in the Hungarian adult population aged between 18 and 64 years. Among female participants, both past year and past month prevalence of sedative/hypnotic use were approximately twice compared to the male group. The lifetime prevalence of NMU was 3.2% ($\pm 1\%$), the past year prevalence was 2.9% ($\pm 0.9\%$), while the past month prevalence was 2.4% ($\pm 0.8\%$). There was no significant difference in terms of gender in the past year and past month prevalence of NMU of sedatives/hypnotics. These results can help us to objectify this public health concern in Hungary as well as to examine the occurrence of this behavior in an international context.

2. In Study 2, the relationship between non-medical sedative/hypnotic use and several behavioral addictions (problematic internet use, problematic social media use, problem gambling, exercise addiction, eating disorders, compulsive buying behavior and work addiction) was comprehensively explored among young adults. The severity of most of these behavioral addiction symptoms was significantly higher among lifetime and/or current non-medical sedative/hypnotic users, therefore, the relationship between non-medical sedative/hypnotic use and more severe symptoms of several behavioral addictions was supported in this high-risk population. Based on the previous results in the scientific literature, depressive symptoms, greater perceived stress, lower sleep quality and lower well-being may play mediating roles between non-medical sedative/hypnotic use and behavioral addictions, however, the causality between addictive behaviors has yet to be established and behavioral addictions may also contribute to symptoms of depression, anxiety or sleep disturbances leading to NMU of prescription drugs. Nevertheless, these results draw attention to the need for adequate preventive interventions in this high-risk population as well as for understanding the potential protective factors. Thus, establishing complex, adequate preventive interventions is crucial among young adults.

3. The results of Study 3 revealed significantly lower past-year prevalence of NMU of sedatives/hypnotics among religious participants, however, this protective role was only shown in the adult sample, but not among young adults. The protective effect of religiosity/spirituality in SUDs is well-known, however, our results among adults suggest that religiosity also has implications regarding healthcare compliance and adherence. Therefore, these findings can also help in the development of more complex and integrative prevention programs by drawing the clinicians' attention to the importance of the patients' religious beliefs.

4. In Study 4, motives for BZD use were comprehensively explored among BZD users and summarized from the literature as a first step to design a standardized tool for assessing BZD use motives. In Study 5, the Motives for Benzodiazepine Use Questionnaire (MBUQ-48) (see Table S3 of the Supplementary Material) was developed by identifying the factor structure of the previously collected motives. The construct and incremental validity of the questionnaire was also evaluated in community and clinical samples. Based on our results, 48 different motivations were identified comprising four factors: '*personal and interpersonal benefits*', '*substance use regulation*', '*coping*', and '*sleep facilitation*' with significantly higher occurrence of all these four motives in the clinical sample. In conclusion, the MBUQ-48 is a reliable and valid scale for assessing motives for BZD use. To the best of our knowledge, ours was the first study which comprehensively examined the motives for BZD use and developed

a new assessment for exploring BZD motives. Using the MBUQ-48 and taking into account the predictive effect of motivational subtypes on different outcomes of BZD use, we can help clinicians to identify individuals with risk of non-medical use and BZD use disorder symptoms.

Overall, the results of the studies included in the present thesis can help us to identify sedative/hypnotic use and NMU, BZD abuse or dependence as well as to develop more individualized treatment plans.

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XI. References

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XII. Supplementary Material

Table S1: *The final list and source of 82 motivations collected in Study 4*

	Motivation	Source		Motivation	Source
1	It helps me with sleep	Our collection; Messina et al., 2016; Nattala et al., 2011; Stein et al., 2016; Vogel et al., 2013	42	To get high	Messina et al., 2016; Milner, 2015; Nattala et al., 2011; Stein et al., 2016; Vogel et al., 2013
2	It helps me to fall asleep	McCabe & Cranford, 2012; Milner, 2015	43	To be in a better mood	Nattala et al., 2011
3	It helps me to sleep deeper	Our collection	44	To feel refreshed	Gelkopf et al., 1999; Vogel et al., 2013
4	It helps me to reduce sleep disturbances	Gelkopf et al., 1999; Milner, 2015; Vogel et al., 2013	45	To feel better	Gelkopf et al., 1999; Vogel et al., 2013
5	It helps me to rest	Gelkopf et al., 1999; Vogel et al., 2013	46	To get energy	McCabe & Cranford, 2012; Nattala et al., 2011
6	To improve the quality of sleep	Vogel et al., 2013	47	It's a pleasant feeling	Milner, 2015
7	It helps me to sleep well enough	Milner, 2015	48	It makes me feel better when I'm in a bad mood	Milner, 2015; Nattala et al., 2011
8	It calms me down	Our collection; Milner, 2015	49	To make me feel more confident	Milner, 2015
9	It helps me when I'm stressed	Nattala et al., 2011	50	To make me feel more assertive	Milner, 2015
10	It helps me when I'm nervous	Milner, 2015	51	It banishes boredom	McCabe & Cranford, 2012; Vogel et al., 2013
11	It helps me to deal with stress	Milner, 2015	52	It is exciting	Milner, 2015
12	It eases my anger	McCabe & Cranford, 2012	53	Out of curiosity	Nattala et al., 2011
13	It eases my frustration	McCabe & Cranford, 2012	54	To experiment	McCabe & Cranford, 2012; Messina et al., 2016; Nattala et al., 2011
14	It helps me to relax	Gelkopf et al., 1999; McCabe & Cranford, 2012; Vogel et al., 2013	55	It is fun to take medicines	Milner, 2015

15	It relieves my tension	McCabe & Cranford, 2012	56	It helps me to enjoy a party	Nattala et al., 2011
16	It eases my restlessness	Our collection	57	It improves parties and celebrations	Milner, 2015
17	It eases my anxiety	Messina et al., 2016; Vogel et al., 2013	58	To make it easier for me to socialize	Milner, 2015
18	It helps to manage my anxiety	Stein et al., 2016	59	To get to know myself better	Milner, 2015
19	It helps in difficult situations	Milner, 2015	60	It helps me see things differently	Milner, 2015
20	To avoid panic attacks	Our collection	61	To increase my awareness	Milner, 2015
21	It helps in difficult times	Our collection	62	It makes me more open to new experiences	Milner, 2015
22	It helps me to deal with depression	Milner, 2015; Stein et al., 2016	63	It makes me more creative	Milner, 2015
23	It helps me to deal with bad mood	Milner, 2015	64	It helps me see things from a new perspective	Milner, 2015
24	It helps me to deal with loneliness	Our collection	65	To be able to fulfill my duties	Nattala et al., 2011
25	It helps curb suicidal thoughts	Our collection	66	It helps to stay focused	Milner, 2015
26	To forget about my problems	Gelkopf et al., 1999, 1999; Milner, 2015; Vogel et al., 2013	67	It makes me more efficient	Milner, 2015
27	To make my problems less pressing	Gelkopf et al., 1999	68	It helps me concentrate	Messina et al., 2016; Milner, 2015; Nattala et al., 2011
28	To get away from my problems	McCabe & Cranford, 2012	69	It helps in studying	Milner, 2015; Nattala et al., 2011
29	To forget about my worries	Milner, 2015	70	To relieve my pain	McCabe & Cranford, 2012; Messina et al., 2016; Nattala et al., 2011
30	To get through the day	McCabe & Cranford, 2012	71	To reduce the effect of some medicine	Nattala et al., 2011

31	It helps me not to think about everyday problems	Milner, 2015	72	To increase the effect of some medicine	Nattala et al., 2011
32	It helps to quit drugs	Our collection	73	To relieve physical symptoms	Our collection
33	It helps to drink less alcohol	Stein et al., 2016	74	To fit into a group of people I like	McCabe & Cranford, 2012; Milner, 2015
34	It helps to deal with my alcohol problems	Our collection	75	To have fun with my friends	McCabe & Cranford, 2012
35	It alleviates the lack of alcohol or other drugs	Stein et al., 2016; Vogel et al., 2013	76	My friends put pressure on me to consume them	Milner, 2015; Nattala et al., 2011
36	It reduces my withdrawal symptoms	Stein et al., 2016; Vogel et al., 2013	77	To don't feel like I'm missing out on something	Milner, 2015
37	It reduces the effect of other drugs	Gelkopf et al., 1999; McCabe & Cranford, 2012; Vogel et al., 2013	78	To be liked by others	Milner, 2015
38	To counteract the effects of other drugs	Messina et al., 2016; Milner, 2015	79	To reduce my appetite	Milner, 2015
39	Because alcohol works better that way	McCabe & Cranford, 2012	80	It helps me to lose weight	McCabe & Cranford, 2012; Messina et al., 2016; Milner, 2015; Nattala et al., 2011
40	It enhances the effect of other drugs	Gelkopf et al., 1999; McCabe & Cranford, 2012; Vogel et al., 2013	81	Because I am addicted	McCabe & Cranford, 2012; Messina et al., 2016
41	It enhances the effect of alcohol	Our collection	82	It is safer than other drugs	Messina et al., 2016

Table S2: *Descriptive statistics and comparisons between the community and clinical samples in Study 5*

	Community sample	Clinical sample	Test statistic	Effect size
Gender ¹ N (%)				
Females	1157 (81.71%)	69 (61.06%)	$\chi^2=28.08^{***}$	V=0.14
Males	259 (18.29%)	44 (38.94%)		
Age M (SD)	49.31 (14.75)	46.13 (14.54)	$t=2.20^*$	d=0.22
Illegal BZD access N (%)				
No	859 (60.92%)	62 (55.36%)	$\chi^2=1.35$	V=0.03
Yes	551 (39.08%)	50 (44.64%)		
Frequency of medical sedative use N (%)				
Never in the last 12 months	261 (18.52%)	7 (6.48%)	$\chi^2=44.05^{***}$	V=0.17
Less than monthly	213 (15.12%)	9 (8.33%)		
Approx. monthly	104 (7.38%)	9 (8.33%)		
3-5 times a month	112 (7.95%)	4 (3.70%)		
Several times a week	106 (7.52%)	6 (5.56%)		
Daily	402 (28.53%)	33 (30.56%)		
Several times a day	211 (14.98%)	40 (37.04%)		
Frequency of non-medical sedative use: greater dose or frequency N (%)				
Never in the last 12 months	1056 (77.48%)	44 (42.31%)	$\chi^2=91.96^{***}$	V=0.25
Less than monthly	113 (8.29%)	18 (17.31%)		
Approx. monthly	49 (3.60%)	5 (4.81%)		
3-5 times a month	51 (3.74%)	12 (11.54%)		
Several times a week	38 (2.79%)	6 (5.77%)		
Daily	27 (1.98%)	4 (3.85%)		
Several times a day	29 (2.13%)	15 (14.42%)		
Frequency of non-medical sedative use: with alcohol or other substances N (%)				
Never in the last 12 months	1134 (83.14%)	54 (51.92%)	$\chi^2=110.30^{***}$	V=0.2
Less than monthly	105 (7.70%)	15 (14.42%)		
Approx. monthly	34 (2.49%)	3 (2.88%)		
3-5 times a month	38 (2.79%)	9 (8.65%)		
Several times a week	25 (1.83%)	9 (8.65%)		
Daily	17 (1.25%)	3 (2.88%)		
Several times a day	11 (0.81%)	11 (10.58%)		
Frequency of non-medical sedative use: without medical prescription N (%)				

	Community sample	Clinical sample	Test statistic	Effect size
Never in the last 12 months	937 (68.39%)	68 (64.15%)		
Less than monthly	184 (13.43%)	10 (9.43%)		
Approx. monthly	67 (4.89%)	3 (2.83%)		
3-5 times a month	75 (5.47%)	4 (3.77%)	$\chi^2=57.64^{***}$	V=0.20
Several times a week	52 (3.80%)	6 (5.66%)		
Daily	36 (2.63%)	2 (1.89%)		
Several times a day	19 (1.39%)	13 (12.26%)		
Sedative use disorder symptom severity M (SD)	3.04 (2.56)	5.34 (3.06)	$t=7.21^{***}$	d=0.89
Well-being M (SD)	11.46 (3.35)	9.72 (3.71)	$t=5.17^{***}$	d=0.52
Stress M (SD)	10.98 (3.61)	13.85 (3.27)	$t=8.08^{***}$	d=0.80
Rumination M (SD)	21.01 (6.01)	24.22 (6.28)	$t=5.24^{***}$	d=0.53
Sleep difficulties M (SD)	7.87 (4.67)	10.20 (5.57)	$t=4.22^{***}$	d=0.49
Impulsivity M (SD)	20.88 (4.96)	23.89 (5.63)	$t=5.73^{***}$	d=0.60
Alcohol use N (%)				
Abstinence or low risk drinking	1212 (85.35%)	43 (49.43%)		
Hazardous use	208 (14.65%)	44 (50.57%)	$\chi^2=75.98^{***}$	V=0.23
Cannabis use N (%)				
Abstinence or low risk use	1284 (90.42%)	88 (89.80%)		
Hazardous use	136 (9.58%)	10 (10.20%)	$\chi^2=0.04$	V=0.01
Current treatment for a psychiatric or neurologic disorder N (%)				
No	823 (57.84%)	-	-	-
Yes	600 (42.16%)	-	-	-
Alcohol-related disorders N (%)				
Absence	-	68 (60.18%)	-	-
Presence	-	45 (39.82%)	-	-
Other substance use-related disorders N (%)				
Absence	-	95 (84.82%)	-	-
Presence	-	17 (15.18%)	-	-
Schizophrenia- and psychosis-related disorders N (%)				
Absence	-	97 (85.84%)	-	-
Presence	-	16 (14.16%)	-	-
Mood disorders: N (%)				
Absence	-	68 (60.18%)	-	-

	Community sample	Clinical sample	Test statistic	Effect size
Presence	-	45 (39.82%)		
Anxiety disorders N (%)				
Absence	-	79 (69.91%)	-	-
Presence	-	34 (30.09%)		

Notes. χ^2 : Pearson's Chi-square statistic. *t*: independent samples *t*-test value. *V*: Cramer's V effect size index. *d*: Cohen's *d* effect size index. Level of significance: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. ¹In the community sample 8 participants had 'other' gender. They were not considered for the comparison.

Table S3: *The Motives for Benzodiazepine Use Questionnaire (MBUQ-48)*

Thinking now of all the times you have used benzodiazepines in the past year, how often have you used these substances for the following reasons?						
During the past year I consumed benzodiazepine(s)...		Never/ almost never	Sometimes	In half of the cases	In most cases	Always/ almost always
1	To make my problems less pressing	1	2	3	4	5
2	To ease my anxiety	1	2	3	4	5
3	To be able to fulfill my duties	1	2	3	4	5
4	Because it helps in difficult times	1	2	3	4	5
5	To counteract the effects of other drugs	1	2	3	4	5
6	To increase my awareness	1	2	3	4	5
7	Because it helps me to relax	1	2	3	4	5
8	Because it helps to drink less alcohol	1	2	3	4	5
9	Because it makes me more creative	1	2	3	4	5
10	Because it helps me see things from a new perspective	1	2	3	4	5
11	To make me feel more confident	1	2	3	4	5
12	Because it alleviates the lack of alcohol or other drugs	1	2	3	4	5
13	To feel refreshed	1	2	3	4	5
14	Because it helps to deal with my alcohol problems	1	2	3	4	5
15	Because it helps in studying	1	2	3	4	5
16	To be able to rest	1	2	3	4	5
17	To be more efficient	1	2	3	4	5
18	To sleep well enough	1	2	3	4	5
19	Because it makes me more open to new experiences	1	2	3	4	5
20	To make it easier for me to socialize	1	2	3	4	5
21	To don't feel like I'm missing out on something	1	2	3	4	5
22	To stay focused	1	2	3	4	5
23	Because it helps with sleep	1	2	3	4	5
24	Because it helps in difficult situations	1	2	3	4	5
25	Because it eases my anger	1	2	3	4	5
26	To get high	1	2	3	4	5
27	Because it helps me to deal with depression	1	2	3	4	5

28	Because it eases my frustration	1	2	3	4	5
29	To have fun with my friends	1	2	3	4	5
30	Because it calms me down	1	2	3	4	5
31	To avoid panic attacks	1	2	3	4	5
32	Beacuse it helps me not to think about everyday problems	1	2	3	4	5
33	Beacuse it eases my restlessness	1	2	3	4	5
34	To feel better	1	2	3	4	5
35	To relieve my tension	1	2	3	4	5
36	To fit into a group of people I like	1	2	3	4	5
37	Because it helps me to fall asleep	1	2	3	4	5
38	To get energy	1	2	3	4	5
39	To reduce the effect of other drugs	1	2	3	4	5
40	Because it helps to deal with stress	1	2	3	4	5
41	Because it helps me to reduce sleep disturbances	1	2	3	4	5
42	Because it helps me when I'm nervous	1	2	3	4	5
43	Because it helps me to sleep deeper	1	2	3	4	5
44	Because it helps me when I'm tense	1	2	3	4	5
45	To forget about my worries	1	2	3	4	5
46	To make me feel more assertive	1	2	3	4	5
47	To improve the quality of sleep	1	2	3	4	5
48	Because it helps me concentrate	1	2	3	4	5
Personal and interpersonal benefits: 3, 6, 9, 10, 11, 13, 15, 17, 19, 20, 21, 22, 26, 29, 36, 38, 46, 48 Substance use regulation: 5, 8, 12, 14, 39 Coping: 1, 2, 4, 7, 24, 25, 27, 28, 30, 31, 32, 33, 34, 35, 40, 42, 44, 45 Sleep facilitation: 16, 18, 23, 37, 41, 43, 47						

Co-author certification

I, myself as a corresponding author of the following publication(s) declare that the authors have no conflict of interest, and Lea Finta-Péter Ph.D. candidate had significant contribution to the jointly published research(es). The results discussed in her thesis were not used and not intended to be used in any other qualification process for obtaining a PhD degree.

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The publication(s) relevant to the applicant's thesis:

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